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Point Centred Variography to Assess the Spatial Representativeness of Air Quality Monitoring Sites

Application to the Datasets of the FAIRMODE Intercomparison Exercise of Spatial Representativeness

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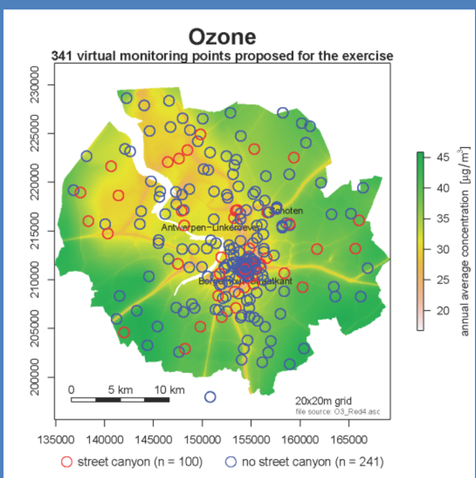

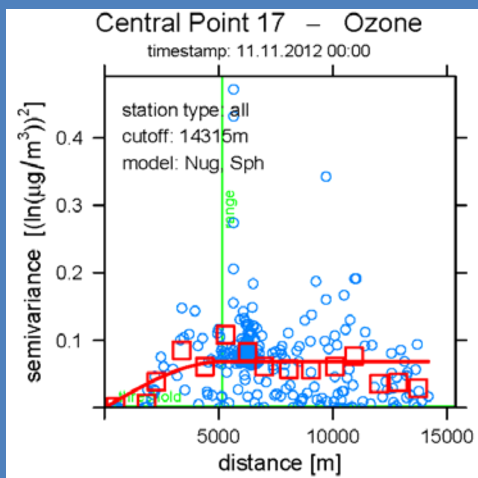

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Contents

Abstract

Common definitions for the spatial representativeness of air quality monitoring sites are based on the evaluation of the similarity of pollutant concentrations, in which the representativeness area of a monitoring site is basically described by the set of all locations where the concentration of a pollutant does not differ from the measurements at the central point by more than a certain threshold.

Classical geostatistical analysis describes the spatial correlation structure of a concentration field in terms of the variogram. Point centred variography on the other hand is based on the average of squared concentration differences observed in pairs formed between a particular central point and the set of all other points in the domain. It thereby places a monitoring station in the context of the local or regional air quality pattern.

In this report we demonstrate how a mathematical inversion of the point centred variogram can provide information about the extent of the spatial representativeness area of a monitoring site. The application of this approach is tested on a set of modelling data from the city of Antwerp. This dataset contains information at a very high spatial (street level) and temporal resolution for three main pollutants (PM_{10}, NO_2 and Ozone), over the whole city. Furthermore, FAIRMODE (Forum for Air Quality Modelling in Europe) is currently concluding an intercomparison exercise on spatial representativeness methods, which is also based on sharing this same dataset.

1 Introduction

The assessment of the spatial representativeness of air quality monitoring stations is an important subject that has substantial links to several highly topical areas, including risk assessment and population exposure (ref: Directive 2008/50/EC ([1]) and Implementing Decision 2011/850/EU ([2])), the design of monitoring networks, model development, model evaluation and data assimilation.

Within the 2013 FAIRMODE (Forum for Air Quality Modelling in Europe) activities on spatial representativeness a geostatistical technique based on point-centered semi-variograms has been suggested, which has the potential for being further advanced into a promising tool for assessing the representativeness of an individual monitoring station ([3], [4]). This method can provide an estimate of the spatial variability when validating models with monitoring data. However, important further improvements of the method were needed and have been proposed to be carried out within this contract. Furthermore, FAIRMODE is currently organizing an intercomparison exercise of methods for the assessment of the spatial representativeness of air quality monitoring sites ([5]). In this context a shared dataset has been selected among a set of modelling data from the city of Antwerp. This dataset contains information at a very high spatial (street level) and temporal (hourly) resolution for three main pollutants (PM_{10}, NO_2 and Ozone), over the whole city. The application of the point-centered variography method to this dataset does thus also serve a favorable scientific context within FAIRMODE.

The work required within this study had been set out to comprise the following tasks:

Task 1: To identify the technical requirements for the further development of the point-centered variography method

Task 2: To design the mathematical framework and algorithms

Task 3: To design the technical framework for the requested toolset

Task 4: To further develop the functionalities for the point-centered variography method

Task 5: To apply the point-centered variography method to the Antwerp dataset proposed for intercomparison exercise within FAIRMODE

Task 6: To summarize the outcomes in a Technical Report

([1]) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe, Official Journal of the European Union L 152/1 of 11.6.2008

([2]) Commission Implementing Decision 2011/850/EU of the European Commission of 12 December 2011 laying down rules for Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council as regards the reciprocal exchange of information and reporting on ambient air quality. Official Journal of the European Union L 335/86 of 17.12.2011.

([3]) Solazzo, E., Gerboles, M., Kracht, O., Stockers, J., Carruthers, D. and Galmarini, S. (2014): Spatial Representativeness - Report of 2013 WG2/SG1 Activity. 22 p. JRC Technical Reports 87277. EUR 26539 EN. EUR – Scientific and Technical Research Series. DOI 10.2788/14035.

([4]) Solazzo, E., Kracht, O., Carruthers, D., Gerboles, M., Stockers, J. and Galmarini, S. (2014): A Novel Methodology for Assessing the Spatial Representativeness of Air Quality Monitoring Stations in Europe. AQ 2014: 9th International Conference on Air Quality Science and Application, Garmisch-Partenkirchen, Germany, 24-28 March 2014. Proceedings of Abstracts. ISBN 978-1-909291-20-1. p. 95.

([5]) Kracht, O. (2014): Spatial Representativeness, Classification & Siting. 23rd AQUILA Meeting of National Air Quality Reference Laboratories, Ispra, Italy, 24-25 November 2014.

2 General Description and Characterization of the Datasets

Within FAIRMODE the cross-cutting activity group on spatial representativeness (FAIRMODE CCA-1) is currently organising an intercomparison exercise of methods for the assessment of the spatial representativeness of air quality monitoring sites. The main objective of this activity will be to evaluate the possible variety of spatial representativeness results obtained by applying the range of different contemporary approaches to a jointly used example case study. For the purpose of this FAIRMODE intercomparison exercise a dataset has been prepared by VITO (Belgium) by applying the RIO-IFDM-OSPM model chain to the modelling domain of the city of Antwerp for the year 2012 ([6]). In this model chain, the RIO land-use regression model, based on the data of the official monitoring network in Belgium, provides the regional background concentration. The local increment due to traffic and industrial emissions is calculated using IFDM, a bi-Gaussian plume model designed to simulate non-reactive pollutant dispersion at a local scale. For the computation of concentrations in street canyons, the RIO-IFDM chain is furthermore coupled to the OSPM box model ([7]).

Within the framework of the FAIRMODE intercomparison exercise, the following three monitoring sites have been selected for closer evaluation:

As an example for the traffic sites:

— Borgerhout II (Belgium Lambert 72 coordinates: 154396 / 211055)

As examples for the urban background sites:

— Antwerpen-Linkeroever (Belgium Lambert 72 coordinates: 150865 / 214046)

— Schoten (Belgium Lambert 72 coordinates: 158560 / 215807)

The geostatistical analyses presented in this report are using the positions of these three selected stations. The analyses are based on a set of 341 virtual monitoring points time series with hourly data that have been extracted from the RIO-IFDM-OSPM model chain outputs. The aim of these time series is to simulate virtual monitoring stations with daily averages for PM_{10}, and virtual diffusive samplers with to 2-week averages for NO_2 and O_3.

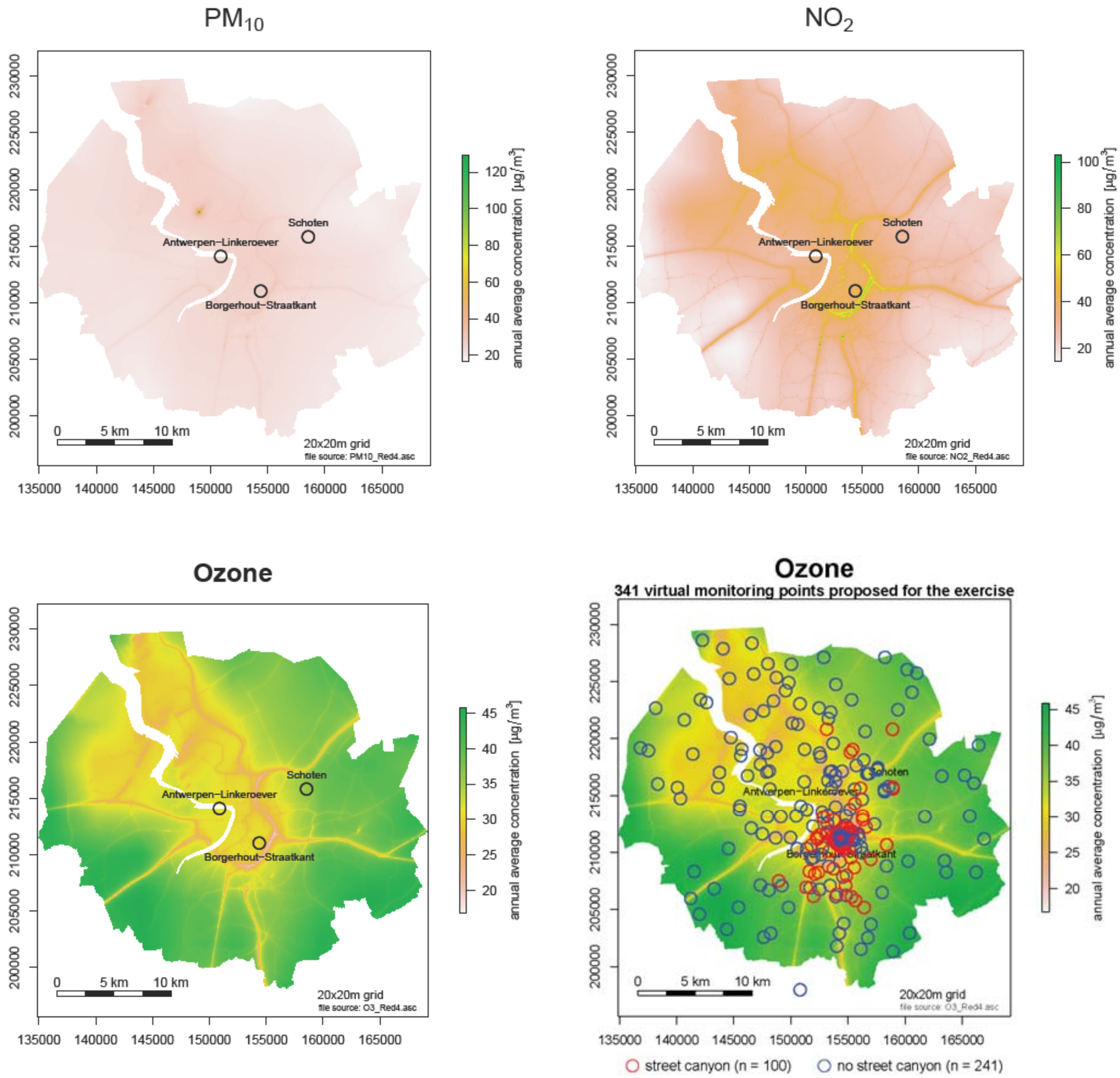
Figure 1 provides an Overview of the annual average concentration fields obtained for PM_{10}, NO_2 and Ozone for the modelling year 2012. In addition, the locations or the three selected monitoring sites, and the positioning of 341 virtual monitoring points are shown.

Table 1 summarizes some general statistical characterisation of the underlying dataset. In total, time series of 341 virtual monitoring points have been extracted from the model data. These 341 virtual receptors ca be distinguished into points located within street-canyons (SC) and points located outside of street-canyons (noSC). Furthermore, the immediate modelling outputs, consisting of simulated hourly data, are aggregated into time series of 1-day averages and 14-days averages. It should be noted that the summary statistics calculated for this set of virtual monitoring points should approximate to, but are not necessarily exactly identical to, the means and standard deviations of the full set of gridded data.

([6]) Kracht, O., Hooyberghs, H., Lefebvre, W., Janssen, S., Maiheu, B., Martin, F., Santiago, J.L., Garcia, L. and Gerboles, M. (2016): FAIRMODE Intercomparison Exercise - Dataset to Assess the Area of Representativeness of Air Quality Monitoring Stations. 267 p. JRC Technical Reports 102775. EUR 28135 EN. EUR – Scientific and Technical Research Series. ISSN 1831-9424 (online), ISBN 978-92-79-62295-3 (PDF), DOI 10.2790/479282.

([7]) Berkowicz, R., Hertel, O., Larsen, S.E., Sørensen, N.N., Nielsen, M. (1997): Modelling traffic pollution in streets (report in PDF format, 850 kB, http://www.dmu.dk/en/air/models/ospm/ospm_description/)

Figure 1. Overview of the annual average concentration fields obtained for PM_{10}, NO_2 and Ozone for the modelling year 2012.



Coordinates are referring to a projection in the Belgium Lambert 72 system (EPSG: 31370). The locations of the three selected monitoring stations (Antwerpen-Linkeroever and Schoten for urban background sites, and Borgerhout-Straatkant for the traffic site) are also shown in the plots.

The bottom right panel illustrates the positioning of 341 virtual monitoring points (the Ozone concentration fields is repeated in the background of this panel for a better spatial orientation).

Table 1. Summary statistics of the time series of 341 virtual monitoring points

Simulated Hourly Data (Antwerp 2012)													
Virtual Station Type	**Number of Points**	**Grand Mean [µg/m³]**			**Grand Standard Deviation [µg/m³]**			**Pooled Standard Deviations of the Individual Time Series [µg/m³]**			**Standard Deviation of the Annual Means of the Time Series [µg/m³]**		
		PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3
all	341	24.7	40.0	31.2	16.0	22.3	25.3	15.8	18.2	25.0	2.3	11.8	4.1
SC	100	26.0	49.4	30.1	16.2	21.8	24.9	16.1	18.9	24.8	1.9	10.8	2.4
noSC	241	24.1	36.1	31.7	15.8	21.2	25.4	15.6	18.0	25.0	2.3	10.0	4.5
1-day Averages of Simulated Data (Antwerp 2012)													
Virtual Station Type	**Number of Points**	**Grand Mean [µg/m³]**			**Grand Standard Deviation [µg/m³]**			**Pooled Standard Deviations of the Individual Time Series [µg/m³]**			**Standard Deviation of the Annual Means of the Time Series [µg/m3]**		
		PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3
all	341	24.7	40.0	31.2	14.2	17.7	18.6	14.0	12.9	18.2	2.3	11.8	4.1
SC	100	26.0	49.4	30.1	14.4	16.7	18.3	14.3	12.8	18.2	1.9	10.8	2.4
noSC	241	24.1	36.1	31.7	14.1	16.6	18.7	13.9	13.0	18.2	2.3	10.0	4.5
14-days Averages of Simulated Data (Antwerp 2012)													
Virtual Station Type	**Number of Points**	**Grand Mean [µg/m³]**			**Grand Standard Deviation [µg/m³]**			**Pooled Standard Deviations of the Individual Time Series [µg/m³]**			**Standard Deviation of the Annual Means of the Time Series [µg/m3]**		
		PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3	PM_{10}	NO_2	O_3
all	341	24.7	40.1	31.1	9.8	13.8	13.5	9.7	7.1	13.1	2.3	11.9	4.1
SC	100	26.0	49.5	30.0	9.8	12.7	13.1	9.8	6.9	13.1	1.9	10.8	2.4
noSC	241	24.2	36.2	31.6	9.7	12.2	13.6	9.6	7.2	13.1	2.3	10.0	4.5

Summary statistics of the time series of 341 virtual monitoring points extracted from the modelled dataset for the city of Antwerp for 2012. The total set of 341 receptor points is additionally disaggregated into points located within street-canyons (SC) and points located outside of street-canyons (noSC). The immediate modelling outputs (simulated hourly data) are compared to the aggregated time series (1-day averages and 14-days averages of simulated data).

The annual average concentrations of PM_{10}, NO_2 and Ozone for these three groups of selected virtual monitoring points are derived by calculating the arithmetic means of the complete set of all time series values of all selected receptor points ("grand mean"). The grand means of hourly data and 1-day averages are naturally exactly the same. Note that, however, the grand means of 14-day averages do not exactly match these former values, because the 26 full 14-day periods considered do not include the last 2 days of the year: the series of 14-day averages contain only 364 of the 366 days in total for the leap year 2012.

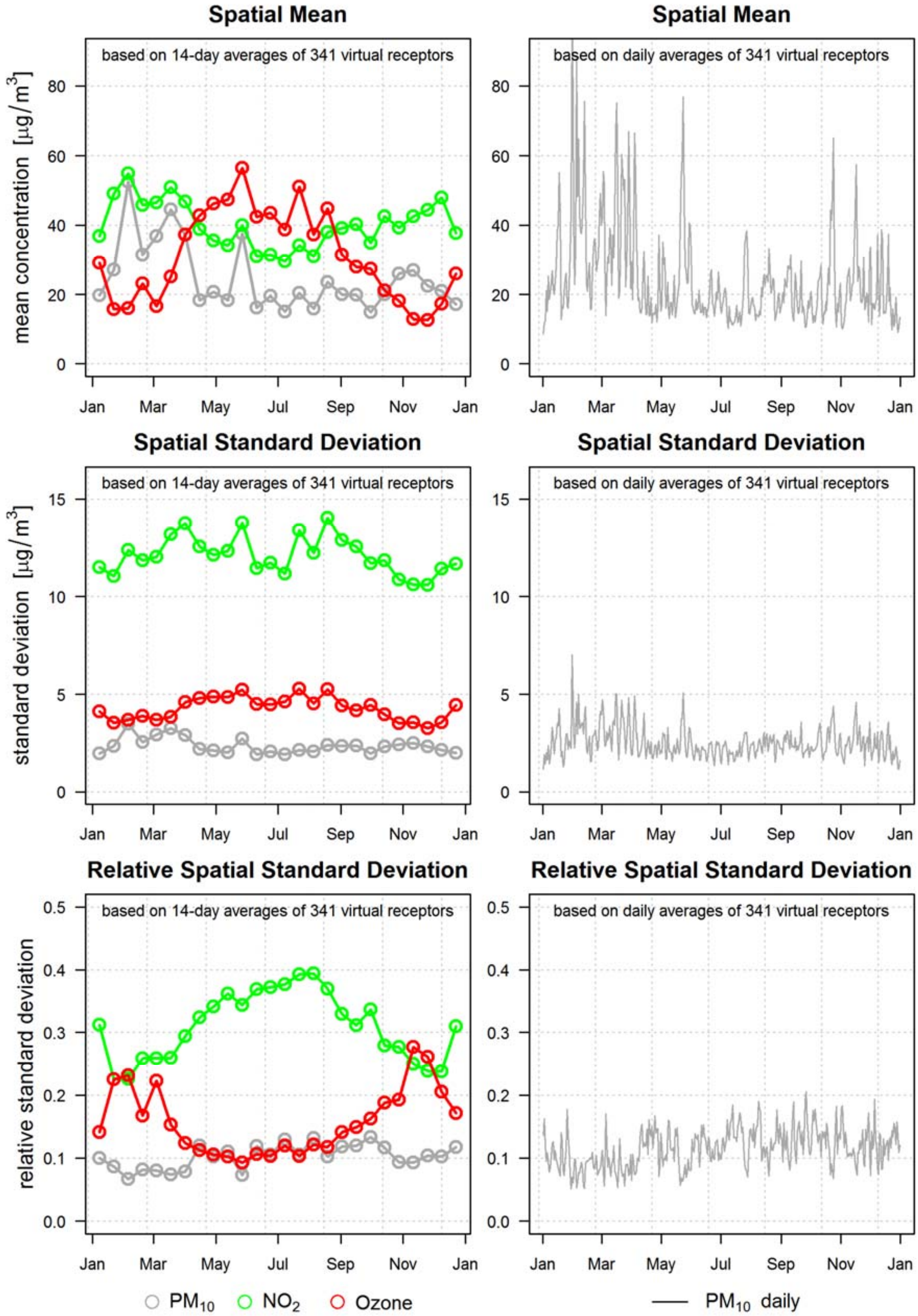
In analogy to the grand mean, the overall variability of the pollutant concentrations is described by the grand standard deviation, which is likewise calculated from all time series values of all selected receptor points. This overall standard deviation includes all contributions originating from the temporal and from the spatial variability. By comparison, the "pooled standard deviation of the individual time series" reflects the inter-annual temporal variations within the individual receptor points' time series only. To complement this, the field "standard deviation of the annual means of the time series" provides the standard deviation of the annual averages of the selected receptor points (a measure of the spatial variability within the annual average concentration field).

As a general observation from these simple characterisations, the spatial variability tends to be highest for NO_2, whereas the temporal variability tends to be highest for Ozone. For all three aggregations (hourly, daily and 14-days) the spatial variability is lowest for PM_{10}. The temporal variability is lowest for PM_{10} in the case of the hourly time series. However, for the daily and for the 14-days time series the temporal variability is lowest for NO_2. This change in the ranking positions with longer averaging times is probably attributable to the relatively short life-time of NO_2 (stronger fluctuations observable in the hourly values which are then suppressed by the daily and 14-days averaging).

In order to get a better insight into the inter-annual evolutions of the spatial concentration fields, figure 2 presents time series of the spatial mean, the spatial standard deviation, and the relative spatial standard deviation calculated for the full set of 341 virtual monitoring points. These calculations have been based on the 14-day averages time series of NO_2, PM_{10} and Ozone, and on the daily averages time series for PM_{10}. For the brevity of the illustration, a split-up into street-canyon and non-street-canyons locations has been omitted.

From these time series presented in figure 2, the mean ozone concentration shows a typical continental annual cycle with a broad summer maximum. In contrast to ozone, the annual variation of NO_2 concentration reveals an anti-cyclic behaviour with higher levels in the winter time and a broad depression of concentrations in the summer time. The seasonal variation of PM_{10} is less pronounced, with elevated concentrations occurring in late winter and in spring. An important characteristic with regards to considerations on the spatial representativeness of monitoring sites is the annual evolution of the spatial variability within the concentration fields. It can be seen that the spatial variability of NO_2 concentrations increases in summer time, whereas ozone shows the opposite behaviour. This is especially expressed very clearly in the relative standard deviation time series. A seasonal variation of the spatial variability of PM_{10} is less clearly pronounced.

Figure 2. Time series of spatial mean, spatial standard deviation, and relative spatial standard deviation of virtual monitoring points.



Time series of spatial mean, spatial standard deviation, and relative spatial standard deviation of the 14-day average values (left side) and 1-day average values (right side) of 341 virtual monitoring points for the modelling year 2012. These metrics reflect the overall means, the total standard deviations and total relative standard deviations of concentrations of virtual monitoring points within the full spatial extent of the model domain as can be obtained for each timestep.

3 Introduction to the Variogram and to the Traditional Semivariance

Geostatistical analysis expresses the spatial correlation structure of the observations of an environmental variable in terms of the variogram (sometimes also called the semivariogram). The experimental semivariance is defined as one half of the average of squared differences of all data pairs that are separated by a particular lag distance *h*:

$$\gamma(h) = \frac{1}{2}\frac{1}{N_h}\sum_{i=1}^{N_h}\left[Z(s_i) - Z(s_i + h)\right]^2 \qquad (1)$$

where N_h is the total number of data pairs *i* at each lag distance *h*, and $Z(s_i)$ and $Z(s_i + h)$ are the values of *Z* at the corresponding locations (s_i) and $(s_i + h)$. The function $\gamma(h)$ is called the experimental variogram (sometimes also referred to as the empirical variogram or the sample variogram).

In common practice, a certain tolerance is applied to the lag distance *h* in order to arrange the data into classes of lag distance intervals $\overline{h_j}$ (data binning). The experimental semivariance for each lag class can then be estimated to:

$$\hat{\gamma}\left(\overline{h}_j\right) = \frac{1}{2}\frac{1}{N_h}\sum_{i=1}^{N_h}\left[Z(s_i) - Z(s_i + h)\right]^2 \quad \forall\, h \in \overline{h}_j \qquad (2)$$

In this way, the experimental variogram $\gamma(h)$ is an empirical estimate of the variances among pairs of points formed within groups of observations as a function of distance between these observations.

A related concept to the experimental variogram is the variogram cloud, which collects the individual semivariance contributions from all point pairs (without binning of data). Note that in the variogram cloud, each point pair appears only once. If *n* is the total number of observations within a spatial dataset, a full variogram cloud thus consists of Nfull-cloud point pairs according to:

$$N_{full\ cloud} = \frac{n(n-1)}{2} \qquad (3)$$

When compared with the experimental variogram, the variogram cloud allows a subjective impression to be gained of whether the apparent pattern of spatial variation is related to systematic trends in the data, or if the variogram might be influenced by a few unusual points.

For practical reasons, it can be helpful to introduce a maximum spatial separation distance hcutoff up to which point pairs are included into the semivariance estimates. The number of point pairs in the variogram cloud then reduces according to:

$$N_{cloud} \le N_{full-cloud} \quad with \quad N_{cloud} = f(N_{full-cloud}, h_{cutoff}) \qquad (4)$$

In geostatistical applications, the experimental semivariance values are often approximated by a simple continuous model function in which the semi-variance γ is described as a function of lag distance *h*. Such a model fit is referred to as the theoretical variogram. In this context the Gaussian, the exponential or the spherical variogram models are the most commonly used. The spherical model (equation 5) is often considered the best choice when spatial autocorrelation decreases to a point after which it becomes zero.

$$\begin{aligned} \gamma(h) &= C_0 + C_1\left[1.5\, h/a - 0.5\left(h/a\right)^3\right] \quad &&if \quad 0 \le h \le a \\ \gamma(h) &= C_0 + C_1 &&if \quad h > a \end{aligned} \qquad (5)$$

The parameters of the spherical model are the nugget C_0, the partial sill C_1, and the range a. The nugget variance C_0 represents the variability of the observations at small distances (tending towards 0). The empirical nugget variance is unknown since it is the value of the theoretical variogram at the origin. The nugget parameter C_0 is thus estimated by extrapolating the variogram towards $h = 0$. From this point, the semivariance increases until the full sill variance $C_0 + C_1$ is reached at a lag distance called the range (a). The range provides the distance beyond which semivariances remain constant. Up to this distance, observations of the regionalized variable in the sampling locations are correlated, afterwards they must be considered to be spatially independent. Note specifically that the term partial sill is used to denote C_1, whereas the term sill denotes $C_0 + C_1$.

In the context of the assessments presented in this report, we focus on the use of the spherical model. However, it can be useful to also evaluate the use of alternative variogram models. For example the use of a power model might be considered if the established variograms do not have well defined sills.

4 The Point Centred Semivariance

The point centred experimental semivariance is defined as the average of squared differences of within data pairs formed between a particular central point (*cp*) and all other points in the domain that are separated from this central point by a lag distance *h*:

$$\gamma_{cp}(h) = \frac{1}{2}\frac{1}{N_{cp,h}}\sum_{N_{cp,h}}\left[Z(s_{cp}) - Z(s_{cp}+h)\right]^2 \qquad (6)$$

where $N_{cp,h}$ is the total number of data pairs formed with the central point at lag distance *h*, and $Z(s_{cp})$ and $Z(s_{cp} + h)$ are the values of *Z* at the corresponding locations (s_{cp}) and ($s_{cp} + h$).

As for the traditional experimental variogram, the lag distance *h* can be accompanied by a tolerance interval to create distance classes $\overline{h_j}$. For each lag class, the point centred experimental semivariance is then estimated to:

$$\hat{\gamma}_{cp}(\overline{h}_j) = \frac{1}{2}\frac{1}{N_{h,cp}}\sum_{N_{cp,h}}\left[Z(s_{cp}) - Z(s_{cp}+h)\right]^2 \quad \forall\, h \in \overline{h}_{j,cp} \qquad (7)$$

Likewise a point centred variogram cloud can be created that collects the individual point-pair contributions to the final point centred variogram. If *n* is the total number of observations within a spatial dataset, the full point centred variogram cloud consists of $N_{full\ cloud,\ pc}$ point pairs according to:

$$N_{full\ cloud,\ pc} = (n-1) \qquad (8)$$

Comparing the traditional variogram and the point centred variogram it should be noted that different types of variograms are needed for different purposes. For its scope of applications, the point centred variogram $\gamma_{cp}(h)$ does not in fact serve as a substitute for the traditional variogram $\gamma(h)$ in the sense that geostatistical methods like kriging require a model for the traditional variogram. Rather than this, the aim of the point centred variogram is to provide additional information and a clearer description of the spatial continuity around a central reference point.

5 The Interrelation between the Point Centred Variogram and Spatial Representativeness

Most of the commonly used definitions of spatial representativeness are based on the similarity of concentrations of a specific pollutant around a monitoring site. Hence, the representativeness area is defined as the area where the concentration $z(x_i)$ at locations x_i does not differ from the concentration $z(x_{cp})$ measured at the monitoring station located at x_{cp} (central point) by more than a specified threshold Δz. In the following we need to establish a link between the information provided by point centred variography and these limits of the spatial representativeness area.

The point centred semivariance in fact provides a measure of dissimilarity between the pollutant concentrations observed at different locations and the corresponding reference concentration observed at the central point x_{cp}. Let h_{SR} be the lag distance at the limits of spatial representativeness around the central point x_{cp} of a point centred variogram, and $z(x_{cp} + h_{SR})$ the pollutant concentration at locations positioned at this limit. The semivariance at the limits of spatial representativeness can then be calculated to be

$$\gamma(h_{SR}) = \frac{1}{2}\left(z(x_{cp}) - z(x_{cp} + h_{SR})\right)^2 = \frac{1}{2}\left(z(x_{cp}) - \left(z(x_{cp}) + \Delta z_{threshold}\right)\right)^2 \qquad (9)$$

where $\Delta z_{threshold}$ is the maximum permissible deviation of concentrations within the limits of spatial representativeness.

This relationship can then be reduced to:

$$\gamma(h_{SR}) = \frac{1}{2}\left(\Delta z_{threshold}\right)^2 \qquad (10)$$

which immediately provides the relevant threshold value for $\gamma(h_{SR})$ in absolute units of the semivariance. The lag distance h_{SR} can then be computed by inverting the corresponding semivariance model function obtained beforehand from a fit to the experimental data.

When the point centred semivariance is calculated for log-transformed data, the threshold value $\gamma(h_{SR})$ needs to be determined in a slightly different way. In this case equation 10 needs to be modified to:

$$\gamma(h_{SR}) = \frac{1}{2}\left(\ln\left(z(x_{cp})\right) - \ln\left(z(x_{cp} + h_{SR})\right)\right)^2 = \frac{1}{2}\left(\ln\left(z(x_{cp})\right) - \ln\left(z(x_{cp}) + \Delta z_{threshold}\right)\right)^2 \qquad (11)$$

which can be converted to:

$$\gamma(h_{SR}) = \frac{1}{2}\left(\ln\left(\frac{z(x_{cp}) + \Delta z_{threshold}}{z(x_{cp})}\right)\right)^2 = \frac{1}{2}\left(\ln\left(1 + \frac{\Delta z_{threshold}}{z(x_{cp})}\right)\right)^2 \qquad (12)$$

By introducing $\Delta_{relative} z_{threshold}$, which is the maximum relative deviation of concentrations permissible within the limits of spatial representativeness, this relationship can then be further reduced to:

$$\gamma(h_{SR}) = \frac{1}{2}\left(\ln\left(1+\frac{\Delta_{relative}z_{threshold}\cdot z(x_{cp})}{z(x_{cp})}\right)\right)^2 = \frac{1}{2}\left(\ln\left(1+\Delta_{relative}z_{threshold}\right)\right)^2 \qquad (13)$$

In order to establish a suitable reference value for $\Delta_{relative}z_{threshold}$ for the purpose of this exercise we can refer to the data quality objectives (DQO) provided in Annex 1 of the European Directive 2008/50/EC on ambient air quality and cleaner air for Europe [8]. For fixed measurements the uncertainties (expressed at a 95 % confidence level) of the assessment methods are given as:

Table 2. Data quality objectives used as a default input for the similarity criterion thresholds.

PM_{10}	NO_2	Ozone
25 %	15 %	15 %

We need to consider that these DQOs are expressed at the 95 % confidence level, which corresponds to approximately two times the standard deviation *(2σ-level)*, whereas the variogram is conventionally providing semivariance values corresponding to the *1σ-level*.

Considering this necessary conversion, the semivariance threshold value for the lag distance corresponding to the limit of spatial representativeness *(h_{SR})* is thus finally calculated as:

$$\gamma(h_{SR}) = \frac{1}{2}\left(\ln\left(1+\frac{DQO}{2}\right)\right)^2 \qquad (14)$$

(8) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe, Official Journal of the European Union L 152/1 of 11.6.2008

6 Inversion of the Spherical Variogram Model

In order to extract information about spatial representativeness, we need to solve the spherical model equation for the priori unknown lag distance *h*, at which a certain semivariance $\gamma(h)$ is reached. For example, $\gamma(h)$ might then be set to a predefined limit value $\gamma(h_{SR})$ for still accepting spatial representativeness. From equation 5 (describing the spherical variogram model) we consider that if $0 \leq h \leq a$ the semivariance $\gamma(h)$ *is given by:*

$$\gamma(h) = C_0 + C_1\left[1.5\,h/a - 0.5\left(h/a\right)^3\right] \qquad (15)$$

which can be transformed to:

$$\frac{\gamma(h) - C_0}{C_1} = 1.5\,h/a - 0.5\left(h/a\right)^3 \qquad (16)$$

Equation 16 can then easily be rearranged into the general form of the cubic equation:

$$0.5\left(h/a\right)^3 - 1.5\,h/a + \frac{\gamma(h) - C_0}{C_1} = 0 \qquad (17)$$

And then into the depressed cubic form:

$$h^3 - 3a^2 * h + 2a^3\,\frac{\gamma(h) - C_0}{C_1} = 0 \qquad (18)$$

In the general case, a cubic equation with real coefficients has three solutions, some of which may equal each other if they are real, and two of which may be complex non-real numbers. We can find these solutions by following Cardano's method (Gerolamo Cardano, 1545). For doing this, we first define:

$$p = -3a^2 \qquad (19)$$

and

$$q = 2a^3\,\frac{\gamma(h) - C_0}{C_1} \qquad (20)$$

and the discriminant *D* as being:

$$D = \left(\frac{p}{3}\right)^3 + \left(\frac{q}{2}\right)^2 \qquad (21)$$

In the case of $D < 0$ the cubic equation has three real roots. By using the trigonometric method these three solutions can be found to be:

$$h_1 = 2 \cdot \sqrt{\left|\frac{p}{3}\right|} \cdot \cos\left(\frac{\phi}{3}\right)$$

$$h_2 = 2 \cdot \sqrt{\left|\frac{p}{3}\right|} \cdot \cos\left(\frac{\phi}{3} + \frac{2}{3} \cdot \pi\right) \qquad (22)$$

$$h_3 = 2 \cdot \sqrt{\left|\frac{p}{3}\right|} \cdot \cos\left(\frac{\phi}{3} + \frac{4}{3} \cdot \pi\right)$$

where *Φ* is defined as:

$$\phi = \arccos\left(-\frac{q}{2 \cdot \left(\left|\frac{p}{3}\right|\right)^{\frac{3}{2}}} \right) \qquad (23)$$

From these three solutions h_1, h_2, h_3 one particular solution h_{select} needs to be selected that is applicable for the inverted variogram model. For this selection, the criterion

$$0 \leq h_{select} \leq a \qquad (24)$$

is applied. This is justified, because we started these derivations by assuming equation 5, which defines the spherical variogram model for exactly this range of *h* values.

In the case of D > 0 the cubic equation has one real root and two conjugated complex roots. In the case of D = 0 the cubic equation has three real roots, one of which is duplicated. However, in our application inverting the spherical variogram model we did not so far encounter cases of D ≥ 0. For brevity, the solutions for the cases of D > 0 and of D = 0 are thus not presented here.

Note that as an alternative procedure, an option for the numerical inversion of the variogram model has been implemented into the point centred variography toolbox, too. This numerical solution is in the same way restricted to be found within the boundaries of *0* and the range *a*.

If, for the evaluation of spatial representativeness, an inversion of the variogram model is used, but the required semivariance $\gamma(h)$ is not reached within the range of the variogram (i.e. the variogram's total sill is smaller than the required $\gamma(h)$ *value*), a specific exception handling needs to be applied. In such cases we chose to consider the distance of spatial representativeness to equal the value of the variogram's range parameter. This interpretation is, however, not necessarily universally applicable. The specific exception handling procedures will be explained in more detail in the data treatment and results section of this report.

7 Inversion of the Exponential and of the Gaussian Variogram Model

Though the inversion of the exponential variogram model and of the Gaussian variogram model have not been used for the assessments presented in this report, these functionalities have been implemented into the point centred variography toolbox. For completeness, the corresponding mathematical relations are briefly described here:

In the **exponential model** the semivariance *γ(h)* is defined as:

$$\gamma(h) = C_0 + C_1\left[1 - \exp\left(-\frac{h}{r}\right)\right] \quad (25)$$

which can be rearranged to:

$$\frac{\gamma(h) - C_0}{C_1} = 1 - \exp\left(-\frac{h}{r}\right) \quad (26)$$

and:

$$\exp\left(-\frac{h}{r}\right) = 1 - \frac{\gamma(h) - C_0}{C_1} \quad (27)$$

Finally, the inversion of the exponential model is calculated by:

$$h = -r \cdot \ln\left(1 - \frac{\gamma(h) - C_0}{C_1}\right) \quad (28)$$

In the **Gaussian model** the semivariance *γ(h)* is defined as:

$$\gamma(h) = C_0 + C_1\left[1 - \exp\left(-\frac{h^2}{r^2}\right)\right] \quad (29)$$

which can be rearranged to:

$$\frac{\gamma(h) - C_0}{C_1} = 1 - \exp\left(-\frac{h^2}{r^2}\right) \quad (30)$$

and:

$$\exp\left(-\frac{h^2}{r^2}\right) = 1 - \frac{\gamma(h) - C_0}{C_1} \quad (31)$$

Finally, the inversion of the Gaussian model is calculated by:

$$h = \sqrt{-r^2 \cdot \ln\left(1 - \frac{\gamma(h) - C_0}{C_1}\right)} \qquad (32)$$

8 Numerical Tools

All the computer codes used in this analysis have been programmed in the R environment for statistical computing which is freely available under the GNU General Public License ([9]). In order to extend the necessary capacities, we have made use of and included functionalities provided by the following contributed packages:

For geostatistical techniques, projections and spatial analyses:

- "sp" ([10]), ([11])
- "gstat" ([12])
- "rgdal" ([13])
- "raster" ([14])

For data manipulation, filtering and working with time series:

- " data.table" ([15])
- "zoo" ([16])

For evaluations of numerical performance:

- "microbenchmark" ([17])

For graphical display of results:

- "lattice" ([18])
- "grid" ([19])

In the course of the preparation of the Antwerp dataset and the subsequent code implementation and evaluation of the point centred variography methodology, the following functions have been consolidated into a dedicated toolbox (Tables 3 and 4):

([9]) R Core Team (2016): R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. *http://www.R-project.org/* .
([10]) Pebesma, E.J. and Bivand, R.S. (2005): Classes and methods for spatial data in R. R News 5 (2), *http://cran.r-project.org/doc/Rnews/* .
([11]) Bivand, R.S., Pebesma, E.J. and Gomez-Rubio, V. (2013): Applied spatial data analysis with R, Second edition. Springer, NY. *http://www.asdar-book.org/* .
([12]) Pebesma, E.J., (2004): Multivariable geostatistics in S: the gstat package. Computers & Geosciences, 30: 683-691.
([13]) Bivand, R.S., Keitt, T. and Rowlingson, B. (2016): rgdal: Bindings for the Geospatial Data Abstraction Library. R package version 1.1-9. *https://CRAN.R-project.org/package=rgdal* .
([14]) Hijmans, R.S. (2015): raster: Geographic Data Analysis and Modeling. R package version 2.5-2. *https://CRAN.R-project.org/package=raster* .
([15]) Dowle, M., Srinivasan, A., Short, T. and Lianoglou, S. with contributions from Saporta, R. and Antonyan, E. (2015): data.table: Extension of Data.frame. R package version 1.9.6. *https://CRAN.R-project.org/package=data.table* .
([16]) Zeileis, A. and Grothendieck, G. (2005): zoo: S3 Infrastructure for Regular and Irregular Time Series. Journal of Statistical Software, 14(6), 1-27. doi:10.18637/jss.v014.i06.
([17]) Mersmann, O. (2015): microbenchmark: Accurate Timing Functions. R package version 1.4-2.1. *https://CRAN.R-project.org/package=microbenchmark* .
([18]) Deepayan, S. (2008): Lattice: Multivariate Data Visualization with R. Springer, New York. ISBN 978-0-387-75968-5
([19]) The 'grid' package is part of R. R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Table 3. Toolbox for Point Centered Variography. Part 1: Functions for the implementation and evaluation of the point centred variography methodology.

Function	Arguments and their default values	Description
variogramPC	object data locations = coordinates(data) cPoints cutoff cutoffDefaultMPL = 1/3 cloud = FALSE allwaysList = FALSE projected = TRUE logscale = FALSE ...	Calculates a set of point centred experimental variograms (PCV) from a spatially referenced dataset.
variogramPC.applyToZoo	object data coordsData ...	Helper function and wrapper that can be used to apply variogramPC to all rows of a zoo-like data frame object.
variogram.fromCloud	variogramCloud cutoff width = cutoff/15 boundaries = NULL ...	Calculates an experimental variogram from a variogram cloud.
getLag	gamma model interval = c(0, range) forceNumeric = FALSE	Calculates a corresponding lag-distance h given a variogram model and a certain semivariance threshold (gamma).
compCaption	x	Returns a formatted caption of a component (including pollutants, but also landcover, population density, etc).

plot.VariogramFit	variogram cloud model timestamp component = NA stationType = NA logSemiVar.threshold = NA	Helper function used to visualize a point centered variogram model fit, and to relate it to the x-y data of the variogram and the variogram cloud.
print.VariogramFit.TS	variogram.TS cloud.TS model.TS columns rows ...	Helper function used to visualize a temporally ordered series of point centered variogram model fits on a multipanel plot.
print.VariogramFit.dualTS	varData.1 component.1 stationType.1 varData.2 component.2 stationType.2 rows ...	A variant of print.VariogramFit.TS that can be used to visualize a side by side comparison of two different sets of variogram fits.

Table 4. Toolbox for Point Centered Variography. Part 2: Functions for the preparation of data files for the FAIRMODE intercomparison exercise on spatial representativeness.

Function	Arguments and their default values	Description
checkFile	file dataDir	Helper function used in loading files of the FAIRMODE SR intercomparison exercise.
readAntwerp_Stations	file dataDir = NA	Helper function to read and convert files of the FAIRMODE SR intercomparison exercise: applied to time series files of existing monitoring stations
readAntwerp_virtualStations	file dataDir = NA timestep = 3600 origin = "2012/01/01"	Helper function to read and convert files of the FAIRMODE SR intercomparison exercise: applied to time series files of virtual stations
readAntwerp_StationConfig	file dataDir = NA	Helper function to read and convert files of the FAIRMODE SR intercomparison exercise: applied to configuration files of existing monitoring stations
readAntwerp_virtualStationConfig	file dataDir = NA	Helper function to read and convert files of the FAIRMODE SR intercomparison exercise: applied to configuration files of virtual stations
aggregate_to_deltaT	x FUN = sum ... new.deltaT new.units = c("auto", "secs", "mins", "hours", "days", "weeks")	Helper function that aggregates a "zoo" object into subsets along a coarser index grid. This function is a convenience wrapper around an aggregate.zoo{zoo} call.

makeNoisy	x
	
	sd.rel = 0
	
	sd.abs = 0
	
	GVM = NULL
	
	GVM.sq = NULL
	
	GVM.minVar =
	if(is.null(detectionLimit))
	0
	else
	(detectionLimit/3)^2
	
	returnVar = FALSE
	
	detectionLimit = NULL
	
	substitute = 0.5 * detectionLimit
		Helper function that is used to add noise to a time series object of class "zoo".

summaryTable_FAIRMODE.1	left right leftName rightName filterName digits = 0	Helper function that combines the results of some time series aggregations into a suitable table.
lmOrtho	x y = NULL	Orthogonal regression (see ANNEX B of the Guide to the Demonstration of Equivalence of Ambient Air Monitoring Methods).
write.FAIRMODEmodJRC	data coordinates file dir	

9 Results and Discussion

The algorithms for point centred variography have been applied to the aggregated time series of the Antwerp dataset (time series of 14-day averages of PM_{10}, NO_2 and Ozone, and 1-day averages of PM_{10}).

For the purpose of demonstrating the sequences of data analyses applied, Figure 3 illustrates four different examples of point centred variogram clouds, experimental variograms, and variogram model fits obtained for the virtual station cp17 (location corresponding to the existing monitoring station "Schoten"). These examples of point centred variograms have been constructed using the 14-day average values of PM_{10} and NO_2 concentrations for the time interval 29.01.2016 until 11.02.2016.

In a first step of the analysis, point centred variogram clouds have been calculated for all data pairs formed between the central point cp17 and the other virtual monitoring points located within a cutoff-distance of 14315 m around cp17 (shown as blue circles in figure 3). This cutoff-distance of 14315 m corresponds to one third of the diagonal of the bounding box of the total Antwerp modelling domain. Based on these variogram clouds, 15 equidistant lag classes have been formed to calculate the experimental variograms (red squares used in figure 3).

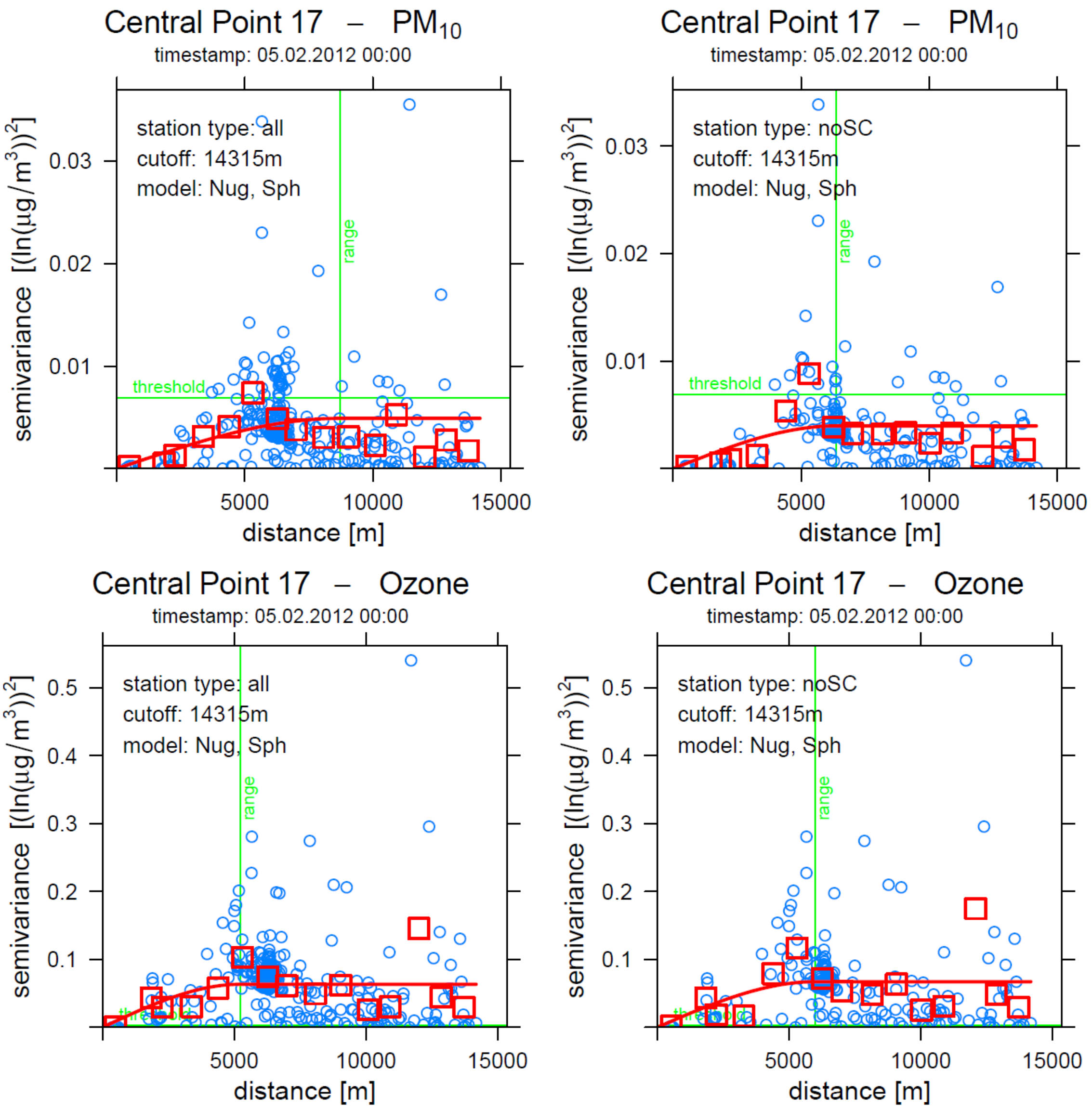
Subsequently, the experimental semivariance values have been fitted with a continuous model function (red lines used in figure 3). The fitted model is a spherical variogram model with nugget effect. Model fits have been performed by using the fit.variogram function from the gstat package.

During a first exploration we tried to establish variogram model fits using the immediate pollutant concentrations (µg/m^3). However, the success rate for achieving acceptable model fits on this direct scale was not satisfactory and for a larger proportion of the data no model fit was found by the automatic algorithm at all. We thus decided to apply a log transformation to the concentration values first. Working on the log-scale indeed improved the success rate and quality of the model fits immediately.

The evolution of the fitted model curve is compared to the semivariance threshold associated with the maximum relative deviation of concentrations permissible within the limits of spatial representativeness (horizontal green line, corresponding to a maximum deviation of concentrations of 15% for NO_2). For additional comparisons, the range distance is also highlighted in the plots.

The illustrations in figure 3 furthermore compare the results obtained by using data from all virtual monitoring points (panels to the left) to results obtained by using the non street canyon points only. The motivation for this comparison was that cp17 ("Schoten") is an urban background site which by anticipation might have had stronger similarities with the 241 non street canyon points than with the full dataset, which contains also 100 points located inside street canyons (note that effective numbers of points that have been used for cp17 are somewhat less than 341 and 241, as not all virtual points are within the reach of the cutoff-distance).

Figure 3. Examples of point centred variograms obtained for virtual station cp17 on 14-day average values of PM_{10} and NO_2.



The averaging time interval of these examples is 29.01.2016 until 11.02.2016 (timestamp 05.02.2016 - 00:00 o'clock at the midpoint of this interval). A cutoff-distance of 14315 m has been applied, which corresponds to one third of the diagonal of the bounding box of the Antwerp modelling domain.

Blue circles indicate the point centred semivariance values of all paired observations formed between individual points and the corresponding central point **(variogram cloud)**. Red squares are the average values of semivariance formed within the 15 lag distance classes **(experimental variogram)**. Red line is the **variogram model** (spherical model with nugget effect fitted to the experimental variogram).

Horizontal green lines mark the **semivariance thresholds** associated with the maximum relative deviation of concentrations permissible within the limits of spatial representativeness. Vertical green lines mark the **range distances** of the variogram models. These vertical lines are not visible when the estimated range falls beyond the cutoff distance used in the variogram calculations.

A complete set of all point centred variograms established on the time series of 14-day average PM_{10}, NO_2 and Ozone concentrations for all three selected virtual stations cp7 (corresponding to "Antwerpen-Linkeroever"), cp17 (corresponding to "Schoten") and cp216 (corresponding to "Borgerhout-Straatkant") is provided in ANNEX I. Note, however, that point centred variograms for the 1-day average time series have not been included in the ANNEX I for practical reasons (these series would comprise nearly 1100 pages). However, a summary of results obtained for the 1-day average time series of PM_{10} is included in the tables presented in ANNEX II.

From inspecting the detailed results presented in ANNEX I, we can summarise that after applying the log-transformation the success rate for the convergence of the subsequent model fitting was close to 100%. However, it is nevertheless observed that the overall fitting quality of the spherical models is not particularly good. This basically means that the principal structure of the applied variogram model cannot fully capture the observed relation between semivariances and increasing lag-distances among points.

Following the model fitting of point centred variograms, individual estimates for the limits of spatial representativeness (dist.SR) have been calculated by inverting the fitted variogram model functions. The full set of results obtained from these inversions is presented in ANNEX II, while table 2 provides a summary statistics of these estimates.

In these tables, dist.SR is the estimated limit of spatial representativeness which has been derived based on the assumed maximum permissible deviations of concentrations (25% for PM_{10}, 15% for NO_2 and Ozone). If this threshold of concentration deviations was not reached within the range of the variogram (i.e. the variogram's total sill is smaller than the concentration threshold), dist.SR has been considered to be equal to the variogram's range parameter. NA values indicate that neither the concentration threshold nor the range was reached within the selected cutoff distance of 14315 m. The feature "criterion" indicates which of these three alternatives had been applied in the specific cases.

In summary, all estimates of dist.SR related to NO_2 and Ozone could be based on the selected threshold of concentration deviations. A similar observation applies to estimates of dist.SR for PM_{10} for the traffic station located at cp216. For the background stations located at cp7 and p17 a significant proportion of the dist.SR estimates had to be either based on the range parameter value or have been labelled NA, because neither the concentration threshold nor the range was reached within the cutoff distance. This indicates frequent situations where the effective range of spatial representativeness is relatively large (i.e. the central point is at times representative of nearly all the points within the cutoff distance).

Median values for the spatial representativeness distance of PM_{10} extend between 2277 m (cp17_all for daily PM_{10}) and 10864 m (cp7_noSC for 14-day average PM_{10}) for the two background site related central points at cp7 and p17. The median value for PM_{10} for the traffic site related central point cp216 ranges between 1529 m (cp216_all for daily PM_{10}).and 2586 m (cp216_SC for 14-day average PM_{10}).

For Ozone 14-day averages the estimated limits of spatial representativeness for the two background site related central points at cp7 and p17 have median values between 262 m (cp17_noSC) and 1111 m (cp7_all).

For NO_2 the estimated limits of spatial representativeness are clearly shorter than for PM_{10} and Ozone. Particularly for the traffic site cp216 a zero distance of spatial representativeness was found. These findings are consistent with the observations that have already been inferred from the general statistical characterizations of the dataset (table 1 and figure 2), where the total spatial variances of NO_2 were shown to be significantly larger than the spatial variances of PM_{10} and Ozone.

As a general observation, the estimated values for dist.SR are larger when variograms are based on data which are restricted to the corresponding station area types (_noSC for the background stations at cp7 and p17, and _SC for the traffic station at cp216), as compared to those results obtained by considering all virtual monitoring points simultaneously. This was anticipated, as the set of monitoring points becomes more homogeneous when street canyon and non-street canyon sites are distinguished from another. The only exceptions are in the case of Ozone for the background stations cp7 and p17, where the dist.SR values are a little smaller for the groups cp7_noSC and cp17_noSC as compared to the groups cp7_all and cp17_all.

With regard to the integration time-scales, the estimated distances of spatial representativeness tend to be higher for the PM_{10} data based on 14-day averages than for PM_{10} based on daily values (daily values have not been investigated for NO_2 and Ozone; they can thus not be compared).

In summary, the three virtual monitoring stations can consistently be ranked for all three pollutants: The distance of spatial representativeness tends to be highest for virtual station cp7 (corresponding to the urban background station Antwerpen-Linkeroever), second highest for virtual station cp17 (corresponding to the urban background station Schoten) and lowest for virtual station cp216 (corresponding to the traffic station Borgerhout-Straatkant).

Table 5. Summary statistics of estimated limits of spatial representativeness (dist.SR) obtained from the inversion of point centred variograms.

PM_{10} (based on 14-day average concentrations, ΔPM_{10}-threshold = 25%)						
dist.SR	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
min	3822 m	5976 m	1381 m	1836 m	0 m	1325 m
1st quartile	6739 m	8729 m	2074 m	2518 m	1063 m	1863 m
median	**7457 m**	**10864 m**	**2670 m**	**3251 m**	**1925 m**	**2586 m**
3rd quartile	9477 m	12413 m	3530 m	4880 m	4015 m	4334 m
max	12928 m	14278 m	8720 m	7101 m	9634 m	10606 m
criterion used	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
estimated from threshold	62%	65%	92%	81%	100%	100%
estimated from range	19%	4%	8%	19%	0%	0%
NA because dist.SR > cutoff	19%	31%	0%	0%	0%	0%

NO_2 (based on 14-day average concentrations, ΔNO_2-threshold = 15%)						
dist.SR	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
min	87 m	148 m	0 m	45 m	0 m	0 m
1st quartile	116 m	218 m	52 m	87 m	0 m	0 m
median	**161 m**	**273 m**	**69 m**	**130 m**	**0 m**	**0 m**
3rd quartile	210 m	391 m	120 m	178 m	0 m	0 m
max	385 m	679 m	175 m	237 m	0 m	0 m
criterion used	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
estimated from threshold	100%	100%	100%	100%	100%	100%
estimated from range	0%	0%	0%	0%	0%	0%
NA because dist.SR > cutoff	0%	0%	0%	0%	0%	0%

Ozone (based on 14-day average concentrations, ΔO_3-threshold = 15%)						
dist.SR	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
min	0 m	0 m	131 m	143 m	0 m	0 m
1st quartile	505 m	772 m	223 m	203 m	0 m	387 m
median	**1111 m**	**929 m**	**298 m**	**262 m**	**180 m**	**658 m**
3rd quartile	2068 m	1627 m	455 m	452 m	298 m	1261 m
max	3491 m	3103 m	783 m	723 m	1086 m	4365 m
criterion used	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
estimated from threshold	100%	100%	100%	100%	100%	100%
estimated from range	0%	0%	0%	0%	0%	0%
NA because dist.SR > cutoff	0%	0%	0%	0%	0%	0%

PM_{10}-daily (based on daily average concentrations, ΔPM_{10}-threshold = 25%)						
dist.SR	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
min	854 m	1242 m	600 m	750 m	0 m	0 m
1st quartile	4272 m	5433 m	1585 m	1883 m	142 m	1257 m
median	**5864 m**	**7124 m**	**2277 m**	**2653 m**	**1529 m**	**2348 m**
3rd quartile	7972 m	9610 m	3797 m	4585 m	3829 m	4445 m
max	14149 m	14295 m	9217 m	11378 m	13704 m	14193 m
criterion used	**cp7_all**	**cp7_noSC**	**cp17_all**	**cp17_noSC**	**cp216_all**	**cp216_SC**
estimated from threshold	63%	63%	88%	82%	98%	98%
estimated from range	20%	15%	12%	18%	0%	0%
NA because dist.SR > cutoff	17%	22%	0%	0%	2%	2%

Underlying time series of point centred variograms have been established for virtual monitoring stations **cp7** (location corresponding to "Antwerpen-Linkeroever"), **cp17** (location corresponding to "Schoten") and **cp216** (location corresponding to "Borgerhout-Straatkant"). A comparison is made between results obtained by considering all 341 virtual monitoring points (columns denoted as **_all**), and results obtained by using only the 241 non-street-canyon points for the evaluation of virtual monitoring stations cp1 and cp17 (columns denoted as **_noSC**), and only the 100 street-canyon points for the evaluation of virtual monitoring station cp216 (columns denoted as **_SC**). Note that a more detailed presentation of individual results is provided in ANNEX II.

10 Limitations and Open Questions

From our experiences obtained in applying the point centred semivariance to the Antwerp dataset, we can summarise a set of limitations and open questions that have been observed. These aspects deserve a closer evaluation in future developments:

10.1 Features of the concentration field not well captured by the fitted variogram models

From closer inspections of the calculated variogram clouds, we can see that different features of the concentration field, which are potentially relevant with regard to the limits of spatial representativeness, are not always well captured by the fitted variogram models. Specifically we can note that:

1. The concept of a spatial representativeness distance (dist.SR) implies the assumption of a radially symmetric area of spatial representativeness. This corresponds to the use of an omni-directional variogram. This approach is probably oversimplified and more detailed information (i.e. about the anisotrophy of the variogram) could be extracted from the data. In future developments of the toolbox it would be recommendable to extend the evaluation by applying directional variograms. Example given, this could be done by building directional variograms for the 0° - 90°, 90° - 180°, 180° -270°, and 270° – 360° angular classes. A finer classification, although it would probably be desirable, might be limited by the availability of datapoints (such angular zones could contain too little data from which useful statistics may be derived), or by the computational capabilities (see points 10.3). An evaluation with directional variograms using overlapping angular classes could thus be considered as an alternative (e.g., 0° - 90°, 45° – 135°, 90° -180°, 135° – 225°, etc).

   It is anticipated that the use of directional point centred variograms could also contribute to solving parts of the issues that are summarised in the following point 2. However, from a programming point of view it has to be taken in mind that a certain effort would be required to smoothly integrate directional variograms into the yet existing code. This is because the datastructure for directional variograms provided by the external functionalities of the underlying gstat package differs from the one used for the omni-directional variogram.

2. Certain statistical features of the concentration field that could be relevant to the spatial representativeness are not well captured by the variogram model. They can, however, be seen by using the variogram cloud. This is basically the case, because the variogram model describes the average evolution of spatial variability as lag distance increases. It does, however, not capture the local fluctuations of spatial variability around this average property. These local discontinuities in spatial variability are nevertheless of potential relevance for the concept of spatial representativeness.

   Such local instationarities of semivariance values are an important feature of the concentration field of the Antwerp dataset and in principle are not describable by a fitted variogram model only. This also means that the examined concentration field does not fully satisfy the requirements of geostationarity. This lack of geostationarity would firstly be of importance and to be considered if the results of the variography were be intended to be used for traditional geostatistical applications like kriging interpolation. The intended use of the variograms is however different here and the requirement of geostationarity can possibly be somewhat relaxed within the scope of this application. Nevertheless, the local variation of $\gamma(h)$ is an important feature to be paid attention for when inferring the limits of spatial representativeness.

   The resulting heteroscedasticity which becomes observable in the variogram cloud is a feature that is in principal not reflected by the semivariance model. Because of heteroscedasticity (non-constant variance of the random process over a region) two potential issues arise:

First, heteroscedasticity opposes the stationarity assumption where variability is independent from location. Traditional variogram fitting by ordinary least squares regression (OLS) might thus be compromised. In consequence, on might need to apply GLS (generalized least squares) or GLM (generalized linear model) techniques instead.

Second, the instationarity of local variances can in fact further restrict the extent of the area of spatial representativeness within the limits already imposed by the general evolution of semivariance. This effect is not reflectable by the variogram model, but would require additional information to be considered, as could possibly be described by the use of a general variance model (e.g., the general concept and informative basis provided in Lark 2009, Pinheiro and Bates 2000). However, the introduction of a suitable generalized spatial variance function model would certainly be a difficult and non-trivial task.

In other words, these considerations also point towards an essential conceptual question: Are the limits of spatial representativeness determined by the average evolution of spatial variability with increasing lag distances as described by the fitted variogram model? Or are these limits rather expressed by the fluctuations around this model as they can be observed from the variogram cloud? The answer to this question might well depend on the intended use of the spatial representativeness evaluation outcomes. For example, the results obtained from fitted variogram models could reasonably serve for the purpose of model calibration, whereas the requirements for the assessment of the exceedance of air quality limit values might be different.

3. With this present study we focused on the use of a spherical variogram model. However, it is not intrinsically obvious that the spherical model is the optimal choice and it could be worth evaluating different variogram models as an alternative. A parameter free approximation of the experimental variogram might also be useful. In some of the variogram results, a drop of semivariance was observed beyond a certain point of lag distances. Such drop effect is hardly describable by any of the conventional variogram models. In such cases, a systematic adjustment of the cutoff parameter might lead to a better solution.
4. For this present study we have established the point centred variogram based on a modification of the traditional variogram. It is however a common observation in geostatistics that traditional variograms often suffer in practice from the effects of heteroscedasticity and clustering. One practical solution to overcome at least part of these problems can be the use of the family of relative variograms (the pairwise relative variogram, the general relative variograms, etc.). Functionalities for a "pairwise relative point centred variogram" have already been considered in the development the point centred variography toolbox which has been described here, and would certainly deserve a closer evaluation.

10.2 Remarks regarding the criteria deployed for the limits of the spatial representativeness area

1. For this exercise we have selected a relative concentration criterion in order to define the limits of spatial representativeness. The relative concentration thresholds have been deduced from the information about data quality objectives (DQO) provided in the European Directive 2008/50/EC, which refer to measurements averaged over the periods considered by the limit values. However, depending on the time-scales and the range of concentrations, other threshold levels might be considered. It can also be discussed if relative concentration thresholds are an optimal choice. The use of relative thresholds might potentially distort the results in subregions with low absolute concentrations levels. It could be considered, whether a combination of relative and absolute concentration thresholds would be preferable.

2. It is not inherently clear how to handle situations where the total sill of the point centred variogram is smaller than the selected delta concentration threshold. In this exercise we have chosen to then take the range of the variogram as the limit of spatial representativeness. However, other interpretations could be possible. For example, one might argue that in such cases the spatial variability within the concentration field is always lower than the selected threshold value and that the central point would thus be always representative for the full region within the scope of the given delta concentration limits.
3. In addition to the criterion used for the deviation of concentrations, introducing a frequency criterion to the time series evaluations (i.e. how often the threshold of deviations in concentrations is exceeded) could be investigated. This does not seem to be applicable to the 14 day data (too few data points), but could be considered for the daily data.

10.3 Remarks regarding the numerical procedures

1. For reasons of computational efficiency, the toolbox procedures are currently limited to the evaluation of datasets containing a few hundreds of spatial locations. For very large datasets, the calculations will become exceedingly slow and will finally be impractical. The numerical bottleneck is the computation of the variogram cloud, which in its current version is performed by the external functionalities of the underlying gstat package.
2. In the context of fitting the variogram models, a weak convergence of the optimization algorithm was sometimes observed (e.g., by internal warning messages received). One might try to evaluate different fitting procedures (however, limitations are imposed by the underlying gstat package), or to reduce the number of fitted parameters (e.g., by fixing the sill value beforehand).

10.4 Remarks regarding the choice of datapoints

1. Within this report, point centred variograms have been established with regard to the three different central points and geolocalised concentrations obtained for 341 virtual monitoring points. The time series data for these 341 virtual locations have been extracted from the RIO-IFDM-OSPM model chain outputs. However, for the preparation of the FAIRMODE intercomparison exercise on spatial representativeness it is also intended to add a certain amount of additional random noise to these time series data. This is motivated by the aim of reproducing a realistic simulation of "real world" monitoring stations and diffusive sampler time series. It would thus be informative to repeat the point centred variograms analysis using these "noisy data", too.
2. As an alternative to the use of the 341 virtual monitoring points the analysis could also be based on a random subsampling of the annual gridded data. However, no timeseries information would be available in that case.

11 Conclusions

Depending on the spatial scale of the investigation, point centred variography places a monitoring station in the context of the local or regional air quality pattern. It thereby enables systematic evaluation of the spatial relationship between point observations of pollutant concentrations at this monitoring site and the corresponding concentration fields within its immediate and / or wider environment. Point centred variography can thus provide valuable information with regard to the spatial representativeness of the air quality monitoring site. The point centred variogram does not, however, serve as a substitute for the traditional variogram in the sense that geostatistical methods like kriging require a model fitted for the traditional variogram.

Time series of spatial representativeness results have been inferred from the Antwerp dataset for three selected monitoring station locations. Statistical summaries of these results have been tabulated and detailed results are documented within the annexes.

With regard to the transferability and generalisation of results, it needs to be pointed out that in this exercise the evaluation of spatial representativeness was specifically done from the methodological perspective of the point centred variography. A comparison with results obtained by other spatial representativeness approaches or based on different conceptualizations is not necessarily simply one-to-one. It should rather be anticipated that the integration of information obtained by different spatial representativeness methodologies requires a certain degree of technical effort and of expert knowledge to be applied.

A set of recommendations has been provided that can be used for planning further developments of the methodology and that would deserve closer evaluations. These proposals do specifically include suggestions for (i) possible variations of the underlying type of the variogram (directional variogram, relative variograms), (ii) modifications of the variogram model functions, (iii) the criteria deployed for defining the limits of the spatial representativeness area, (iv) the numerical procedures, and (v) the pre-treatment and selection of datapoints.

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Annexes

Annex 1. Point centred variograms for PM_{10}

Point centred variograms obtained from log-transformed concentration time series for virtual stations cp7, cp17 and cp 216 of the Antwerp dataset:

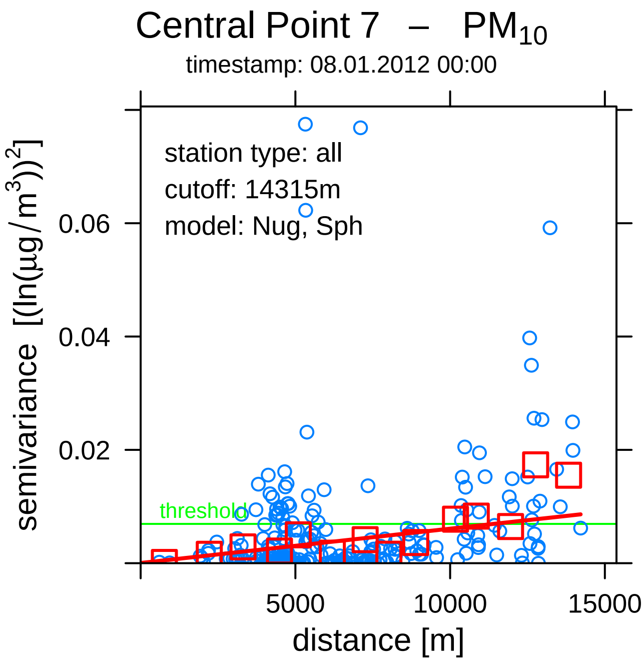
- time series of point centred variograms calculated on 14-day average concentrations
- variogram model fits using a spherical model with nugget effect
- identification of an effective distance of spatial representativeness

Part 1: PM_{10}

Note that plots on the **left side** display the point centred variography results obtained by using data from all 341 virtual monitoring points. Plots on the **right side** display the results obtained by using only the 241 non-street-canyon points for the point centred variograms of virtual monitoring stations cp7 and cp17, and only the 100 street-canyon points for the point centred variograms of virtual monitoring station cp216.

Blue circles indicate the point centred semivariance values of all paired observations formed between individual points and the corresponding central point (**variogram cloud**). Red squares are the average values of semivariance formed within the 15 lag distance classes (**empirical variogram**). Red line is the **variogram model** (spherical model with nugget effect fitted to the empirical variogram).

Horizontal green lines mark the **semivariance threshold** associated with the maximum relative deviation of concentrations permissible within the limits of spatial representativeness. Vertical green lines mark the **range distance** of the variogram model. This vertical line is not visible when the estimated range falls beyond the cutoff distance used in the variogram calculations.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0.04
0.06
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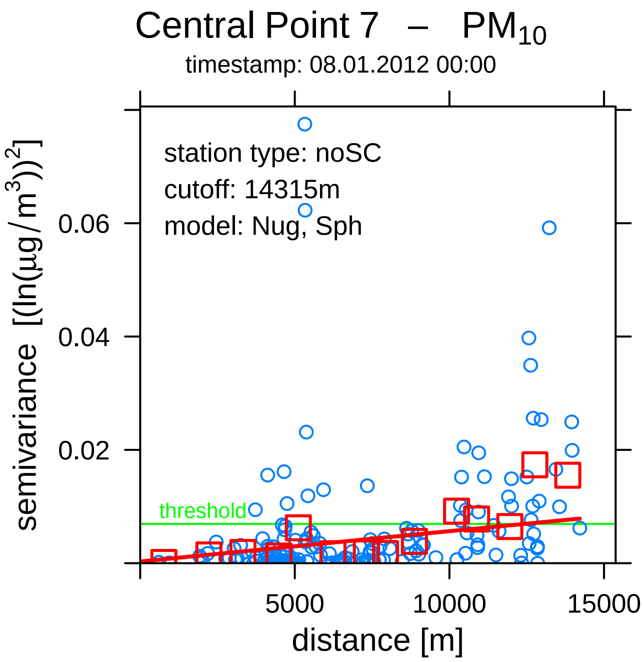
10000
15000
distance [m]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10000
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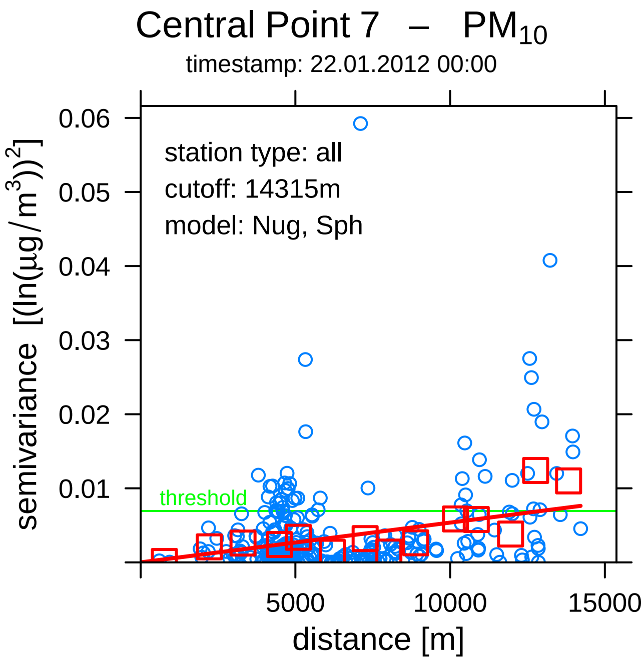
distance [m]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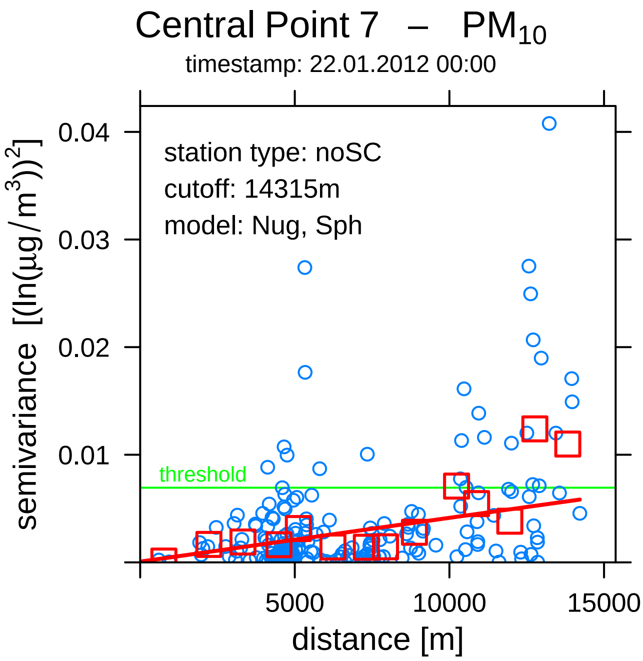
10000
15000
distance [m]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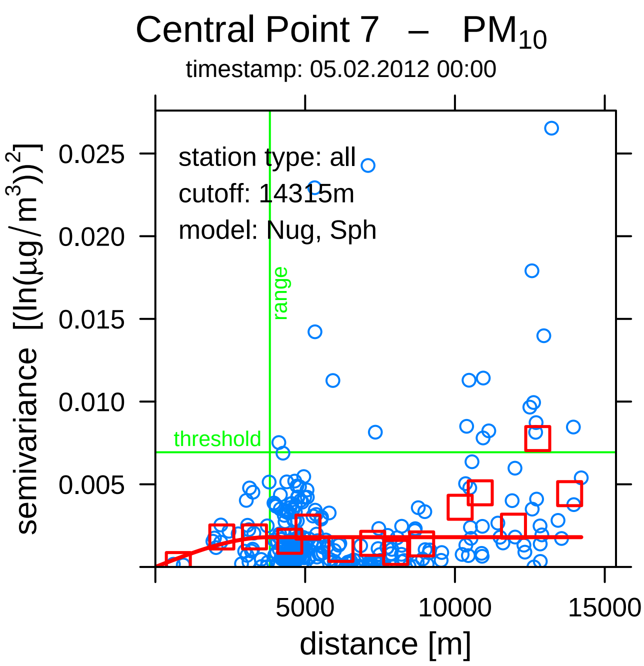
15000
distance [m]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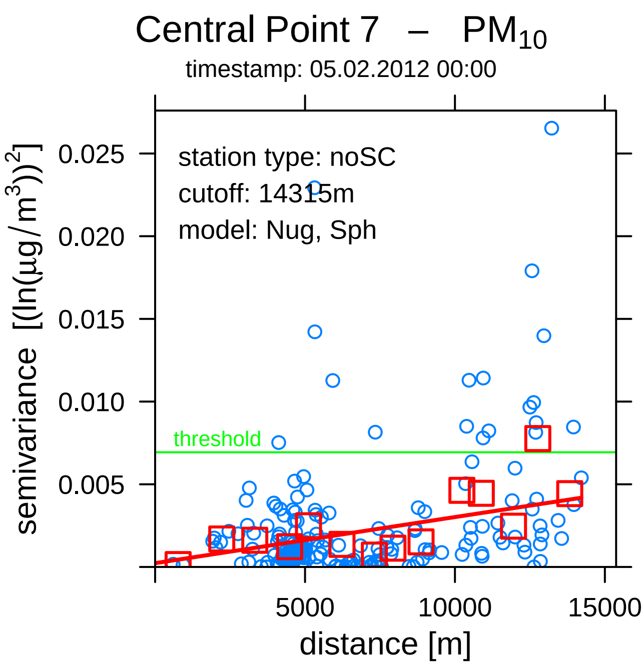
5000
10000
15000
distance [m]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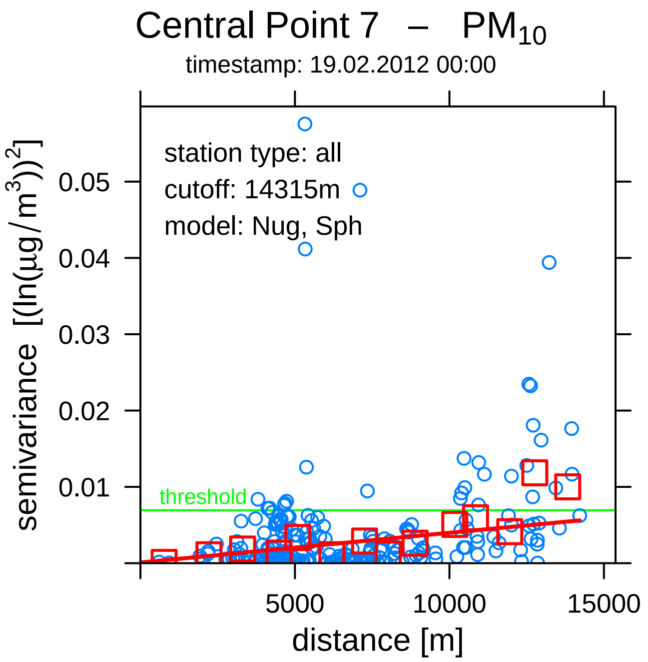
distance [m]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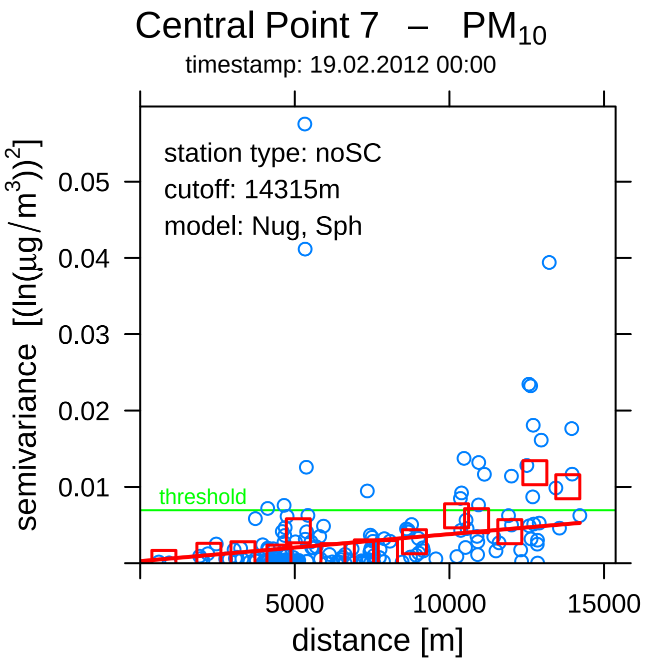
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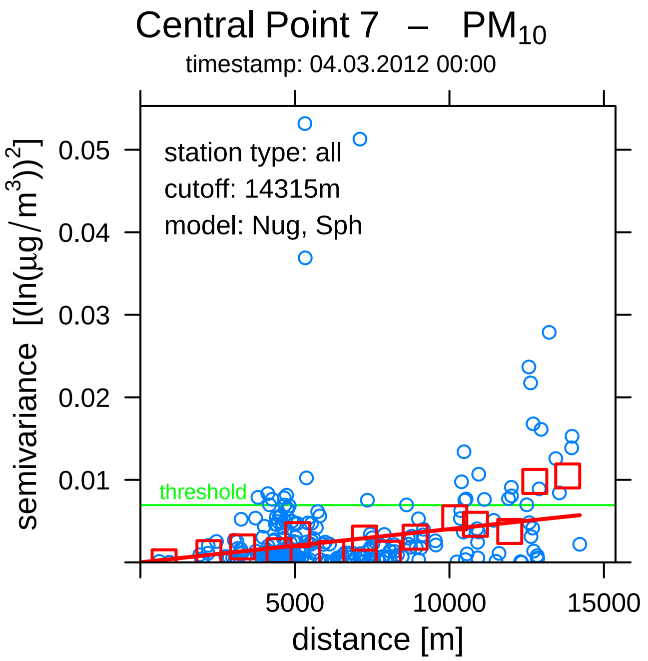
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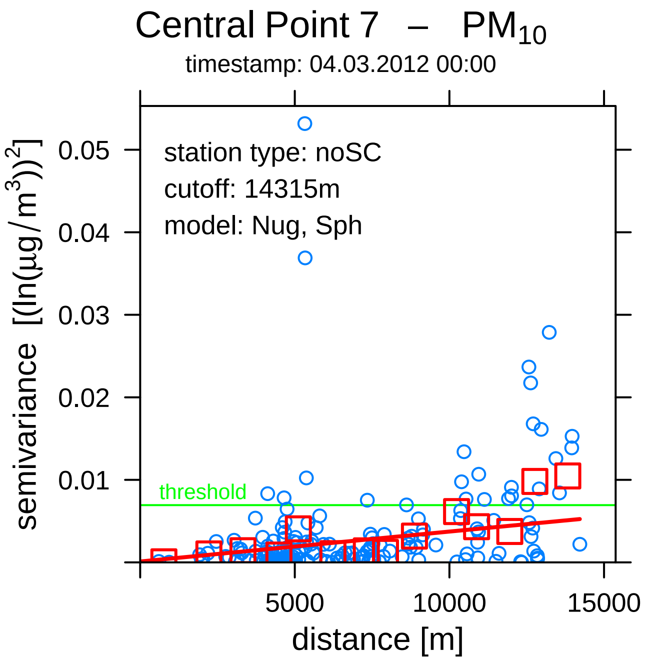
distance [m]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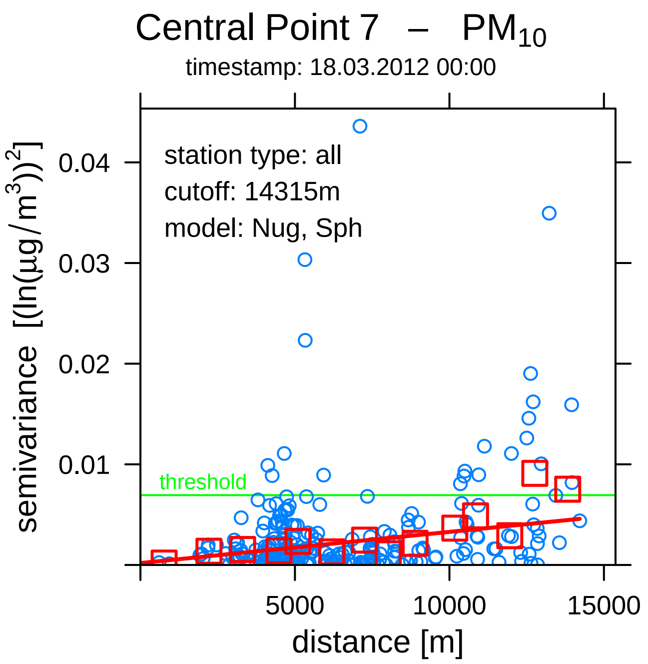
distance [m]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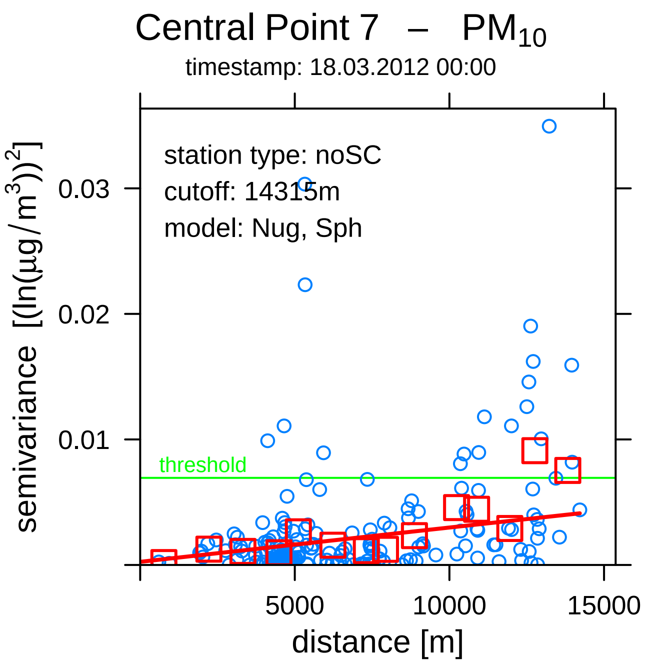
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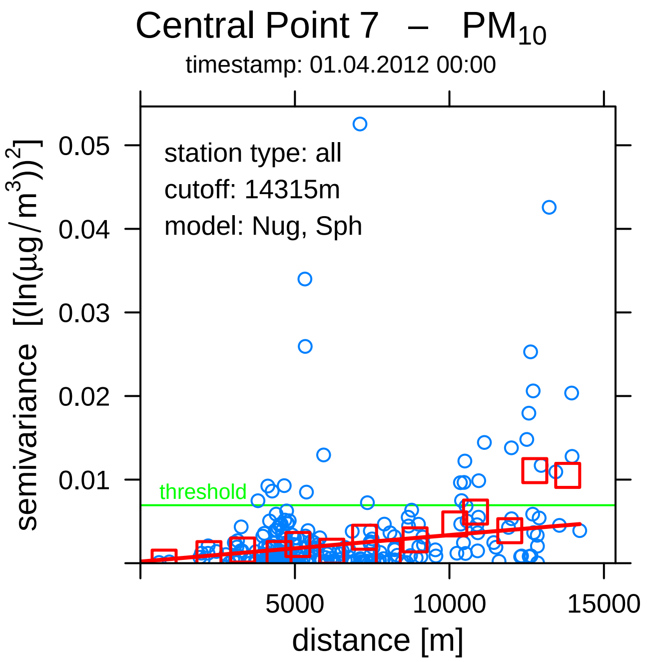
distance [m]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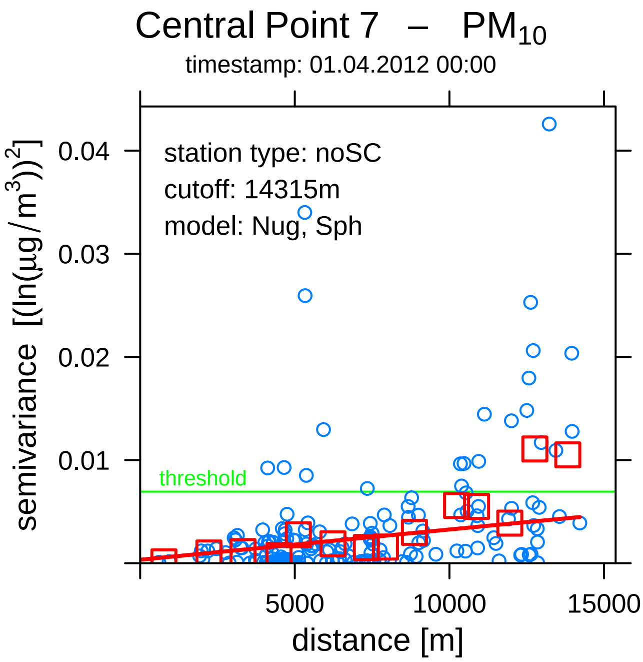
0.04
0.05
5000
10000
15000
distance [m]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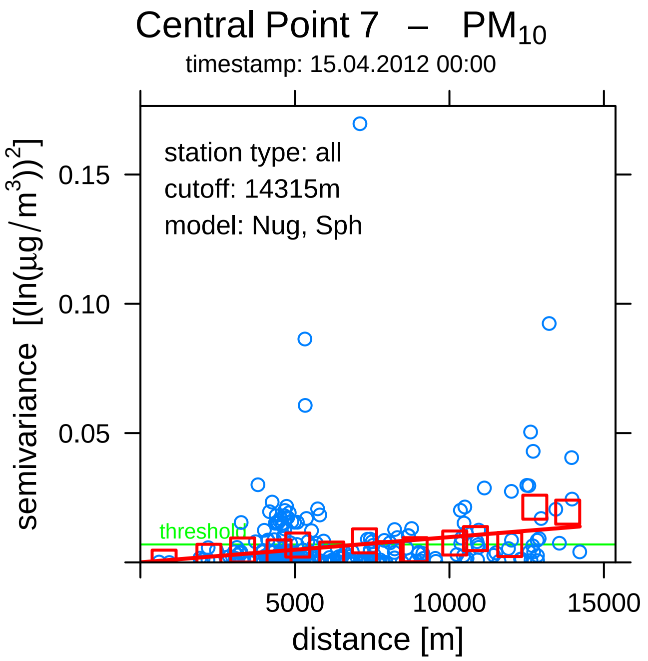
0.03
0.04
5000
10000
15000
distance [m]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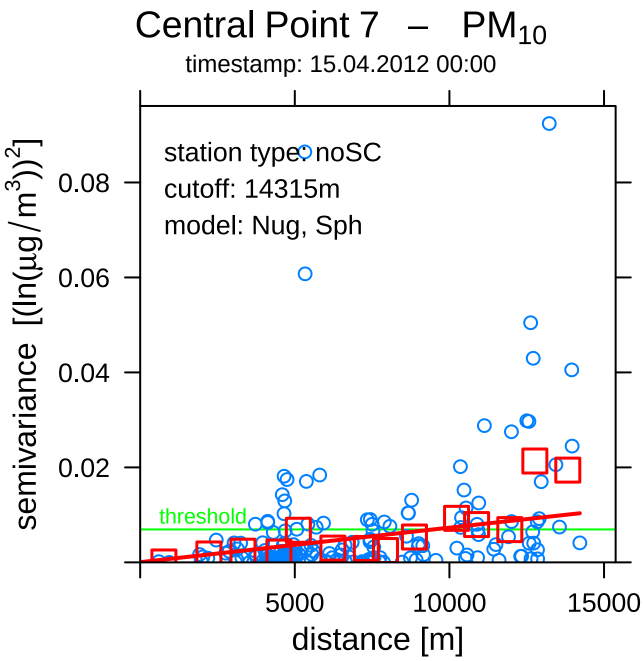
15000
distance [m]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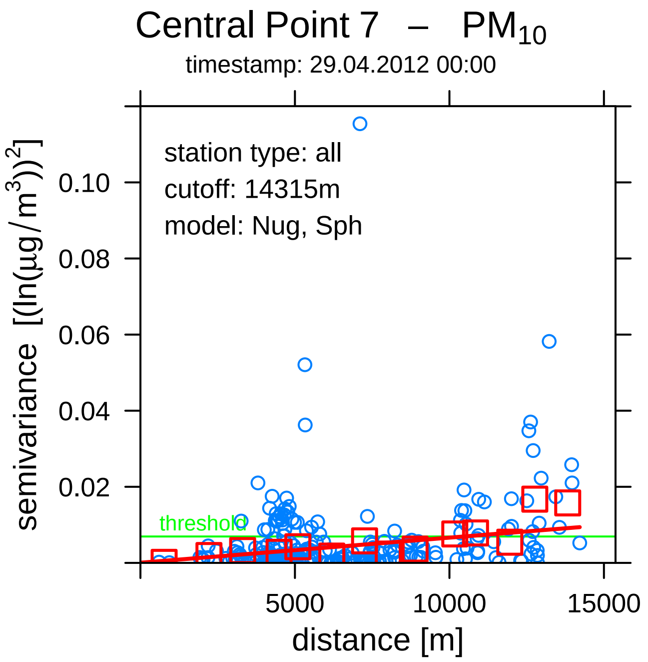
15000
distance [m]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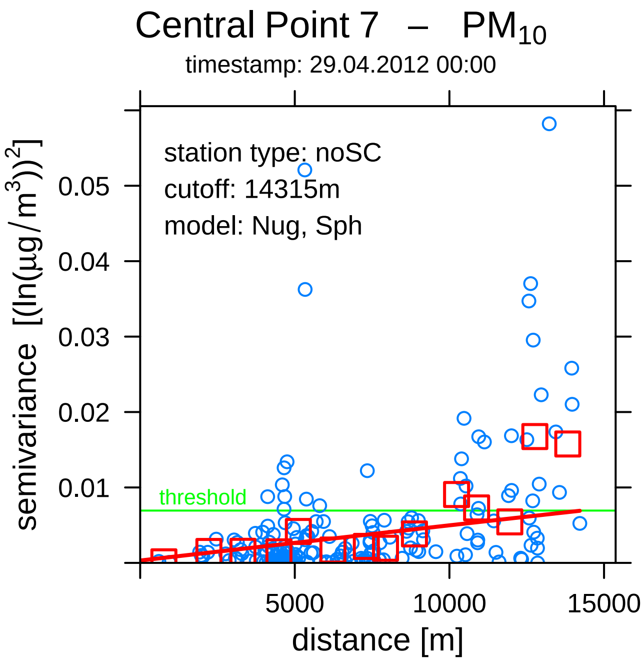
distance [m]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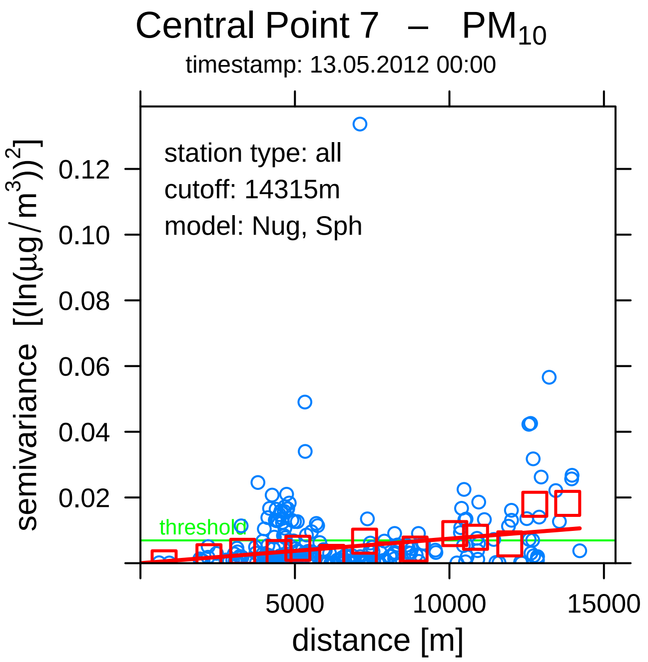
distance [m]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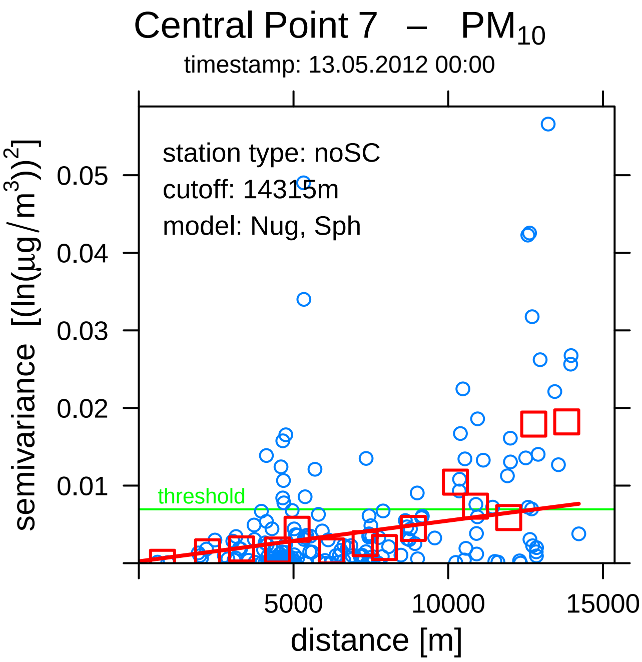
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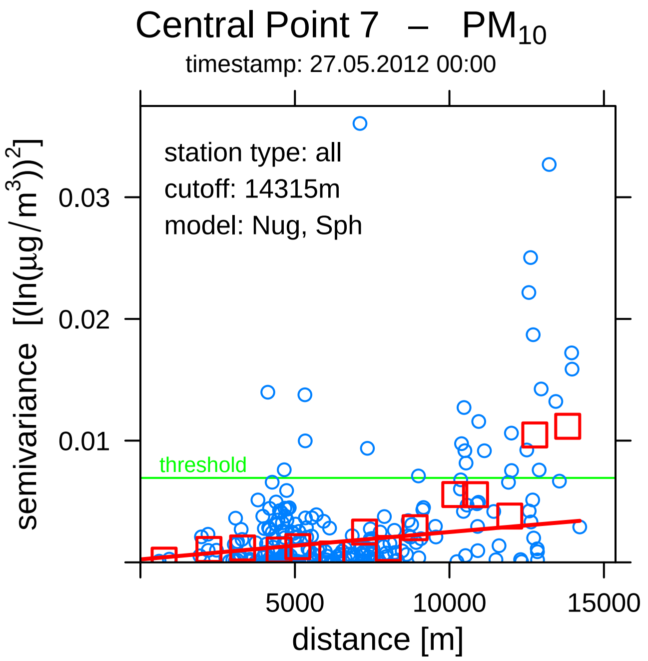
distance [m]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10000
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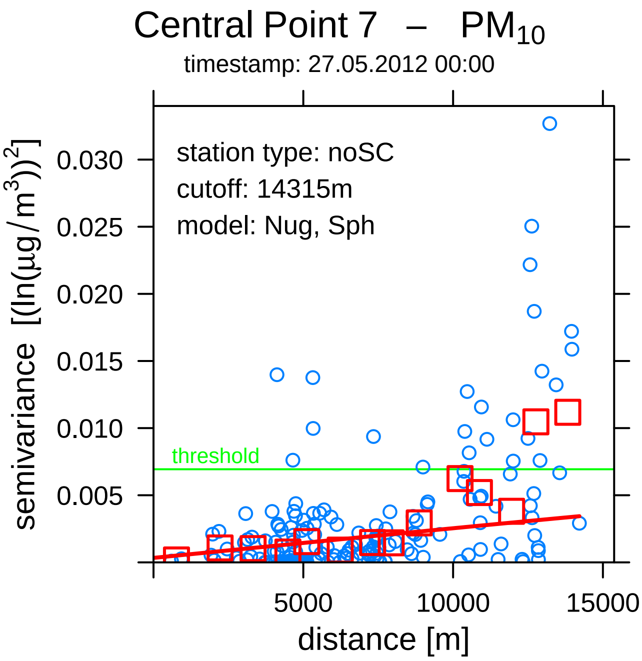
distance [m]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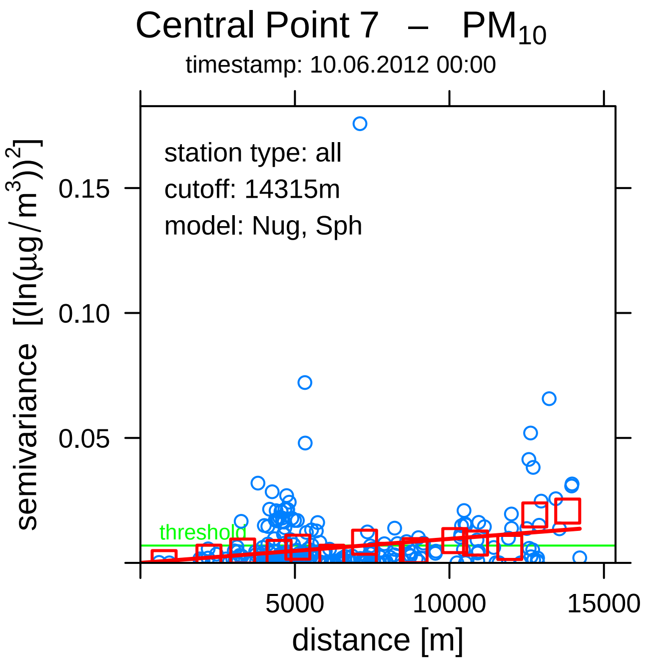
0.030
5000
10000
15000
distance [m]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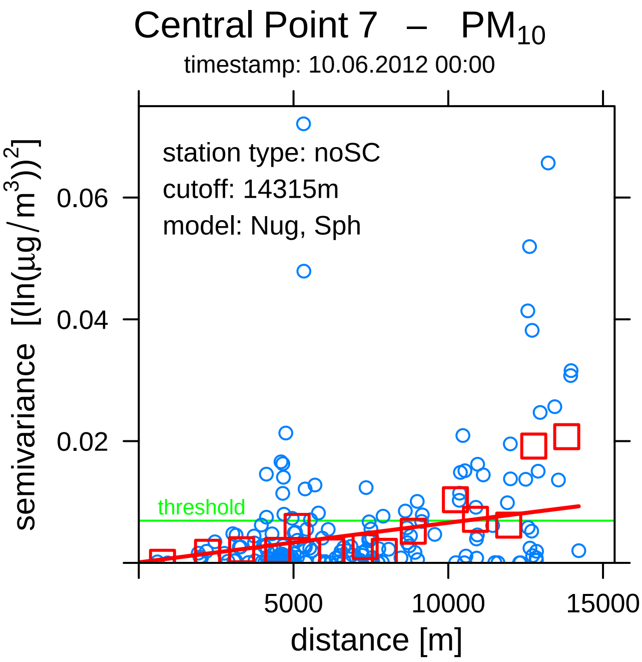
5000
10000
15000
distance [m]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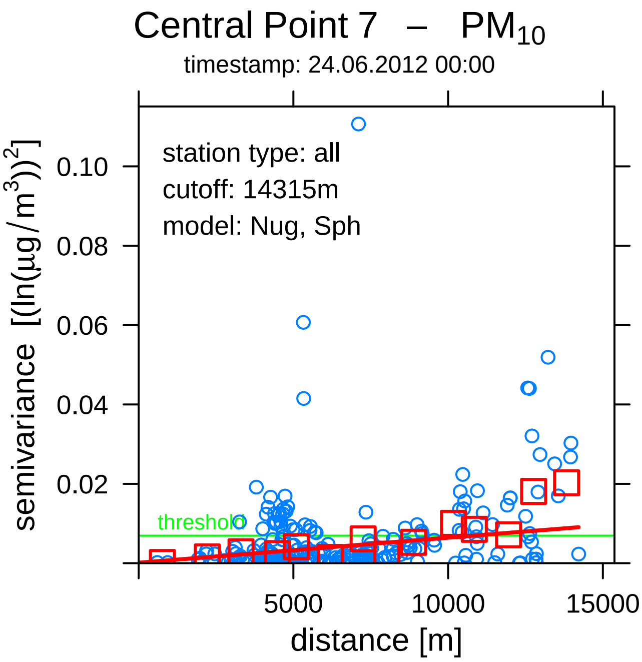
15000
distance [m]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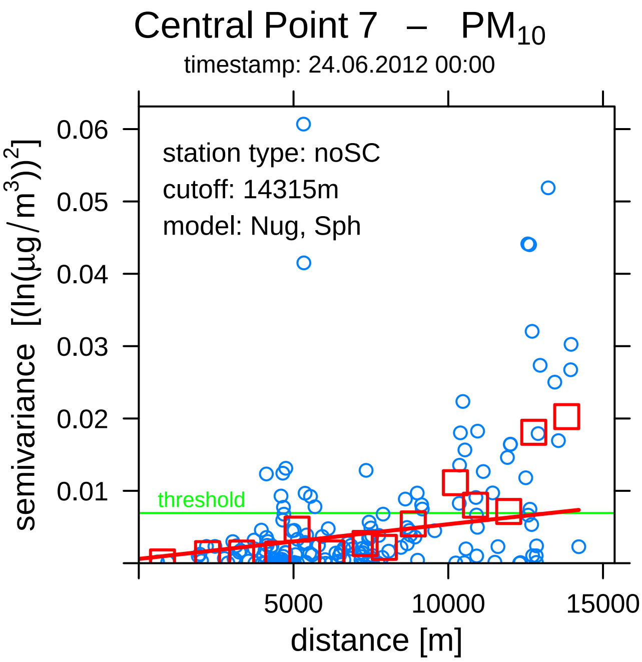
5000
10000
15000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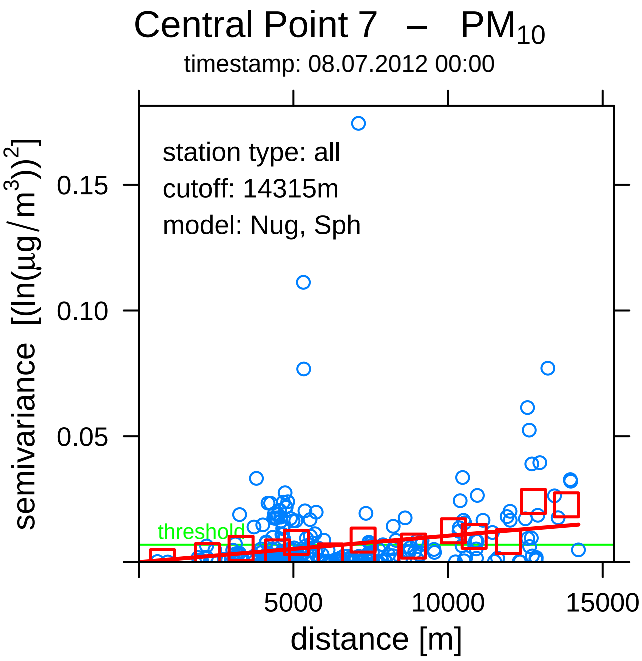
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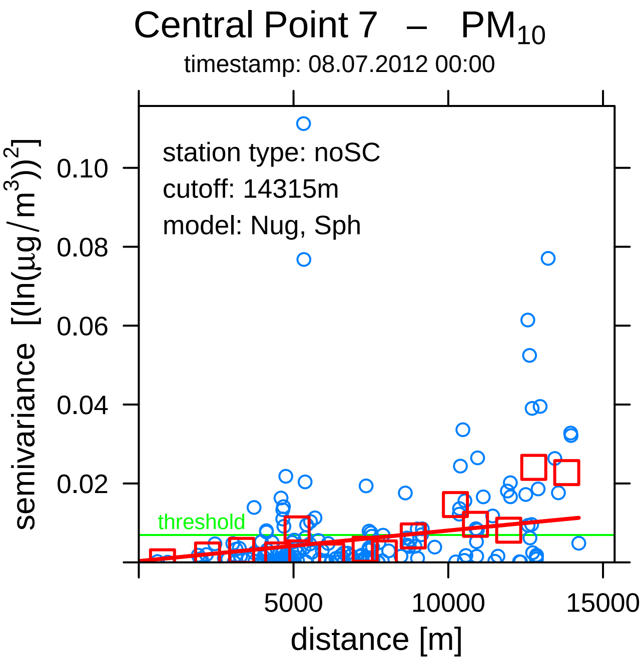
0.15
5000
10000
15000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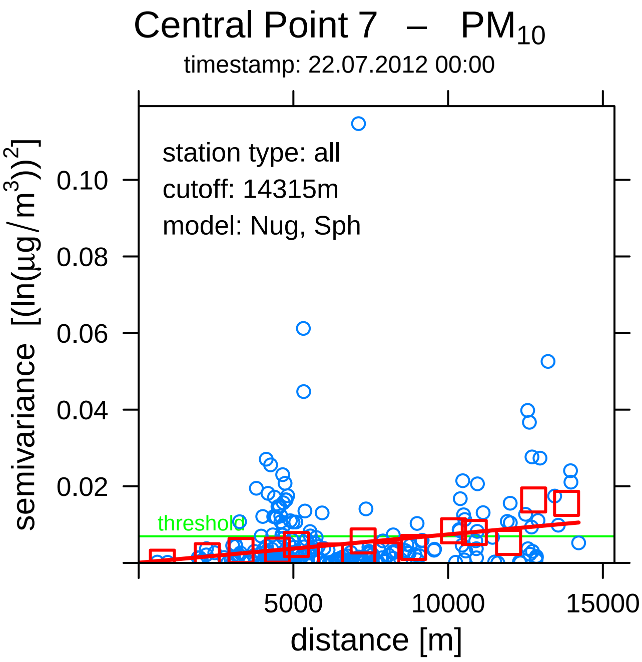
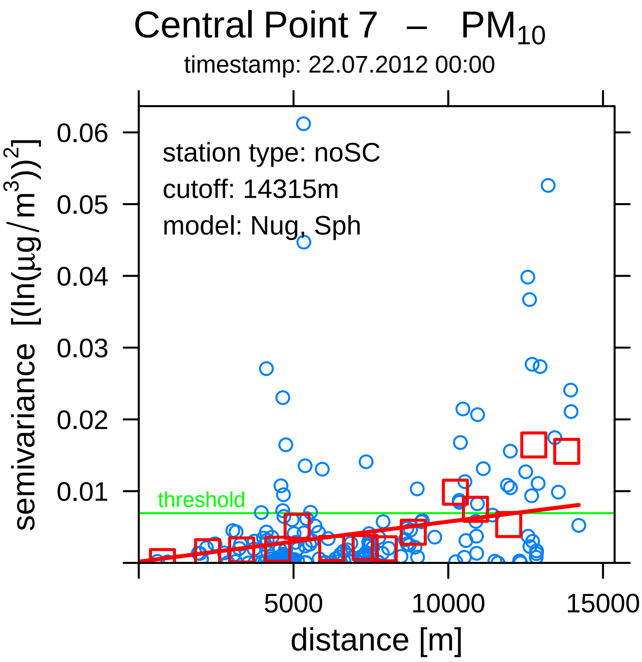
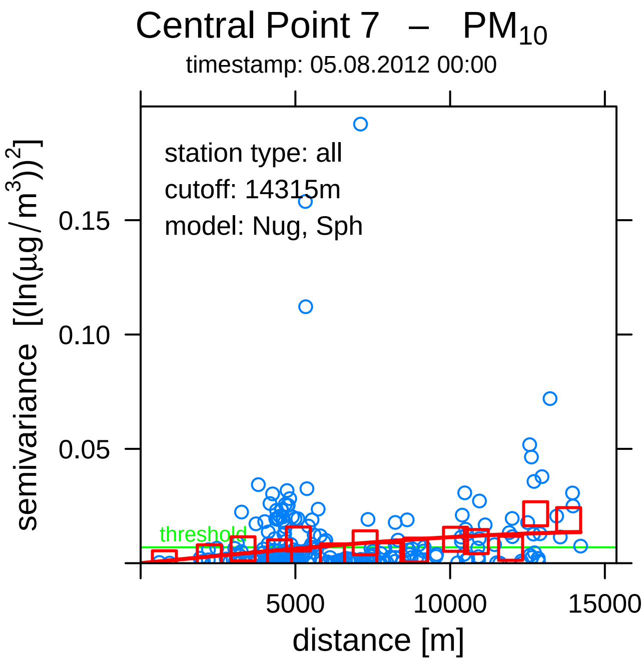
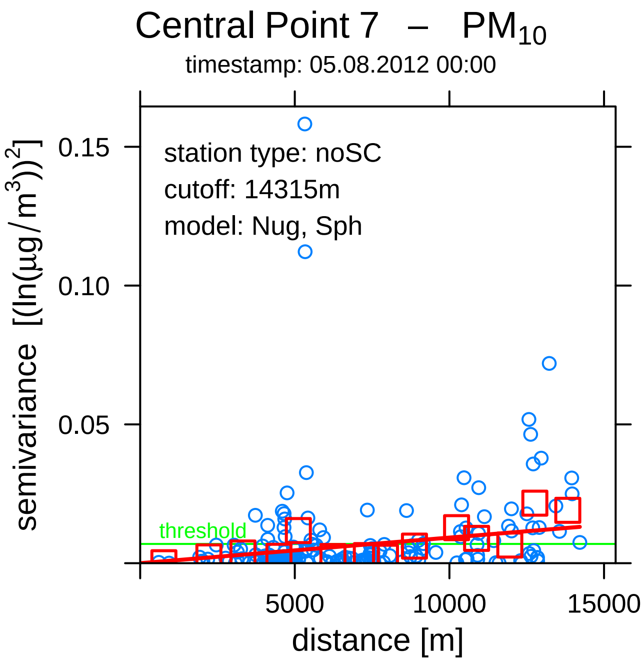
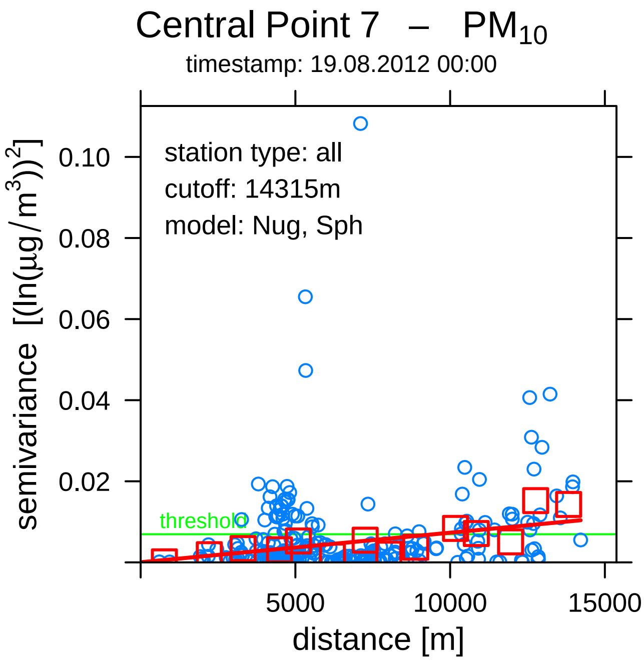
0.04
0.06
0.08
0.10
5000
10000
15000

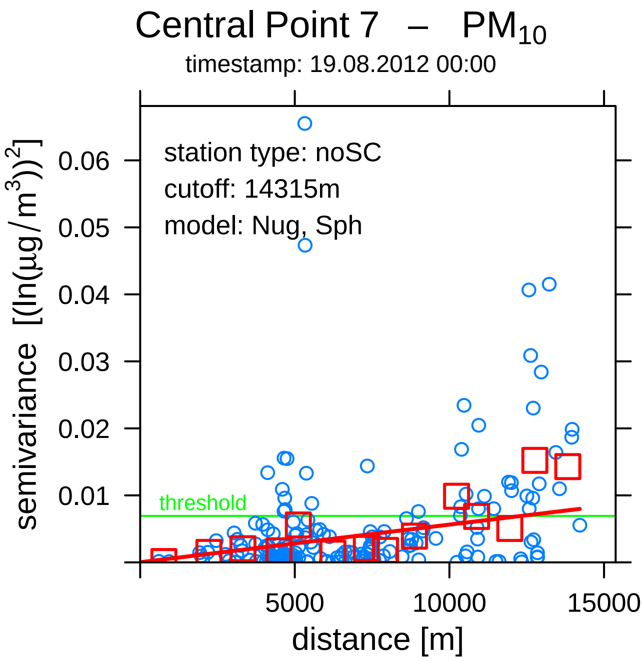

Central Point 7 – PM10
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000

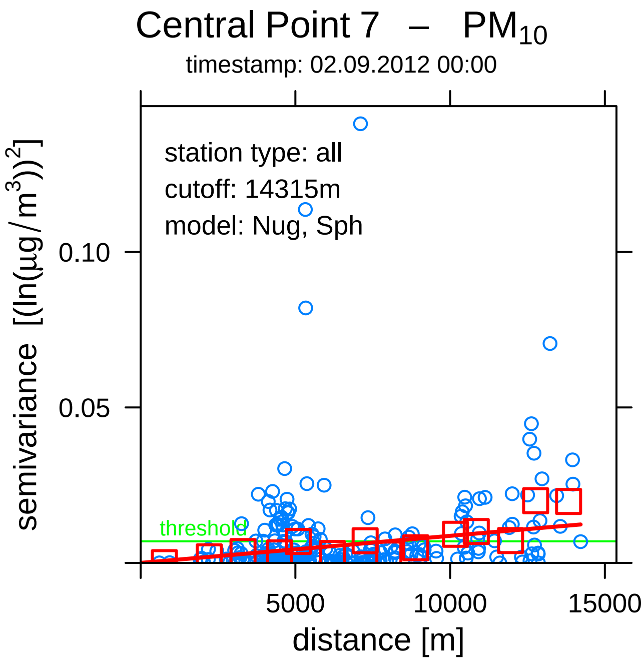

Central Point 7 – PM10
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000

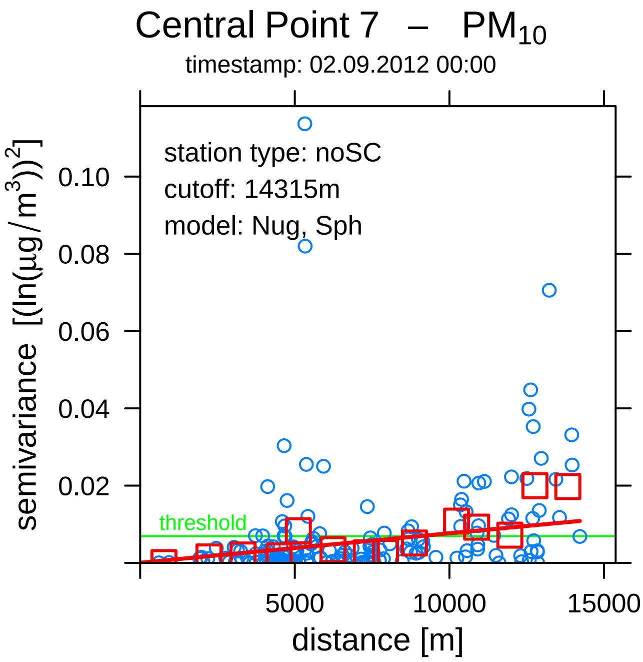

Central Point 7 – PM10
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

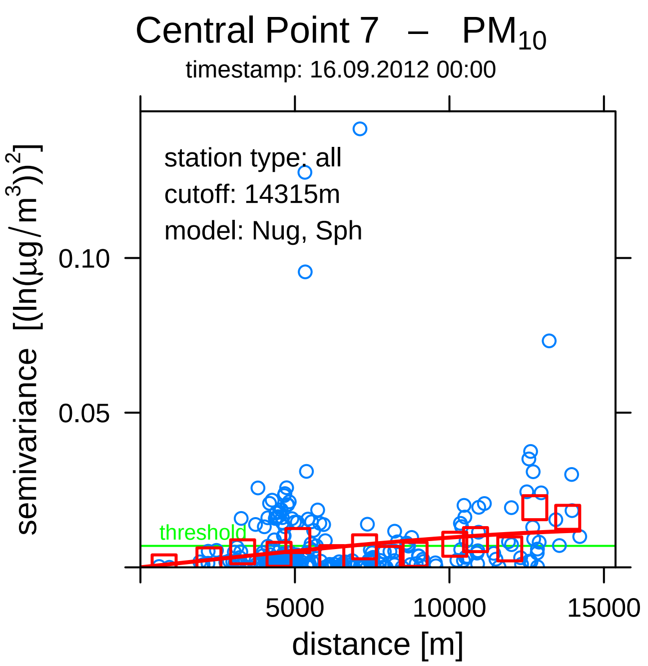

Central Point 7 – PM10
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

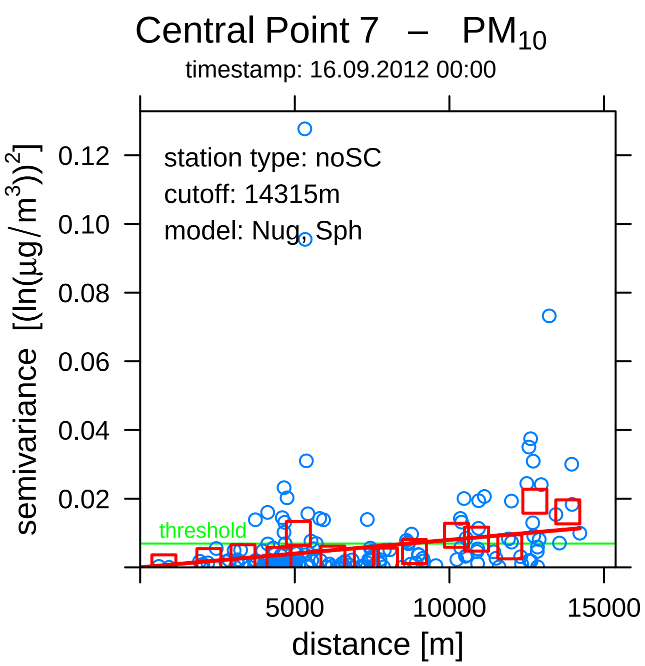

Central Point 7 – PM10
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

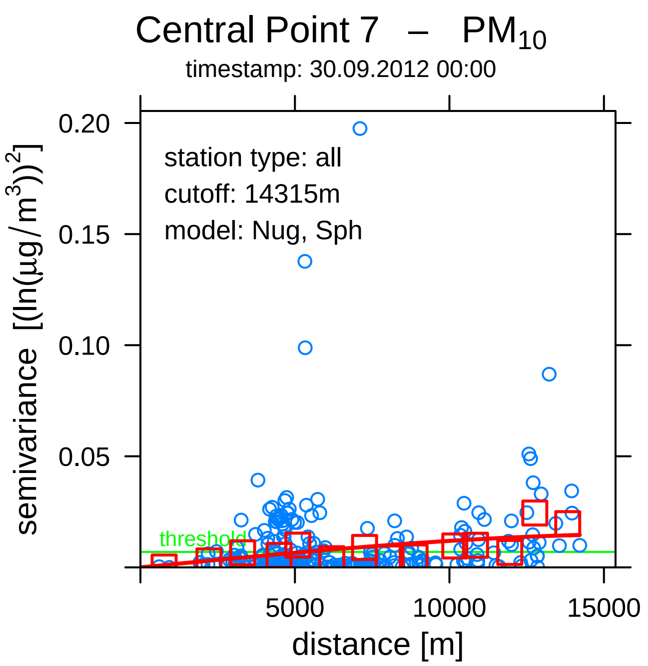

Central Point 7 – PM10
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000
distance [m]

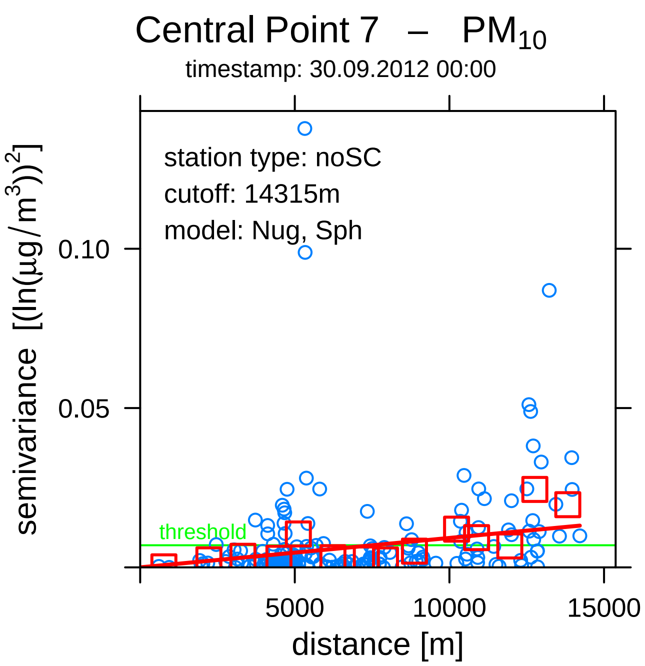

Central Point 7 – PM10
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
5000
10000
15000
distance [m]

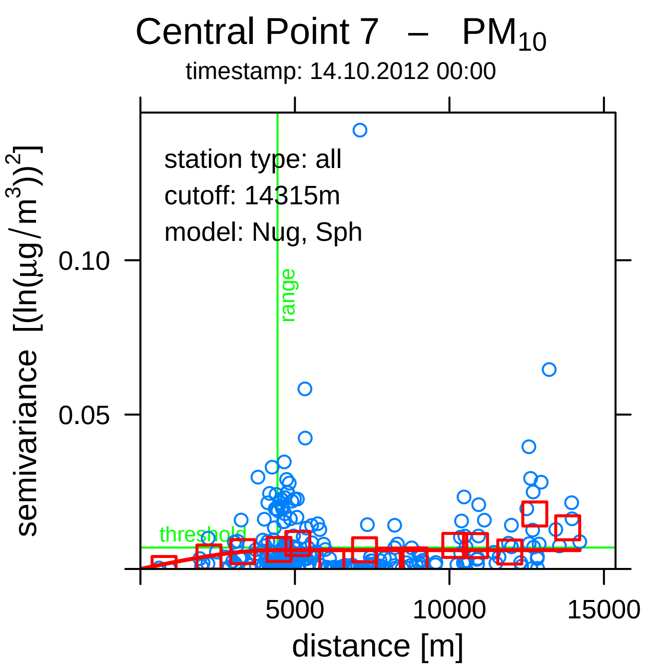

Central Point 7 – PM10
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

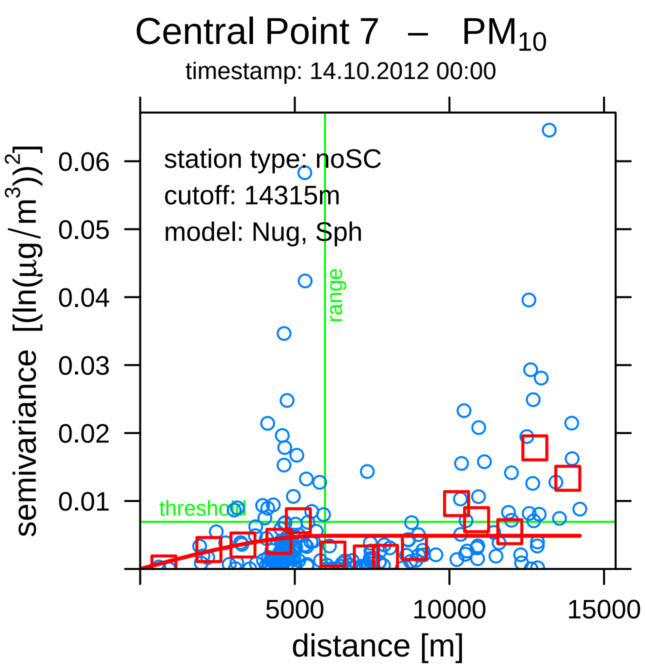

Central Point 7 – PM10
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

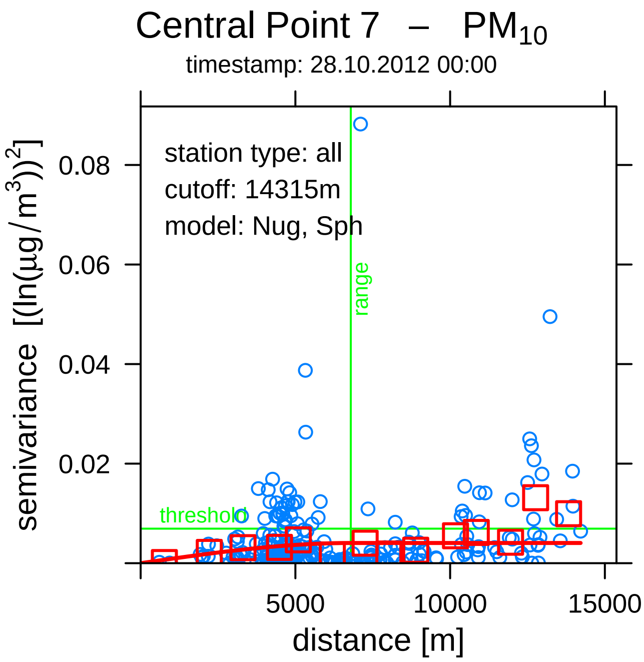

Central Point 7 – PM10
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
0.12
distance [m]
5000
10000
15000

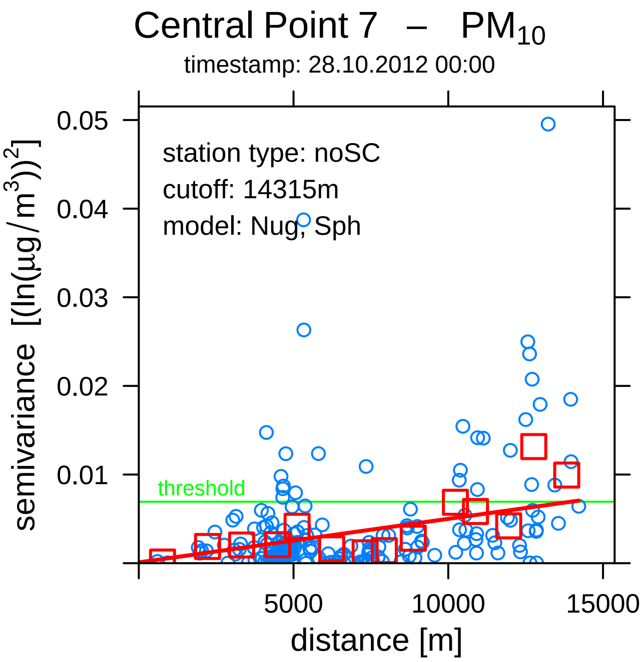

Central Point 7 – PM10
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
distance [m]
5000
10000
15000

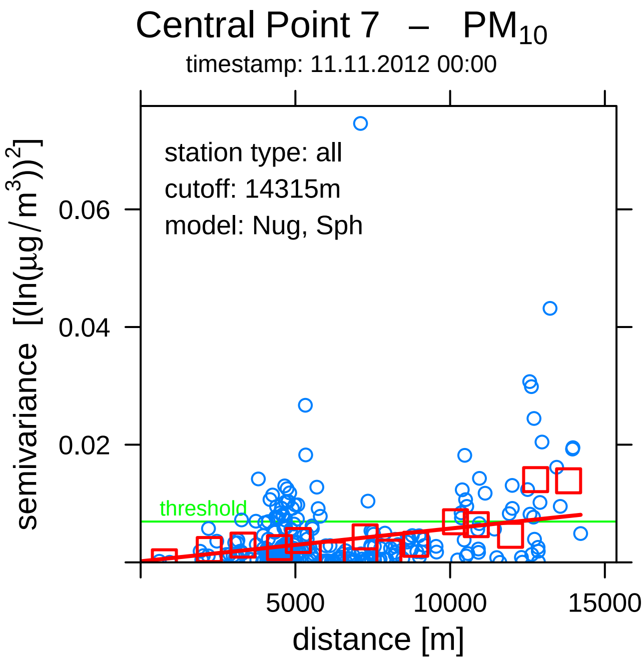

Central Point 7 – PM10
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

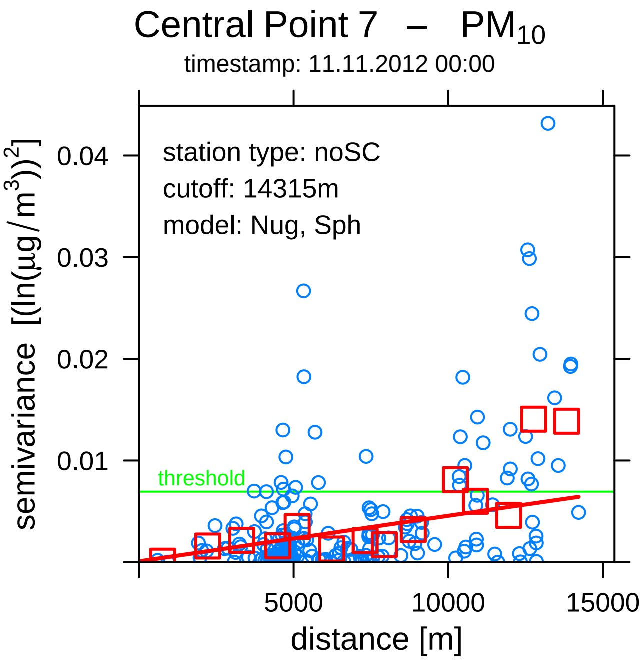

Central Point 7 – PM10
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

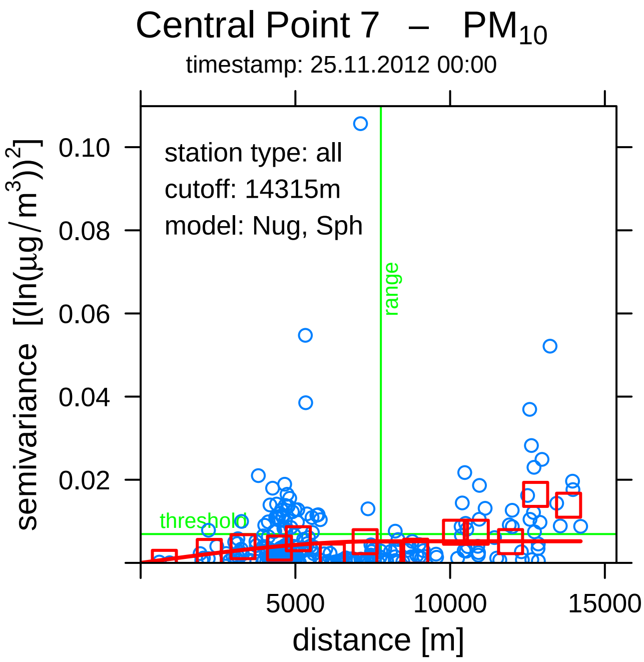

Central Point 7 – PM10
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
0.06
distance [m]
5000
10000
15000

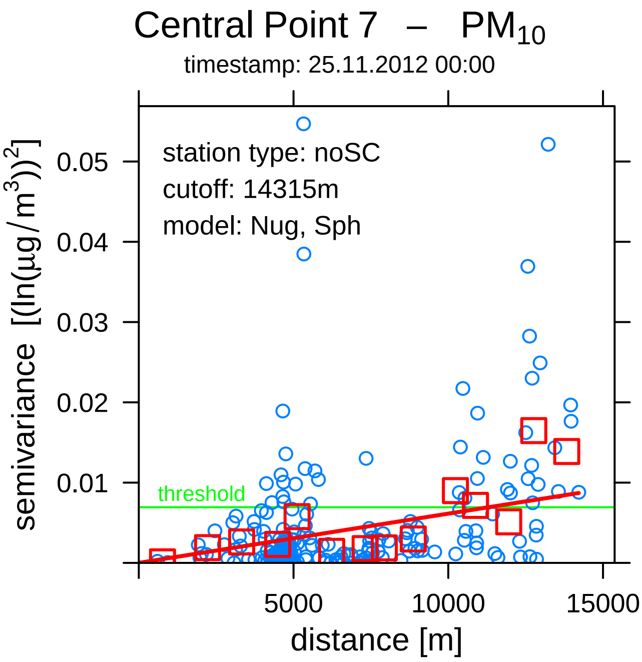

Central Point 7 – PM10
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

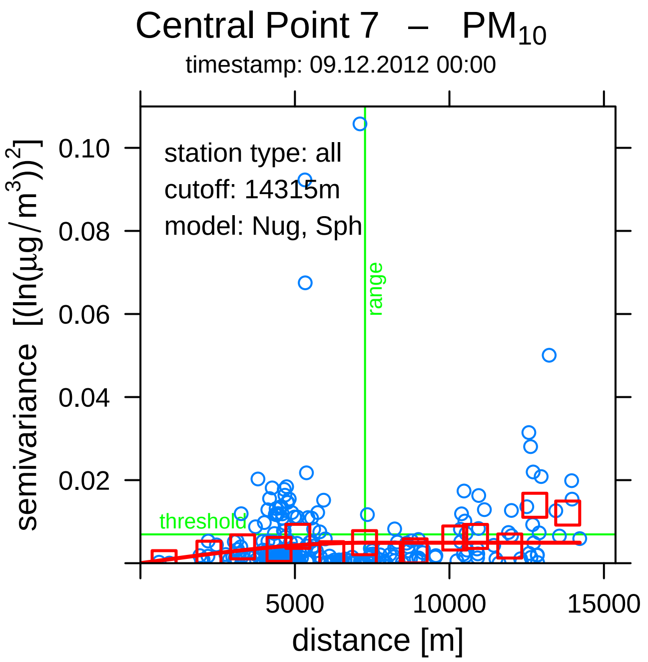

Central Point 7 – PM10
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000
distance [m]

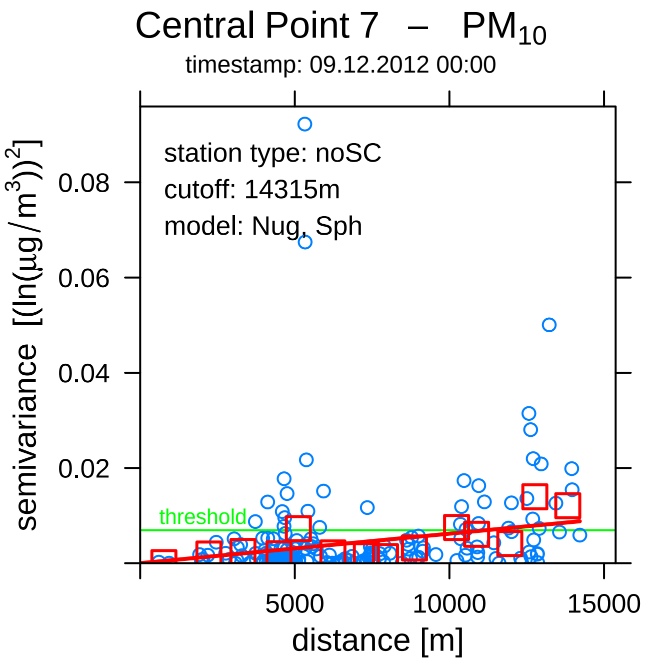

Central Point 7 – PM10
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
5000
10000
15000
distance [m]

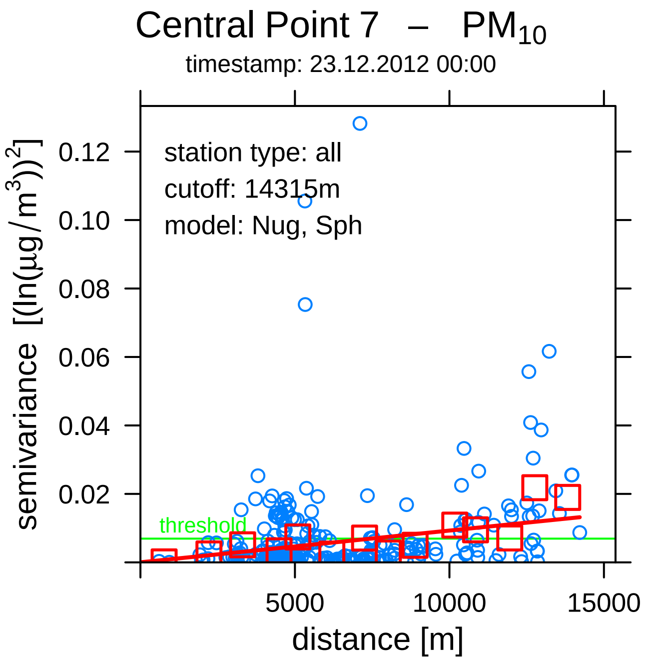

Central Point 7 – PM10
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
5000
10000
15000
distance [m]

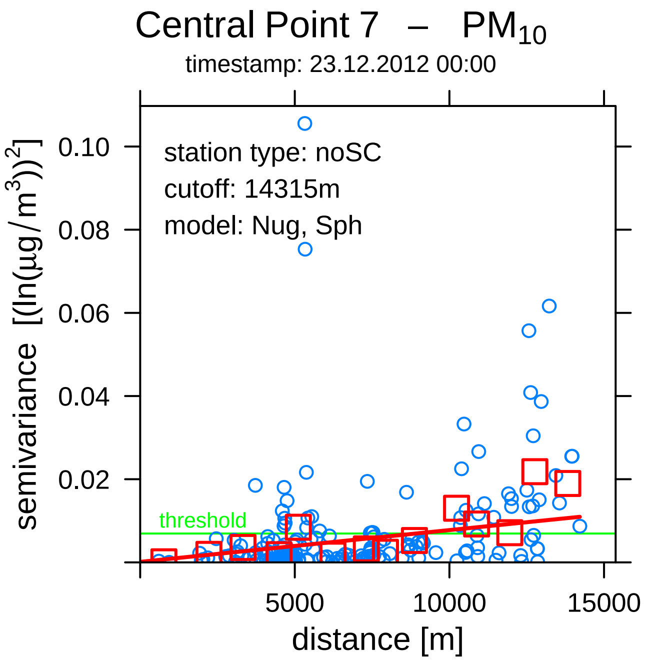

Central Point 7 – PM10
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

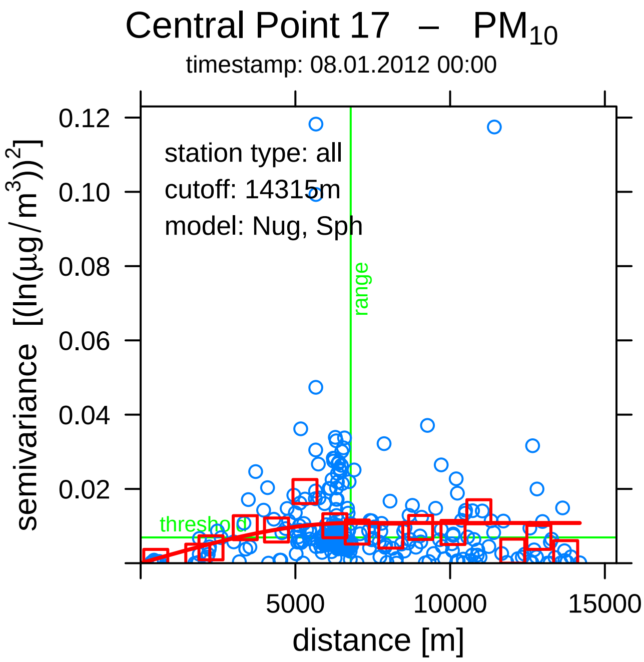

Central Point 7 – PM10
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000
distance [m]


Central Point 7 – PM10
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
range
semivariance [(ln(µg/m3))2]
distance [m]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

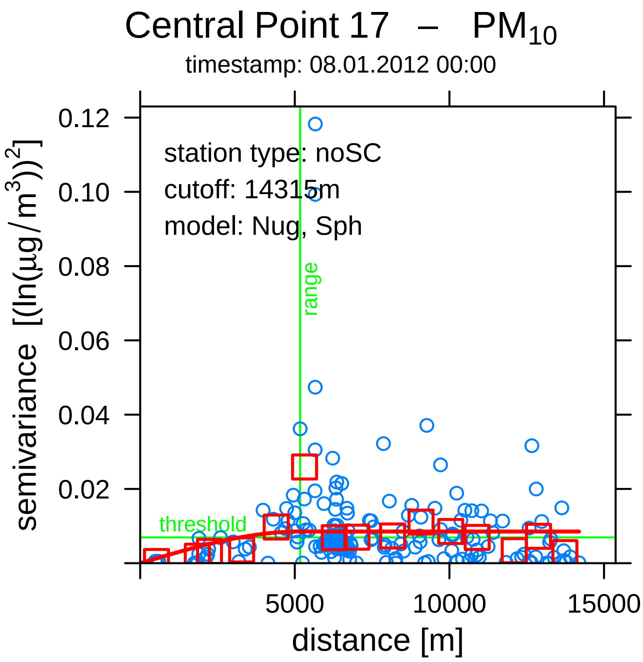

Central Point 7 – PM10
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.08
0.06
0.04
0.02
5000
10000
15000


Central Point 7 – PM10
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

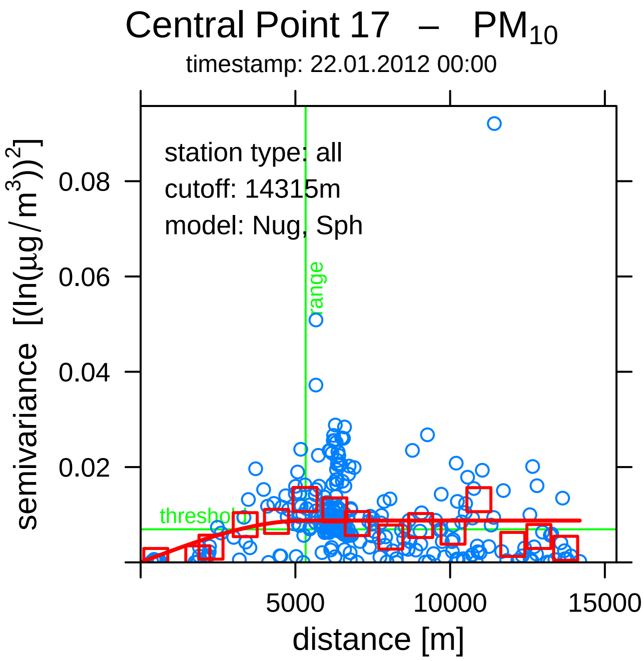

Central Point 7 – PM10
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000



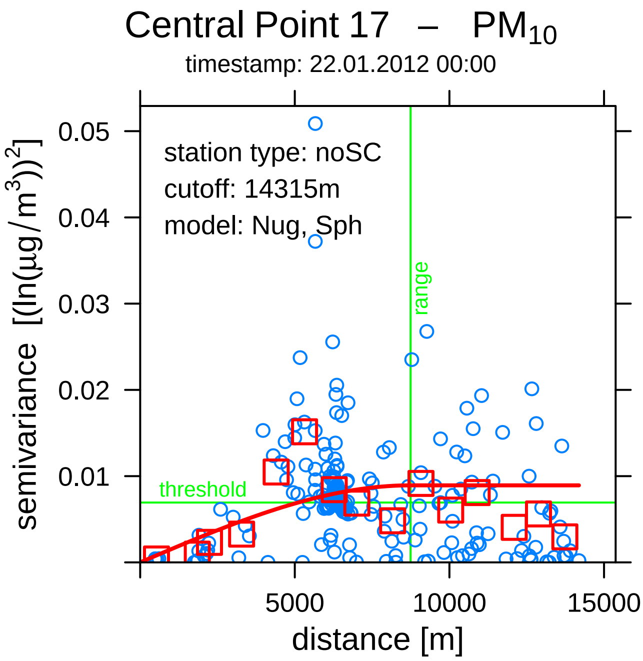
Central Point 17 – PM10
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]



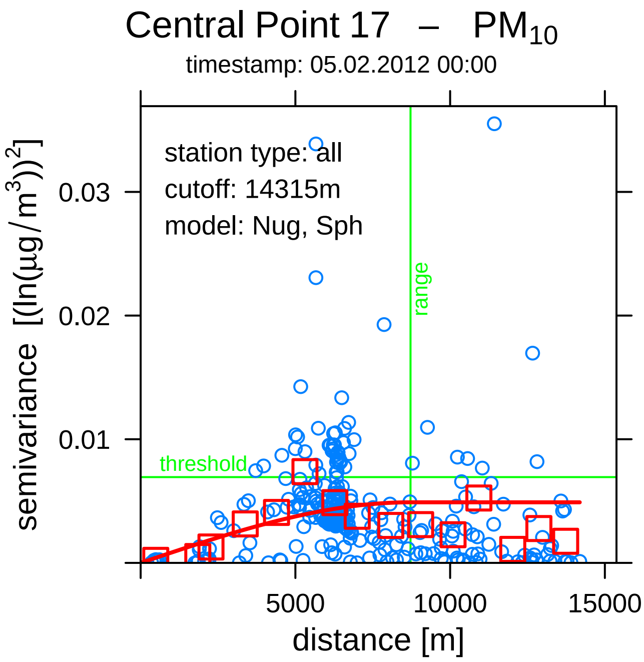
Central Point 17 – PM10
timestamp: 08.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]



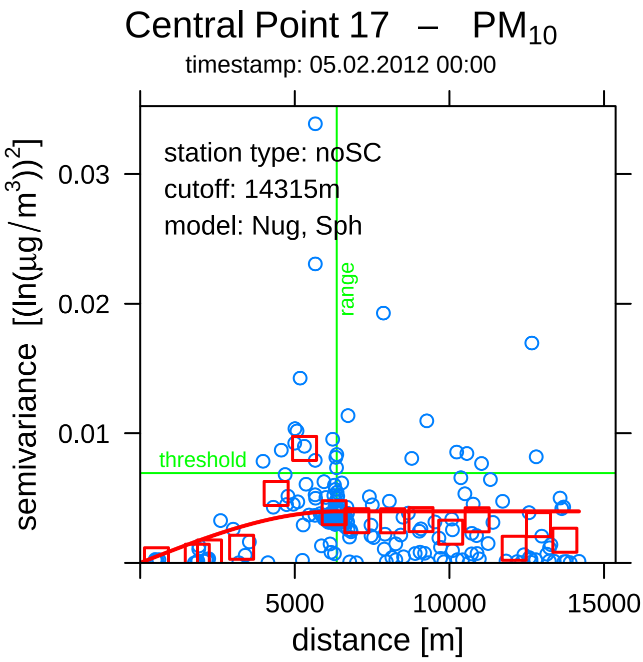
Central Point 17 – PM10
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]



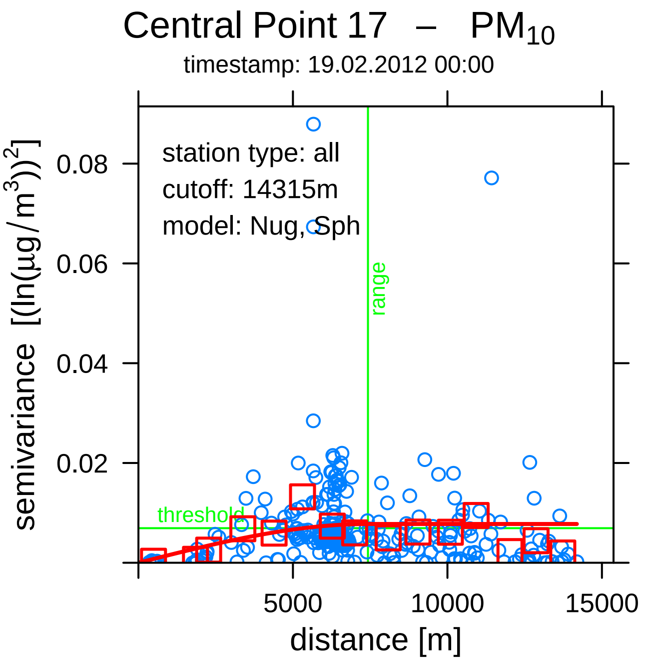
Central Point 17 – PM10
timestamp: 22.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.04
0.03
0.02
0.01
5000
10000
15000
distance [m]

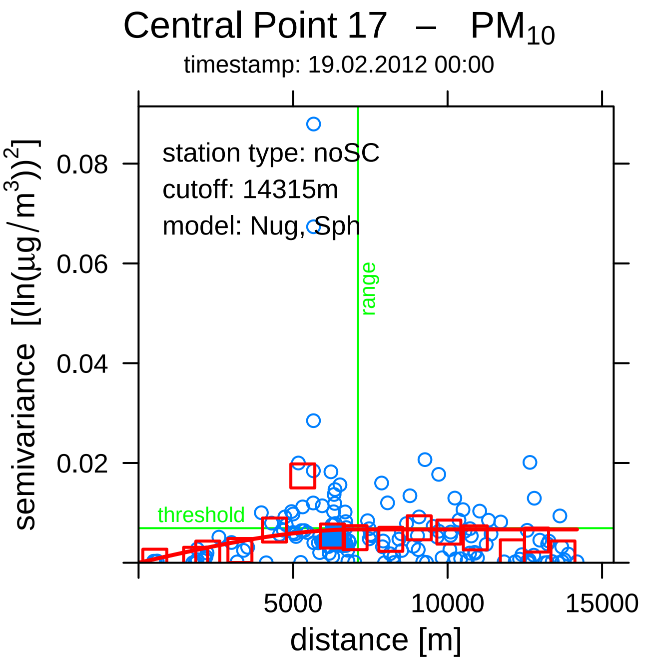


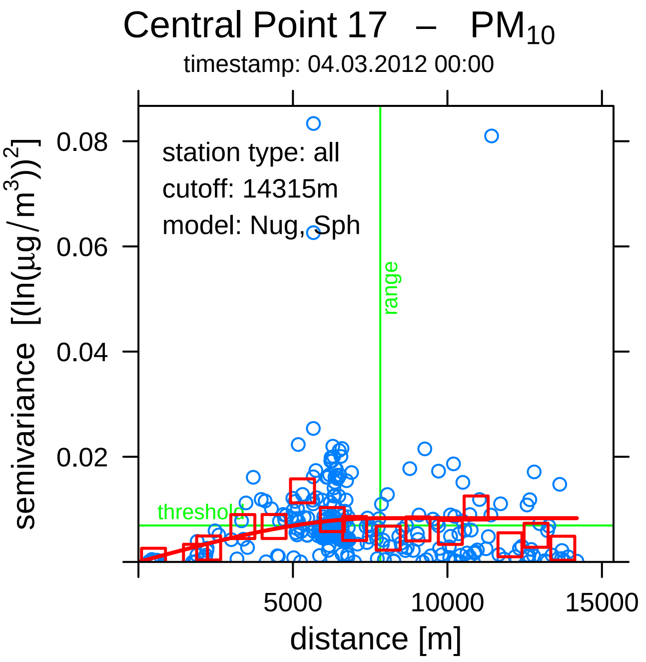
Central Point 17 – PM10
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.03
0.02
0.01
5000
10000
15000
distance [m]

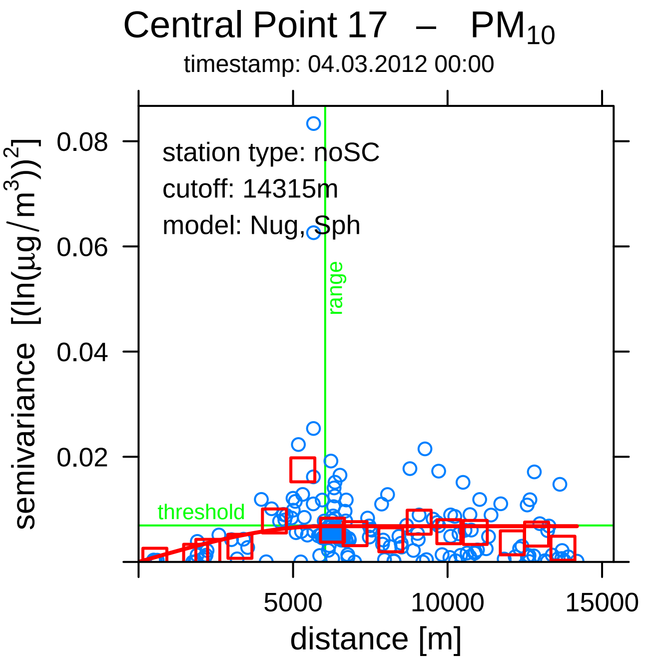


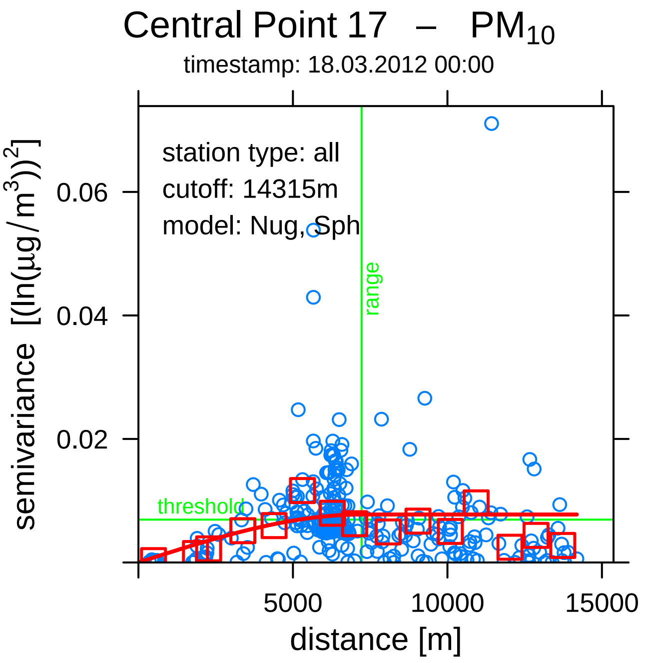
Central Point 17 – PM10
timestamp: 05.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.03
0.02
0.01
5000
10000
15000
distance [m]

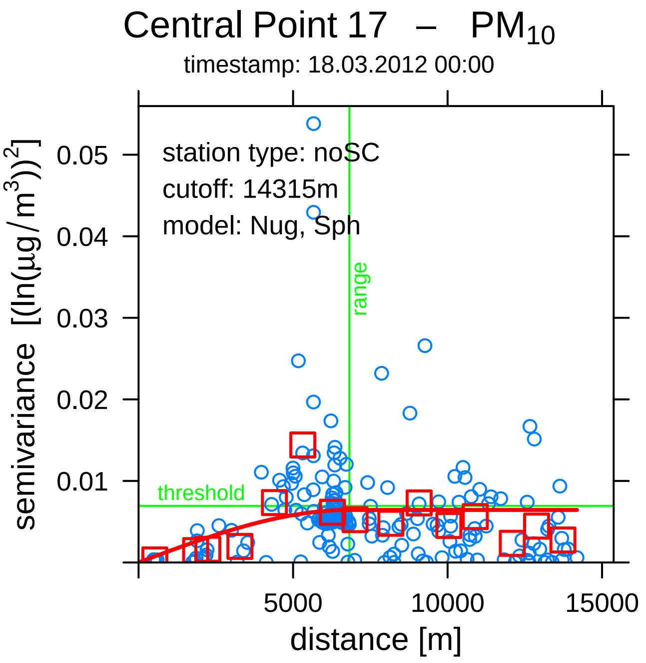

Central Point 17 – PM10
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

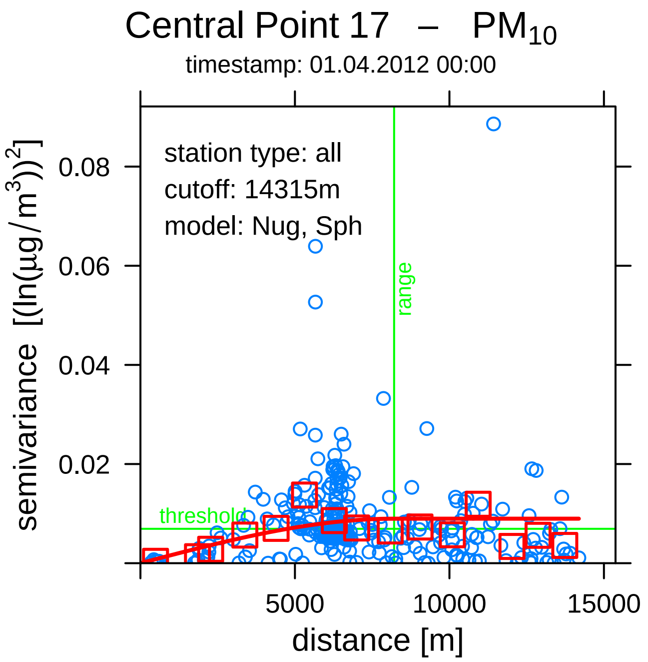

Central Point 17 – PM10
timestamp: 19.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

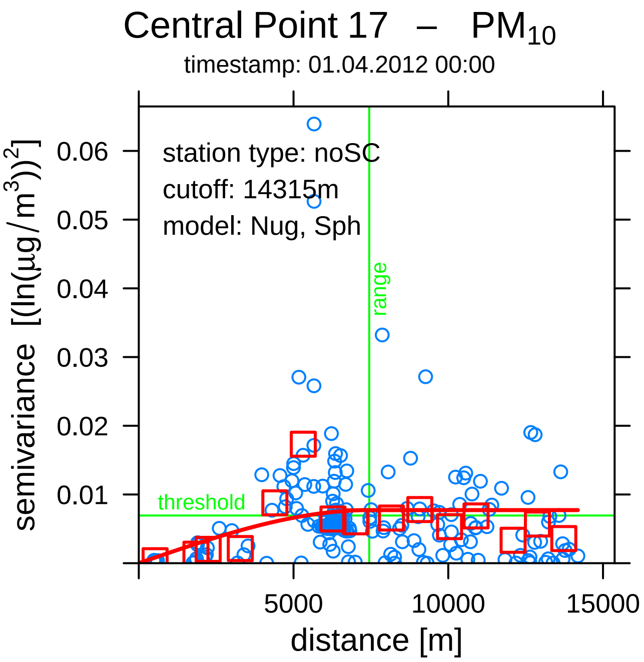

Central Point 17 – PM10
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

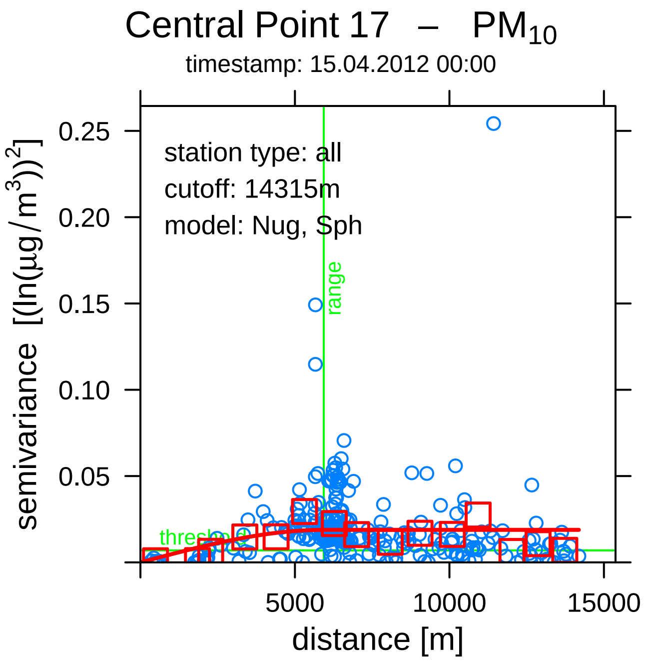

Central Point 17 – PM10
timestamp: 04.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

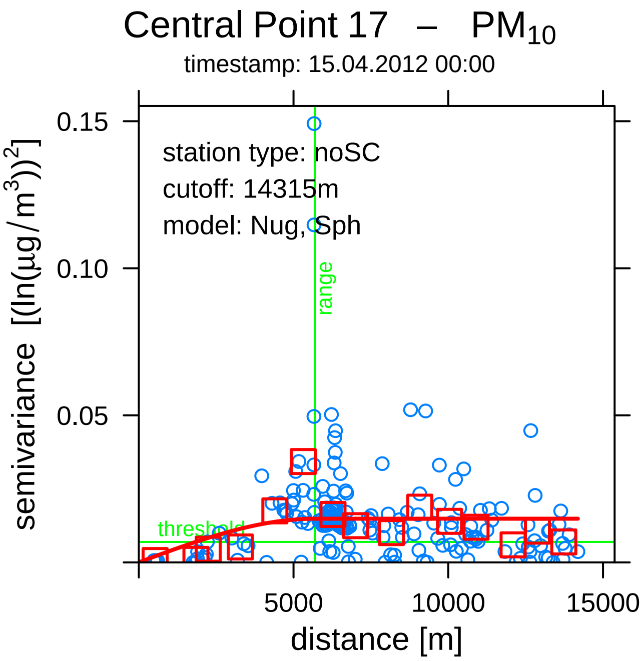

Central Point 17 – PM10
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
5000
10000
15000

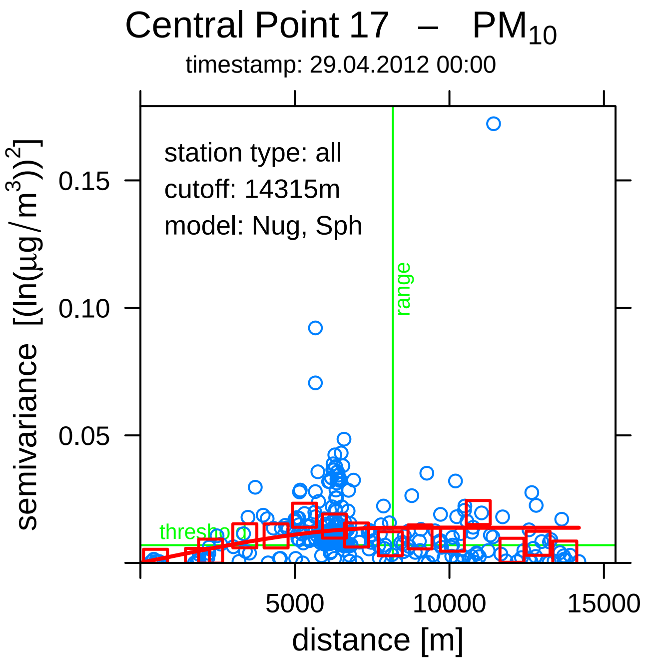

Central Point 17 – PM10
timestamp: 18.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000

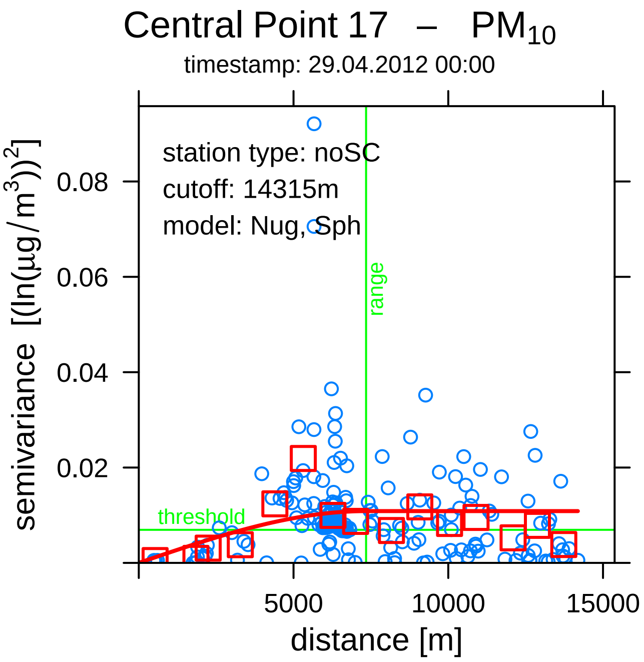

Central Point 17 – PM10
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

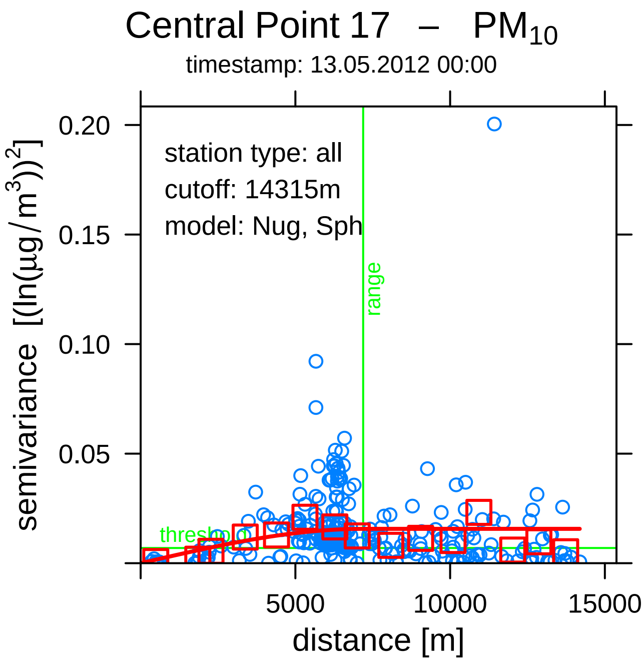

Central Point 17 – PM10
timestamp: 01.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000

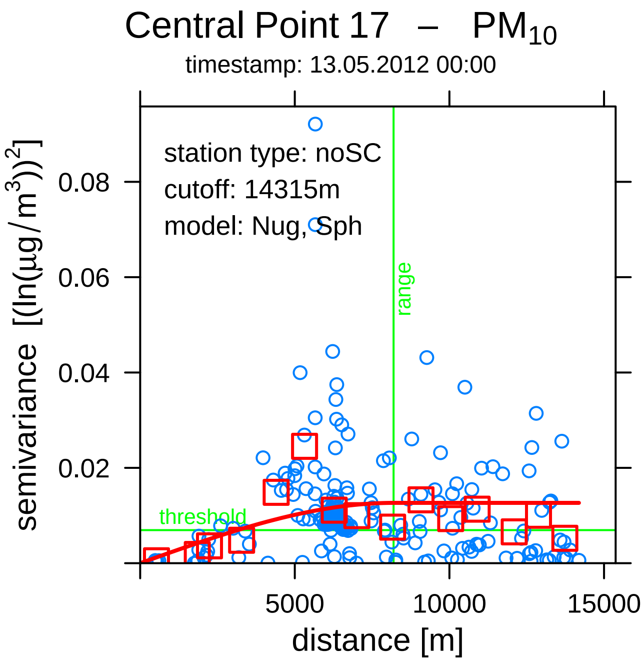

Central Point 17 – PM10
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000

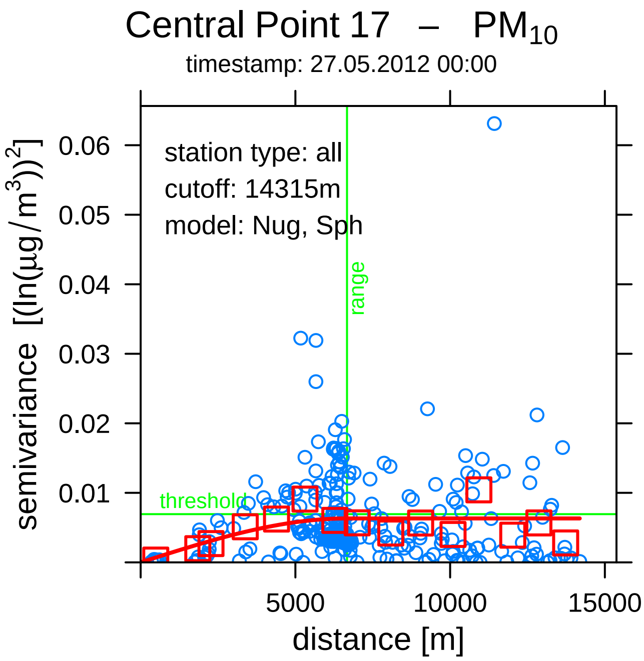

Central Point 17 – PM10
timestamp: 15.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
5000
10000
15000

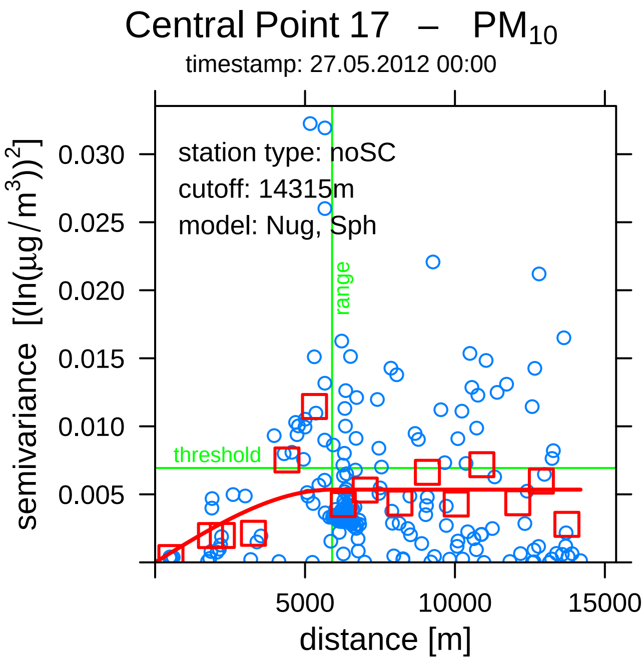

Central Point 17 – PM10
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
5000
10000
15000

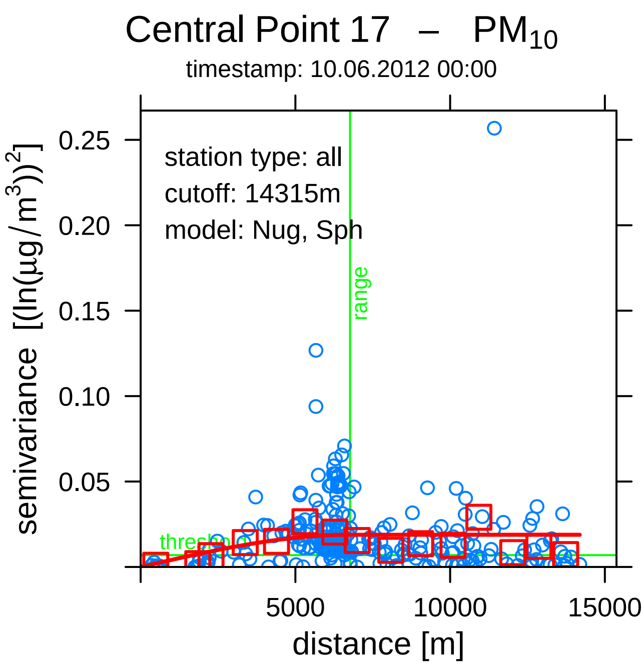

Central Point 17 – PM10
timestamp: 29.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

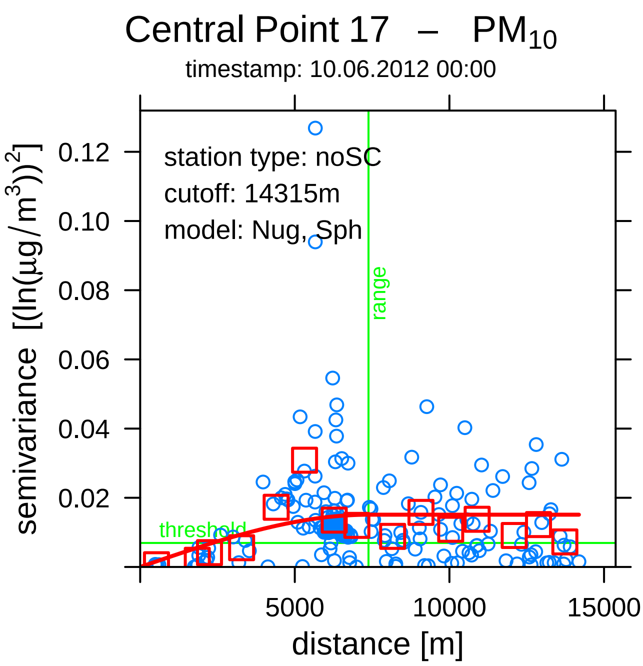

Central Point 17 – PM10
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.20
0.15
0.10
0.05
5000
10000
15000

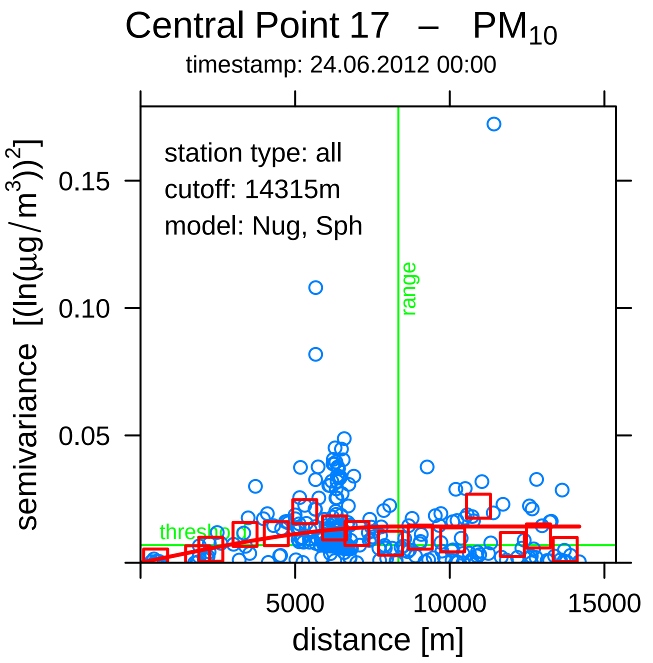

Central Point 17 – PM10
timestamp: 13.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.08
0.06
0.04
0.02
5000
10000
15000

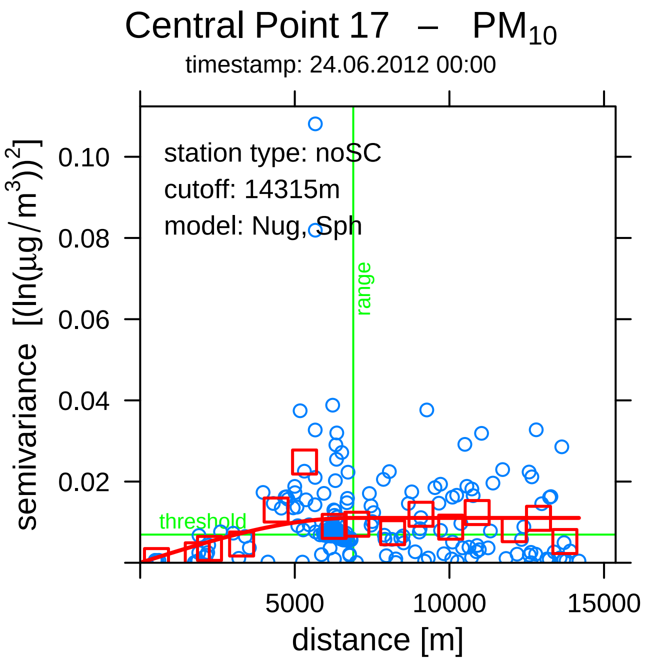

Central Point 17 – PM10
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.06
0.05
0.04
0.03
0.02
0.01
5000
10000
15000

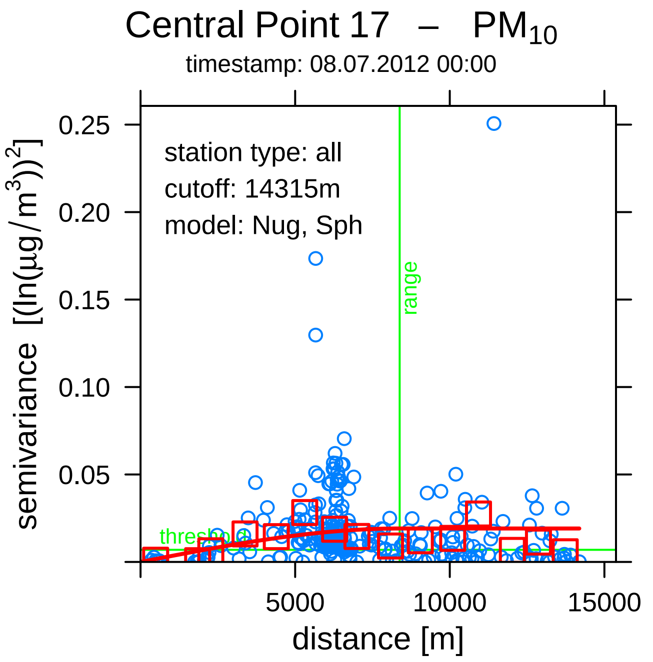

Central Point 17 – PM10
timestamp: 27.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.030
0.025
0.020
0.015
0.010
0.005
5000
10000
15000

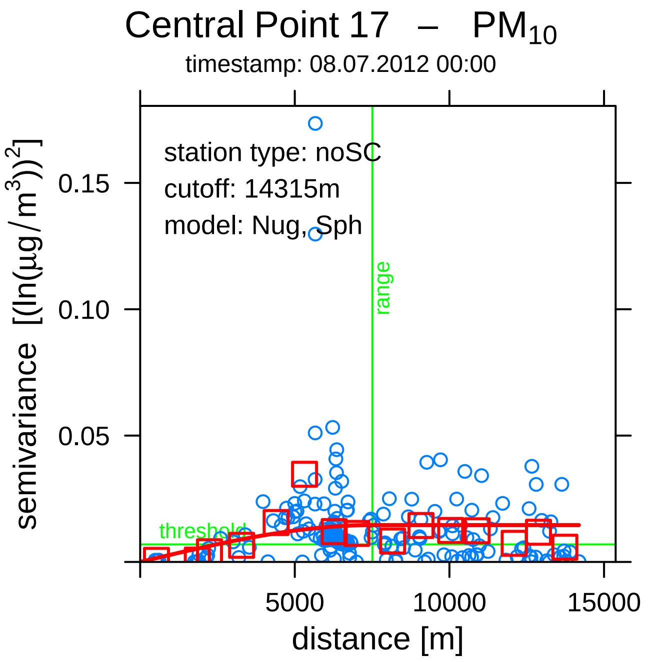

Central Point 17 – PM10
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

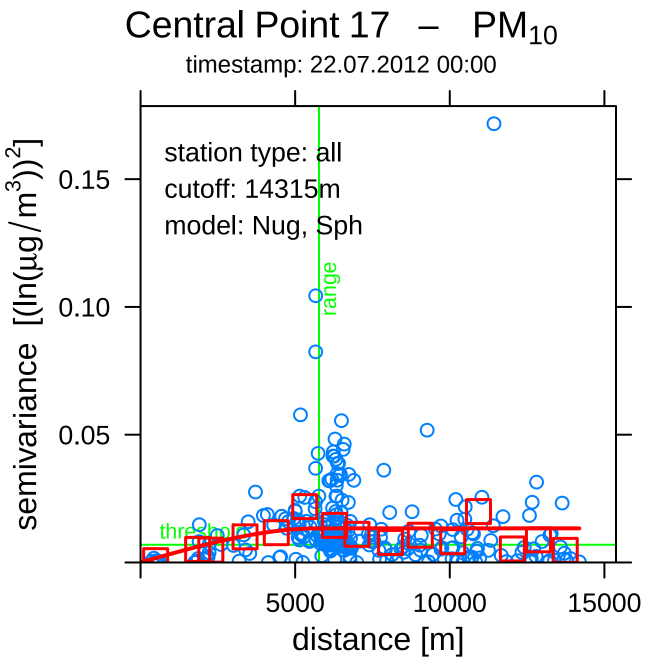

Central Point 17 – PM10
timestamp: 10.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

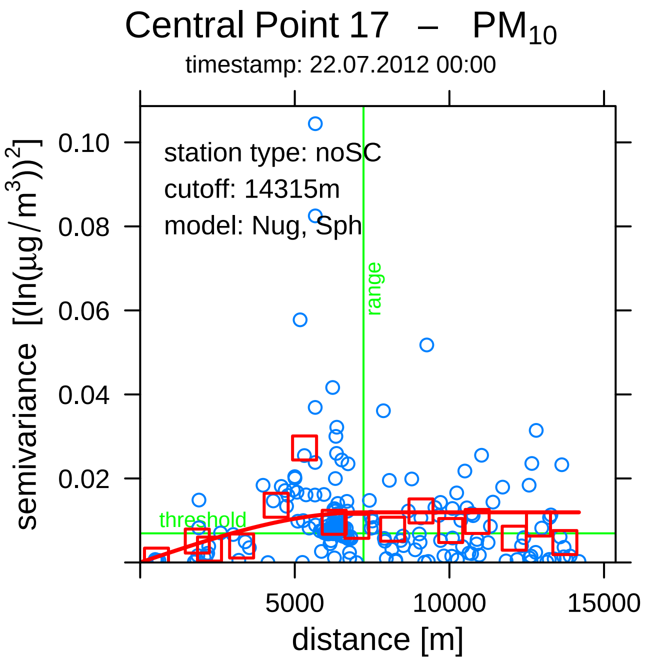

Central Point 17 – PM10
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

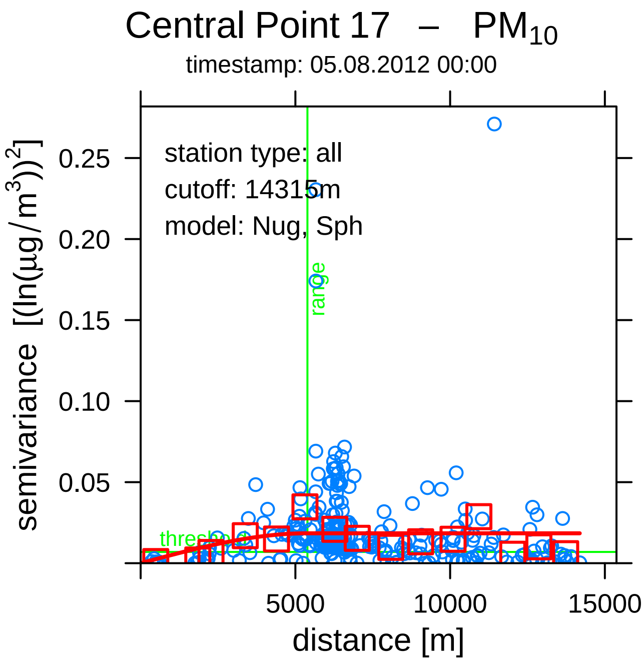

Central Point 17 – PM10
timestamp: 24.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

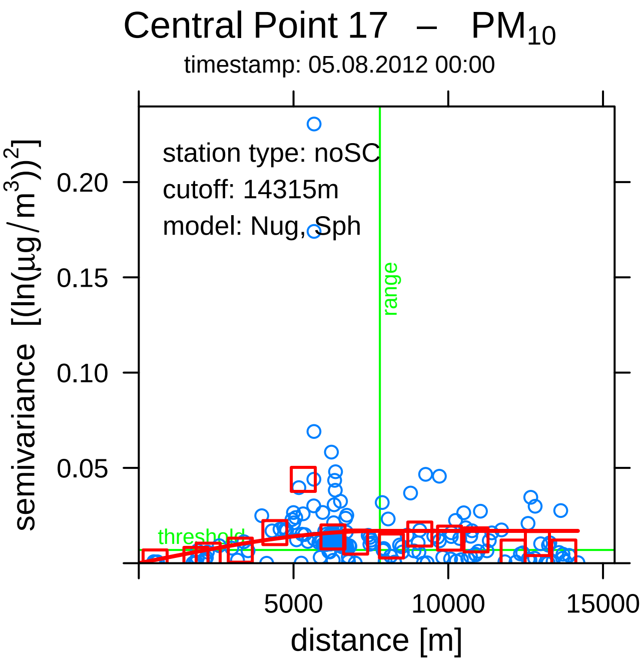

Central Point 17 – PM10
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000
distance [m]

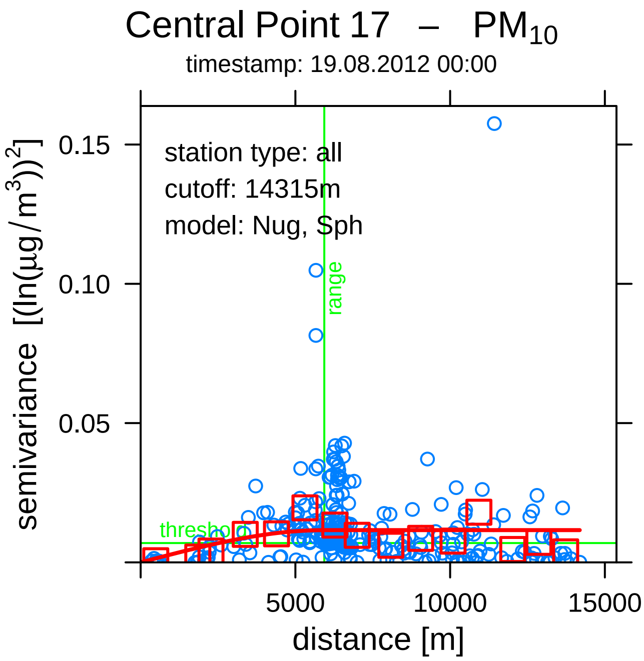

Central Point 17 – PM10
timestamp: 08.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

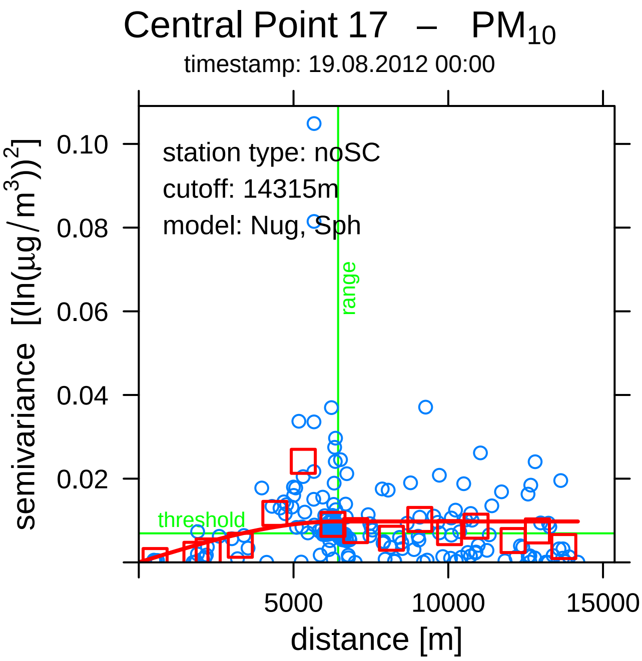

Central Point 17 – PM10
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

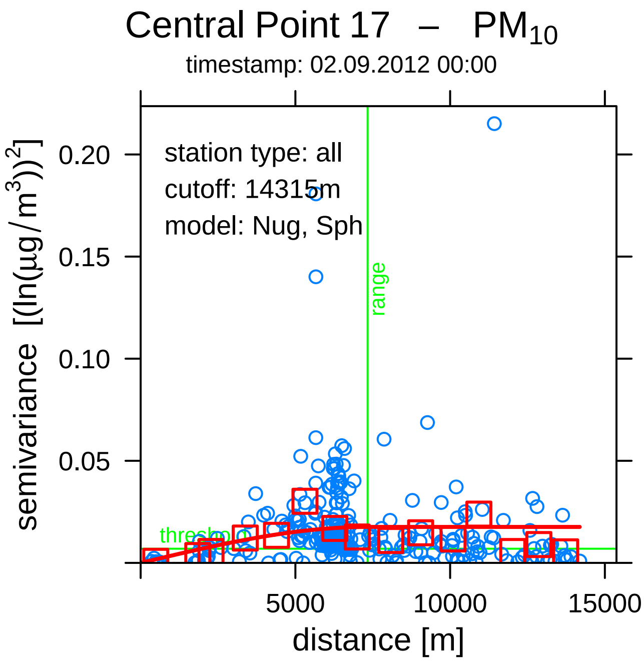

Central Point 17 – PM10
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

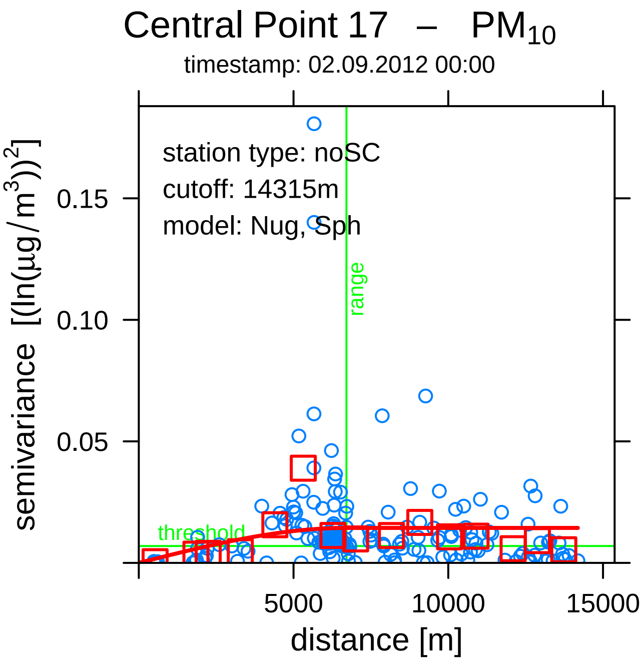

Central Point 17 – PM10
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

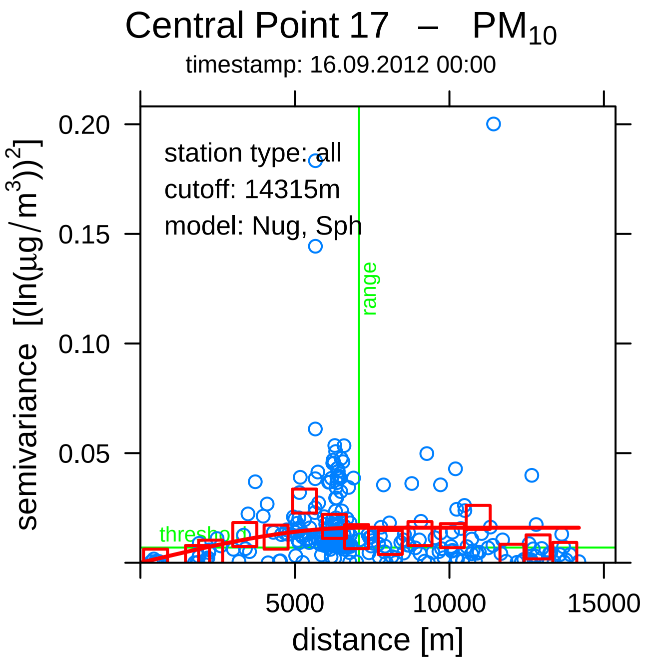

Central Point 17 – PM10
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.20
0.15
0.10
0.05
5000
10000
15000

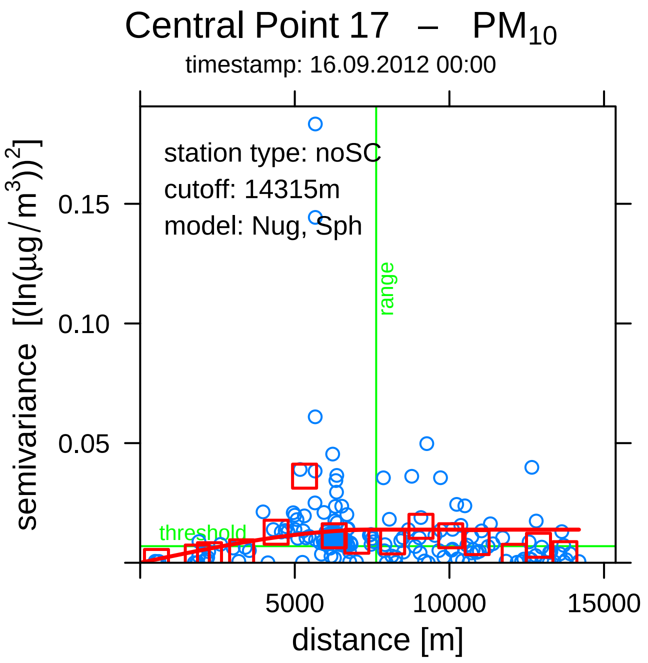

Central Point 17 – PM10
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.15
0.10
0.05
5000
10000
15000

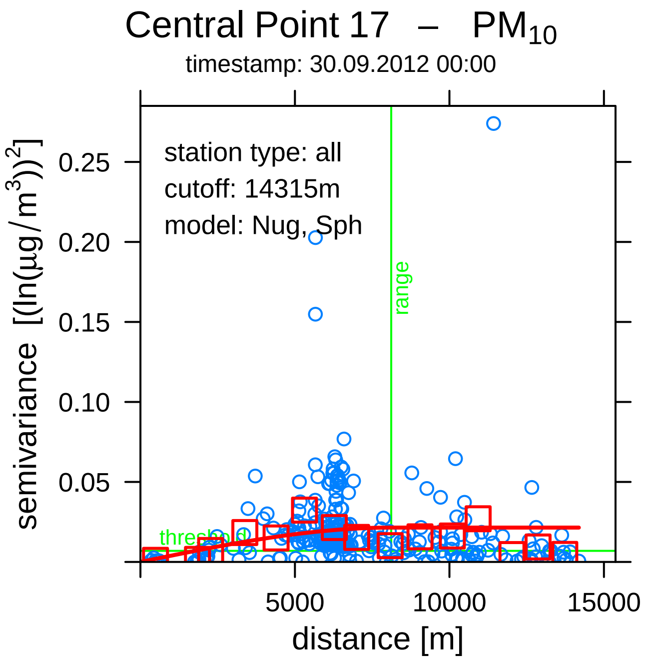

Central Point 17 – PM10
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

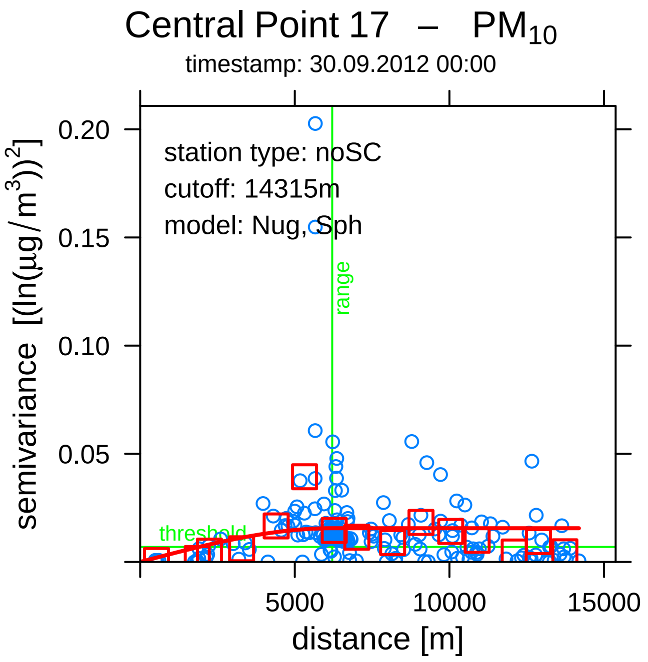

Central Point 17 – PM10
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.20
0.15
0.10
0.05
5000
10000
15000

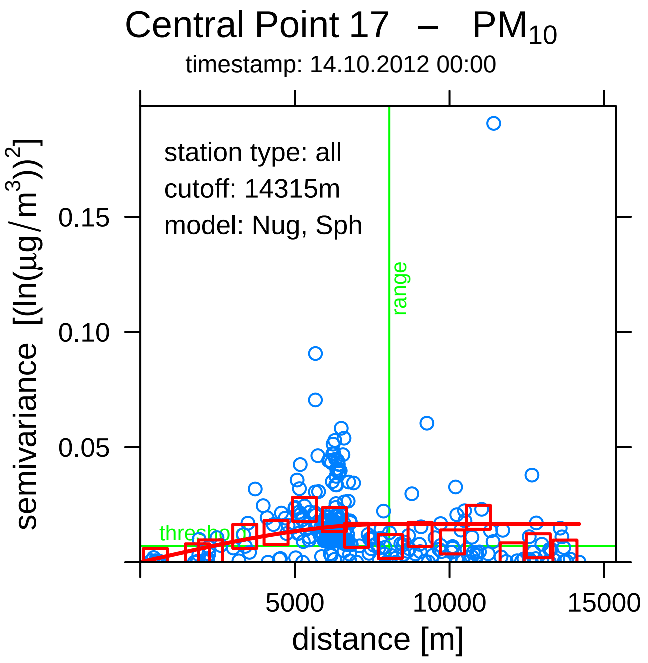

Central Point 17 – PM10
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.15
0.10
0.05
5000
10000
15000

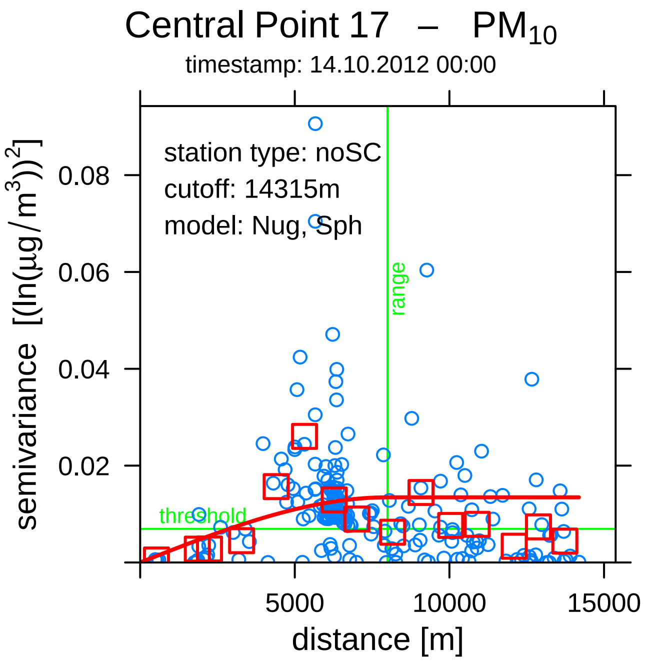

Central Point 17 – PM_{10}
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.20
0.15
0.10
0.05
5000
10000
15000

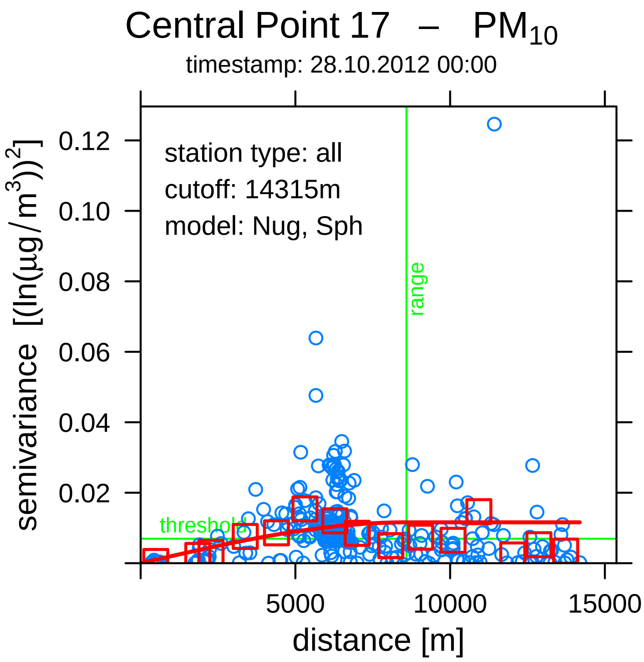

Central Point 17 – PM_{10}
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.15
0.10
0.05
5000
10000
15000

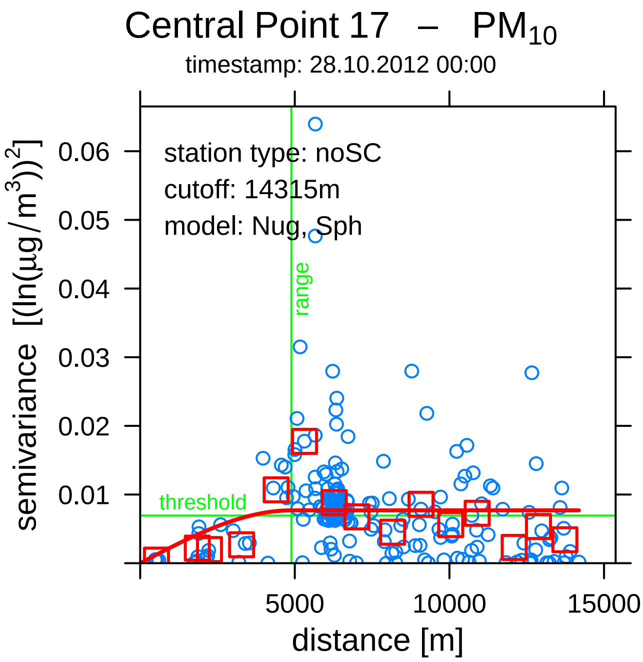

Central Point 17 – PM_{10}
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

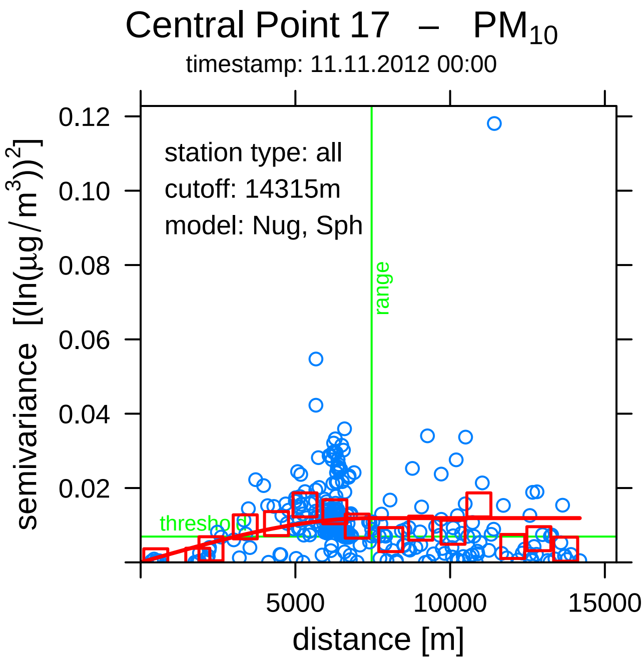

Central Point 17 – PM_{10}
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.20
0.15
0.10
0.05
5000
10000
15000

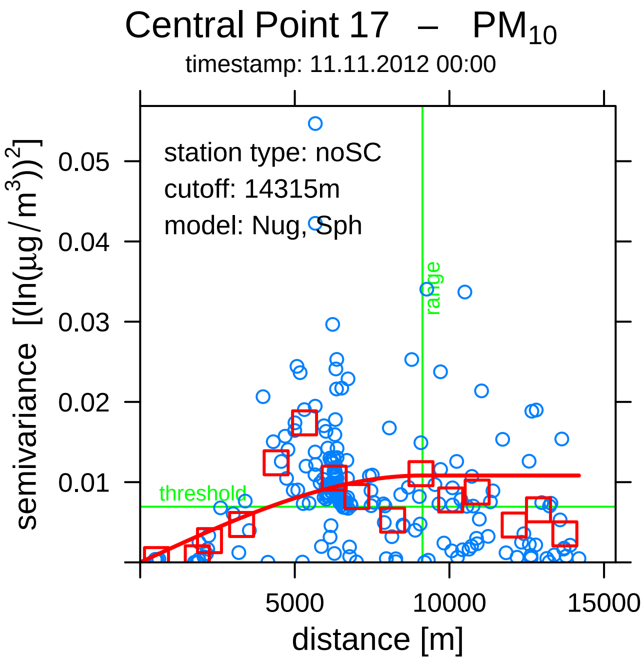

Central Point 17 – PM_{10}
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.15
0.10
0.05
5000
10000
15000

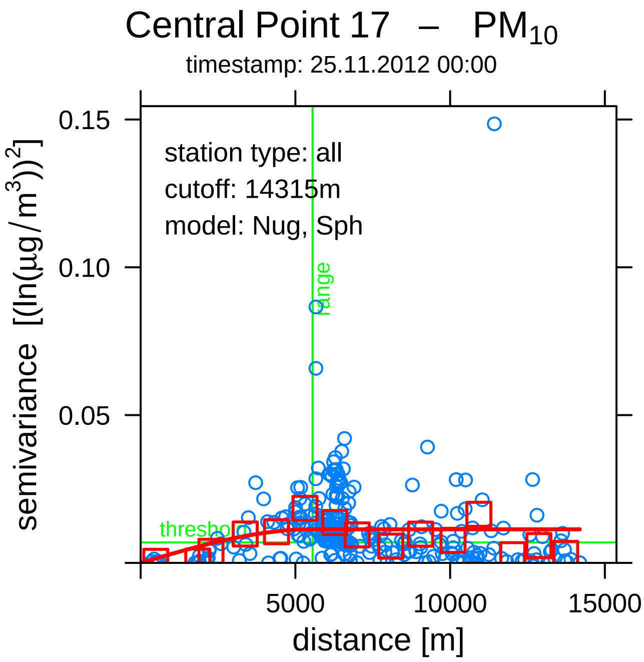

Central Point 17 – PM_{10}
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.08
0.06
0.04
0.02
5000
10000
15000

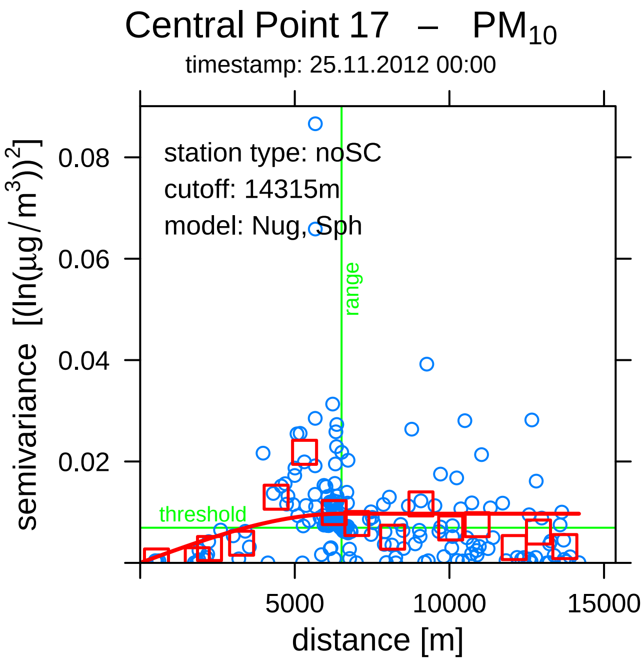

Central Point 17 – PM10
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

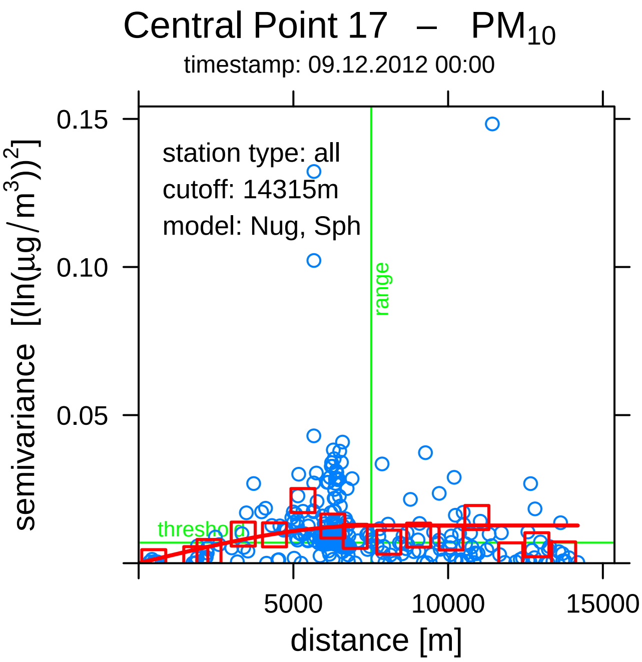

Central Point 17 – PM10
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.06
0.05
0.04
0.03
0.02
0.01
5000
10000
15000

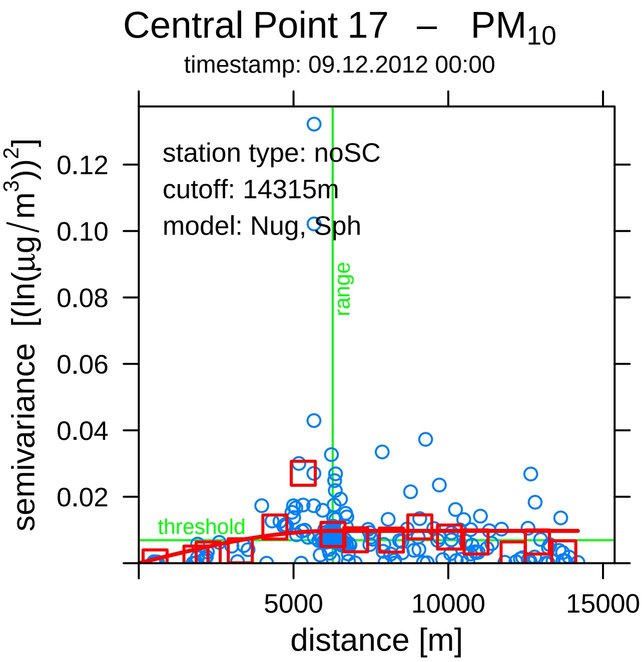

Central Point 17 – PM10
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000

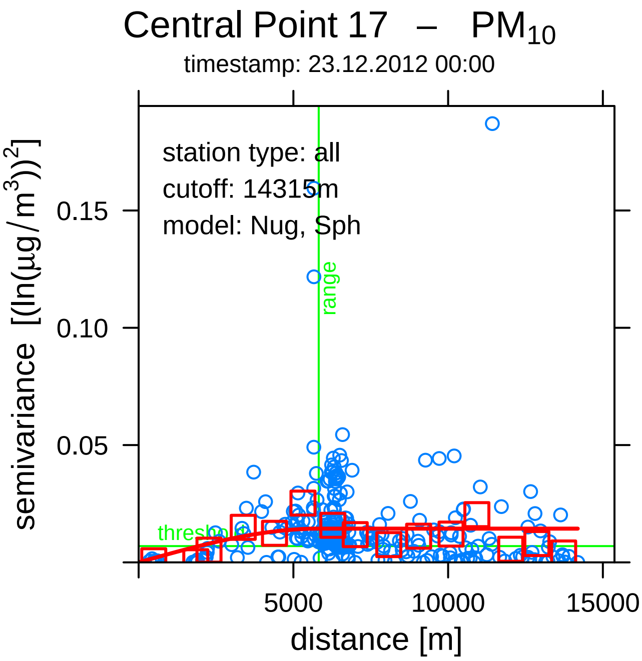

Central Point 17 – PM10
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.04
0.03
0.02
0.01
5000
10000
15000

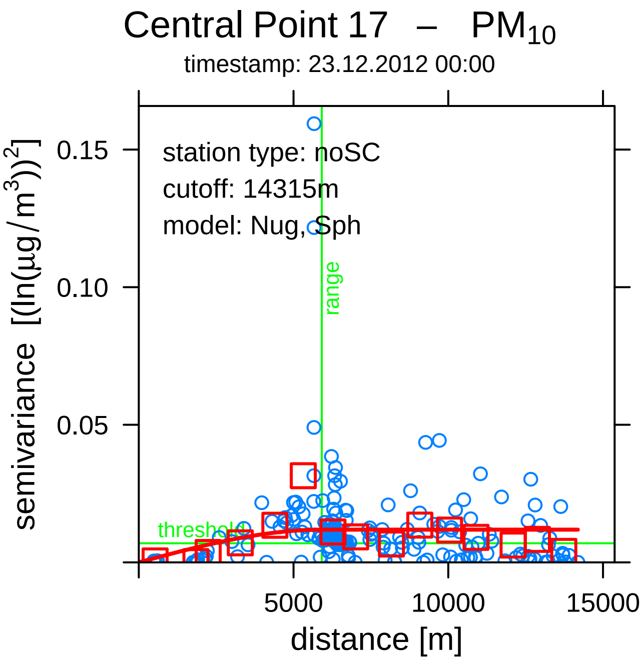

Central Point 17 – PM10
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.15
0.10
0.05
5000
10000
15000

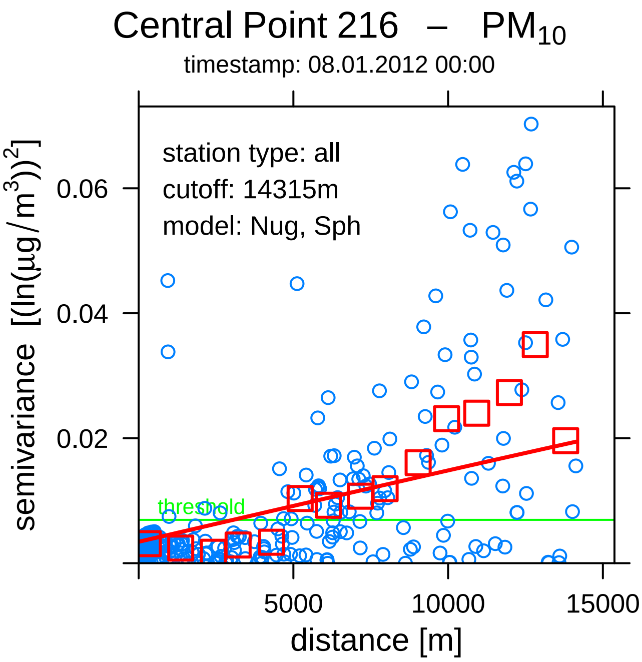

Central Point 17 – PM10
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.08
0.06
0.04
0.02
5000
10000
15000

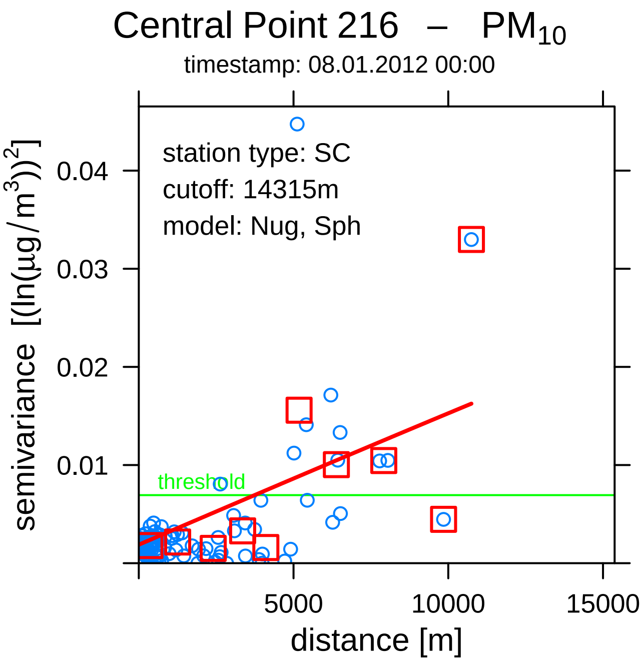

Central Point 17 – PM10
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.15
0.10
0.05
distance [m]
5000
10000
15000

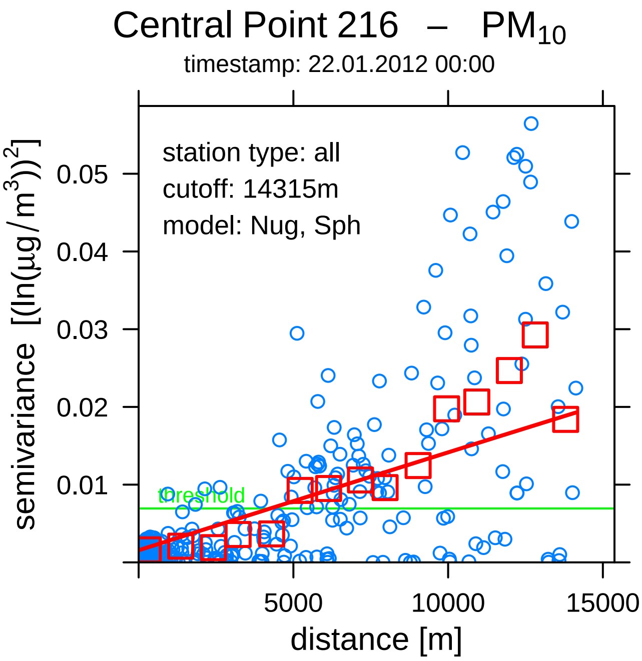

Central Point 17 – PM10
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.12
0.10
0.08
0.06
0.04
0.02
distance [m]
5000
10000
15000

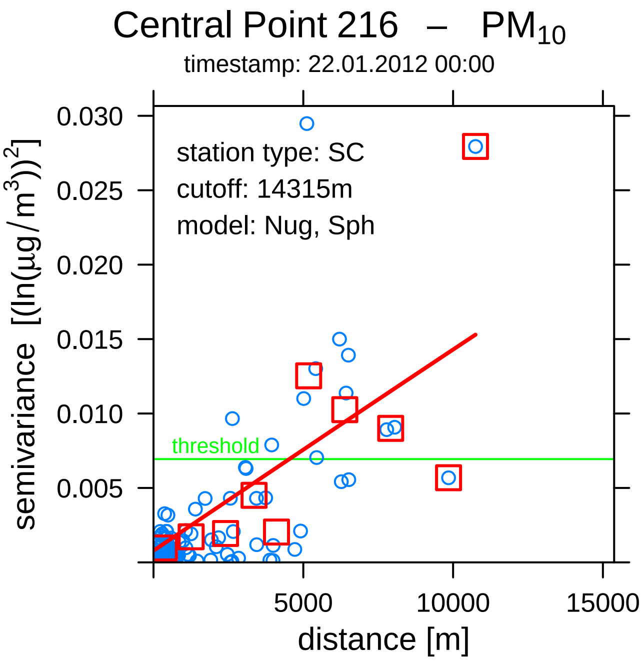

Central Point 17 – PM10
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.15
0.10
0.05
distance [m]
5000
10000
15000

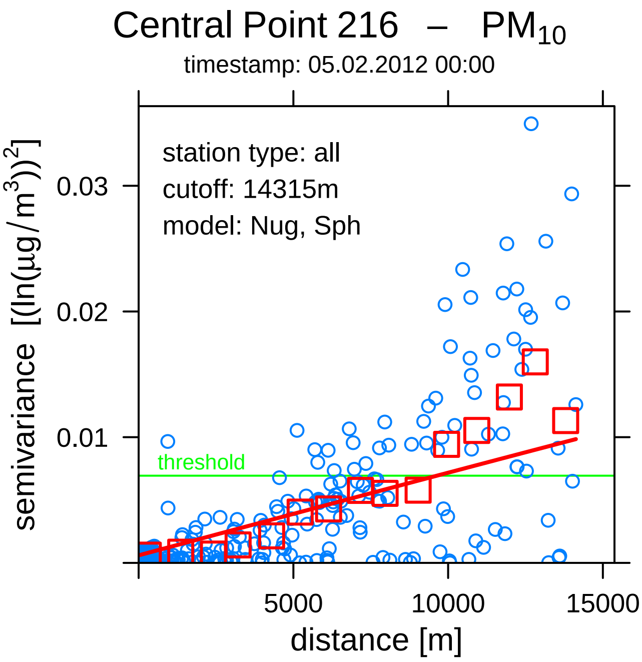

Central Point 17 – PM10
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.15
0.10
0.05
distance [m]
5000
10000
15000

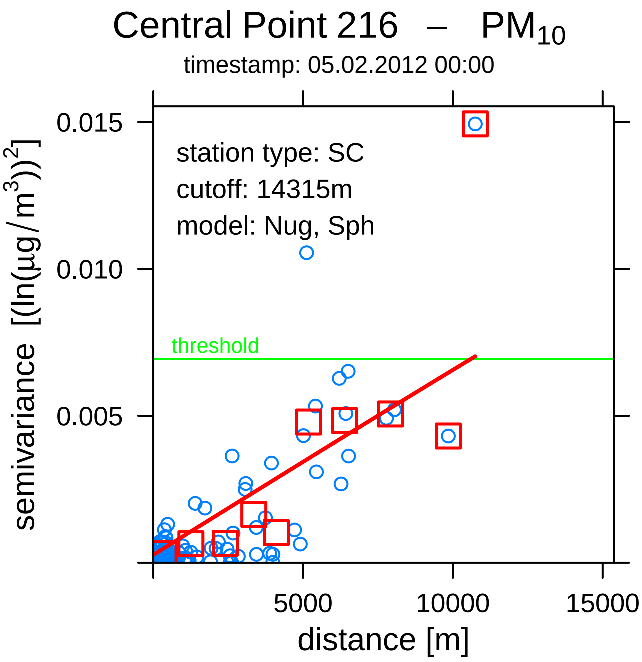

Central Point 216 – PM10
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
5000
10000
15000

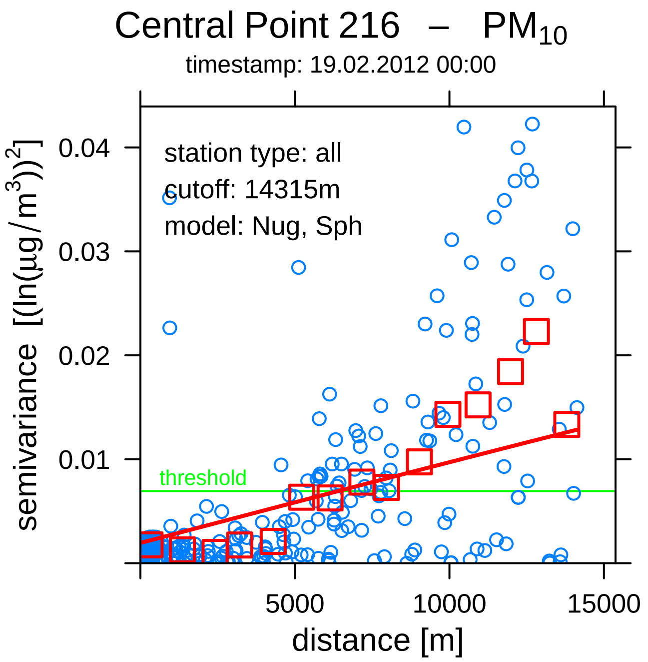

Central Point 216 – PM10
timestamp: 08.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
5000
10000
15000

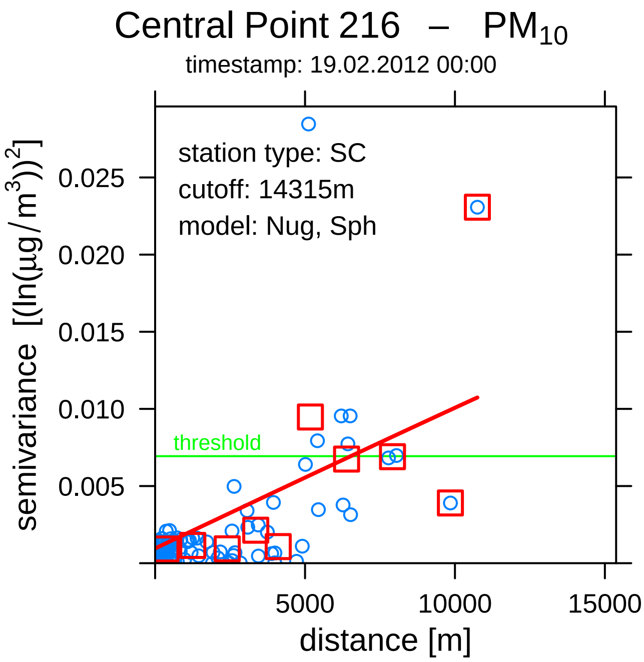

Central Point 216 – PM10
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000

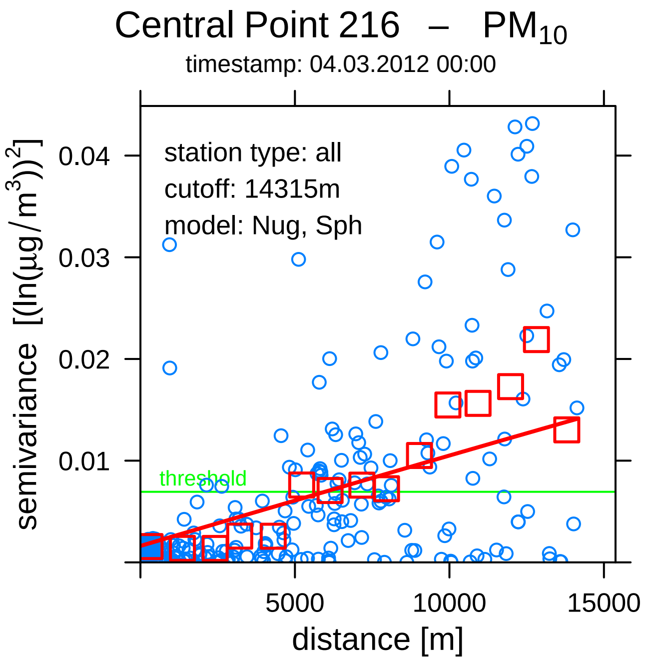

Central Point 216 – PM10
timestamp: 22.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.005
0.010
0.015
0.020
0.025
0.030
5000
10000
15000

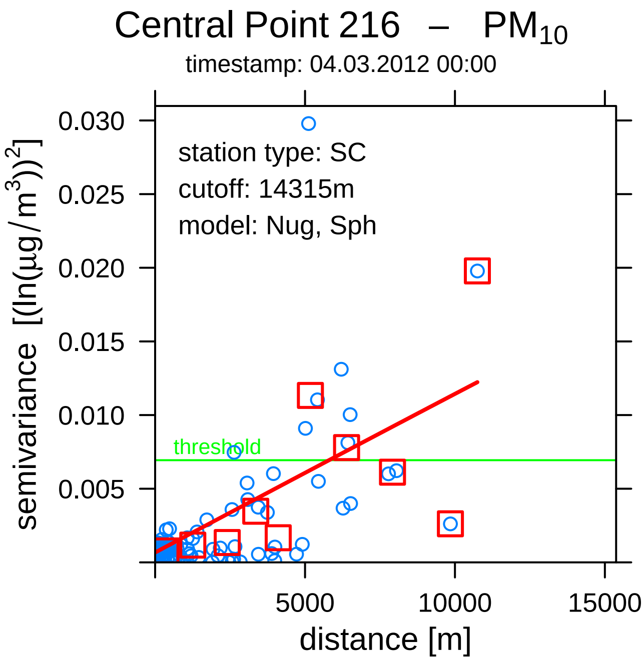

Central Point 216 – PM10
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
5000
10000
15000

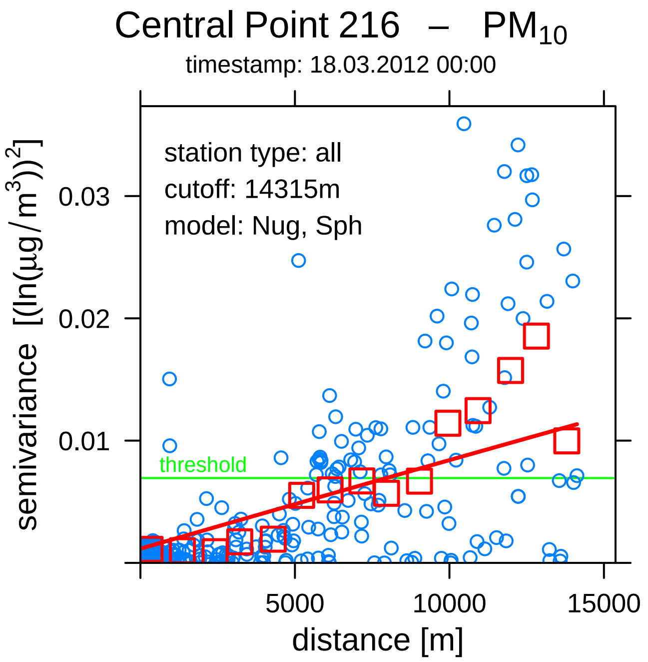

Central Point 216 – PM10
timestamp: 05.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.005
0.010
0.015
5000
10000
15000

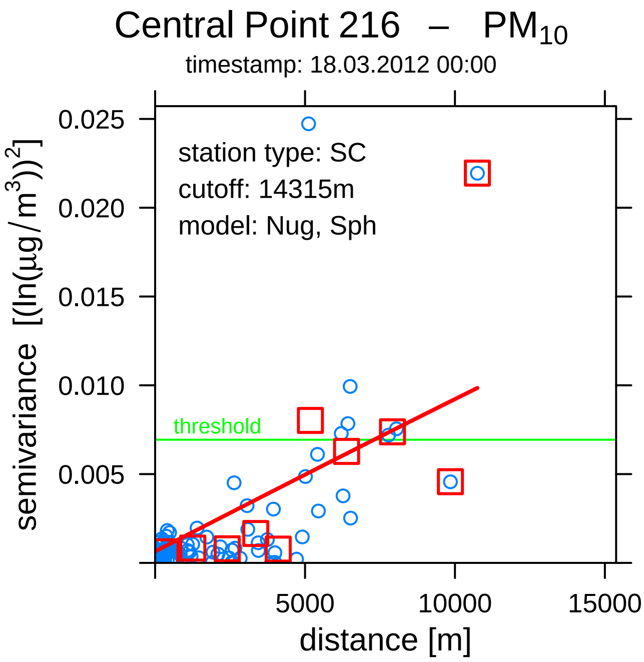

Central Point 216 – PM10
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

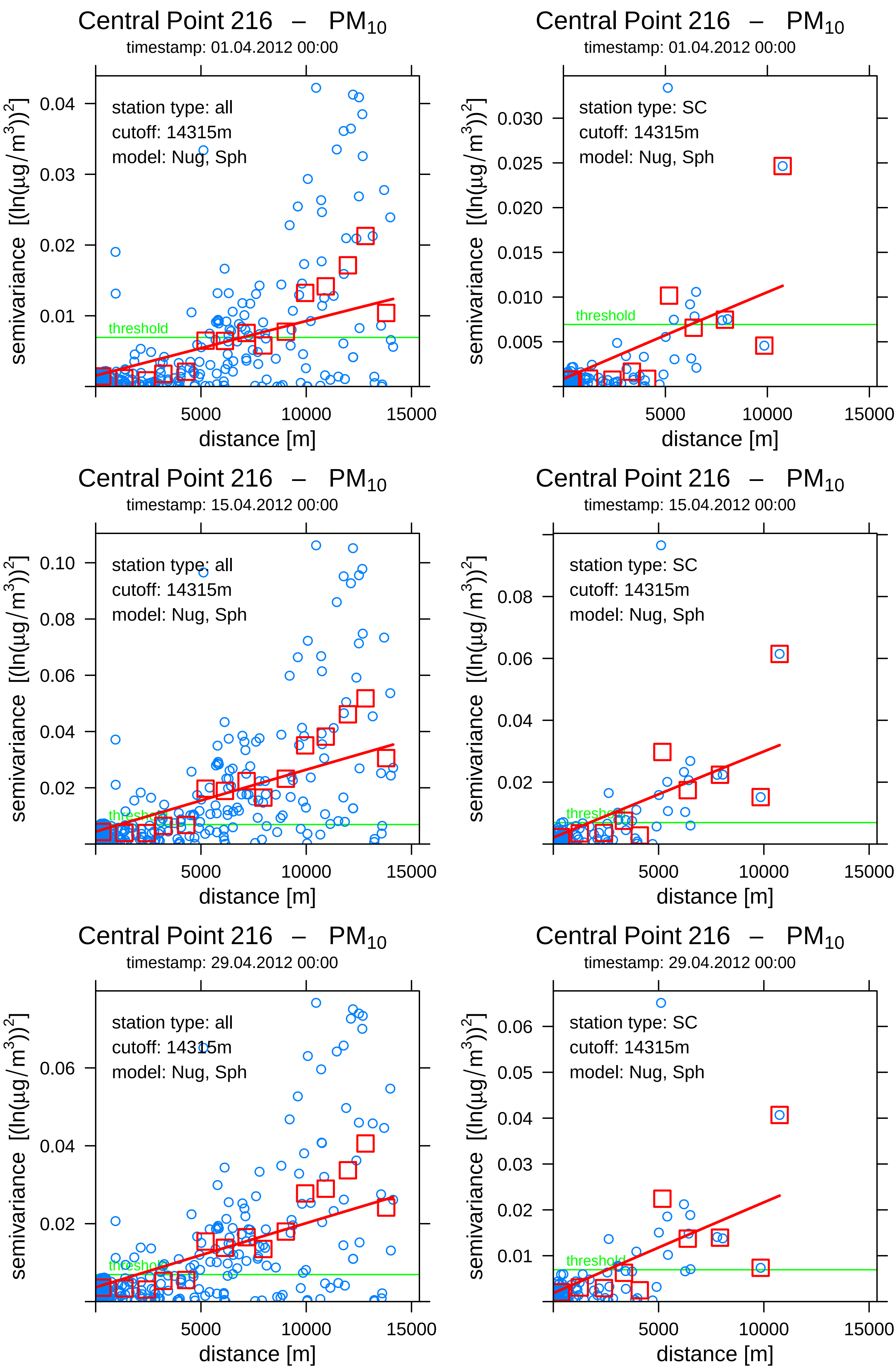

Central Point 216 – PM10
timestamp: 19.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

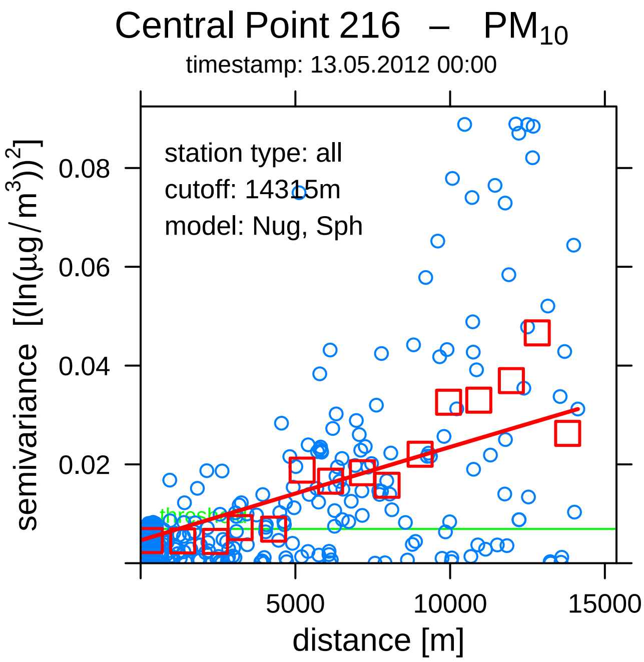

Central Point 216 – PM10
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

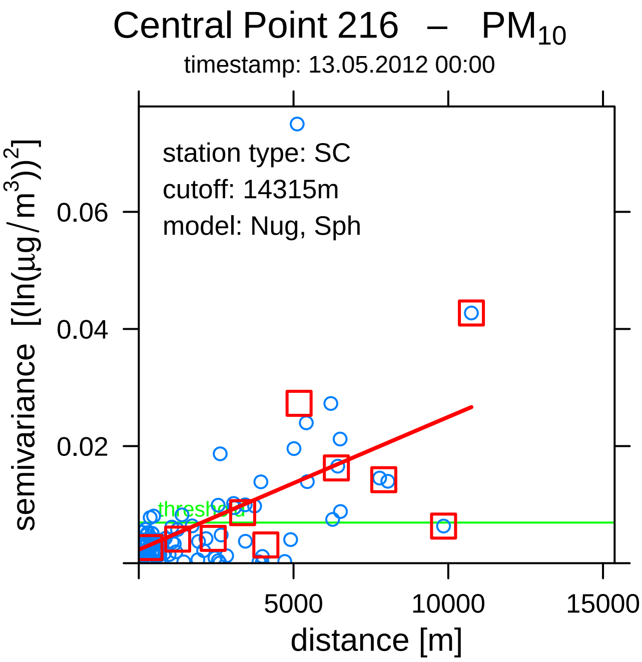

Central Point 216 – PM10
timestamp: 04.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

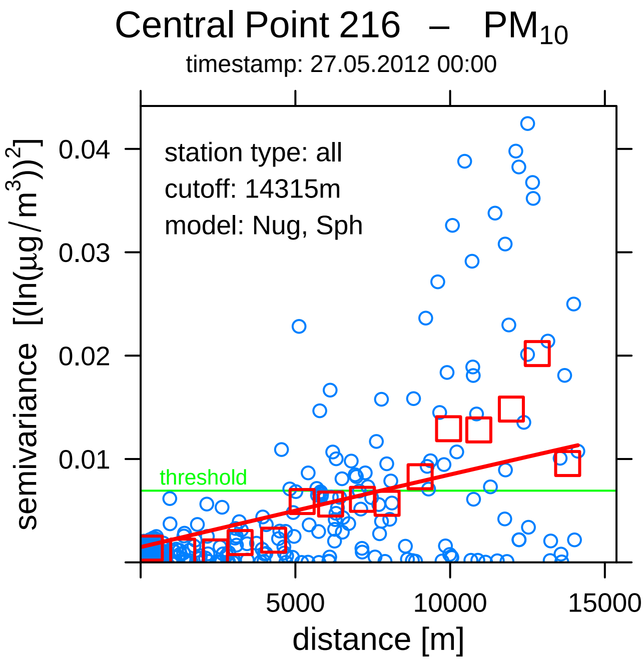

Central Point 216 – PM10
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

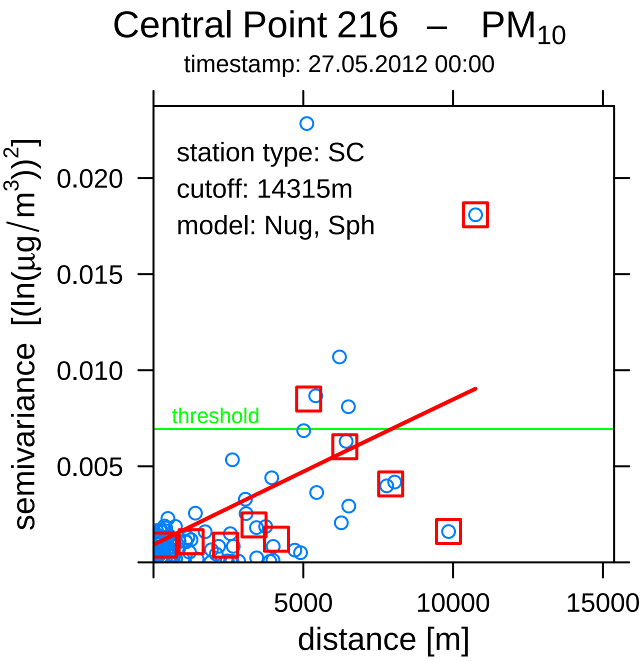

Central Point 216 – PM10
timestamp: 18.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

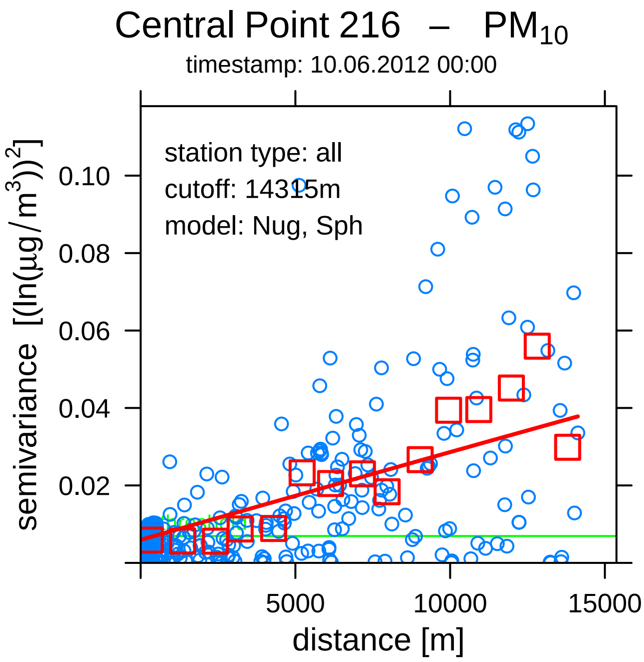

Central Point 216 – PM_{10}
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]
Central Point 216 – PM_{10}
timestamp: 01.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]
Central Point 216 – PM_{10}
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]
Central Point 216 – PM_{10}
timestamp: 15.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]
Central Point 216 – PM_{10}
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]
Central Point 216 – PM_{10}
timestamp: 29.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m^3))^2]
distance [m]

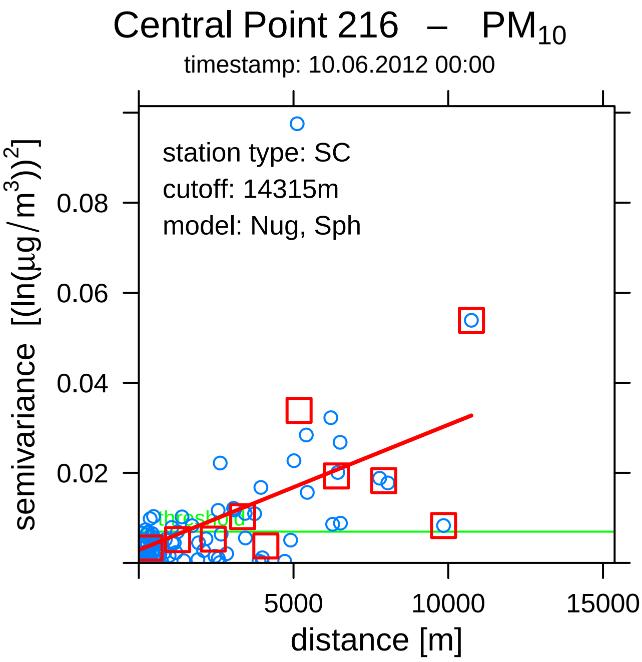

Central Point 216 – PM10
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

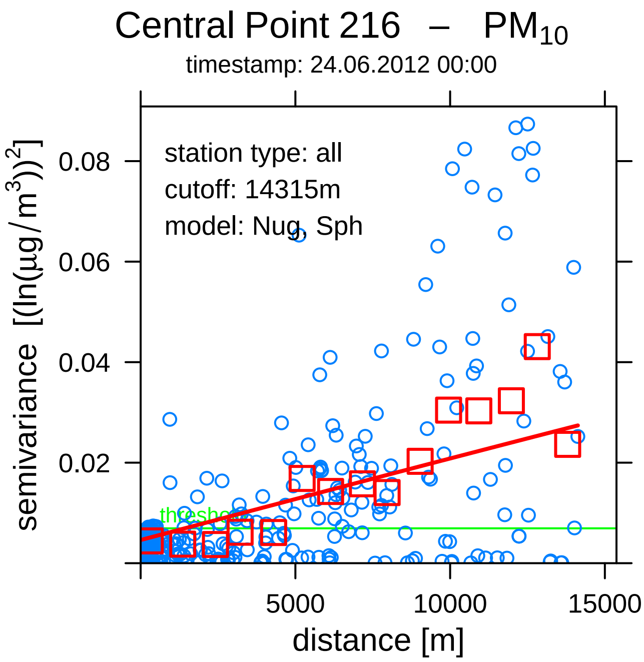

Central Point 216 – PM10
timestamp: 13.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
5000
10000
15000
distance [m]

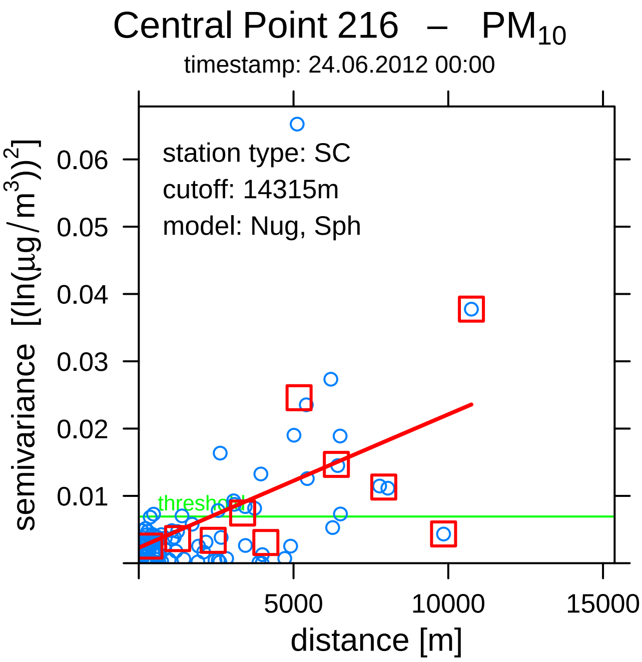

Central Point 216 – PM10
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
5000
10000
15000
distance [m]

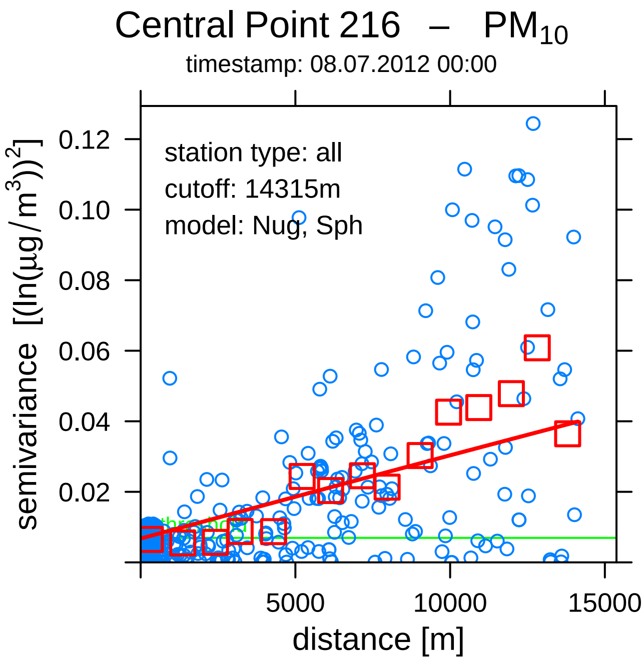

Central Point 216 – PM10
timestamp: 27.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.005
0.010
0.015
0.020
5000
10000
15000
distance [m]

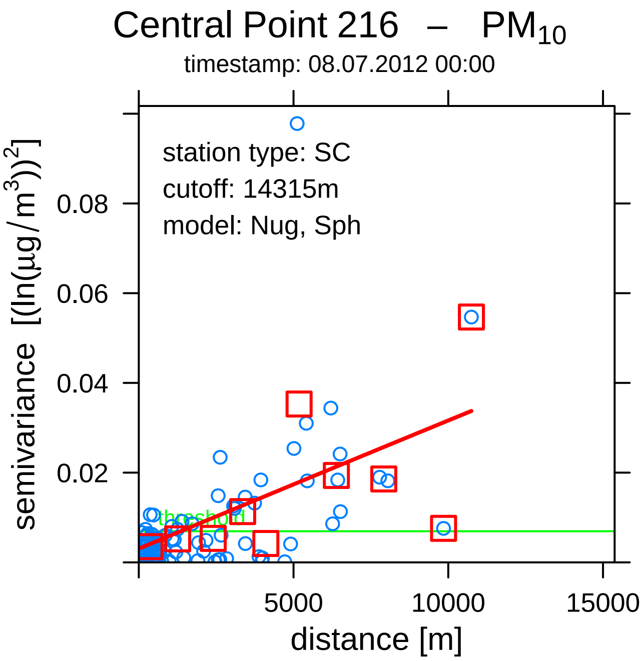

Central Point 216 – PM10
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

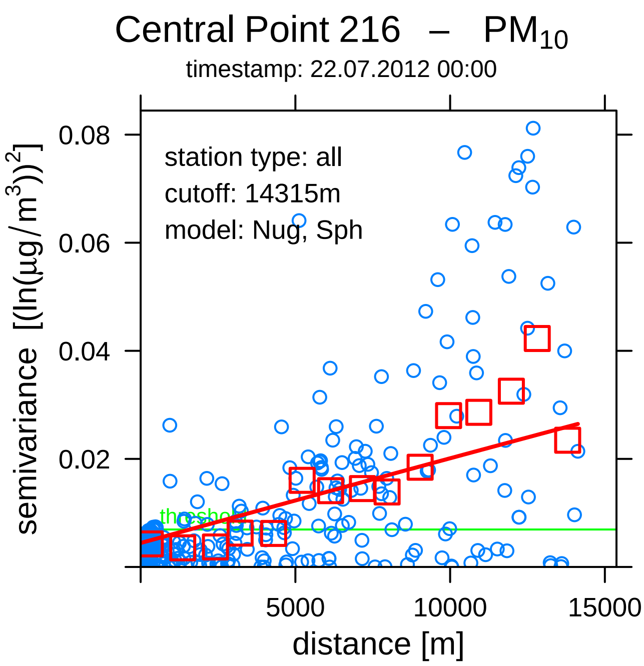

Central Point 216 – PM10
timestamp: 10.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

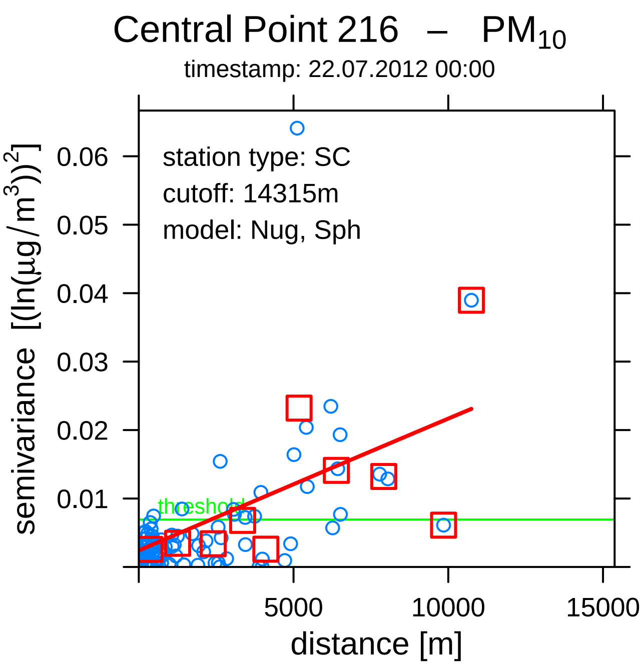

Central Point 216 – PM10
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

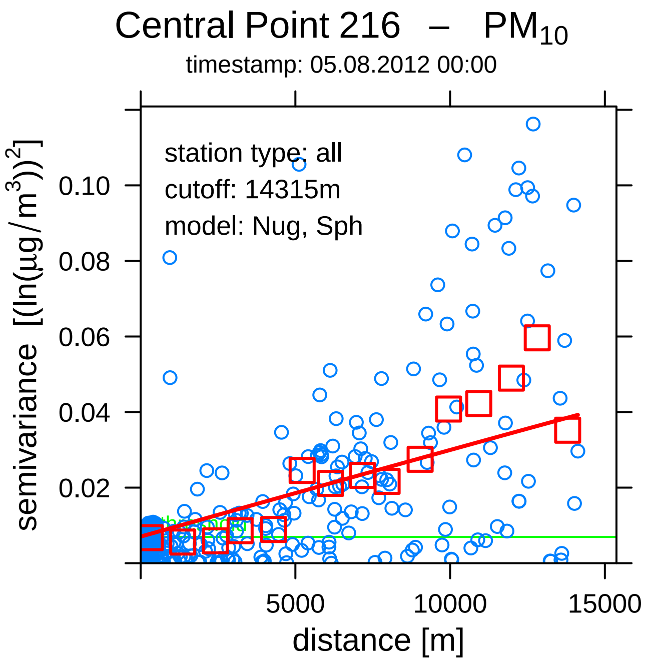

Central Point 216 – PM10
timestamp: 24.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000

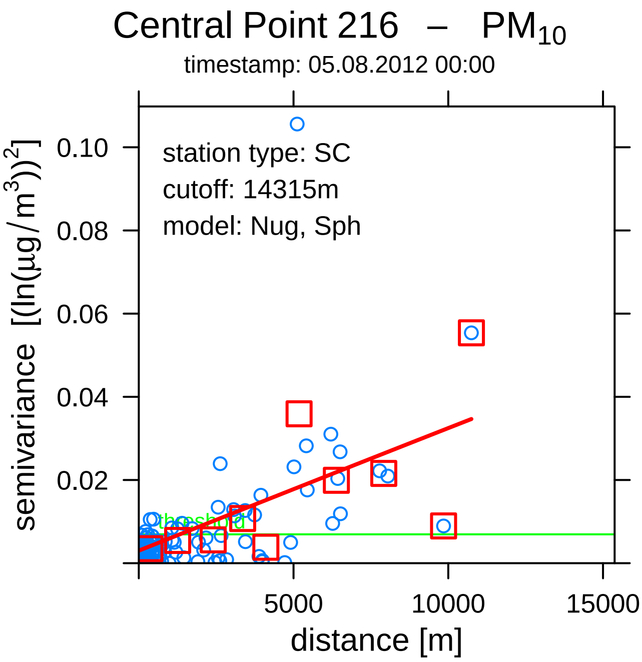

Central Point 216 – PM10
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
0.10
0.12
5000
10000
15000

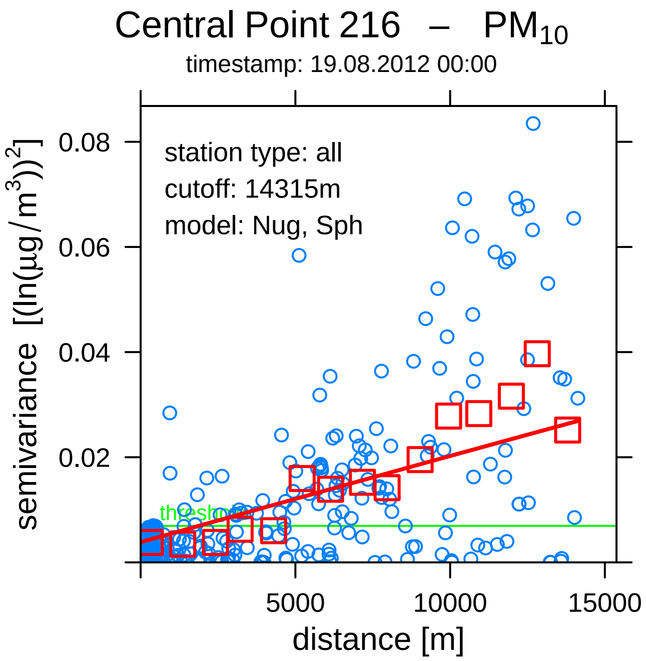

Central Point 216 – PM10
timestamp: 08.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

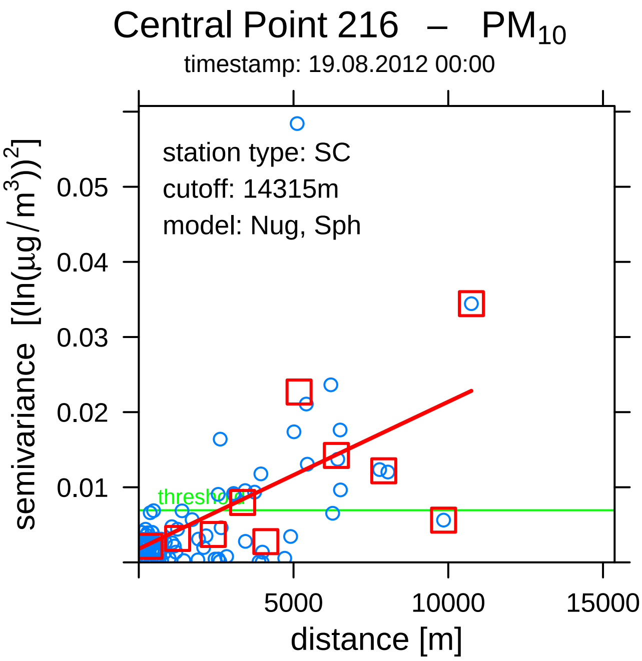

Central Point 216 – PM10
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.02
0.04
0.06
0.08
5000
10000
15000

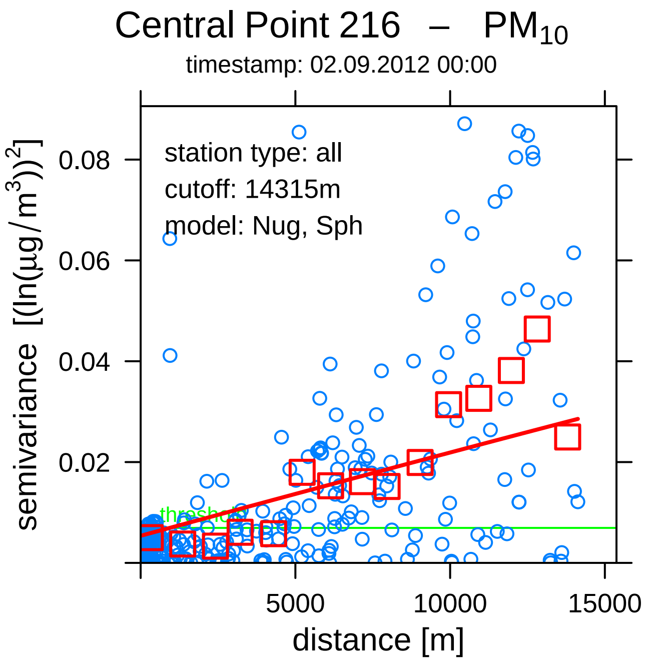

Central Point 216 – PM10
timestamp: 22.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000

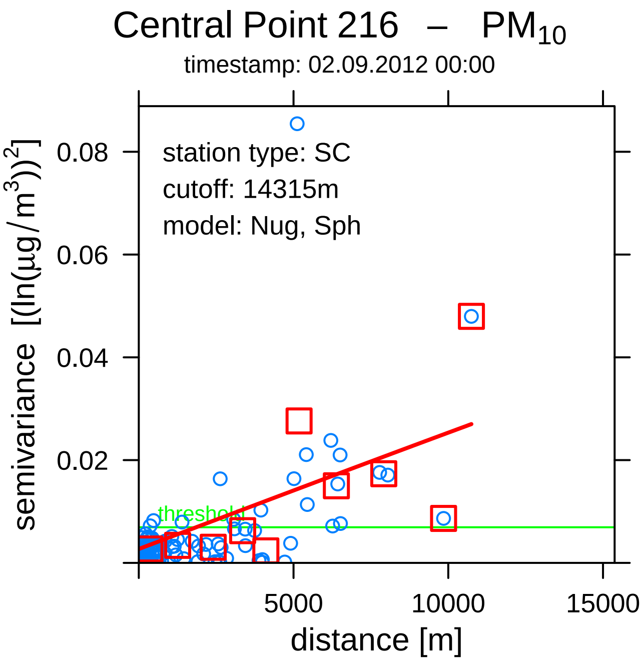

Central Point 216 – PM_{10}
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

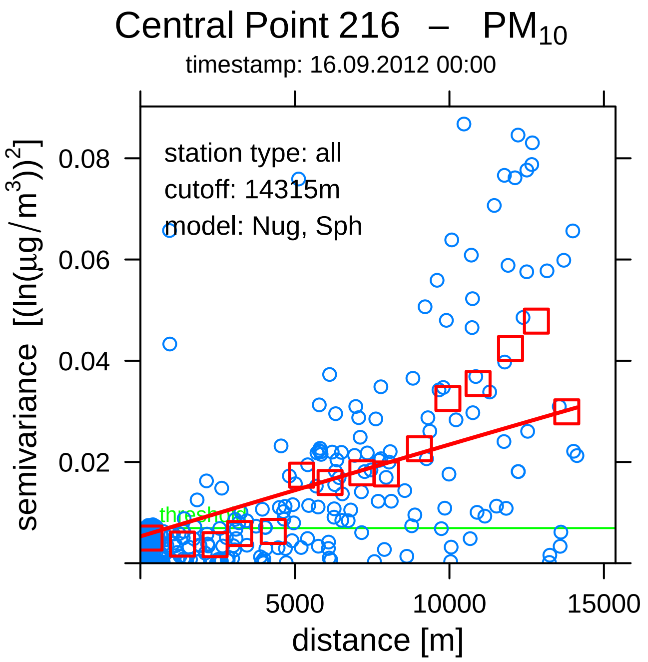

Central Point 216 – PM_{10}
timestamp: 05.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

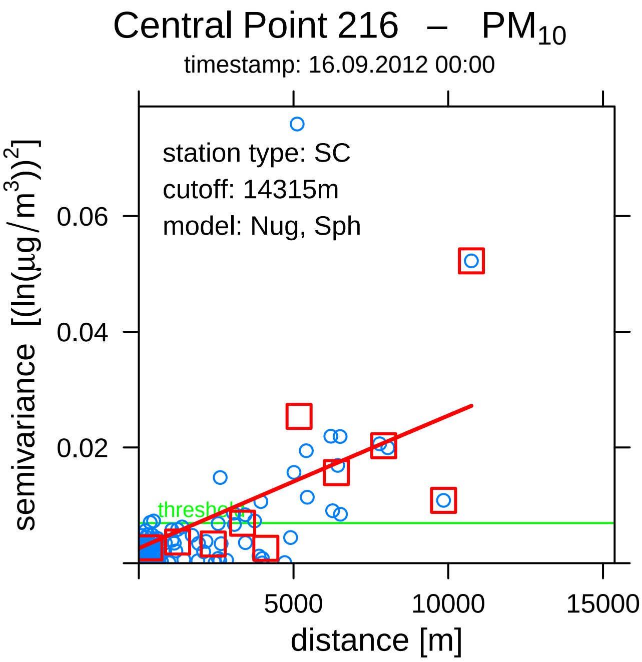

Central Point 216 – PM_{10}
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

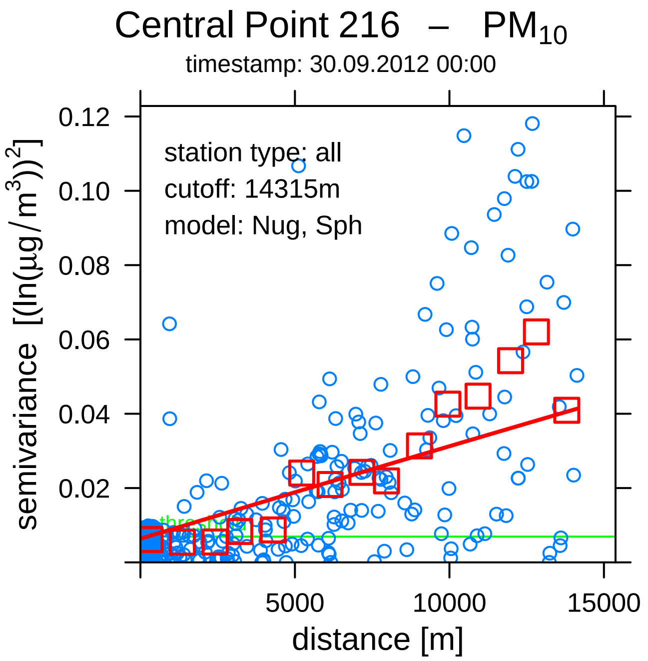

Central Point 216 – PM_{10}
timestamp: 19.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000
distance [m]

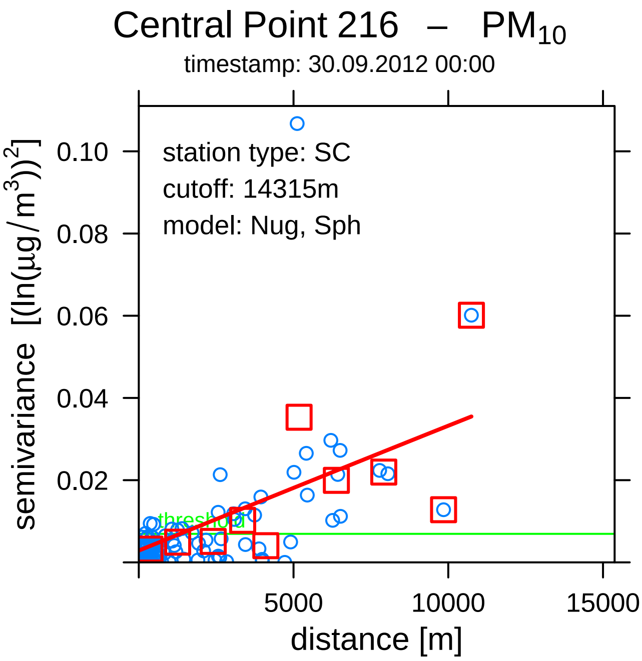

Central Point 216 – PM_{10}
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

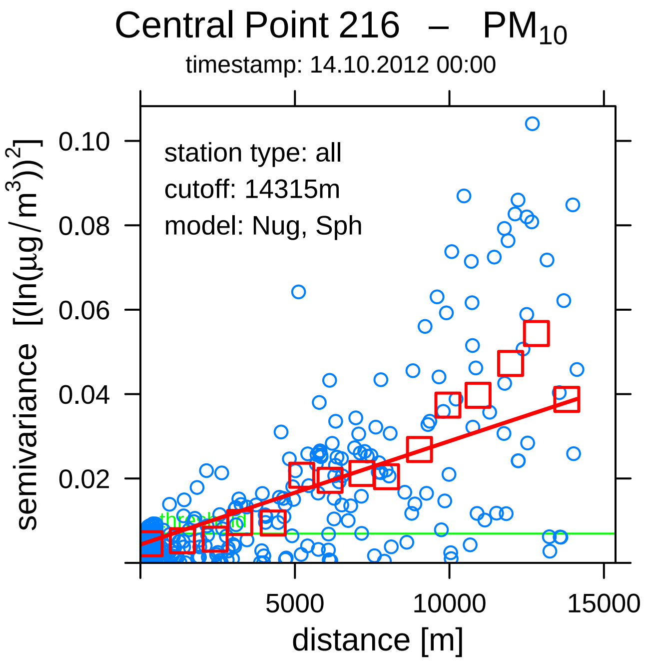

Central Point 216 – PM_{10}
timestamp: 02.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

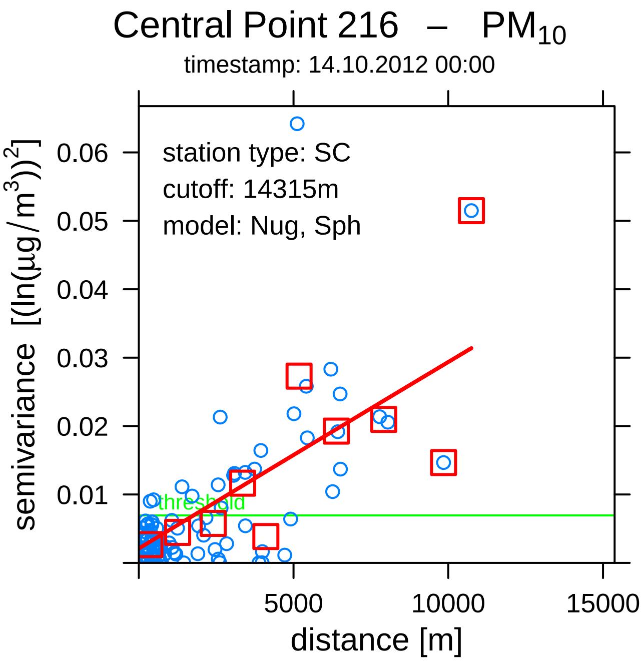

Central Point 216 – PM_{10}
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]

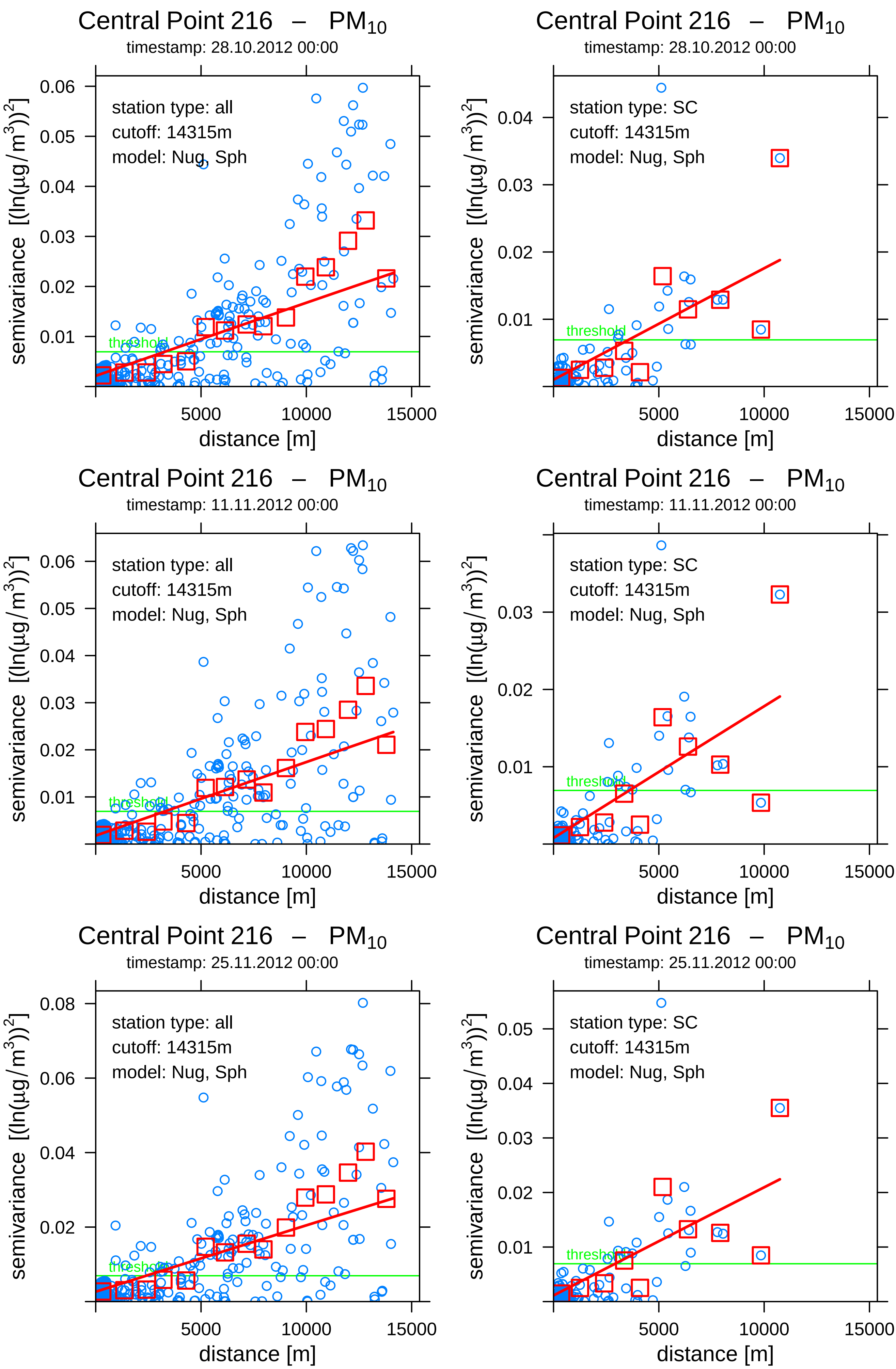

Central Point 216 – PM_{10}
timestamp: 16.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.06
0.04
0.02
5000
10000
15000
distance [m]

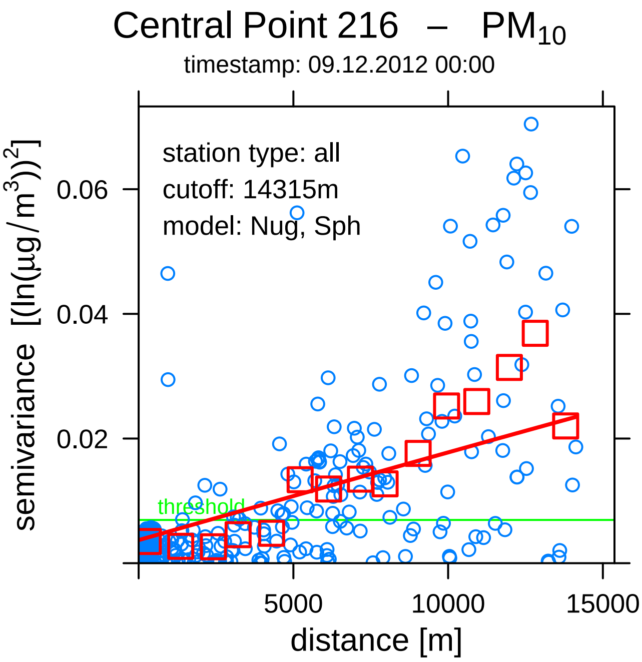

Central Point 216 – PM_{10}
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.12
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]

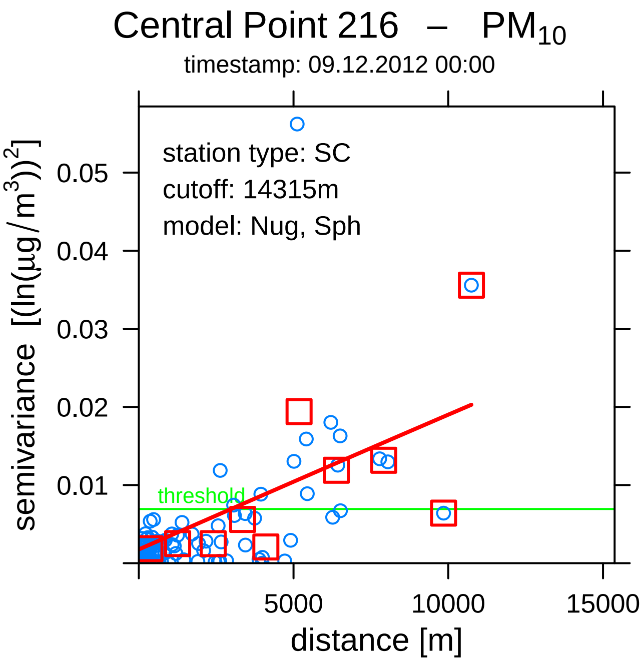

Central Point 216 – PM_{10}
timestamp: 30.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]

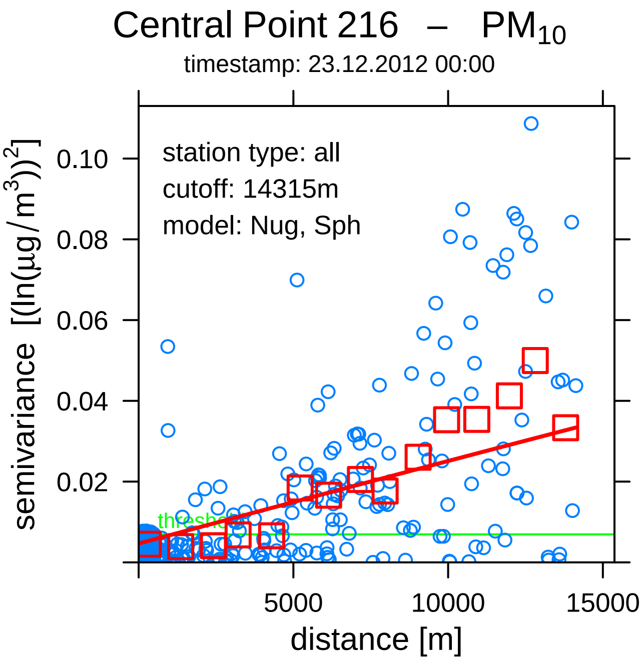

Central Point 216 – PM_{10}
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]

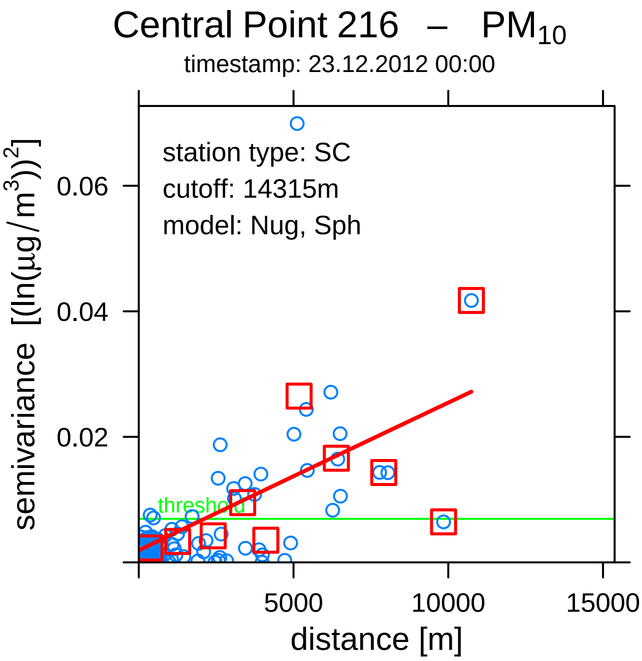

Central Point 216 – PM_{10}
timestamp: 14.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.06
0.05
0.04
0.03
0.02
0.01
5000
10000
15000
distance [m]


Central Point 216 – PM10
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – PM10
timestamp: 28.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – PM10
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – PM10
timestamp: 11.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – PM10
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – PM10
timestamp: 25.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]


Central Point 216 – PM10
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
5000
10000
15000
distance [m]


Central Point 216 – PM10
timestamp: 09.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000
distance [m]


Central Point 216 – PM10
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]


Central Point 216 – PM10
timestamp: 23.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
5000
10000
15000
distance [m]

Annex 2. Point centred variograms for NO_2

Point centred variograms obtained from log-transformed concentration time series for virtual stations cp7, cp17 and cp 216 of the Antwerp dataset:

— time series of point centred variograms calculated on 14-day average concentrations

— variogram model fits using a spherical model with nugget effect

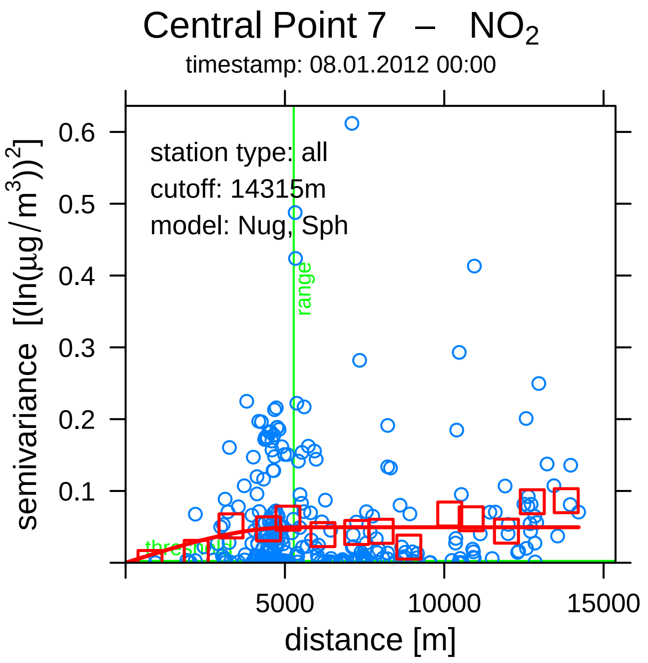
— identification of an effective distance of spatial representativeness

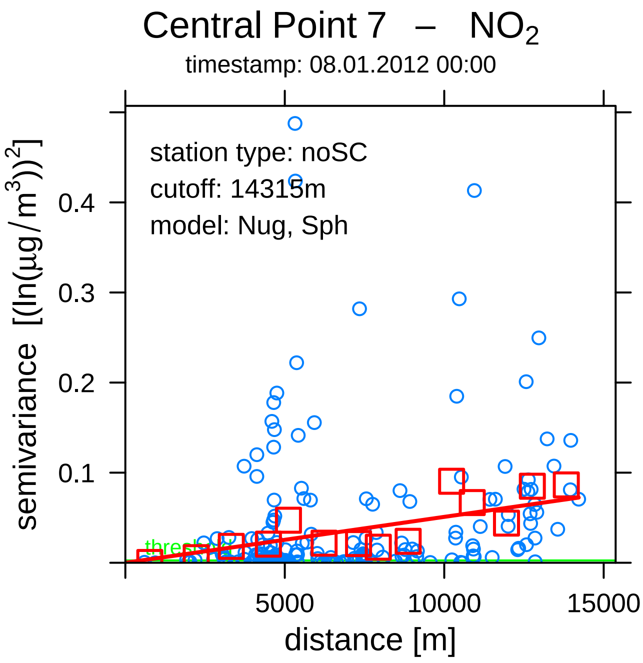
Part 2: NO_2

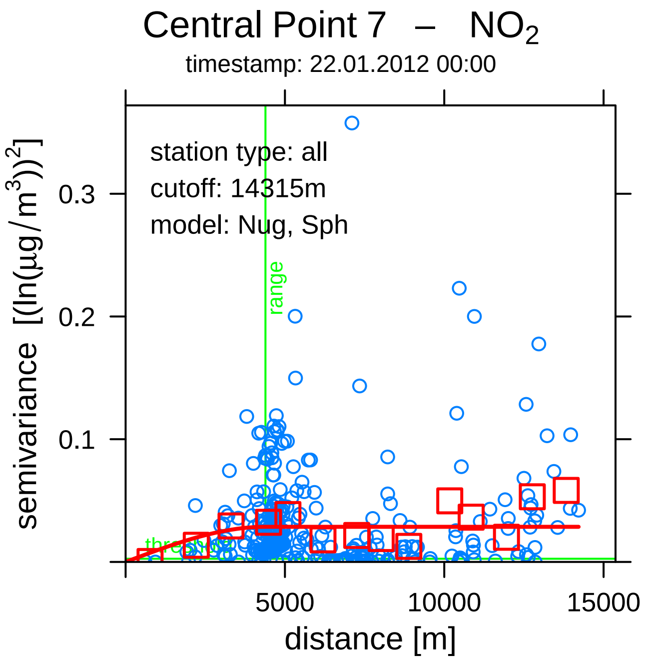
Note that plots on the **left side** display the point centred variography results obtained by using data from all 341 virtual monitoring points. Plots on the **right side** display the results obtained by using only the 241 non-street-canyon points for the point centred variograms of virtual monitoring stations cp7 and cp17, and only the 100 street-canyon points for the point centred variograms of virtual monitoring station cp216.

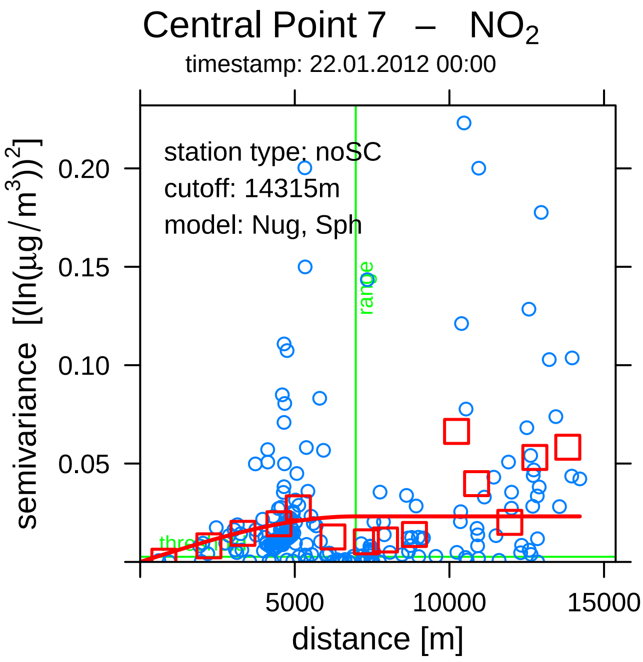
Blue circles indicate the point centred semivariance values of all paired observations formed between individual points and the corresponding central point (**variogram cloud**). Red squares are the average values of semivariance formed within the 15 lag distance classes (**empirical variogram**). Red line is the **variogram model** (spherical model with nugget effect fitted to the empirical variogram).

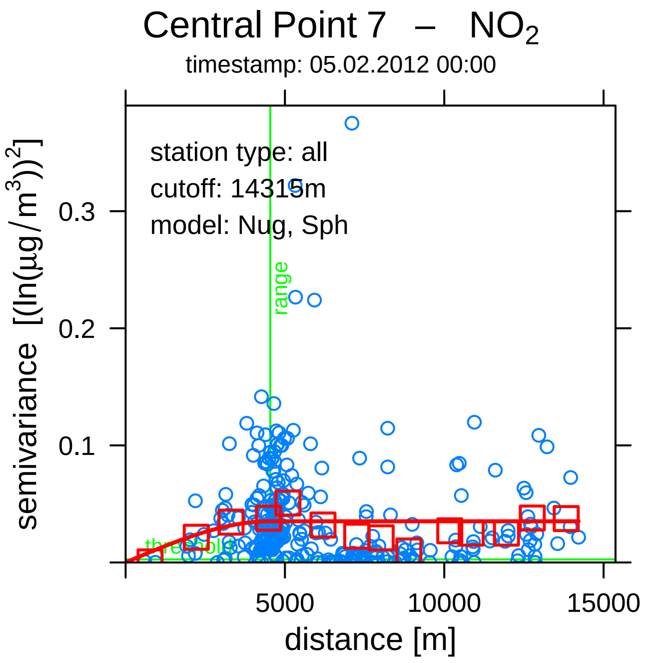
Horizontal green lines mark the **semivariance threshold** associated with the maximum relative deviation of concentrations permissible within the limits of spatial representativeness. Vertical green lines mark the **range distance** of the variogram model. This vertical line is not visible when the estimated range falls beyond the cutoff distance used in the variogram calculations.

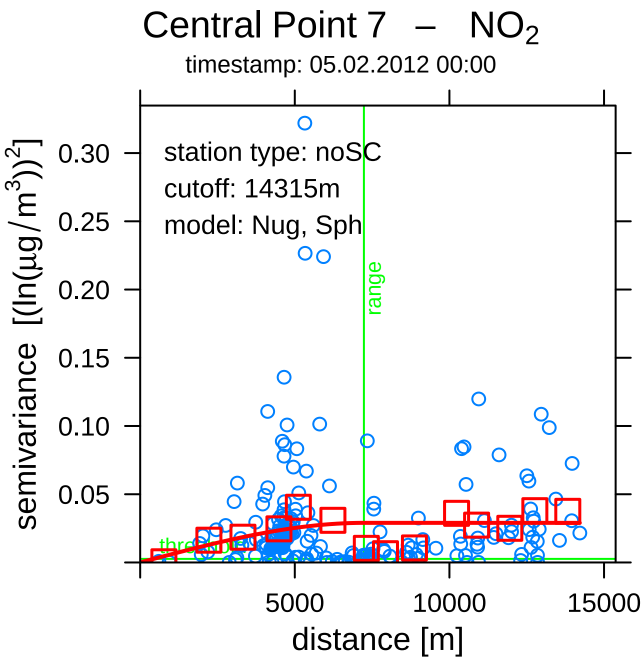

Central Point 7 – NO2
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

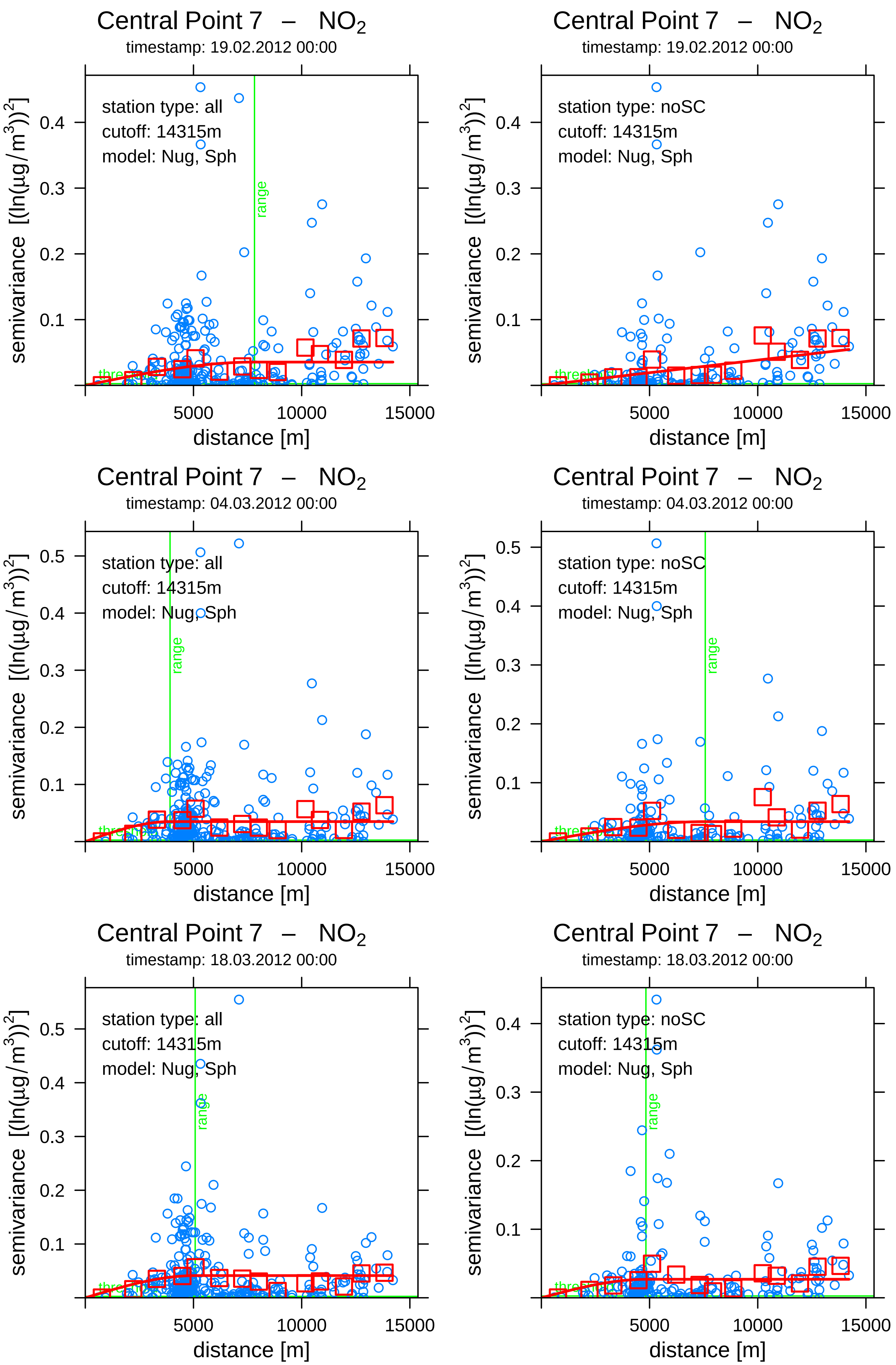

Central Point 7 – NO2
timestamp: 08.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]


Central Point 7 – NO2
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]


Central Point 7 – NO2
timestamp: 22.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

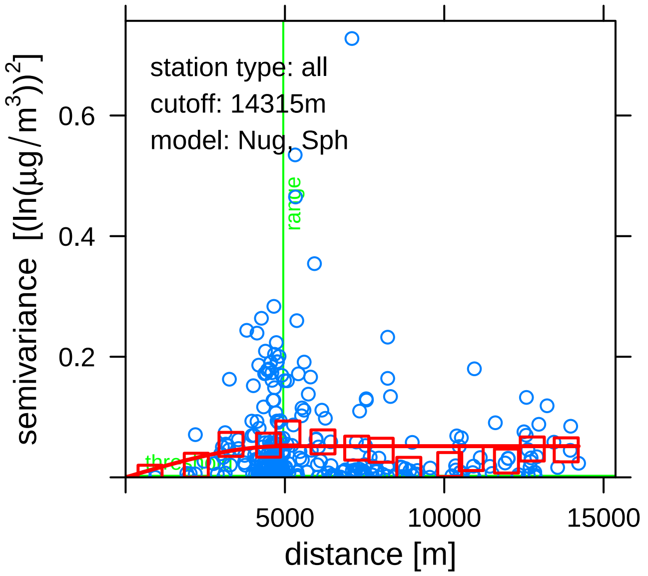

Central Point 7 – NO2
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]


Central Point 7 – NO2
timestamp: 05.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

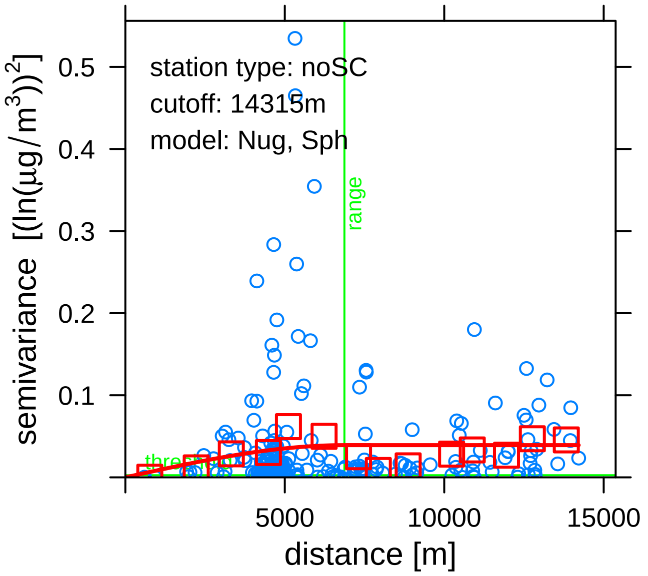


Central Point 7 – NO2
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 7 – NO2
timestamp: 19.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
Central Point 7 – NO2
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 7 – NO2
timestamp: 04.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
Central Point 7 – NO2
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 7 – NO2
timestamp: 18.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
5000
10000
15000
0.1
0.2
0.3
0.4
0.5

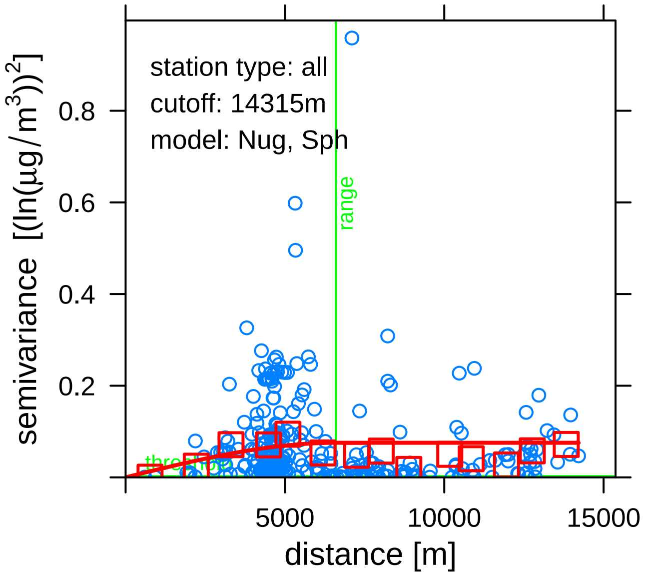
Central Point 7 – NO_2
timestamp: 01.04.2012 00:00



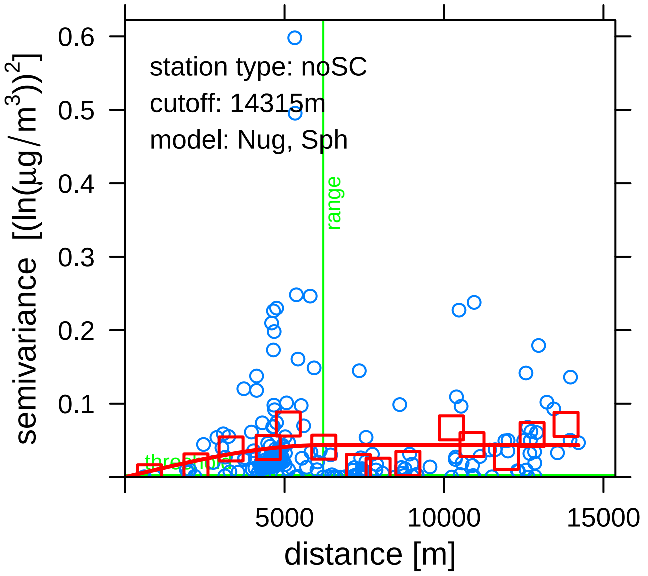
Central Point 7 – NO_2
timestamp: 01.04.2012 00:00



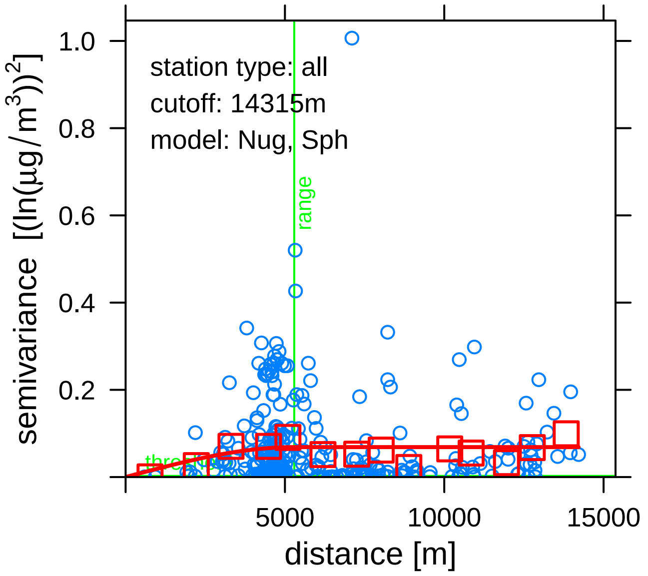
Central Point 7 – NO_2
timestamp: 15.04.2012 00:00



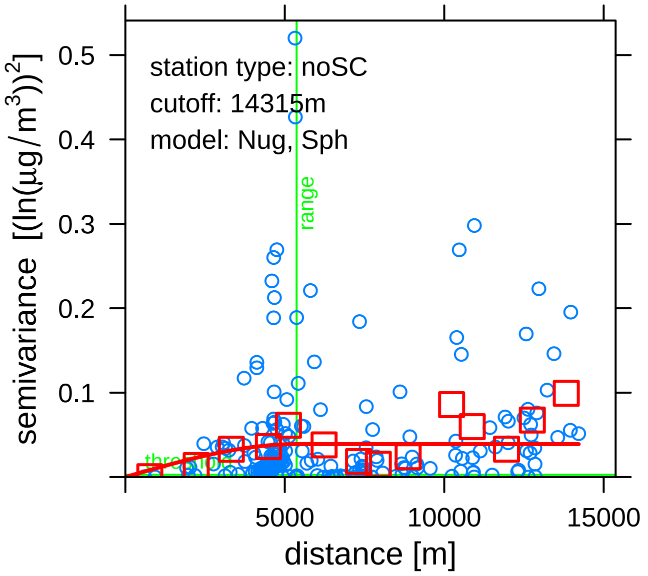
Central Point 7 – NO_2
timestamp: 15.04.2012 00:00

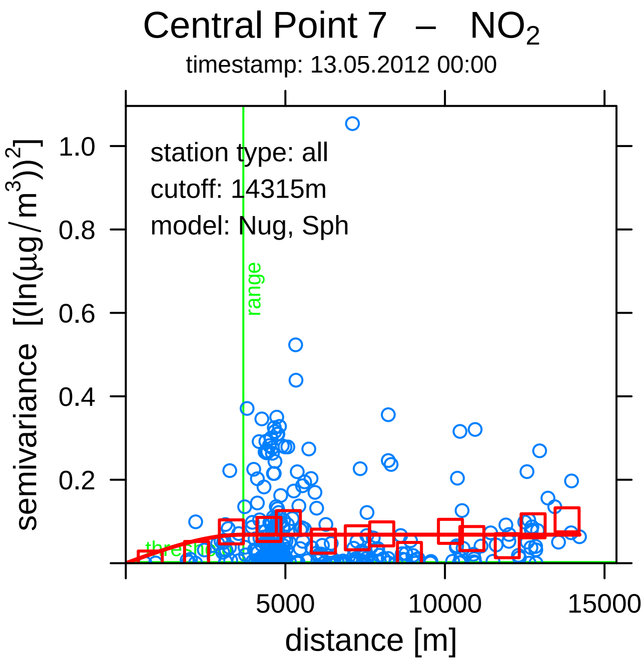


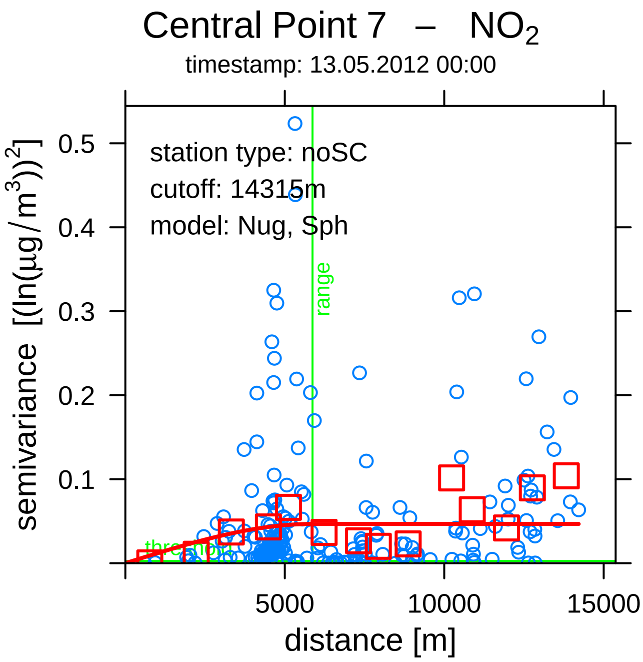
Central Point 7 – NO_2
timestamp: 29.04.2012 00:00

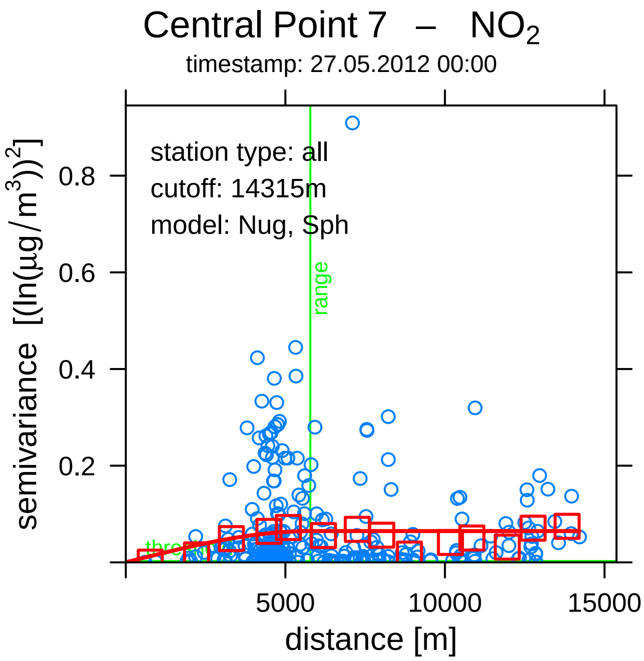


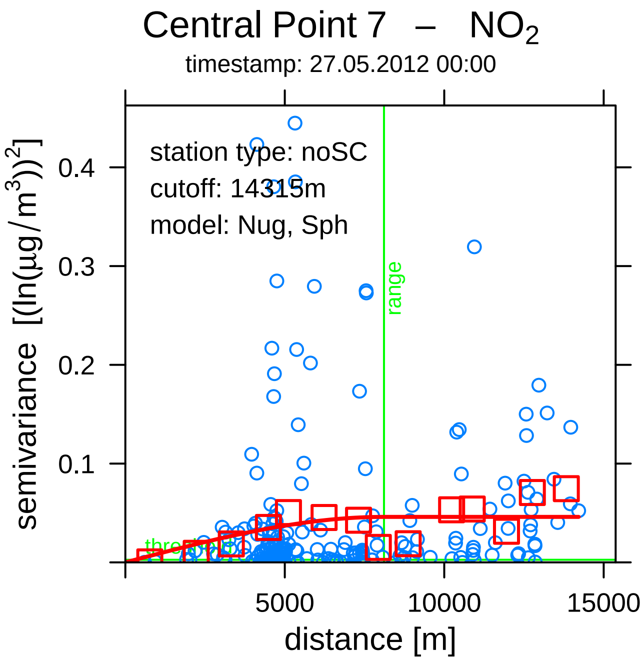
Central Point 7 – NO_2
timestamp: 29.04.2012 00:00

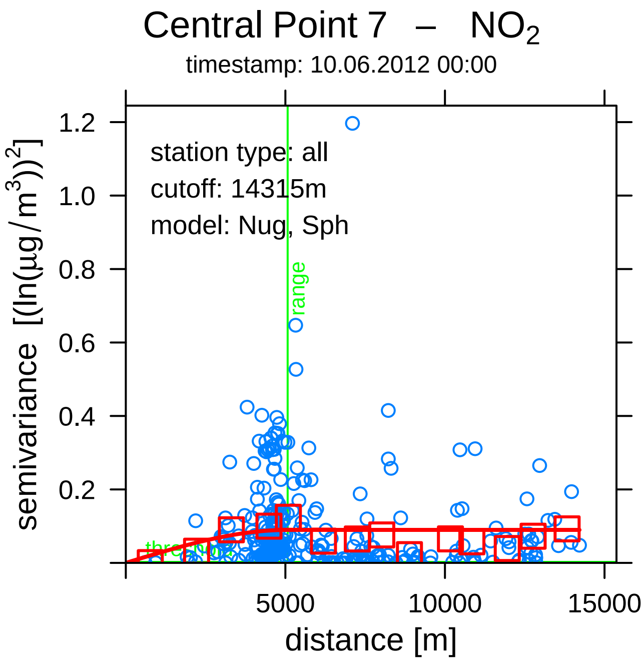


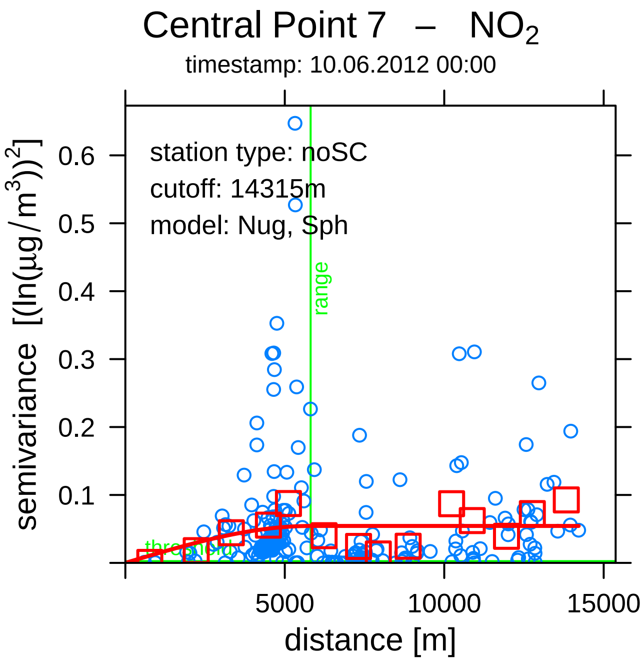

Central Point 7 – NO2
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
1.0
0.8
0.6
0.4
0.2
5000
10000
15000
distance [m]

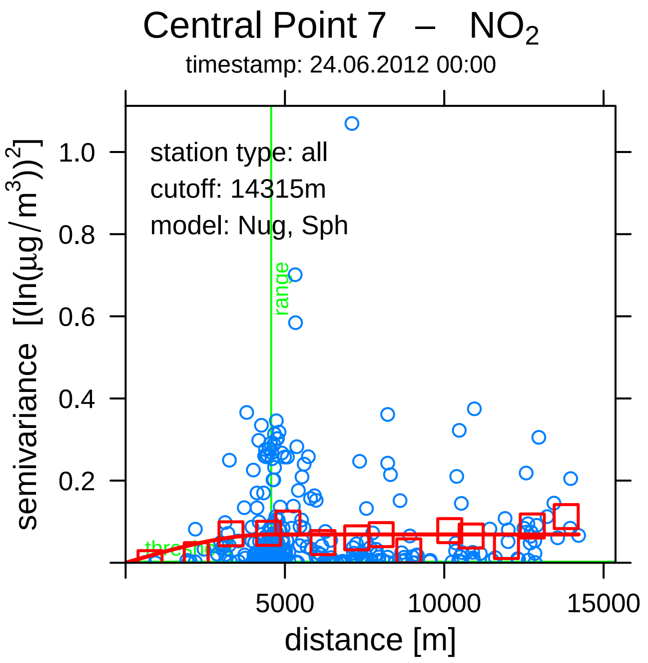

Central Point 7 – NO2
timestamp: 13.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.5
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

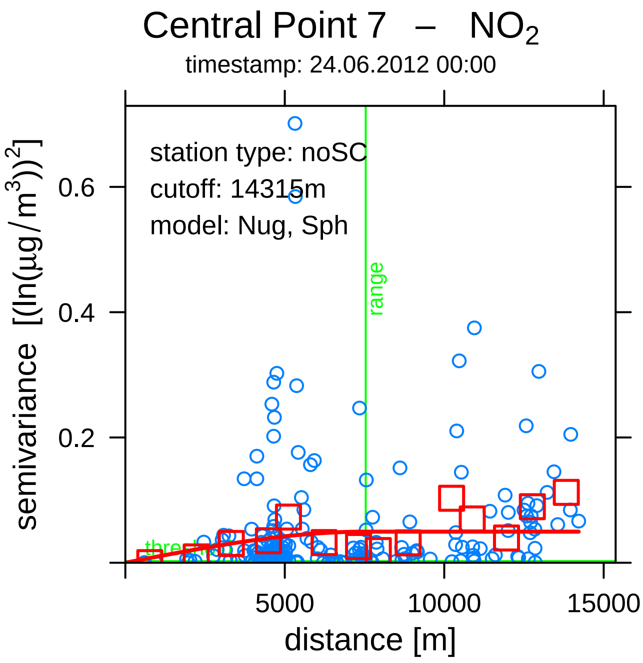

Central Point 7 – NO2
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.8
0.6
0.4
0.2
5000
10000
15000
distance [m]

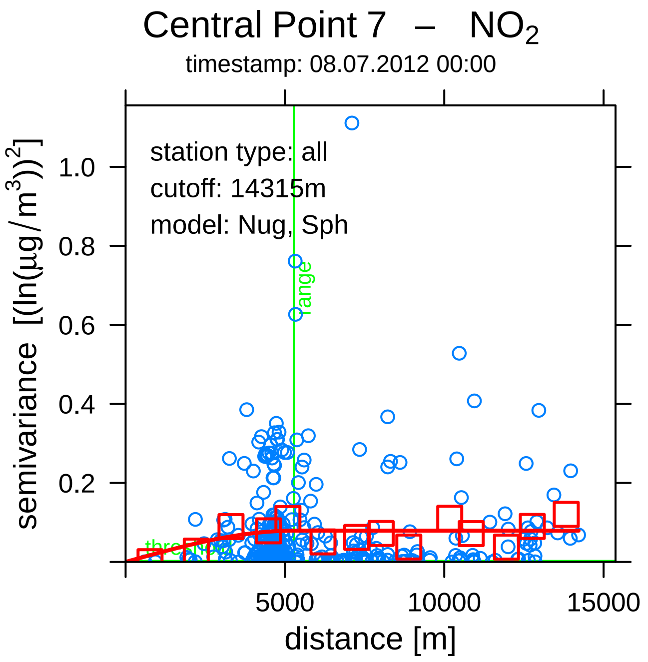

Central Point 7 – NO2
timestamp: 27.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

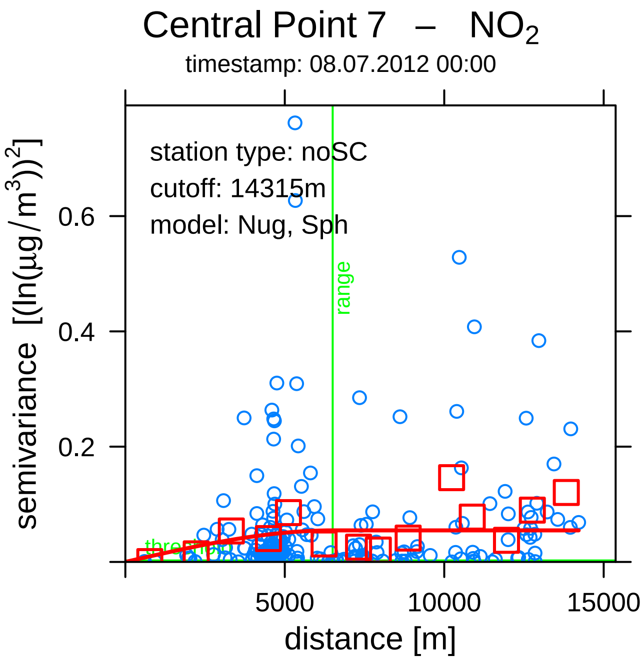

Central Point 7 – NO2
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
1.2
1.0
0.8
0.6
0.4
0.2
5000
10000
15000
distance [m]

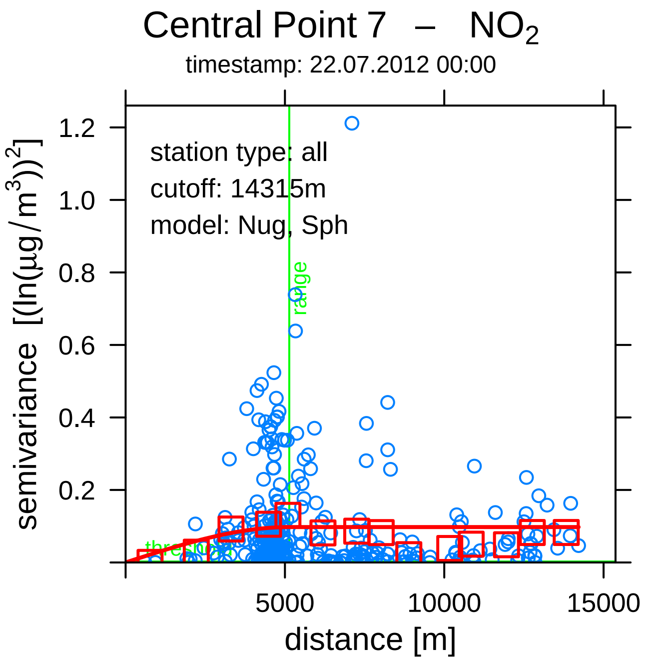

Central Point 7 – NO2
timestamp: 10.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.6
0.5
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

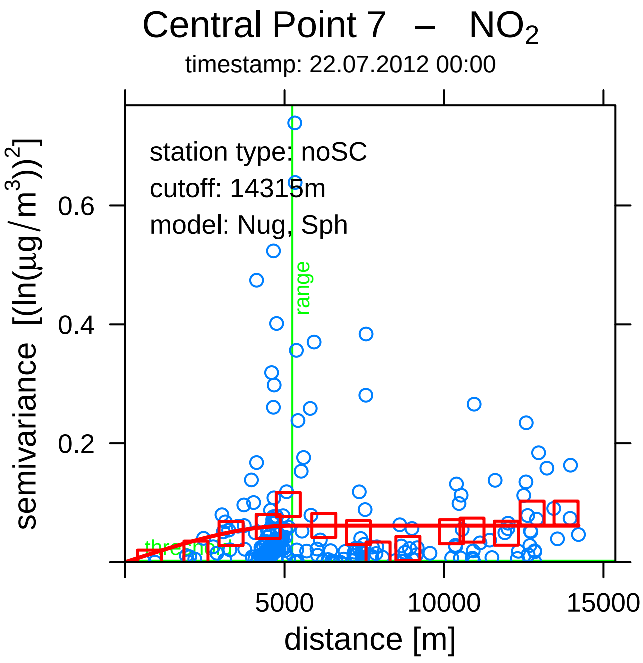

Central Point 7 – NO_2
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
1.0
0.8
0.6
0.4
0.2
5000
10000
15000

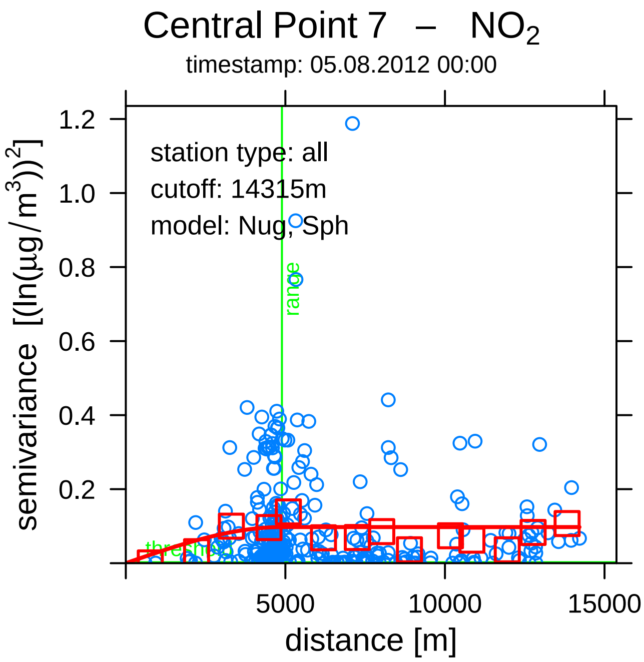

Central Point 7 – NO_2
timestamp: 24.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.6
0.4
0.2
5000
10000
15000

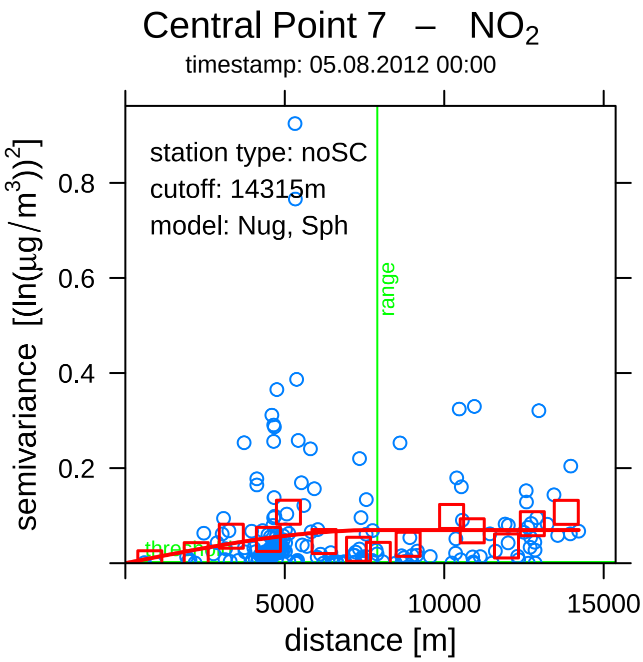

Central Point 7 – NO_2
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
1.0
0.8
0.6
0.4
0.2
5000
10000
15000

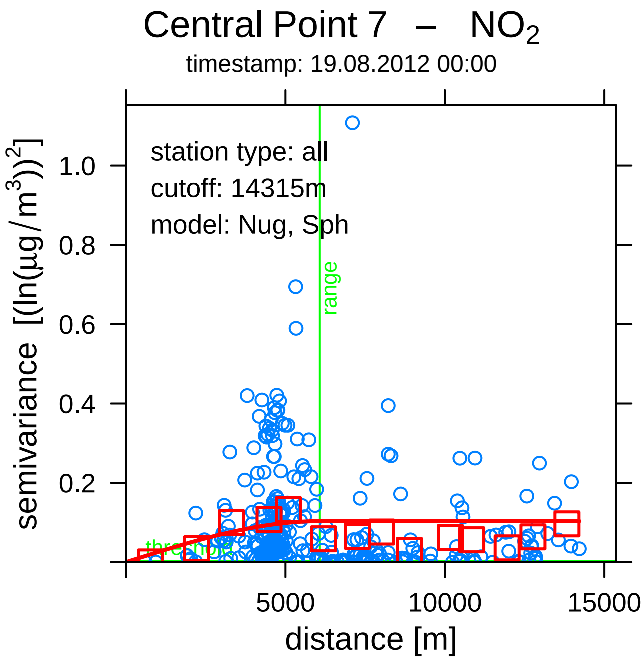

Central Point 7 – NO_2
timestamp: 08.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.6
0.4
0.2
5000
10000
15000

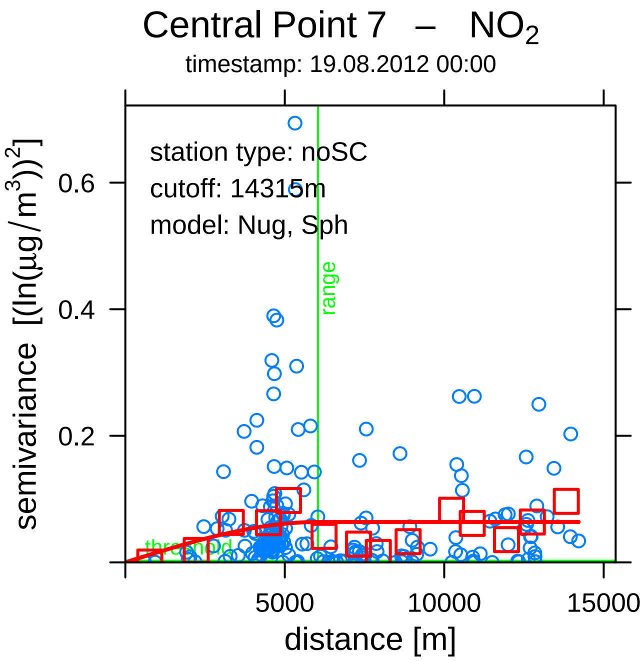

Central Point 7 – NO_2
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
1.2
1.0
0.8
0.6
0.4
0.2
5000
10000
15000

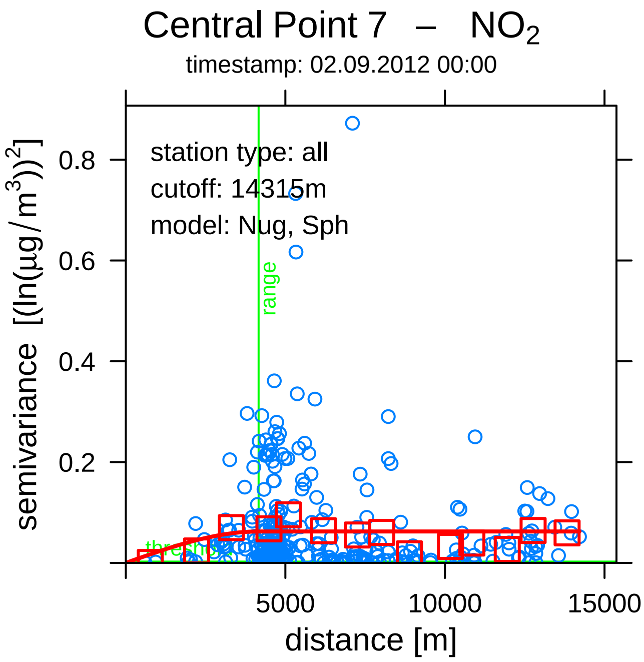

Central Point 7 – NO_2
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.6
0.4
0.2
5000
10000
15000

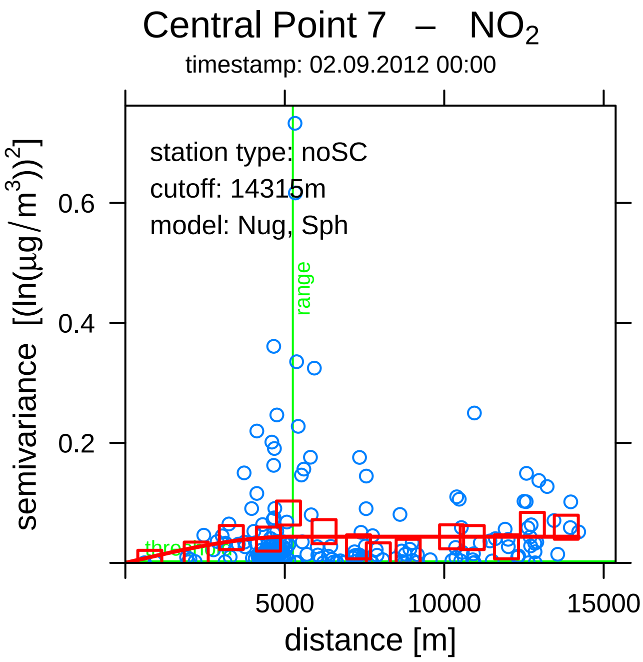

Central Point 7 – NO2
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

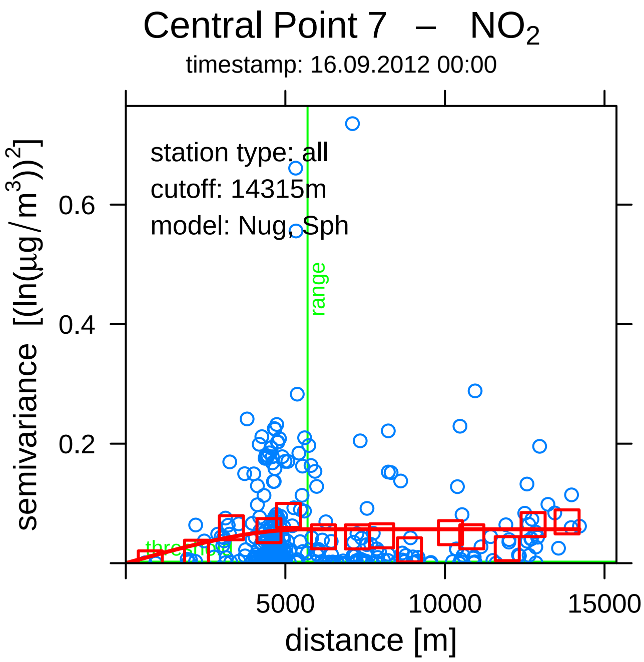

Central Point 7 – NO2
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

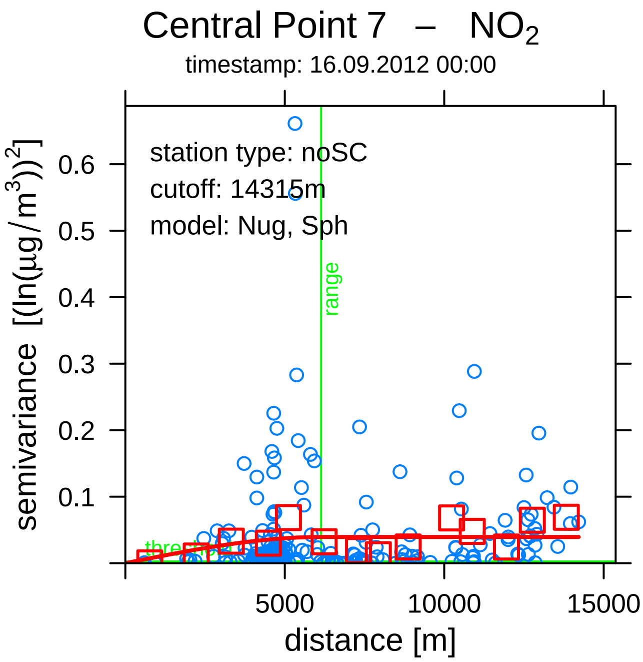

Central Point 7 – NO2
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

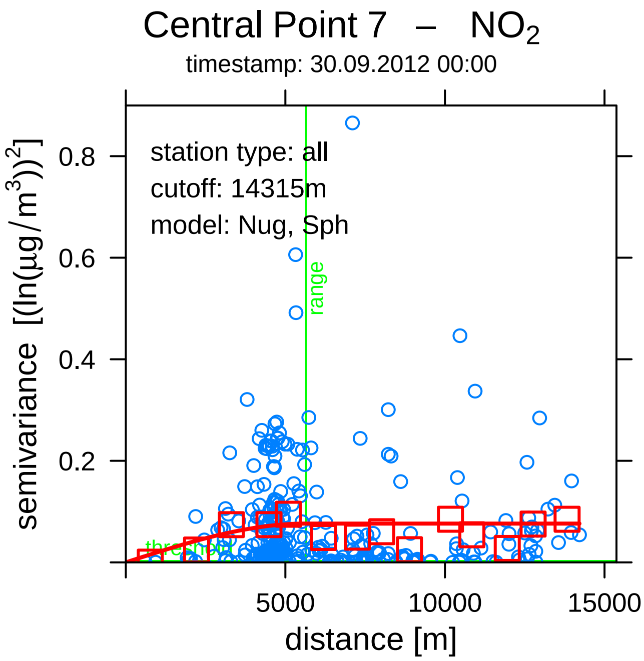

Central Point 7 – NO2
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

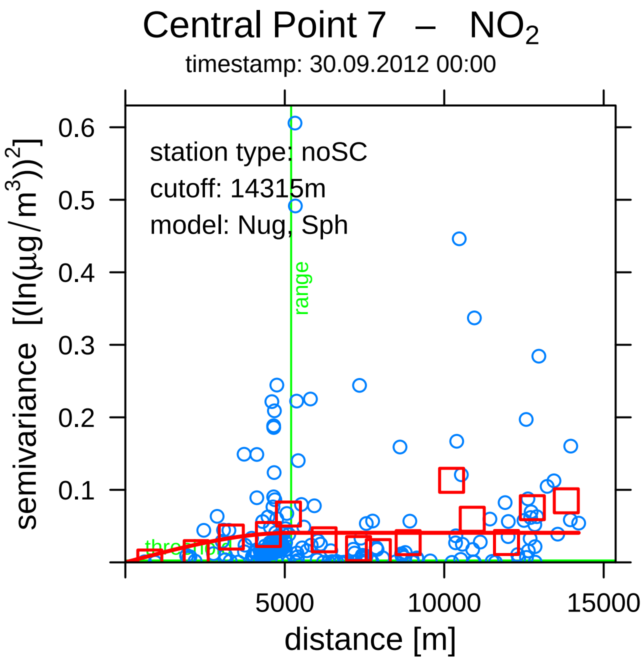

Central Point 7 – NO2
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

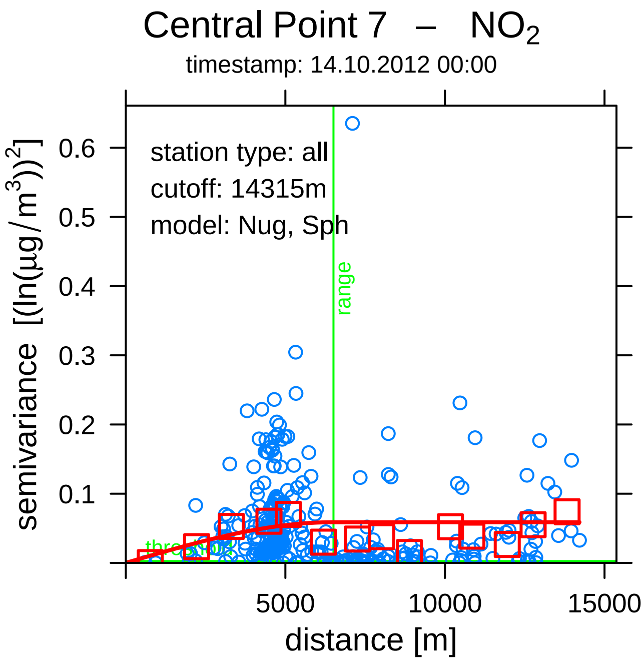

Central Point 7 – NO2
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

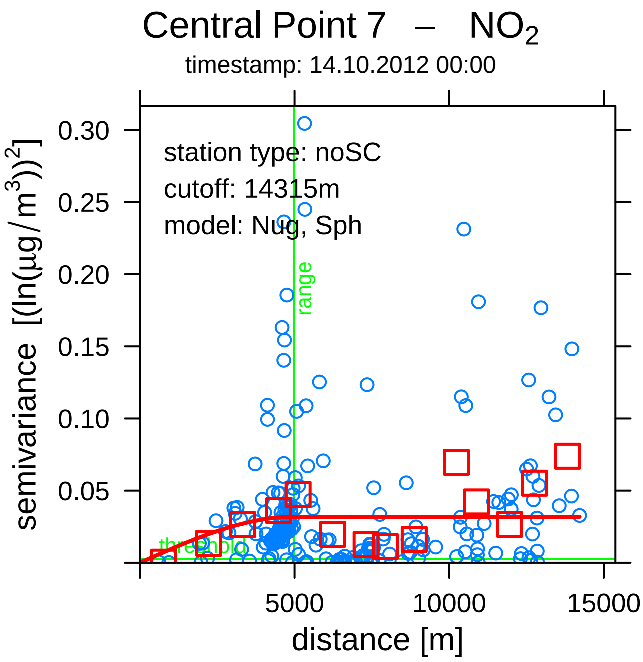

Central Point 7 – NO_2
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.2
0.4
0.6
5000
10000
15000

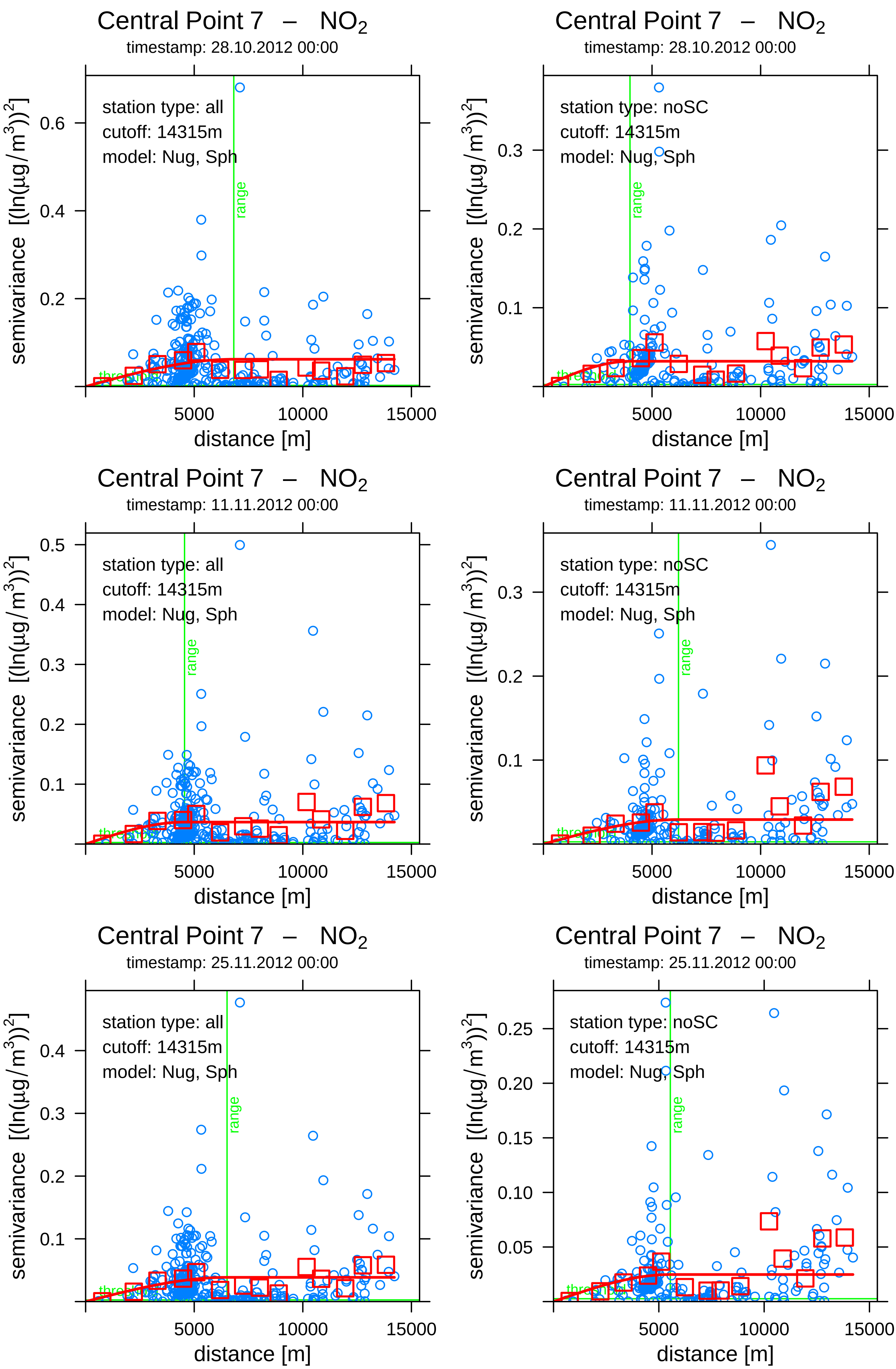

Central Point 7 – NO_2
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000

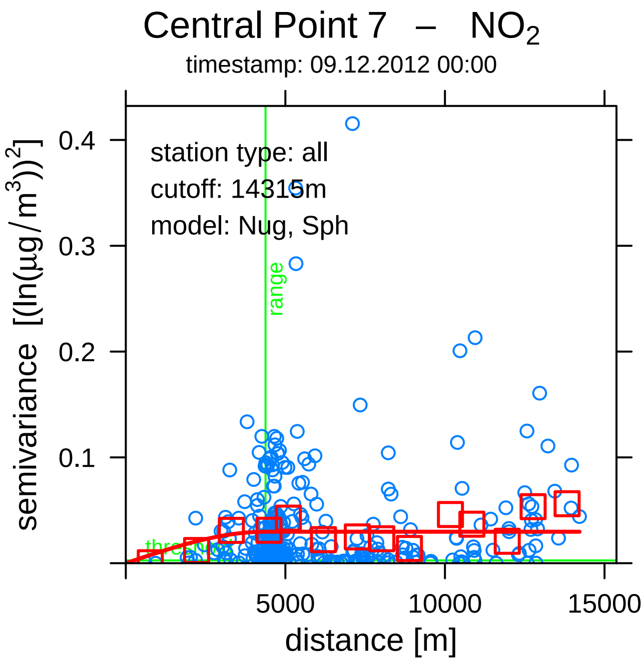

Central Point 7 – NO_2
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

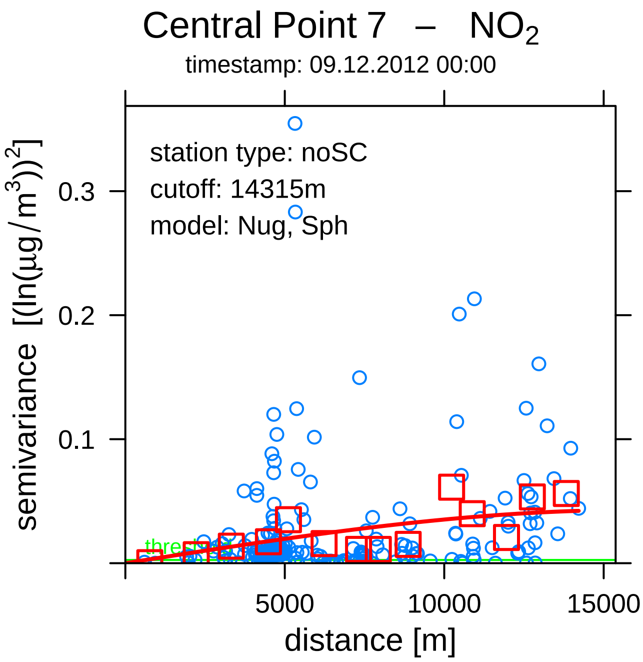

Central Point 7 – NO_2
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000

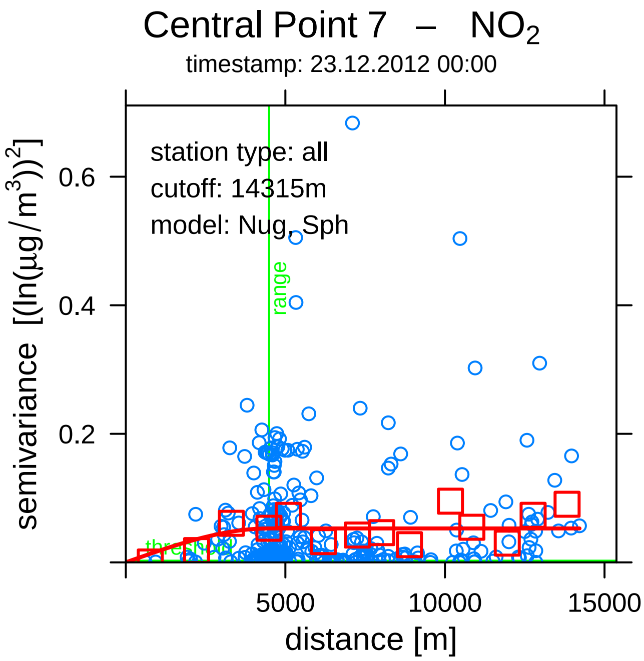

Central Point 7 – NO_2
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000

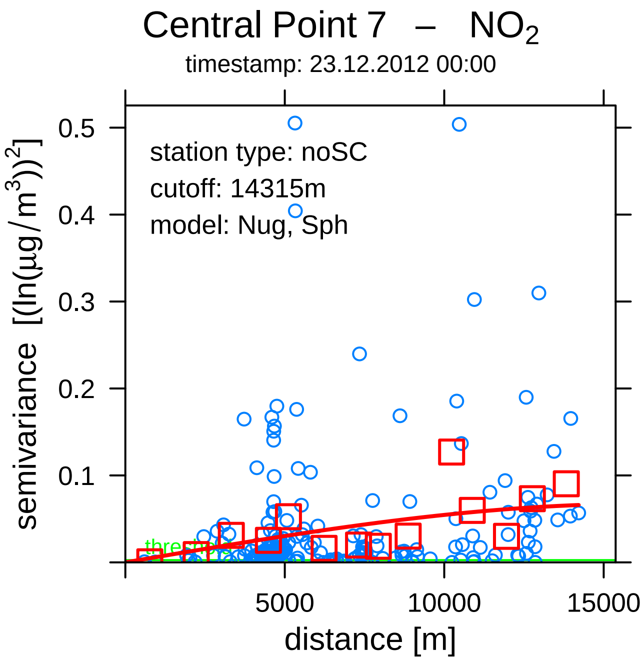

Central Point 7 – NO_2
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000

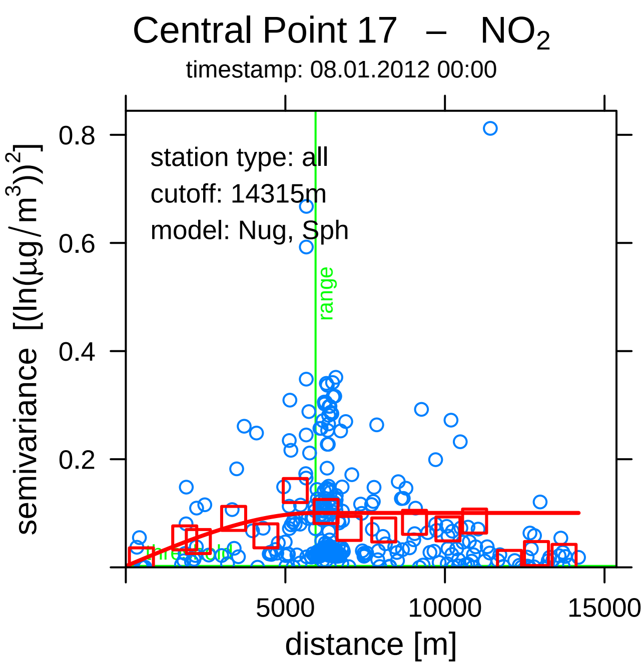

Central Point 7 – NO2
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 7 – NO2
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 7 – NO2
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 7 – NO2
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 7 – NO2
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 7 – NO2
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

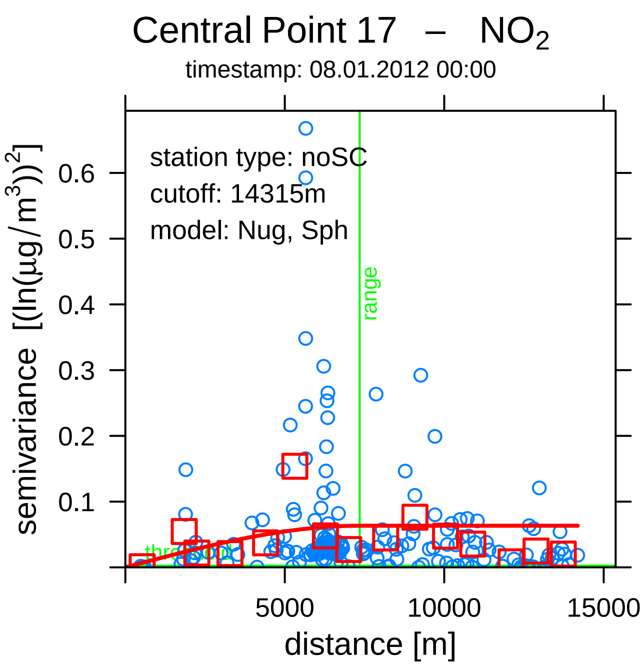

Central Point 7 – NO2
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

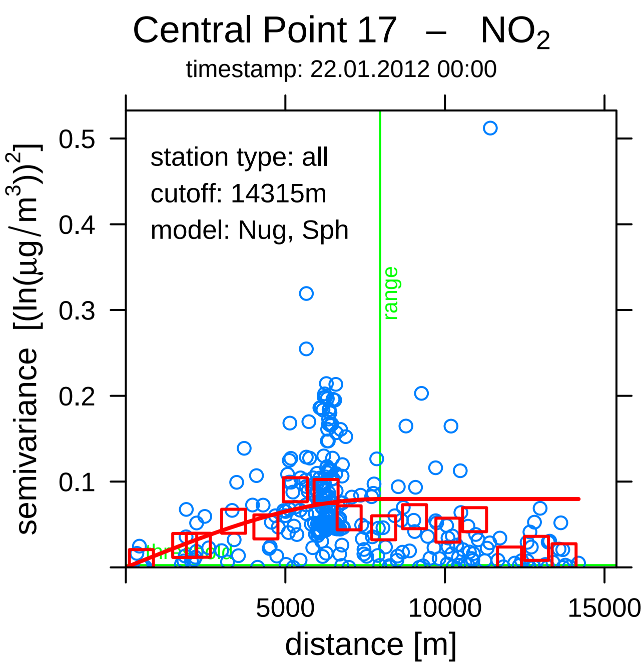

Central Point 7 – NO2
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.3
0.2
0.1
5000
10000
15000
distance [m]

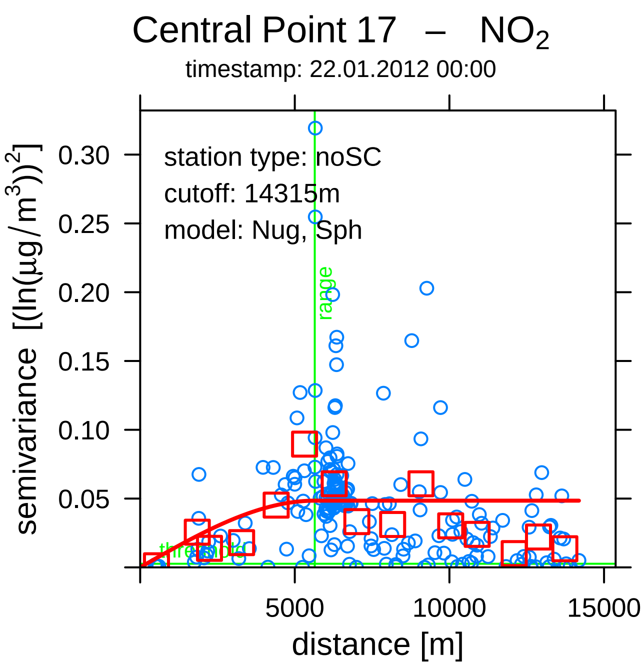

Central Point 7 – NO2
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.6
0.4
0.2
5000
10000
15000
distance [m]

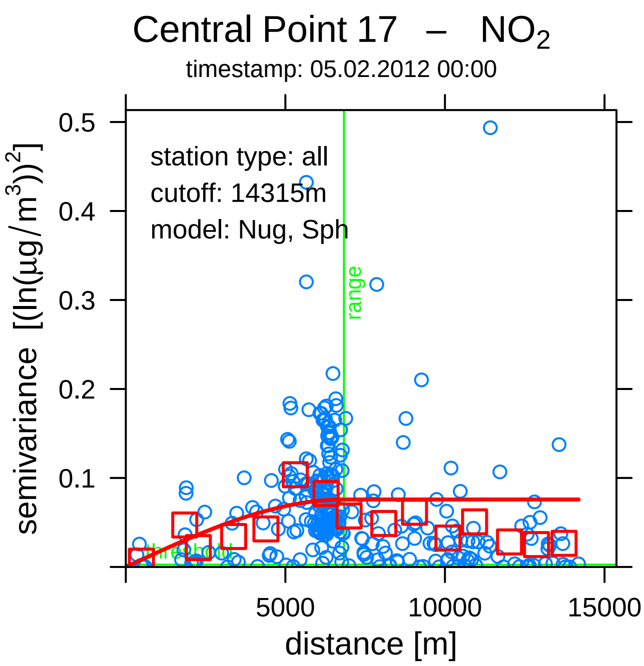

Central Point 7 – NO2
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.5
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

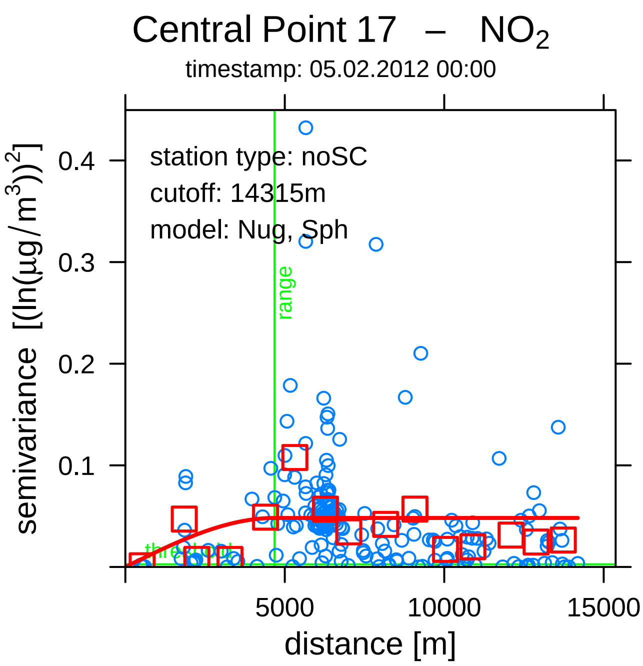

Central Point 17 – NO2
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

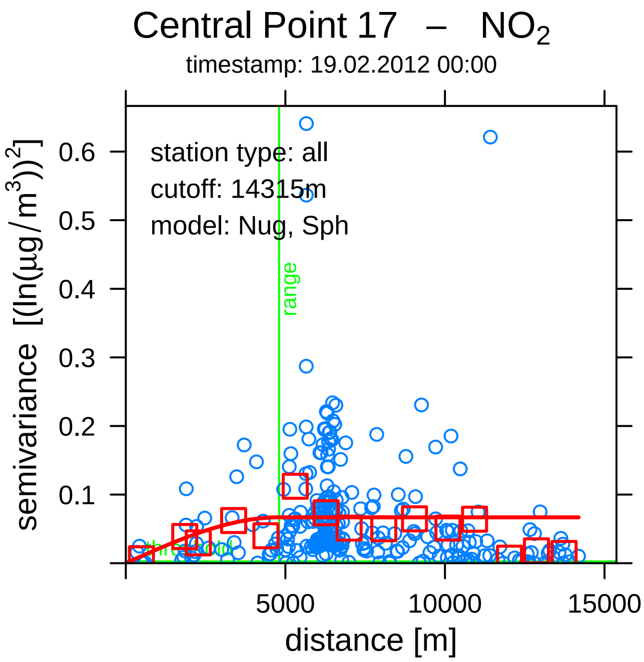

Central Point 17 – NO2
timestamp: 08.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000

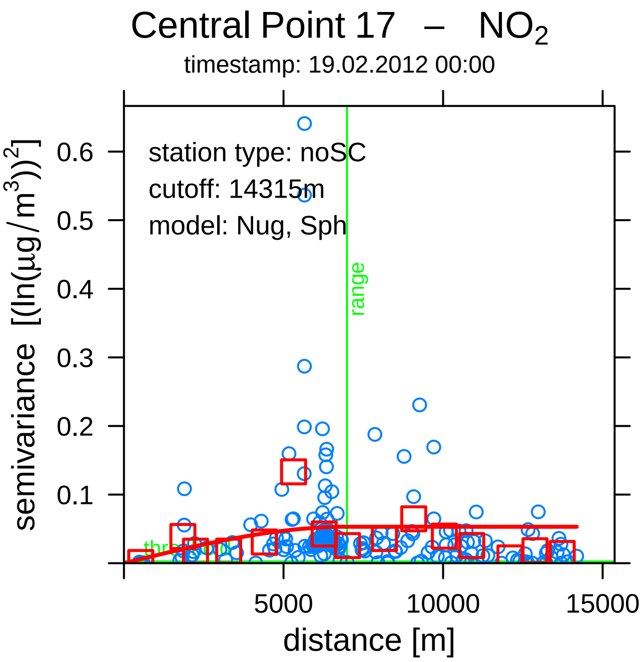

Central Point 17 – NO2
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000

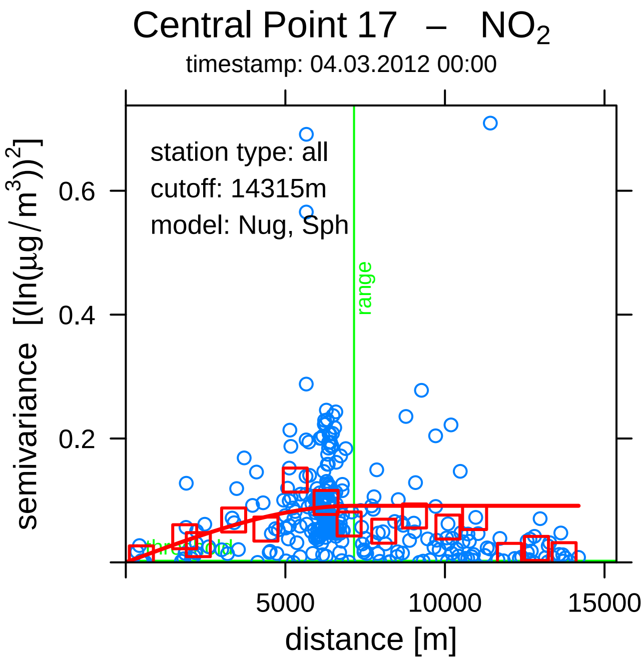

Central Point 17 – NO2
timestamp: 22.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000

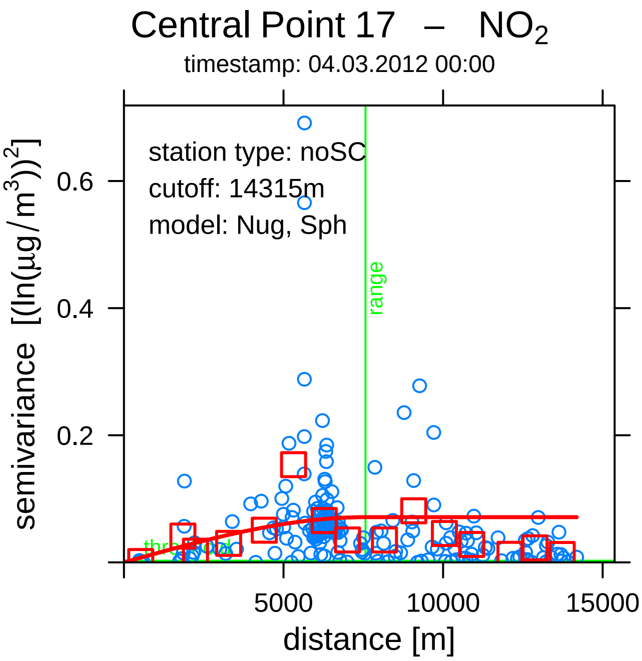

Central Point 17 – NO2
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000

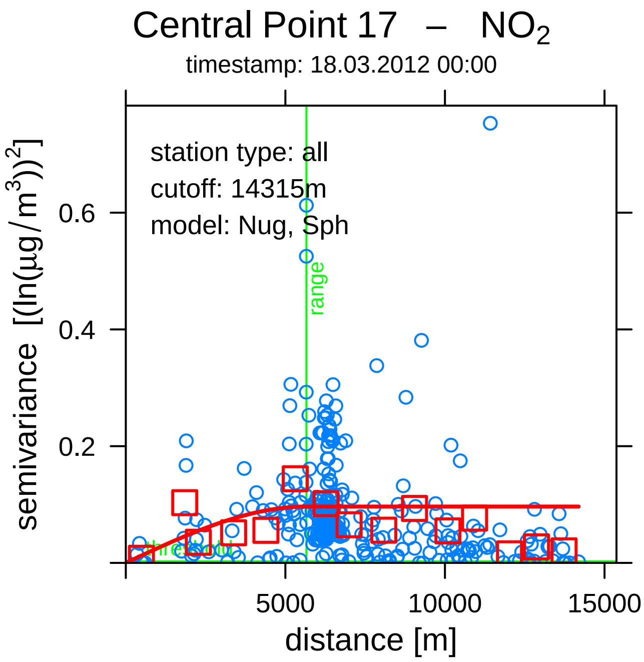

Central Point 17 – NO2
timestamp: 05.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
0.4
5000
10000
15000

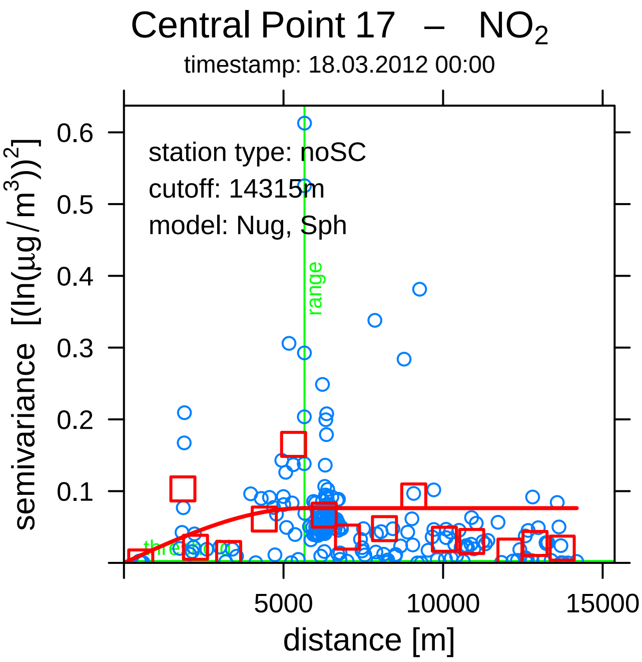

Central Point 17 – NO2
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

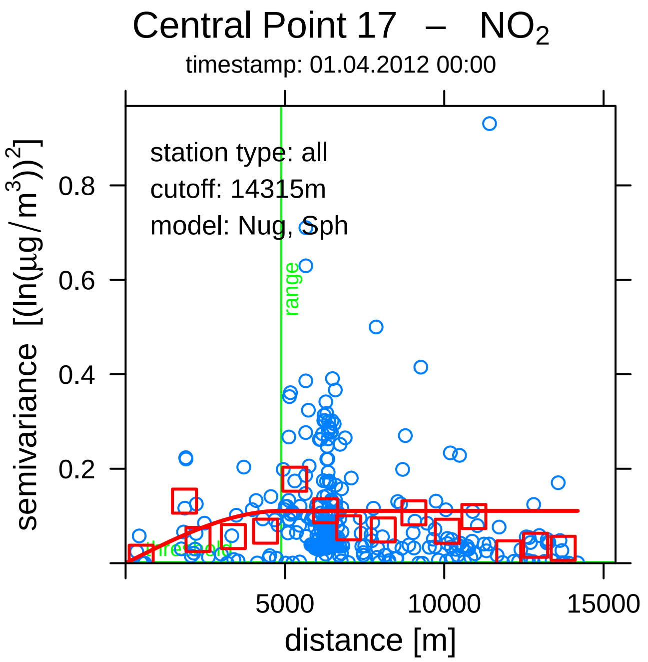

Central Point 17 – NO2
timestamp: 19.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

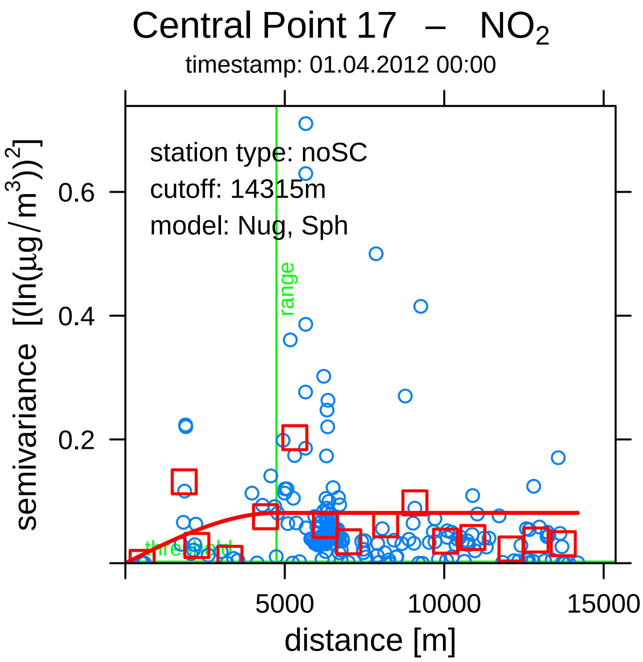

Central Point 17 – NO2
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

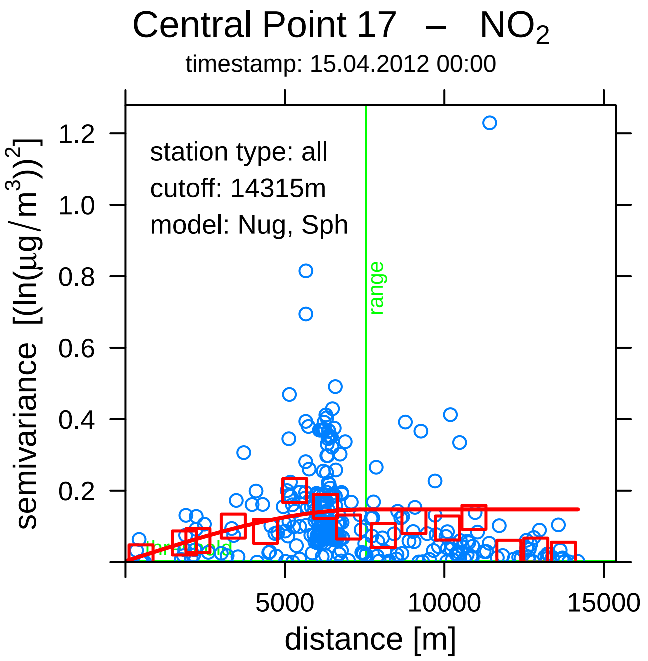

Central Point 17 – NO2
timestamp: 04.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

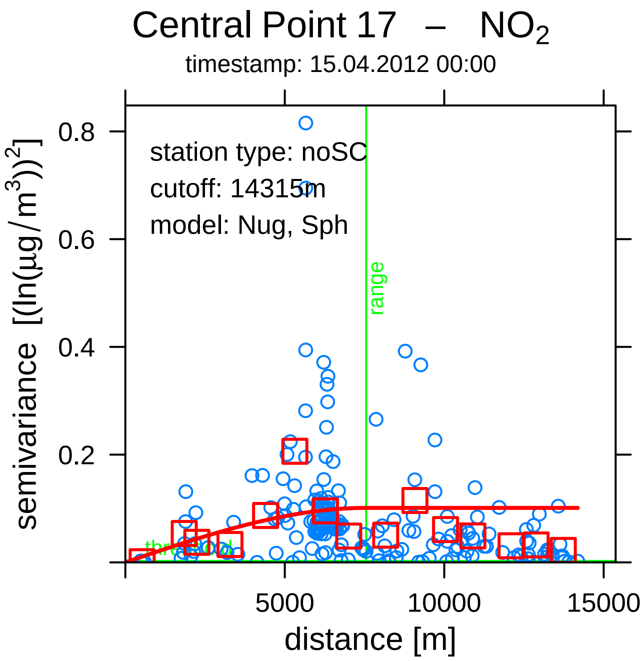

Central Point 17 – NO2
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

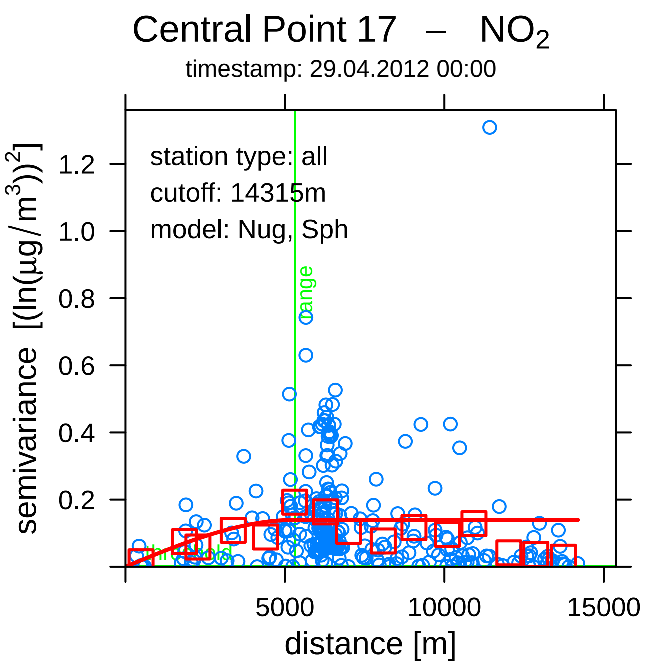

Central Point 17 – NO2
timestamp: 18.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

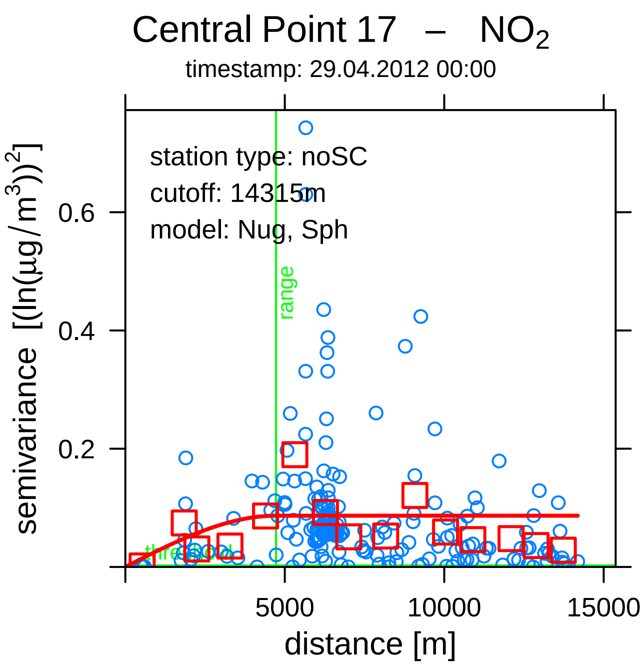

Central Point 17 – NO2
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

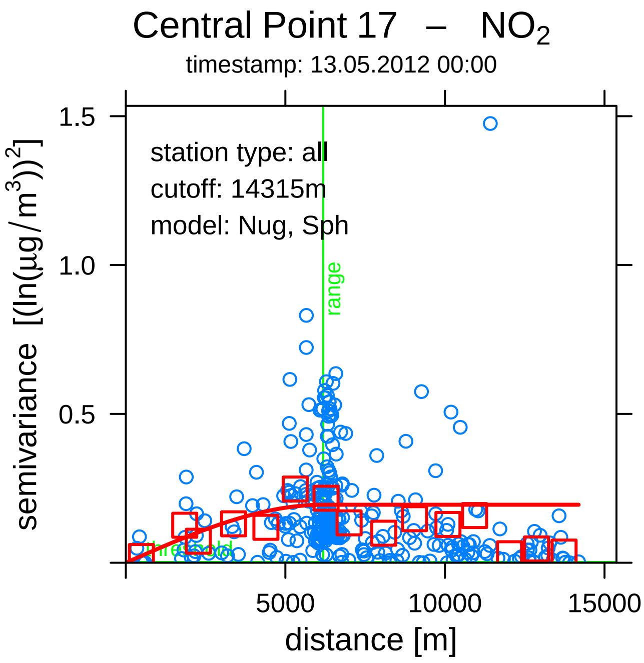

Central Point 17 – NO2
timestamp: 01.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

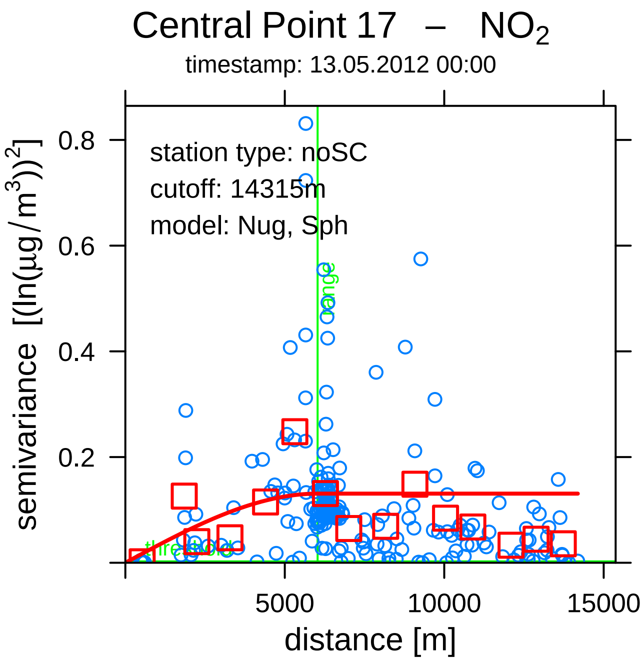

Central Point 17 – NO2
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

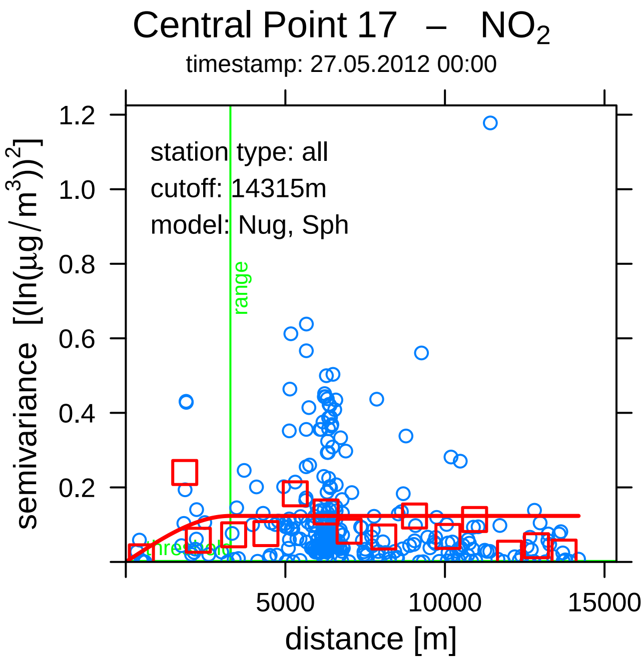

Central Point 17 – NO2
timestamp: 15.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

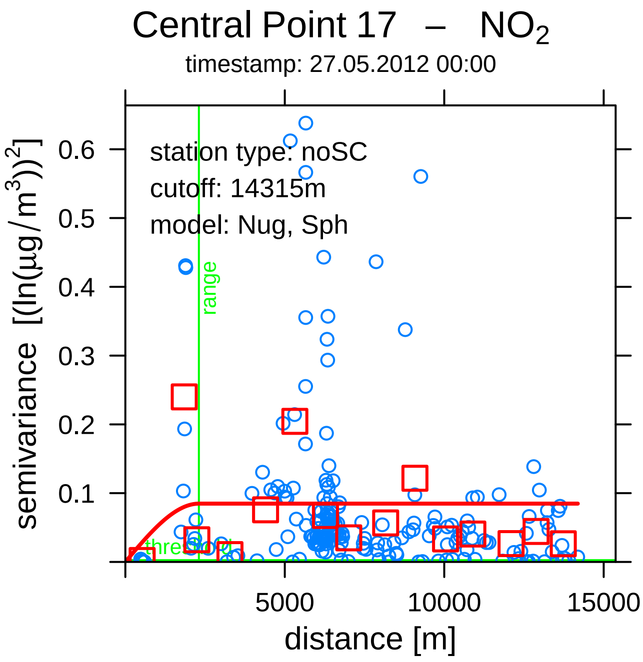

Central Point 17 – NO2
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

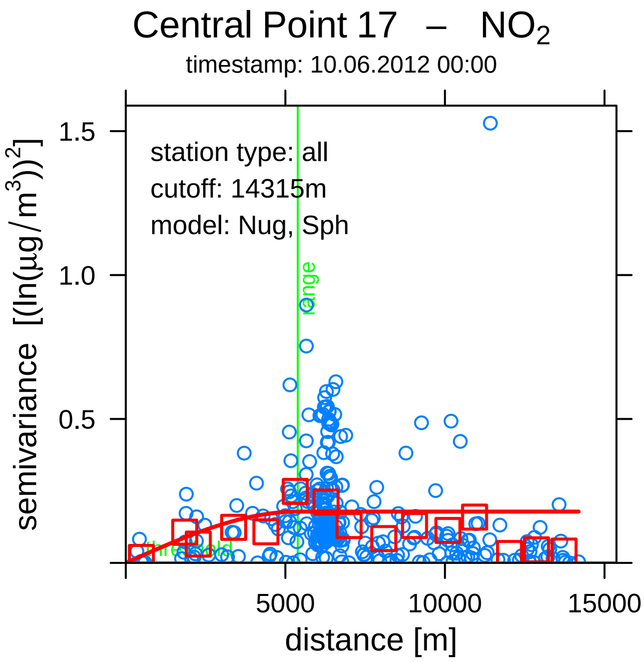

Central Point 17 – NO2
timestamp: 29.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

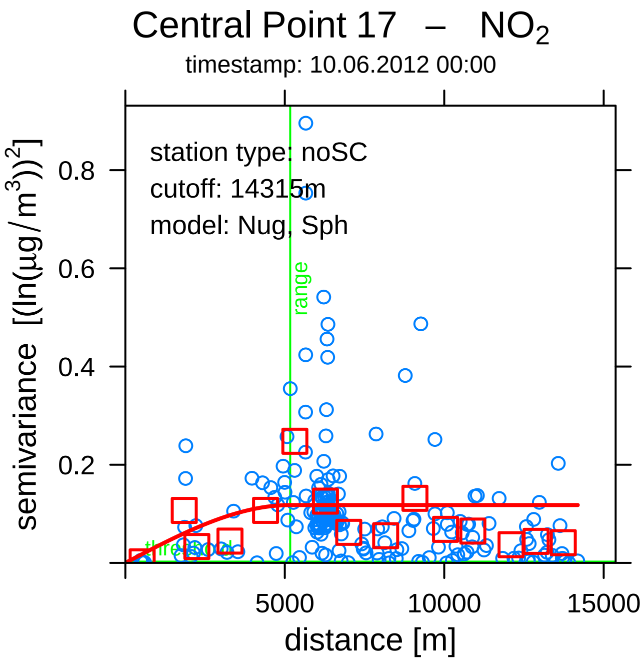

Central Point 17 – NO_2
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.5
1.0
1.5
5000
10000
15000

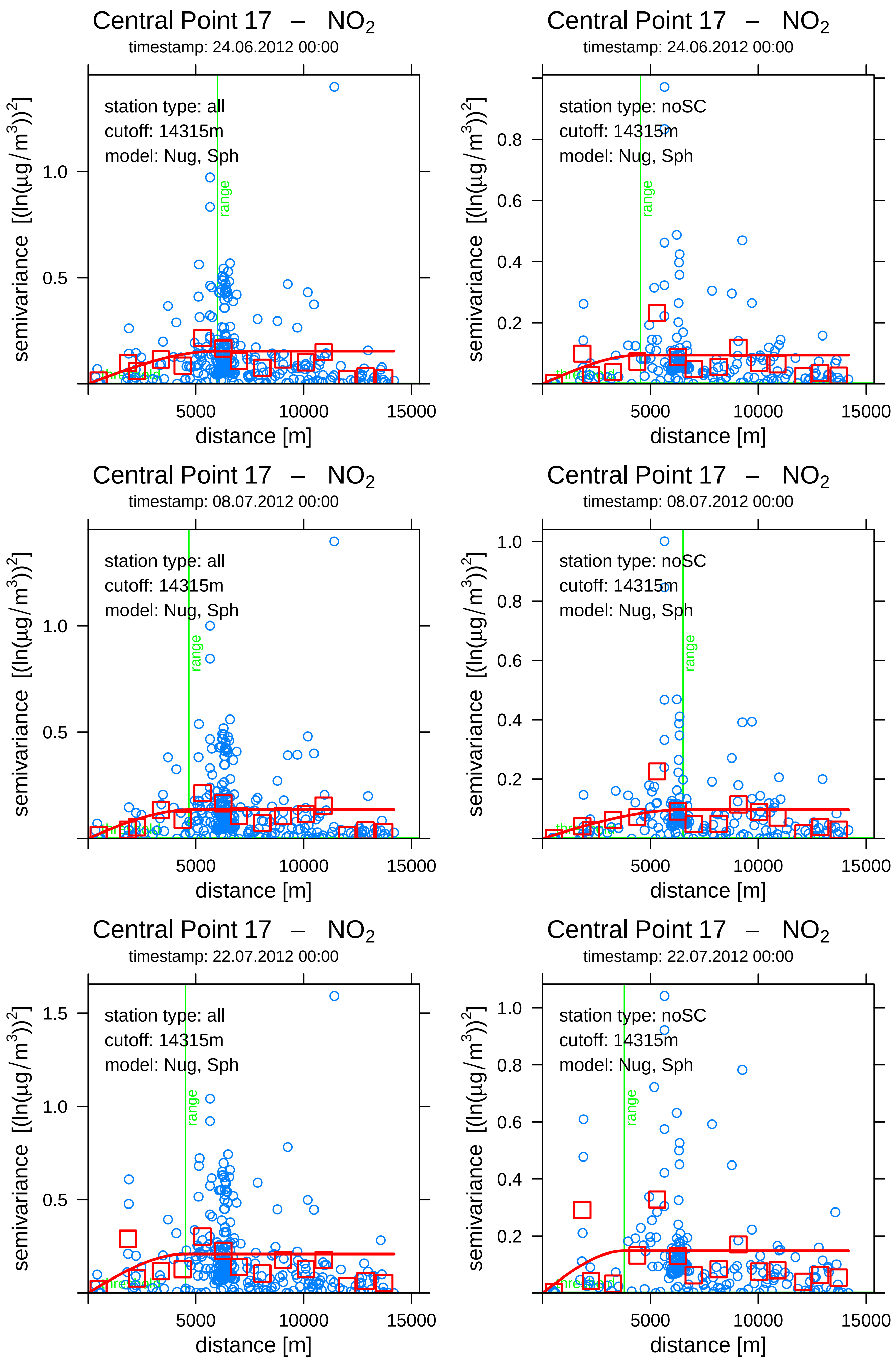

Central Point 17 – NO_2
timestamp: 13.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

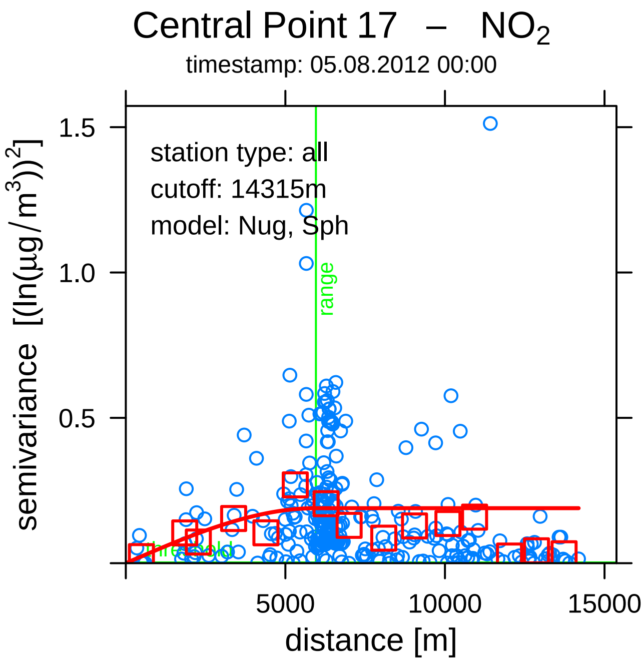

Central Point 17 – NO_2
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.2
0.4
0.6
0.8
1.0
1.2
5000
10000
15000

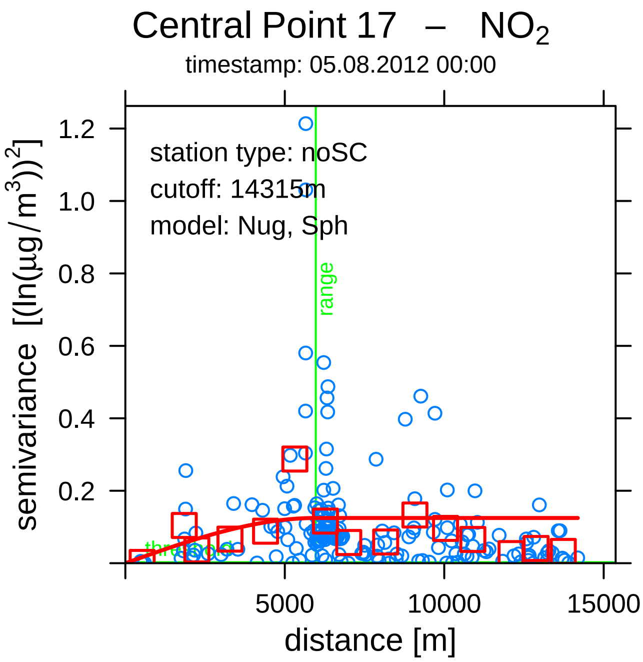

Central Point 17 – NO_2
timestamp: 27.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000

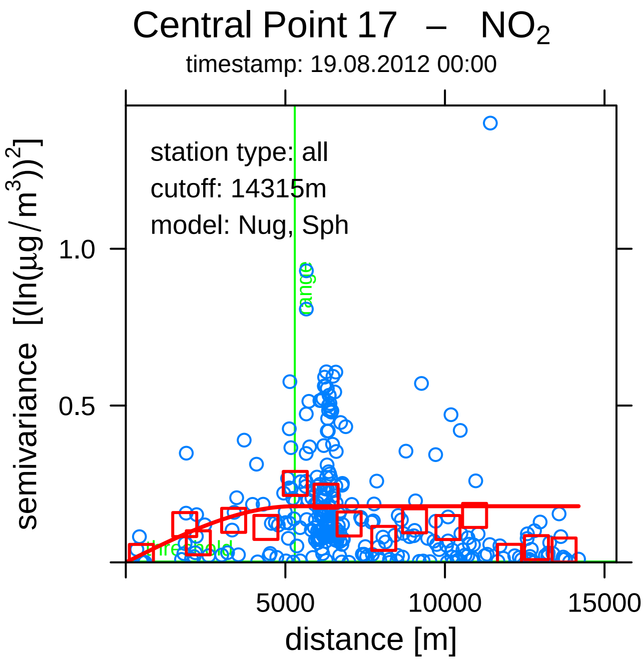

Central Point 17 – NO_2
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.5
1.0
1.5
5000
10000
15000

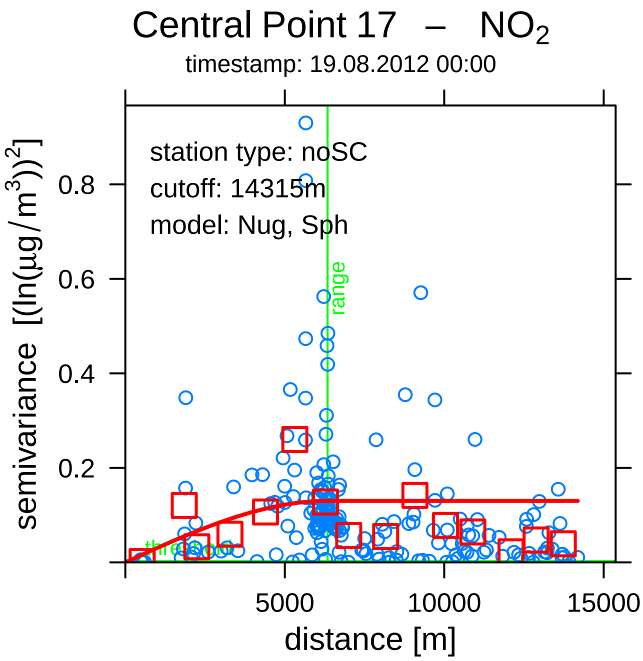

Central Point 17 – NO_2
timestamp: 10.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance $[(\ln(\mu g/m^3))^2]$
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

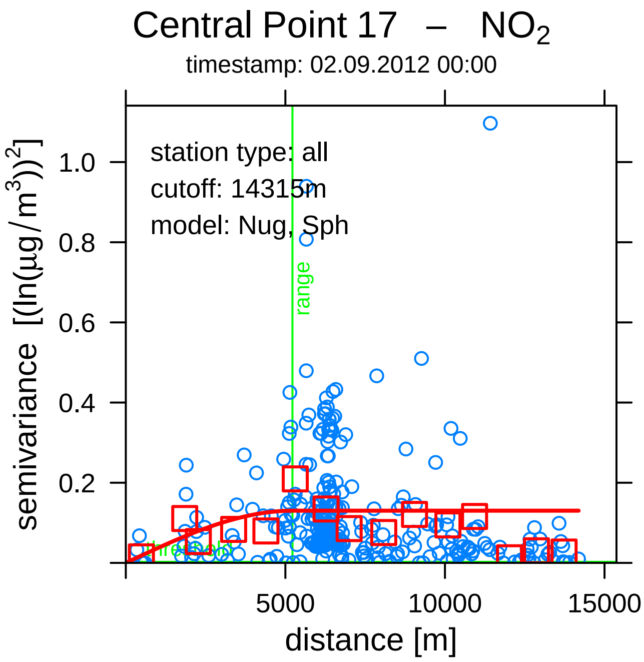

Central Point 17 – NO_2
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 17 – NO_2
timestamp: 24.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 17 – NO_2
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 17 – NO_2
timestamp: 08.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 17 – NO_2
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 17 – NO_2
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]

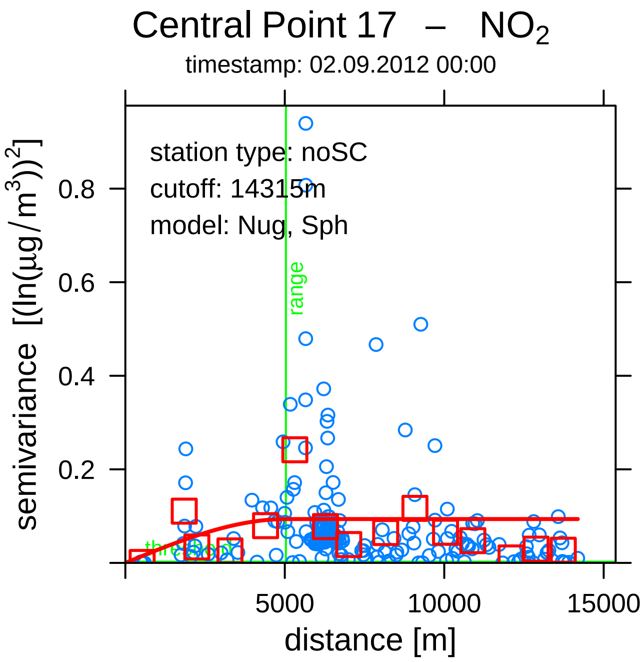

Central Point 17 – NO2
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.5
1.0
1.5
5000
10000
15000

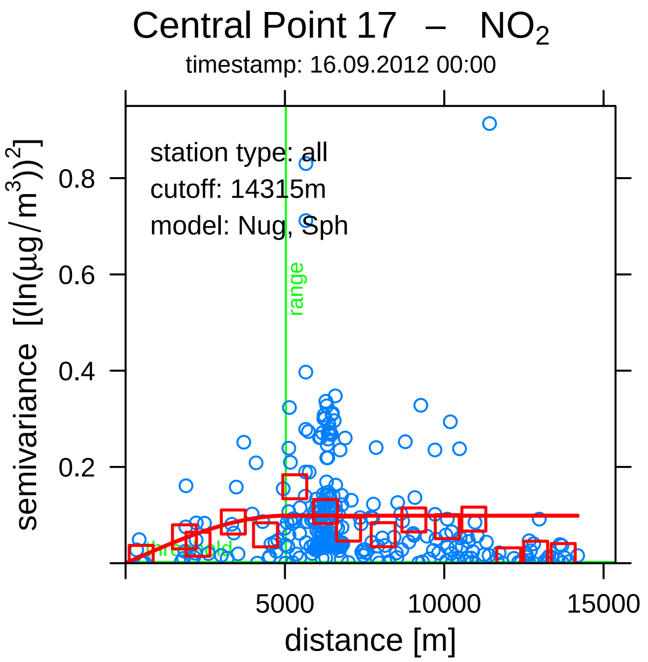

Central Point 17 – NO2
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
1.0
1.2
5000
10000
15000

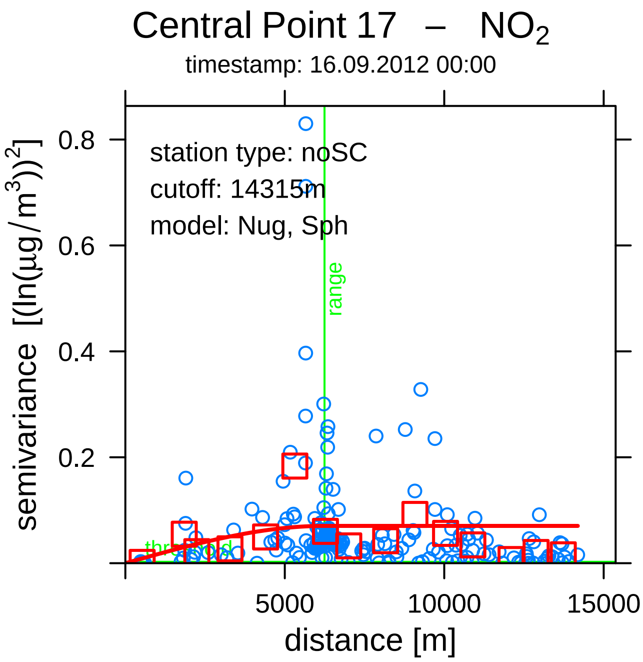

Central Point 17 – NO2
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.5
1.0
5000
10000
15000

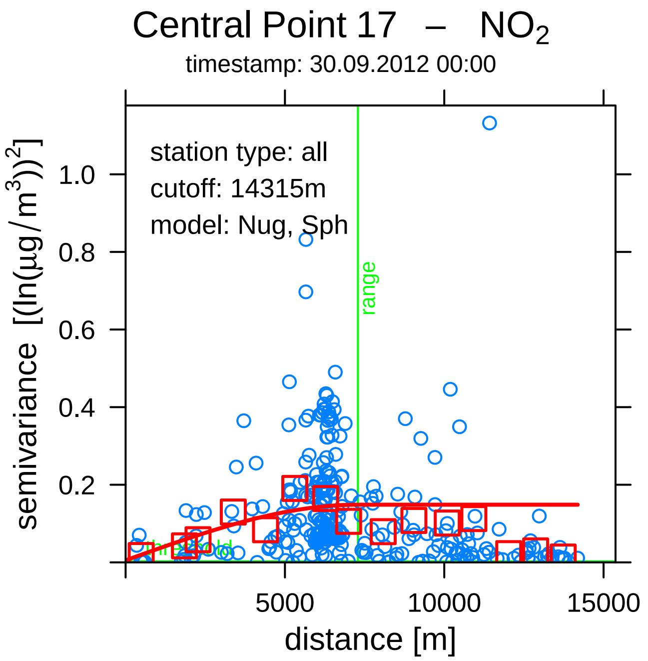

Central Point 17 – NO2
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

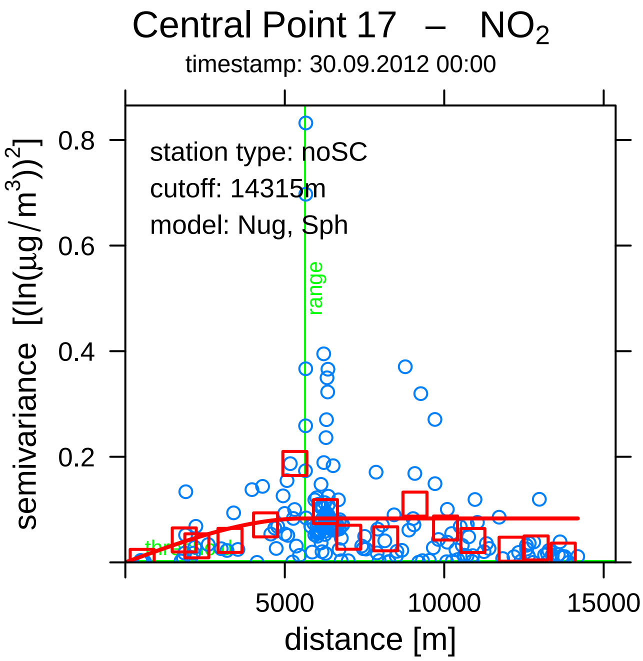

Central Point 17 – NO2
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
1.0
5000
10000
15000

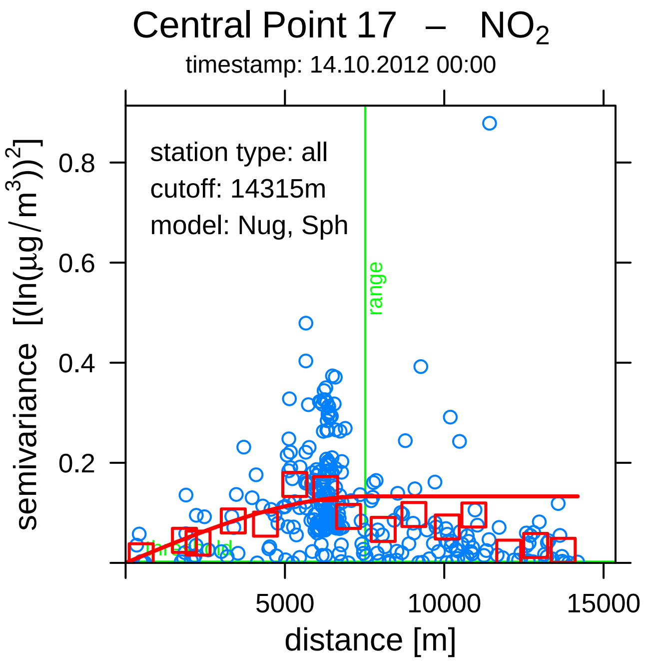

Central Point 17 – NO2
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

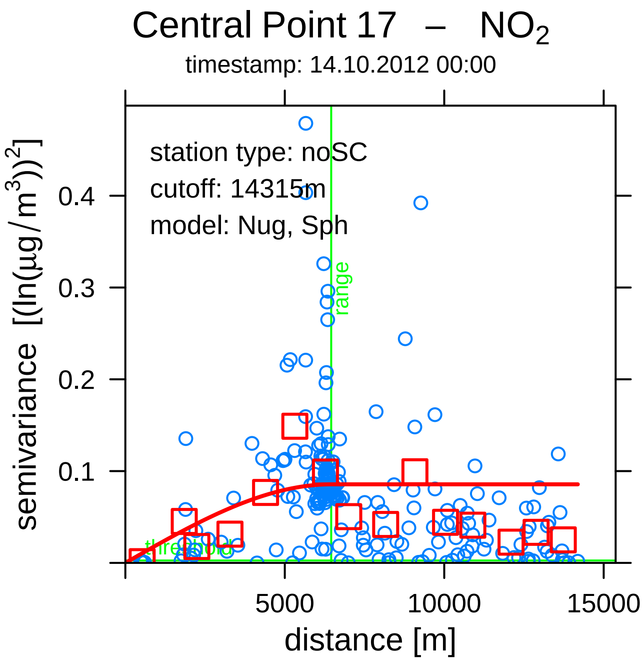

Central Point 17 – NO2
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

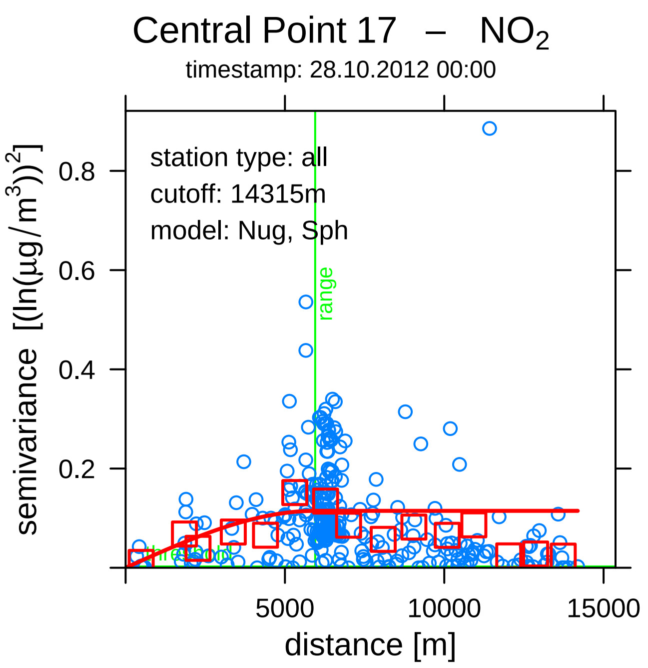

Central Point 17 – NO2
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

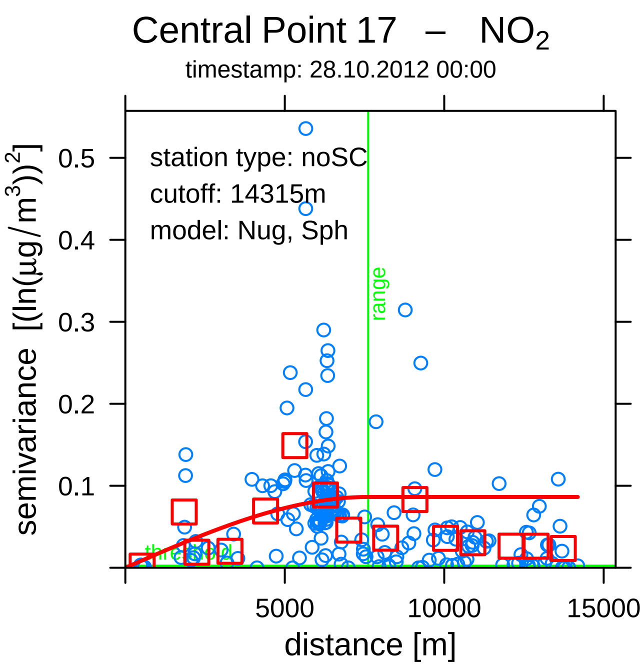

Central Point 17 – NO2
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

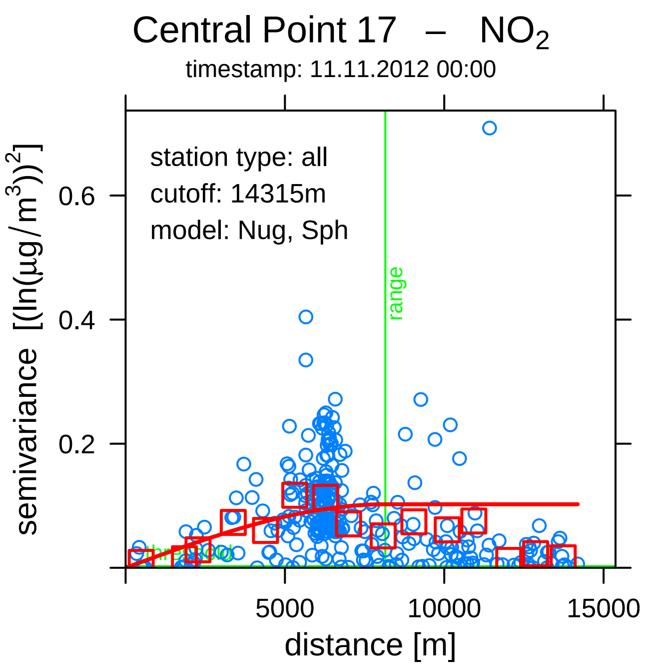

Central Point 17 – NO2
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

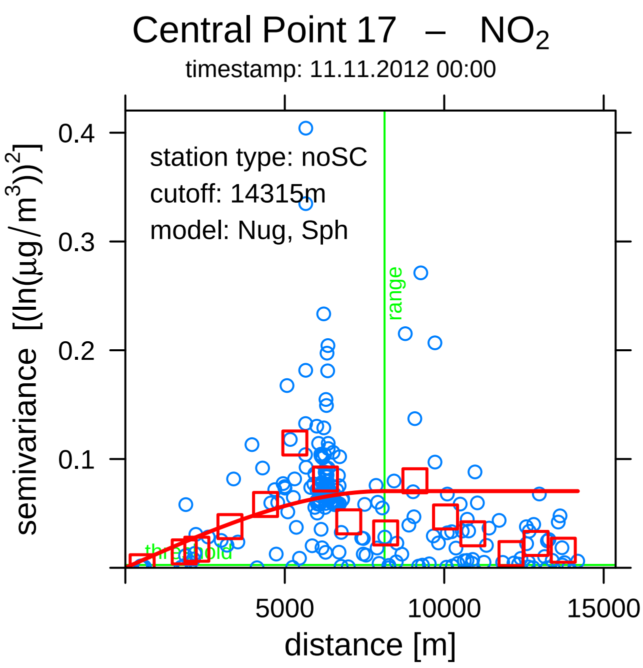

Central Point 17 – NO2
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

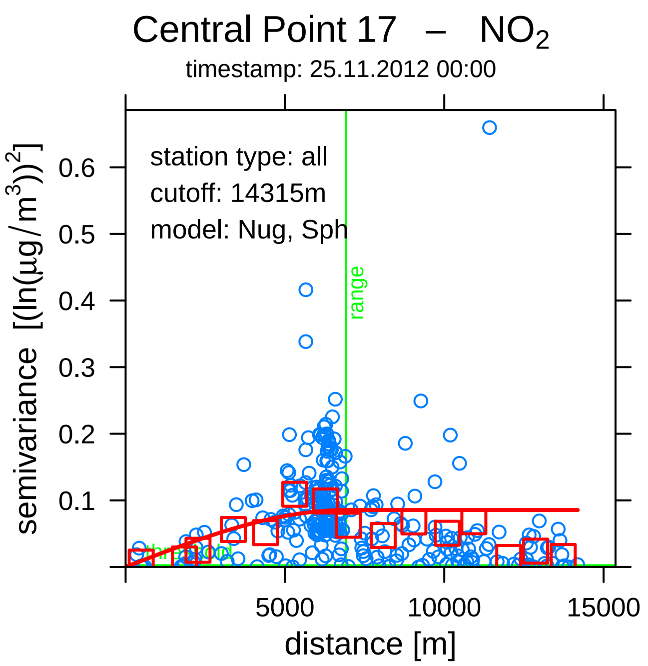

Central Point 17 – NO2
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]

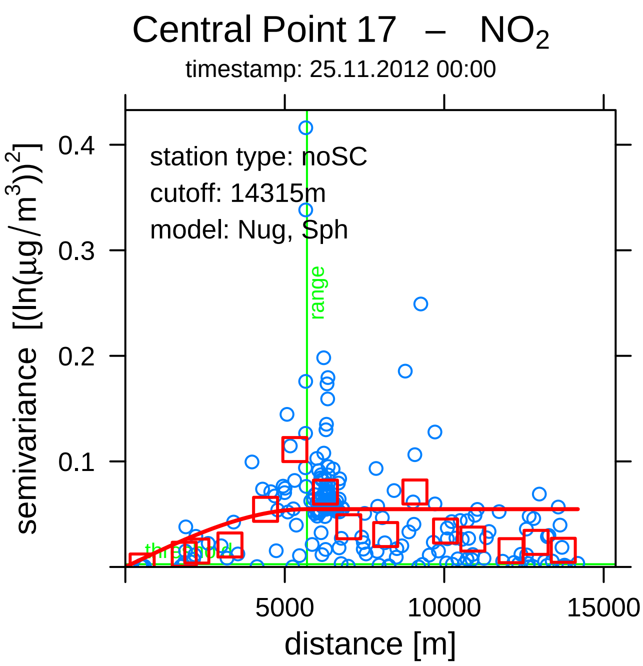

Central Point 17 – NO_2
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.2
0.4
0.6
0.8
5000
10000
15000
distance [m]

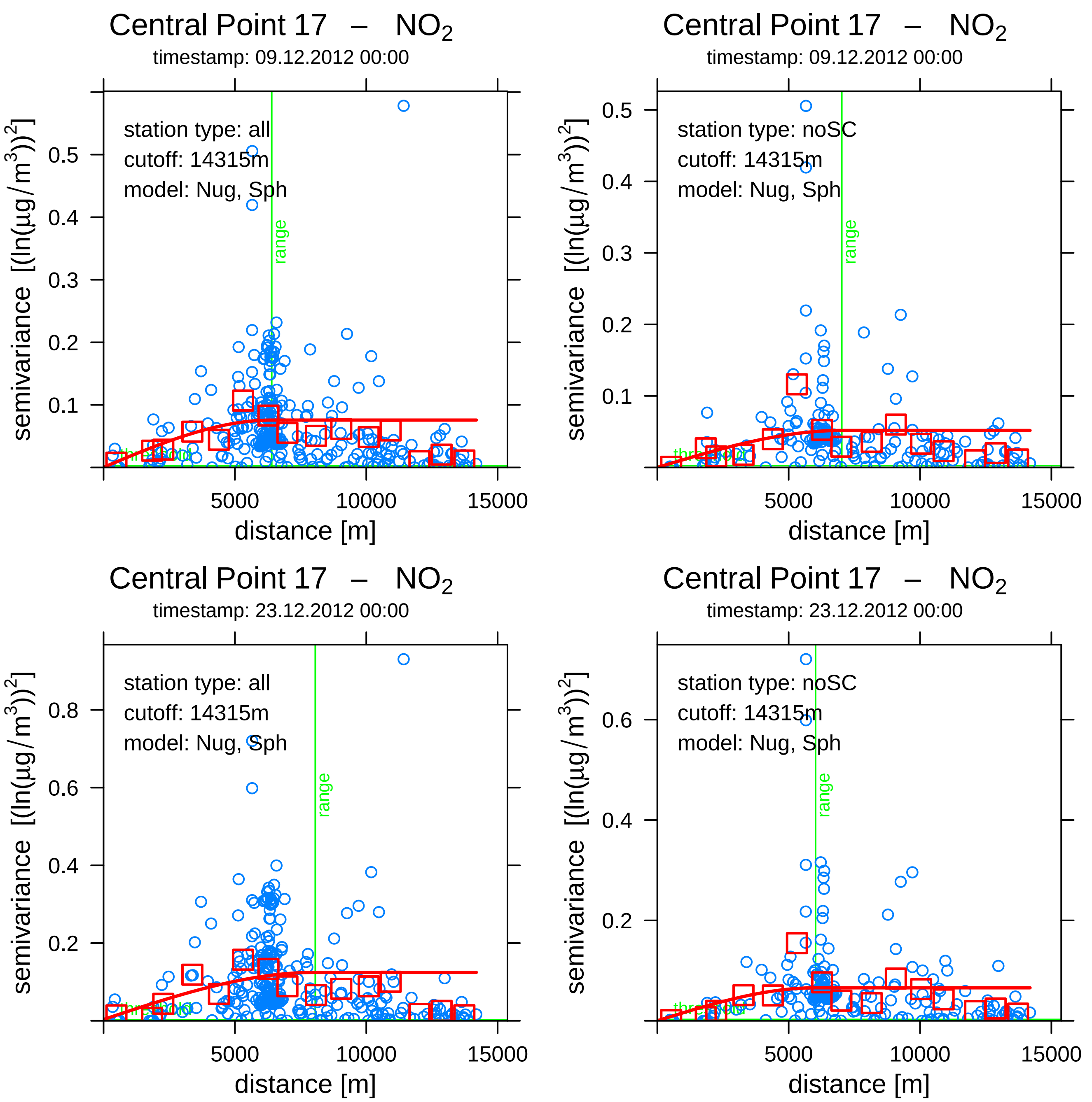

Central Point 17 – NO_2
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000
distance [m]


Central Point 17 – NO_2
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.2
0.4
0.6
5000
10000
15000
distance [m]

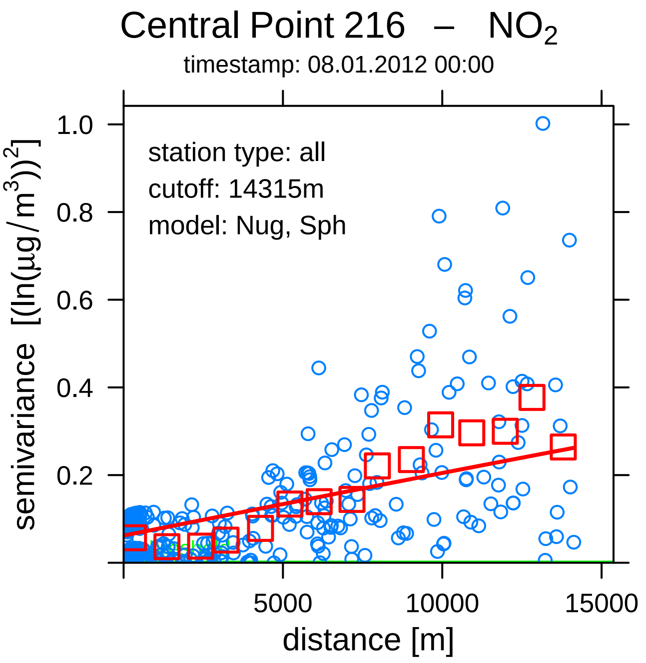

Central Point 17 – NO_2
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
5000
10000
15000
distance [m]

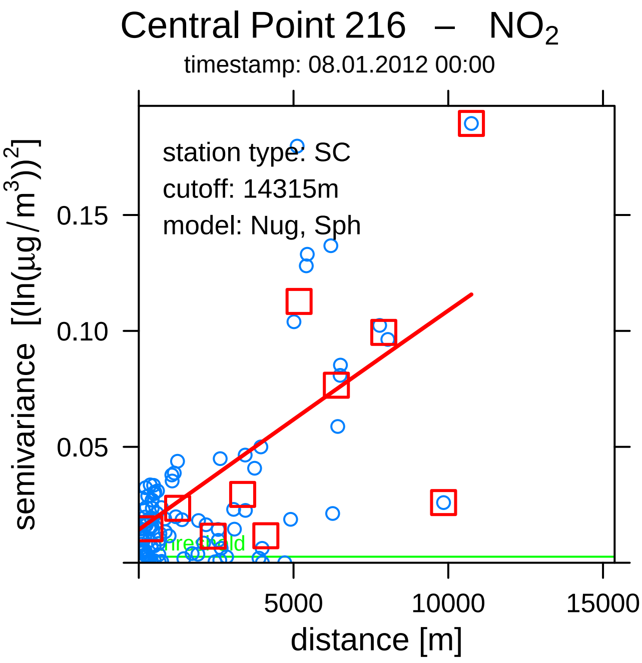

Central Point 17 – NO_2
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000
distance [m]

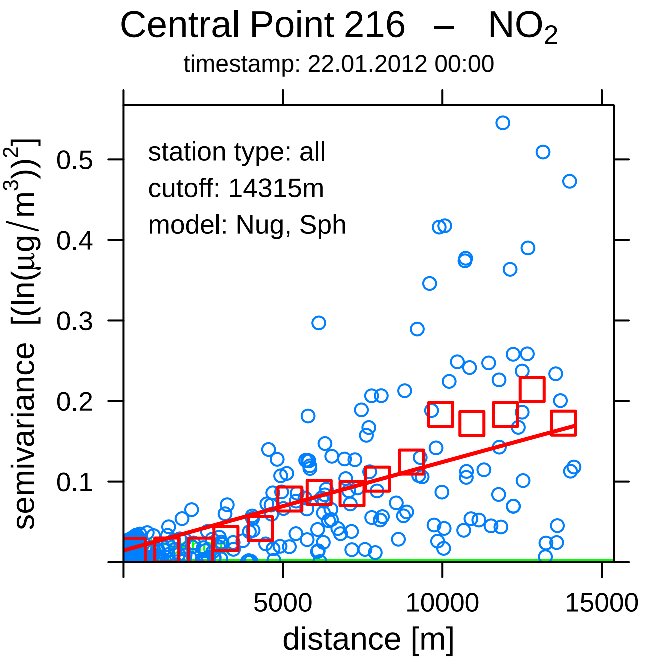

Central Point 17 – NO_2
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
5000
10000
15000
distance [m]

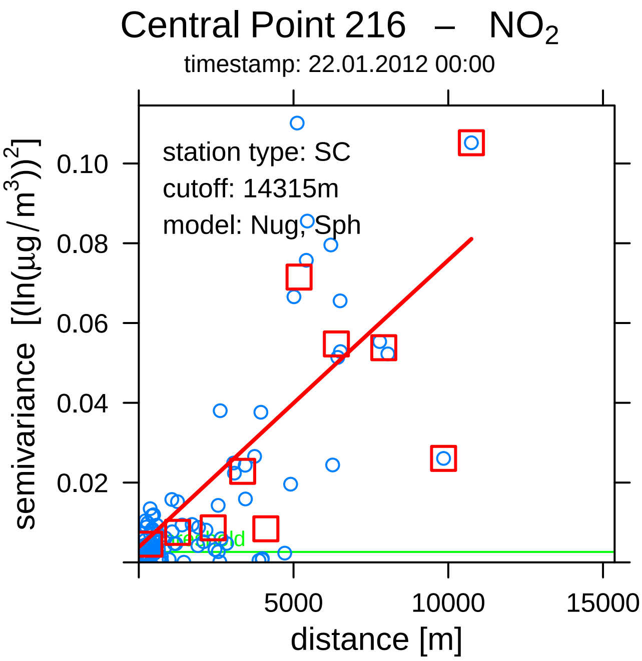


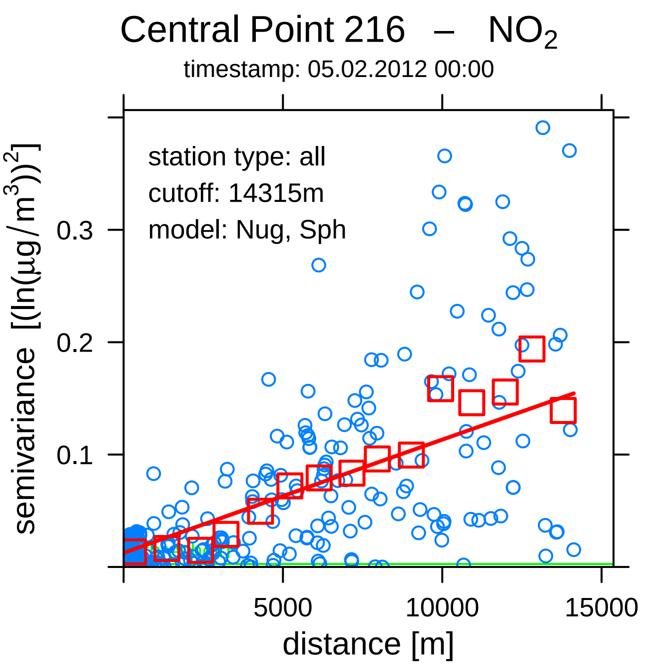
Central Point 17 – NO2
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 17 – NO2
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 17 – NO2
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 17 – NO2
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
distance [m]

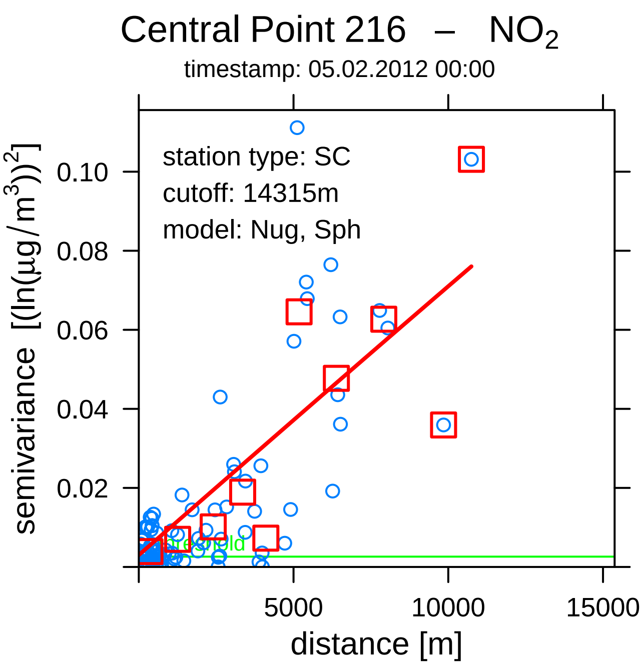

Central Point 216 – NO_2
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.2
0.4
0.6
0.8
1.0
5000
10000
15000

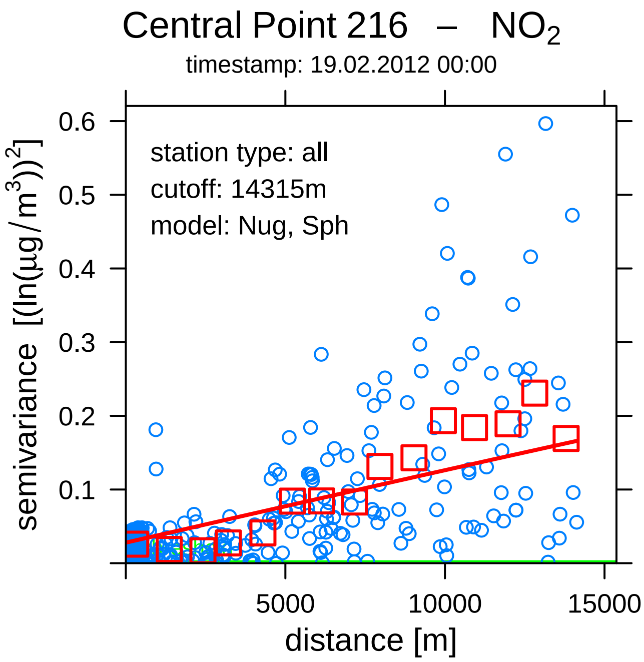

Central Point 216 – NO_2
timestamp: 08.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

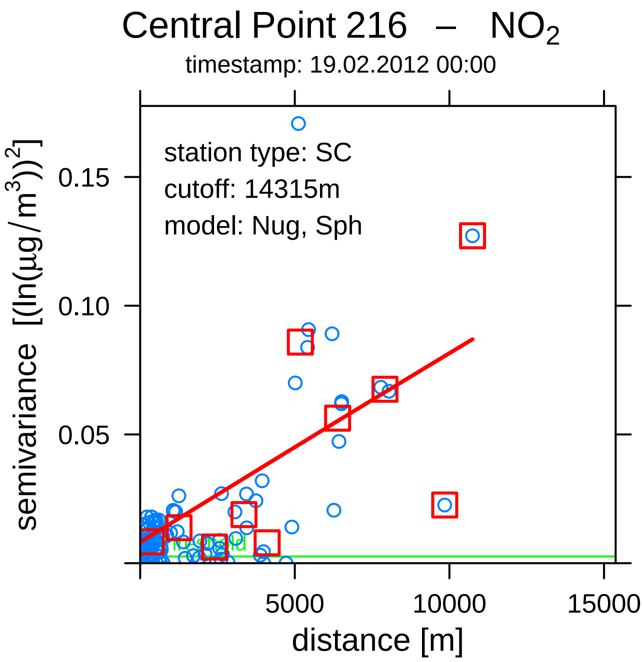

Central Point 216 – NO_2
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000

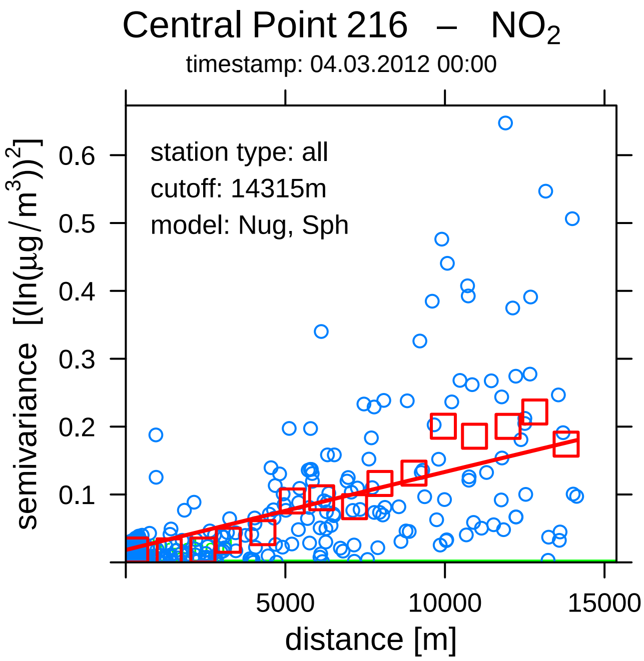

Central Point 216 – NO_2
timestamp: 22.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000

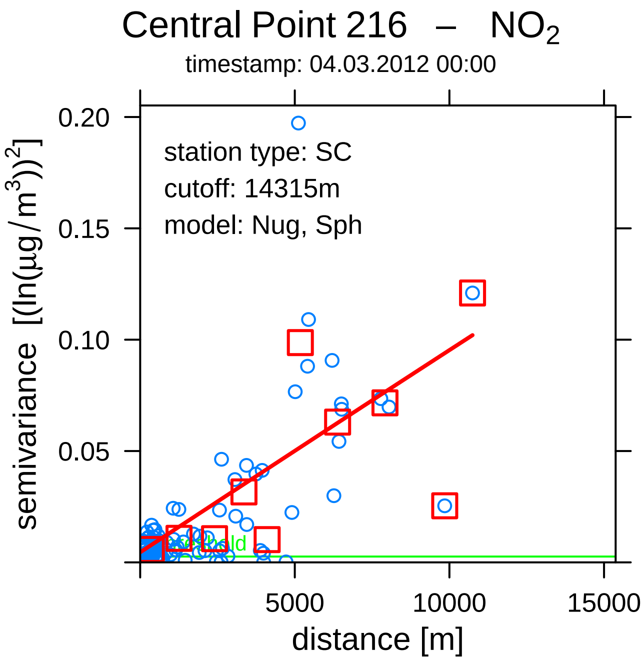

Central Point 216 – NO_2
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
5000
10000
15000

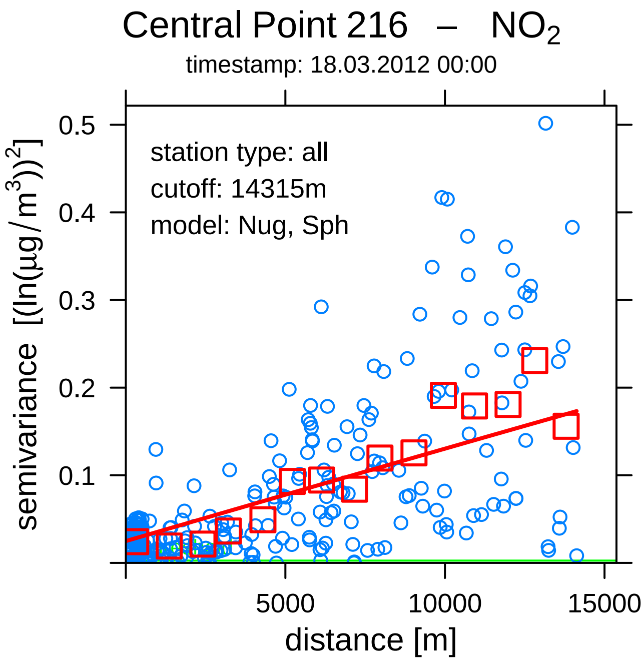

Central Point 216 – NO_2
timestamp: 05.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000

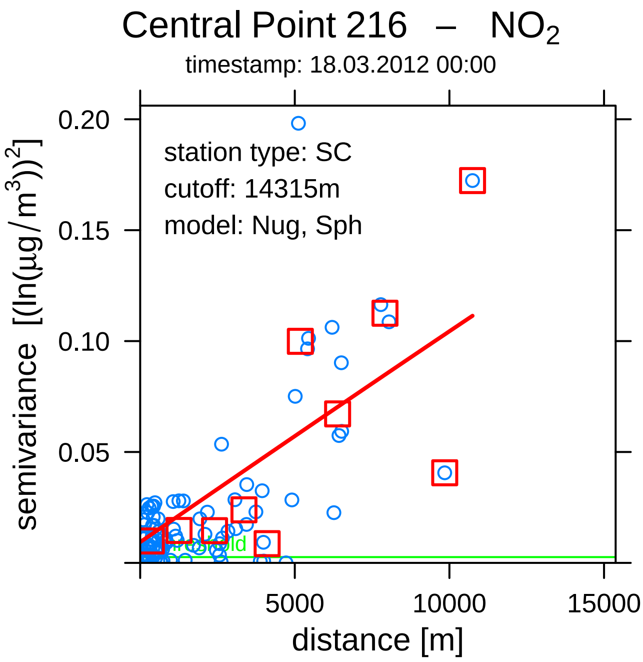

Central Point 216 – NO2
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000
distance [m]

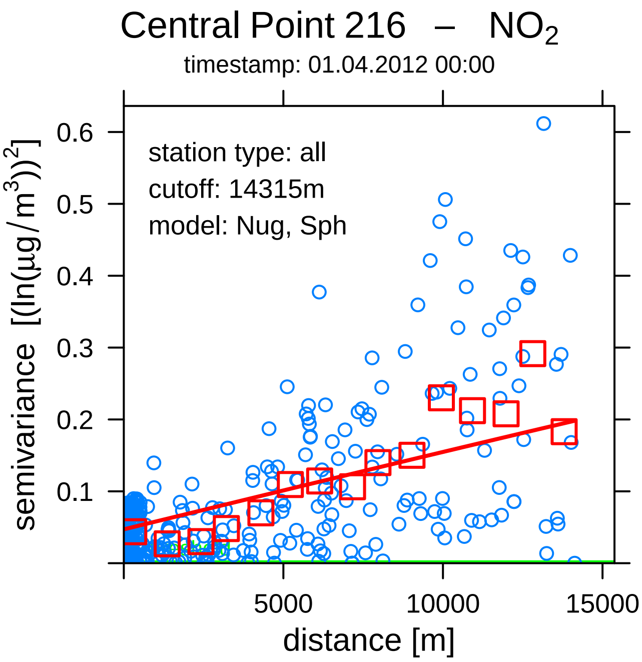

Central Point 216 – NO2
timestamp: 19.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

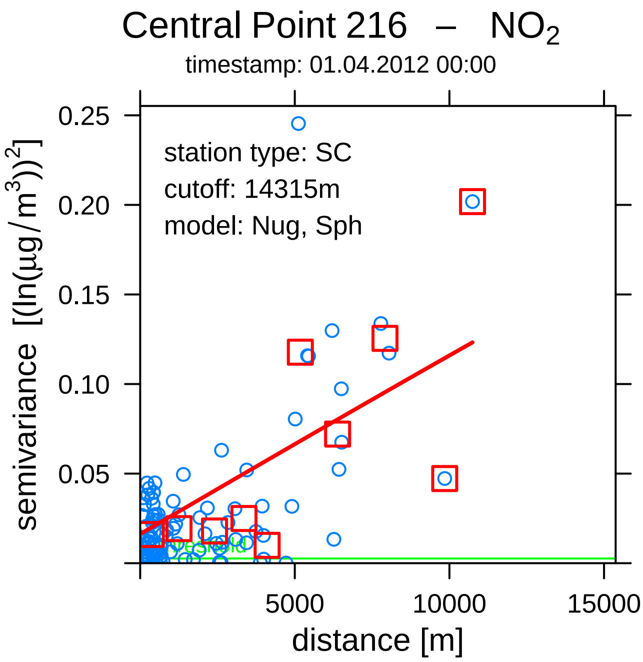

Central Point 216 – NO2
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
0.4
0.5
0.6
5000
10000
15000
distance [m]

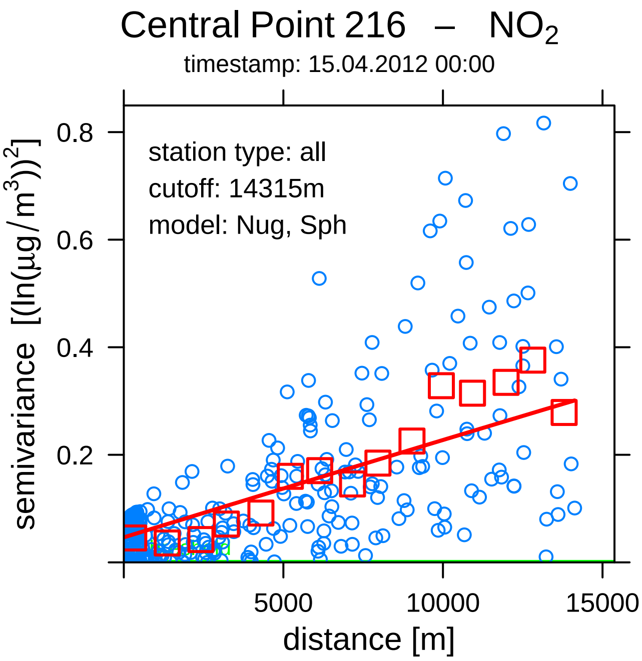

Central Point 216 – NO2
timestamp: 04.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]

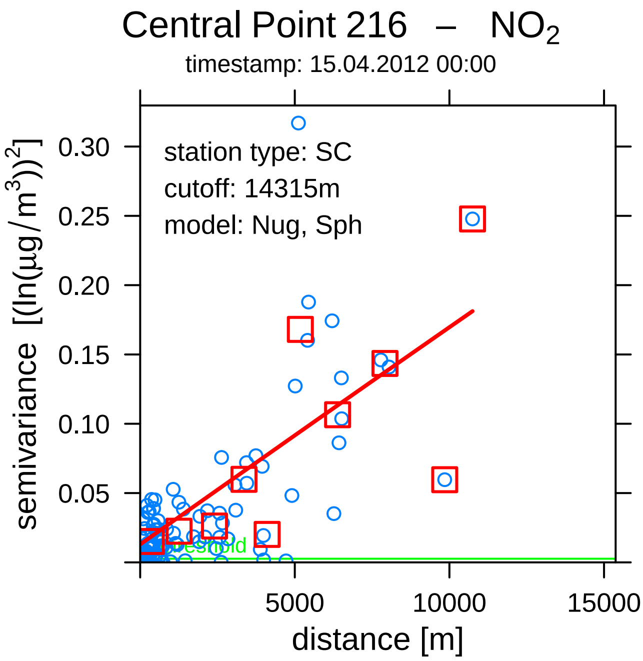

Central Point 216 – NO2
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000
distance [m]

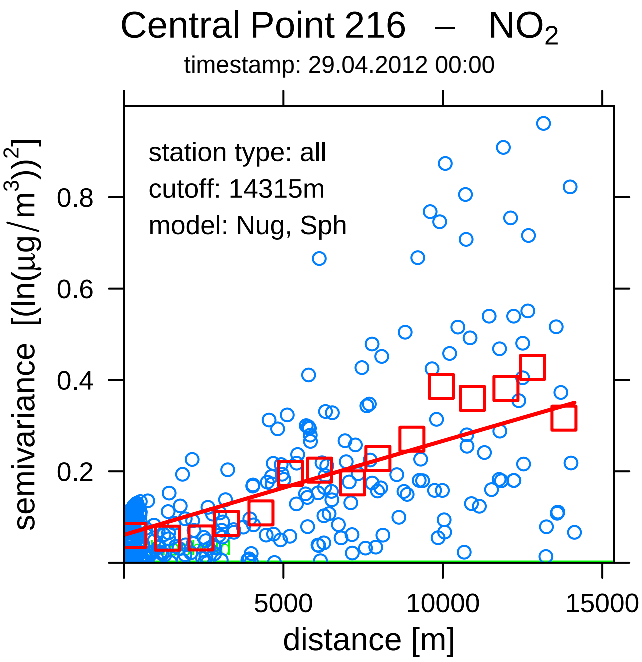

Central Point 216 – NO2
timestamp: 18.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]

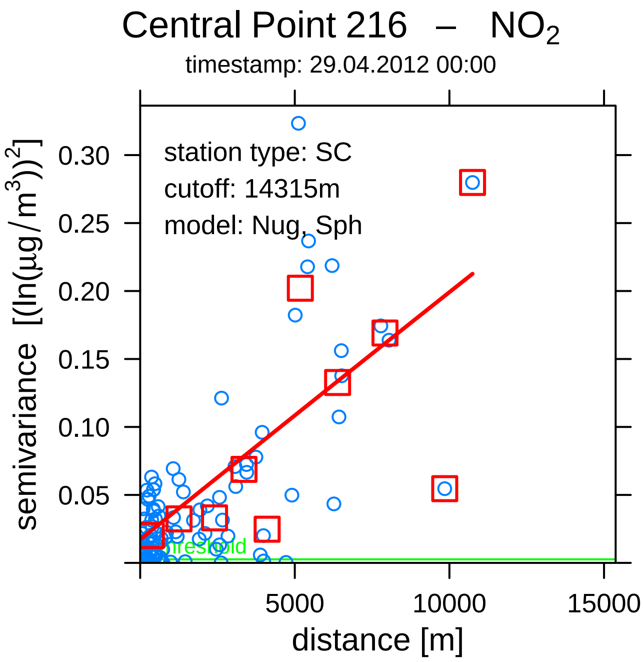

Central Point 216 – NO2
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.1 0.2 0.3 0.4 0.5 0.6
5000 10000 15000

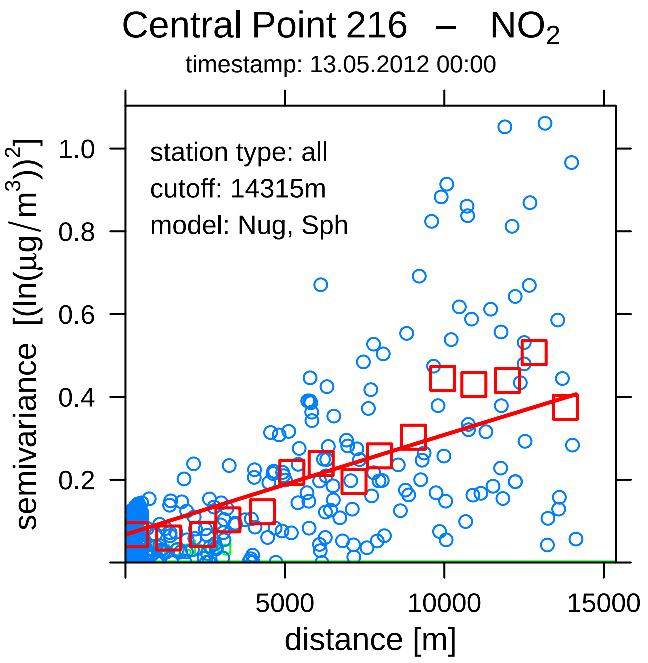

Central Point 216 – NO2
timestamp: 01.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05 0.10 0.15 0.20 0.25
5000 10000 15000

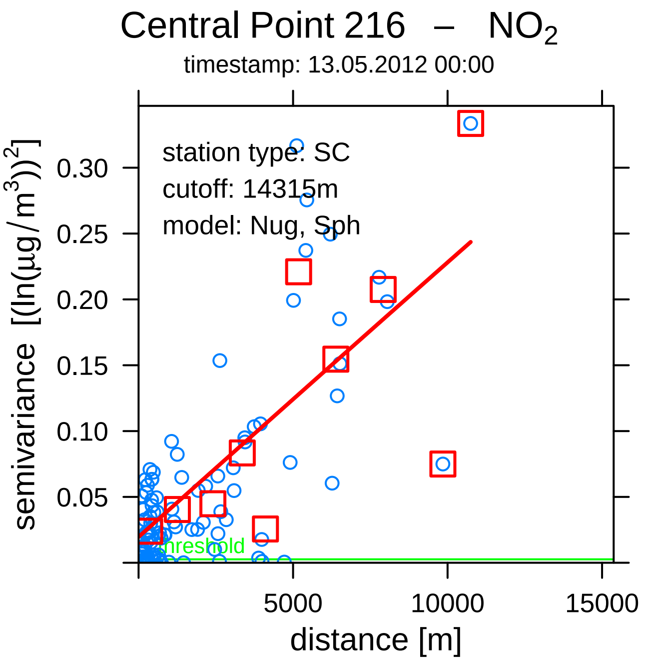

Central Point 216 – NO2
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2 0.4 0.6 0.8
5000 10000 15000

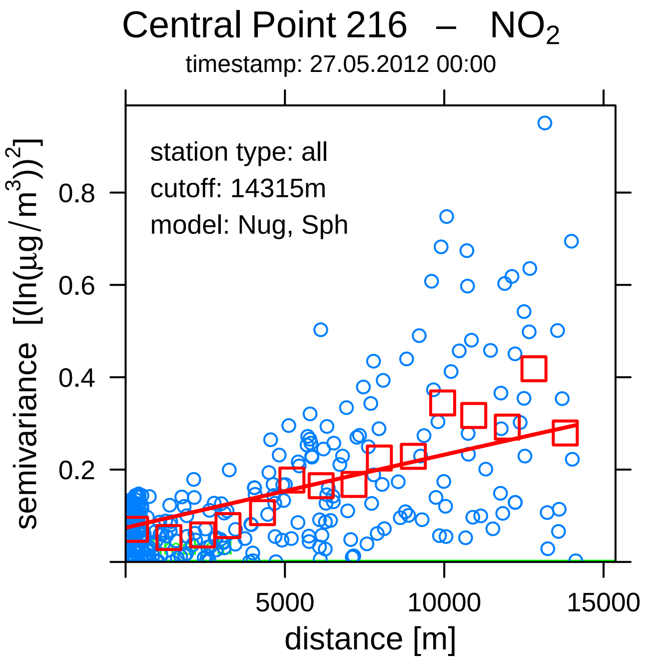

Central Point 216 – NO2
timestamp: 15.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05 0.10 0.15 0.20 0.25 0.30
5000 10000 15000

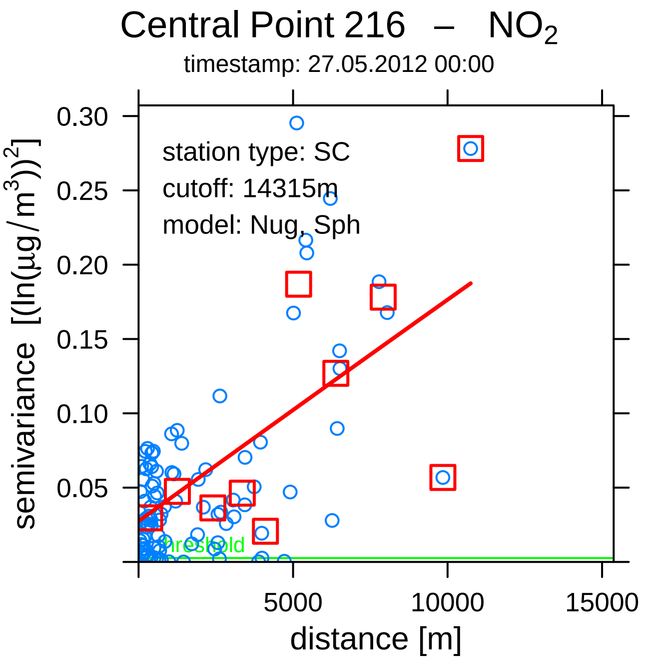

Central Point 216 – NO2
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2 0.4 0.6 0.8
5000 10000 15000

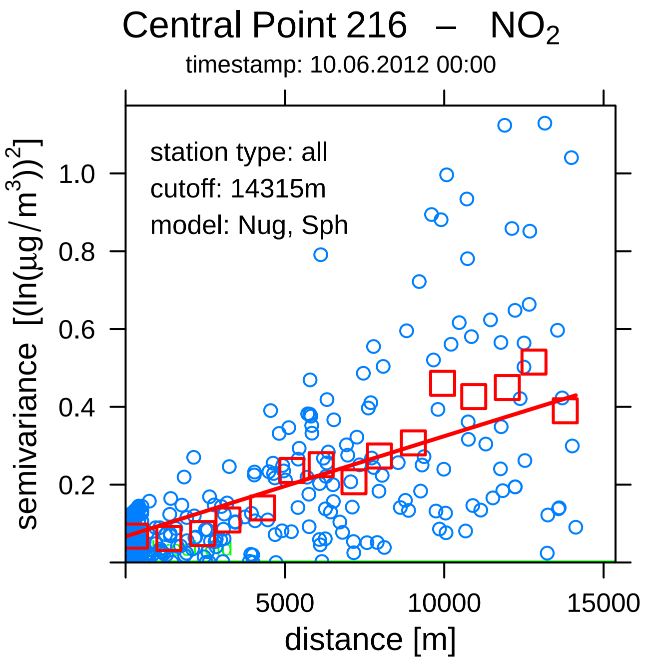

Central Point 216 – NO2
timestamp: 29.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05 0.10 0.15 0.20 0.25 0.30
5000 10000 15000

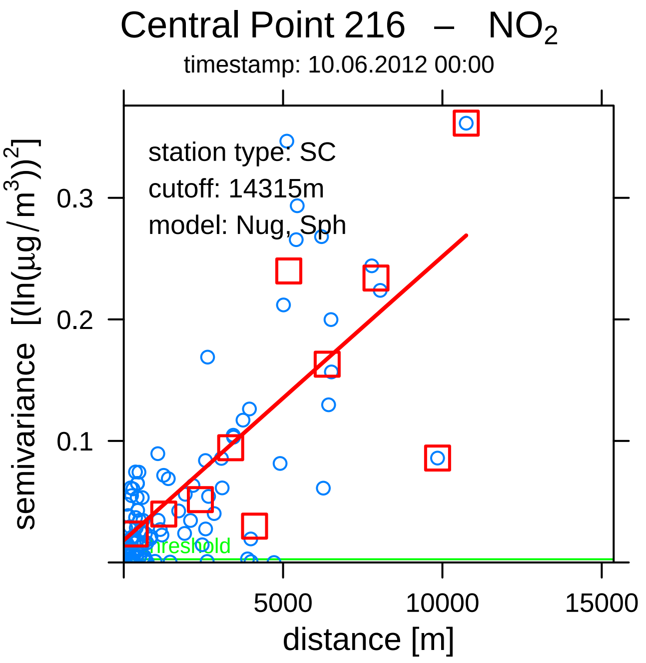

Central Point 216 – NO_2
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold

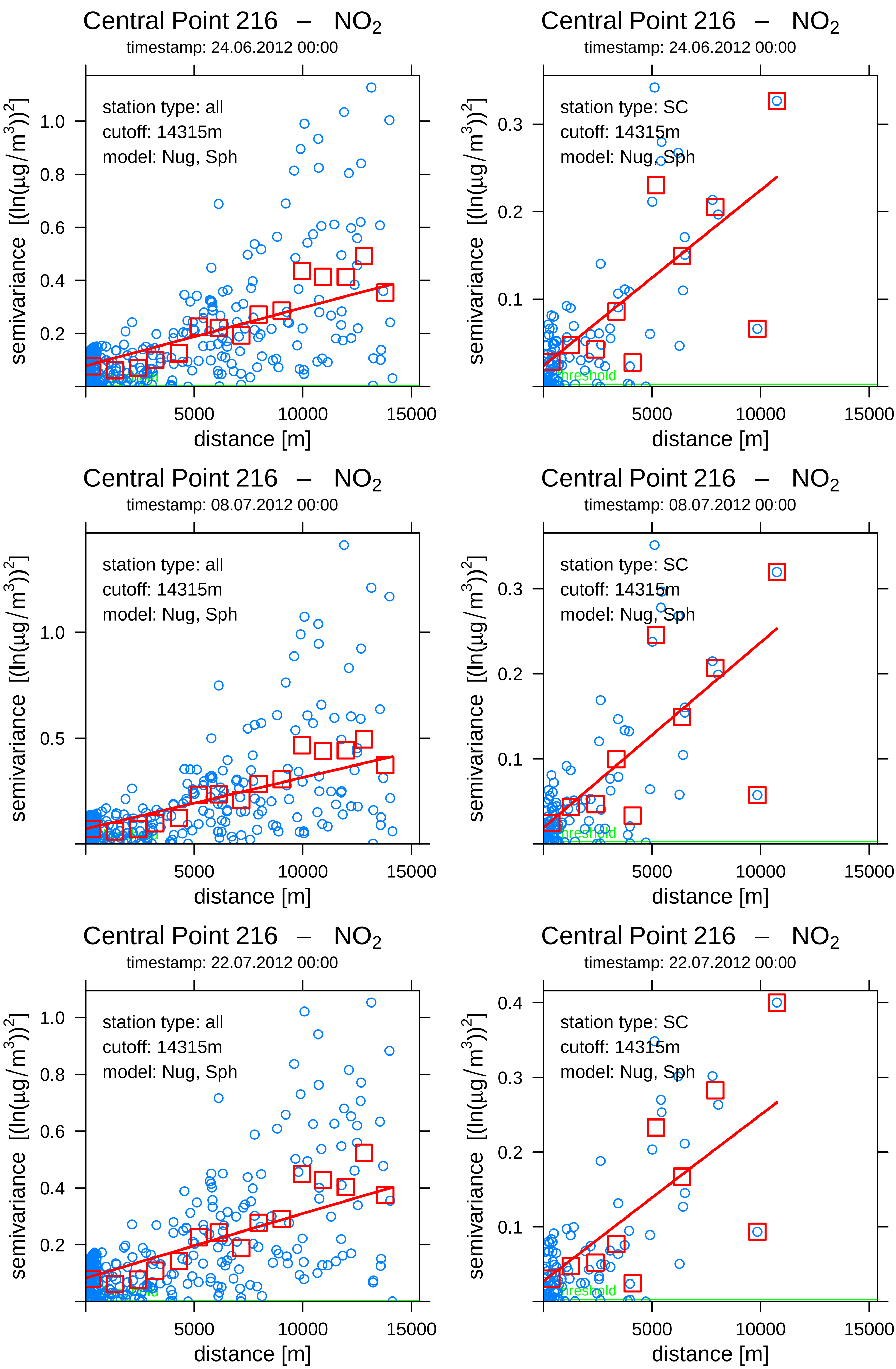

Central Point 216 – NO_2
timestamp: 13.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold


Central Point 216 – NO_2
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold

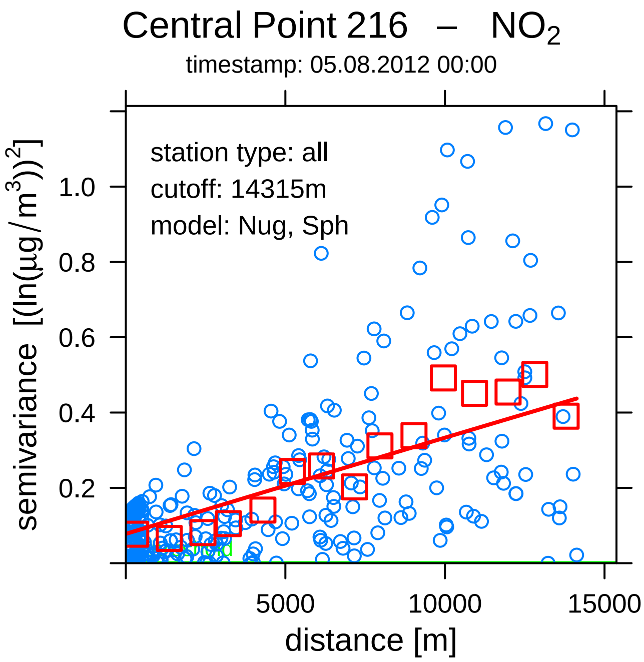

Central Point 216 – NO_2
timestamp: 27.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold

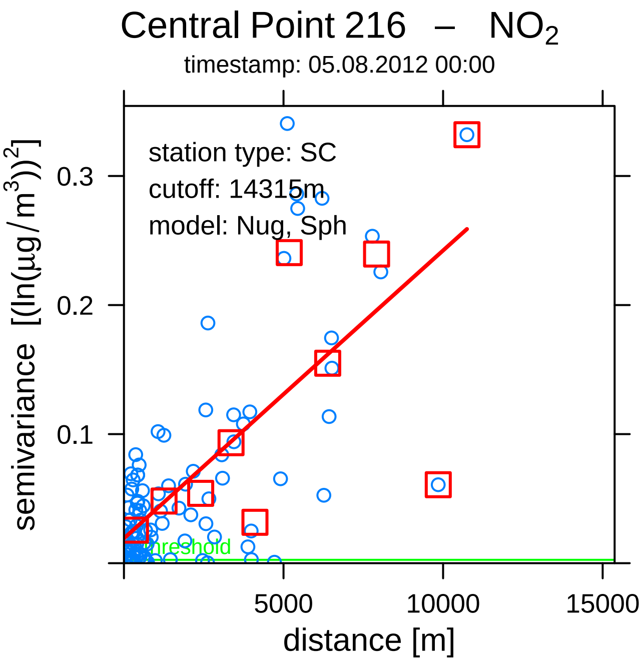

Central Point 216 – NO_2
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold

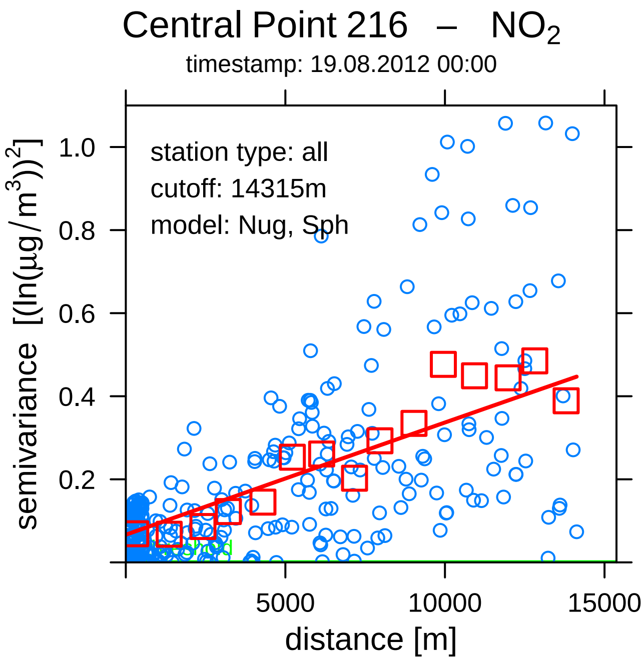

Central Point 216 – NO_2
timestamp: 10.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
threshold

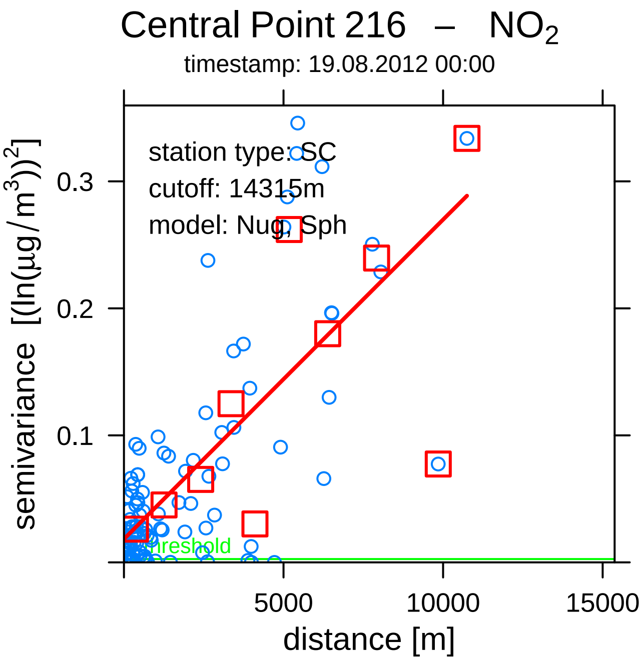


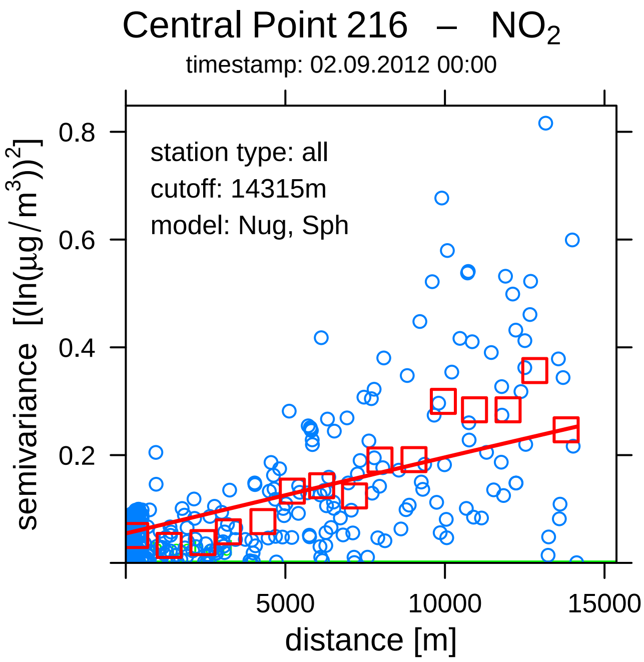
Central Point 216 – NO2
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – NO2
timestamp: 24.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – NO2
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – NO2
timestamp: 08.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – NO2
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]
Central Point 216 – NO2
timestamp: 22.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
distance [m]

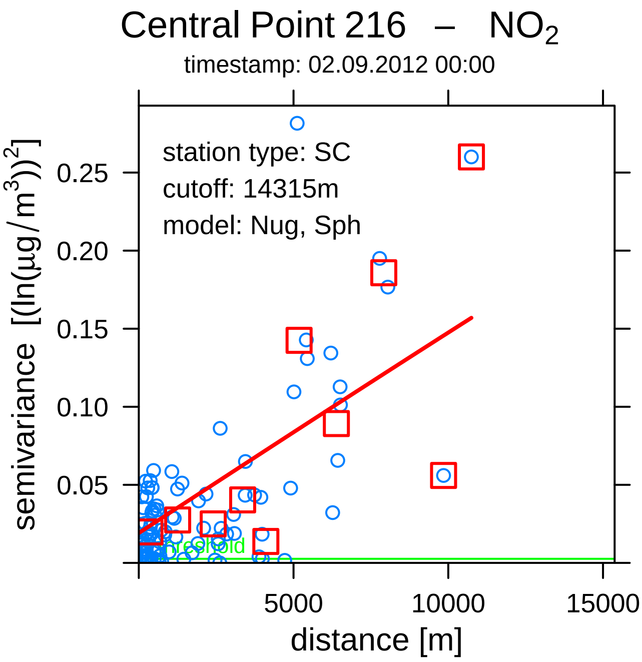

Central Point 216 – NO2
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
1.0
5000
10000
15000

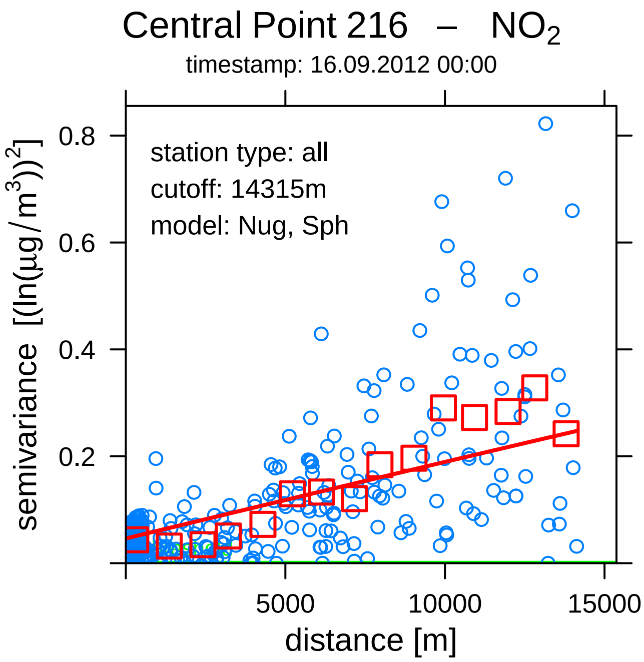

Central Point 216 – NO2
timestamp: 05.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
5000
10000
15000

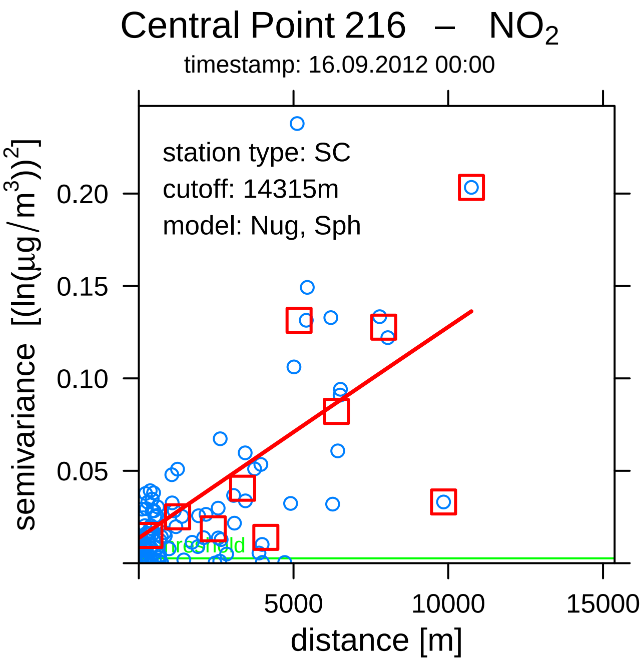

Central Point 216 – NO2
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
1.0
5000
10000
15000

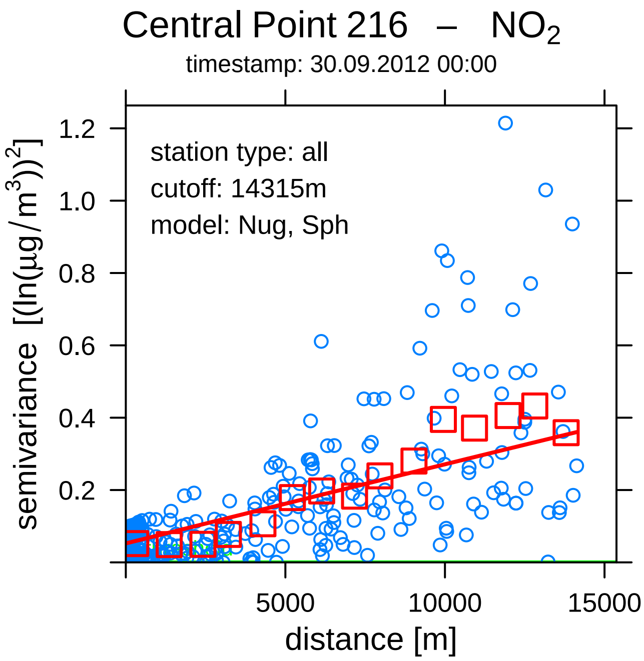

Central Point 216 – NO2
timestamp: 19.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.1
0.2
0.3
5000
10000
15000

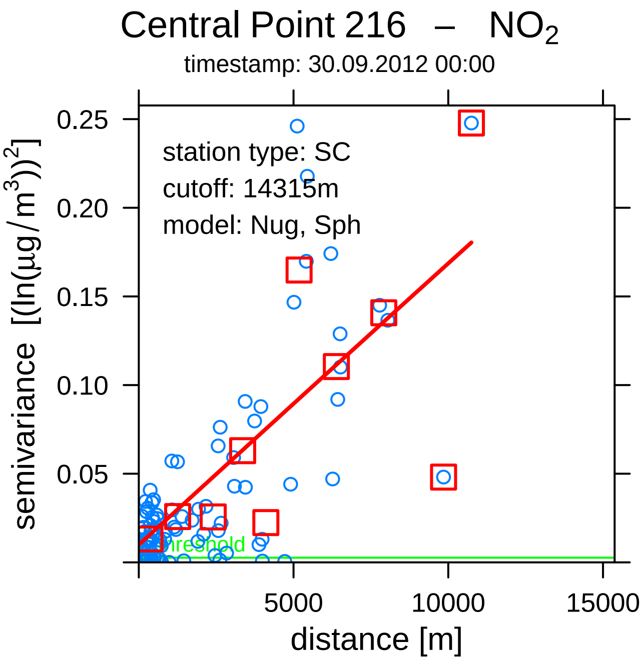

Central Point 216 – NO2
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

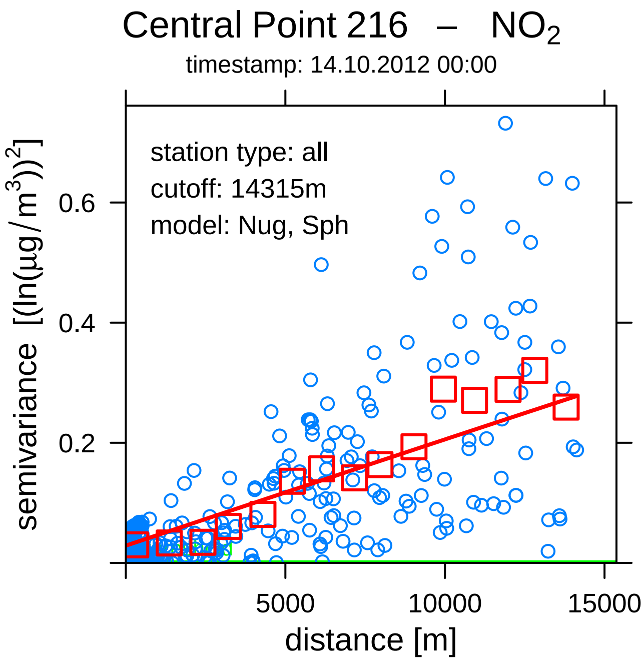

Central Point 216 – NO2
timestamp: 02.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000

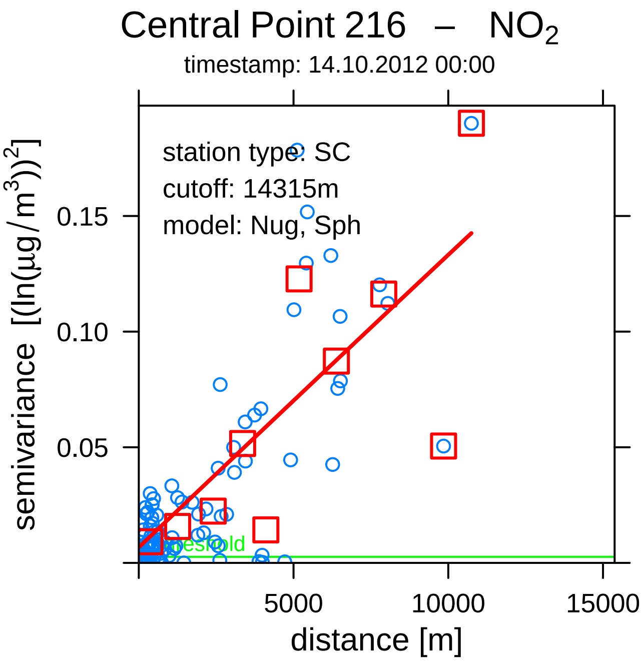

Central Point 216 – NO2
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
5000
10000
15000

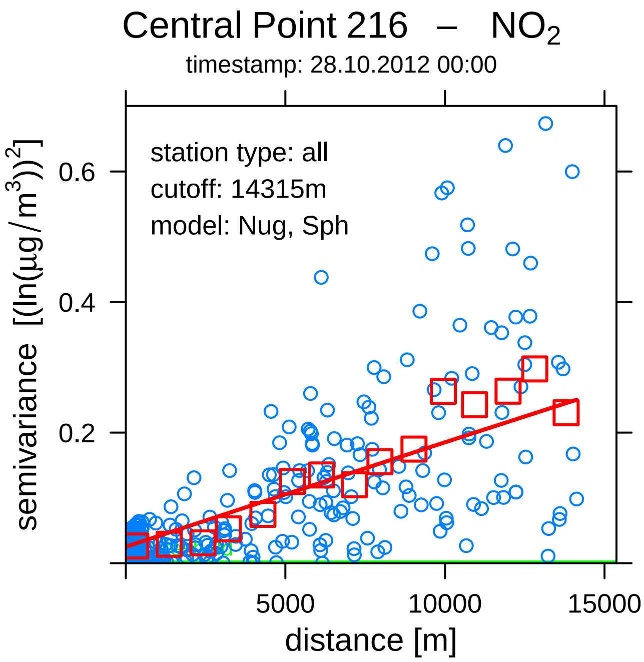

Central Point 216 – NO2
timestamp: 16.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
0.20
5000
10000
15000


Central Point 216 – NO2
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
0.8
1.0
1.2
5000
10000
15000

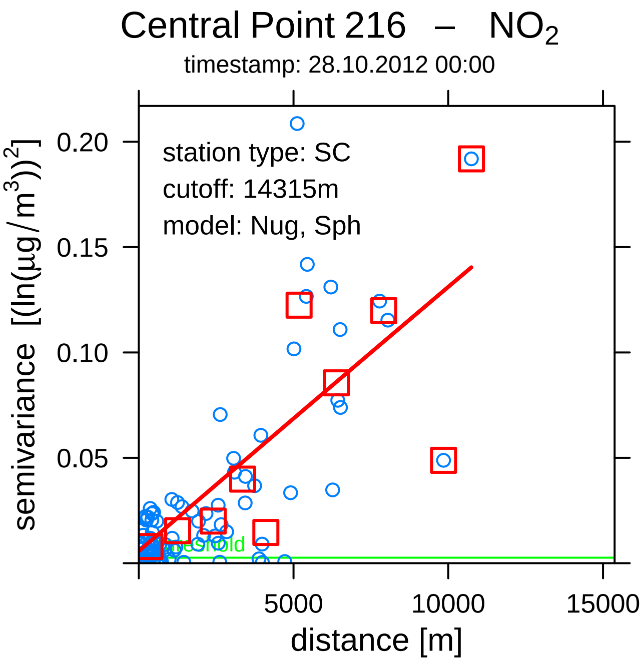

Central Point 216 – NO2
timestamp: 30.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000


Central Point 216 – NO2
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.2
0.4
0.6
5000
10000
15000

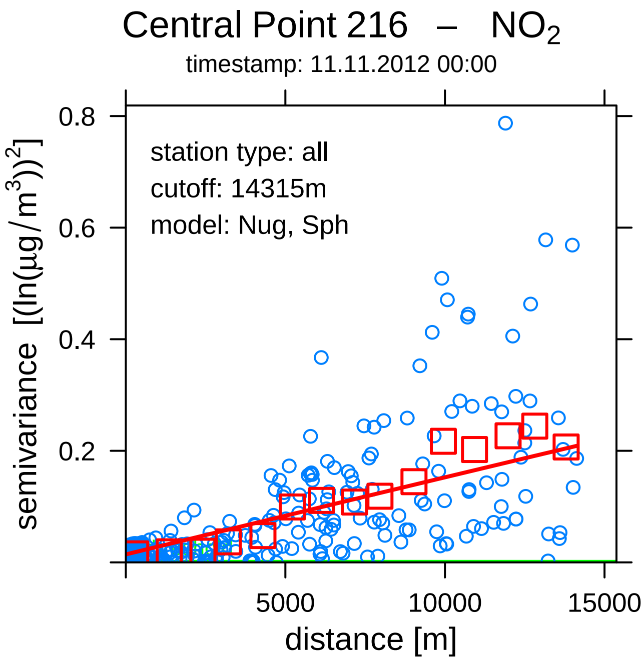

Central Point 216 – NO2
timestamp: 14.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
0.05
0.10
0.15
5000
10000
15000



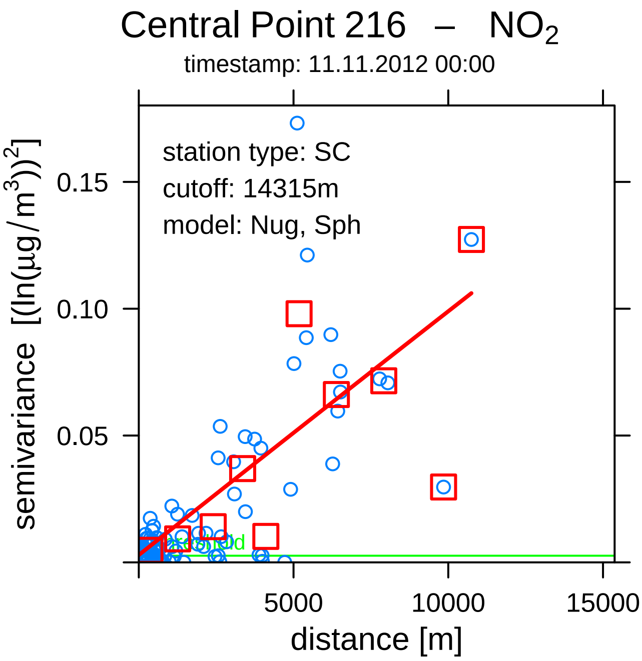
Central Point 216 – NO_2
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



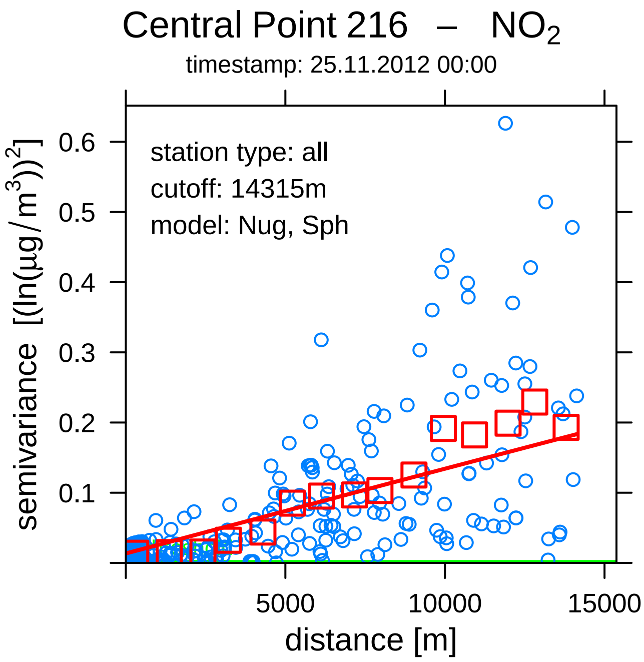
Central Point 216 – NO_2
timestamp: 28.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



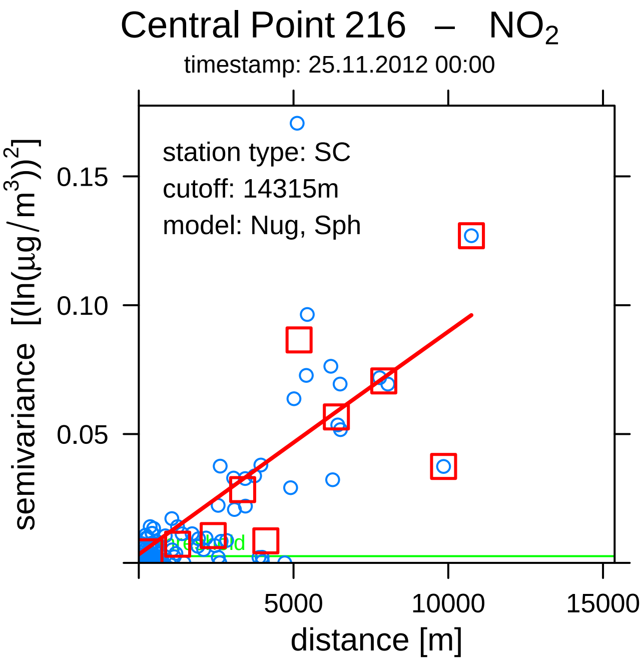
Central Point 216 – NO_2
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



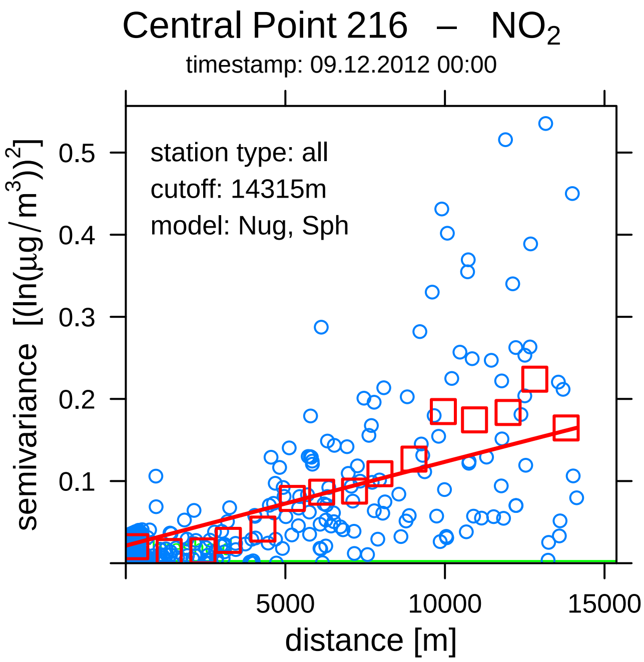
Central Point 216 – NO_2
timestamp: 11.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



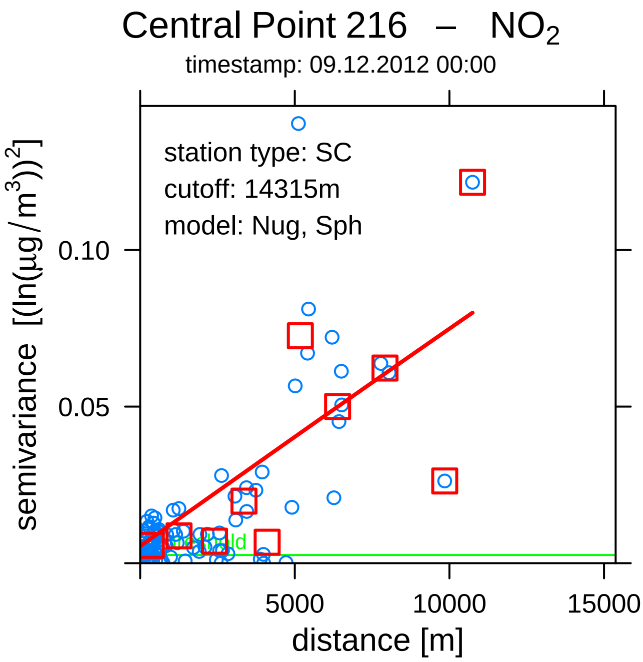
Central Point 216 – NO_2
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



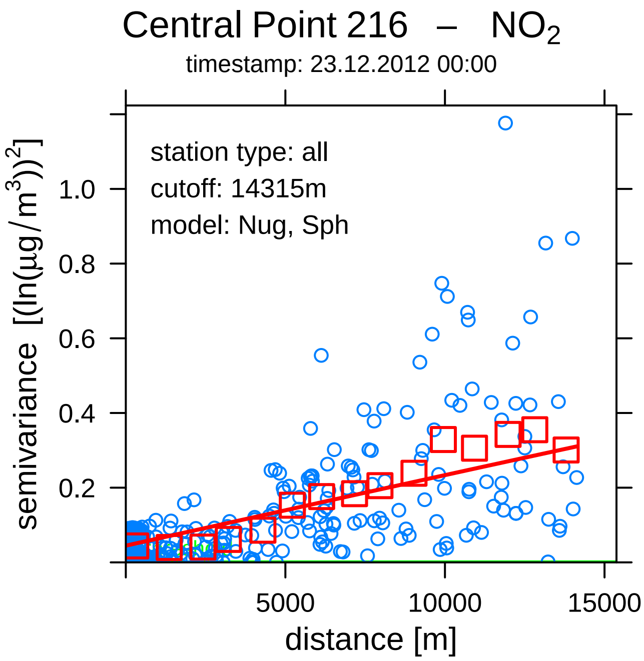
Central Point 216 – NO_2
timestamp: 25.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]



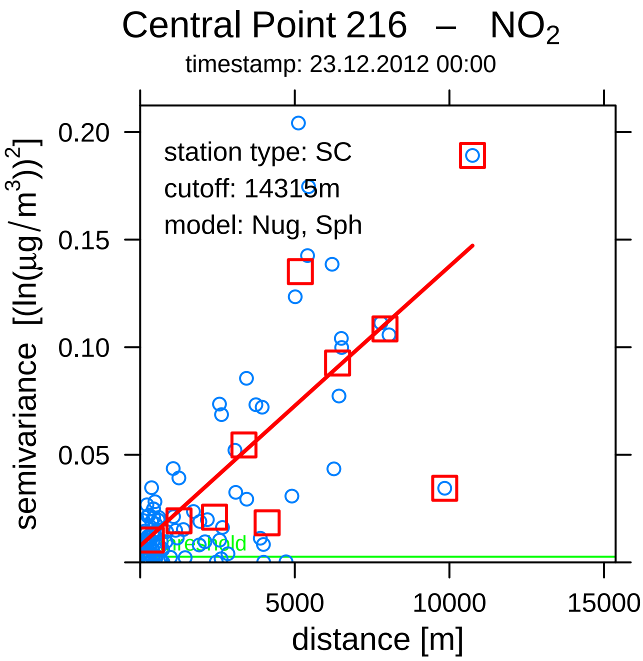
Central Point 216 – NO2
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000
distance [m]



Central Point 216 – NO2
timestamp: 09.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.05
0.10
threshold
5000
10000
15000
distance [m]



Central Point 216 – NO2
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.2
0.4
0.6
0.8
1.0
5000
10000
15000
distance [m]



Central Point 216 – NO2
timestamp: 23.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
threshold
5000
10000
15000
distance [m]

Annex 3. Point centred variograms for Ozone

Point centred variograms obtained from log-transformed concentration time series for virtual stations cp7, cp17 and cp 216 of the Antwerp dataset:

— time series of point centred variograms calculated on 14-day average concentrations

— variogram model fits using a spherical model with nugget effect

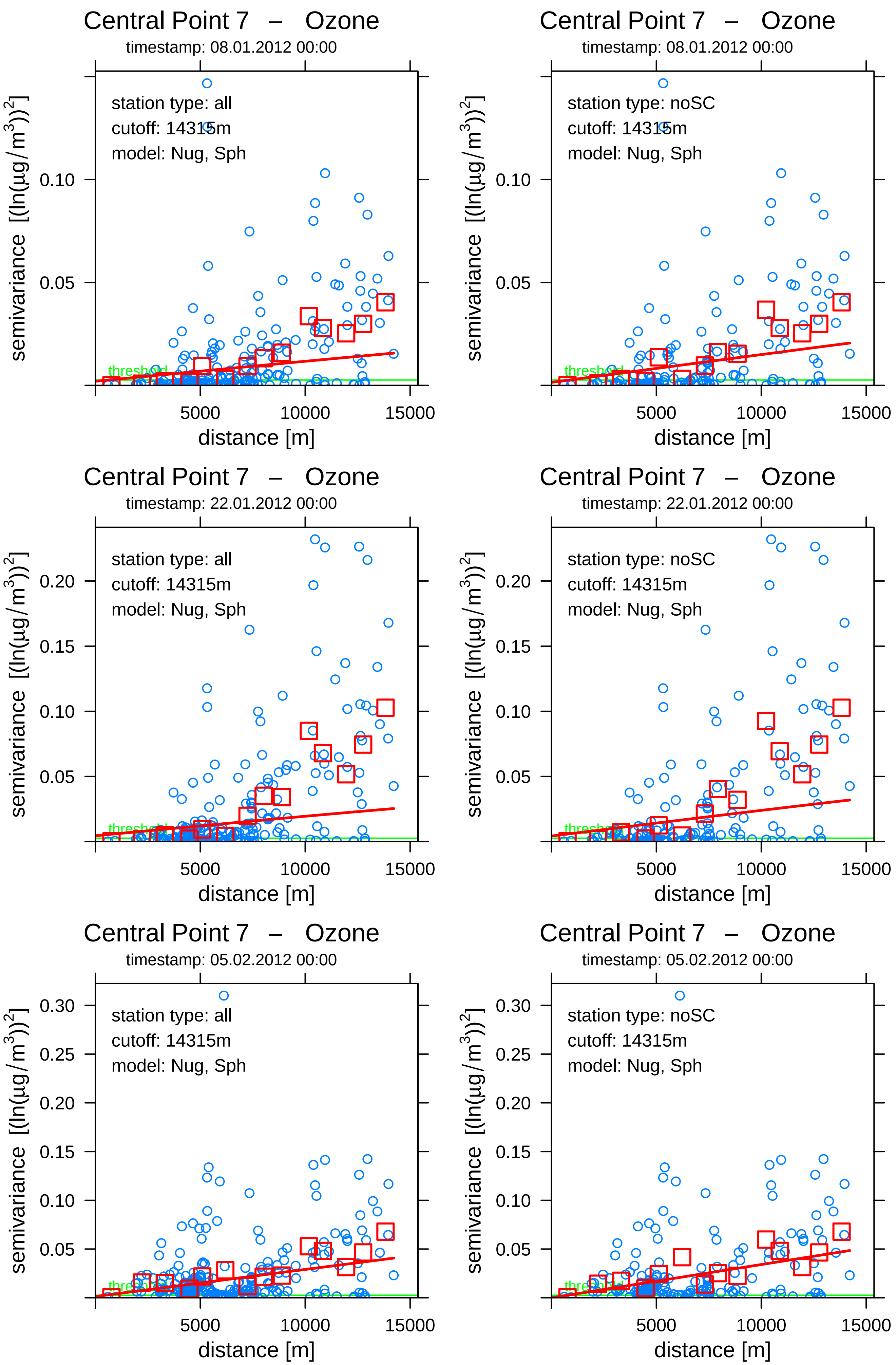
— identification of an effective distance of spatial representativeness

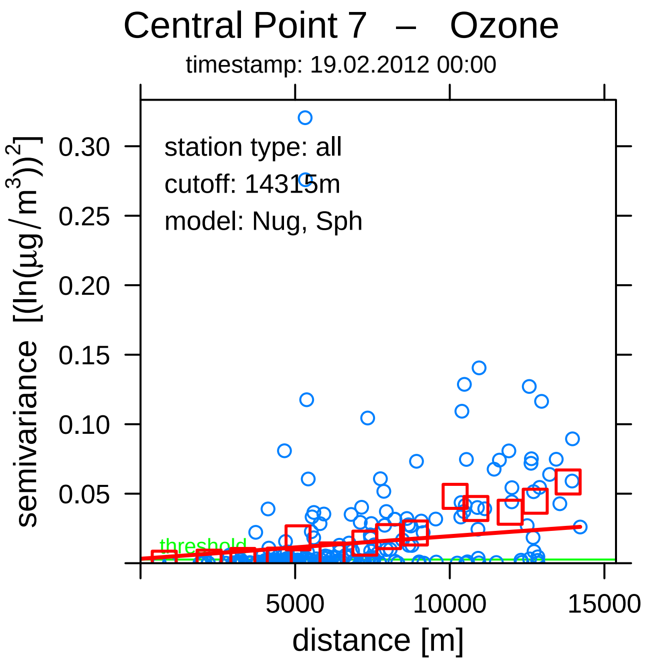
Part 3: Ozone

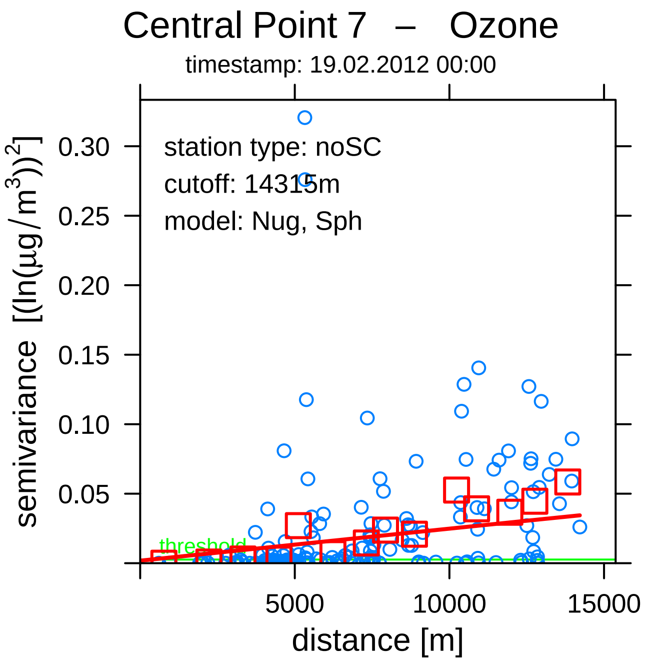
Note that plots on the **left side** display the point centred variography results obtained by using data from all 341 virtual monitoring points. Plots on the **right side** display the results obtained by using only the 241 non-street-canyon points for the point centred variograms of virtual monitoring stations cp7 and cp17, and only the 100 street-canyon points for the point centred variograms of virtual monitoring station cp216.

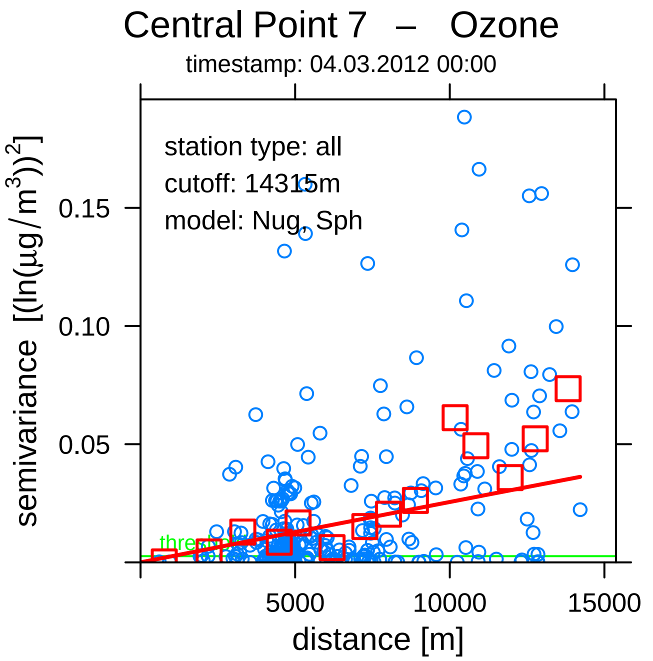
Blue circles indicate the point centred semivariance values of all paired observations formed between individual points and the corresponding central point (**variogram cloud**). Red squares are the average values of semivariance formed within the 15 lag distance classes (**empirical variogram**). Red line is the **variogram model** (spherical model with nugget effect fitted to the empirical variogram).

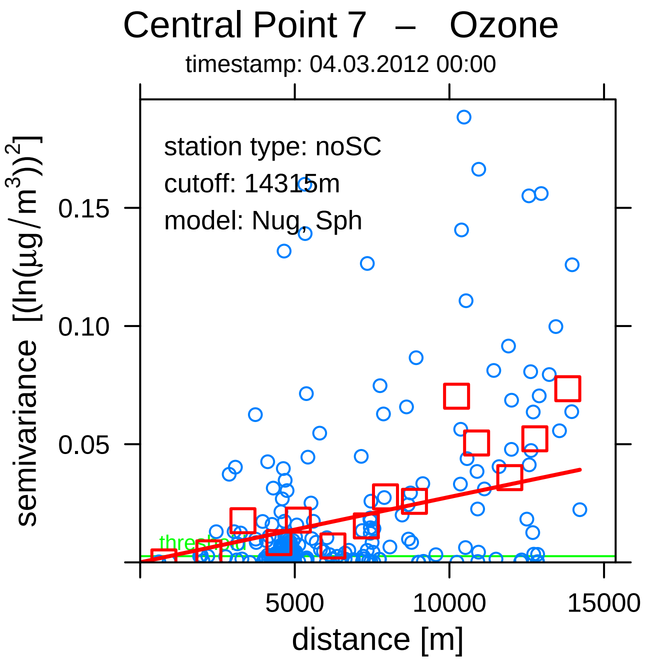
Horizontal green lines mark the **semivariance threshold** associated with the maximum relative deviation of concentrations permissible within the limits of spatial representativeness. Vertical green lines mark the **range distance** of the variogram model. This vertical line is not visible when the estimated range falls beyond the cutoff distance used in the variogram calculations.

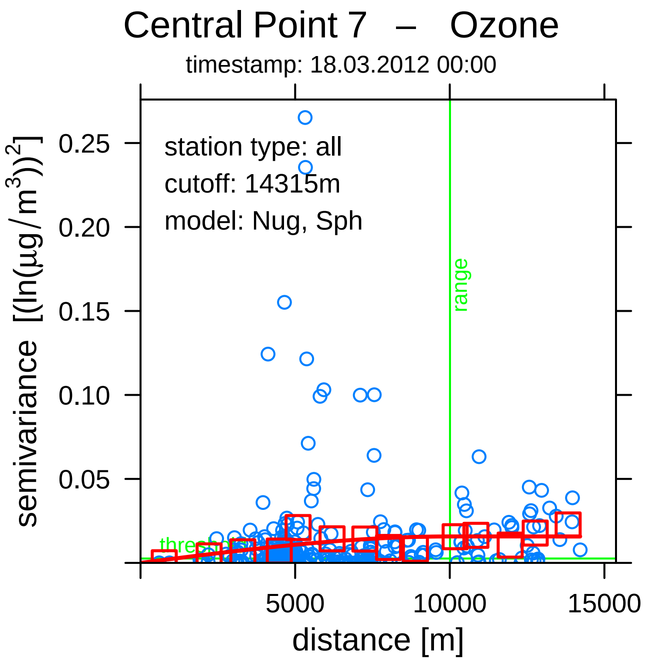

Central Point 7 – Ozone
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m3))2]
distance [m]
threshold
Central Point 7 – Ozone
timestamp: 08.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 22.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 05.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph

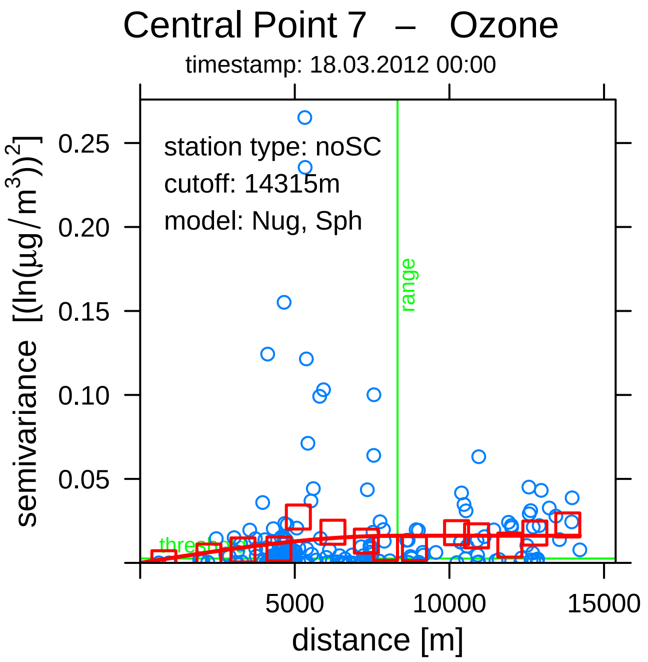

Central Point 7 – Ozone
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

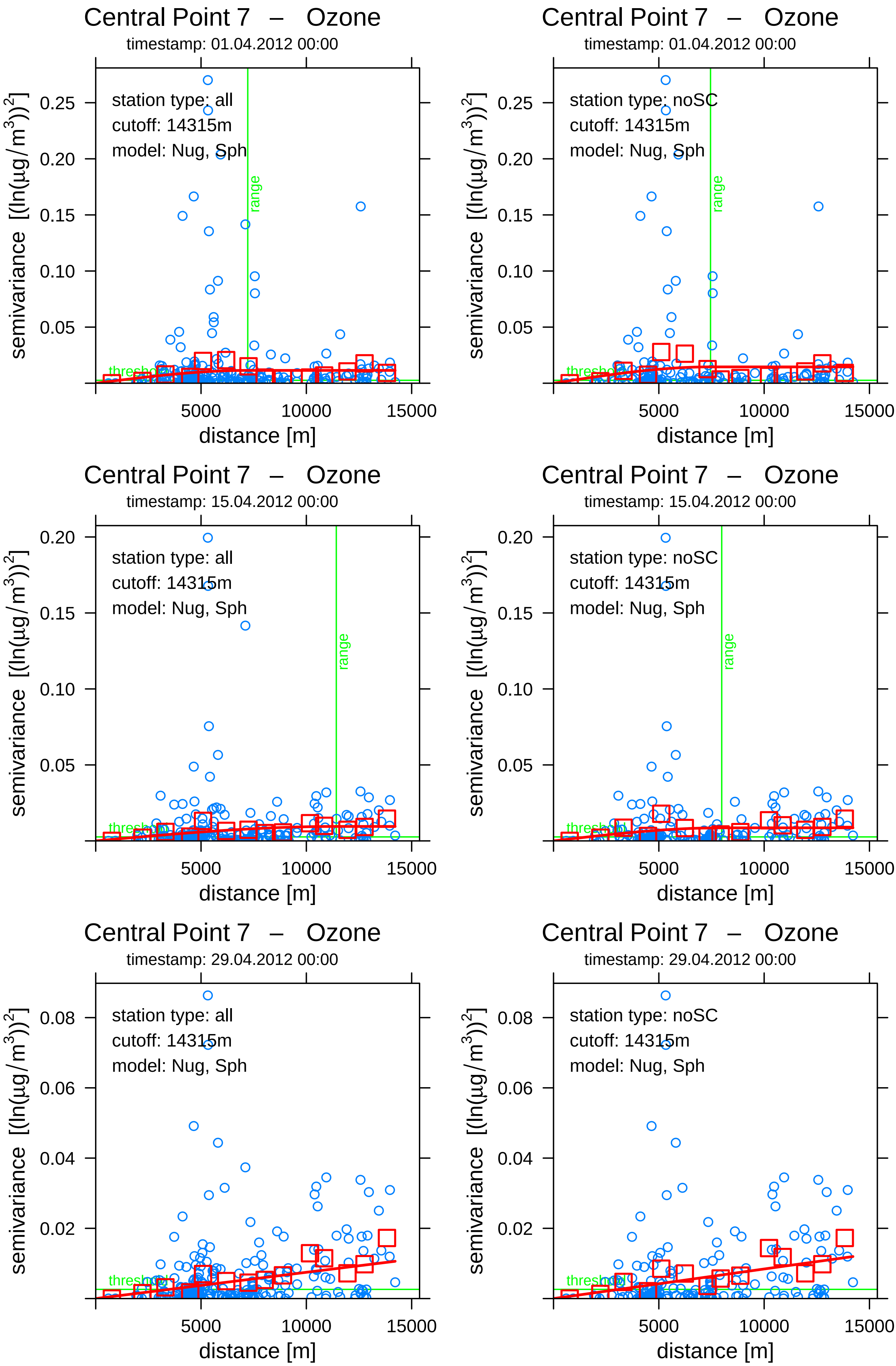

Central Point 7 – Ozone
timestamp: 19.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]


Central Point 7 – Ozone
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

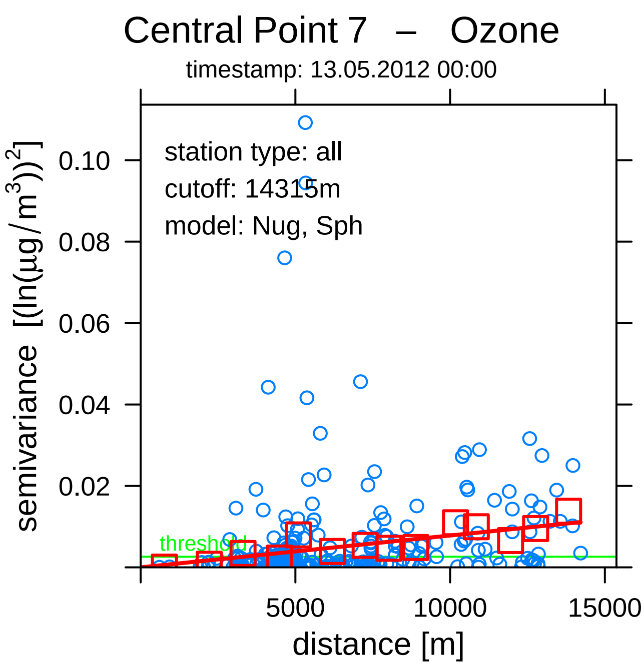

Central Point 7 – Ozone
timestamp: 04.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

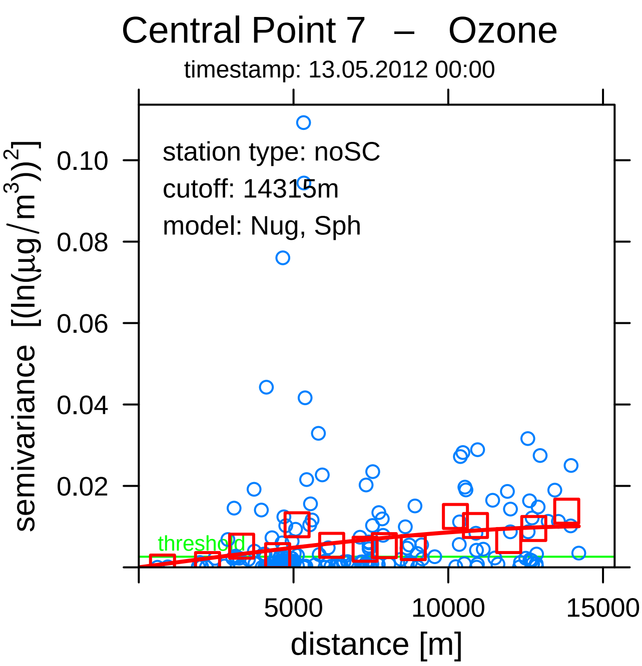

Central Point 7 – Ozone
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]

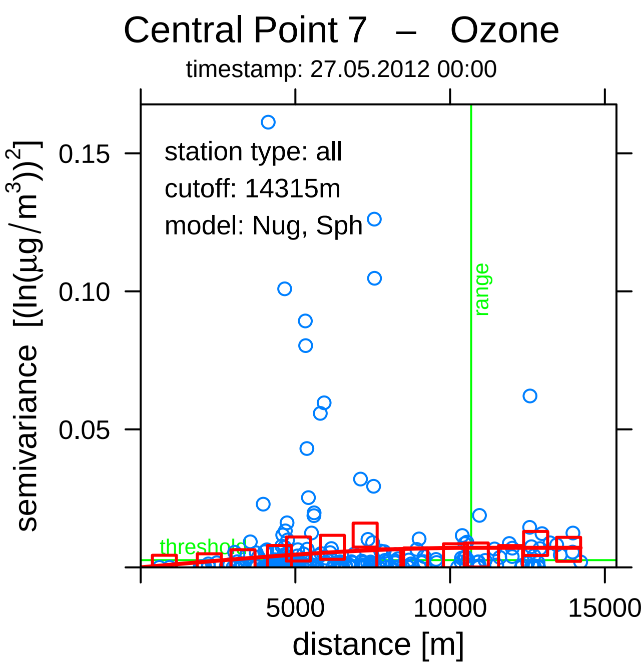

Central Point 7 – Ozone
timestamp: 18.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]

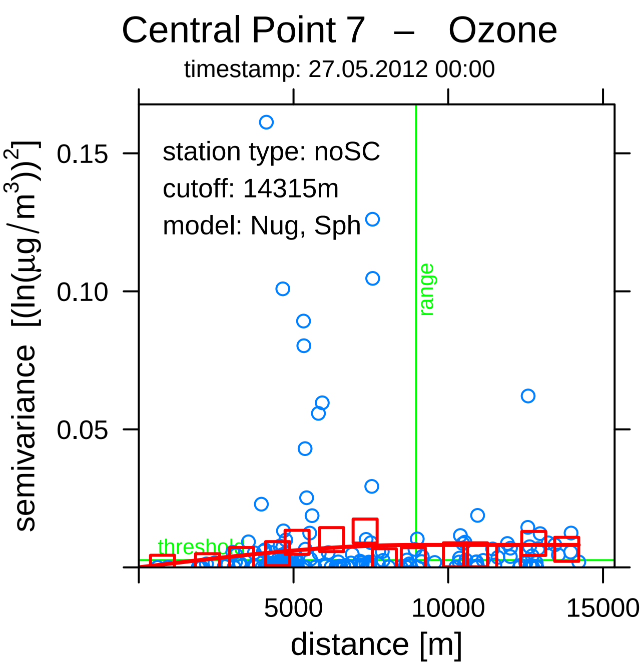


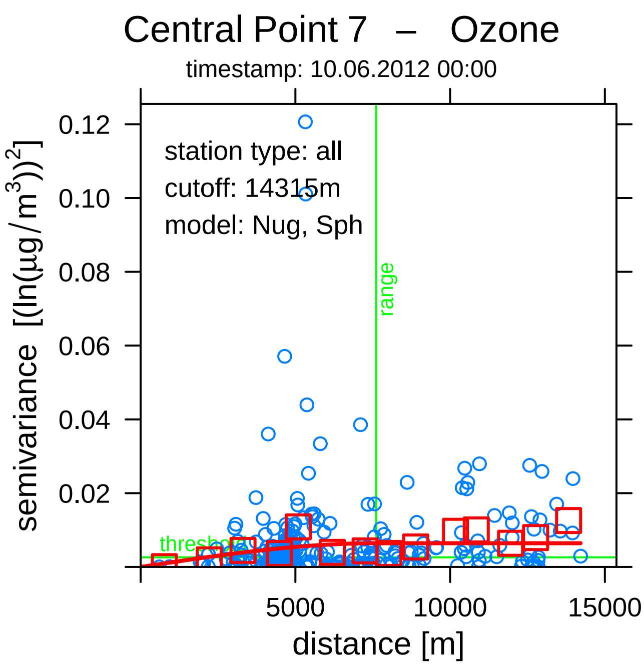
Central Point 7 – Ozone
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
Central Point 7 – Ozone
timestamp: 01.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 15.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
Central Point 7 – Ozone
timestamp: 29.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph

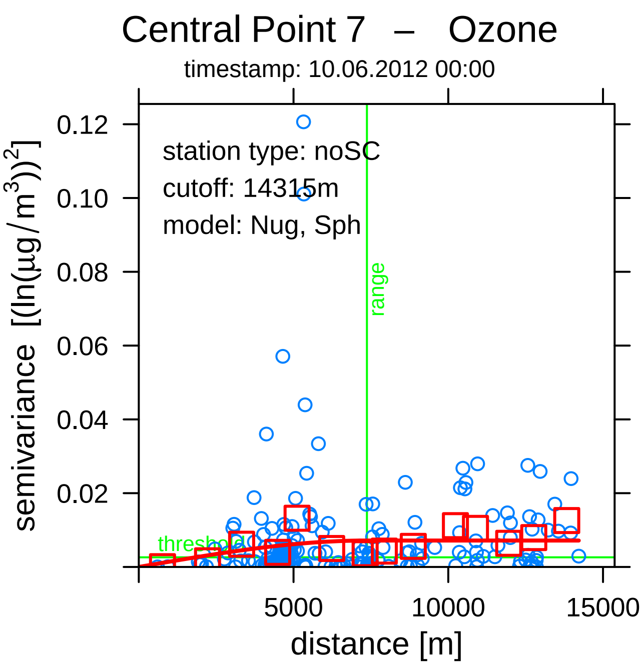

Central Point 7 – Ozone
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.10
0.08
0.06
0.04
0.02
distance [m]
5000
10000
15000

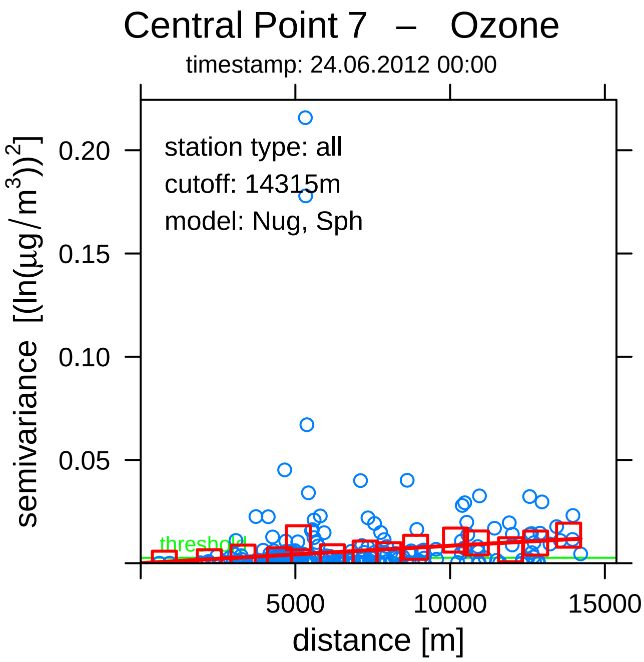

Central Point 7 – Ozone
timestamp: 13.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.10
0.08
0.06
0.04
0.02
distance [m]
5000
10000
15000

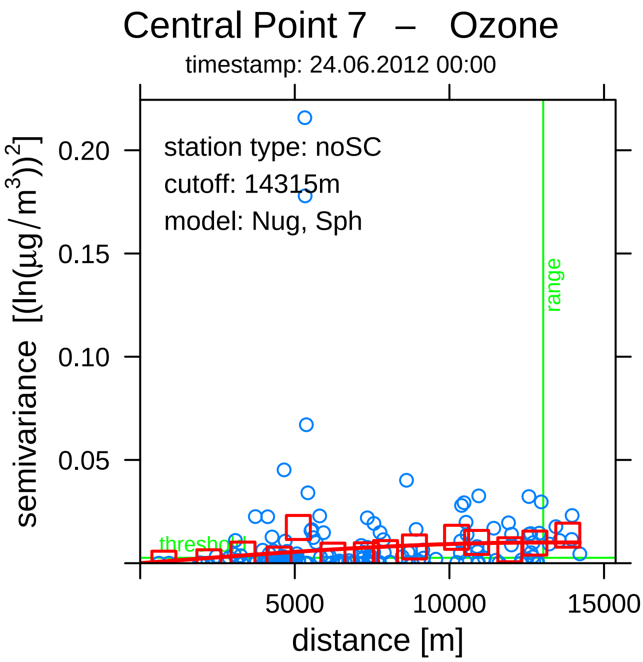

Central Point 7 – Ozone
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.15
0.10
0.05
distance [m]
5000
10000
15000

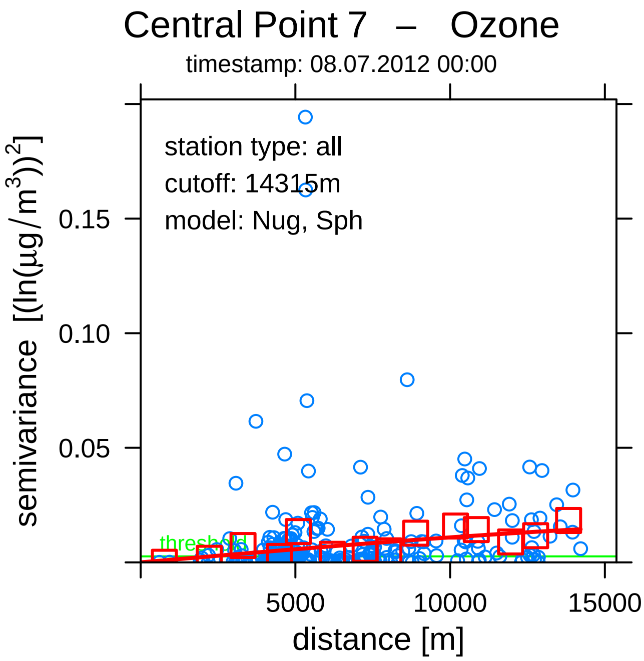

Central Point 7 – Ozone
timestamp: 27.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.15
0.10
0.05
distance [m]
5000
10000
15000

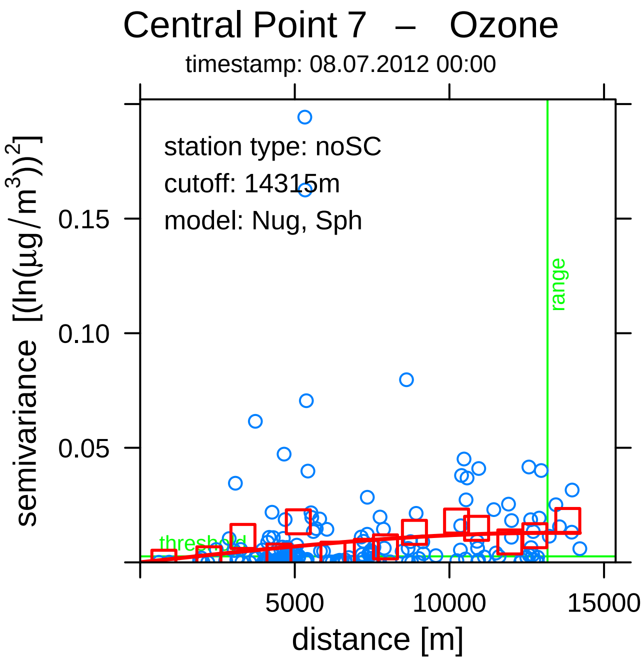

Central Point 7 – Ozone
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.12
0.10
0.08
0.06
0.04
0.02
distance [m]
5000
10000
15000

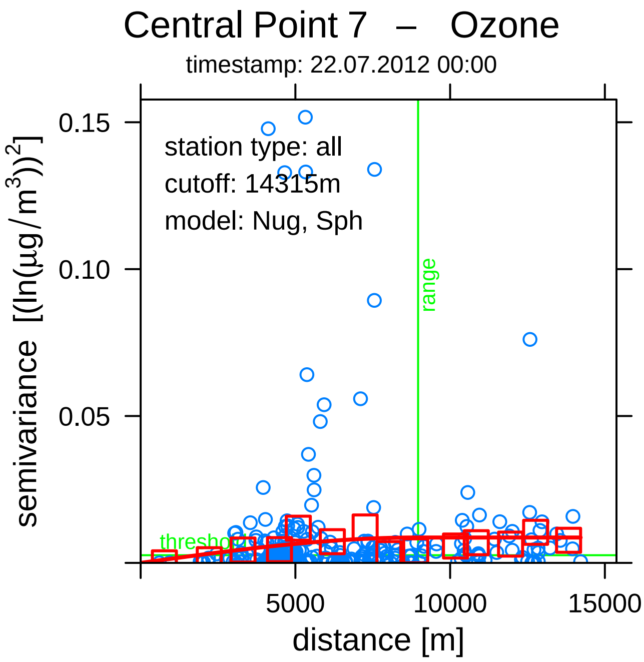

Central Point 7 – Ozone
timestamp: 10.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.12
0.10
0.08
0.06
0.04
0.02
distance [m]
5000
10000
15000

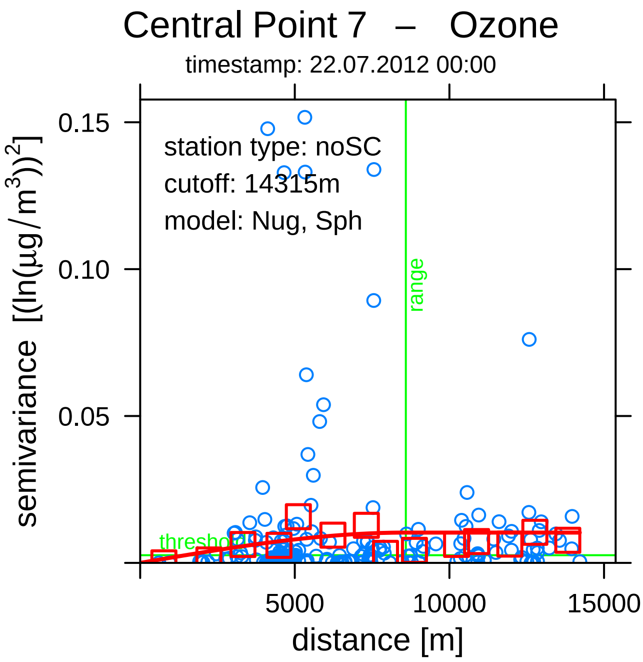

Central Point 7 – Ozone
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]

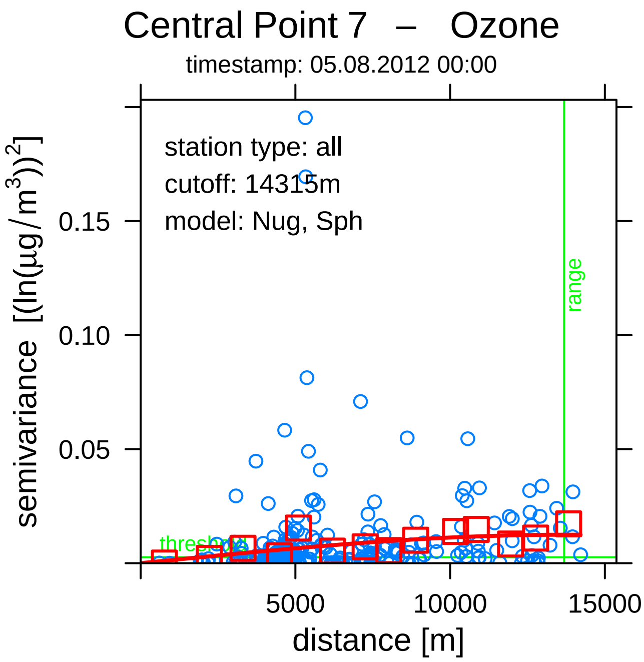

Central Point 7 – Ozone
timestamp: 24.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]

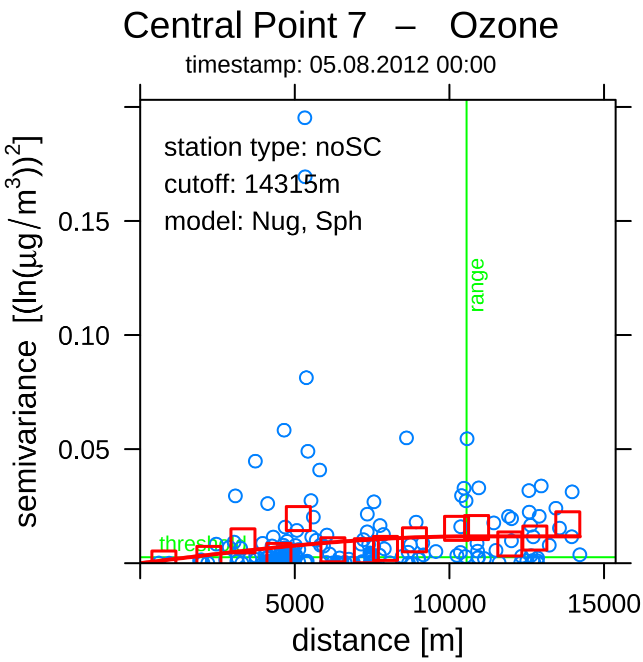

Central Point 7 – Ozone
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

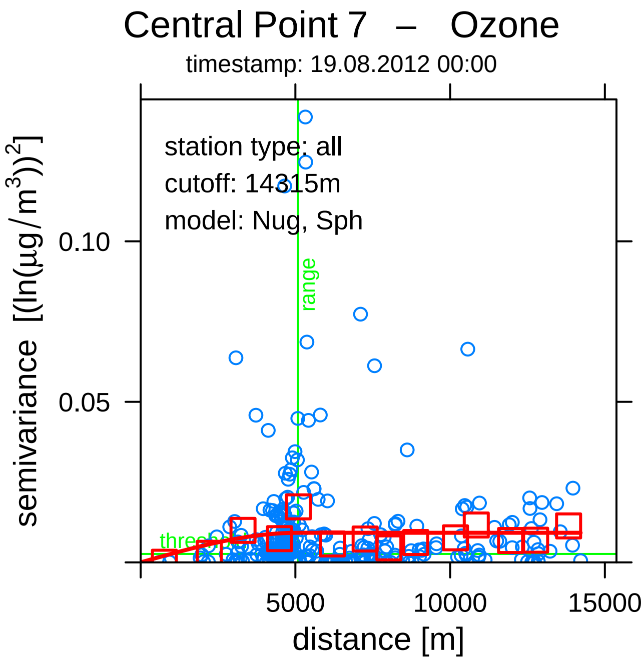

Central Point 7 – Ozone
timestamp: 08.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

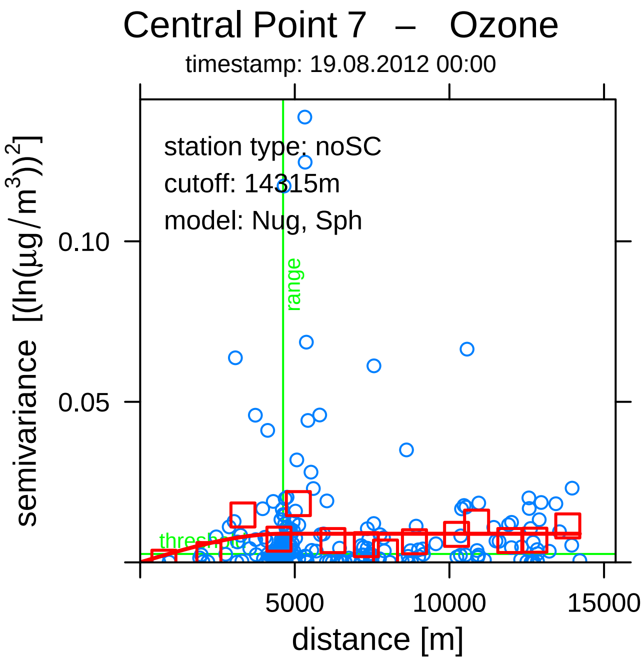

Central Point 7 – Ozone
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

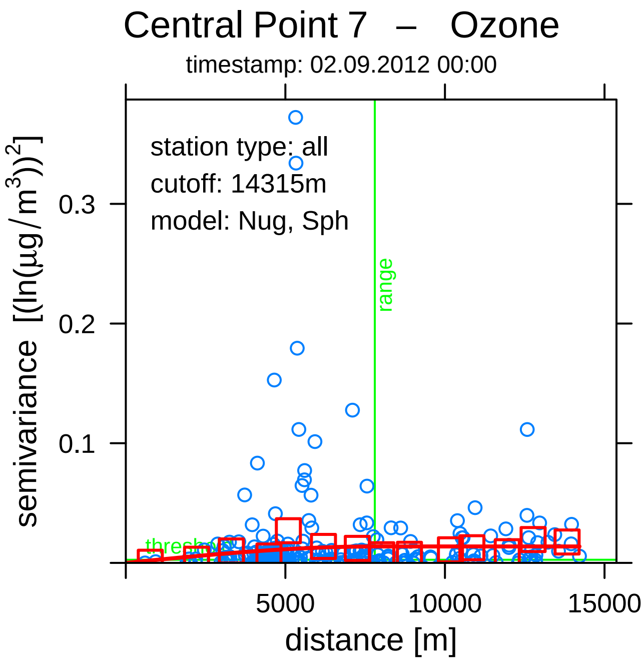

Central Point 7 – Ozone
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

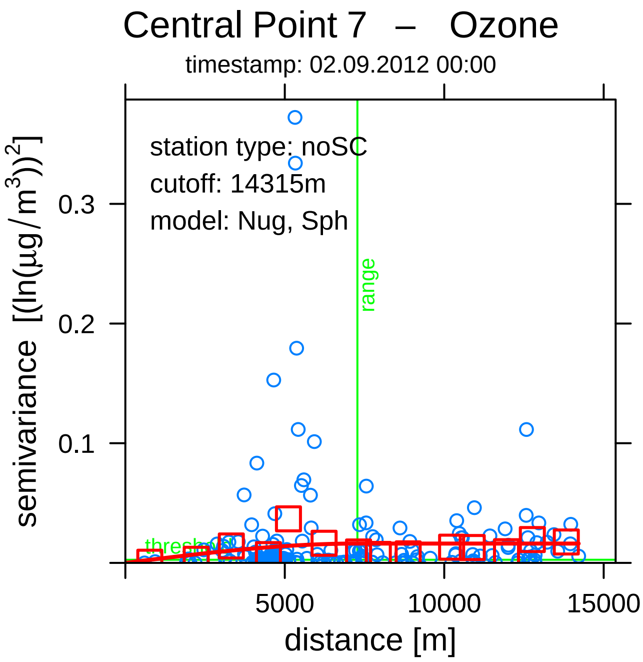

Central Point 7 – Ozone
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
distance [m]
5000
10000
15000

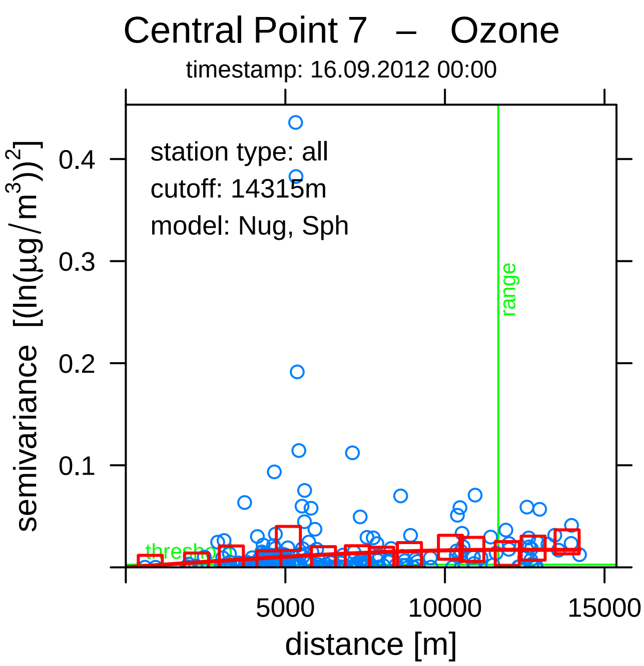

Central Point 7 – Ozone
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
distance [m]
5000
10000
15000

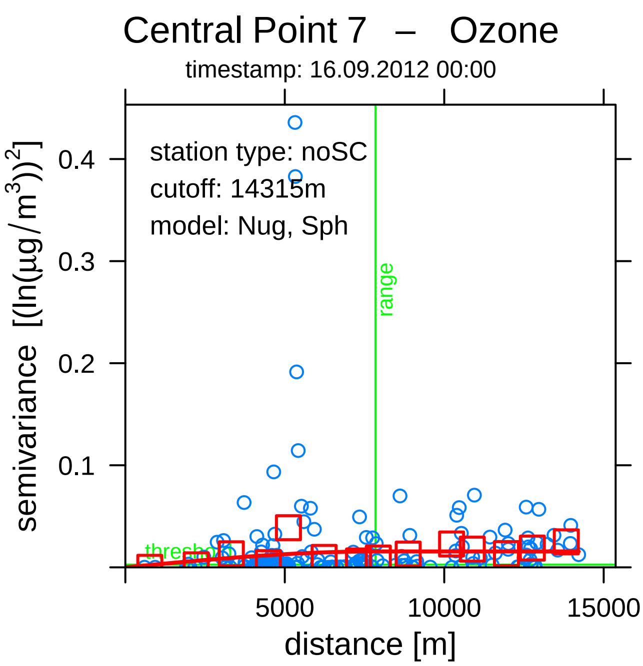

Central Point 7 – Ozone
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

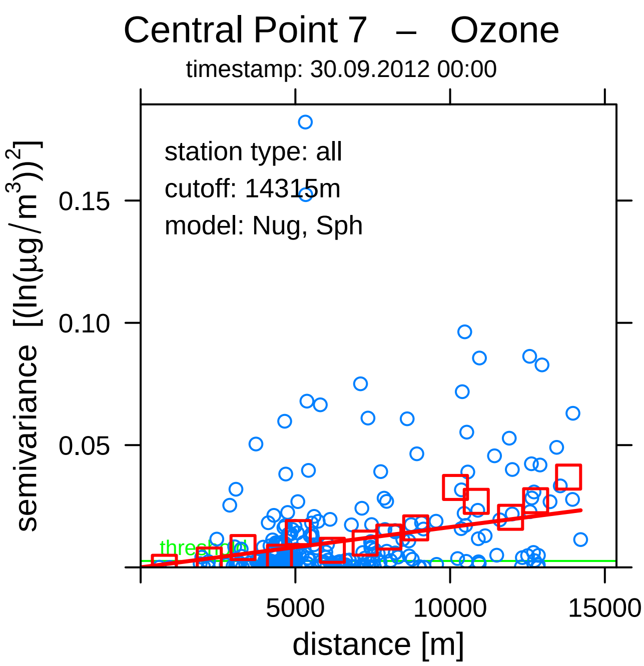

Central Point 7 – Ozone
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

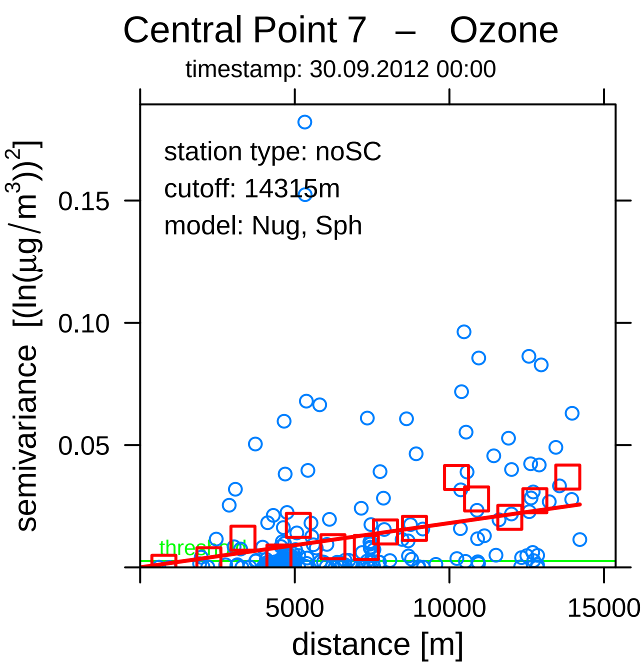

Central Point 7 – Ozone
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
distance [m]
5000
10000
15000

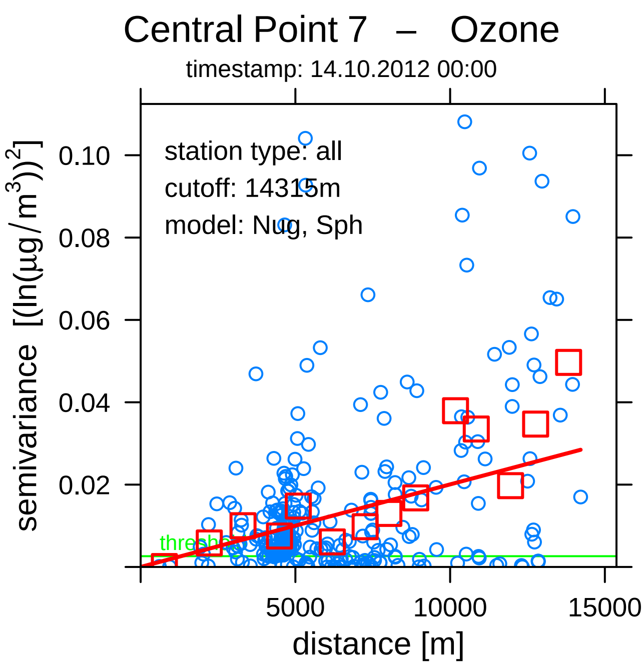

Central Point 7 – Ozone
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
distance [m]
5000
10000
15000

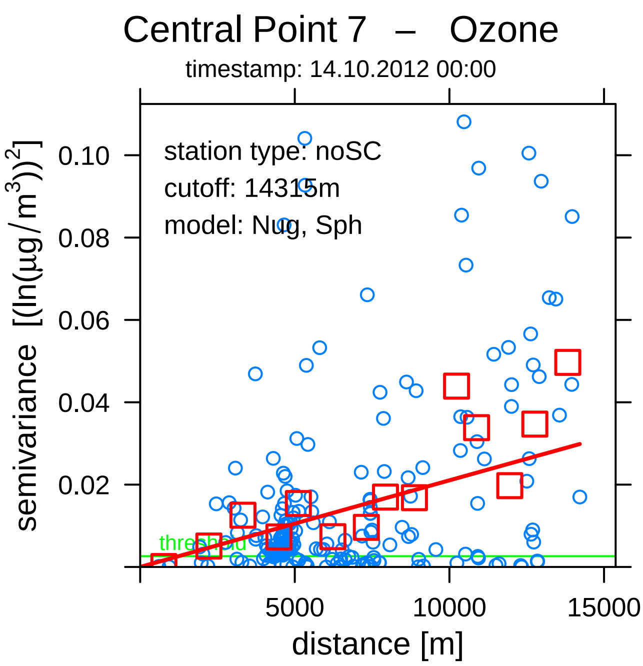

Central Point 7 – Ozone
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
5000
10000
15000
distance [m]

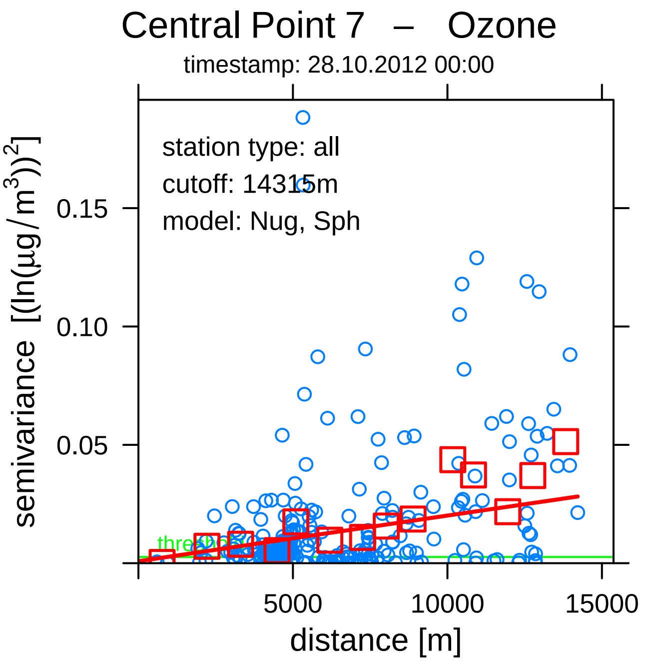

Central Point 7 – Ozone
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
5000
10000
15000
distance [m]

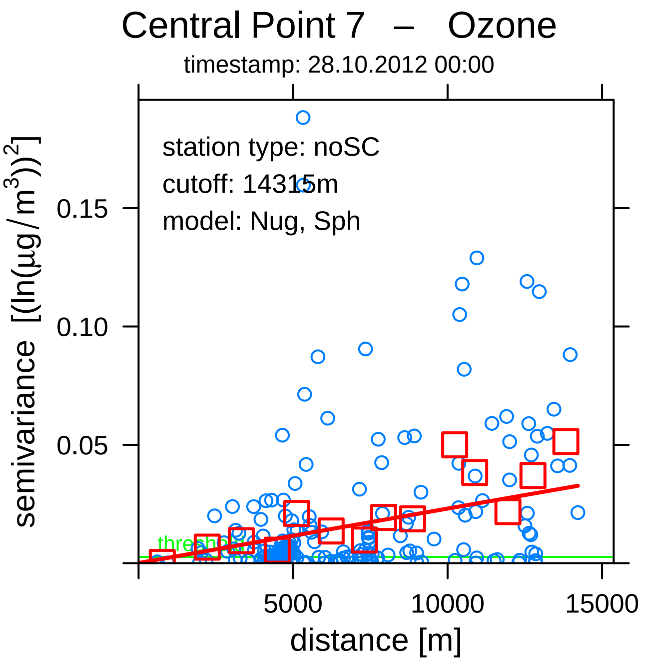

Central Point 7 – Ozone
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

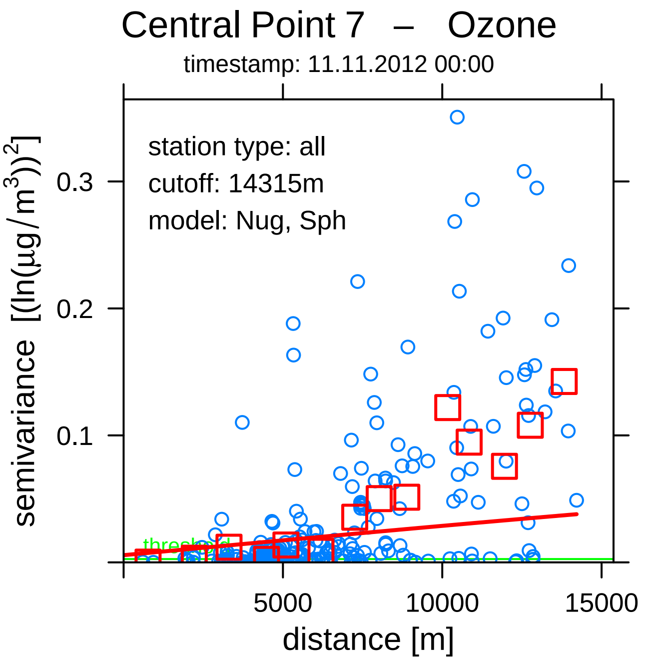

Central Point 7 – Ozone
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

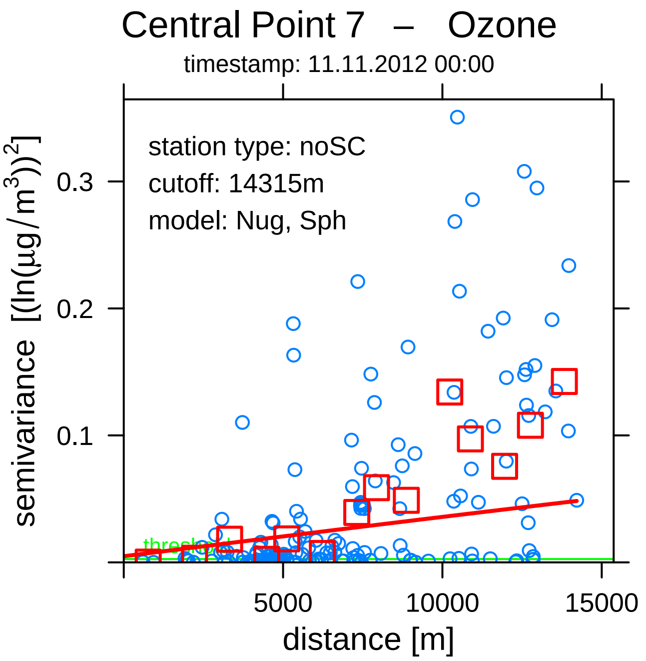

Central Point 7 – Ozone
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

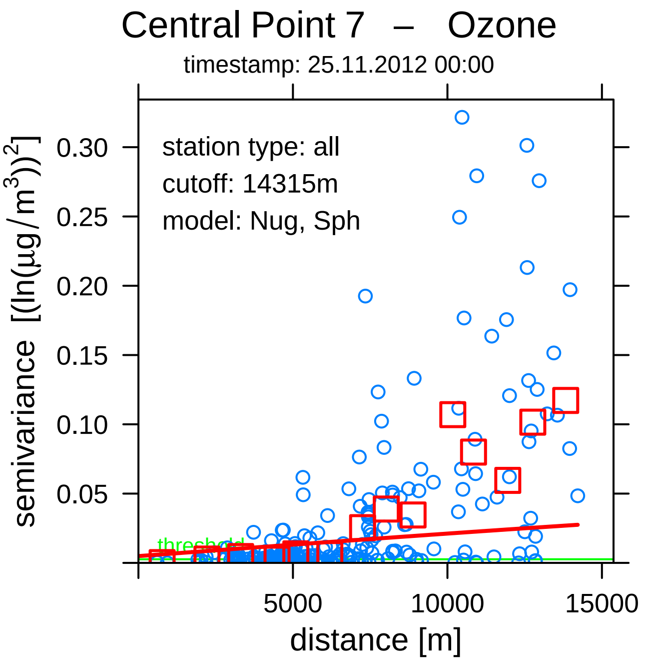

Central Point 7 – Ozone
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

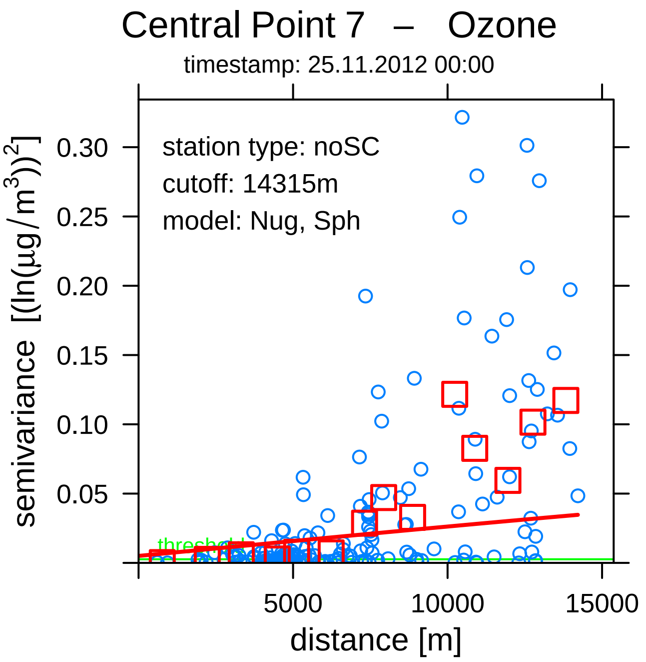

Central Point 7 – Ozone
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

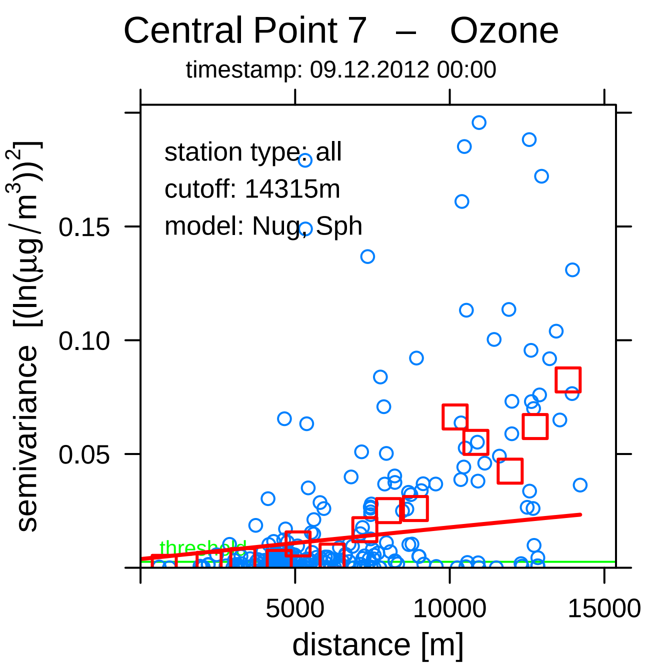

Central Point 7 – Ozone
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]

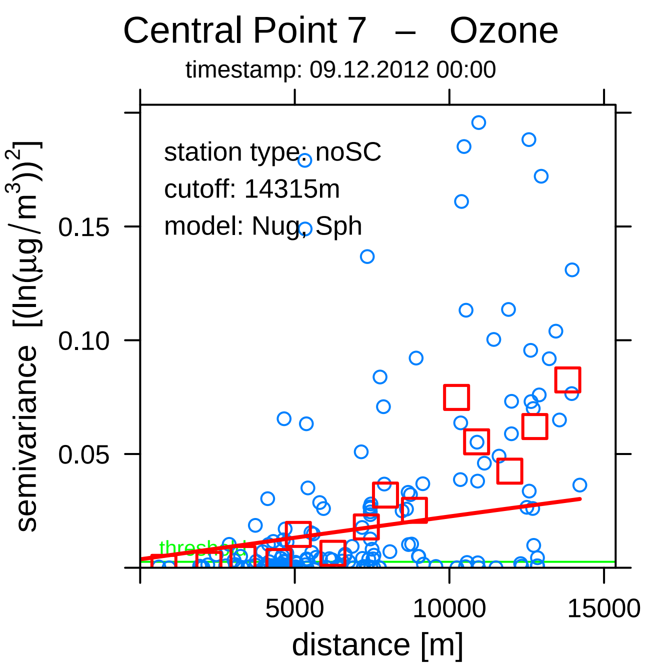

Central Point 7 – Ozone
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
5000
10000
15000
distance [m]

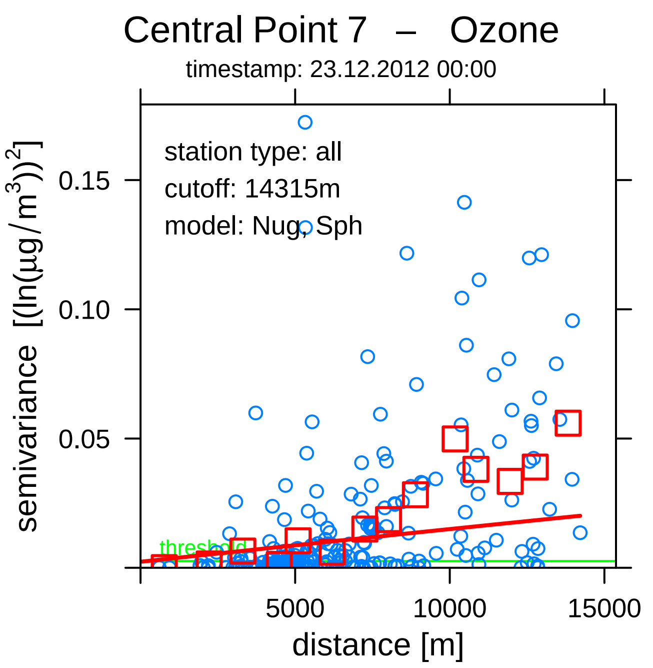

Central Point 7 – Ozone
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
5000
10000
15000
distance [m]

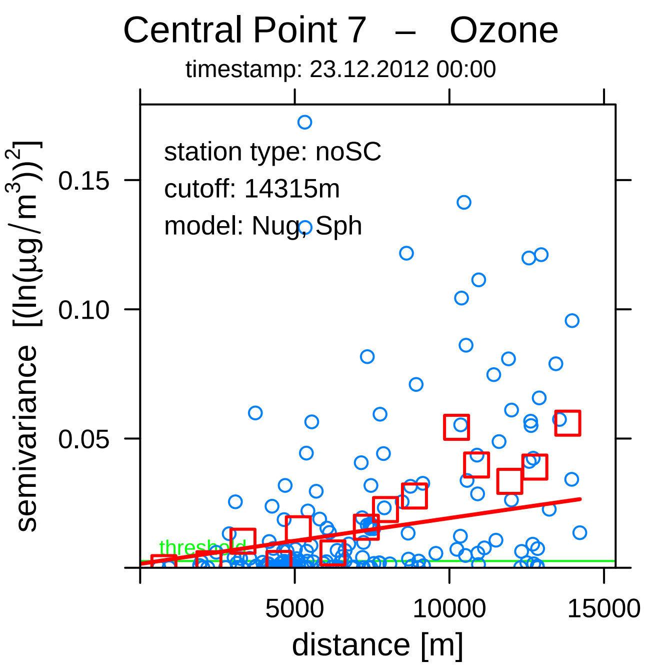

Central Point 7 – Ozone
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000
distance [m]

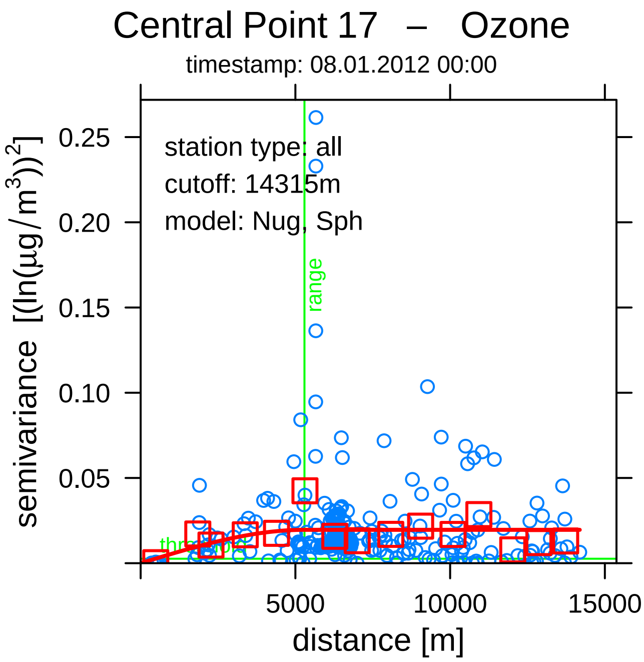

Central Point 7 – Ozone
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000
distance [m]

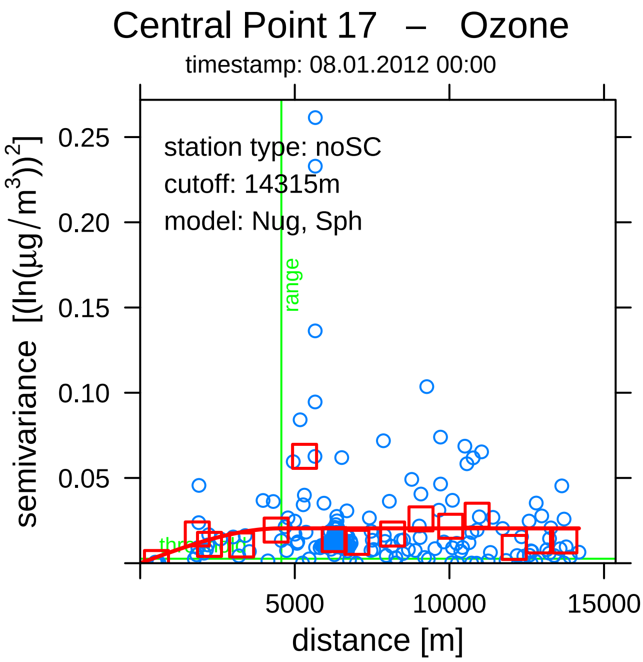

Central Point 7 – Ozone
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

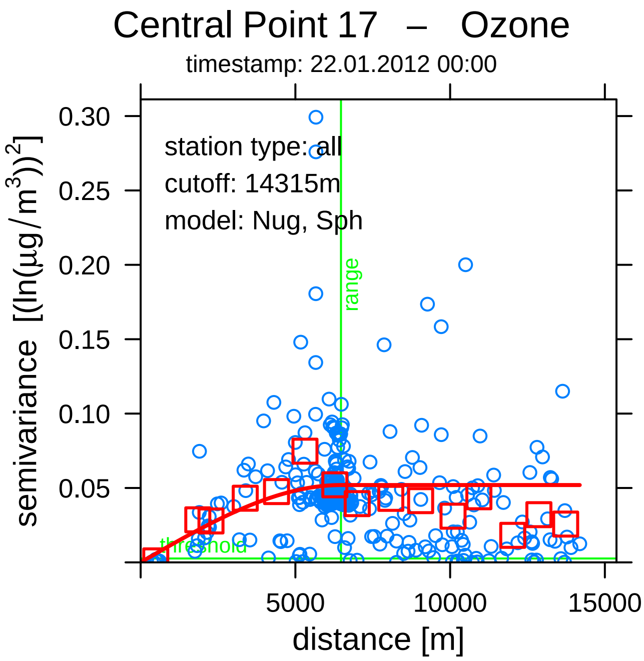

Central Point 7 – Ozone
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

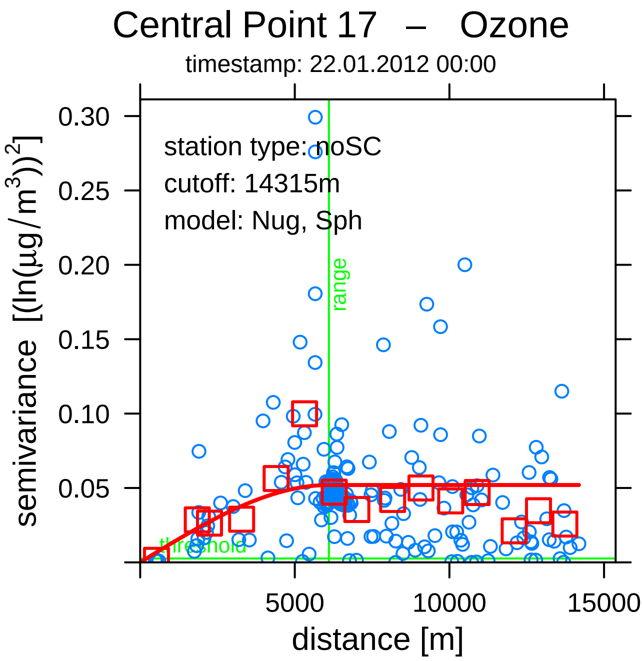

Central Point 7 – Ozone
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

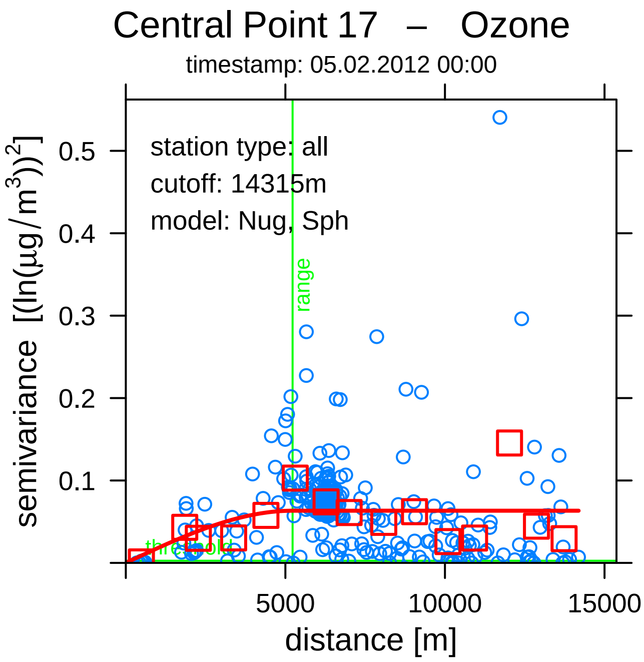

Central Point 7 – Ozone
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

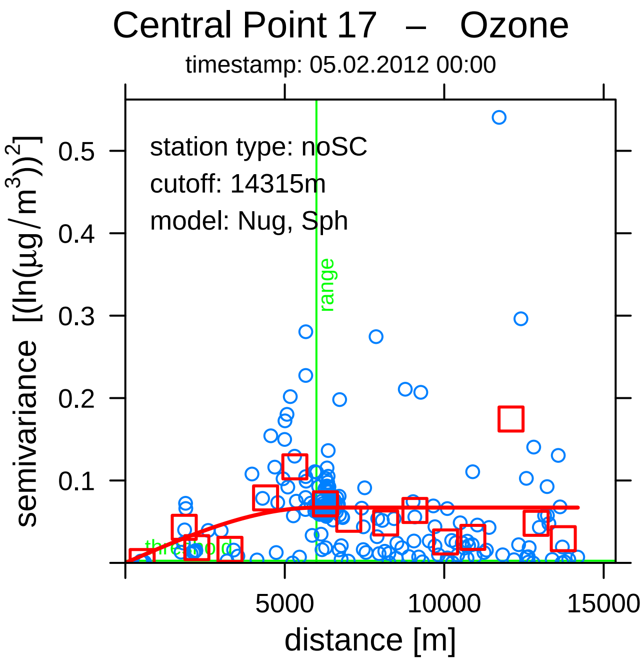

Central Point 17 – Ozone
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

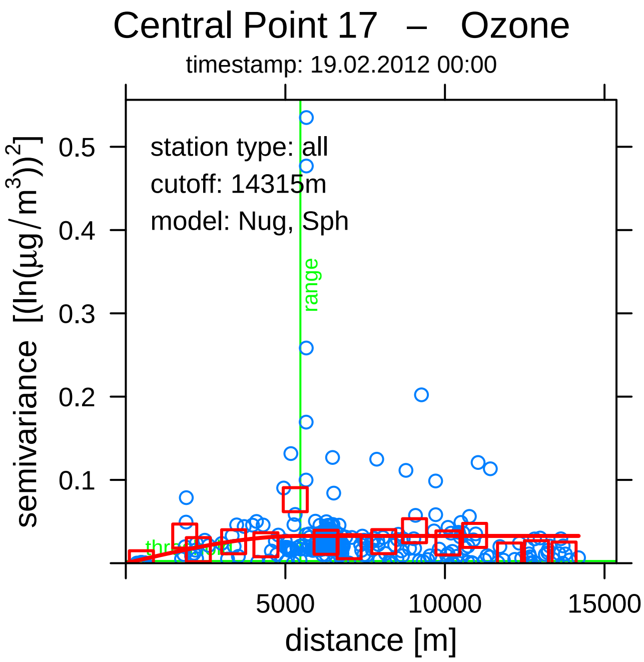

Central Point 17 – Ozone
timestamp: 08.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

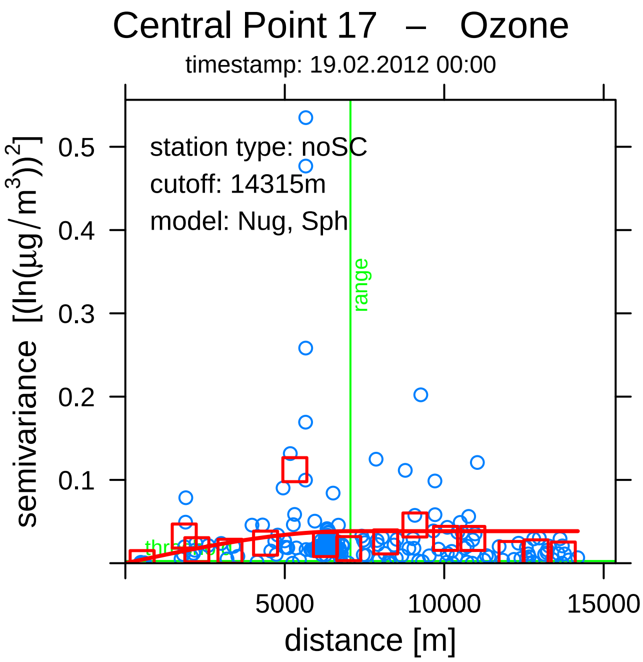

Central Point 17 – Ozone
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

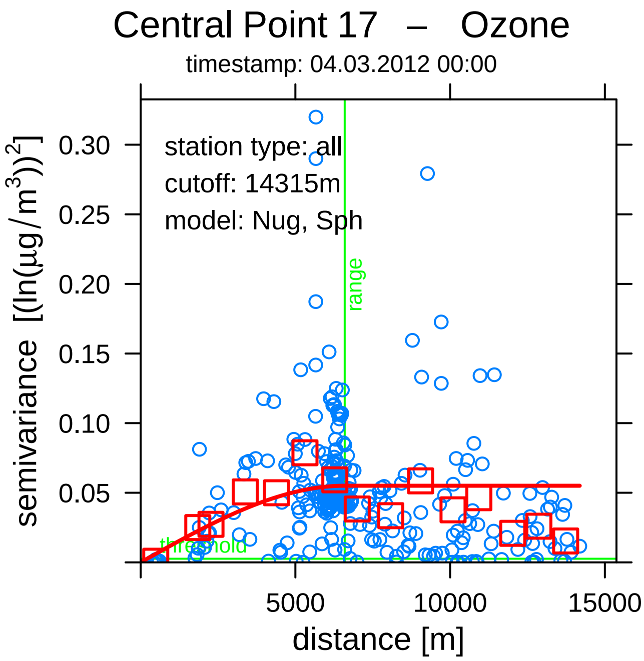

Central Point 17 – Ozone
timestamp: 22.01.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000

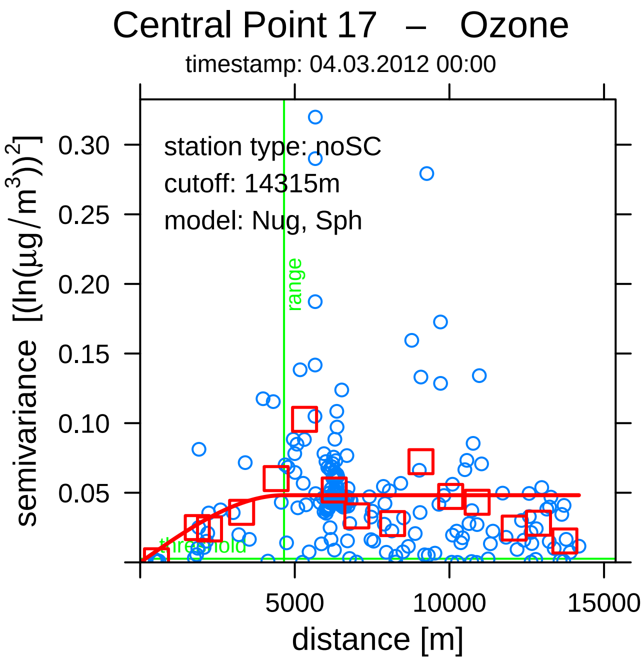

Central Point 17 – Ozone
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.5
0.4
0.3
0.2
0.1
5000
10000
15000

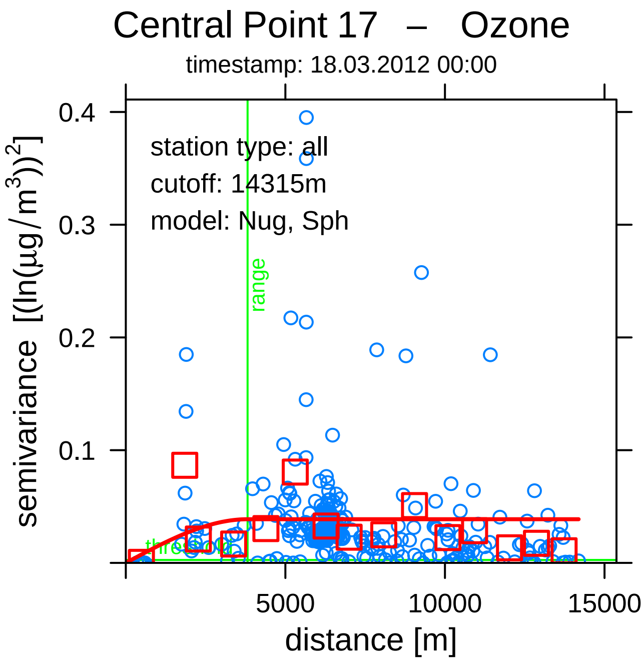

Central Point 17 – Ozone
timestamp: 05.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
distance [m]
0.5
0.4
0.3
0.2
0.1
5000
10000
15000

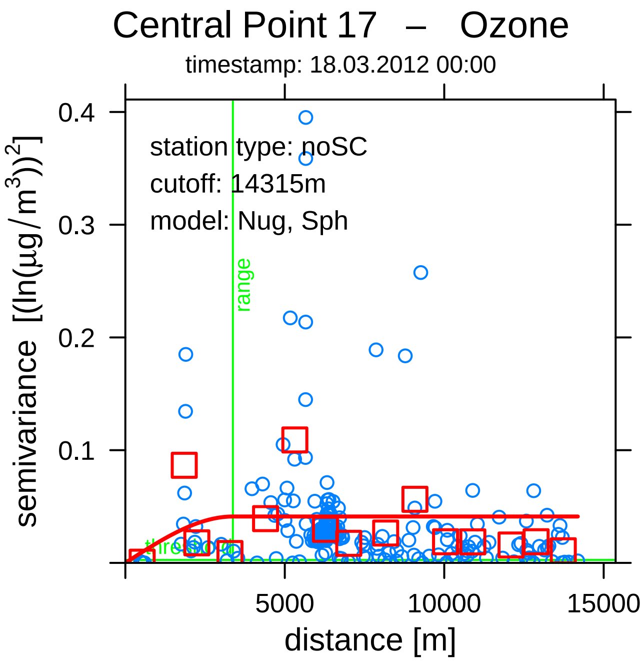

Central Point 17 – Ozone
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000

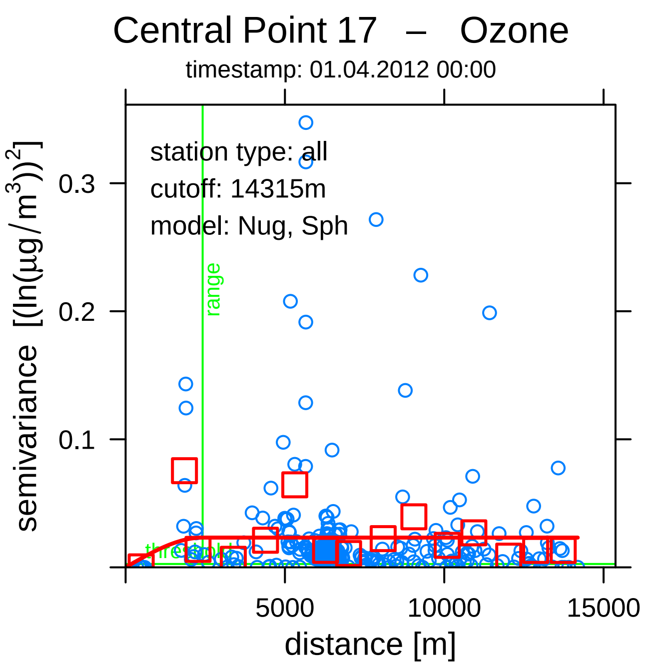

Central Point 17 – Ozone
timestamp: 19.02.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
0.5
5000
10000
15000

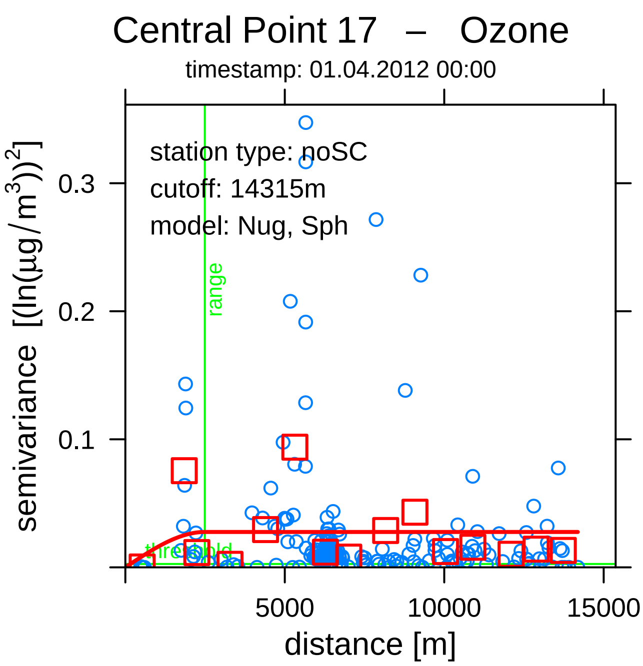

Central Point 17 – Ozone
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000

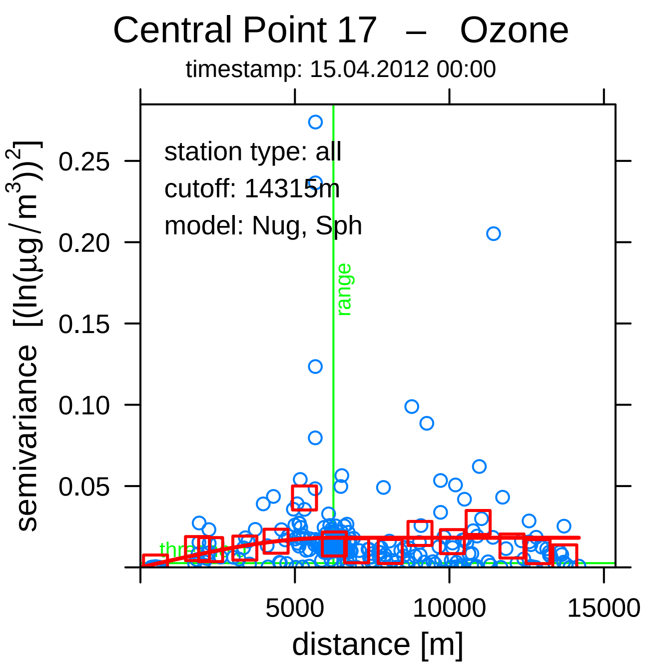

Central Point 17 – Ozone
timestamp: 04.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000

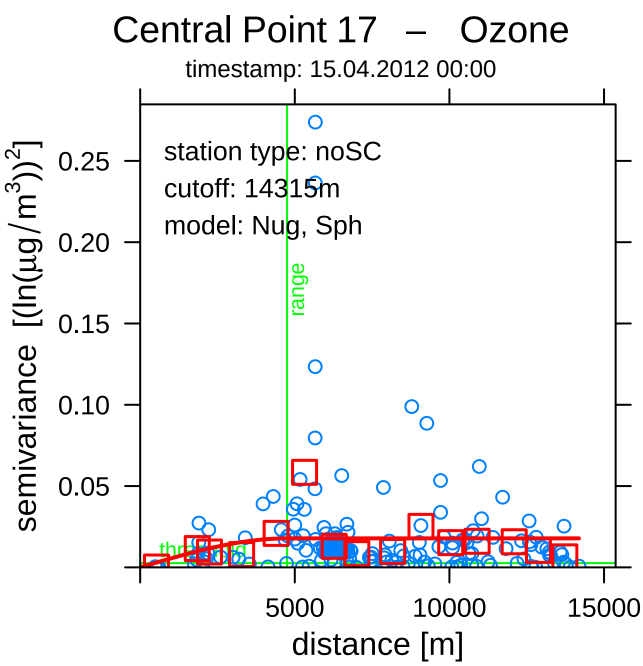

Central Point 17 – Ozone
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
5000
10000
15000

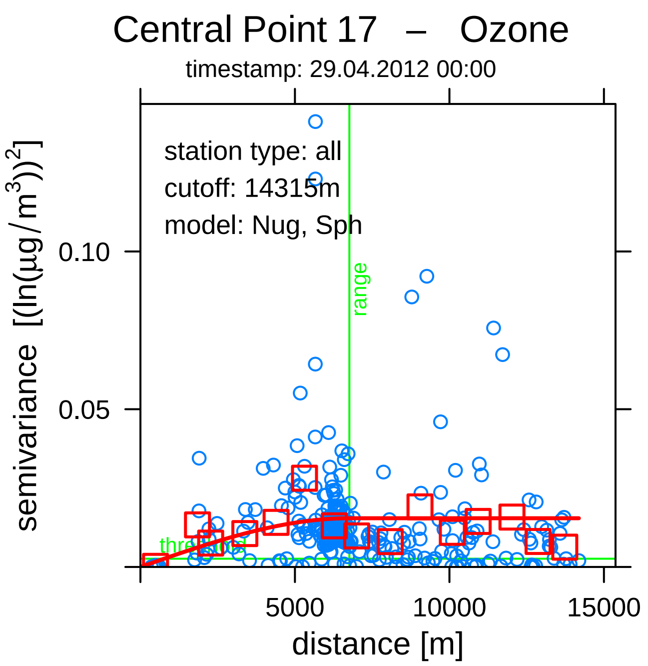

Central Point 17 – Ozone
timestamp: 18.03.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
5000
10000
15000

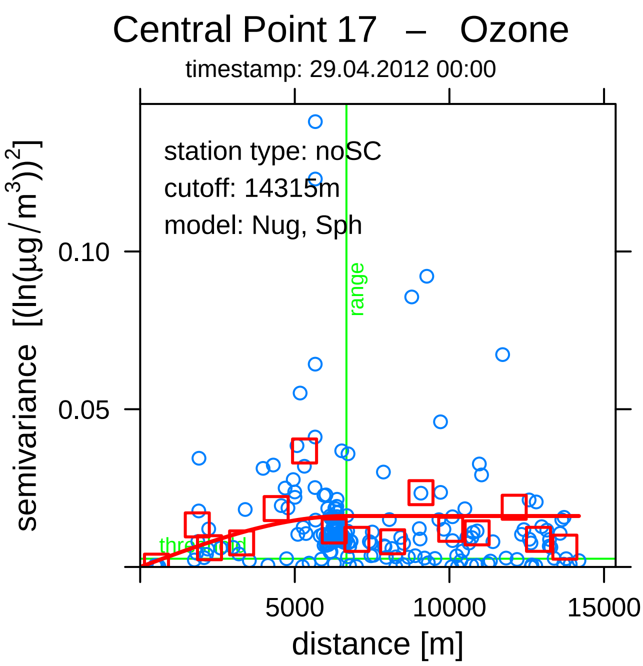

Central Point 17 – Ozone
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
5000
10000
15000
distance [m]

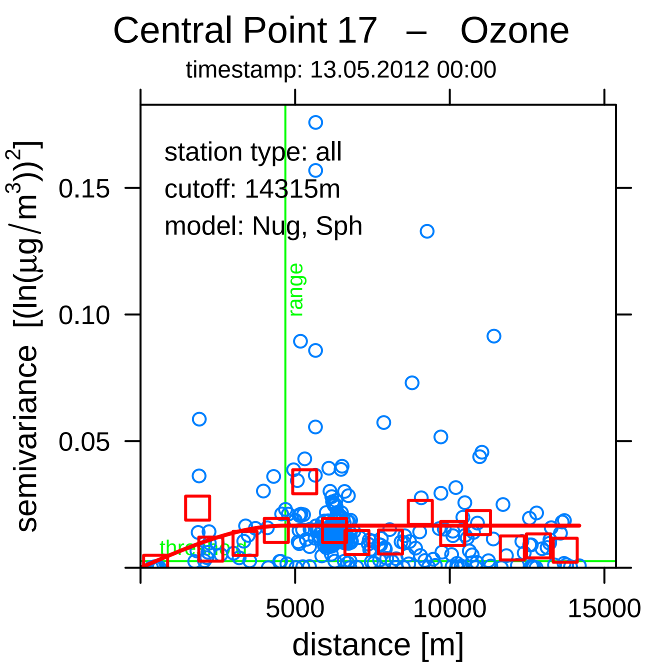

Central Point 17 – Ozone
timestamp: 01.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
5000
10000
15000
distance [m]

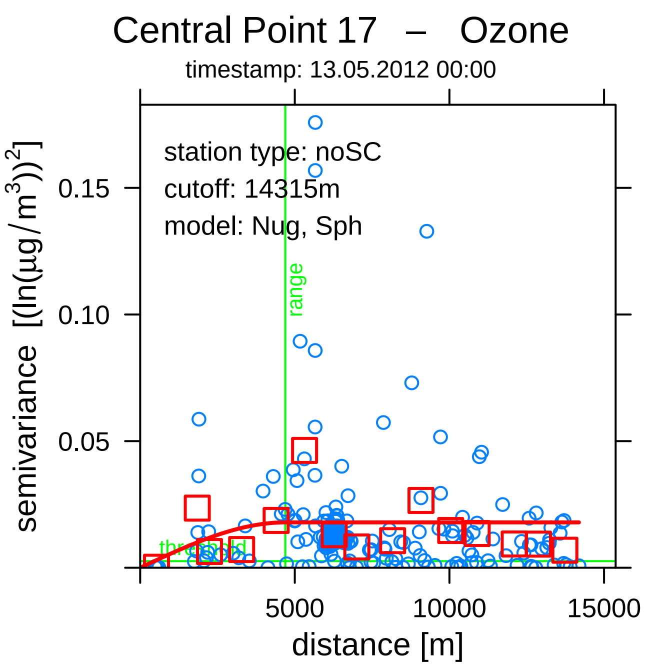

Central Point 17 – Ozone
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000
distance [m]

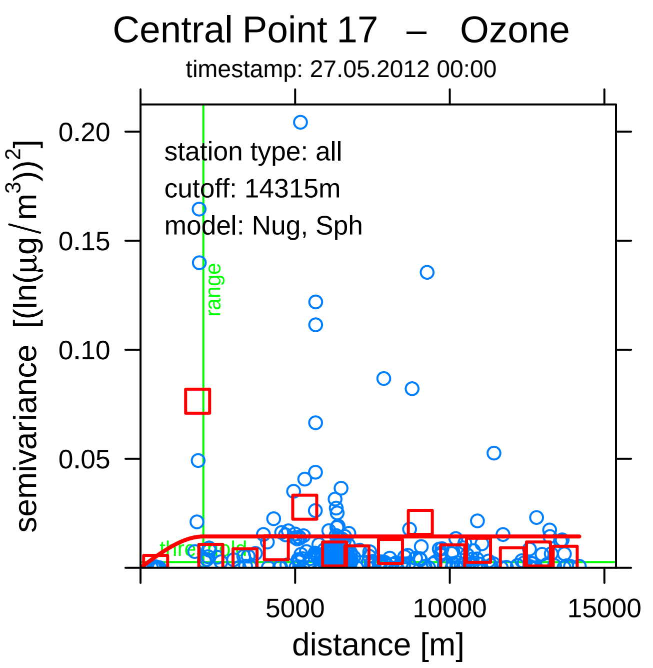

Central Point 17 – Ozone
timestamp: 15.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000
distance [m]

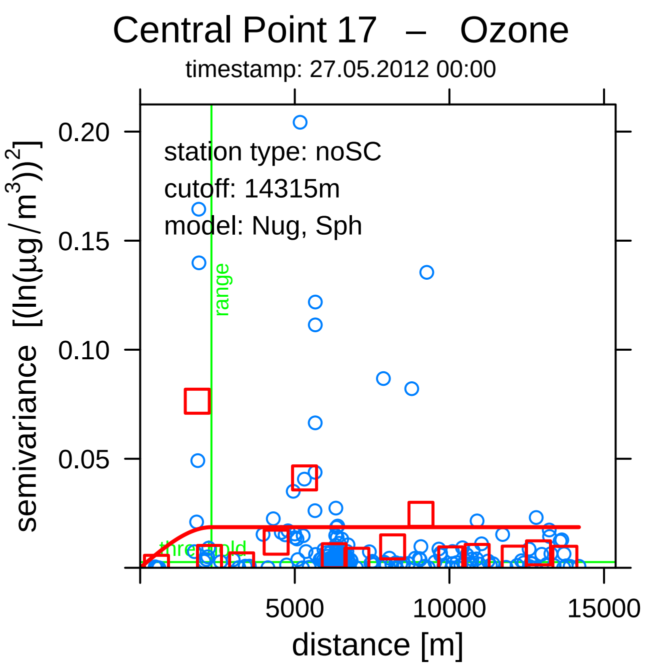

Central Point 17 – Ozone
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
5000
10000
15000
distance [m]

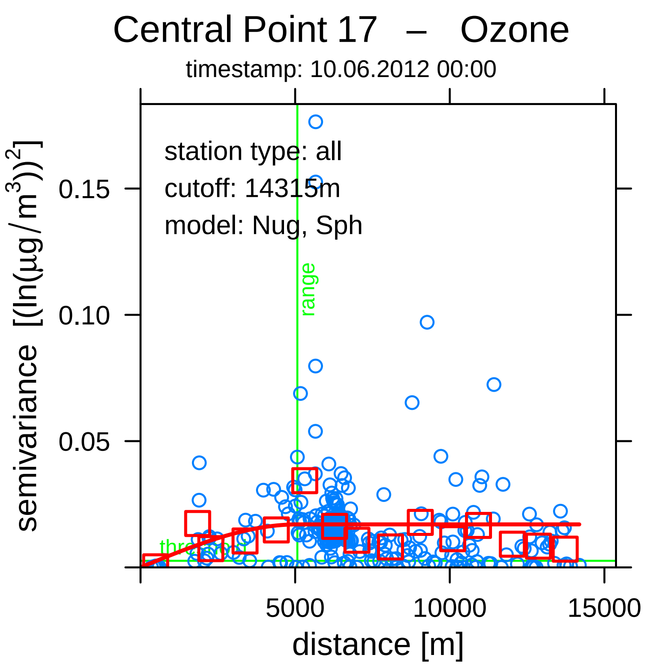

Central Point 17 – Ozone
timestamp: 29.04.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
5000
10000
15000
distance [m]

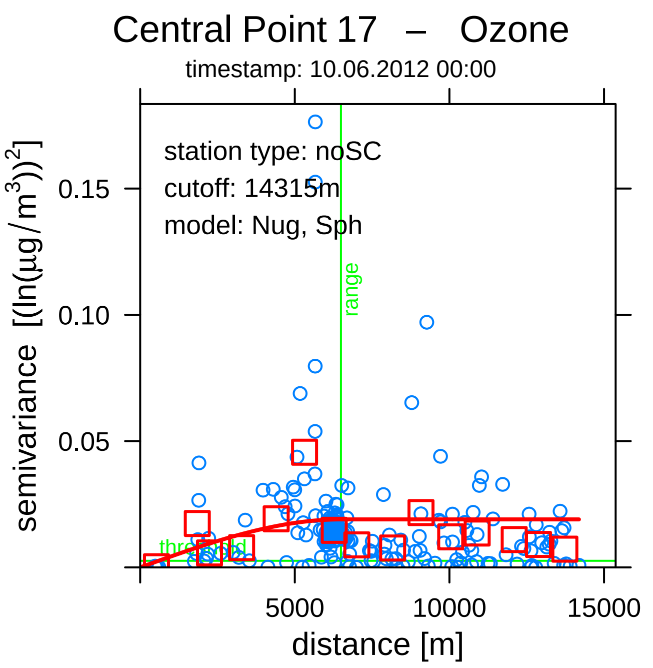

Central Point 17 – Ozone
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

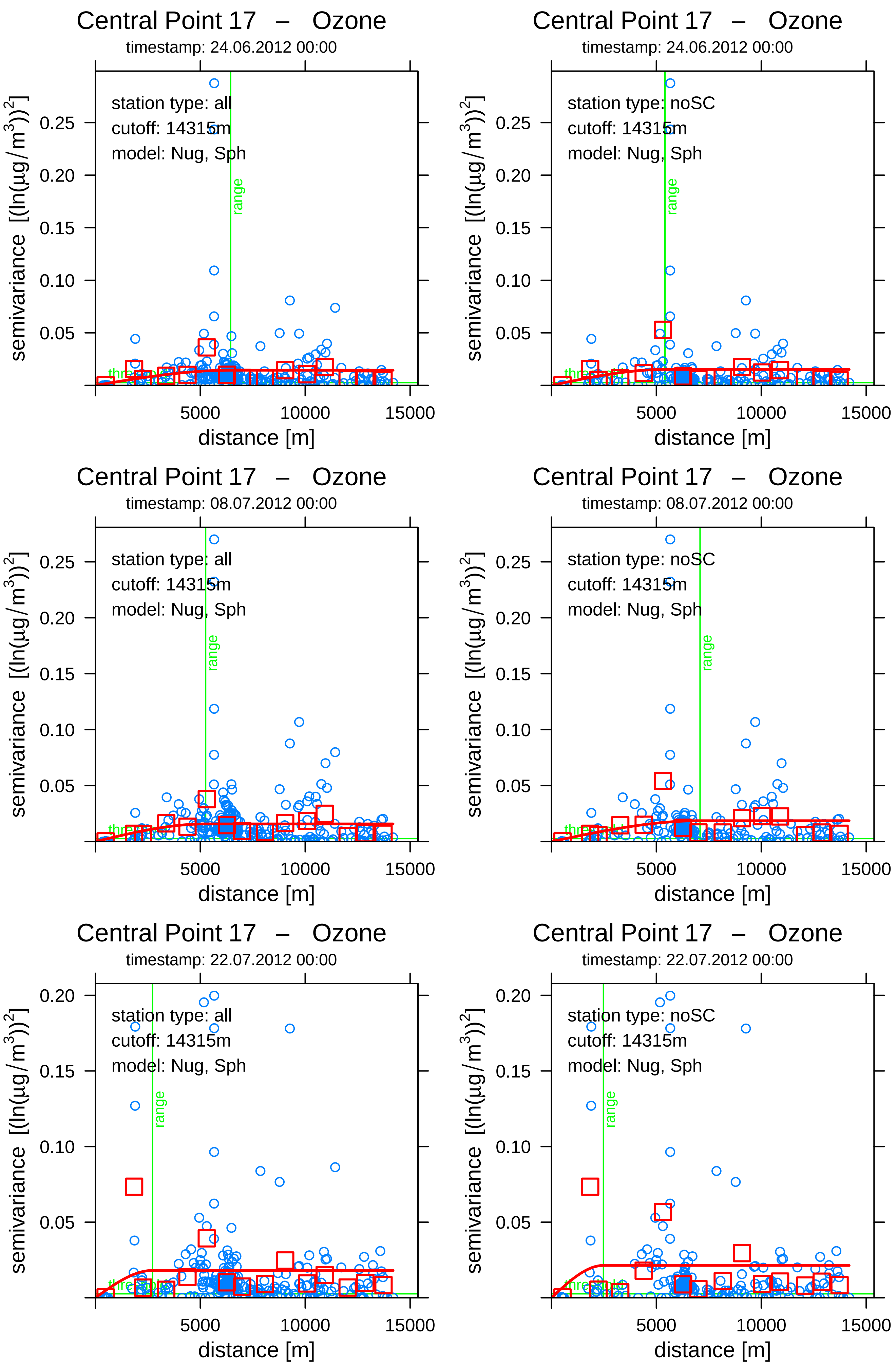

Central Point 17 – Ozone
timestamp: 13.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

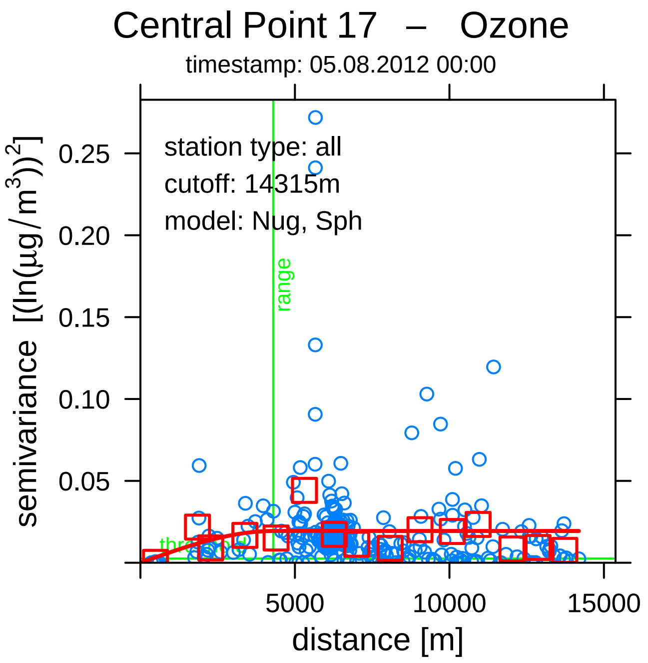

Central Point 17 – Ozone
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
5000
10000
15000

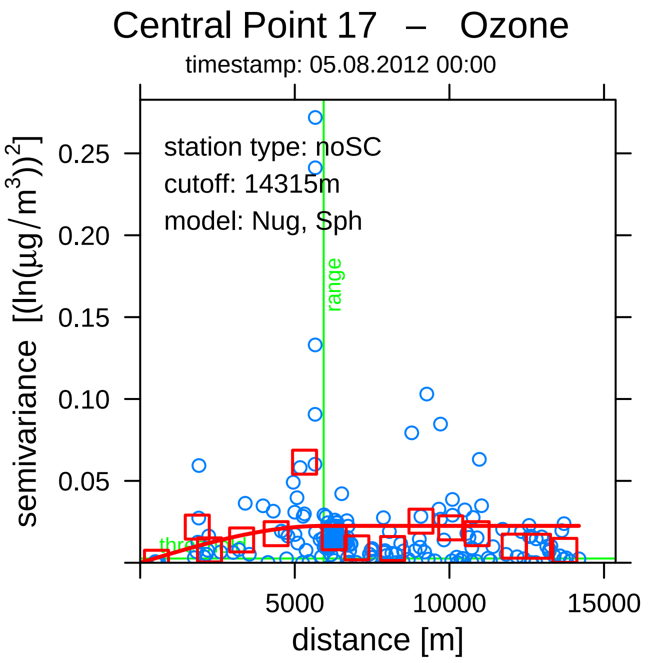

Central Point 17 – Ozone
timestamp: 27.05.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
5000
10000
15000

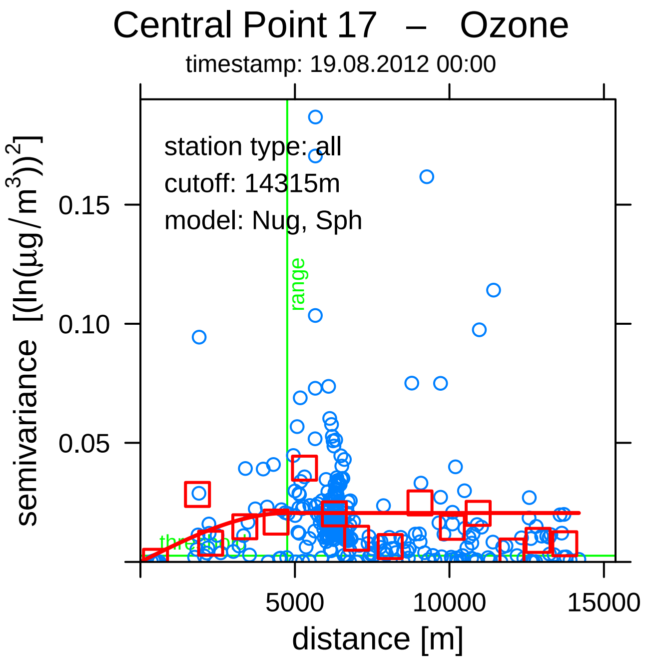

Central Point 17 – Ozone
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

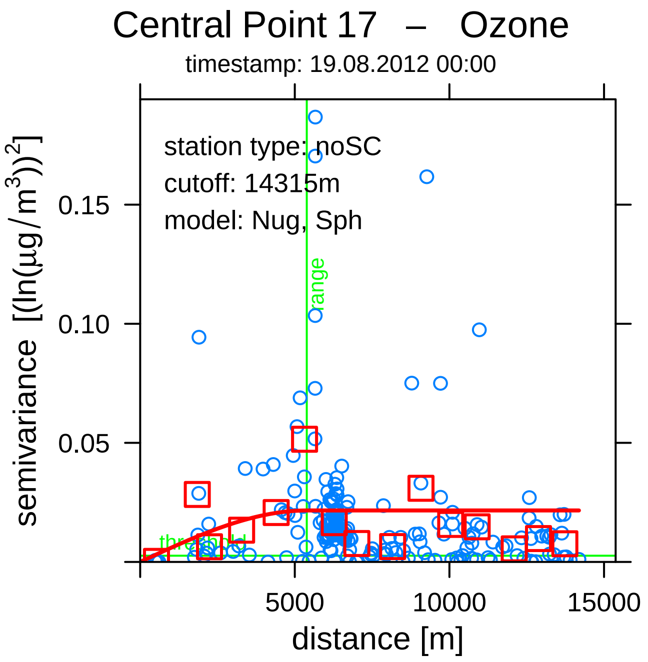

Central Point 17 – Ozone
timestamp: 10.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

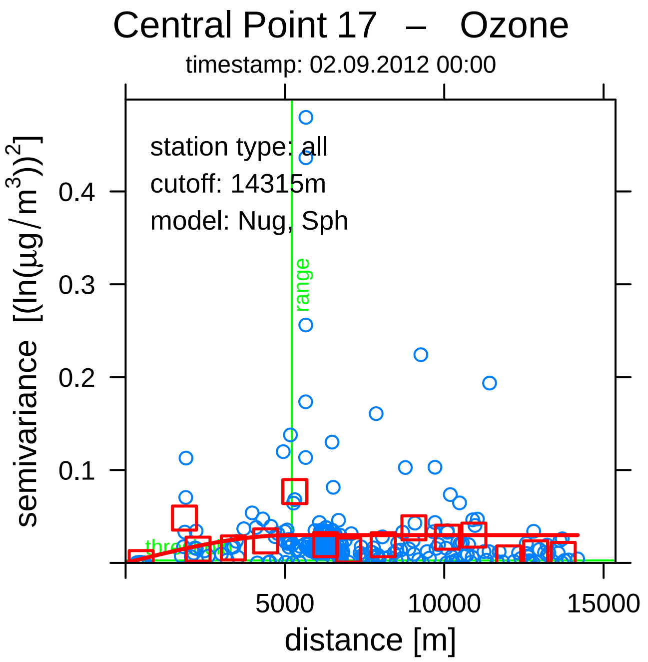

Central Point 17 – Ozone
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 17 – Ozone
timestamp: 24.06.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
Central Point 17 – Ozone
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 17 – Ozone
timestamp: 08.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
Central Point 17 – Ozone
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
Central Point 17 – Ozone
timestamp: 22.07.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000

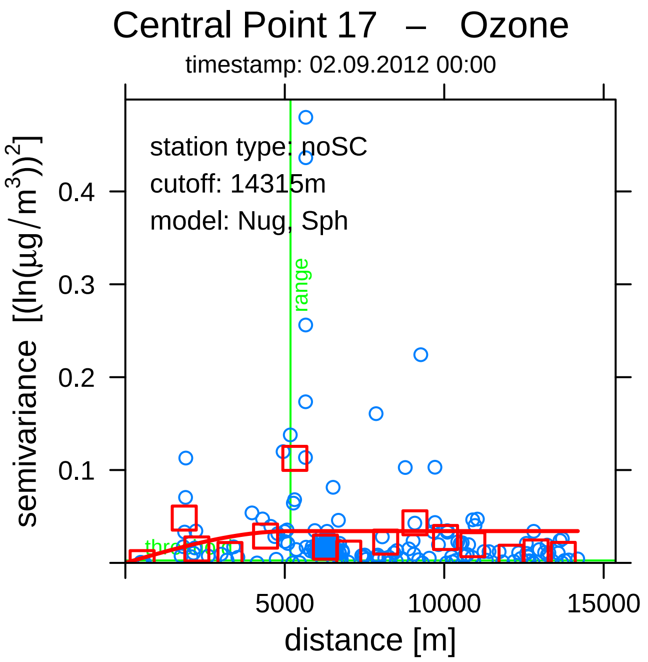

Central Point 17 – Ozone
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000

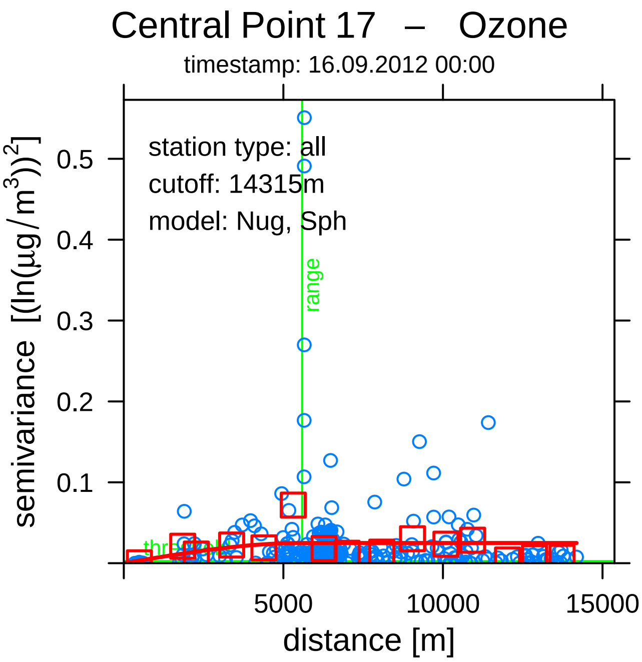

Central Point 17 – Ozone
timestamp: 05.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
0.20
0.25
5000
10000
15000

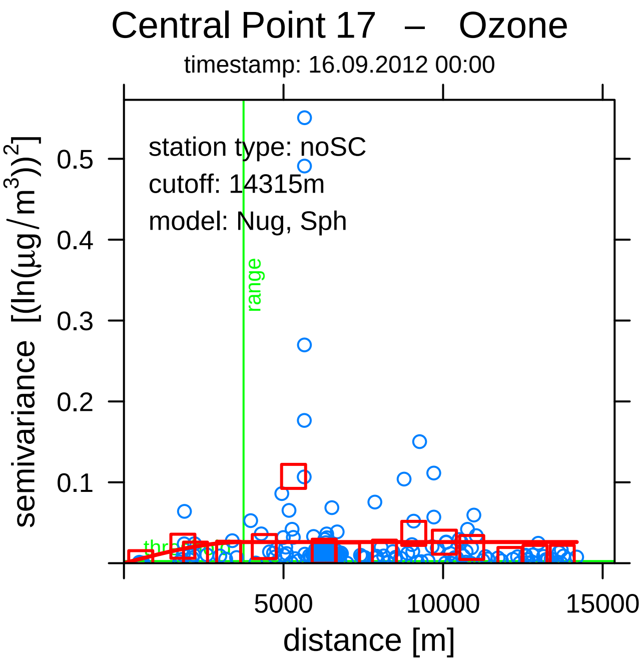

Central Point 17 – Ozone
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

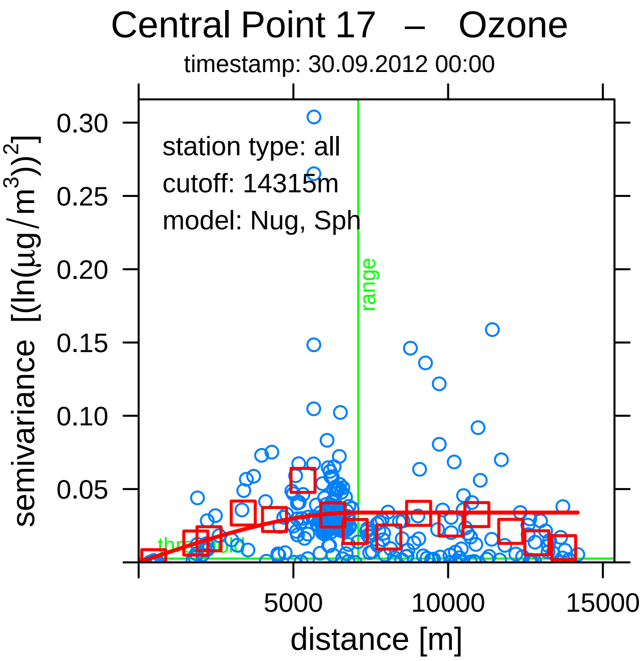

Central Point 17 – Ozone
timestamp: 19.08.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

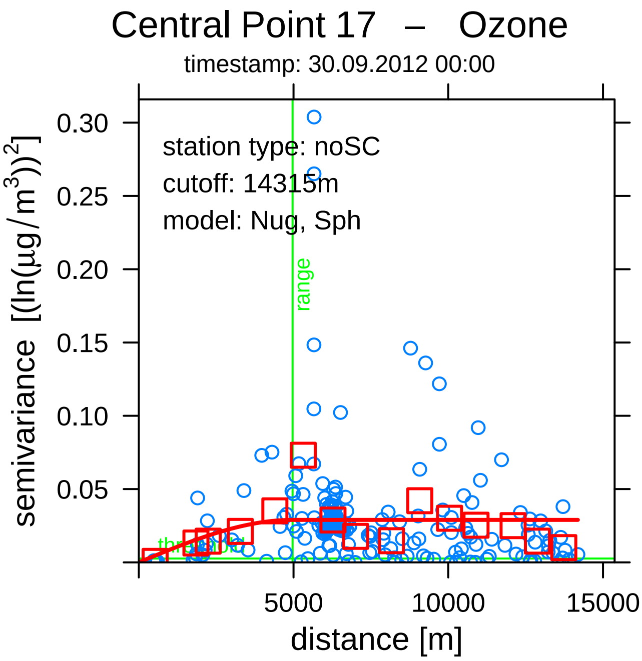

Central Point 17 – Ozone
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
5000
10000
15000

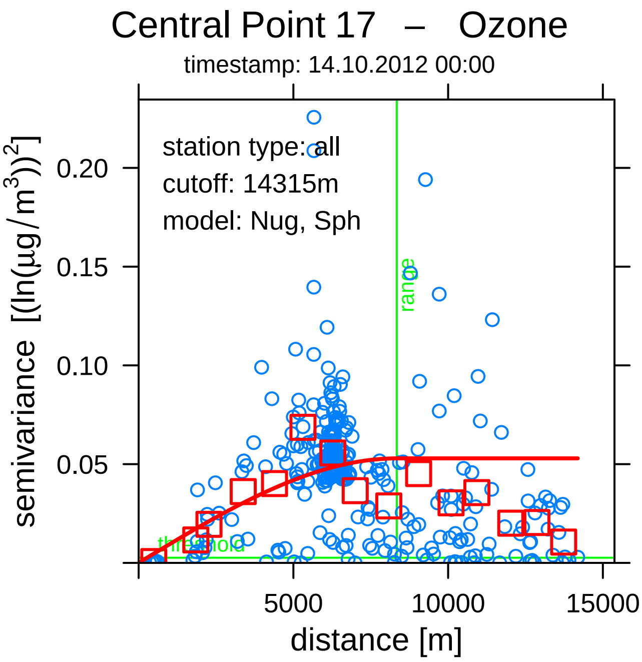

Central Point 17 – Ozone
timestamp: 02.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.1
0.2
0.3
0.4
5000
10000
15000

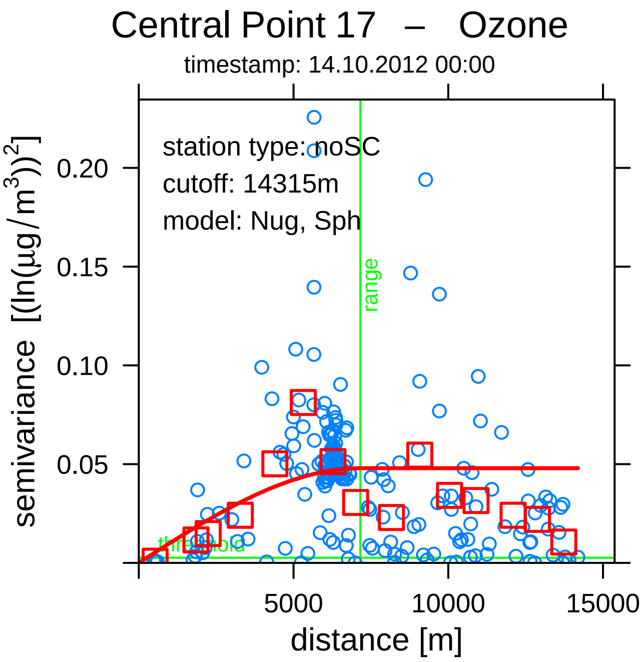

Central Point 17 – Ozone
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]

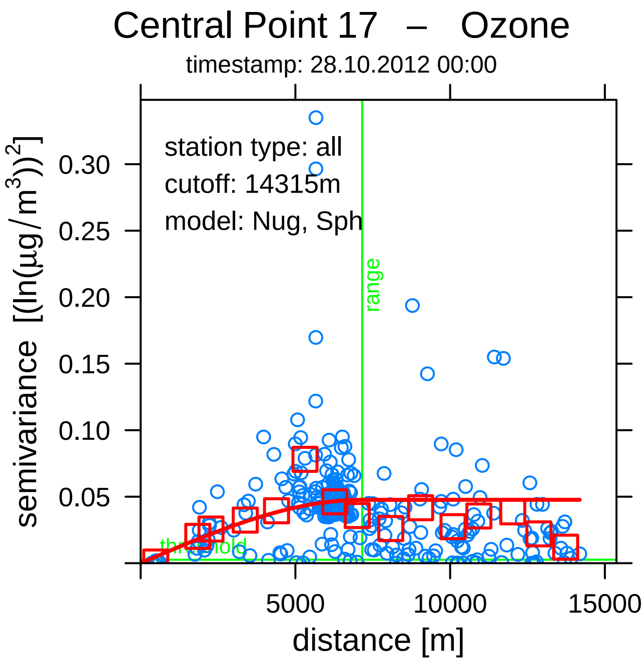

Central Point 17 – Ozone
timestamp: 16.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]


Central Point 17 – Ozone
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]

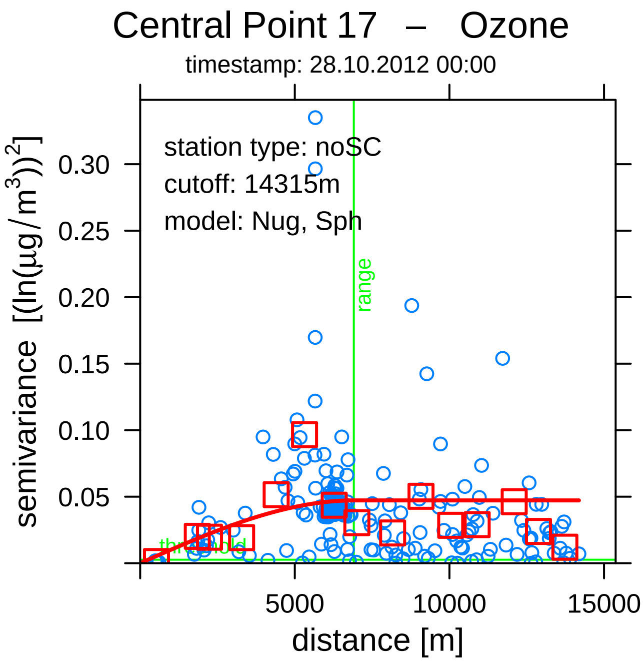

Central Point 17 – Ozone
timestamp: 30.09.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]


Central Point 17 – Ozone
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]

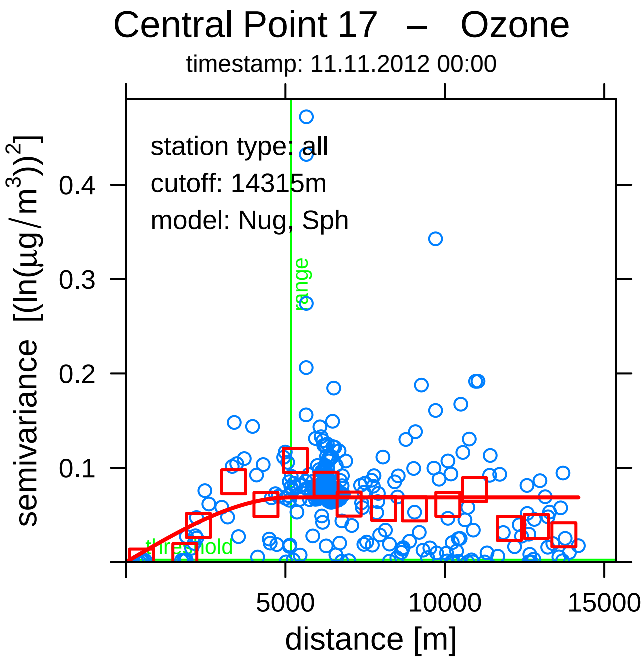

Central Point 17 – Ozone
timestamp: 14.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]



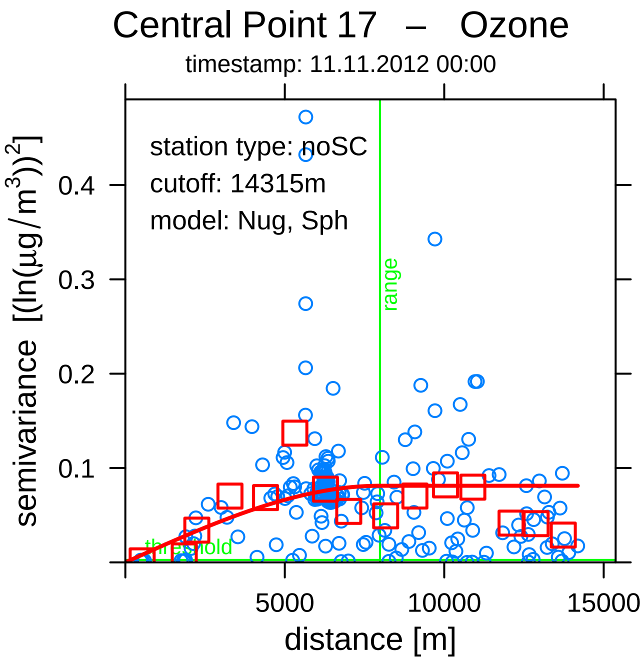
Central Point 17 – Ozone
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]



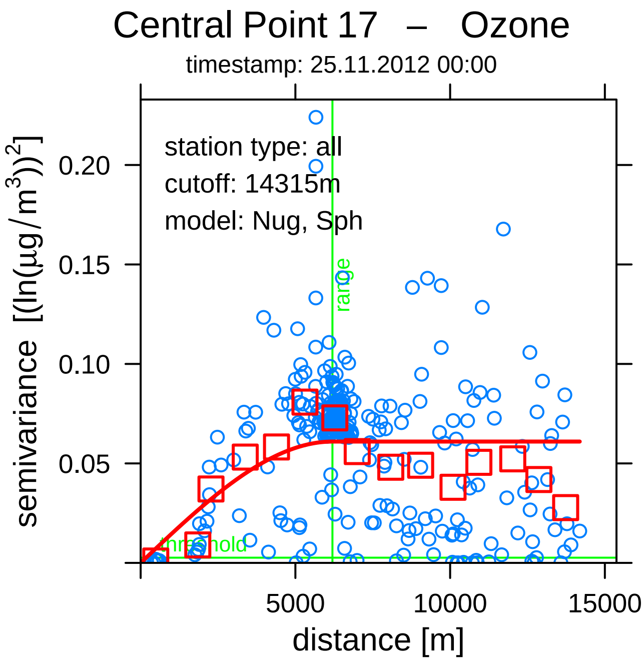
Central Point 17 – Ozone
timestamp: 28.10.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]



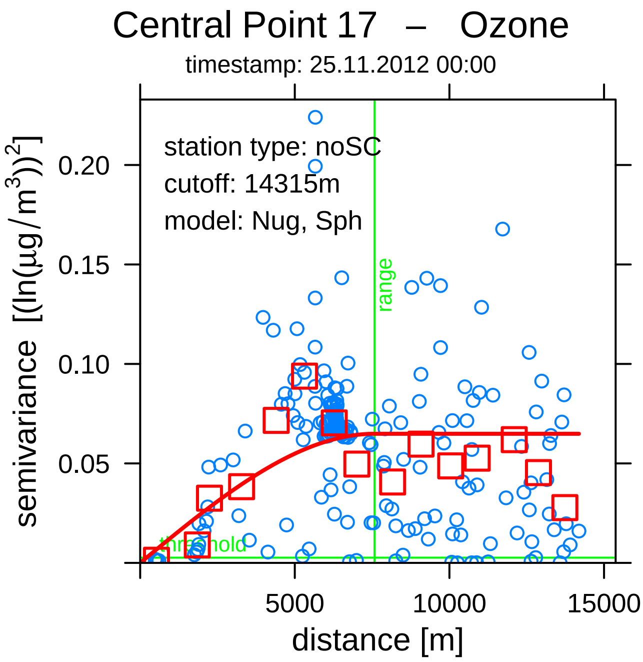
Central Point 17 – Ozone
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]



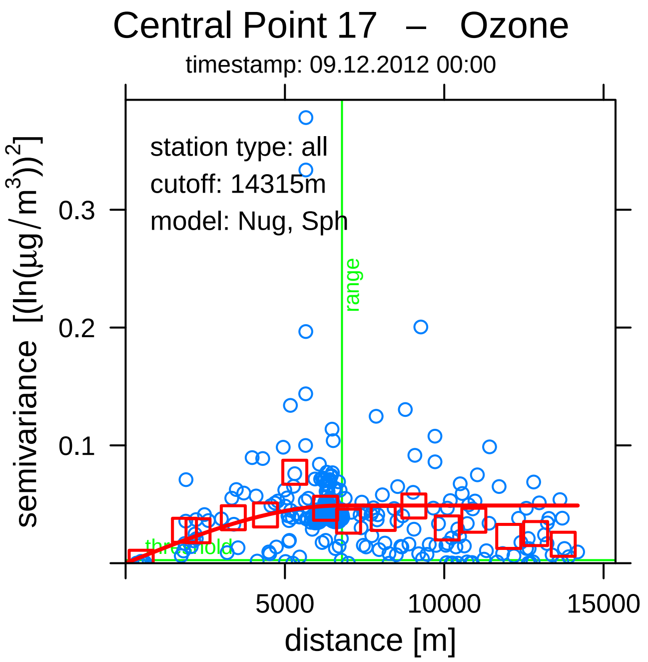
Central Point 17 – Ozone
timestamp: 11.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.4
0.3
0.2
0.1
5000
10000
15000
distance [m]

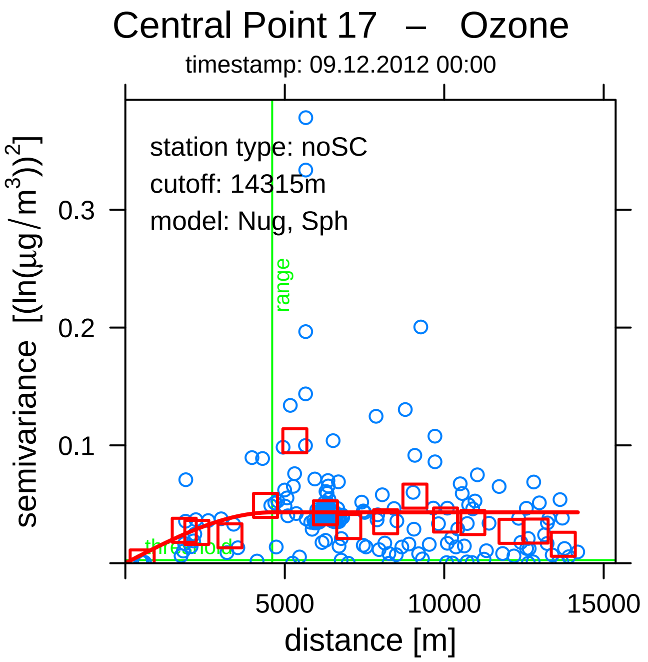


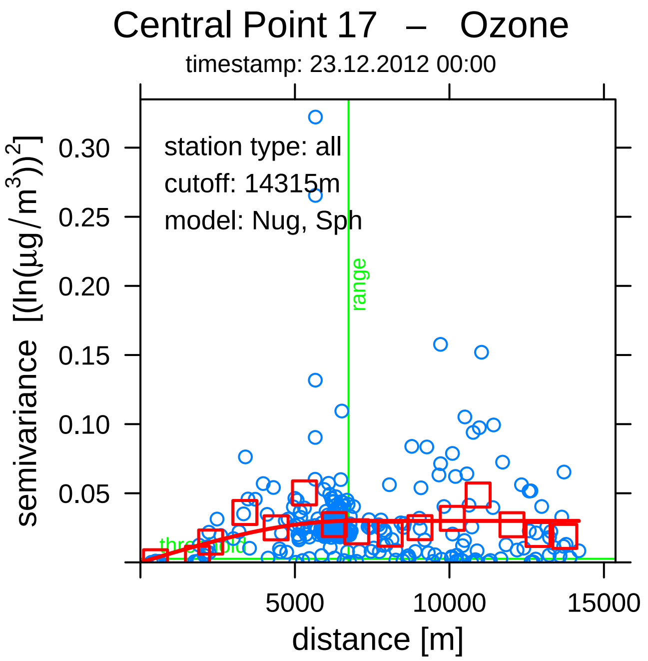
Central Point 17 – Ozone
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]

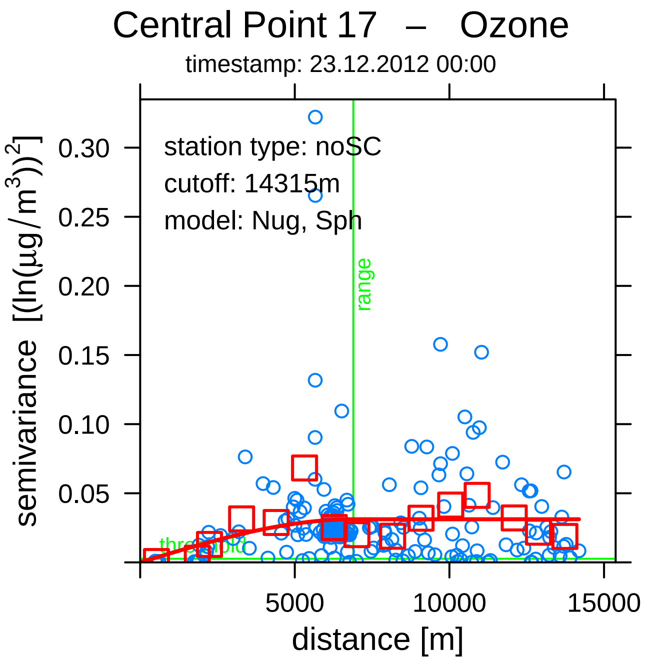


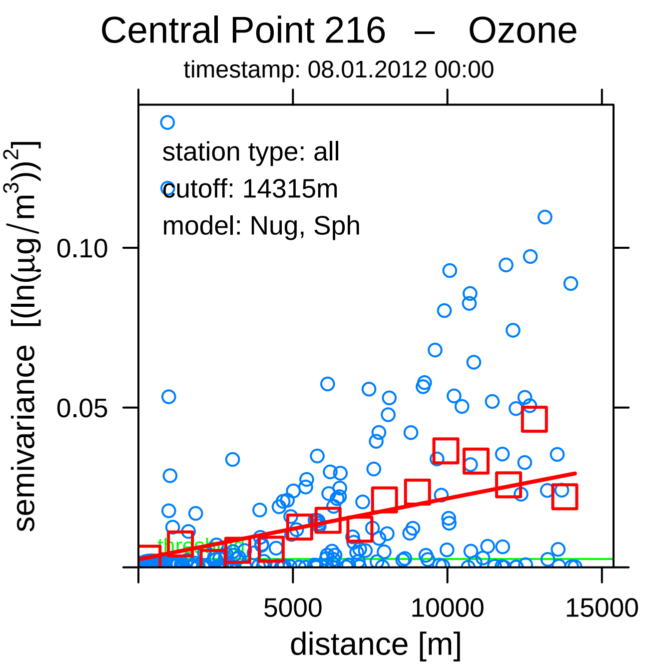
Central Point 17 – Ozone
timestamp: 25.11.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]

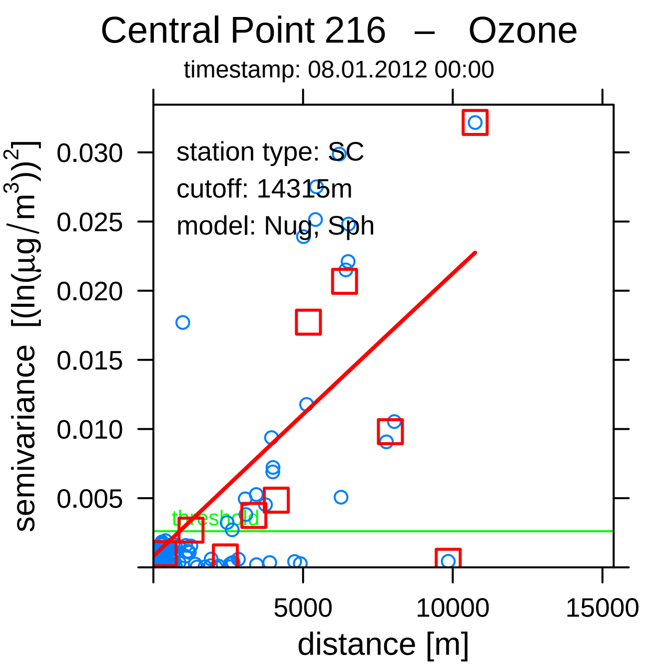

Central Point 17 – Ozone
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
5000
10000
15000
distance [m]

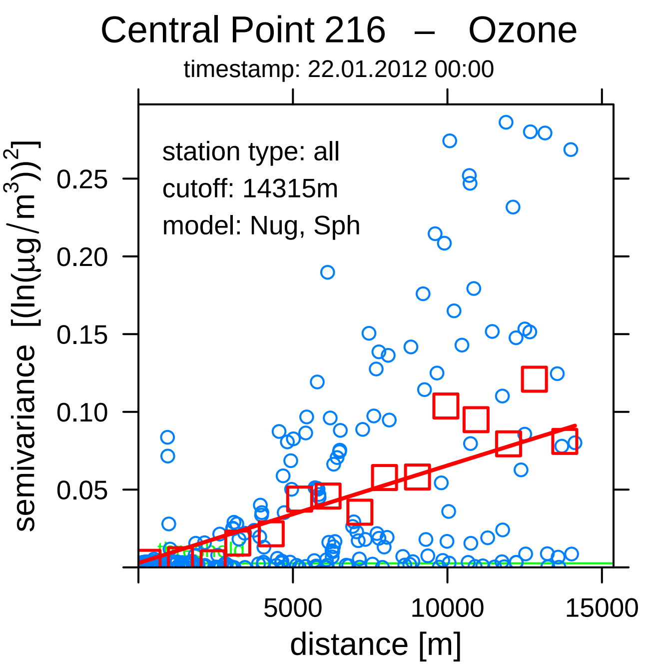

Central Point 17 – Ozone
timestamp: 09.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.1
0.2
0.3
5000
10000
15000
distance [m]

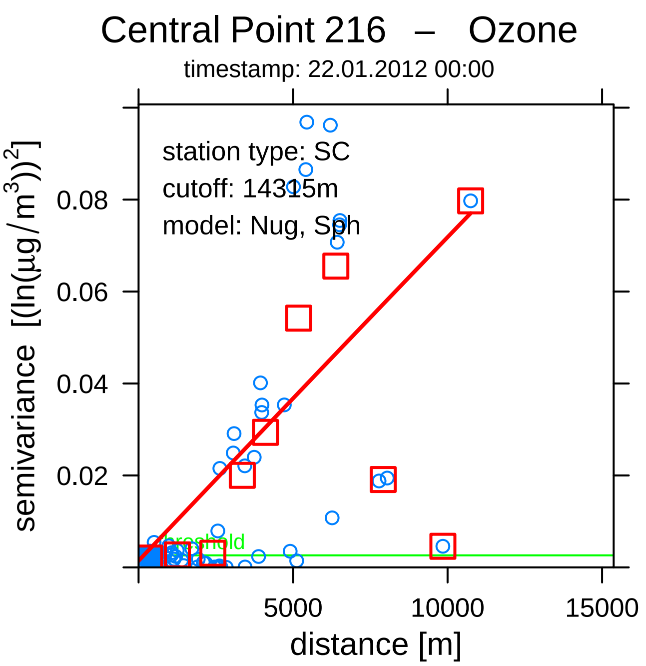

Central Point 17 – Ozone
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000
distance [m]

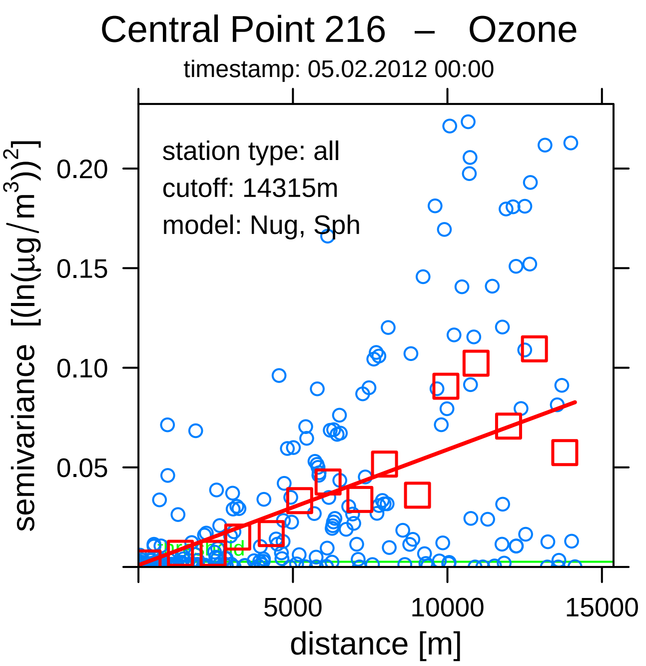

Central Point 17 – Ozone
timestamp: 23.12.2012 00:00
station type: noSC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000
distance [m]

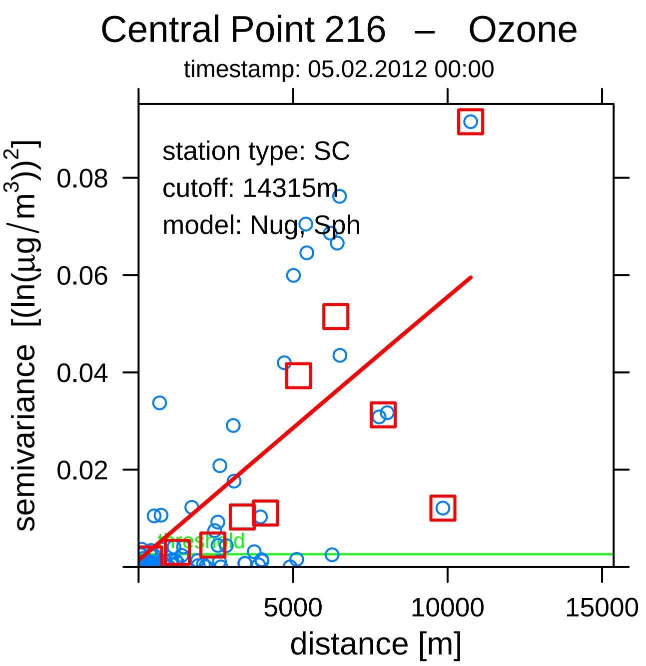

Central Point 216 – Ozone
timestamp: 08.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
distance [m]
5000
10000
15000

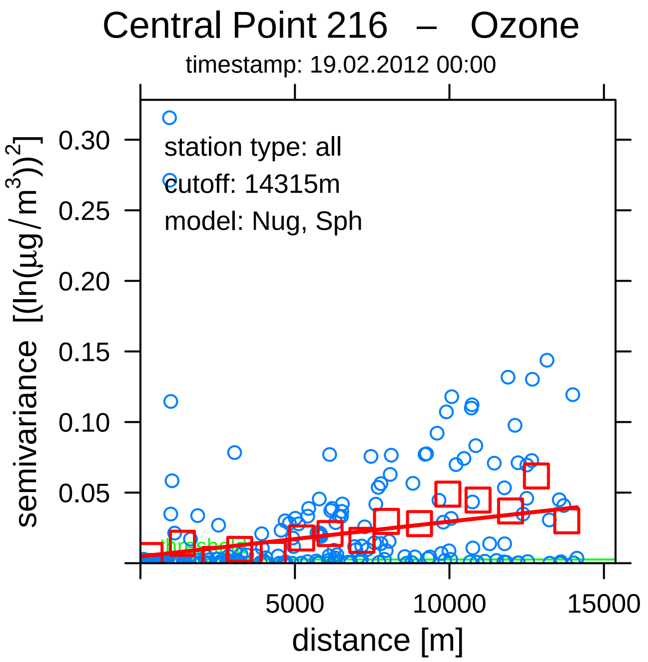

Central Point 216 – Ozone
timestamp: 08.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.005
0.010
0.015
0.020
0.025
0.030
distance [m]
5000
10000
15000

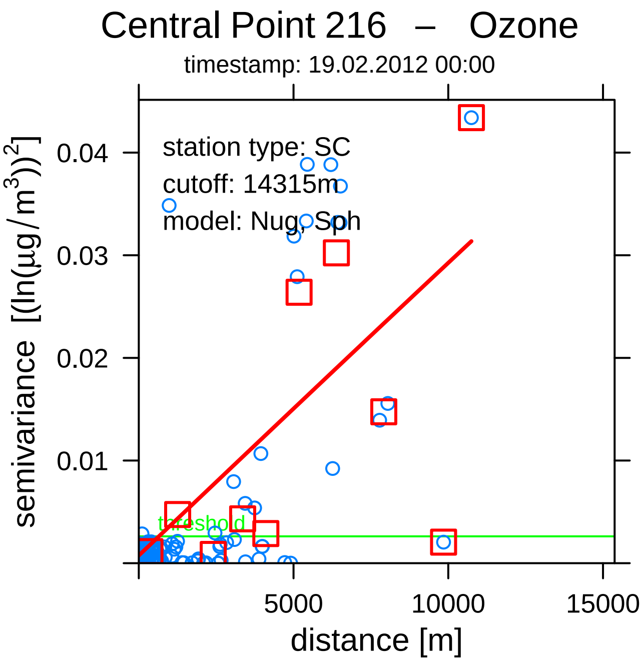

Central Point 216 – Ozone
timestamp: 22.01.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
0.25
distance [m]
5000
10000
15000

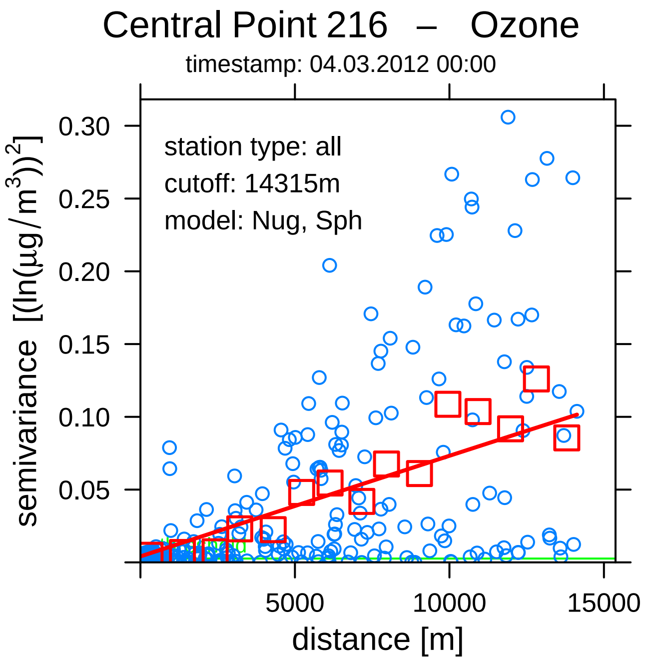

Central Point 216 – Ozone
timestamp: 22.01.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
distance [m]
5000
10000
15000

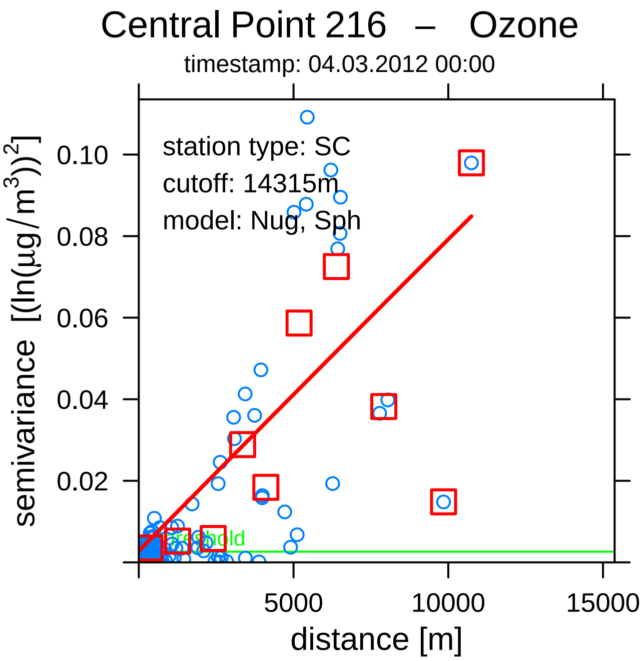

Central Point 216 – Ozone
timestamp: 05.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
distance [m]
5000
10000
15000

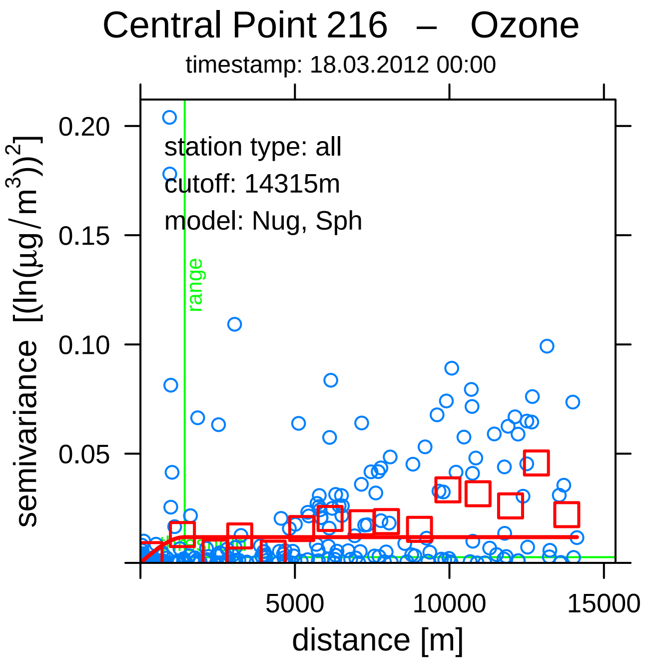

Central Point 216 – Ozone
timestamp: 05.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
distance [m]
5000
10000
15000

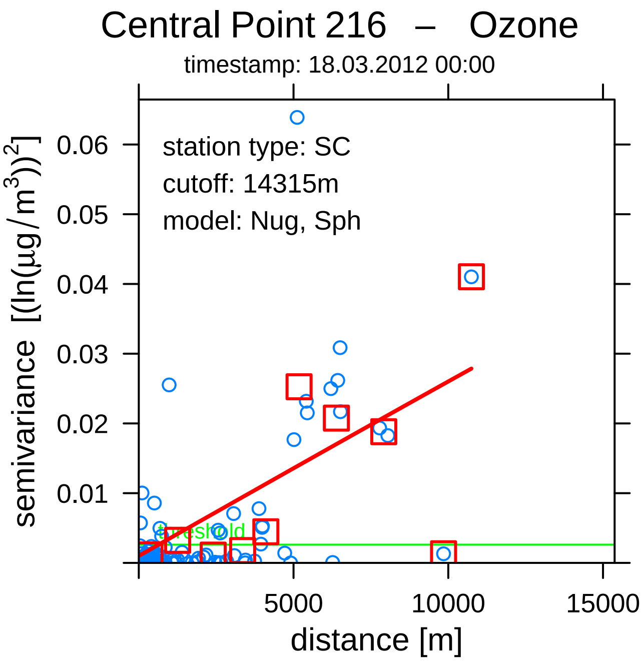

Central Point 216 – Ozone
timestamp: 19.02.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]

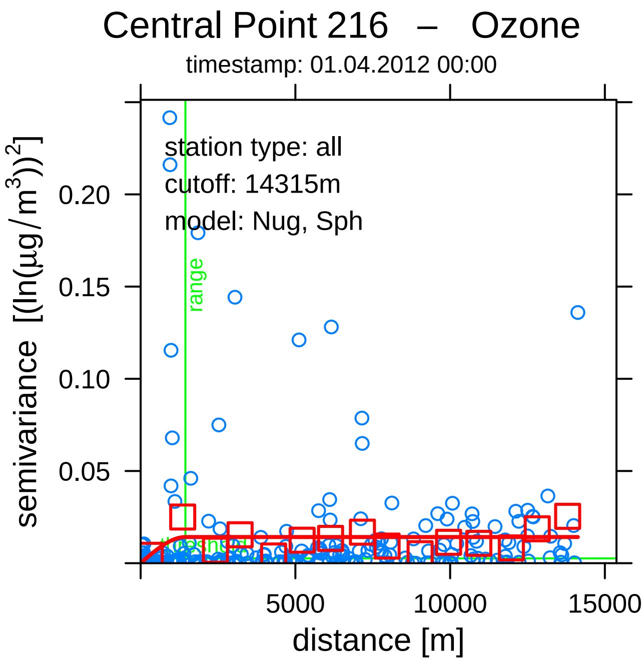

Central Point 216 – Ozone
timestamp: 19.02.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.04
0.03
0.02
0.01
5000
10000
15000
distance [m]

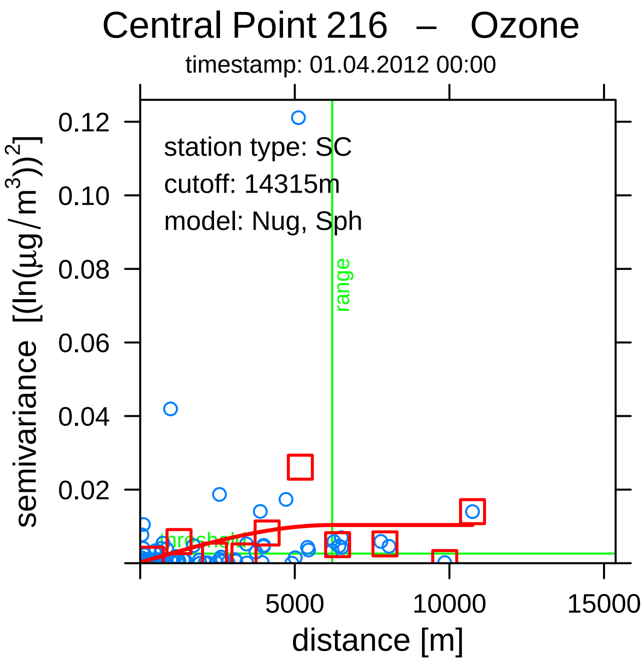

Central Point 216 – Ozone
timestamp: 04.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.30
0.25
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]

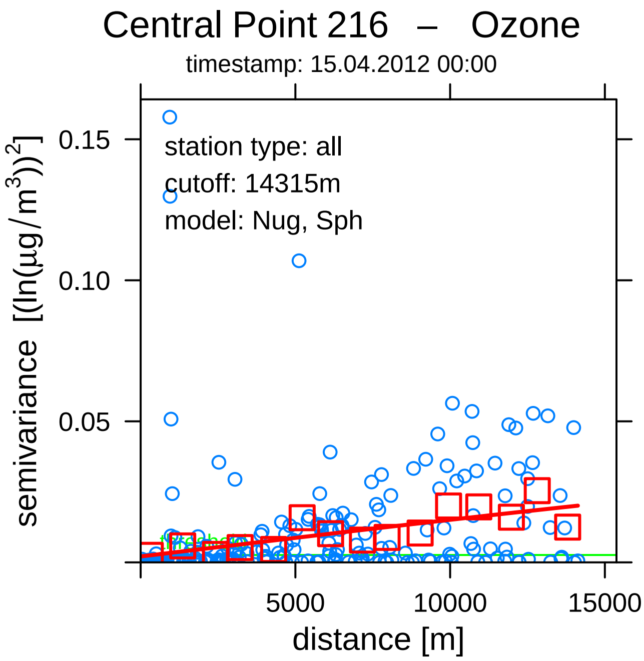

Central Point 216 – Ozone
timestamp: 04.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.10
0.08
0.06
0.04
0.02
5000
10000
15000
distance [m]

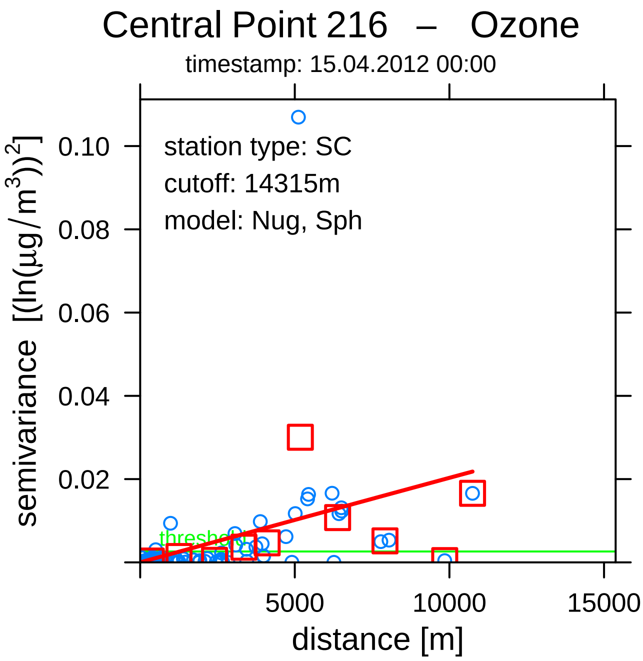

Central Point 216 – Ozone
timestamp: 18.03.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.20
0.15
0.10
0.05
5000
10000
15000
distance [m]

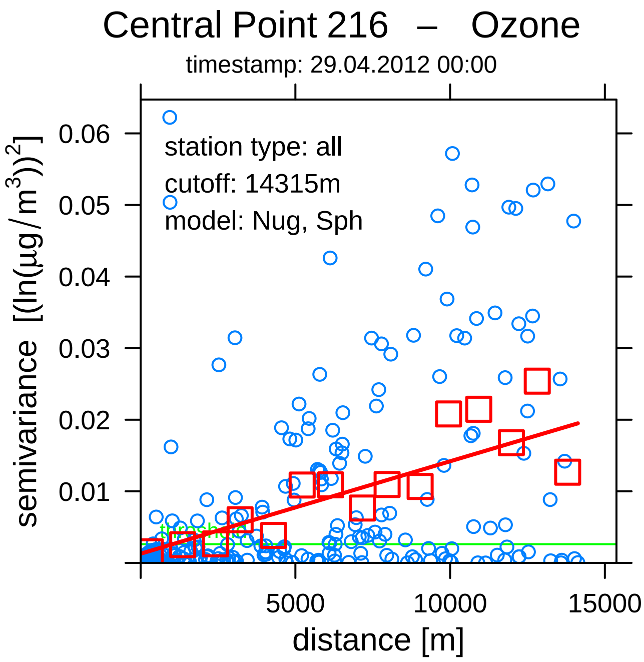

Central Point 216 – Ozone
timestamp: 18.03.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.06
0.05
0.04
0.03
0.02
0.01
5000
10000
15000
distance [m]

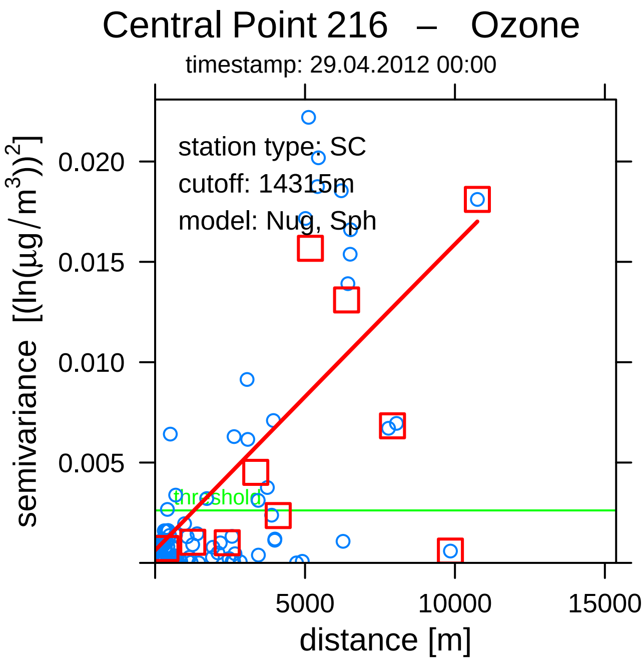

Central Point 216 – Ozone
timestamp: 01.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]

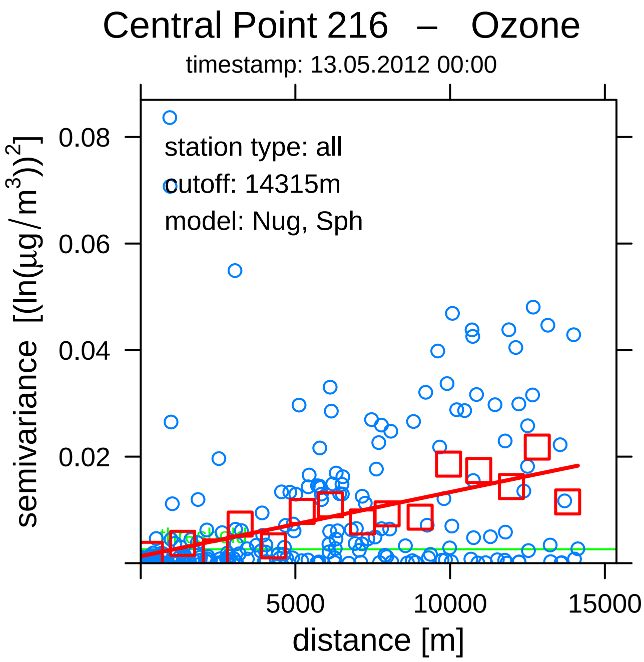

Central Point 216 – Ozone
timestamp: 01.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
0.12
5000
10000
15000
distance [m]

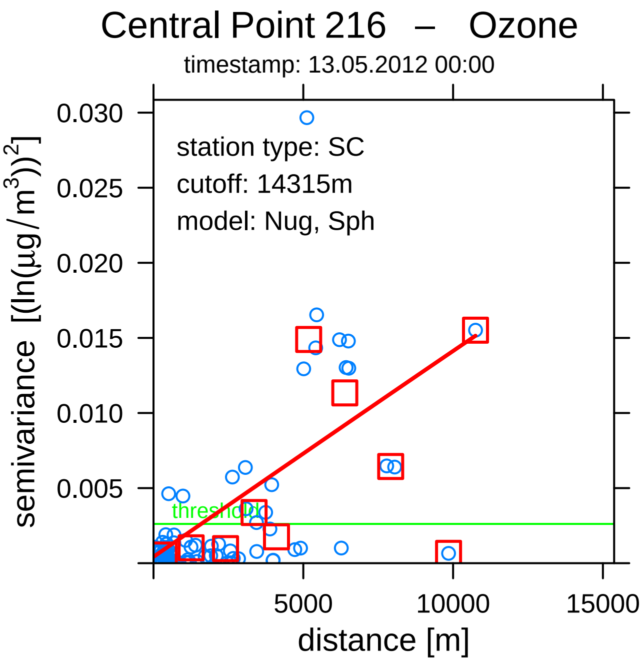

Central Point 216 – Ozone
timestamp: 15.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.05
0.10
0.15
5000
10000
15000
distance [m]

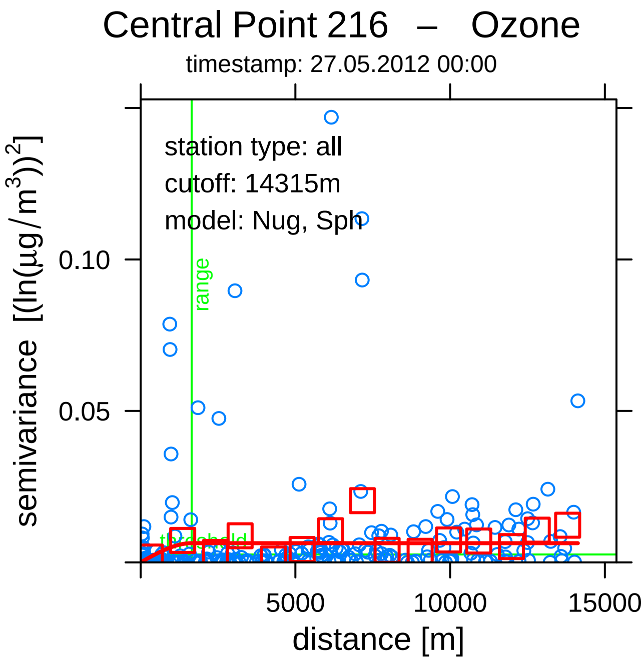

Central Point 216 – Ozone
timestamp: 15.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.02
0.04
0.06
0.08
0.10
5000
10000
15000
distance [m]

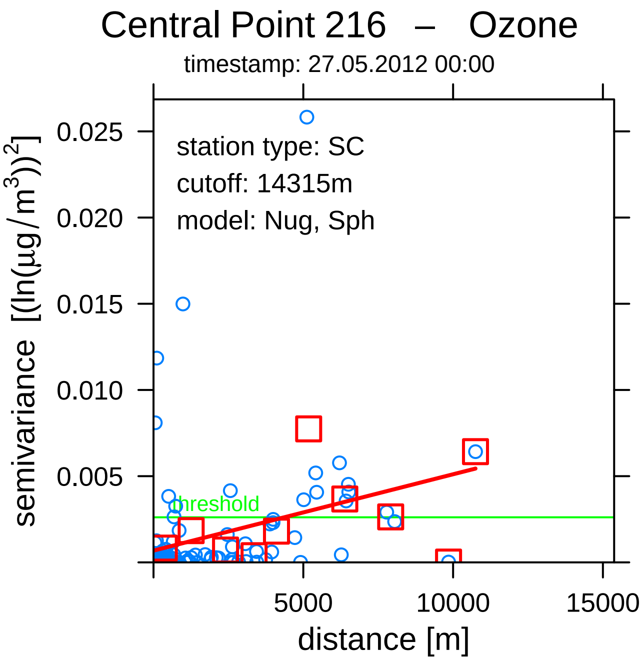

Central Point 216 – Ozone
timestamp: 29.04.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000
distance [m]

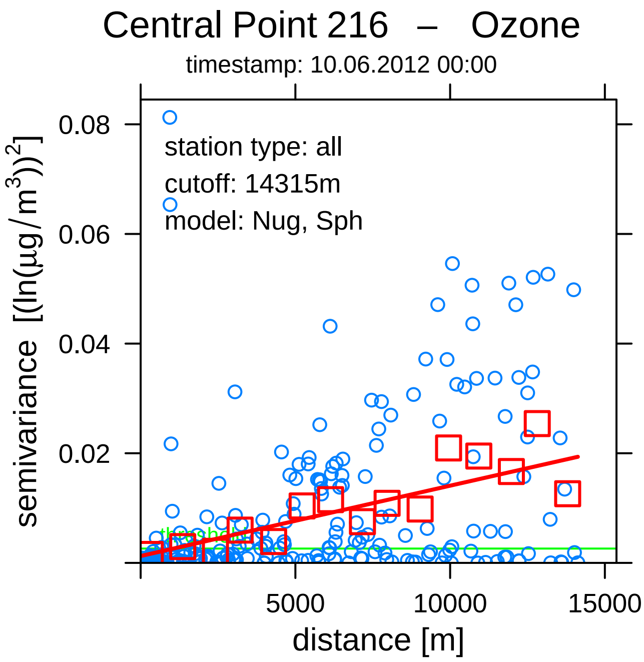

Central Point 216 – Ozone
timestamp: 29.04.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m3))2]
0.005
0.010
0.015
0.020
5000
10000
15000
distance [m]

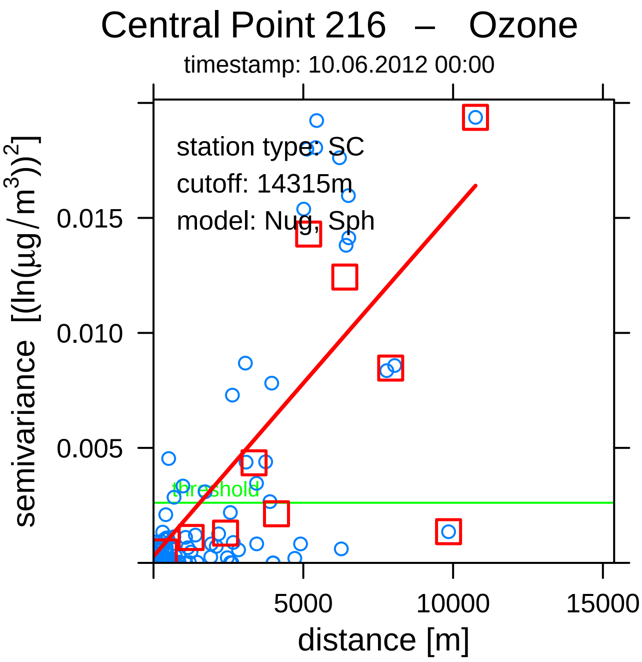

Central Point 216 – Ozone
timestamp: 13.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

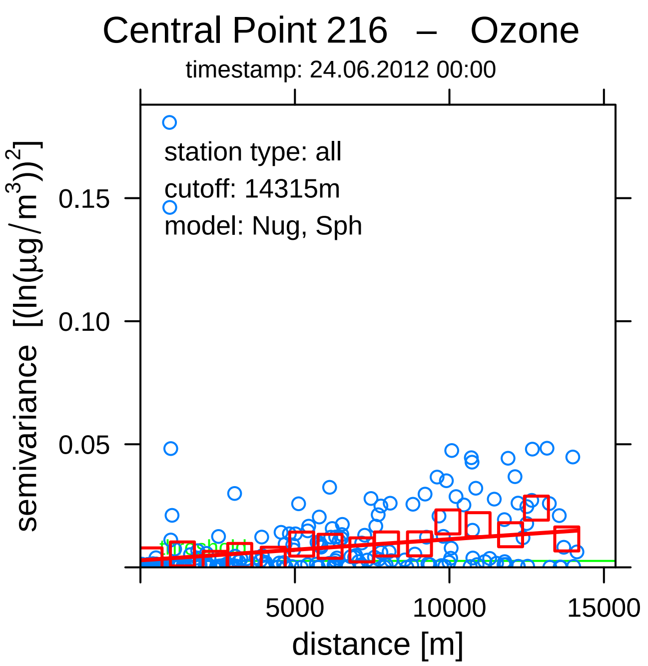

Central Point 216 – Ozone
timestamp: 13.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

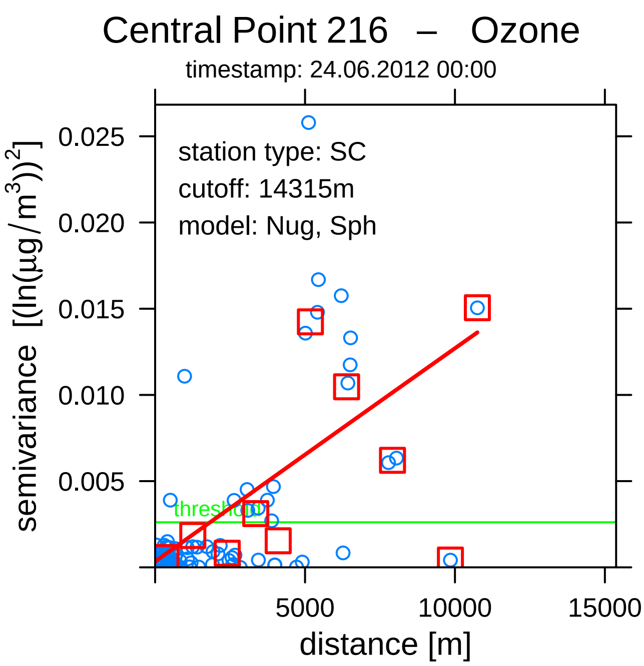

Central Point 216 – Ozone
timestamp: 27.05.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
threshold
semivariance [(ln(µg/m³))²]
distance [m]

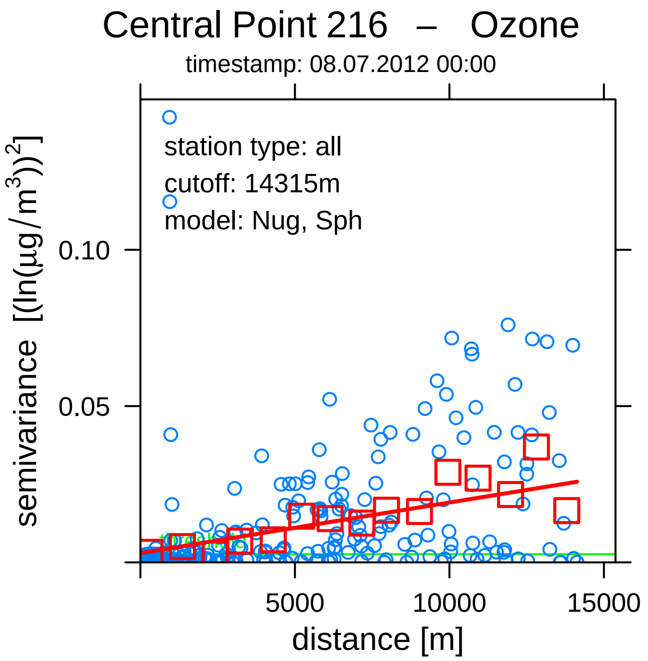

Central Point 216 – Ozone
timestamp: 27.05.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

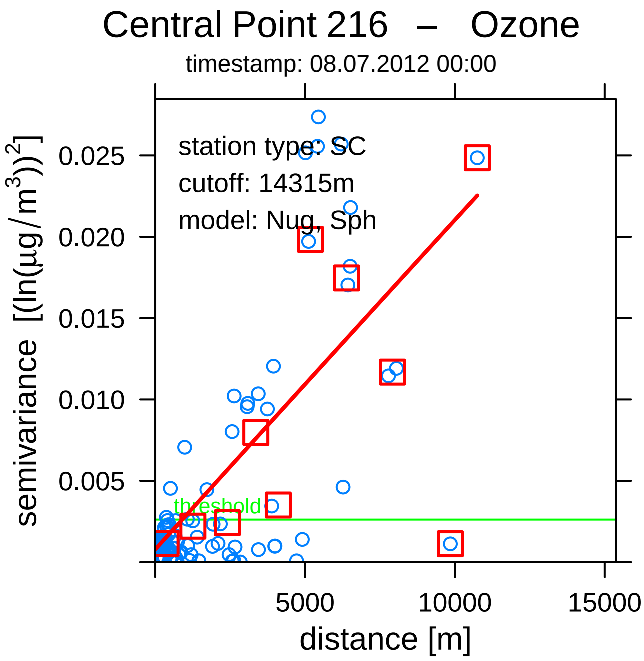

Central Point 216 – Ozone
timestamp: 10.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

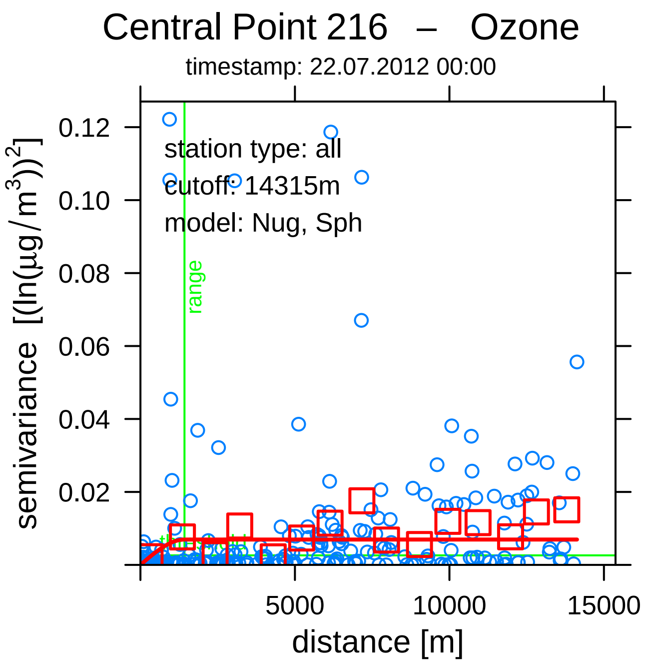

Central Point 216 – Ozone
timestamp: 10.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]

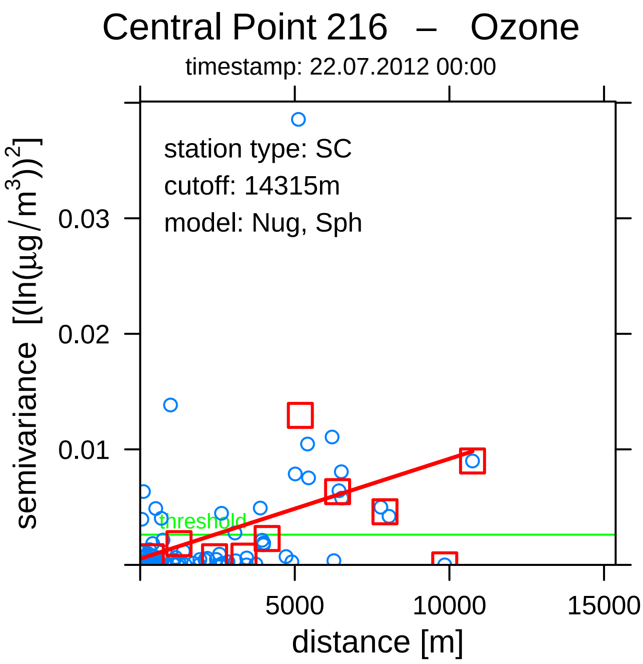

Central Point 216 – Ozone
timestamp: 24.06.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
0.15
5000
10000
15000

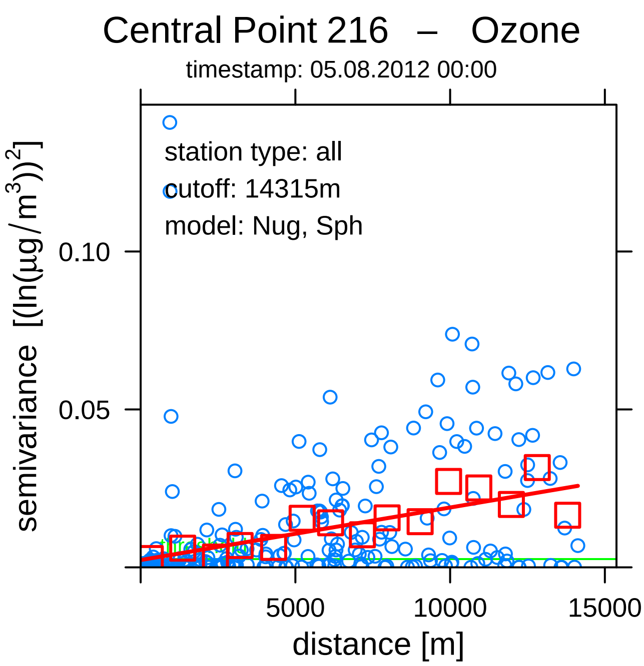

Central Point 216 – Ozone
timestamp: 24.06.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.005
0.010
0.015
0.020
0.025
5000
10000
15000

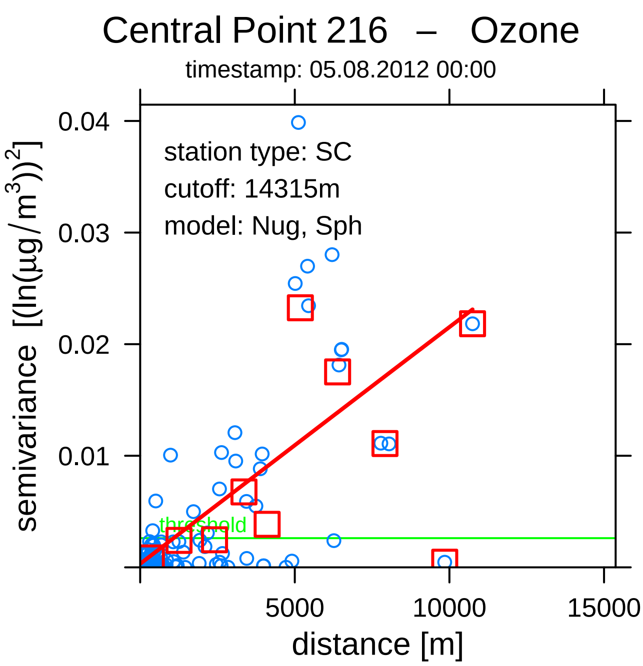

Central Point 216 – Ozone
timestamp: 08.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
distance [m]
0.05
0.10
5000
10000
15000

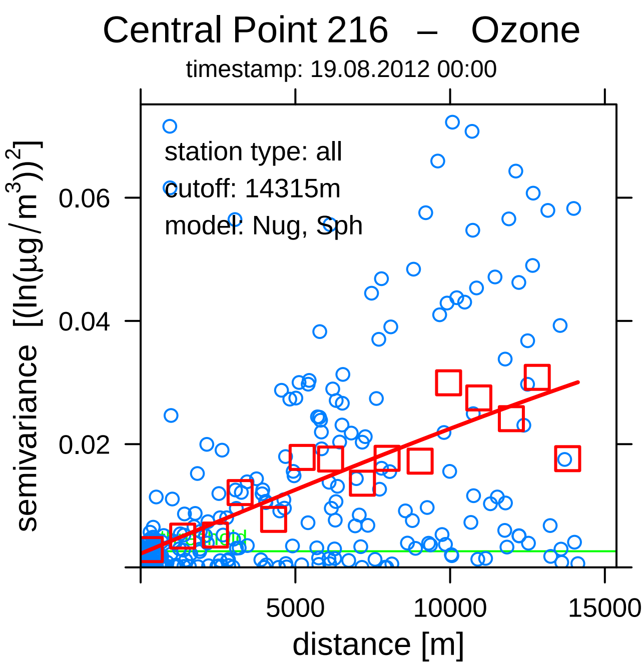

Central Point 216 – Ozone
timestamp: 08.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.005
0.010
0.015
0.020
0.025
5000
10000
15000

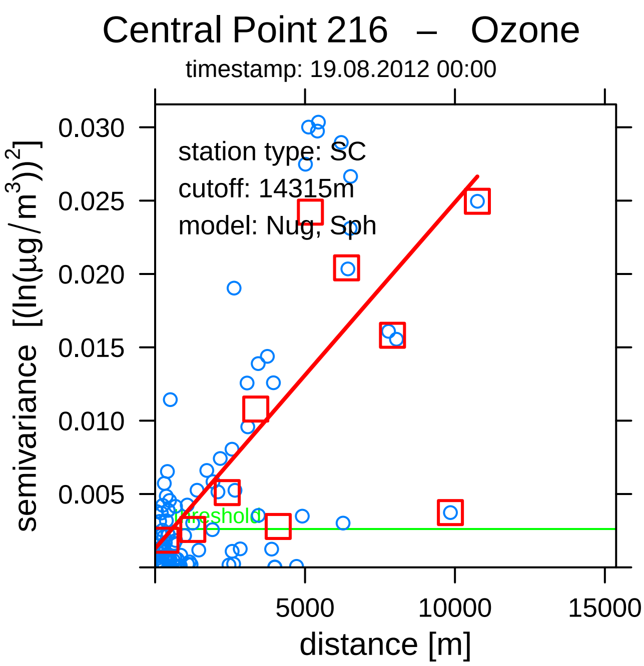

Central Point 216 – Ozone
timestamp: 22.07.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
distance [m]
0.02
0.04
0.06
0.08
0.10
0.12
5000
10000
15000

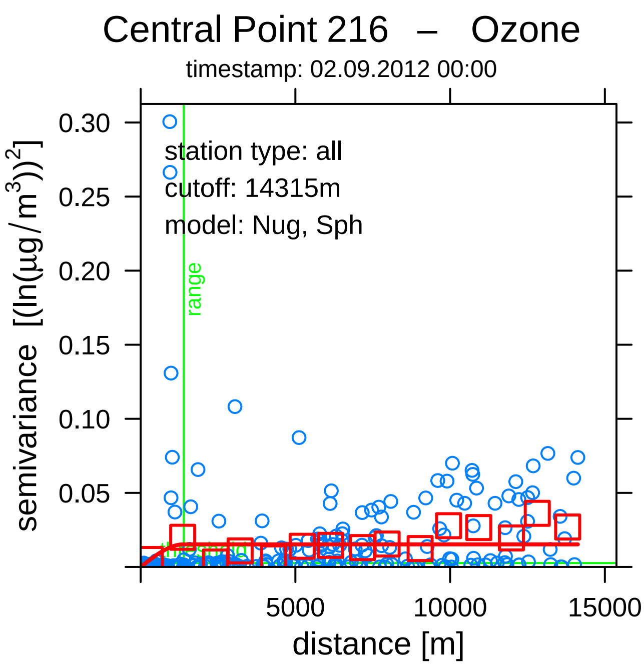

Central Point 216 – Ozone
timestamp: 22.07.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
distance [m]
0.01
0.02
0.03
5000
10000
15000

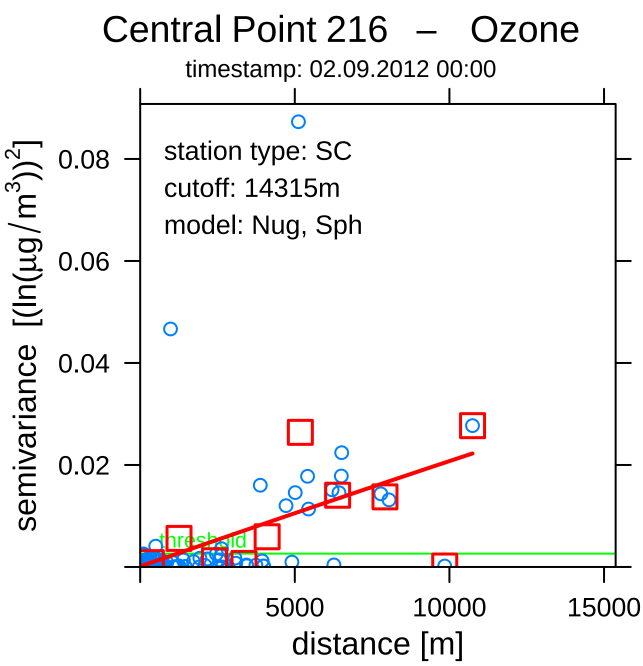

Central Point 216 – Ozone
timestamp: 05.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
5000
10000
15000
distance [m]

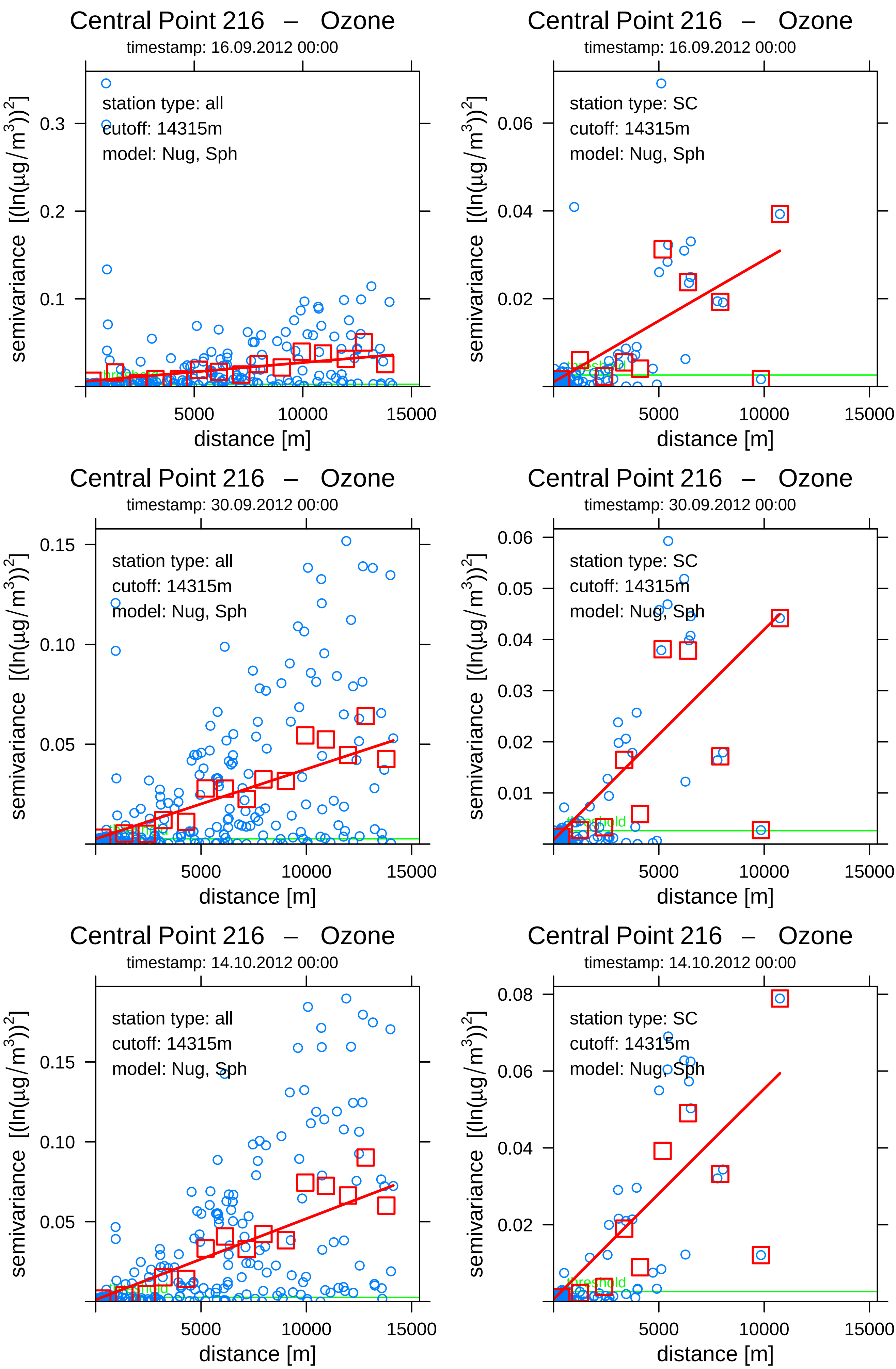

Central Point 216 – Ozone
timestamp: 05.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.01
0.02
0.03
0.04
5000
10000
15000
distance [m]


Central Point 216 – Ozone
timestamp: 19.08.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
5000
10000
15000
distance [m]

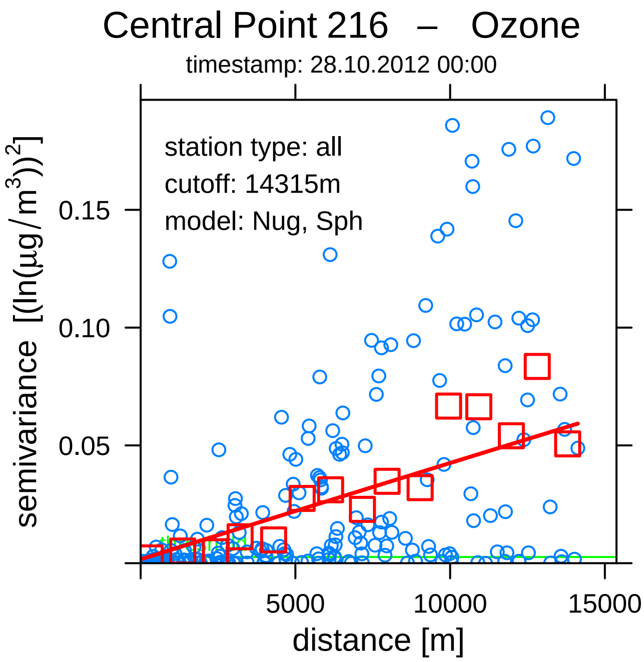

Central Point 216 – Ozone
timestamp: 19.08.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.005
0.010
0.015
0.020
0.025
0.030
5000
10000
15000
distance [m]

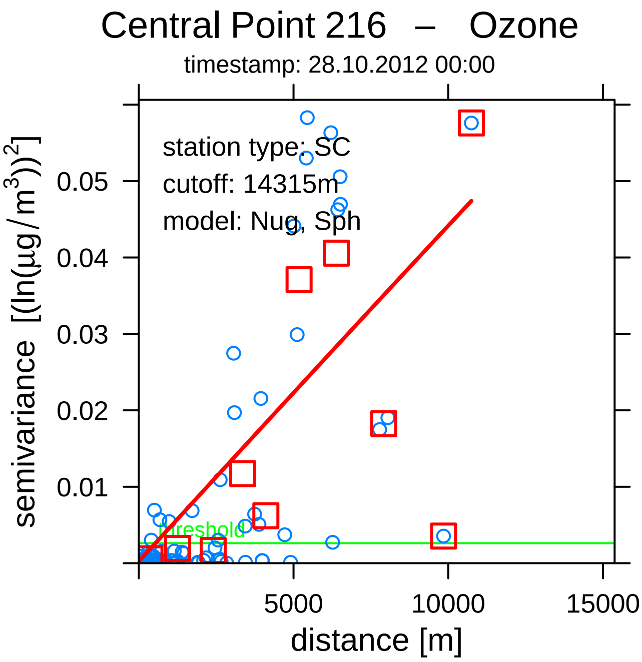

Central Point 216 – Ozone
timestamp: 02.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
range
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
0.25
0.30
5000
10000
15000
distance [m]

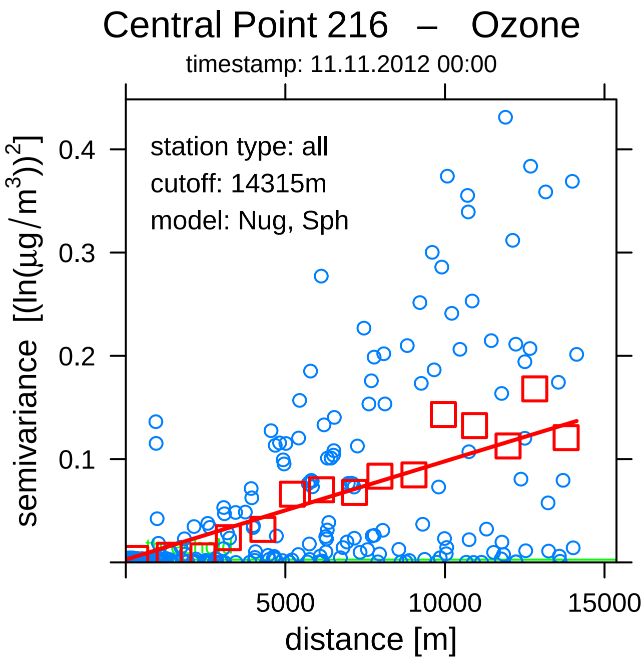

Central Point 216 – Ozone
timestamp: 02.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

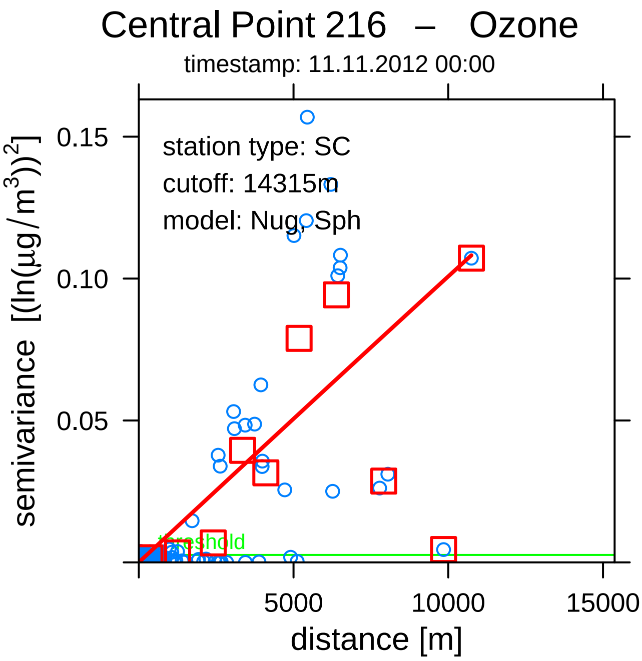


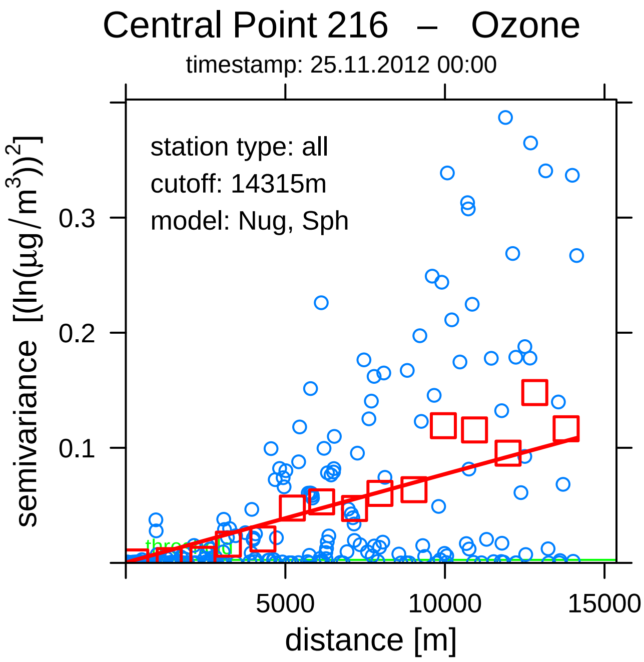
Central Point 216 – Ozone
timestamp: 16.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
5000
10000
15000
distance [m]
Central Point 216 – Ozone
timestamp: 16.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
5000
10000
15000
distance [m]
Central Point 216 – Ozone
timestamp: 30.09.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]
Central Point 216 – Ozone
timestamp: 30.09.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.01
0.02
0.03
0.04
0.05
0.06
5000
10000
15000
distance [m]
Central Point 216 – Ozone
timestamp: 14.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]
Central Point 216 – Ozone
timestamp: 14.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
5000
10000
15000
distance [m]

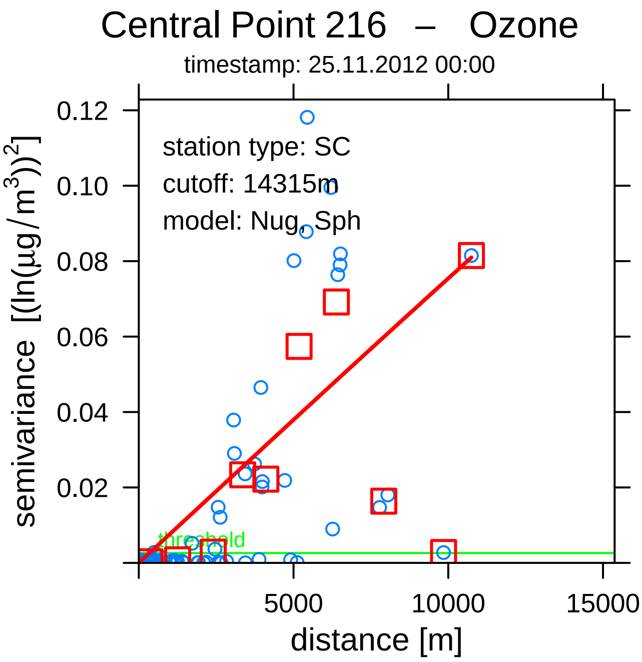

Central Point 216 – Ozone
timestamp: 28.10.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
distance [m]
5000
10000
15000

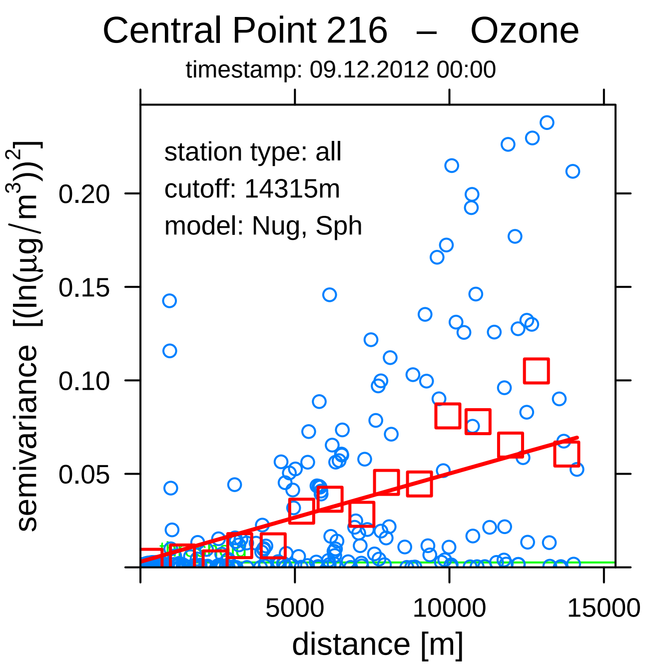

Central Point 216 – Ozone
timestamp: 28.10.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.01
0.02
0.03
0.04
0.05
distance [m]
5000
10000
15000

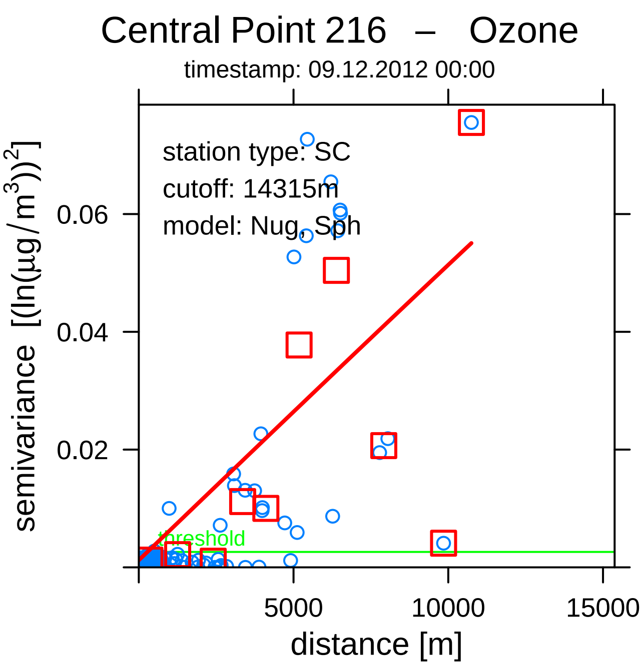

Central Point 216 – Ozone
timestamp: 11.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
0.4
distance [m]
5000
10000
15000

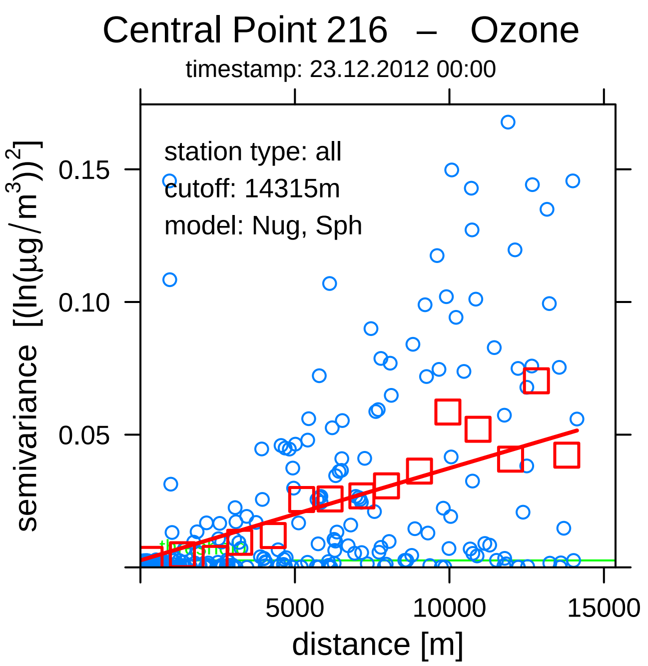

Central Point 216 – Ozone
timestamp: 11.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
distance [m]
5000
10000
15000

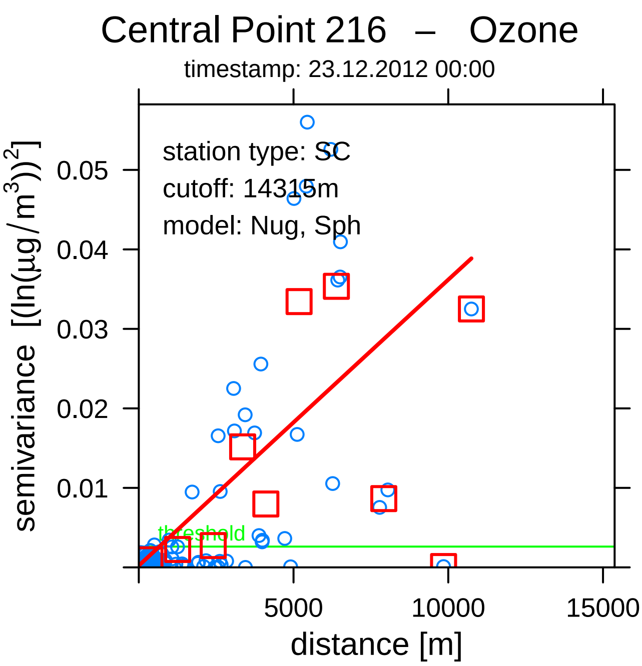

Central Point 216 – Ozone
timestamp: 25.11.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.1
0.2
0.3
distance [m]
5000
10000
15000


Central Point 216 – Ozone
timestamp: 25.11.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
0.08
0.10
0.12
distance [m]
5000
10000
15000


Central Point 216 – Ozone
timestamp: 09.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
0.20
5000
10000
15000
distance [m]


Central Point 216 – Ozone
timestamp: 09.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.02
0.04
0.06
5000
10000
15000
distance [m]


Central Point 216 – Ozone
timestamp: 23.12.2012 00:00
station type: all
cutoff: 14315m
model: Nug, Sph
semivariance [(ln(µg/m³))²]
0.05
0.10
0.15
5000
10000
15000
distance [m]


Central Point 216 – Ozone
timestamp: 23.12.2012 00:00
station type: SC
cutoff: 14315m
model: Nug, Sph
threshold
semivariance [(ln(µg/m³))²]
0.01
0.02
0.03
0.04
0.05
5000
10000
15000
distance [m]

Annex 4. Time series of effective distances of spatial representativeness estimated by point centred variography

Individual results obtained for virtual monitoring stations cp7, cp17 and cp216 from calculations based on:

— PM_{10} 14-days average concentrations

— NO_2 14-days average concentrations

— Ozone 14-days average concentrations

— PM_{10} daily average concentrations

Note that the tables also present a comparison of results obtained by using data from all 341 virtual monitoring points (columns denoted as **_all**), to the results obtained by using only the 241 non-street-canyon points for the evaluation of virtual monitoring stations cp1 and cp17 (columns denoted as **_noSC**), and only the 100 street-canyon points for the evaluation of virtual monitoring station cp216 (columns denoted as **_SC**).

Colum **dist.SR [m]** is the estimated limit of spatial representativeness based on the assumptions chosen for the maximum permissible deviations of concentrations (25% for PM_{10}, 15% for NO_2 and Ozone). If this threshold of concentration deviations is not reached within the range of the variogram (i.e. the variogram's total sill is smaller than the concentration threshold), dist.SR is considered to be equal to the variogram's range parameter. NA values indicate that within the selected cutoff distance of 14315 m neither the concentration threshold nor the range is reached. The column **criterion** informs which of these three alternatives applies in the specific case.

PM_{10} (based on 14-day average concentrations and ΔPM_{10}-threshold = 25%)												
	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
08.01.2012	11405	threshold	12439	threshold	3120	threshold	3224	threshold	3054	threshold	3743	threshold
22.01.2012	12928	threshold	NA	> cutoff	3191	threshold	5108	threshold	4258	threshold	4532	threshold
05.02.2012	3822	range	NA	> cutoff	8720	range	6356	range	9634	threshold	10606	threshold
19.02.2012	NA	> cutoff	NA	> cutoff	5340	threshold	7101	range	6395	threshold	6525	threshold
04.03.2012	NA	> cutoff	NA	> cutoff	5050	threshold	6038	range	5965	threshold	5799	threshold
18.03.2012	NA	> cutoff	NA	> cutoff	5200	threshold	6824	range	7956	threshold	7300	threshold
01.04.2012	NA	> cutoff	NA	> cutoff	4762	threshold	5406	threshold	6966	threshold	6235	threshold
15.04.2012	7099	threshold	9485	threshold	1488	threshold	1836	threshold	1140	threshold	1728	threshold
29.04.2012	10460	threshold	14278	threshold	2854	threshold	3361	threshold	1975	threshold	2559	threshold
13.05.2012	9281	threshold	12809	threshold	2188	threshold	3149	threshold	1217	threshold	2035	threshold
27.05.2012	NA	> cutoff		> cutoff	6669	range	5902	range	7760	threshold	7935	threshold
10.06.2012	7213	threshold	10536	threshold	1696	threshold	2338	threshold	430	threshold	1464	threshold
24.06.2012	10808	threshold	13303	threshold	2816	threshold	3092	threshold	1424	threshold	2328	threshold
08.07.2012	6603	threshold	8528	threshold	2068	threshold	2471	threshold	75	threshold	1354	threshold
22.07.2012	9330	threshold	12145	threshold	2091	threshold	2965	threshold	1587	threshold	2337	threshold
05.08.2012	5494	threshold	7521	threshold	1381	threshold	2183	threshold	0	threshold	1325	threshold
19.08.2012	9477	threshold	12336	threshold	2523	threshold	3348	threshold	1875	threshold	2613	threshold
02.09.2012	7967	threshold	9041	threshold	1974	threshold	2239	threshold	937	threshold	1856	threshold
16.09.2012	6739	threshold	8667	threshold	2110	threshold	2657	threshold	892	threshold	1886	threshold
30.09.2012	5301	threshold	7508	threshold	1777	threshold	1902	threshold	227	threshold	1332	threshold
14.10.2012	4437	range	5976	range	2307	threshold	2873	threshold	1049	threshold	1767	threshold
28.10.2012	6790	range	13963	threshold	3644	threshold	3574	threshold	3276	threshold	3562	threshold
11.11.2012	12144	threshold		> cutoff	3073	threshold	4195	threshold	3286	threshold	3598	threshold
25.11.2012	7763	range	11308	threshold	2411	threshold	3420	threshold	2393	threshold	2922	threshold
09.12.2012	7268	range	11191	threshold	2871	threshold	3278	threshold	2283	threshold	2982	threshold
23.12.2012	7457	threshold	8915	threshold	1943	threshold	2441	threshold	1104	threshold	2122	threshold
min	3822 m		5976 m		1381 m		1836 m		0 m		1325 m	
1st quartile	6739 m		8729 m		2074 m		2518 m		1063 m		1863 m	
median	**7457 m**		**10864 m**		**2670 m**		**3251 m**		**1925 m**		**2586 m**	
3rd quartile	9477 m		12413 m		3530 m		4880 m		4015 m		4334 m	
max	12928 m		14278 m		8720 m		7101 m		9634 m		10606 m	
criterion used												
estimated from threshold	62%		65%		92%		81%		100%		100%	
estimated from range	19%		4%		8%		19%		0%		0%	
NA because dist.SR > cutoff	19%		31%		0%		0%		0%		0%	

NO_2 (based on 14-day average concentrations and ΔNO_2-threshold = 15%)												
	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
08.01.2012	186	threshold	513	threshold	15	threshold	202	threshold	0	threshold	0	threshold
22.01.2012	268	threshold	526	threshold	175	threshold	203	threshold	0	threshold	0	threshold
05.02.2012	225	threshold	435	threshold	157	threshold	169	threshold	0	threshold	0	threshold
19.02.2012	385	threshold	679	threshold	125	threshold	229	threshold	0	threshold	0	threshold
04.03.2012	195	threshold	390	threshold	136	threshold	186	threshold	0	threshold	0	threshold
18.03.2012	215	threshold	313	threshold	102	threshold	129	threshold	0	threshold	0	threshold
01.04.2012	167	threshold	306	threshold	77	threshold	102	threshold	0	threshold	0	threshold
15.04.2012	152	threshold	249	threshold	1	threshold	130	threshold	0	threshold	0	threshold
29.04.2012	134	threshold	240	threshold	67	threshold	95	threshold	0	threshold	0	threshold
13.05.2012	94	threshold	219	threshold	55	threshold	80	threshold	0	threshold	0	threshold
27.05.2012	156	threshold	307	threshold	46	threshold	47	threshold	0	threshold	0	threshold
10.06.2012	98	threshold	186	threshold	53	threshold	77	threshold	0	threshold	0	threshold
24.06.2012	116	threshold	265	threshold	68	threshold	84	threshold	0	threshold	0	threshold
08.07.2012	116	threshold	207	threshold	61	threshold	117	threshold	0	threshold	0	threshold
22.07.2012	92	threshold	148	threshold	38	threshold	45	threshold	0	threshold	0	threshold
05.08.2012	87	threshold	197	threshold	55	threshold	83	threshold	0	threshold	0	threshold
19.08.2012	102	threshold	165	threshold	52	threshold	85	threshold	0	threshold	0	threshold
02.09.2012	116	threshold	210	threshold	70	threshold	94	threshold	0	threshold	0	threshold
16.09.2012	175	threshold	272	threshold	89	threshold	155	threshold	0	threshold	0	threshold
30.09.2012	129	threshold	223	threshold	0	threshold	118	threshold	0	threshold	0	threshold
14.10.2012	193	threshold	273	threshold	99	threshold	132	threshold	0	threshold	0	threshold
28.10.2012	192	threshold	217	threshold	90	threshold	154	threshold	0	threshold	0	threshold
11.11.2012	217	threshold	372	threshold	139	threshold	201	threshold	0	threshold	0	threshold
25.11.2012	294	threshold	391	threshold	141	threshold	181	threshold	0	threshold	0	threshold
09.12.2012	257	threshold	645	threshold	133	threshold	237	threshold	0	threshold	0	threshold
23.12.2012	148	threshold	418	threshold	0	threshold	160	threshold	0	threshold	0	threshold
min	87 m		148 m		0 m		45 m		0 m		0 m	
1st quartile	116 m		218 m		52 m		87 m		0 m		0 m	
median	**161 m**		**273 m**		**69 m**		**130 m**		**0 m**		**0 m**	
3rd quartile	210 m		391 m		120 m		178 m		0 m		0 m	
max	385 m		679 m		175 m		237 m		0 m		0 m	
criterion used												
estimated from threshold	100%		100%		100%		100%		100%		100%	
estimated from range	0%		0%		0%		0%		0%		0%	
NA because dist.SR > cutoff	0%		0%		0%		0%		0%		0%	

Ozone (based on 14-day average concentrations and ΔO_3-threshold = 15%)												
	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
08.01.2012	621	threshold	859	threshold	472	threshold	390	threshold	64	threshold	879	threshold
22.01.2012	0	threshold	0	threshold	217	threshold	205	threshold	0	threshold	167	threshold
05.02.2012	466	threshold	766	threshold	144	threshold	156	threshold	291	threshold	228	threshold
19.02.2012	0	threshold	344	threshold	292	threshold	320	threshold	0	threshold	651	threshold
04.03.2012	1020	threshold	942	threshold	209	threshold	168	threshold	0	threshold	0	threshold
18.03.2012	1113	threshold	901	threshold	172	threshold	143	threshold	213	threshold	640	threshold
01.04.2012	1110	threshold	897	threshold	182	threshold	157	threshold	179	threshold	986	threshold
15.04.2012	2118	threshold	1642	threshold	600	threshold	466	threshold	391	threshold	1282	threshold
29.04.2012	3491	threshold	3103	threshold	766	threshold	723	threshold	1032	threshold	1298	threshold
13.05.2012	3343	threshold	2634	threshold	493	threshold	458	threshold	1086	threshold	1591	threshold
27.05.2012	2686	threshold	1953	threshold	248	threshold	216	threshold	466	threshold	4365	threshold
10.06.2012	2115	threshold	1832	threshold	521	threshold	597	threshold	1060	threshold	1546	threshold
24.06.2012	3069	threshold	2290	threshold	783	threshold	625	threshold	0	threshold	1835	threshold
08.07.2012	2256	threshold	1796	threshold	583	threshold	665	threshold	0	threshold	901	threshold
22.07.2012	1833	threshold	1466	threshold	264	threshold	202	threshold	366	threshold	2407	threshold
05.08.2012	1925	threshold	1581	threshold	387	threshold	460	threshold	180	threshold	1080	threshold
19.08.2012	974	threshold	916	threshold	404	threshold	436	threshold	185	threshold	563	threshold
02.09.2012	996	threshold	788	threshold	304	threshold	264	threshold	159	threshold	1197	threshold
16.09.2012	1191	threshold	883	threshold	391	threshold	250	threshold	0	threshold	573	threshold
30.09.2012	1585	threshold	1441	threshold	364	threshold	300	threshold	6	threshold	436	threshold
14.10.2012	1302	threshold	1241	threshold	275	threshold	260	threshold	289	threshold	371	threshold
28.10.2012	922	threshold	1100	threshold	262	threshold	255	threshold	232	threshold	536	threshold
11.11.2012	0	threshold	0	threshold	131	threshold	171	threshold	0	threshold	258	threshold
25.11.2012	0	threshold	0	threshold	177	threshold	204	threshold	300	threshold	344	threshold
09.12.2012	0	threshold	0	threshold	242	threshold	186	threshold	0	threshold	278	threshold
23.12.2012	221	threshold	609	threshold	392	threshold	386	threshold	0	threshold	664	threshold
min	0 m		0 m		131 m		143 m		0 m		0 m	
1st quartile	505 m		772 m		223 m		203 m		0 m		387 m	
median	**1111 m**		**929 m**		**298 m**		**262 m**		**180 m**		**658 m**	
3rd quartile	2068 m		1627 m		455 m		452 m		298 m		1261 m	
max	3491 m		3103 m		783 m		723 m		1086 m		4365 m	
criterion used												
estimated from threshold	100%		100%		100%		100%		100%		100%	
estimated from range	0%		0%		0%		0%		0%		0%	
NA because dist.SR > cutoff	0%		0%		0%		0%		0%		0%	

PM_{10}-daily (based on daily average concentrations and ΔPM_{10}-threshold = 25%)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.01.2012 12:00	6149	threshold	8708	threshold	1577	threshold	1980	threshold	476	threshold	1348	threshold
02.01.2012 12:00	4557	threshold	4303	threshold	1305	threshold	1397	threshold	0	threshold	1231	threshold
03.01.2012 12:00	10191	threshold	12093	threshold	1906	threshold	2342	threshold	1504	threshold	2110	threshold
04.01.2012 12:00	NA	> cutoff	NA	> cutoff	4189	threshold	5229	threshold	3384	threshold	4582	threshold
05.01.2012 12:00	12973	threshold	14184	threshold	2807	threshold	3557	threshold	1145	threshold	2095	threshold
06.01.2012 12:00	NA	> cutoff	NA	> cutoff	4773	threshold	7553	range	3091	threshold	4150	threshold
07.01.2012 12:00	NA	> cutoff	NA	> cutoff	5037	range	5923	range	4616	threshold	5790	threshold
08.01.2012 12:00	7201	range	NA	> cutoff	5357	range	5122	range	5158	threshold	6218	threshold
09.01.2012 12:00	11368	threshold	11671	threshold	2397	threshold	2285	threshold	3104	threshold	3558	threshold
10.01.2012 12:00	7972	threshold	7219	threshold	2269	threshold	2364	threshold	2880	threshold	3918	threshold
11.01.2012 12:00	7729	threshold	6826	threshold	1875	threshold	1961	threshold	1541	threshold	3147	threshold
12.01.2012 12:00	NA	> cutoff	NA	> cutoff	3350	threshold	3750	threshold	3130	threshold	3954	threshold
13.01.2012 12:00	7185	range	7583	range	2287	threshold	2358	threshold	3378	threshold	3504	threshold
14.01.2012 12:00	7455	range	7995	range	5826	range	6118	range	7936	threshold	7159	threshold
15.01.2012 12:00	4973	range	5358	range	8180	threshold	6152	range	5778	threshold	7698	threshold
16.01.2012 12:00	4903	range	4477	range	3489	threshold	3706	threshold	5802	threshold	6042	threshold
17.01.2012 12:00	NA	> cutoff	NA	> cutoff	4452	threshold	6127	threshold	6460	threshold	6846	threshold
18.01.2012 12:00	NA	> cutoff	NA	> cutoff	5536	threshold	6886	threshold	7983	threshold	8122	threshold
19.01.2012 12:00	6369	threshold	6797	threshold	1374	threshold	1654	threshold	0	threshold	793	threshold
20.01.2012 12:00	5787	threshold	7275	threshold	1460	threshold	2444	threshold	0	threshold	1020	threshold
21.01.2012 12:00	NA	> cutoff	NA	> cutoff	6065	threshold	6895	range	4325	threshold	5490	threshold
22.01.2012 12:00	NA	> cutoff	NA	> cutoff	4892	range	5022	range	6561	threshold	8718	threshold
23.01.2012 12:00	13286	threshold	NA	> cutoff	3552	threshold	4122	threshold	3611	threshold	4451	threshold
24.01.2012 12:00	8603	threshold	9043	threshold	2030	threshold	3199	threshold	2647	threshold	3385	threshold
25.01.2012 12:00	1746	threshold	3027	threshold	1585	threshold	1855	threshold	448	threshold	962	threshold
26.01.2012 12:00	3341	threshold	6861	range	1563	threshold	1667	threshold	995	threshold	1645	threshold
27.01.2012 12:00	7333	threshold	9242	threshold	2247	threshold	2377	threshold	2391	threshold	2552	threshold
28.01.2012 12:00	4042	range	7056	range	4966	range	7123	range	4405	threshold	4629	threshold
29.01.2012 12:00	3193	range	3684	range	6860	range	6698	range	NA	> cutoff	NA	> cutoff
30.01.2012 12:00	5108	range	6125	range	4606	range	6827	range	8706	threshold	11530	threshold
31.01.2012 12:00	NA	> cutoff	NA	> cutoff	8773	range	9082	range	13704	threshold	NA	> cutoff

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.02.2012 12:00	3240	range	NA	> cutoff	9076	range	8971	range	8455	threshold	9868	threshold
02.02.2012 12:00	7379	range	11345	threshold	3804	threshold	4804	threshold	3834	threshold	4549	threshold
03.02.2012 12:00	4275	range	4664	range	3564	threshold	3165	threshold	3814	threshold	3993	threshold
04.02.2012 12:00	3844	range	4546	range	7664	range	5408	range	NA	> cutoff	NA	> cutoff
05.02.2012 12:00	5333	range	6766	range	8152	range	11378	range	9518	threshold	13464	threshold
06.02.2012 12:00	5296	range	NA	> cutoff	6185	range	6753	range	5696	threshold	6376	threshold
07.02.2012 12:00	NA	> cutoff	NA	> cutoff	7286	threshold	8233	range	8485	threshold	8776	threshold
08.02.2012 12:00	14149	threshold	NA	> cutoff	5080	threshold	6117	threshold	6686	threshold	6974	threshold
09.02.2012 12:00	5863	range	5283	range	4273	threshold	4675	threshold	7689	threshold	6712	threshold
10.02.2012 12:00	6310	range	7032	range	6514	threshold	7277	range	7556	threshold	7971	threshold
11.02.2012 12:00	6321	range	6923	range	7875	range	5748	range	NA	> cutoff	NA	> cutoff
12.02.2012 12:00	NA	> cutoff	NA	> cutoff	8362	range	4840	range	NA	> cutoff	NA	> cutoff
13.02.2012 12:00	11730	threshold	11554	threshold	7209	range	6292	range	7472	threshold	10522	threshold
14.02.2012 12:00	14049	threshold	NA	> cutoff	3001	threshold	3485	threshold	2806	threshold	3486	threshold
15.02.2012 12:00	NA	> cutoff	NA	> cutoff	3150	threshold	3920	threshold	2855	threshold	3727	threshold
16.02.2012 12:00	11927	threshold	12965	threshold	2562	threshold	3060	threshold	3724	threshold	3827	threshold
17.02.2012 12:00	11635	threshold	11857	threshold	3080	threshold	3902	threshold	3980	threshold	4459	threshold
18.02.2012 12:00	12460	threshold	13165	threshold	3442	threshold	4095	threshold	3005	threshold	3933	threshold
19.02.2012 12:00	7998	range	12456	threshold	4031	threshold	4921	range	2298	threshold	3188	threshold
20.02.2012 12:00	9847	threshold	9496	threshold	2306	threshold	2041	threshold	2907	threshold	3652	threshold
21.02.2012 12:00	NA	> cutoff	NA	> cutoff	4063	threshold	4823	threshold	5603	threshold	5790	threshold
22.02.2012 12:00	NA	> cutoff	NA	> cutoff	3818	threshold	4570	threshold	6147	threshold	6297	threshold
23.02.2012 12:00	NA	> cutoff	NA	> cutoff	4597	threshold	5078	threshold	4935	threshold	5686	threshold
24.02.2012 12:00	11164	threshold	10201	threshold	4169	threshold	4685	threshold	2818	threshold	4137	threshold
25.02.2012 12:00	7747	range	NA	> cutoff	5327	range	4689	range	11793	threshold	10068	threshold
26.02.2012 12:00	NA	> cutoff	NA	> cutoff	5204	range	5987	range	NA	> cutoff	9712	threshold
27.02.2012 12:00	NA	> cutoff	NA	> cutoff	4512	threshold	4595	threshold	7151	threshold	7185	threshold
28.02.2012 12:00	NA	> cutoff	NA	> cutoff	5760	range	7409	range	8458	threshold	9995	threshold
29.02.2012 12:00	10506	threshold	9978	threshold	4924	range	5059	range	5712	threshold	7142	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.03.2012 12:00	10054	threshold	8297	threshold	2504	threshold	2104	threshold	3507	threshold	4398	threshold
02.03.2012 12:00	NA	> cutoff	NA	> cutoff	5118	range	5124	range	4764	threshold	5073	threshold
03.03.2012 12:00	NA	> cutoff	NA	> cutoff	9217	range	6115	range	13010	threshold	12355	threshold
04.03.2012 12:00	3991	range	NA	> cutoff	6756	threshold	8652	range	4936	threshold	5585	threshold
05.03.2012 12:00	1635	threshold	2710	threshold	898	threshold	1041	threshold	80	threshold	683	threshold
06.03.2012 12:00	7152	threshold	8084	threshold	1454	threshold	1479	threshold	716	threshold	1693	threshold
07.03.2012 12:00	NA	> cutoff	NA	> cutoff	3585	threshold	4586	threshold	4672	threshold	4595	threshold
08.03.2012 12:00	10646	threshold	11072	threshold	2537	threshold	2928	threshold	2990	threshold	3719	threshold
09.03.2012 12:00	NA	> cutoff	NA	> cutoff	4053	threshold	4372	threshold	5497	threshold	5611	threshold
10.03.2012 12:00	7758	range	NA	> cutoff	6748	range	6246	range	13484	threshold	11558	threshold
11.03.2012 12:00	13342	threshold	7823	range	3155	threshold	3346	threshold	8728	threshold	5419	threshold
12.03.2012 12:00	NA	> cutoff	12158	threshold	2708	threshold	2802	threshold	7206	threshold	5787	threshold
13.03.2012 12:00	4321	threshold	4431	range	1658	threshold	1736	threshold	2811	threshold	2733	threshold
14.03.2012 12:00	6682	range	6653	range	4933	threshold	6209	threshold	7832	threshold	6846	threshold
15.03.2012 12:00	NA	> cutoff	NA	> cutoff	5131	threshold	7287	range	6331	threshold	6978	threshold
16.03.2012 12:00	NA	> cutoff	NA	> cutoff	5704	range	6578	range	12477	threshold	12970	threshold
17.03.2012 12:00	NA	> cutoff	NA	> cutoff	5097	range	6221	range	NA	> cutoff	NA	> cutoff
18.03.2012 12:00	NA	> cutoff	NA	> cutoff	6181	threshold	5930	range	4355	threshold	4987	threshold
19.03.2012 12:00	6582	threshold	6946	threshold	1712	threshold	1808	threshold	641	threshold	1720	threshold
20.03.2012 12:00	12124	threshold	12855	threshold	3104	threshold	3344	threshold	5324	threshold	5287	threshold
21.03.2012 12:00	5499	range	NA	> cutoff	4320	threshold	6412	threshold	5548	threshold	5947	threshold
22.03.2012 12:00	NA	> cutoff	NA	> cutoff	6123	threshold	6000	range	7089	threshold	7701	threshold
23.03.2012 12:00	NA	> cutoff	NA	> cutoff	4842	threshold	4958	threshold	6893	threshold	5966	threshold
24.03.2012 12:00	5000	range	5000	range	9184	range	5954	range	NA	> cutoff	14193	threshold
25.03.2012 12:00	8710	range	8320	range	3099	threshold	3278	threshold	6095	threshold	4406	threshold
26.03.2012 12:00	NA	> cutoff	NA	> cutoff	3310	threshold	3611	threshold	5113	threshold	4834	threshold
27.03.2012 12:00	8228	range	7224	range	3218	threshold	3851	threshold	7180	threshold	5342	threshold
28.03.2012 12:00	NA	> cutoff	NA	> cutoff	5274	threshold	6155	threshold	10932	threshold	10390	threshold
29.03.2012 12:00	NA	> cutoff	NA	> cutoff	5021	threshold	5802	threshold	8607	threshold	8460	threshold
30.03.2012 12:00	11359	threshold	11522	threshold	2031	threshold	2217	threshold	2280	threshold	2505	threshold
31.03.2012 12:00	NA	> cutoff	NA	> cutoff	7144	range	6491	range	11137	threshold	9596	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion
01.04.2012 12:00	854	threshold	1242	threshold	2284	threshold	2162	threshold	3363	threshold	3063	threshold
02.04.2012 12:00	13312	threshold	12960	threshold	3346	threshold	3922	threshold	5300	threshold	5003	threshold
03.04.2012 12:00	3268	range	NA	> cutoff	4862	threshold	6646	threshold	6454	threshold	6909	threshold
04.04.2012 12:00	3242	range	3857	range	5850	range	8817	range	6879	threshold	7613	threshold
05.04.2012 12:00	NA	> cutoff	NA	> cutoff	4440	threshold	5549	threshold	5548	threshold	5768	threshold
06.04.2012 12:00	11328	threshold	12696	threshold	2915	threshold	2752	threshold	3619	threshold	3887	threshold
07.04.2012 12:00	11412	threshold	12199	threshold	2663	threshold	2536	threshold	3758	threshold	3034	threshold
08.04.2012 12:00	12986	threshold	13951	threshold	4190	threshold	4050	range	4748	threshold	4306	threshold
09.04.2012 12:00	7066	threshold	7106	threshold	1659	threshold	1970	threshold	479	threshold	1699	threshold
10.04.2012 12:00	4272	threshold	6572	threshold	1222	threshold	1702	threshold	7	threshold	1038	threshold
11.04.2012 12:00	2830	threshold	4158	threshold	1023	threshold	1117	threshold	295	threshold	1094	threshold
12.04.2012 12:00	7557	threshold	8834	threshold	1882	threshold	2035	threshold	1385	threshold	2035	threshold
13.04.2012 12:00	6111	threshold	7448	threshold	1550	threshold	1848	threshold	1441	threshold	1784	threshold
14.04.2012 12:00	5823	threshold	7360	threshold	2277	threshold	2716	threshold	2168	threshold	2549	threshold
15.04.2012 12:00	7460	threshold	9038	threshold	2027	threshold	2526	threshold	1360	threshold	2043	threshold
16.04.2012 12:00	5363	threshold	5119	threshold	1281	threshold	1472	threshold	0	threshold	868	threshold
17.04.2012 12:00	10578	threshold	14137	threshold	2257	threshold	2872	threshold	2934	threshold	3065	threshold
18.04.2012 12:00	3416	threshold	6556	threshold	1126	threshold	1569	threshold	424	threshold	1165	threshold
19.04.2012 12:00	5169	threshold	7738	threshold	1378	threshold	1740	threshold	715	threshold	1235	threshold
20.04.2012 12:00	4116	threshold	7090	threshold	1594	threshold	1998	threshold	689	threshold	1364	threshold
21.04.2012 12:00	4693	threshold	6211	threshold	1004	threshold	1355	threshold	0	threshold	679	threshold
22.04.2012 12:00	9081	threshold	9306	threshold	2358	threshold	2679	threshold	1228	threshold	2688	threshold
23.04.2012 12:00	4772	threshold	7258	threshold	1291	threshold	1932	threshold	319	threshold	1091	threshold
24.04.2012 12:00	3235	threshold	5973	threshold	1056	threshold	1550	threshold	0	threshold	0	threshold
25.04.2012 12:00	7983	threshold	10354	threshold	1925	threshold	2319	threshold	1228	threshold	1950	threshold
26.04.2012 12:00	5151	threshold	7516	threshold	1309	threshold	1650	threshold	382	threshold	1067	threshold
27.04.2012 12:00	4365	threshold	5945	threshold	1355	threshold	1465	threshold	0	threshold	1190	threshold
28.04.2012 12:00	NA	> cutoff	NA	> cutoff	8818	range	9161	range	8016	threshold	8308	threshold
29.04.2012 12:00	6822	range	NA	> cutoff	4052	threshold	6393	threshold	3775	threshold	4022	threshold
30.04.2012 12:00	3033	threshold	6866	threshold	1613	threshold	2472	threshold	0	threshold	412	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion	dist.SR [m]	criterion
01.05.2012 12:00	8272	threshold	9311	threshold	1900	threshold	2385	threshold	33	threshold	1562	threshold
02.05.2012 12:00	NA	> cutoff	NA	> cutoff	4871	range	6387	range	5494	threshold	6009	threshold
03.05.2012 12:00	11998	threshold	13868	threshold	2839	threshold	3444	threshold	3063	threshold	3257	threshold
04.05.2012 12:00	NA	> cutoff	NA	> cutoff	3039	threshold	3425	threshold	3584	threshold	3873	threshold
05.05.2012 12:00	7597	range	11608	threshold	2526	threshold	3153	threshold	1767	threshold	2462	threshold
06.05.2012 12:00	5308	range	5892	range	2493	threshold	3052	threshold	2942	threshold	3346	threshold
07.05.2012 12:00	8458	threshold	11398	threshold	1818	threshold	2339	threshold	1162	threshold	1856	threshold
08.05.2012 12:00	6568	threshold	9625	threshold	1705	threshold	2093	threshold	831	threshold	1599	threshold
09.05.2012 12:00	3739	threshold	5330	threshold	1235	threshold	1632	threshold	0	threshold	761	threshold
10.05.2012 12:00	9194	threshold	11140	threshold	2099	threshold	2526	threshold	1287	threshold	2067	threshold
11.05.2012 12:00	9286	threshold	9567	threshold	2643	threshold	3931	threshold	0	threshold	1501	threshold
12.05.2012 12:00	9060	threshold	9367	threshold	2203	threshold	3404	threshold	252	threshold	1981	threshold
13.05.2012 12:00	6816	range	6947	range	2041	threshold	2502	threshold	1926	threshold	2391	threshold
14.05.2012 12:00	NA	> cutoff	NA	> cutoff	3748	threshold	4483	threshold	3676	threshold	4494	threshold
15.05.2012 12:00	5541	threshold	5928	threshold	1330	threshold	1531	threshold	0	threshold	343	threshold
16.05.2012 12:00	4516	threshold	7019	threshold	1584	threshold	1780	threshold	0	threshold	334	threshold
17.05.2012 12:00	5680	range	8172	threshold	1568	threshold	2183	threshold	358	threshold	967	threshold
18.05.2012 12:00	8363	range	11414	threshold	2199	threshold	2883	threshold	1518	threshold	2070	threshold
19.05.2012 12:00	NA	> cutoff	NA	> cutoff	5625	threshold	6719	range	5628	threshold	5296	threshold
20.05.2012 12:00	NA	> cutoff	NA	> cutoff	4748	range	3913	range	NA	> cutoff	NA	> cutoff
21.05.2012 12:00	3555	range	3743	range	4753	range	5021	range	9949	threshold	14112	threshold
22.05.2012 12:00	3432	range	4995	range	4995	range	4194	range	13320	threshold	NA	> cutoff
23.05.2012 12:00	NA	> cutoff	NA	> cutoff	6979	range	7862	range	12070	threshold	NA	> cutoff
24.05.2012 12:00	NA	> cutoff	NA	> cutoff	3833	threshold	4353	threshold	7356	threshold	7166	threshold
25.05.2012 12:00	NA	> cutoff	NA	> cutoff	3489	threshold	3988	threshold	3765	threshold	4368	threshold
26.05.2012 12:00	7823	range	NA	> cutoff	4958	range	5460	range	5522	threshold	5861	threshold
27.05.2012 12:00	6086	range	NA	> cutoff	3529	threshold	5308	threshold	4795	threshold	4907	threshold
28.05.2012 12:00	12580	threshold	12837	threshold	2367	threshold	2327	threshold	3089	threshold	3388	threshold
29.05.2012 12:00	NA	> cutoff	NA	> cutoff	6080	threshold	6294	range	6835	threshold	7170	threshold
30.05.2012 12:00	NA	> cutoff	NA	> cutoff	4062	threshold	4580	threshold	6278	threshold	6134	threshold
31.05.2012 12:00	NA	> cutoff	NA	> cutoff	4989	threshold	6357	range	5986	threshold	6528	threshold

PM10-daily (continued)												
	cp7_all		**cp7_noSC**		**cp17_all**		**cp17_noSC**		**cp216_all**		**cp216_SC**	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.06.2012 12:00	6774	threshold	7866	threshold	1306	threshold	1390	threshold	0	threshold	801	threshold
02.06.2012 12:00	6172	range	5608	range	1833	threshold	2536	threshold	1021	threshold	2032	threshold
03.06.2012 12:00	6177	range	12374	threshold	2014	threshold	1926	threshold	1067	threshold	1750	threshold
04.06.2012 12:00	5734	threshold	7491	threshold	1317	threshold	1718	threshold	0	threshold	721	threshold
05.06.2012 12:00	4994	threshold	7743	threshold	1791	threshold	2288	threshold	449	threshold	1377	threshold
06.06.2012 12:00	5747	threshold	8929	threshold	1965	threshold	2704	threshold	92	threshold	1271	threshold
07.06.2012 12:00	4329	threshold	8332	threshold	1633	threshold	2292	threshold	319	threshold	1226	threshold
08.06.2012 12:00	NA	> cutoff	NA	> cutoff	2552	threshold	3097	threshold	2901	threshold	3455	threshold
09.06.2012 12:00	NA	> cutoff	NA	> cutoff	4213	threshold	5522	threshold	4152	threshold	4841	threshold
10.06.2012 12:00	6485	range	10742	threshold	2410	threshold	2591	threshold	678	threshold	1789	threshold
11.06.2012 12:00	3588	threshold	5848	threshold	962	threshold	1033	threshold	0	threshold	244	threshold
12.06.2012 12:00	6024	threshold	7125	threshold	1438	threshold	1634	threshold	0	threshold	1287	threshold
13.06.2012 12:00	4755	threshold	5859	threshold	992	threshold	1203	threshold	0	threshold	300	threshold
14.06.2012 12:00	2479	threshold	4869	range	1118	threshold	1383	threshold	180	threshold	946	threshold
15.06.2012 12:00	6067	threshold	9839	threshold	1807	threshold	2451	threshold	111	threshold	1196	threshold
16.06.2012 12:00	8686	threshold	9374	threshold	2335	threshold	2881	threshold	601	threshold	2308	threshold
17.06.2012 12:00	10245	threshold	11573	threshold	2514	threshold	2877	threshold	1557	threshold	2668	threshold
18.06.2012 12:00	5902	threshold	7606	threshold	1323	threshold	1203	threshold	0	threshold	397	threshold
19.06.2012 12:00	6000	threshold	8327	threshold	1351	threshold	1717	threshold	152	threshold	1251	threshold
20.06.2012 12:00	13508	threshold	14011	threshold	2756	threshold	3176	threshold	3577	threshold	3682	threshold
21.06.2012 12:00	NA	> cutoff	NA	> cutoff	3620	threshold	4770	threshold	2520	threshold	3370	threshold
22.06.2012 12:00	9849	threshold	10217	threshold	2213	threshold	2692	threshold	1548	threshold	2465	threshold
23.06.2012 12:00	11434	threshold	12431	threshold	3643	threshold	4431	threshold	2339	threshold	3626	threshold
24.06.2012 12:00	11732	threshold	NA	> cutoff	3945	threshold	4897	threshold	1866	threshold	2899	threshold
25.06.2012 12:00	6492	threshold	8153	threshold	1717	threshold	1949	threshold	0	threshold	1126	threshold
26.06.2012 12:00	7747	threshold	8280	threshold	2159	threshold	2563	threshold	460	threshold	1786	threshold
27.06.2012 12:00	6905	threshold	7469	threshold	1755	threshold	2612	threshold	0	threshold	1191	threshold
28.06.2012 12:00	12522	threshold	NA	> cutoff	3221	threshold	4437	threshold	2263	threshold	2954	threshold
29.06.2012 12:00	10744	threshold	12895	threshold	2736	threshold	3105	threshold	1775	threshold	2454	threshold
30.06.2012 12:00	NA	> cutoff	NA	> cutoff	2967	threshold	3536	threshold	1969	threshold	2848	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.07.2012 12:00	11578	threshold	13057	threshold	3158	threshold	3783	threshold	2255	threshold	3439	threshold
02.07.2012 12:00	4521	threshold	8172	threshold	1588	threshold	2840	threshold	509	threshold	1405	threshold
03.07.2012 12:00	6893	threshold	7748	threshold	1791	threshold	2454	threshold	228	threshold	1710	threshold
04.07.2012 12:00	4589	range	9764	threshold	3067	threshold	4210	threshold	1416	threshold	2348	threshold
05.07.2012 12:00	9838	threshold	11010	threshold	2075	threshold	2494	threshold	1270	threshold	2119	threshold
06.07.2012 12:00	7891	threshold	8465	threshold	2459	threshold	3233	threshold	833	threshold	2023	threshold
07.07.2012 12:00	3552	threshold	7722	threshold	1353	threshold	1840	threshold	178	threshold	901	threshold
08.07.2012 12:00	6765	threshold	9287	threshold	1960	threshold	2719	threshold	0	threshold	1211	threshold
09.07.2012 12:00	7094	threshold	7341	threshold	1946	threshold	2246	threshold	0	threshold	1416	threshold
10.07.2012 12:00	4709	threshold	5191	threshold	1293	threshold	1511	threshold	0	threshold	736	threshold
11.07.2012 12:00	4483	threshold	4995	threshold	1112	threshold	1720	threshold	0	threshold	429	threshold
12.07.2012 12:00	3981	threshold	4796	threshold	1326	threshold	1461	threshold	0	threshold	116	threshold
13.07.2012 12:00	3266	threshold	3981	threshold	821	threshold	1162	threshold	0	threshold	455	threshold
14.07.2012 12:00	4674	threshold	7123	threshold	1754	threshold	1906	threshold	0	threshold	1270	threshold
15.07.2012 12:00	5570	threshold	8074	threshold	1630	threshold	1637	threshold	0	threshold	0	threshold
16.07.2012 12:00	6448	threshold	6899	threshold	1776	threshold	2131	threshold	272	threshold	1661	threshold
17.07.2012 12:00	7107	threshold	8004	threshold	2211	threshold	2631	threshold	309	threshold	1497	threshold
18.07.2012 12:00	5044	threshold	5124	threshold	1193	threshold	1695	threshold	0	threshold	843	threshold
19.07.2012 12:00	4089	threshold	4996	threshold	1074	threshold	1401	threshold	0	threshold	225	threshold
20.07.2012 12:00	1785	threshold	3321	threshold	817	threshold	909	threshold	0	threshold	78	threshold
21.07.2012 12:00	2383	threshold	2938	threshold	1431	threshold	1458	threshold	0	threshold	381	threshold
22.07.2012 12:00	1485	threshold	3277	threshold	1612	threshold	1593	threshold	26	threshold	603	threshold
23.07.2012 12:00	2984	threshold	4889	range	1593	threshold	2030	threshold	0	threshold	615	threshold
24.07.2012 12:00	5749	range	7079	range	1762	threshold	1926	threshold	1109	threshold	1612	threshold
25.07.2012 12:00	NA	> cutoff	NA	> cutoff	3337	threshold	3941	threshold	5308	threshold	5162	threshold
26.07.2012 12:00	NA	> cutoff	NA	> cutoff	4261	threshold	4591	threshold	5470	threshold	5592	threshold
27.07.2012 12:00	NA	> cutoff	NA	> cutoff	4550	threshold	5121	range	7051	threshold	6945	threshold
28.07.2012 12:00	NA	> cutoff	NA	> cutoff	5006	threshold	4874	range	11516	threshold	8633	threshold
29.07.2012 12:00	9669	threshold	11088	threshold	3604	threshold	3531	threshold	1750	threshold	3320	threshold
30.07.2012 12:00	5574	threshold	6034	threshold	1616	threshold	1826	threshold	0	threshold	1169	threshold
31.07.2012 12:00	4606	threshold	5758	threshold	1342	threshold	1761	threshold	65	threshold	1431	threshold

PM$_{10}$-daily (continued)												
	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.08.2012 12:00	3600	threshold	5554	range	1624	threshold	2070	threshold	471	threshold	1204	threshold
02.08.2012 12:00	7075	threshold	7211	threshold	1555	threshold	2064	threshold	240	threshold	1977	threshold
03.08.2012 12:00	4819	threshold	5449	threshold	1164	threshold	1561	threshold	0	threshold	1145	threshold
04.08.2012 12:00	5633	range	6793	range	2386	threshold	2414	threshold	1317	threshold	2109	threshold
05.08.2012 12:00	3653	threshold	6872	range	1998	threshold	2012	threshold	0	threshold	1333	threshold
06.08.2012 12:00	4953	threshold	5398	threshold	1260	threshold	1808	threshold	0	threshold	1255	threshold
07.08.2012 12:00	4758	threshold	5205	threshold	1289	threshold	1718	threshold	0	threshold	754	threshold
08.08.2012 12:00	3064	threshold	3594	threshold	1042	threshold	1123	threshold	0	threshold	537	threshold
09.08.2012 12:00	2931	threshold	3358	threshold	806	threshold	750	threshold	0	threshold	433	threshold
10.08.2012 12:00	1762	threshold	1637	threshold	807	threshold	849	threshold	0	threshold	280	threshold
11.08.2012 12:00	4128	range	6210	range	2844	threshold	3730	threshold	1670	threshold	2026	threshold
12.08.2012 12:00	4165	range	7265	range	2543	threshold	2639	threshold	830	threshold	1220	threshold
13.08.2012 12:00	5836	range	8237	threshold	1676	threshold	2526	threshold	750	threshold	1806	threshold
14.08.2012 12:00	6209	range	8000	threshold	1988	threshold	2393	threshold	1323	threshold	2134	threshold
15.08.2012 12:00	9225	threshold	13927	threshold	2187	threshold	3125	threshold	1435	threshold	2297	threshold
16.08.2012 12:00	8023	threshold	9974	threshold	2209	threshold	3189	threshold	2055	threshold	2650	threshold
17.08.2012 12:00	5500	range	10398	threshold	2763	threshold	3868	threshold	1925	threshold	2525	threshold
18.08.2012 12:00	5051	range	5508	range	4202	threshold	5657	range	3597	threshold	3829	threshold
19.08.2012 12:00	NA	> cutoff	NA	> cutoff	7467	range	10121	range	7128	threshold	7622	threshold
20.08.2012 12:00	10368	threshold	7037	threshold	2665	threshold	4234	threshold	3181	threshold	3808	threshold
21.08.2012 12:00	3923	threshold	6433	threshold	1147	threshold	1629	threshold	0	threshold	1089	threshold
22.08.2012 12:00	8551	threshold	9483	threshold	2531	threshold	2914	threshold	1583	threshold	2563	threshold
23.08.2012 12:00	8535	threshold	10132	threshold	2118	threshold	2332	threshold	1655	threshold	2367	threshold
24.08.2012 12:00	7023	threshold	7975	threshold	1968	threshold	2349	threshold	808	threshold	1892	threshold
25.08.2012 12:00	7266	threshold	9117	threshold	2253	threshold	2887	threshold	501	threshold	2067	threshold
26.08.2012 12:00	6229	threshold	7493	threshold	1769	threshold	1345	threshold	0	threshold	1204	threshold
27.08.2012 12:00	1867	threshold	3681	threshold	1231	threshold	1425	threshold	138	threshold	857	threshold
28.08.2012 12:00	3990	threshold	6403	threshold	1476	threshold	1656	threshold	0	threshold	964	threshold
29.08.2012 12:00	6453	threshold	7966	threshold	2350	threshold	2622	threshold	913	threshold	1827	threshold
30.08.2012 12:00	4744	threshold	5195	threshold	1339	threshold	1476	threshold	0	threshold	1014	threshold
31.08.2012 12:00	5276	threshold	4344	threshold	1370	threshold	1342	threshold	7	threshold	1126	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.09.2012 12:00	5648	threshold	4880	threshold	1975	threshold	2559	threshold	0	threshold	1973	threshold
02.09.2012 12:00	13765	threshold	13101	threshold	4456	threshold	5834	threshold	4494	threshold	4576	threshold
03.09.2012 12:00	1827	threshold	2337	threshold	1116	threshold	944	threshold	0	threshold	938	threshold
04.09.2012 12:00	8101	threshold	7202	threshold	1807	threshold	2248	threshold	1539	threshold	2241	threshold
05.09.2012 12:00	9409	threshold	9242	threshold	2274	threshold	2153	threshold	2441	threshold	2729	threshold
06.09.2012 12:00	2458	threshold	3389	threshold	1477	threshold	1692	threshold	330	threshold	1142	threshold
07.09.2012 12:00	10306	threshold	10268	threshold	2123	threshold	2284	threshold	2328	threshold	2761	threshold
08.09.2012 12:00	13020	threshold	13732	threshold	3432	threshold	3068	threshold	3615	threshold	3825	threshold
09.09.2012 12:00	NA	> cutoff	NA	> cutoff	5989	threshold	9045	range	4970	threshold	5564	threshold
10.09.2012 12:00	10701	threshold	11021	threshold	3541	threshold	3713	threshold	3991	threshold	4452	threshold
11.09.2012 12:00	5690	threshold	6660	threshold	1381	threshold	1400	threshold	0	threshold	951	threshold
12.09.2012 12:00	2650	threshold	4453	threshold	1294	threshold	1339	threshold	0	threshold	0	threshold
13.09.2012 12:00	3255	threshold	3778	threshold	937	threshold	907	threshold	0	threshold	128	threshold
14.09.2012 12:00	6363	threshold	7309	threshold	1793	threshold	1913	threshold	0	threshold	1184	threshold
15.09.2012 12:00	8447	threshold	9438	threshold	2548	threshold	3137	threshold	2536	threshold	3131	threshold
16.09.2012 12:00	13538	threshold	14295	threshold	4632	threshold	6270	threshold	4830	threshold	5143	threshold
17.09.2012 12:00	5908	threshold	6130	threshold	1504	threshold	2049	threshold	0	threshold	1733	threshold
18.09.2012 12:00	3306	threshold	5509	threshold	1137	threshold	1122	threshold	0	threshold	0	threshold
19.09.2012 12:00	2545	threshold	4583	threshold	1377	threshold	1647	threshold	0	threshold	36	threshold
20.09.2012 12:00	4378	threshold	6410	threshold	1616	threshold	2013	threshold	1015	threshold	1713	threshold
21.09.2012 12:00	4537	threshold	6555	range	1598	threshold	1925	threshold	874	threshold	1572	threshold
22.09.2012 12:00	2949	threshold	4175	threshold	1477	threshold	1937	threshold	231	threshold	1263	threshold
23.09.2012 12:00	6156	range	12164	threshold	2496	threshold	2532	threshold	1804	threshold	2297	threshold
24.09.2012 12:00	6055	threshold	8662	threshold	1880	threshold	2076	threshold	1058	threshold	1723	threshold
25.09.2012 12:00	3301	threshold	5301	threshold	851	threshold	1261	threshold	0	threshold	710	threshold
26.09.2012 12:00	2000	threshold	3475	threshold	600	threshold	1011	threshold	0	threshold	669	threshold
27.09.2012 12:00	3440	threshold	5538	threshold	1176	threshold	1561	threshold	0	threshold	0	threshold
28.09.2012 12:00	5808	threshold	6706	threshold	1894	threshold	1603	threshold	229	threshold	1960	threshold
29.09.2012 12:00	6503	range	10270	threshold	2975	threshold	3513	threshold	0	threshold	1568	threshold
30.09.2012 12:00	10661	threshold	10912	threshold	2712	threshold	4172	threshold	2989	threshold	4225	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.10.2012 12:00	7925	threshold	10047	threshold	1977	threshold	2588	threshold	2007	threshold	2663	threshold
02.10.2012 12:00	4483	threshold	6181	threshold	1411	threshold	1762	threshold	211	threshold	1261	threshold
03.10.2012 12:00	3359	threshold	4232	threshold	1021	threshold	1004	threshold	0	threshold	755	threshold
04.10.2012 12:00	3784	threshold	5088	threshold	1059	threshold	1341	threshold	0	threshold	241	threshold
05.10.2012 12:00	3384	threshold	3982	threshold	983	threshold	1150	threshold	0	threshold	270	threshold
06.10.2012 12:00	2530	threshold	2716	threshold	1640	threshold	1959	threshold	0	threshold	1337	threshold
07.10.2012 12:00	1992	threshold	2562	threshold	2114	threshold	1682	threshold	453	threshold	1899	threshold
08.10.2012 12:00	3186	threshold	3708	threshold	1857	threshold	1878	threshold	1137	threshold	1387	threshold
09.10.2012 12:00	2915	threshold	3330	threshold	1515	threshold	1347	threshold	1145	threshold	2117	threshold
10.10.2012 12:00	2453	threshold	4401	threshold	1232	threshold	1478	threshold	0	threshold	488	threshold
11.10.2012 12:00	9404	threshold	12232	threshold	3187	threshold	4011	threshold	1093	threshold	1838	threshold
12.10.2012 12:00	6161	threshold	6664	threshold	1590	threshold	2330	threshold	0	threshold	1274	threshold
13.10.2012 12:00	5716	threshold	7988	threshold	1716	threshold	1972	threshold	169	threshold	1180	threshold
14.10.2012 12:00	5969	threshold	7301	threshold	2587	threshold	2053	threshold	0	threshold	1716	threshold
15.10.2012 12:00	5470	threshold	6395	threshold	1447	threshold	1662	threshold	0	threshold	1055	threshold
16.10.2012 12:00	8072	threshold	10260	threshold	2257	threshold	2335	threshold	1583	threshold	2245	threshold
17.10.2012 12:00	2198	threshold	5251	range	1513	threshold	1767	threshold	569	threshold	1234	threshold
18.10.2012 12:00	2630	threshold	4415	range	1517	threshold	1933	threshold	651	threshold	1173	threshold
19.10.2012 12:00	4172	range	6009	range	2730	threshold	3919	threshold	2190	threshold	2781	threshold
20.10.2012 12:00	6383	threshold	5647	range	3706	threshold	4605	threshold	3393	threshold	3815	threshold
21.10.2012 12:00	4614	range	5323	range	8556	range	7698	range	8704	threshold	10953	threshold
22.10.2012 12:00	4552	range	5350	range	2339	threshold	2754	threshold	3574	threshold	3761	threshold
23.10.2012 12:00	5864	range	NA	> cutoff	5744	range	6977	range	3956	threshold	4150	threshold
24.10.2012 12:00	5838	range	NA	> cutoff	6915	range	8128	range	7175	threshold	7738	threshold
25.10.2012 12:00	5484	range	5725	range	2739	threshold	2667	threshold	3096	threshold	3353	threshold
26.10.2012 12:00	2956	threshold	3875	threshold	1634	threshold	1705	threshold	0	threshold	1172	threshold
27.10.2012 12:00	2404	threshold	2648	threshold	1427	threshold	1962	threshold	0	threshold	613	threshold
28.10.2012 12:00	9738	range	11729	threshold	3711	threshold	5468	threshold	2518	threshold	2918	threshold
29.10.2012 12:00	6200	threshold	7158	threshold	1761	threshold	2113	threshold	540	threshold	1691	threshold
30.10.2012 12:00	5903	threshold	6243	threshold	1349	threshold	1795	threshold	127	threshold	1844	threshold
31.10.2012 12:00	4119	range	10080	threshold	2488	threshold	3674	threshold	2052	threshold	2735	threshold

PM$_{10}$-daily (continued)												
	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.11.2012 12:00	5203	threshold	6438	threshold	1298	threshold	1802	threshold	0	threshold	994	threshold
02.11.2012 12:00	3366	threshold	3576	threshold	963	threshold	1132	threshold	0	threshold	571	threshold
03.11.2012 12:00	4005	threshold	6159	threshold	1874	threshold	1759	threshold	0	threshold	1393	threshold
04.11.2012 12:00	5883	range	9755	threshold	2362	threshold	3795	threshold	1192	threshold	2084	threshold
05.11.2012 12:00	5203	threshold	5646	threshold	1480	threshold	1708	threshold	63	threshold	1725	threshold
06.11.2012 12:00	7036	threshold	7199	threshold	1890	threshold	2083	threshold	780	threshold	2004	threshold
07.11.2012 12:00	13409	threshold	12452	threshold	2700	threshold	3096	threshold	3147	threshold	3992	threshold
08.11.2012 12:00	10245	threshold	9856	threshold	2456	threshold	2625	threshold	3372	threshold	4299	threshold
09.11.2012 12:00	11230	threshold	13830	threshold	2607	threshold	3363	threshold	2749	threshold	3198	threshold
10.11.2012 12:00	9248	threshold	11914	threshold	2885	threshold	3602	threshold	2189	threshold	2568	threshold
11.11.2012 12:00	11510	threshold	10979	threshold	3310	threshold	3626	threshold	3909	threshold	4829	threshold
12.11.2012 12:00	13100	threshold	NA	> cutoff	2030	threshold	2548	threshold	2829	threshold	2988	threshold
13.11.2012 12:00	5445	range	5713	range	1792	threshold	2048	threshold	2004	threshold	2353	threshold
14.11.2012 12:00	6830	range	4936	range	1581	threshold	1552	threshold	1098	threshold	1280	threshold
15.11.2012 12:00	11909	threshold	14025	threshold	2931	threshold	3503	threshold	2986	threshold	3338	threshold
16.11.2012 12:00	4010	range	5582	range	6757	threshold	5399	range	5860	threshold	6816	threshold
17.11.2012 12:00	NA	> cutoff	NA	> cutoff	8465	range	8426	range	6871	threshold	7427	threshold
18.11.2012 12:00	3941	range	5871	range	3776	threshold	4314	threshold	3163	threshold	3864	threshold
19.11.2012 12:00	4984	range	6354	range	2924	threshold	3934	threshold	2637	threshold	3244	threshold
20.11.2012 12:00	5925	range	10178	threshold	3602	threshold	4650	threshold	2689	threshold	3535	threshold
21.11.2012 12:00	7970	threshold	10929	threshold	2416	threshold	2865	threshold	1721	threshold	2399	threshold
22.11.2012 12:00	6992	threshold	9945	threshold	2073	threshold	2768	threshold	1519	threshold	2084	threshold
23.11.2012 12:00	3591	threshold	5207	threshold	1228	threshold	1706	threshold	452	threshold	1434	threshold
24.11.2012 12:00	4596	range	5046	range	3746	threshold	4406	threshold	1226	threshold	1557	threshold
25.11.2012 12:00	NA	> cutoff	NA	> cutoff	7465	range	7334	range	4380	threshold	5465	threshold
26.11.2012 12:00	4471	threshold	7444	threshold	1606	threshold	2131	threshold	1087	threshold	1684	threshold
27.11.2012 12:00	2229	threshold	4405	range	1322	threshold	1940	threshold	1428	threshold	1885	threshold
28.11.2012 12:00	5368	threshold	5478	threshold	1415	threshold	1345	threshold	867	threshold	1781	threshold
29.11.2012 12:00	2918	threshold	2405	threshold	965	threshold	1191	threshold	0	threshold	30	threshold
30.11.2012 12:00	8631	range	8437	threshold	3250	threshold	3133	threshold	4021	threshold	4957	threshold

PM_{10}-daily (continued)

	cp7_all		cp7_noSC		cp17_all		cp17_noSC		cp216_all		cp216_SC	
Date	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**	**dist.SR [m]**	**criterion**
01.12.2012 12:00	NA	> cutoff	NA	> cutoff	4681	range	7360	range	10855	threshold	11323	threshold
02.12.2012 12:00	3481	threshold	4979	threshold	1638	threshold	1898	threshold	0	threshold	0	threshold
03.12.2012 12:00	8488	threshold	10188	threshold	2428	threshold	2499	threshold	1496	threshold	2343	threshold
04.12.2012 12:00	7004	threshold	8640	threshold	2088	threshold	2140	threshold	555	threshold	1716	threshold
05.12.2012 12:00	1822	threshold	1963	threshold	816	threshold	867	threshold	0	threshold	0	threshold
06.12.2012 12:00	4679	threshold	6956	threshold	1855	threshold	2418	threshold	86	threshold	1257	threshold
07.12.2012 12:00	5009	range	5959	range	1421	threshold	2347	threshold	870	threshold	1462	threshold
08.12.2012 12:00	5013	range	5428	range	7700	range	6160	range	13522	threshold	9417	threshold
09.12.2012 12:00	NA	> cutoff	NA	> cutoff	8142	range	7076	range	6779	threshold	7962	threshold
10.12.2012 12:00	4430	threshold	5958	threshold	1485	threshold	1875	threshold	0	threshold	1246	threshold
11.12.2012 12:00	6551	threshold	6191	threshold	2008	threshold	1450	threshold	2389	threshold	3013	threshold
12.12.2012 12:00	NA	> cutoff	NA	> cutoff	4486	threshold	4738	range	6882	threshold	7097	threshold
13.12.2012 12:00	3895	range	4836	range	5071	threshold	7863	range	3645	threshold	4445	threshold
14.12.2012 12:00	4116	range	8225	threshold	1576	threshold	2307	threshold	705	threshold	1493	threshold
15.12.2012 12:00	10474	threshold	NA	> cutoff	2886	threshold	3818	threshold	2240	threshold	2851	threshold
16.12.2012 12:00	7831	threshold	8914	threshold	2739	threshold	3310	threshold	1643	threshold	3034	threshold
17.12.2012 12:00	7755	threshold	7753	threshold	2029	threshold	2272	threshold	1213	threshold	2598	threshold
18.12.2012 12:00	6602	threshold	6017	threshold	1870	threshold	1995	threshold	2305	threshold	3557	threshold
19.12.2012 12:00	4646	range	6218	range	4454	threshold	6008	threshold	2315	threshold	2982	threshold
20.12.2012 12:00	7233	threshold	9549	threshold	2219	threshold	2988	threshold	181	threshold	1033	threshold
21.12.2012 12:00	6857	threshold	6273	threshold	2196	threshold	1848	threshold	1125	threshold	3217	threshold
22.12.2012 12:00	4154	range	11833	threshold	2469	threshold	3166	threshold	1717	threshold	2397	threshold
23.12.2012 12:00	5174	threshold	5982	threshold	1709	threshold	2101	threshold	0	threshold	1865	threshold
24.12.2012 12:00	5227	threshold	6940	threshold	1444	threshold	2200	threshold	1014	threshold	1587	threshold
25.12.2012 12:00	4855	threshold	5161	threshold	1247	threshold	1369	threshold	0	threshold	974	threshold
26.12.2012 12:00	5265	threshold	5350	threshold	1468	threshold	1489	threshold	0	threshold	1309	threshold
27.12.2012 12:00	6512	threshold	7593	threshold	2276	threshold	2953	threshold	1148	threshold	2517	threshold
28.12.2012 12:00	4195	threshold	5531	threshold	1250	threshold	1299	threshold	174	threshold	1067	threshold
29.12.2012 12:00	5879	threshold	10249	threshold	1834	threshold	2564	threshold	489	threshold	1408	threshold
30.12.2012 12:00	9536	threshold	11410	threshold	3657	threshold	6684	range	1917	threshold	3317	threshold
31.12.2012 12:00	7618	threshold	10348	threshold	2267	threshold	3190	threshold	1499	threshold	2188	threshold
min	854 m		1242 m		600 m		750 m		0 m		0 m	
1st quartile	4272 m		5433 m		1585 m		1883 m		142 m		1257 m	
median	**5864 m**		**7124 m**		**2277 m**		**2653 m**		**1529 m**		**2348 m**	
3rd quartile	7972 m		9610 m		3797 m		4585 m		3829 m		4445 m	
max	14149 m		14295 m		9217 m		11378 m		13704 m		14193 m	
criterion used												
estimated from threshold	63%		63%		88%		82%		98%		98%	
estimated from range	20%		15%		12%		18%		0%		0%	
NA because dist.SR > cutoff	17%		22%		0%		0%		2%		2%	

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