

Acknowledgement

We thank PSI and USEPA for financial support. We appreciated the help of Jason Surratt and Xiaolu Zhang for their invaluable support during the field experiment.

Analysed elements

Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Br, Rb, Sr, Y, Zr, Nb, Mo, Ag, Cd, In, Sn, Sb, Ba, Pb

High time-resolution elemental composition of particulate matter in Pasadena



Fig. 1: Rotating drum impactor. Left: Field setup on the roof of the Keck Building at CalTech. Right: RDI (open) for 3-stage particle size segregation.

Rotating drum impactor (RDI)

- high time resolution: 2 hours
- particles segregation into three size fractions: 10 - 2.5 μm , 2.5 - 1.0 μm , 1.0 - 0.1 μm
- air volume flow: 1 $\text{m}^3 \text{h}^{-1}$
- in operation: 2010-05-15 to 2010-06-16

Synchrotron-XRF analysis

X-ray fluorescence (XRF) analysis is a standard method to determine the elemental composition of a sample. We use synchrotron light to illuminate the sample, therefore we performed the measurements at the Swiss Light Source (SLS) at PSI, and at HASYLAB in Hamburg, Germany.



Fig. 3: Synchrotron-XRF setup at Hamburg's HASYLAB, showing the sample holder on the goniometer table.

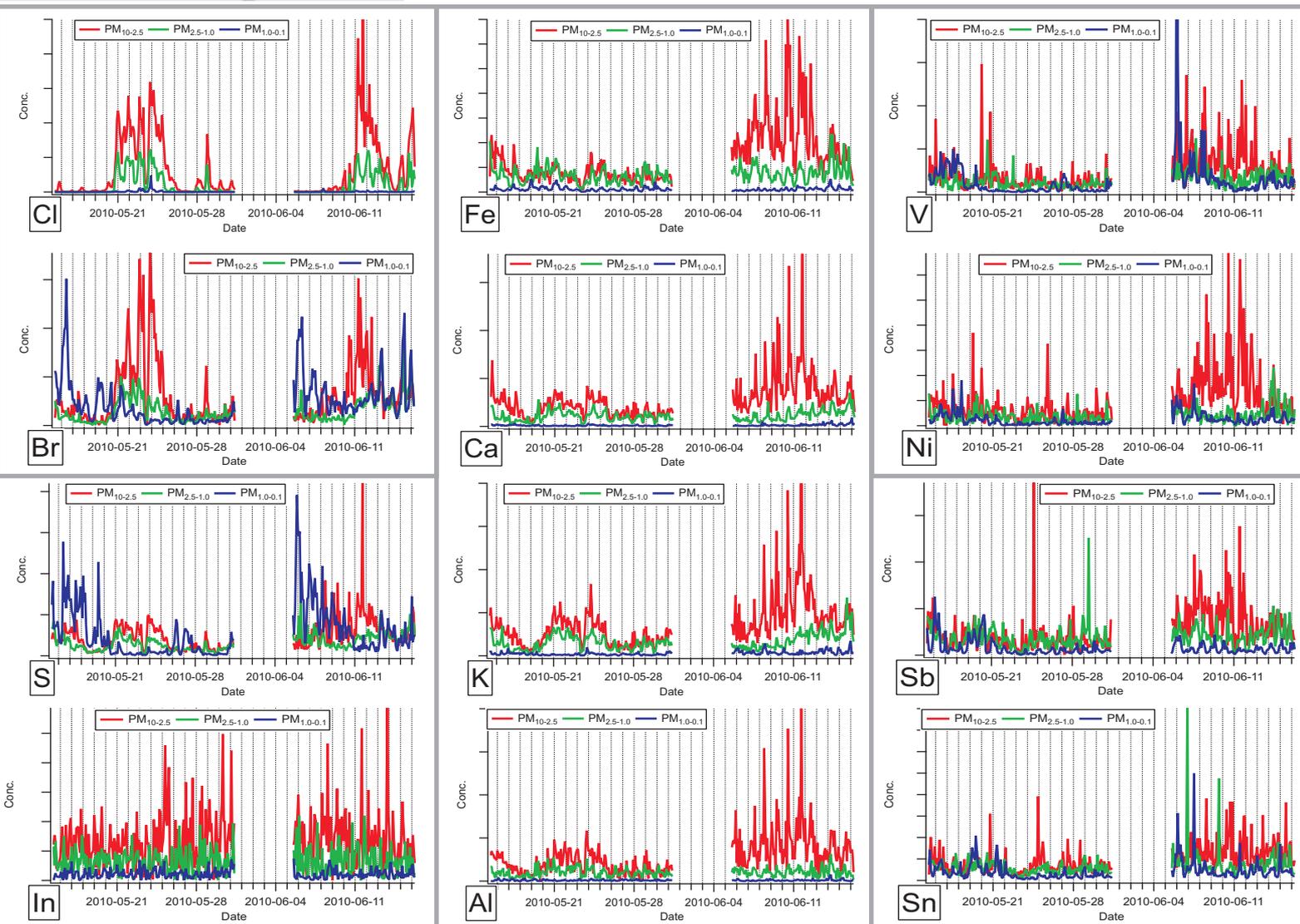


Fig. 2: Sample wheel (stage 1.0 - 0.1 μm particle diameter) with collected particles. Each 'bar' corresponds to 2 h of sampling.

References

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Time series of selected elements in three size fractions

The measurements lasted from 15 May to 16 June 2010, with a gap from 31 May 10:00 to 6 June 14:00 LT due to instrumental problems. Absolute mass calibration has still to be done, and the units are arbitrary. The size-respective behavior is, however, correct. Most of the mass of the measured elements is contained in the largest size fraction ($\text{PM}_{10-2.5}$), but Br and S are prominent in the smallest size fraction ($\text{PM}_{1.0-0.1}$). Notice the distinct difference between phases with mainly $\text{PM}_{10-2.5}$ and those with significant $\text{PM}_{1.0-0.1}$ concentrations. The largest size fraction of Br is well correlated with Cl, indicating a possible sea salt source. The center group of Fe, Ca, K and Al is extremely well correlated and probably of crustal origin. They exhibit a clear diurnal variation, especially in the last ten days. V and Ni, both tracers for crude oil combustion and hence for ship emissions, also vary similarly with time. The finest fraction of V also correlates with that of S. An extraordinarily constant behavior is seen for In. Sb is a tracer for brake wear and resembles to Sn. There is a disparity between the first half of the campaign and the second half. In the second half much more mass in the coarse fraction is present, mostly for crustal material.

These preliminary investigations call for more detailed studies of trace metal sources, e.g. in connection with local and regional meteorological fields, and comparison with other measurements.

Conclusions

The results presented here demonstrate

- the additional information obtained from size-segregated aerosol sampling concerning source apportionment
- the preliminary identification of sources of trace elements (sea salt, crustal material, industrial emissions, ship emissions)
- a differentiation between local and regional sources