

Name of research institute or organization:

EMPA Materials Science and Technology

Title of project:

National Air Pollution Monitoring Network (NABEL)

Project leader and team

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Project description:

The national air pollution monitoring network NABEL is a joint project of the Swiss Agency for Environment, Forests and Landscape (BUWAL) and EMPA. The NABEL network consists of 16 monitoring stations that are distributed all over Switzerland. The monitoring stations represent the most important air pollution levels. The NABEL site at Jungfrauoch is a very low polluted site, representing a background station for the lower free troposphere in central Europe.

The measurement programme at Jungfrauoch includes the continuous measurement of the following gaseous pollutants: Ozone (O₃), carbon monoxide (CO), nitrogen monoxide (NO), nitrogen dioxide (NO₂), and the sum of nitrogen oxides (NO_y). In addition, a selection of VOCs (alkanes, aromatics) are measured with a time resolution of four hours. Daily samples are taken for determination of gaseous SO₂ and for particulate sulphur. Finally, 48-hour samples of total suspended particulate matter (TSP) are collected by use of a high volume sampler. TSP mass concentration is determined from the difference of the filter weight before and after particle collection (gravimetric method). The TSP filter samples are also used to determine the concentrations of lead and cadmium in suspended particulate matter.

Since June 16, 2004, a beta attenuation monitor (Thermo ESM Andersen FH62 I-R) is used for continuous measurements of TSP. These measurements complement the gravimetric 48-hour TSP values, as well as continuous measurements of PM₁ (mass concentration of particles with diameter less than 1 µm) that are also performed with a beta attenuation monitor by the Paul Scherrer Institute. The PM₁ measurements belong to the aerosol characterization activities within the Global Atmosphere Watch Programme (GAW). The main reason for starting continuous TSP measurements at Jungfrauoch was to more accurately investigate the contribution of Saharan dust events (SDEs) to TSP at Jungfrauoch. This can be done by combining TSP data with continuous identification of Saharan dust events by measurement of the optical properties of the aerosol (Collaud Coen et al., 2004).

Figure 1 shows the data for TSP (gravimetric method and continuous beta attenuation method) and PM₁ as 48h mean values. Continuously measured TSP and gravimetrically determined TSP agree very well ($r^2=0.91$, see Figure 2, left), although some of the the continuously measured values are systematically higher than the gravimetrically determined values. The correlation between PM₁ and TSP is poor ($r^2=0.34$, see Figure 2, right), i.e. there are events where TSP concentrations are markedly elevated, but PM₁ remains more or less unchanged. Three of these events

(Oct. 5-6, Oct. 8-10, and Dec. 7-9) were identified as Saharan dust events by visual inspection of TSP collected on the 48-hour filter samples. Figure 3 gives the hourly mean values of TSP and PM1 during the three identified Saharan dust events. Evaluation of these three events indicate that Saharan dust is almost entirely in the size fraction above PM1.

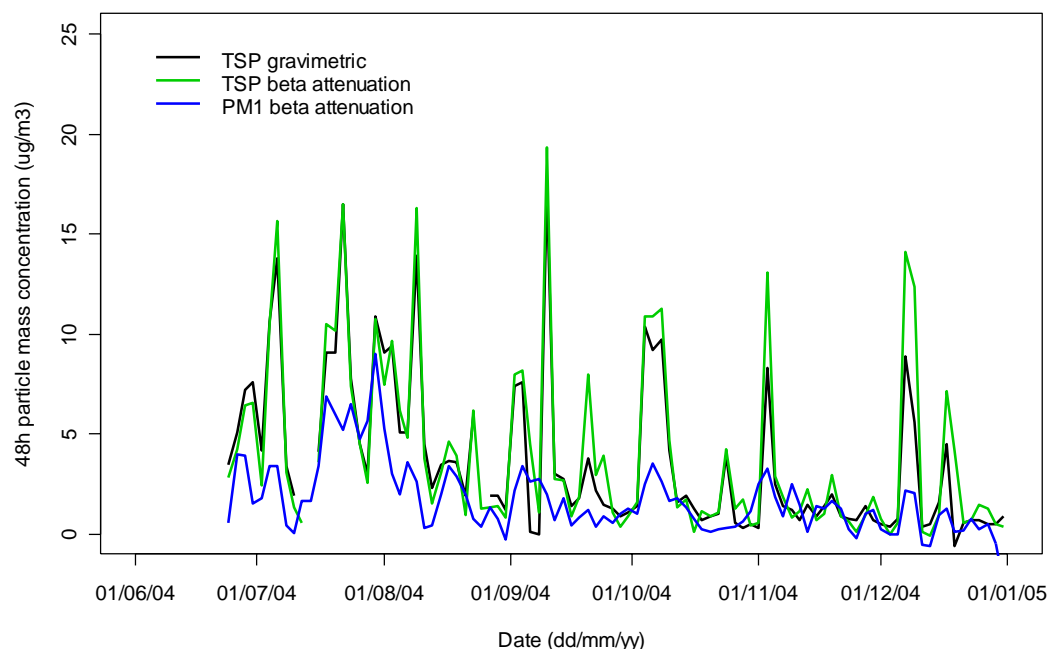


Figure 1: Time series (June 16, 2004 to December 31, 2004) of 48-hour mean values of TSP (gravimetric and continuous beta attenuation method) and PM1 (beta attenuation method).

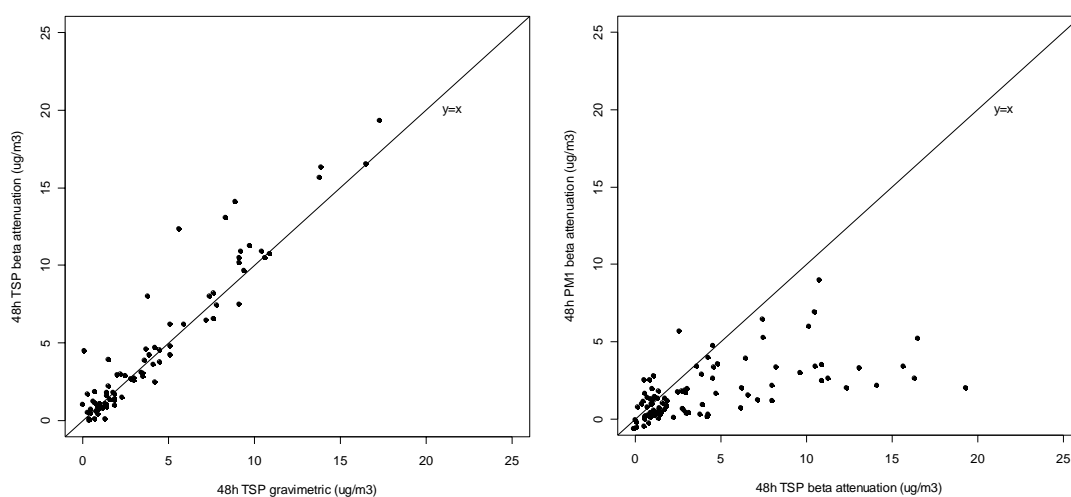


Figure 2: 48-hour mean values of continuously measured total suspended particulate matter (TSP) versus gravimetrically determined TSP (left), and continuously measured PM1 versus continuously measured TSP at Jungfraujoch (June 16, 2004 to December 31, 2004).

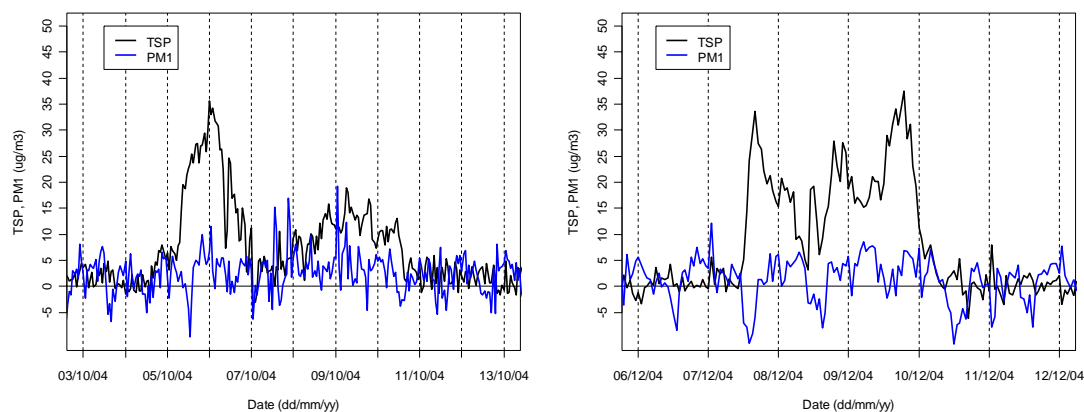


Figure 3: Hourly mean values of TSP and PM1 for few days in October 2004 (left) and December 2004 (right). The elevated TSP levels are caused by Saharan dust events. In contrast to TSP, PM1 signals are not significantly influenced by Saharan dust, indicating that Saharan dust is almost entirely in the size fraction above PM1.

Key words:

Air pollution, long-term measurements, Saharan dust, total suspended particulate matter

Internet data bases:

<http://www.empa.ch/nabel>

http://www.umwelt-schweiz.ch/buwal/de/fachgebiete/fg_luft/luftbelastung/index.html

Collaborating partners/networks:

Bundesamt für Umwelt Wald und Landschaft (BUWAL)

Global Atmosphere Watch (GAW)

Labor für Atmosphärenchemie, Paul Scherrer Institut

Meteo Schweiz

Scientific publications and public outreach 2004:

Refereed journal articles

Colaoud Coen, M., E. Weingartner, D. Schaub, C. Hueglin, C. Corrigan, M. Schwikowski, U. Baltensperger, Saharan Dust Events at the Jungfrauoch: Detection by wavelength dependence of the single scattering albedo and first climatology analysis, *Atmos. Chem. Phys.* **4** 2465-2480, 2004.

Data books and reports

Technischer Bericht zum Nationalen Beobachtungsnetz für Luftfremdstoffe (NABEL), EMPA, 2003.

NABEL, Luftbelastung 2002, Schriftenreihe Umwelt Nr. 360 Luft, Bundesamt für Umwelt Wald und Landschaft, Bern 2003.

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