Chemical composition of PM in a residential area of Beijing, China

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OBJECTIVES

Emission reduction measures were performed to improve air quality during the Olympic Summer Games in 2008: cut down mainly coarse particles.

Question: PM still a problem?

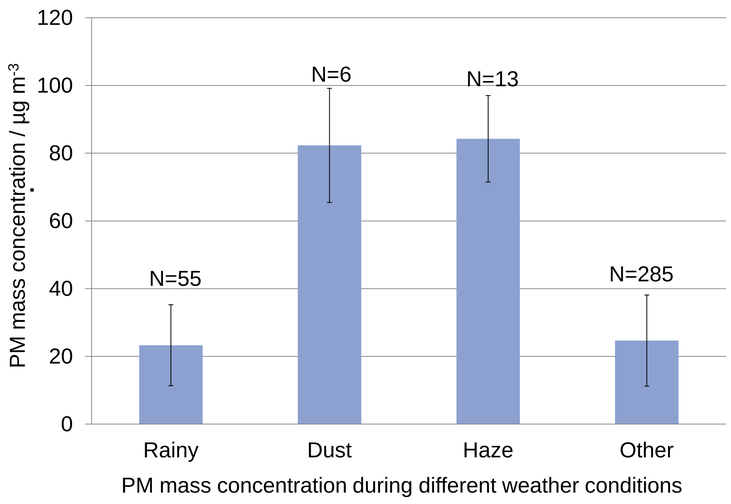
Objectives: Chemical composition of PM, source identification and special case studies during haze and dust events.

METHODOLOGY

Particulate concentrations: Daily PM filter sampling on quartz fibre filters with 2 High-Volume Samplers DHA80 (Digitel) by KIT/IMK-IFU from 2010.06.21 on for one year with CUMTB at the entrance of CUGB in 20 m distance to Mini-Volume Sampler (weekly $PM_{2.5}$ samples) of KIT/IMG.

Meteorological data from IAP and ZBAA (http://weather.uwyo.edu/upperair/sounding.html).

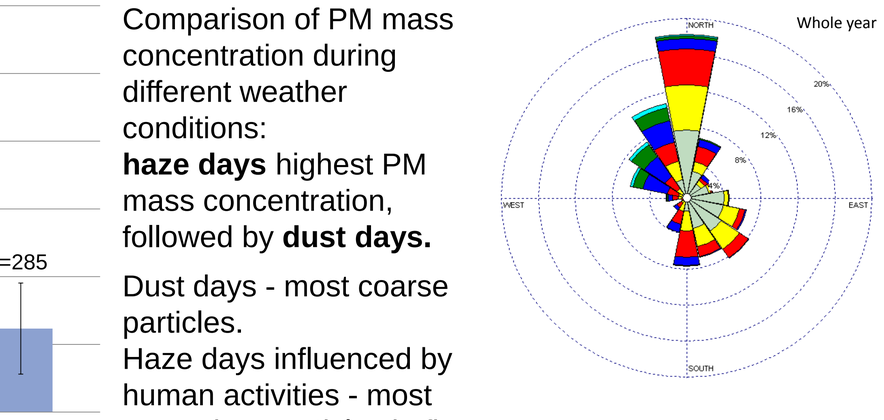
Particle composition: Main and trace elements analysed by PEDXRF (Polarized energy dispersive X-ray fluorescence) from KIT/IMG.



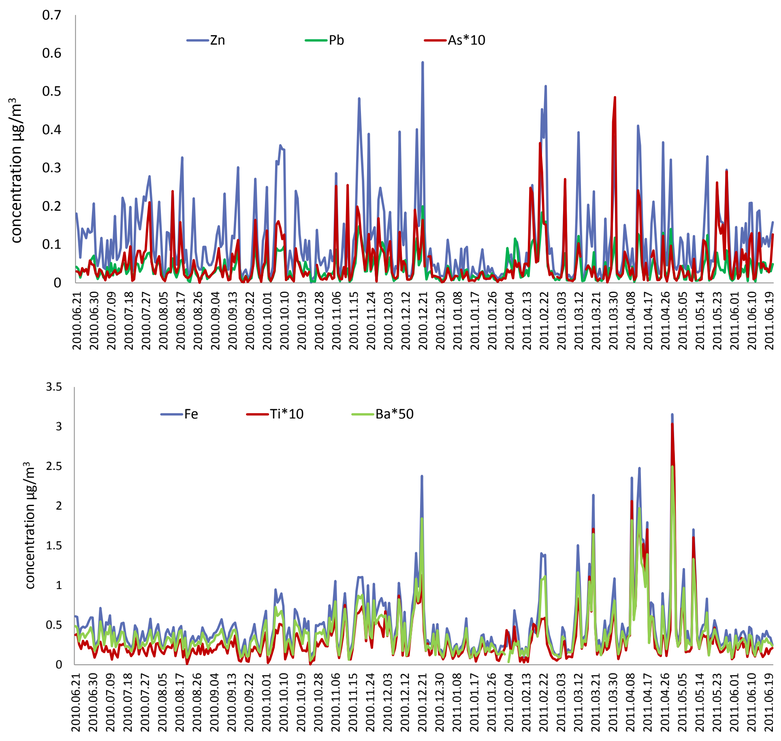
PM mass concentration during different weather conditions

Comparison of PM mass concentration during different weather conditions:
haze days highest PM mass concentration, followed by **dust days.**

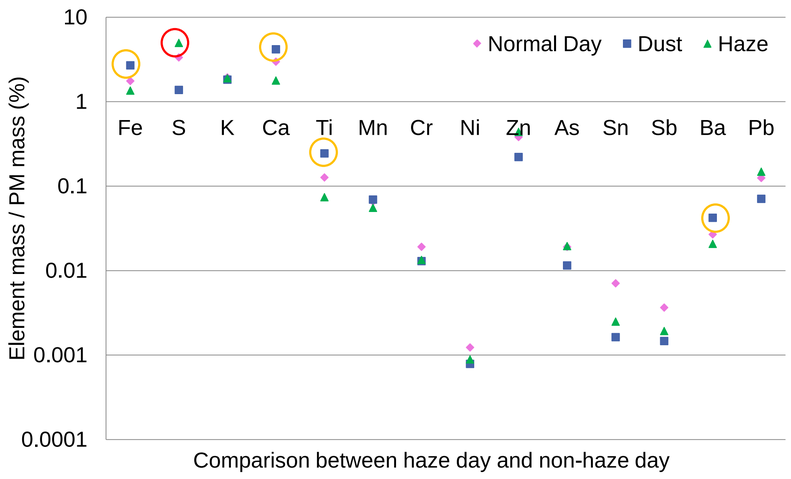
Dust days - most coarse particles.
Haze days influenced by human activities - most secondary particles in fine mode.



Whole year wind rose in Beijing:
prevailing wind direction **north** and **south east**.



Concentrations of **natural sources** (Fe, Ti and Ba) and **anthropogenic sources** (Zn, As and Pb) in PM: dust storm on 2011.04.30 highest Fe, Ti and Ba concentrations.



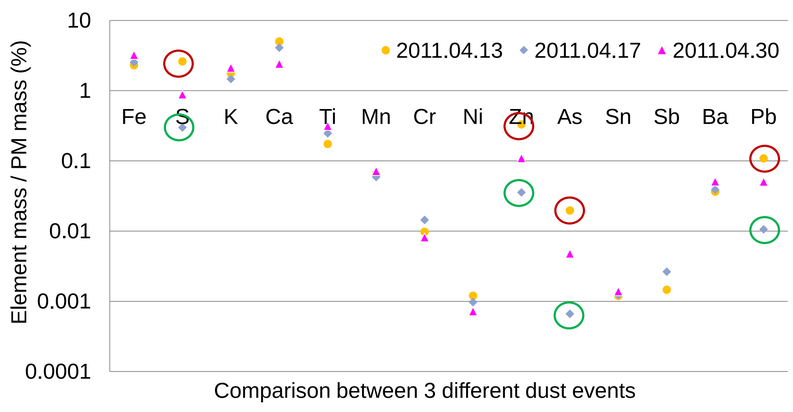
Comparison between haze day and non-haze day

Sulfur, Zinc and **Lead** which refer to anthropogenic influences - highest amount during haze days.

Fe, Ti, Ca, Mn, Ba which refer to geogenic sources - highest amount during dust days.

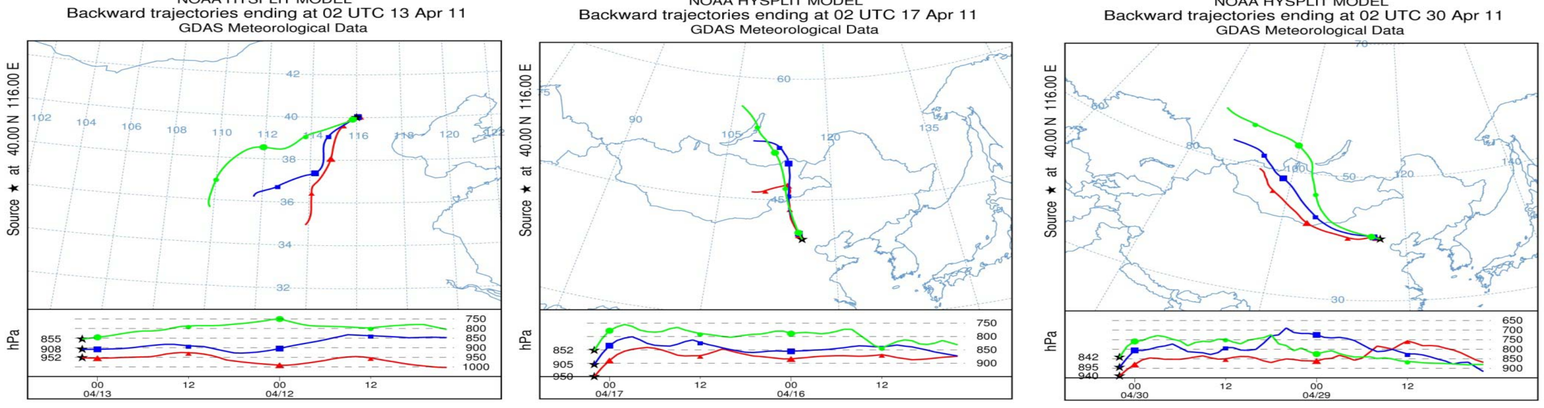
Element	Factor 1	Factor 2	Factor 3
PM	**0.684**	**0.647**	0.129
Fe	**0.944**	0.261	0.107
S	0.009	**0.874**	-0.009
K	**0.620**	**0.653**	0.097
Ca	**0.885**	0.218	0.124
Ti	**0.954**	0.040	0.117
Mn	**0.843**	0.417	0.137
Cr	**0.520**	**0.514**	-0.078
Ni	**0.467**	**0.564**	0.060
Zn	0.367	**0.814**	0.273
As	0.132	**0.677**	0.419
Sn	0.008	0.174	**0.792**
Sb	0.172	0.068	**0.680**
Ba	**0.947**	0.240	0.110
Pb	0.348	**0.850**	0.236

Source apportionment - Factor Analysis:
Factor 1: Geogenic sources
Factor 2: Fossil fuel combustion (oil and coal combustion) and waste incineration
Factor 3: Brake wear



Comparison between 3 different dust events

Sulfur and Zinc highest amount during dust event on 2011.04.13 - influenced by re-suspended dust.



Backward trajectories of 3 different dust events

RESULTS

PM mass concentration:

Highest in April - dust storm, re-suspended road dust.

Lowest in January - low emissions during Spring Festival holiday as well as influenced by wind direction.

Source apportionment by Factor Analysis:

Soil and re-suspended dust (geogenic sources), fossil fuel combustion, waste incineration, and brake wear.

Haze:

S, Zn and Pb - anthropogenic influences - highest contribution to PM and highest mass concentration: relative humidity and wind speed favour formation of secondary aerosols and aggravate pollution level.

Dust:

High PM mass concentration by re-suspended road dust, Mongolian desert and Gobi desert respectively.

CONCLUSIONS

Sources of PM: soil and re-suspended dust (geogenic sources), fossil fuel combustion, waste incineration, and brake wear.

Haze days: highest PM mass concentration from anthropogenic activities, highest sulfur amount.

Dust events: sources different, mainly desert dust, highest Fe, Ti, Ca, Mn, Ba amount.

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