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OMBRA: Observing Montello BRoad Activity Deployment of a temporary seismic network to study the deformation process across Montello fault (Eastern Alps)

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Istituto Nazionale di Geofisica e Vulcanologia

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OMBRA: OBSERVING MONTELLO BROAD ACTIVITY DEPLOYMENT OF A TEMPORARY SEISMIC NETWORK TO STUDY THE DEFORMATION PROCESS ACROSS MONTELLO FAULT (EASTERN ALPS)

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Introduction

The seismicity of the Eastern Alps is characterized by the occurrence of a few recent and historical strong events (Figure 1) generated by S-verging thrust faults, in particular located in the Veneto-Friuli border area [Pondrelli et al., 1999 and reference therein]. The whole region is characterized by a high seismic risk, due to large population density and diffuse human activities (industries and agriculture). Several geodynamics studies outline that most of the convergence rate between the Eurasian plate and the Adria microplate (~2-3 mm/yr) is accommodated across this tectonic domain [Serpelloni et al., 2005; D'Agostino et al., 2005]. The seismic release seems to be concentrated in the easternmost part of the Southern Alps, along the boundary between the Po Plain and the Alpine chain, while beneath the mountain range the seismic activity is more sparse and heterogeneous [Castello et al., 2006].

The most remarkable active tectonic structure of the Eastern Southern Alps is the Montello anticline, sited Northwest of Treviso. It looks like a SSW-NNE elongated hill, generated by the uplift and the deformation produced by a S-verging blind thrust (Figure 1, green dashed contour line). Following the uplift of the Piave river terraces and the variations in time of its course, Benedetti et al. [2000], adopting a morphotectonic approach, studied the growth of this particular geomorphic bulge and suggested a slip rate of the order of 1.8-2.00 mm/yr, a bit larger than the 1.5 mm/yr determined by Burrato et al. [2009].

In most of the recent works reporting Plio-Quaternary fault maps [e.g., DISS 3.0.2; Valensise and Pantosti, 2001; Galadini et al., 2005; Poli et al., 2008], the Montello hill is considered as one of the S-verging seismogenic segments that characterize the tectonically active Southern Alps thrust front (Figure 1).

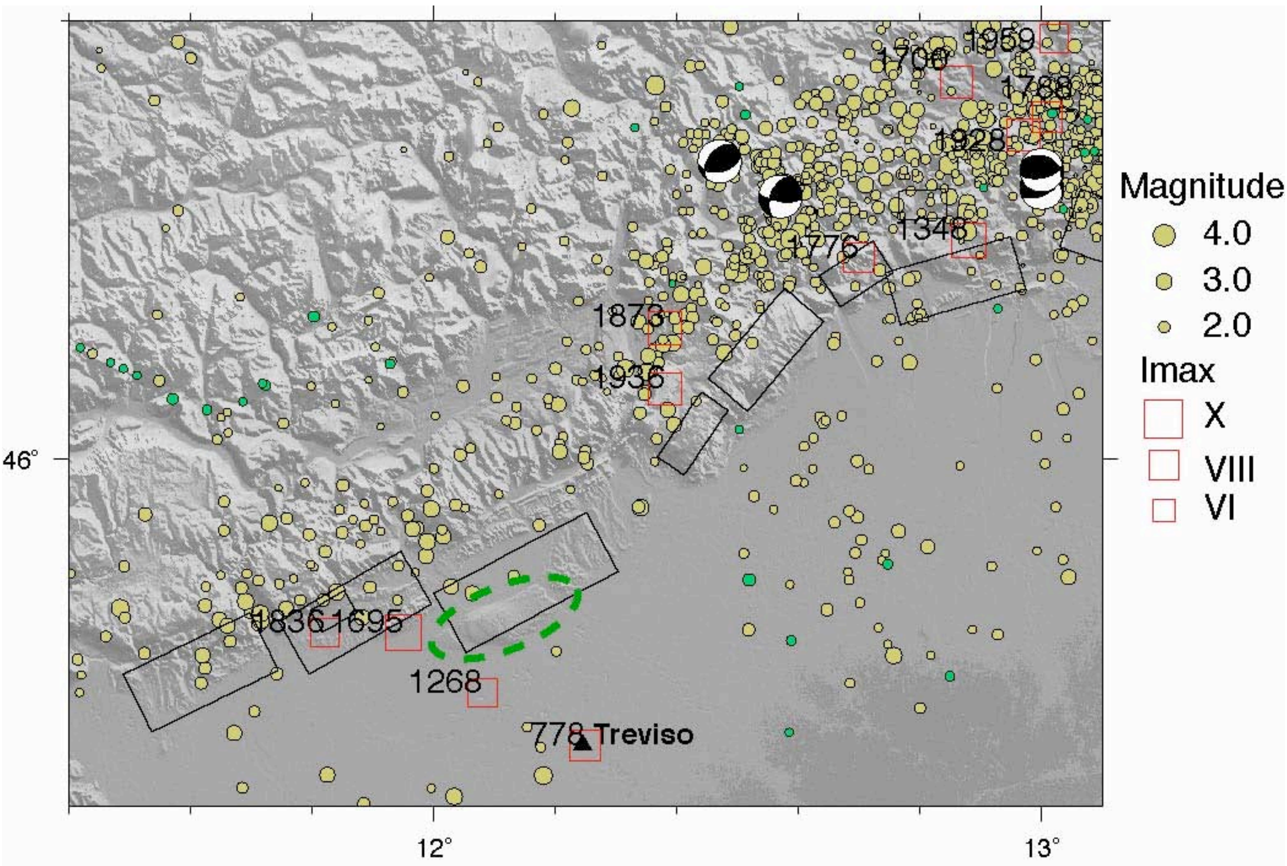

Figure 1. Map of the study region. The dashed green oval points the Montello hill. The seismicity of the last 30 years (circles: yellow for events shallower than 30 km and green for deeper events, Castello et al., 2006), historical events (red squares, Gruppo di Lavoro CPTI, 2004), moment tensors [Pondrelli et al., 2002] and seismogenic sources (black boxes, DISS3.0) have been reported.

Nevertheless, the seismic activity of the last 30 years [Castello et al., 2006; Bollettino Sismico INGV, www.iside.ingv.it, Figure 1] shows that most of the earthquakes with maximum magnitude M_L 4.0 are located east of the study area, across a few dozens km wide belt, encompassing the boundary between the Po plain and the mountain, toward the Cansiglio. Some weaker and sparser seismicity (M_L between 2 and 3) has been recorded along the alpine front, behind the Montello hill. Just a few and low energy earthquakes are located above the Montello hill: the temporary seismic network, operating during the 2004-2005 time interval in the Alpago-Cansiglio region, confirmed the scarce seismicity of the area [Chiaraluce et al., 2009].

The most relevant historical earthquake located close to the Montello is the 1695 Asolo event (I_{max} 10 and M_w 6.61, CPTI04; CPTI Working group 2004), approximately located 15 km northwest of the Montello hill (Figure 1). Moreover, in the last 2000 years other seismic events have shaken the region: in the 778, 1268 and 1836, with macroseismic epicenters located W and SW of the Montello hill, respectively, and in the 1873 and 1936, with macroseismic epicenters located NE of it, in the Alpago-Cansiglio area. An intensity $I_{max} \geq$ VIII has been attributed to these events, corresponding to an equivalent magnitude close to 6.0 (CPTI04). The uncertainty on which active structure has been activated by these events and considering that is unknown if some of them can be associated to the Montello fault, let open the questions about the real seismogenic potential of this active structure.

The OMBRA project aims at investigating about the controversial geophysical questions that arise about the active tectonics and seismogenic potential of the Montello area. From a seismological point of view, we wonder how past relevant seismic events might integrate with the so weak seismicity, lately observed in the area. From a geological point of view, we would like to understand how relatively high plate velocity can accommodate the regional pattern. Moreover, can we discriminate whether the thrust beneath the anticline or the alpine front are potentially active structures?

In order to address the mentioned issues and to study accumulation and geometry of permanent strain through a detailed study of crustal deformation, we have installed a temporary multi-parametric geophysical network, which integrates space geodetic and seismological observations (Figure 2).

Since late 2008, five semi-continuous GPS stations have been installed along a linear NNW-SSW trending 30 km-long array crossing the Montello area [Serpelloni and Cavaliere, 2010] with the goal of studying the deformation processes in the framework of the wider plate boundary kinematics. In particular, we aimed at measuring the local velocity gradient, which will be used to develop models of the geometry and kinematics of faults accumulating elastic deformation. Simultaneous seismic investigations are fundamental to provide independent observations and shed light on a complete geophysical interpretation about the geometry and kinematics of the Montello structure.

For this reason, in 2008 we submitted a request to CoReMo [INGV Consorzio Rete Mobile, Moretti et al., 2010] in order to obtain 10 seismic stations for the monitoring of the Montello region [Serpelloni and Cavaliere, 2010]. Two more stations were provided by the INGV, Sezione di Milano Pavia.

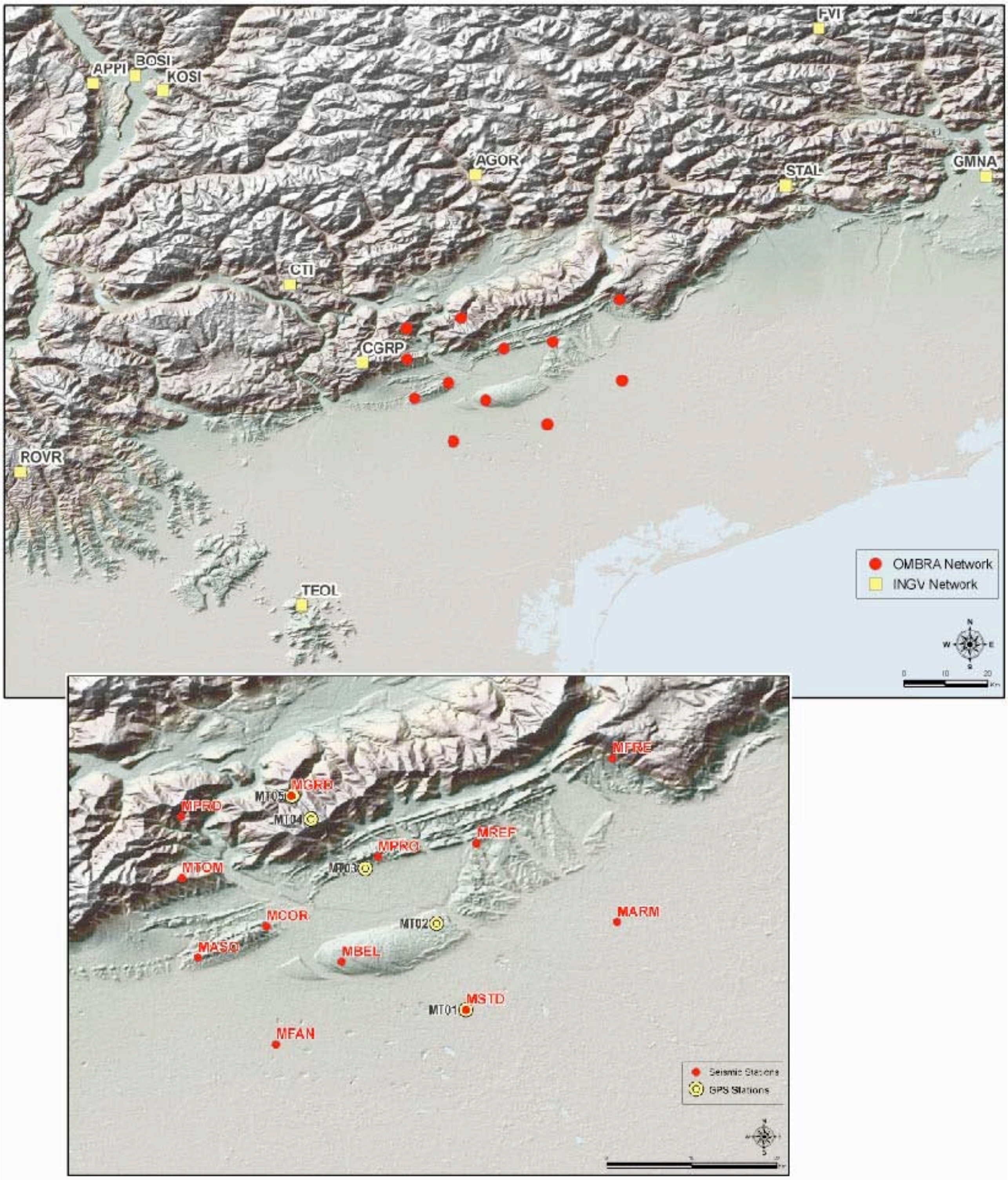

Figure 2. Maps of seismological and geodetical networks operating in the area. Top larger map: RSN Italian national network seismic stations in yellow, Ombra project sites in red. In the bottom inset a zoomed view of Ombra project sites: geodetic semi-permanent stations in yellow, temporary stations in red.

1. The temporary seismometric network: site testing and installation

At first, we worked on site testing in order to find a set of reliable sites for the requested seismic stations. We started with a network design, which would have allowed us to record local seismicity, with the aim to distinguish if the seismic activity occurs on the Montello thrust or on the Alpine thrust, located immediately North of the Montello hill. For this purpose, a "cloud" shaped network around the Montello hill, with a dimension of three times the dimension of the geomorphic body, seemed reliable. This means that some stations are forcedly sited on the Po plain, where the seismic ambient noise is particularly relevant [Marzorati and Bindi, 2009]. Indeed, this area is characterized by a high density in terms of both population and production activities.

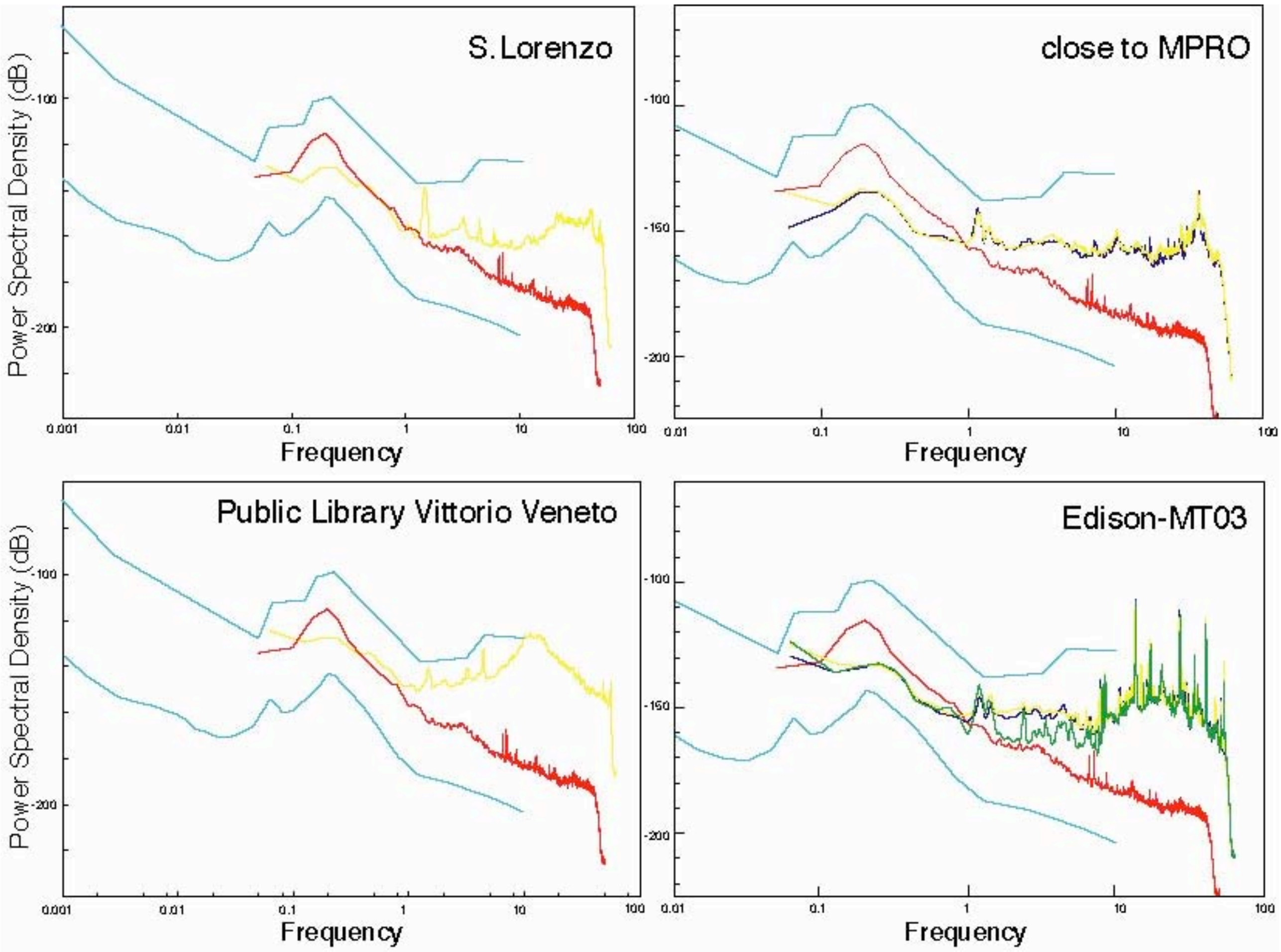

Figure 3. Power spectral densities of some of signals recorded during site-testing. In red is a low noise reference (given by a particularly silent station locate in NW Italy), in light blue are the global minimum (NHLM) and maximum (NHNM) noise reference spectra [Peterson, 1993]. In green are plotted spectra for data recorded at 8 am, in blue for data recorded at 3 pm, and yellow for data recorded at 11 pm. For S. Lorenzo and Public Library sites we have records just for few hours around 12 am, represented by one curve only. The site Edison corresponds to the MT03 point of the geodetic network (Figure 2).

Records for noise evaluation have been acquired with a Triullium 40s (http://www.nanometrics.ca) seismic sensor coupled with a Reftek-130 (www.reftek.com), 24 bit digitizer. At each site we recorded for a minimum of two to a maximum of 12 hours, to allow the sensor to stabilize. Examples of these noise measurements are reported in Figure 3. Noise measurements have been done averaging the three components over one hour of recordings at a sampling rate of 125 Hz. The analysis revealed that some of the sites used for GPS measurements were also reliable for the seismic monitoring, e.g. MGRD (Malga Garda, the northernmost point of our network, corresponding to MT05 of the geodetic network, Figure 2) and MSTD (Sant'Andrà, in the plain, corresponding to MT01 of the geodetic network, Figure 2).

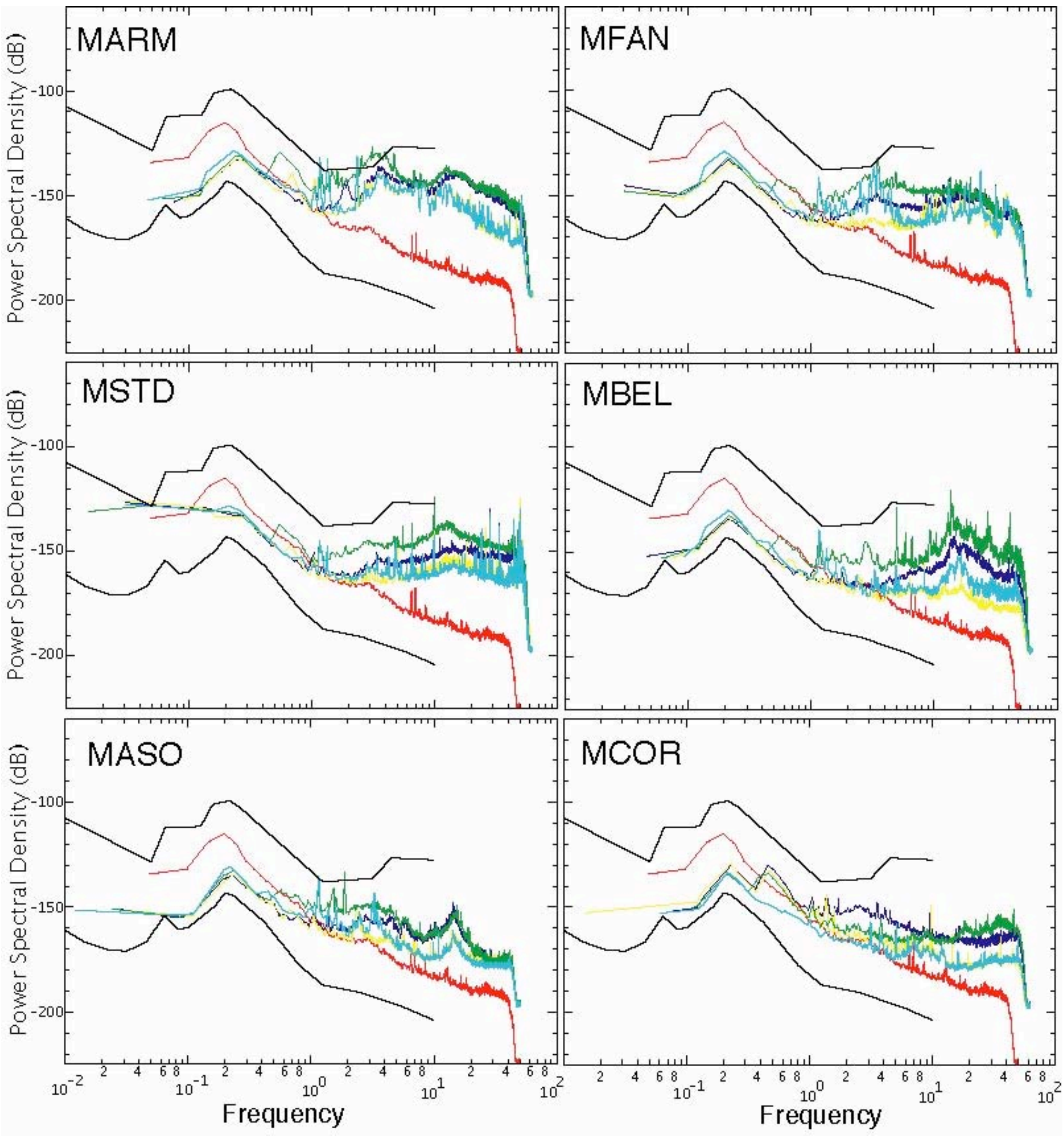

Figure 4. Power spectral densities for stations of OMBRA network, southern sites (see map in Figure 2). Black lines are the global minimum (NHLM) and maximum (NHNM) noise reference level [Peterson, 1993], the red one is a low noise reference level. Colors refer to different day and time: blue and yellow are for a not working day at 7:00-8:00 and 23:00-24:00 respectively; green and light blue are for a working day at the same time intervals.

Due to site testing results, we had to change several times the network design, because of the highly noisy signal that we obtained in many of the investigated sites. The high density of both population and production activities located all around the Montello hill, causes a significant increment in local ambient seismic noise. For instance, in the NE area of the network we tested two sites in Vittorio Veneto, one downtown the city (on the basement of the local Public Library) and one in the first mountain front N of the town center, in the S. Lorenzo village. We were particularly optimistic for this second one, isolated, silent, on outcropping rocks and inside an old unused public building. Unfortunately, spectra of the recorded signal for both sites (Figure 3) showed an evident peak at 1-1.2 Hz, much more evident in the second, more silent place, large enough to exclude forcedly the use of both sites. However, this peak appears in all sites (Figure 3), even if somewhere it is more pronounced; it seems that it may be attributed to the large industrial and human activities of this region [Marzorati and Bindi, 2006], but we consider to investigate and to better understand its source.

In any case, the site testing allowed us to decide where to place our seismic stations, hence as soon as we obtained by the CoReMo the 10 complete sets of instruments, we rapidly installed them around the Montello (Figure 2) in June 2010. Two more stations were provided by the INGV, Sezione di Milano Pavia. The whole network has been operating since early July 2010 for the expected duration of at least one year, covering an area of about 30x40 km^2 (Figure 2).

In Figures 4 and 5 are reported the power spectral densities obtained for sites we finally occupied with OMBRA instruments. Note that MGRD is particularly silent, being located on the peak of the Monte Cesen, with rock outcrops, far away from any kind of noise, excluding cows (see the station sheet in the Supplementary Material), while MSTD, located in the industrial Treviso plain, is very noisy. We choose this last one site for logistic reasons, such as electric power supply availability and place surveillance.

Among the existing installation sites, we decided to include in the network the site of Asolo where a strong-motion station (ASO7) belonging to the strong motion network of Northern Italy [http://rais.mi.ingv.it/; Augliera et al., 2009] is already present. We installed very close to the accelerometer the velocimetric station named MASO (see Figures 2 and 3).

Otherwise, available facilities were not enough tempting to use many places investigated during the site-testing phase of the experiment. As an example, we cannot use the GPS point named MT02 (Figures 2 and 3). Indeed, this site is located inside the area of a gas reservoir control well, belonging to the Edison company, where compressors, working continuously, produce a high level of noise that is not possible to reduce (Figure 3, right-bottom panel).

Each station is equipped with a three components Lennhartz LE-3D/5s seismometer (http://www.lennartz-electronic.de), a Reftek-130, 24 bit digitizer and a GPS antenna. We use 2 and 4 Gb removable disks for local data storage basically depending on site accessibility. The power is provided by solar panels in five sites and electric power in the other seven. The characteristics of each site are summarized in the station sheets added at the end of this report as supplementary material. The coordinates of the final network configuration are listed in Table 1.

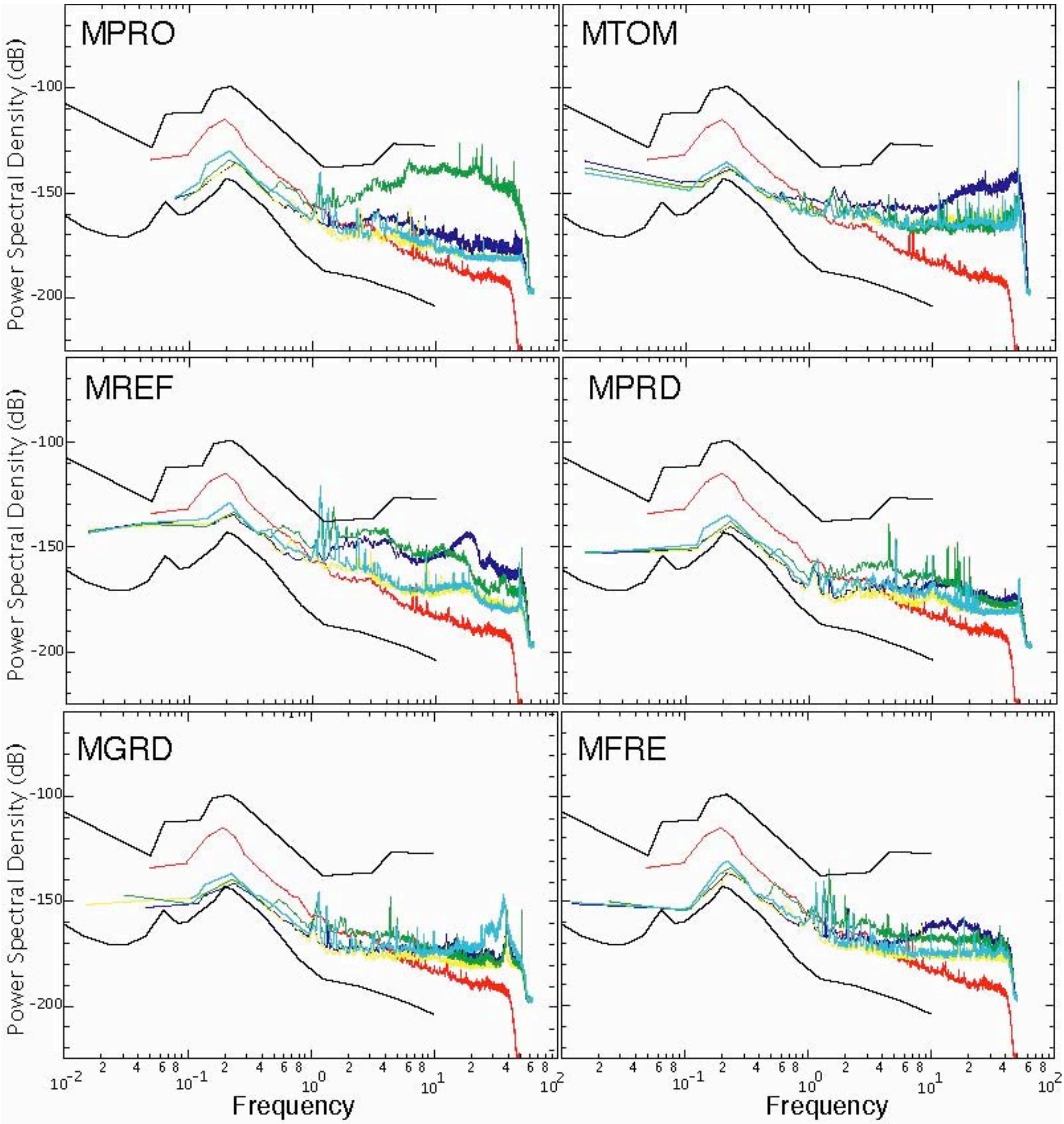

Figure 5. Power spectral densities for stations of OMBRA network, northern sites (see map in Figure 2). Black lines are the global minimum (NHLM) and maximum (NHNM) noise reference level [Peterson, 1993], the red one is a low noise reference level. Colors refer to different day and time: blue and yellow are for a not working day at 7:00-8:00 and 23:00-24:00 respectively; green and light blue are for a working day at the same time intervals.

Table 1. Coordinates of OMBRA station sites (see map in Figure 2).

Station Code	lat	long	quote (m)	Date of installation	Sampling rate (Hz)	Previous location Code / type
MARM	45.84186667	12.36016167	33	06/07/2010	125	
MASO	45.80404167	11.91636167	365	06/22/2010	100	ASO7 /RAIS
MBEL	45.79935000	12.06860333	271	06/09/2010	125	
MCOR	45.83708167	11.98870833	394	06/29/2010	125	
MFAN	45.71194333	11.99893000	65	06/07/2010	125	
MFRE	46.01506000	12.35523500	545	06/22/2010	100	
MGRD	45.97535667	12.01515000	1335	06/08/2010	125	MT05 / GPS
MPRD	45.95337500	11.89855500	705	06/08/2010	125	
MPRO	45.91060833	12.10702667	281	06/07/2010	125	
MREF	45.92492167	12.21168333	268	06/08/2010	125	
MSTD	45.74855500	12.20028333	101	06/08/2010	125	MT01 / GPS
MTOM	45.88829000	11.89927167	897	06/09/2010	125	

2. Working network

On June 23, 2010, at 21:46 UTC, when most of the OMBRA network was already working, in the Montello area an earthquake M_L 2.9 occurred (Figure 6). Seven stations recorded correctly the event (Figure 7), while others had some timing problems (e.g. MASO and MBEL) or power problems (e.g. MREF and MCOR). In figure 6 are mapped the locations obtained by the National Network, the OGS (http://www.crs.inogs.it/) and by the OMBRA network, also reported in Table 2. It is important to remember that these three locations – distant 4 to 8 km each others - have been determined with three different sets of stations; just OMBRA stations where really close to the event and located around it. This favorable condition is enahnced by the lowest horizontal error attributed to the OMBRA location, together with a small r.m.s. of 0.16 (Table 2).

These recordings are particularly interesting because they allow to verify the sensitivity threshold of our network. It is worth noting, in fact, that in this case the national network located an isolated earthquake, whereas we can clearly distinguish a smaller event 14 minutes after the main shock (Figure 8). A good location has been determined using the OMBRA stations only (small star in Figure 6) and preliminary computations estimate a M_w 1.7. This would mean that the OMBRA network is working well enough to improve the local detection threshold.

Table 2. Coordinates of the June, 23 event, determined by three different (see map in Figure 6).

Agency	Latitutde	Longitude	Depth (km)	Horiz. Error (km)
OMBRA	45.777	12.072	13.53	±0.75
INGV NN	45.845	12.063	5.00 (fixed)	±1.9
OGS	45.810	12.058	10.00	±0.8

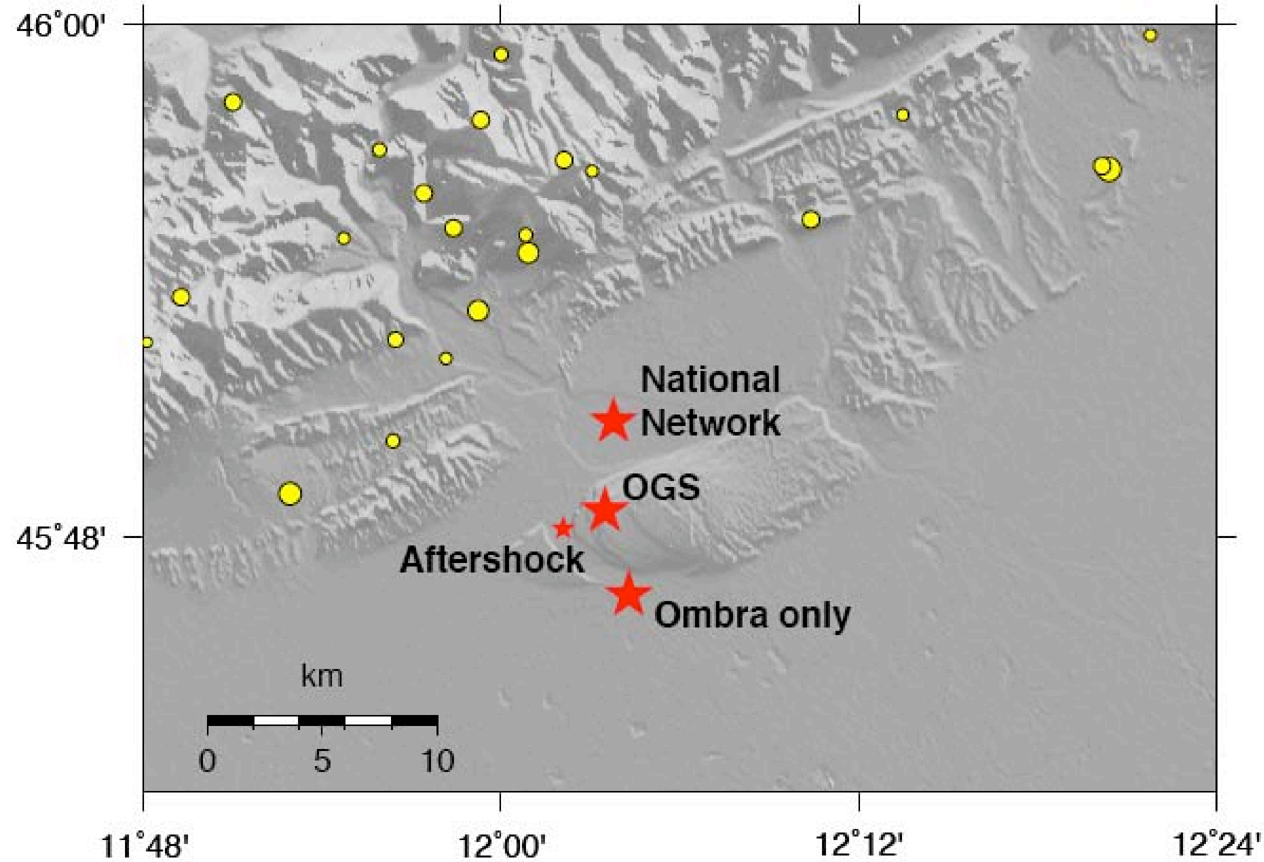

Figure 6. Map of the June 23 earthquake, M_L 2.9, (big red stars) located by the National Network (http://cnt.rm.ingv.it/data_id/2212888260/event.php), OGS (http://www.crs.inogs.it) and OMBRA network. It is drawn together with the smaller event detected 14 minutes later and located with the OMBRA stations. In the background (yellow circles) the seismicity recorded between 2003 and 2008.

At the moment we have more than 4 months of recordings. Just a few problems of power decreased our detection in the first time the networks was switched on, but at present stations are working properly. At the end of this experiment we should have one year of seismic data from our 12 temporary stations, to be added to recordings of the National Network and of OGS (Istituto Nazionale di Oceanografia e Geofisica Sperimentale) permanent stations. We will work on continuous data to identify and localize any seismic events occurring around the Montello hill. All data we acquire at the end of the experiment will be uploaded in the repository of Coremo, but will be open just to OMBRA research group for two years, and successively to will be full open.

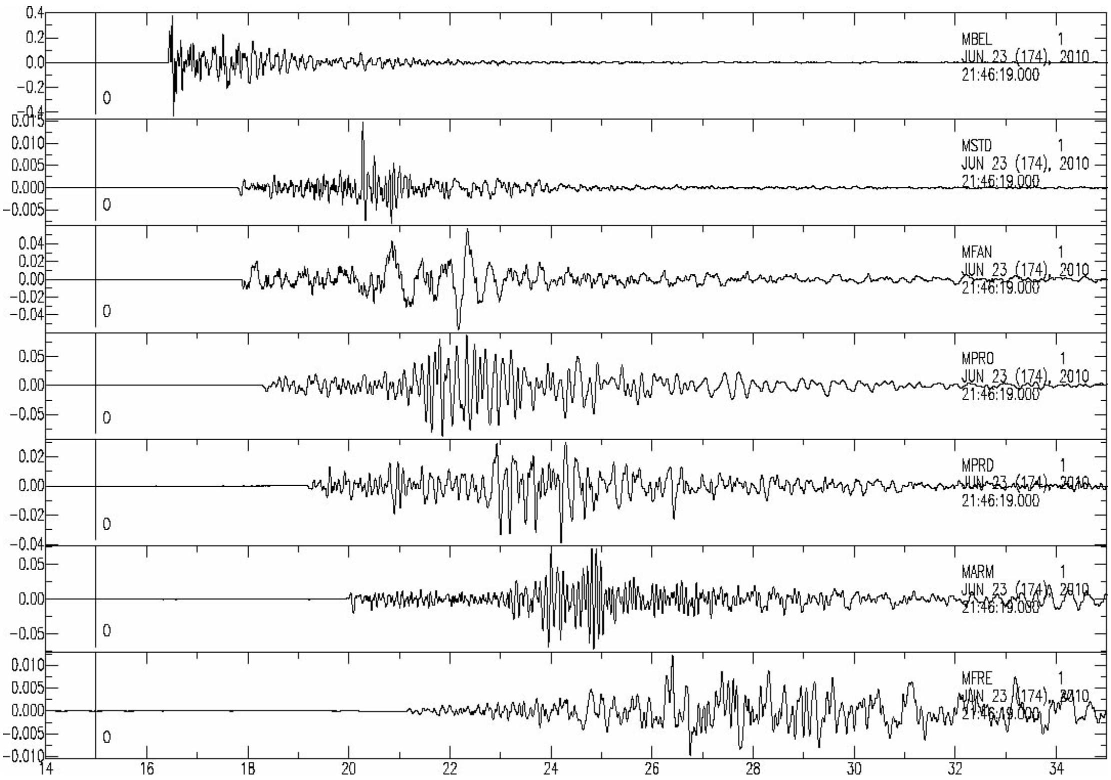

Figure 7. Recordings of unfiltered vertical component (in counts) of available stations of the OMBRA network for the event of June 23, 2010, 21:46 UTC, M_L 2.9.

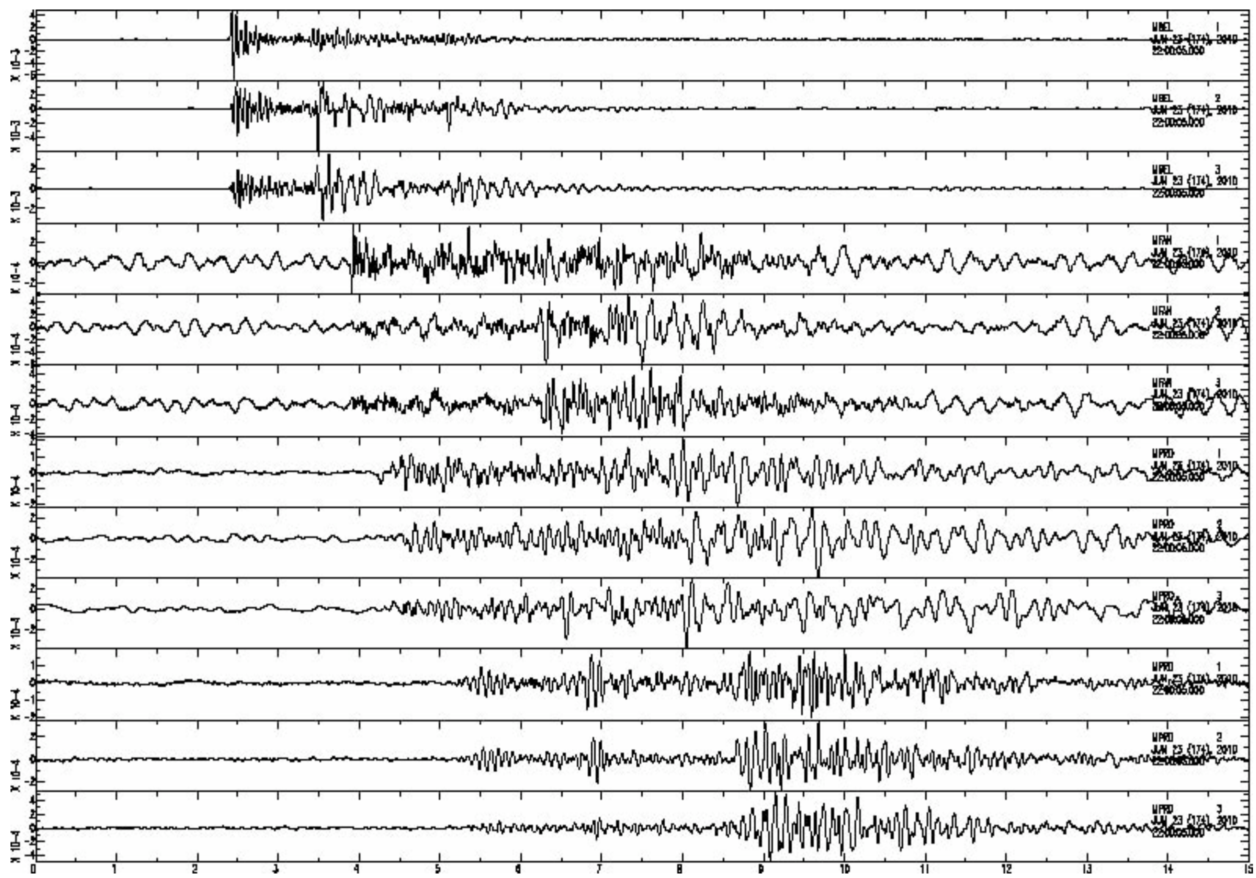

Figure 8. Unfiltered recordings (in counts) of the smaller event occurred 14 minute later with respect to the one of June 23, 2010.

Conclusions

Up to now the OMBRA project installed 12 seismometric stations around the Montello region. A couple of them are located together with GPS stations. We have been acquiring some months of data. Immediately after the installation of OMBRA stations (some of them were not still working properly) we recorded a small earthquake, M_L 2.9, also located by the national network; in the same occasion we have also recorded, and located, another smaller event, occurred 14 minutes later the first and not located by the national network. We thus know that we can increase, with this temporary local network, the event detection with respect to the national network.

At the end of the experiment, after one year of acquisition, we will identify any seismic event occurred in the study area with the help also of OGS and national network stations data. These results would allow to evaluate the seismic rate of this region and to compare it with the geodetic velocity determined by GPS measurements. A detailed investigation of the Montello area, through multi-parametric measurements will help to make light on geometric characteristics and accumulation of elastic strain and deformation. Concerning the kinematics parameters, this study will provide some estimates of the inter-seismic slip rate (to be compared with long term slip rate obtained by geological classical data), the partitioning of slip deformation, the evaluation of seismic moment balance and possible aseismic creep.

Moreover, we aim at determining the geometry of the seismogenetic fault planes, the depth of brittle-ductile transition zone and potential lateral segmentation of the active structures. In particular, with very good location of local seismicity, we intend to identify which thrust fault may be considered active, if the Montello thrust or the Alpine thrust front, just north of the Montello. All these data will be useful in any future evaluation of the seismic risk of an area where only a diffuse micro-seismicity has been recently observed, but potentially active faults have generated significant events in the past.

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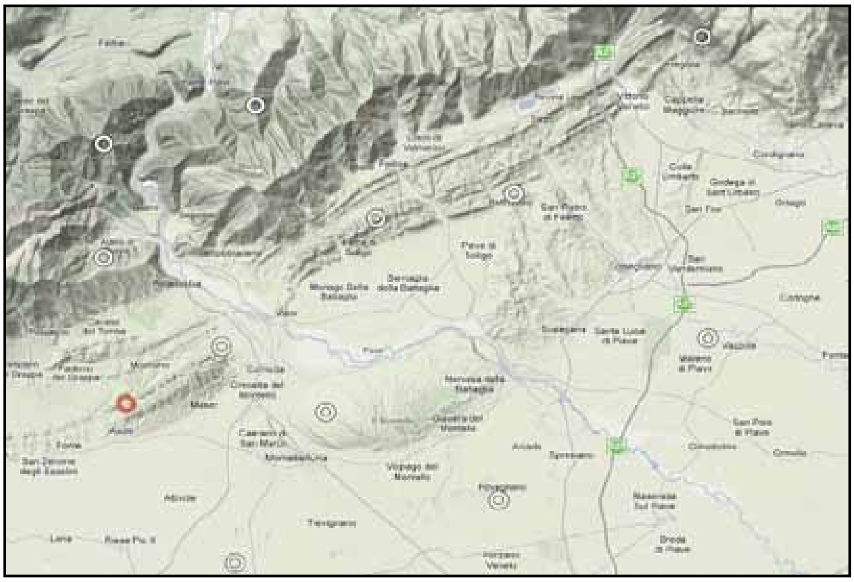
Station Sheets

OMBRA PROJECT

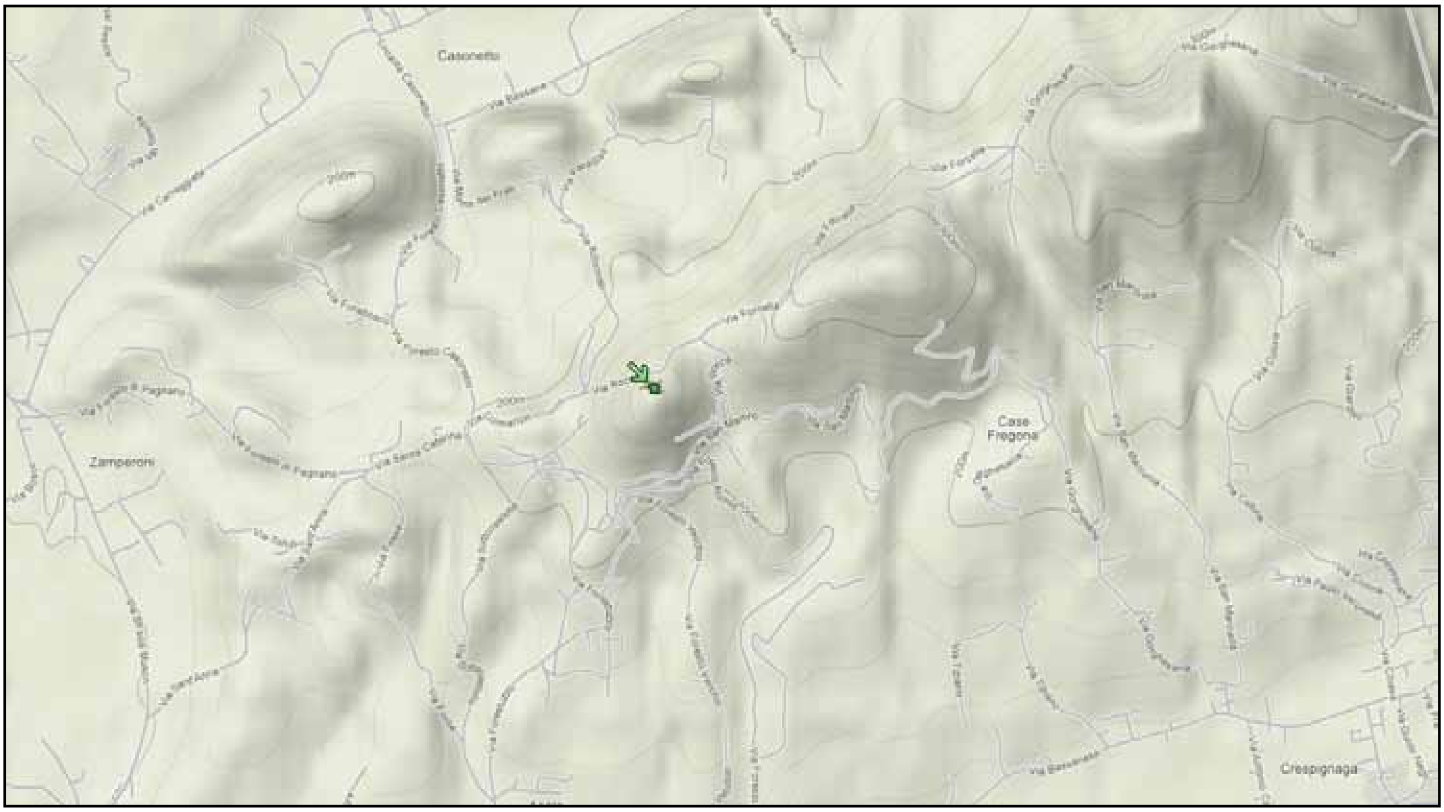
MASO

Station ID

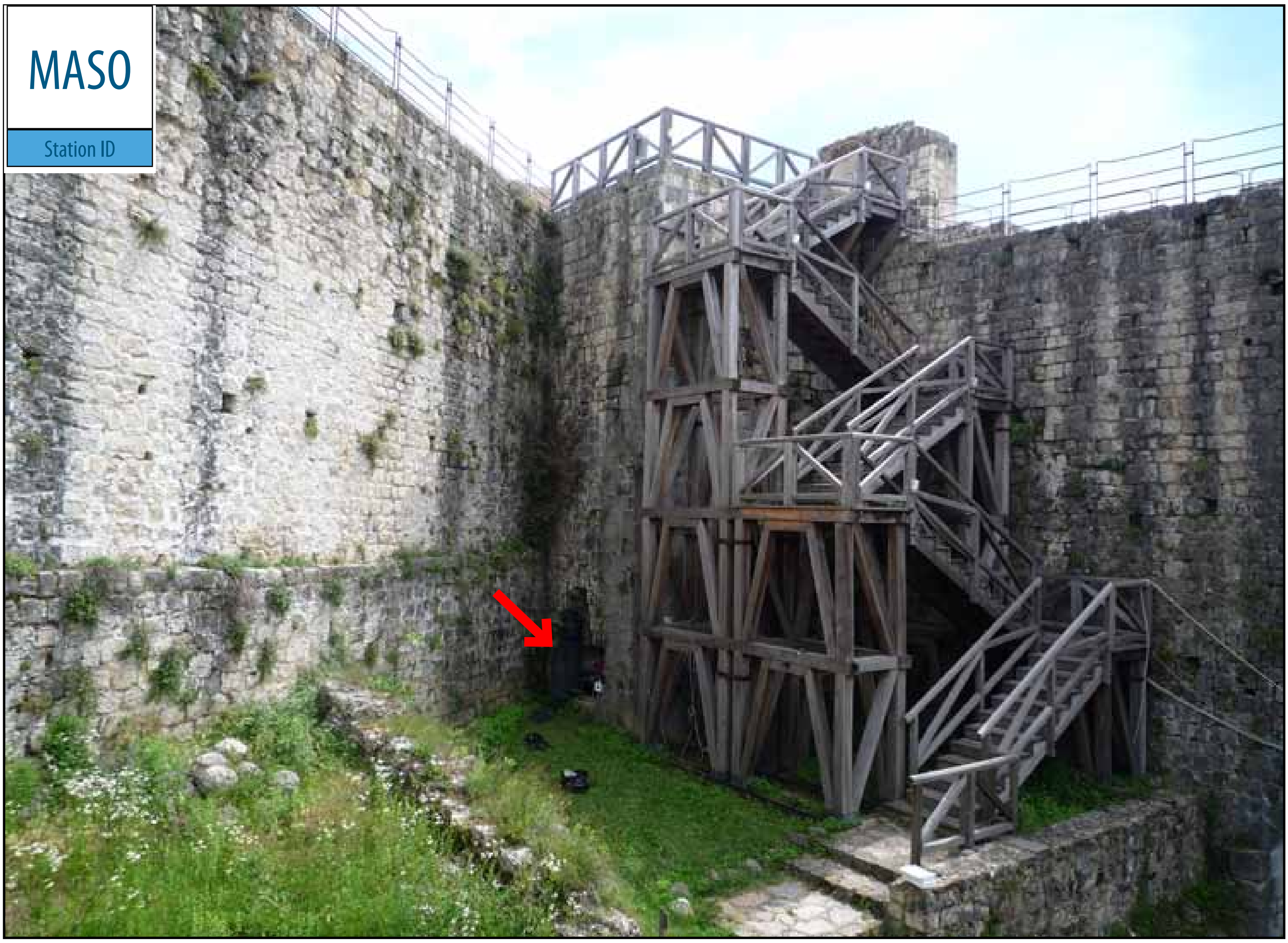
STATION NAME	Asolo
LOCATION	Rocca medioevale, Asolo (TV)



LATITUDE (dd - dm)	45.80404	45:48.24
LONGITUDE (dd - dm)	11.91636	11:54.98
ELEVATION (m)	365	
SUBSTRATE	Building	
MONUMENT	Placed	
ACCESS	Open	
LAND PROPERTY	Public	
SECURITY LEVEL	Low	
4X4 CAR	No	
POWER SUPPLY	Electric Current	



NOTE	Station located on the AS07 site of the RAIS network (http://rais.mi.ingv.it/)


MASO
Station ID

MCOR

Station ID

STATION NAME	Cornuda
LOCATION	Santuario della Madonna della Rocca, Cornuda (TV)

LATITUDE (dd - dm)	45.83708	45:50.22
LONGITUDE (dd - dm)	11.98870	11:59.32
ELEVATION (m)	394	

SUBSTRATE	Sediments
MONUMENT	Buried
ACCESS	Restricted
LAND PROPERTY	Private
SECURITY LEVEL	High
4X4 CAR	No
POWER SUPPLY	Solar Panel

NOTE	The station is open air, in the terrain previously used as kitchen garden by nuns of the monastery

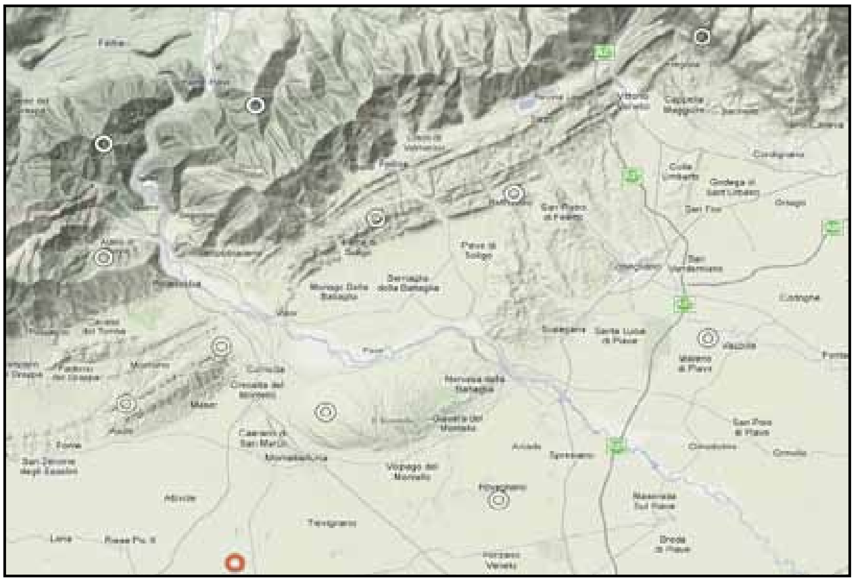
MCOR

Station ID

MFAN

Station ID

STATION NAME	Fanzolo
LOCATION	Cimitero di Fanzolo, Vedelago (TV)



LATITUDE (dd - dm)	45.71194	45:42.72
LONGITUDE (dd - dm)	11.99893	11:59.94
ELEVATION (m)	65	

SUBSTRATE	Building
MONUMENT	Buried
ACCESS	Restricted
LAND PROPERTY	Public
SECURITY LEVEL	High
4X4 CAR	No
POWER SUPPLY	Solar Panel

NOTE	Station is open air, along the east perimeter wall, in the most recent part of the cemetery

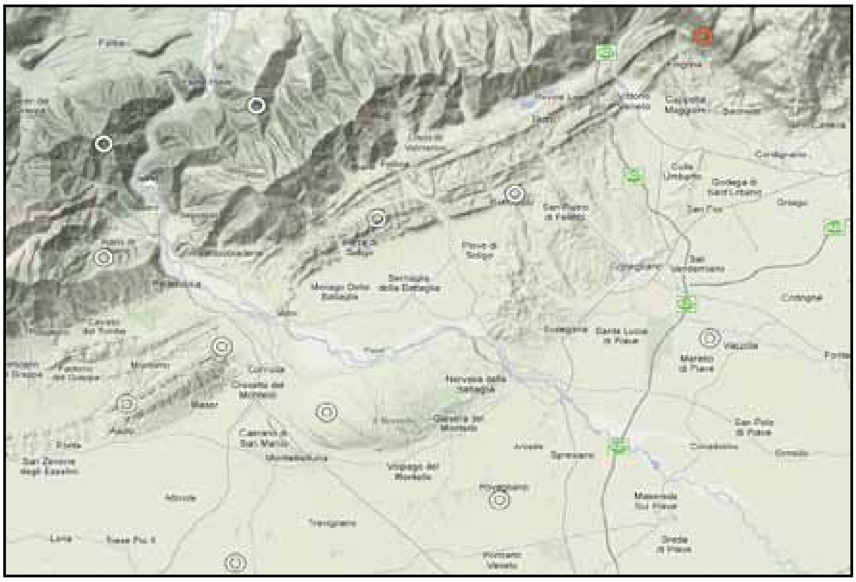
MFAN

Station ID

OMBRA PROJECT

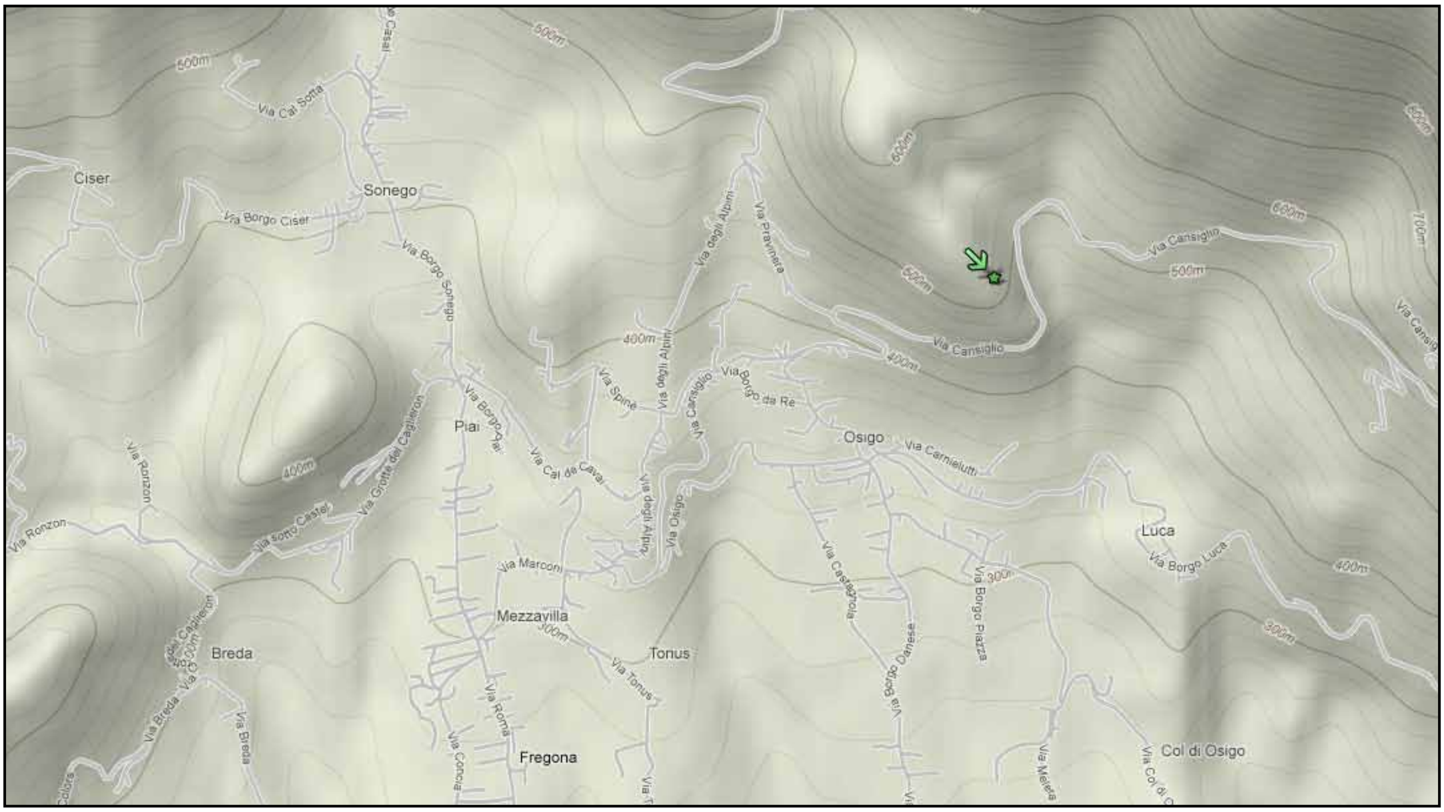
MFRE
Station ID

STATION NAME	Fregona
LOCATION	Via Cansiglio, Chiesa di S.Daniele, Osigo, Comune di Fregona (TV)



LATITUDE (dd - dm)	46.01506	46:0.90
LONGITUDE (dd - dm)	12.35523	12:21.31
ELEVATION (m)	545	

SUBSTRATE	Building
MONUMENT	Placed
ACCESS	Restricted
LAND PROPERTY	Public
SECURITY LEVEL	High
4X4 CAR	No
POWER SUPPLY	Solar Panel



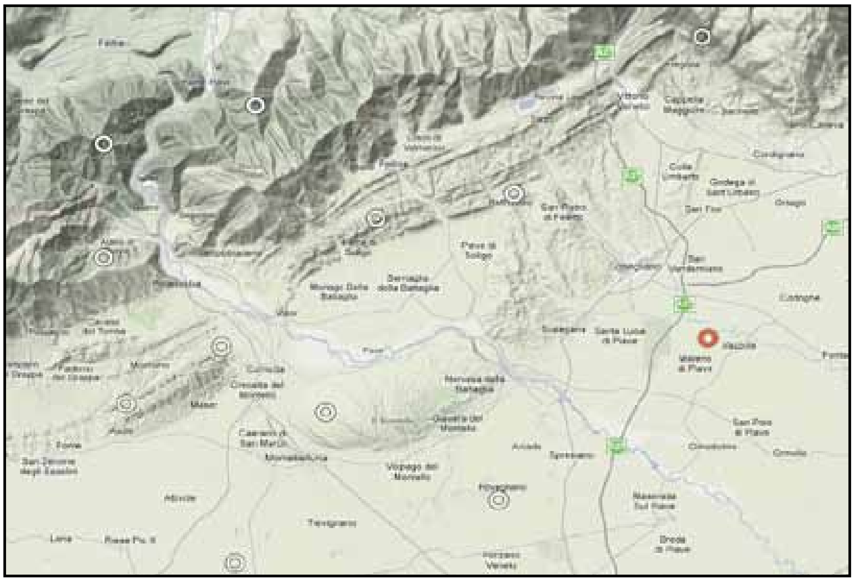
NOTE	


MFRE
Station ID

MARM

Station ID

STATION NAME	Mareno di Piave
LOCATION	Via Biffis, Cimitero di Soffatta, Mareno di Piave (TV)



LATITUDE (dd - dm)	45.84187	45:50.51
LONGITUDE (dd - dm)	12.36016	12:21.61
ELEVATION (m)	33	
SUBSTRATE	Building	
MONUMENT	Placed	
ACCESS	Restricted	
LAND PROPERTY	Public	
SECURITY LEVEL	High	
4X4 CAR	No	
POWER SUPPLY	Solar Panel	

NOTE	we decided for the solar panel instead than electricity power because it is not clear if the power supply is by the Comune or the agency that make the cemetery works

MARM

Station ID

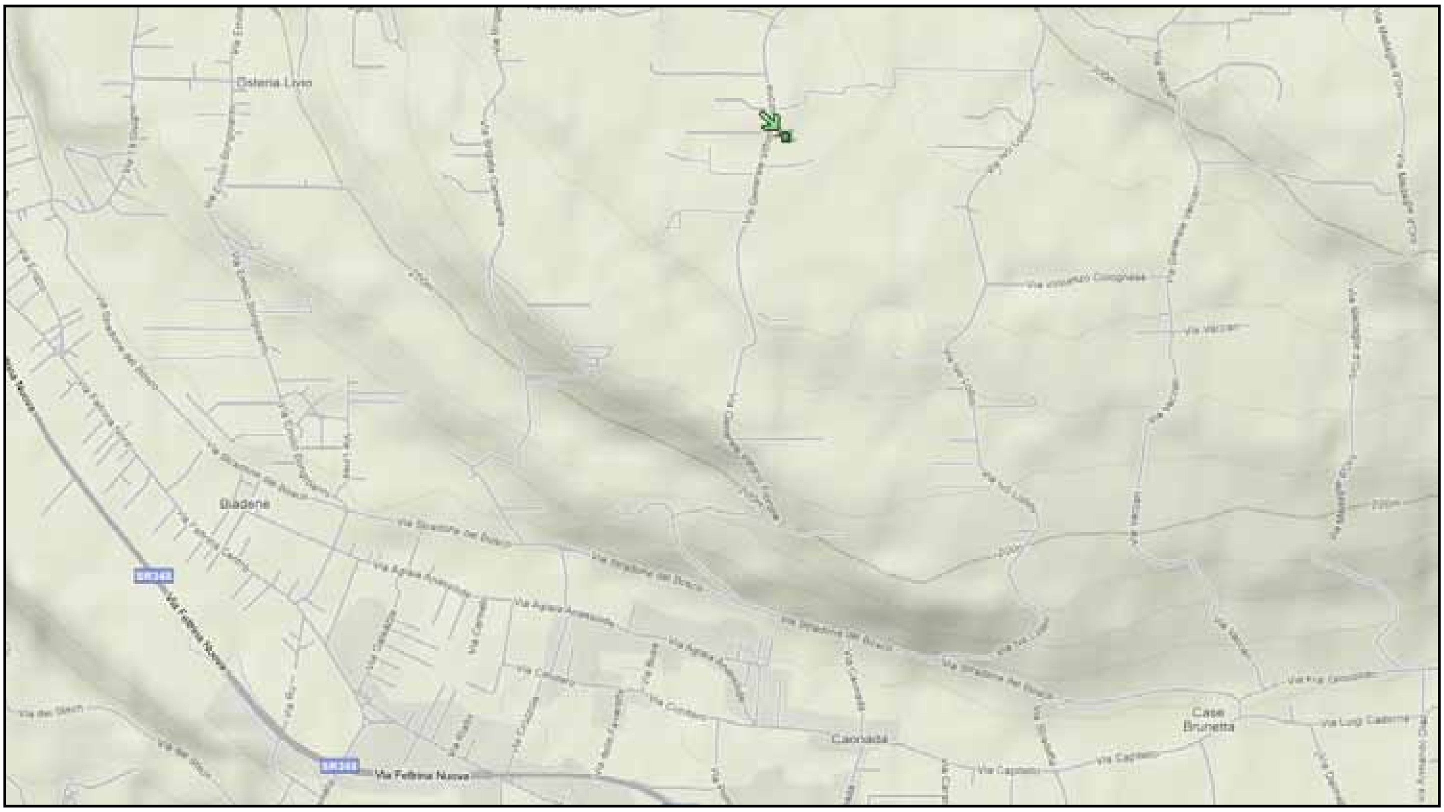
MBEL	Station ID

OMBRA PROJECT

STATION NAME	Montebelluna
LOCATION	Via Generale Vittorio Fiorone, Ex Scuola S.Lucia, Montebelluna (TV)

LATITUDE (dd - dm)	45.79935	45:47.96
LONGITUDE (dd - dm)	12.06860	12:4.12
ELEVATION (m)	271	

SUBSTRATE	Sediments
MONUMENT	Buried
ACCESS	Restricted
LAND PROPERTY	Public
SECURITY LEVEL	High
4X4 CAR	No
POWER SUPPLY	Electric Current



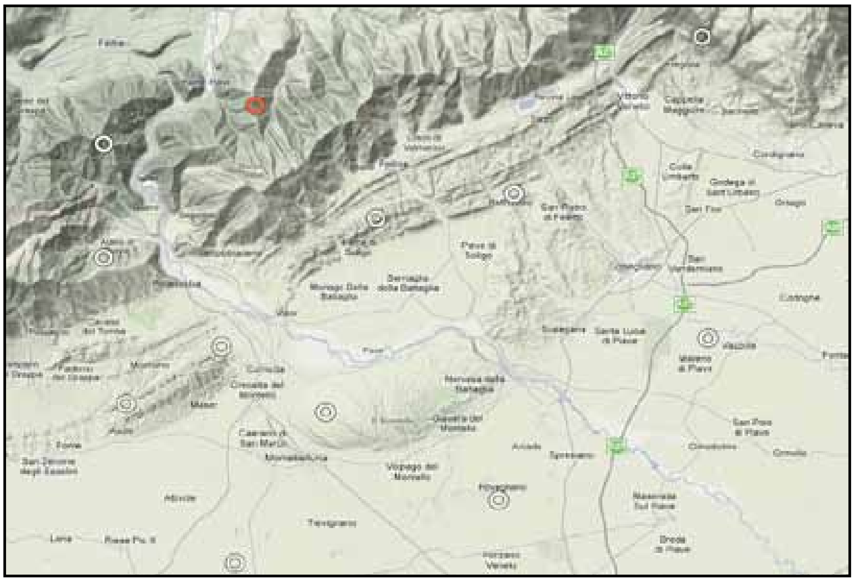
NOTE	The station is in the back garden of the abandoned school, on the northern side of the building

OMBRA PROJECT

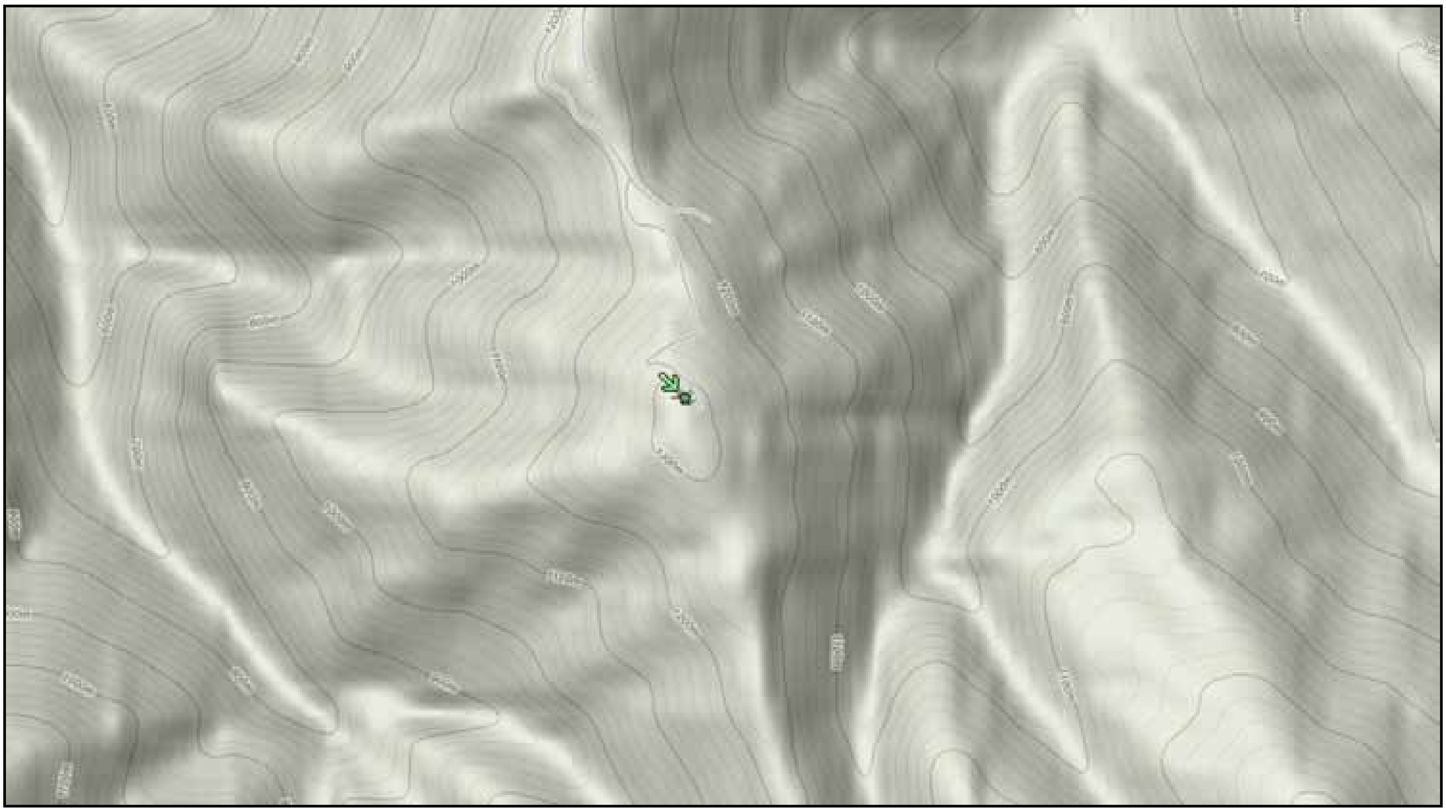
MGRD

Station ID

STATION NAME	Malaga Garda
LOCATION	Lentiai (BL)



LATITUDE (dd - dm)	45.97535	45:58.52
LONGITUDE (dd - dm)	12.01515	12:0.91
ELEVATION (m)	1335	
SUBSTRATE	Bedrocks	
MONUMENT	Placed	
ACCESS	Restricted	
LAND PROPERTY	Public	
SECURITY LEVEL	High	
4X4 CAR	Yes	
POWER SUPPLY	Solar Pannel	



NOTE	Arrived to Malaga Garda the station is on the hill on the right. To reach the site you have to open the gate before the cowshed and climb by car.

MGRD

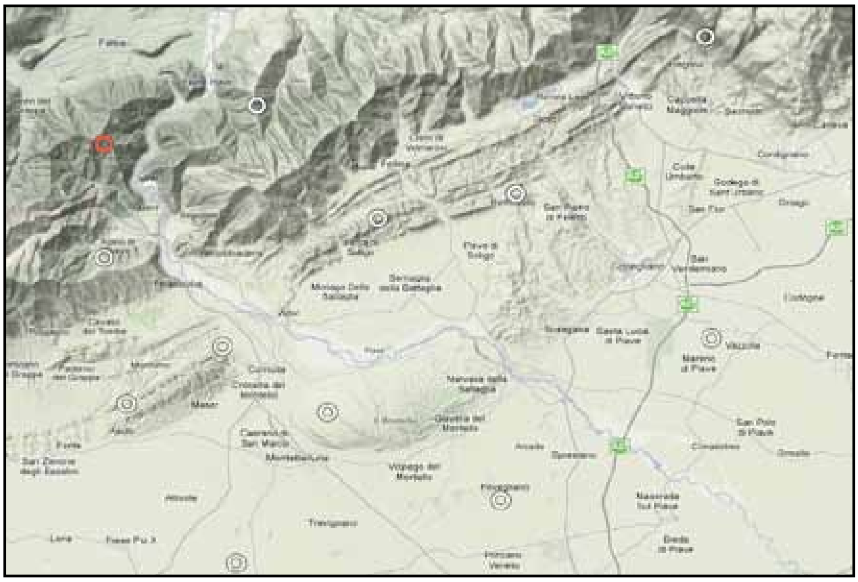
Station ID

OMBRA PROJECT

MPRD

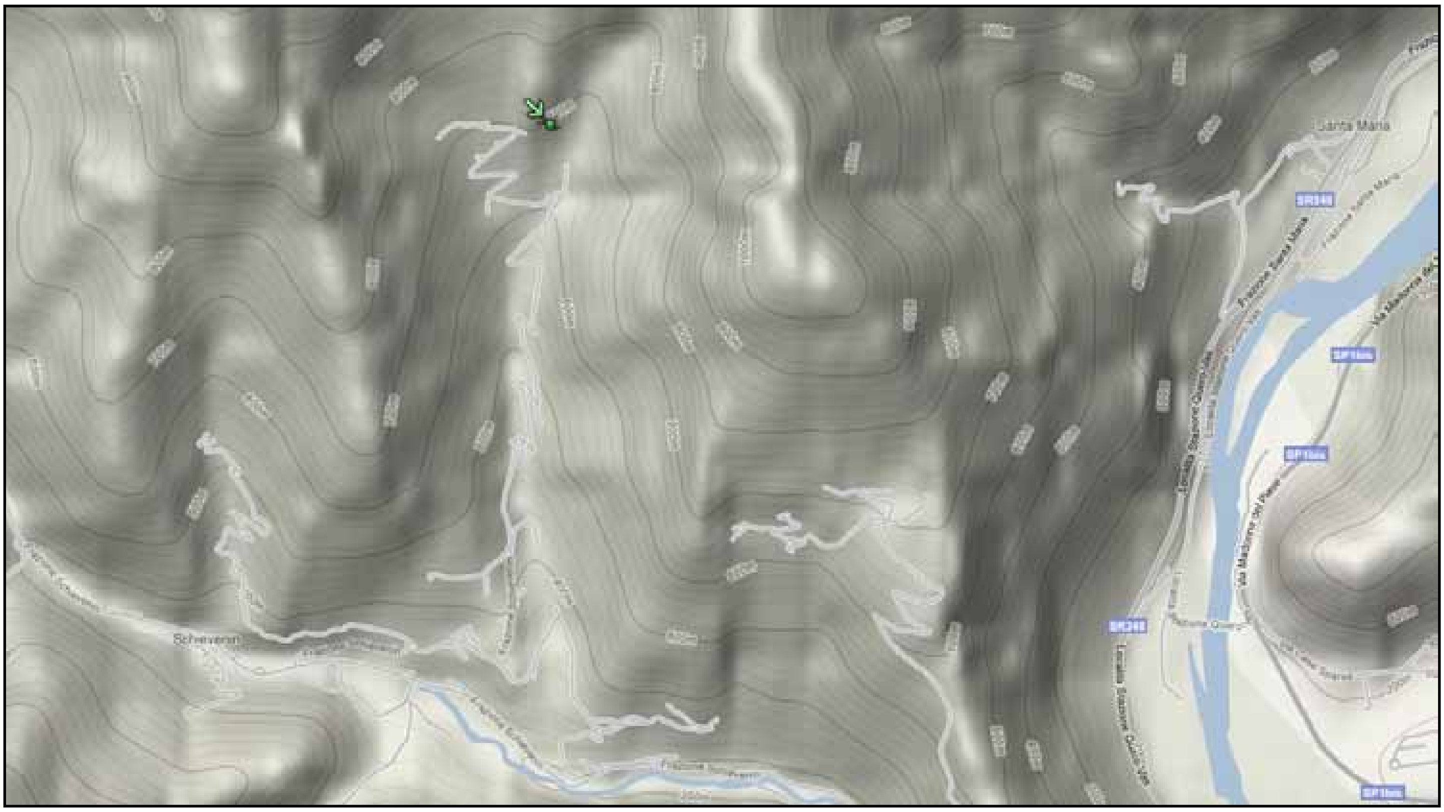
Station ID

STATION NAME	Prada
LOCATION	Via Prada, Schievenin, Quero (BL)



LATITUDE (dd - dm)	45.95337	45:57.2
LONGITUDE (dd - dm)	11.89855	11:53.91
ELEVATION (m)	705	

SUBSTRATE	Bedrocks
MONUMENT	Placed
ACCESS	Open
LAND PROPERTY	Private
SECURITY LEVEL	High
4X4 CAR	Yes
POWER SUPPLY	Electric Current



NOTE	The station is beyond the house, along the trail to the wood, among trees, in a natural gouge. The station may be reached also bypassing the private property, following the trail before the house; thus the access is free, but the security remains high due to the remoteness of site

MPRD

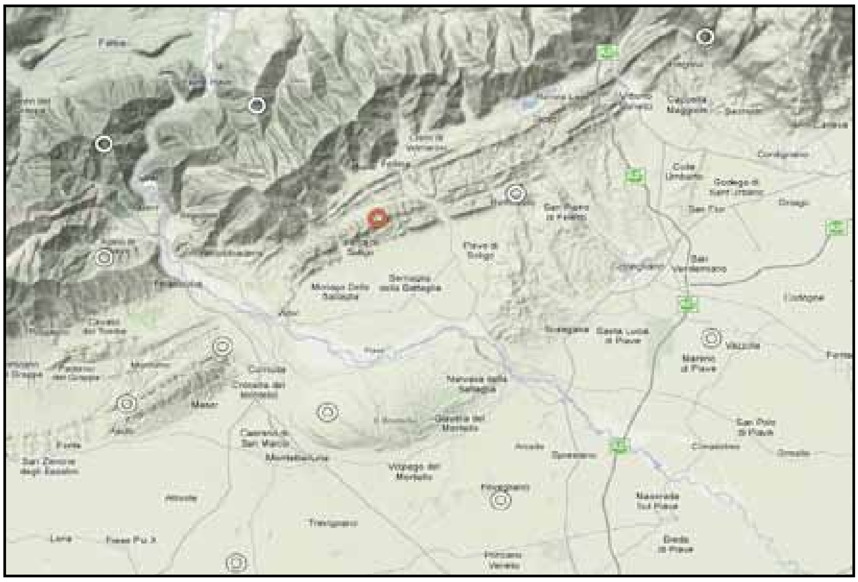
Station ID

OMBRA PROJECT

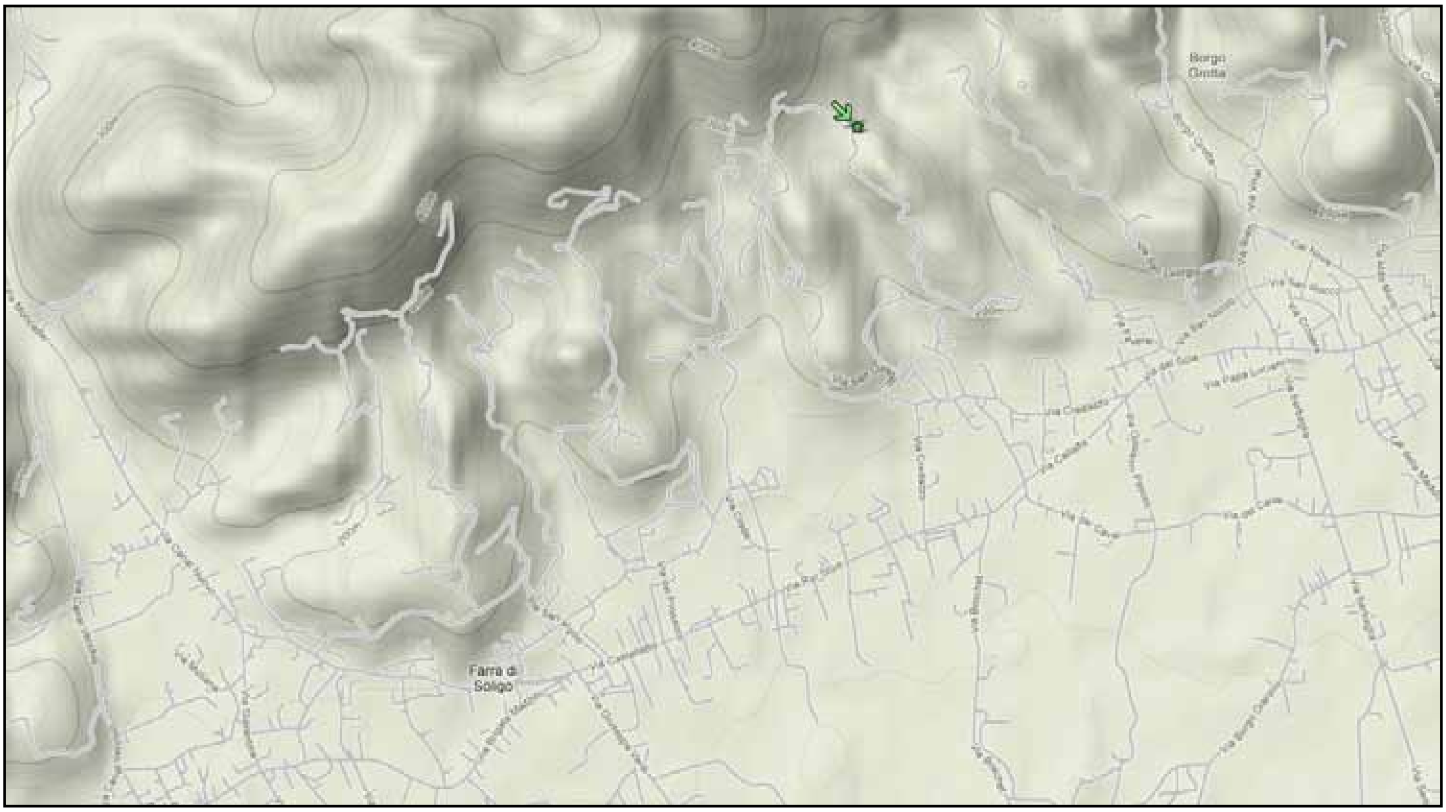
MPRO

Station ID

STATION NAME	Prosecco
LOCATION	Agriturismo "Al Credazzo", via Credazzo, Farra di Soligo (TV)



LATITUDE (dd - dm)	45.91060	45:54.64
LONGITUDE (dd - dm)	12.10702	12:6.42
ELEVATION (m)	281	
SUBSTRATE	Sediments	
MONUMENT	Buried	
ACCESS	Open	
LAND PROPERTY	Private	
SECURITY LEVEL	Low	
4X4 CAR	No	
POWER SUPPLY	Solar Panel	



NOTE	The station is open air, in a vineyard property of the Agriturismo Al Credazzo

MPRO

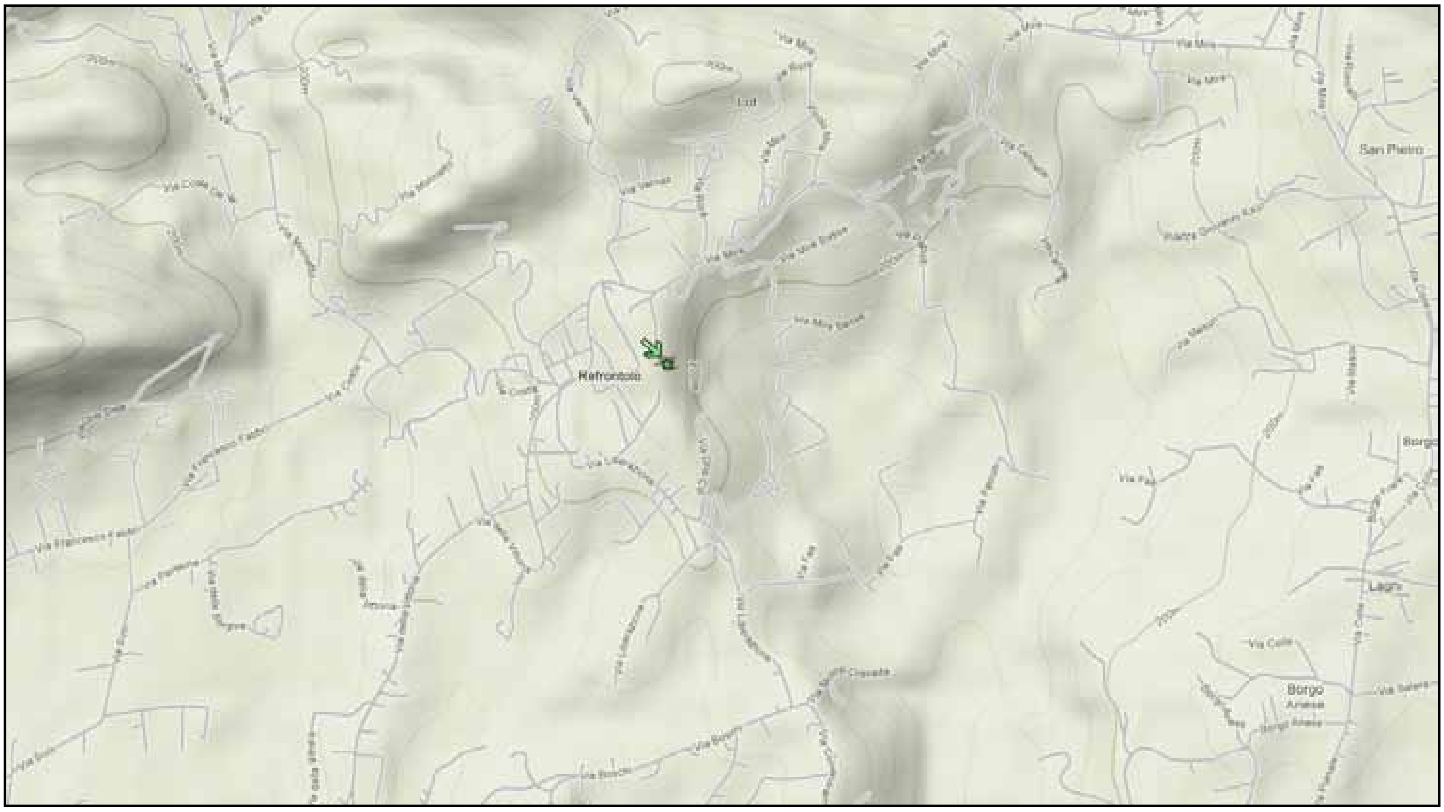
Station ID

MREF

Station ID

STATION NAME	Refrontolo
LOCATION	Via Giorgio di Vittorio, Refrontolo (TV)

LATITUDE (dd - dm)	45.92492	45:55.5
LONGITUDE (dd - dm)	12.21168	12:12.7
ELEVATION (m)	268	
SUBSTRATE	Sediments	
MONUMENT	Buried	
ACCESS	Open	
LAND PROPERTY	Public	
SECURITY LEVEL	Low	
4X4 CAR	No	
POWER SUPPLY	Solar Panel	



NOTE	The station is located on a hill behind a public building close to the "Tempietto della Madonna"

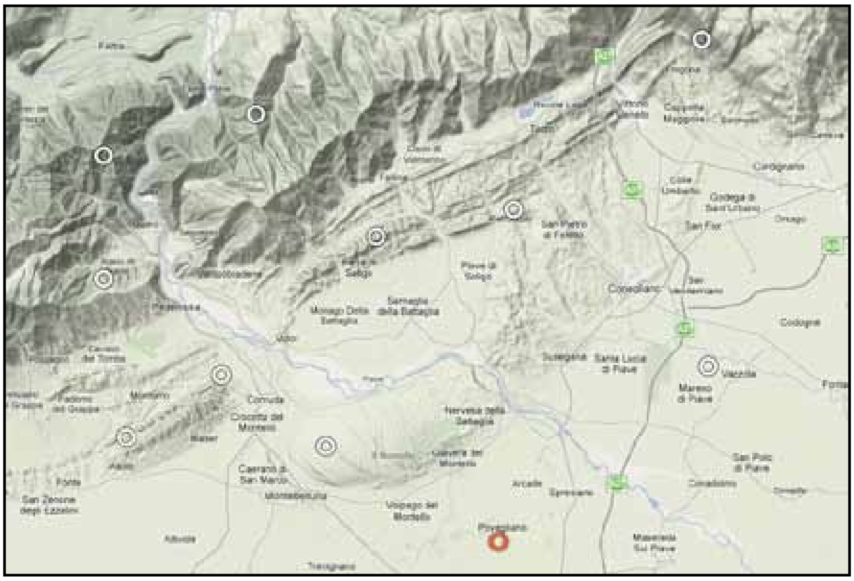

MREF
Station ID

OMBRA PROJECT

MSTD

Station ID

STATION NAME	Santandrà
LOCATION	Via Borè n°10, Santandrà. Povegliano (TV)



LATITUDE (dd - dm)	45.74855	45:44.91
LONGITUDE (dd - dm)	12.20028	12:12.02
ELEVATION (m)	101	
SUBSTRATE	Sediment	
MONUMENT	Buried	
ACCESS	Open	
LAND PROPERTY	Public	
SECURITY LEVEL	Low	
4X4 CAR	No	
POWER SUPPLY	Electric Current	

NOTE	The station is located along the inner boundary of the garden, close to an electric power pale. The power supply is given with a long wire coming from the basement of the building

MSTD

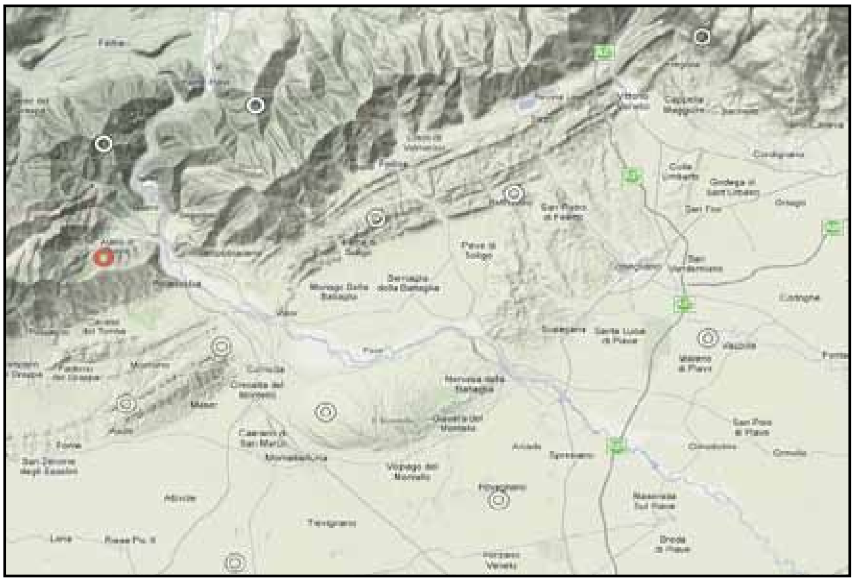
Station ID

OMBRA PROJECT

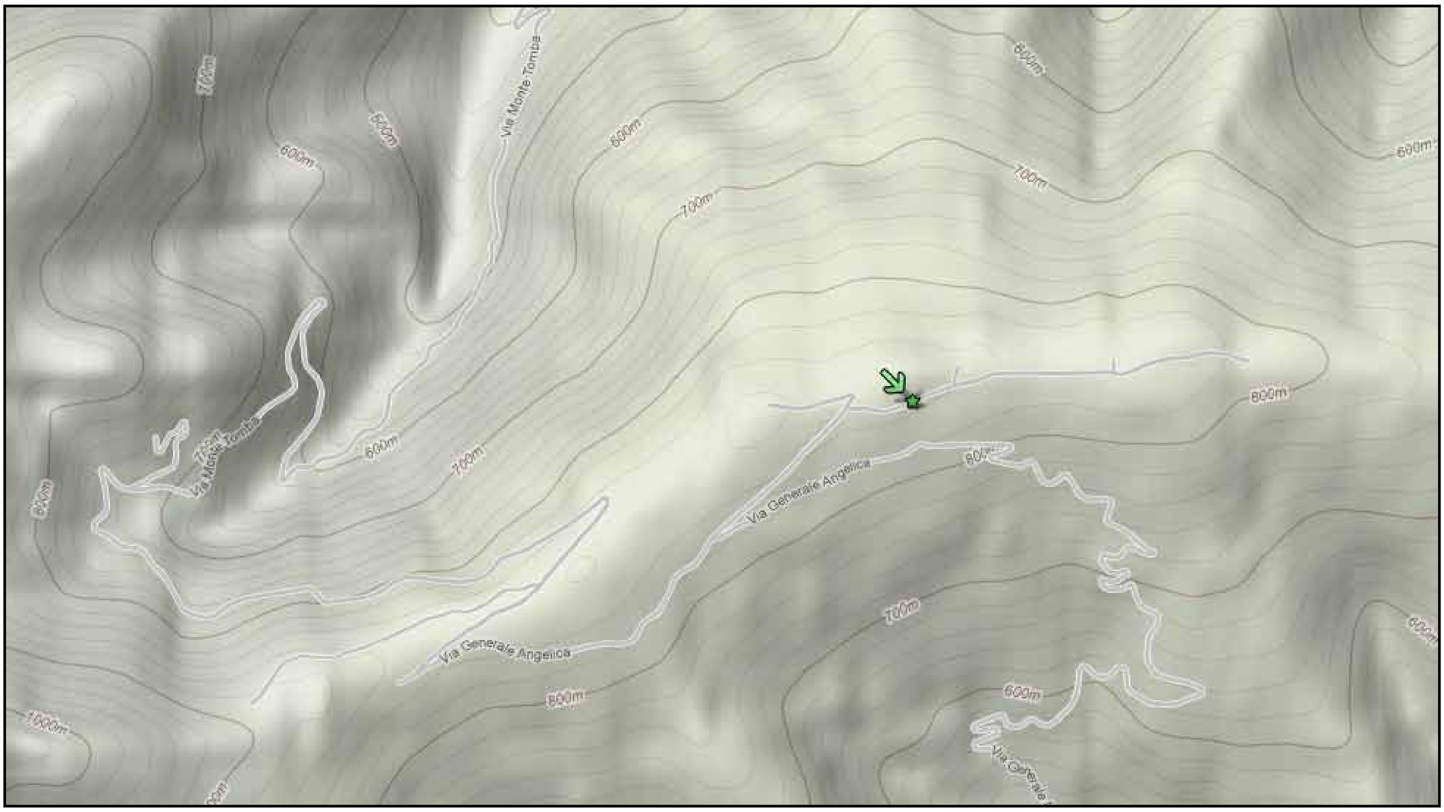
MTOM

Station ID

STATION NAME	Monte Tomba
LOCATION	Rifugio Alpini, Cavaso del Tomba (TV)



LATITUDE (dd - dm)	45.88829	45:53.3
LONGITUDE (dd - dm)	11.89927	11:53.96
ELEVATION (m)	897	
SUBSTRATE	Sediments	
MONUMENT	Buried	
ACCESS	Open	
LAND PROPERTY	Public	
SECURITY LEVEL	Low	
4X4 CAR	No	
POWER SUPPLY	Electric Current	



NOTE	The station is installed immediately outside the Alpines' Refuge, close to the gas container. It is necessary to call someone to open the refuge just in case of power problems.

MTOM

Station ID

Coordinamento editoriale e impaginazione
Centro Editoriale Nazionale | INGV

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