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Zentralanstalt für Meteorologie und Geodynamik

DUSTFALL – Impact of Sahara dust on air quality forecasts in Austria

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Motivation and Goals

Particulate Matter (PM) in air has an important influence on the radiation budget, on cloud physics and cloud properties, the visibility but also on the air quality and consequently on health. PM in urban regions is mostly of anthropogenic origin (traffic, burning of fossil and bio fuels, industrial pollution, secondary aerosols) whereas natural sources contribute the majority of PM on a global scale, e.g. mineral dust from the deserts like the Sahara.
Saharan dust (SD) is episodically transported over thousands of kilometers with synoptic wind patterns to Europe and reaches Austria at about 20 to 30 days per year. This can cause an increase of the concentration of ground level PM concentrations, including contributions to the exceedance of limit values in Austria.
Since PM significantly influences air quality, its forecast gains more and more importance. Forecasts tend to underestimate actual PM-concentrations, thus models have to be evaluated and improved regularly.

The overall aim of this recently started project will be an improvement of the detection of SDEs as well as enhanced knowledge of the processes concerning the long-range transport of Sahara dust. Consequently, this allows enhancement of model forecasts of PM-concentrations and an improvement of the air quality forecast during SDEs.


Source: ZAMG/ L. Rasser

Description

The detection and identification of Saharan Dust Events (SDEs) is performed at an high alpine meteorological observatory at the summit of Mt. Sonnblick at 3.106 m asl in the Austrian Alps (12°57'E, 47°03'N).

The **Sonnblick Observatory (SBO)** is a background site in the center of Europe for the measurement of various aerosol parameters. It is supplied with electricity via a permanent line from the valley to minimize emissions. Internal air of the observatory is disposed of through a vent inside a 20 m high meteorological tower.

Identification of Saharan Dust Events

The method for the **on-line identification of SDEs** is based on the measurements of scattering and absorption properties of PM in air and the subsequent calculation of the wavelength dependent „single scattering albedo (SSA)". This method is thoroughly described by Collaud Coen et al. [1].

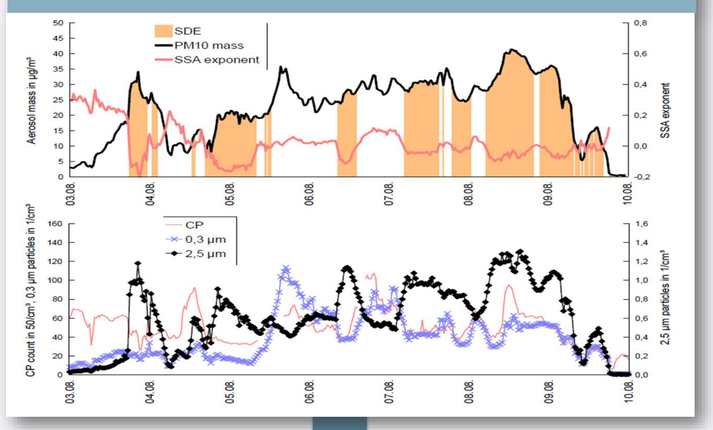
The on-line identification of SDEs is important for interpretation of monitoring data and allows to trigger special sampling programs (e.g. filter sampling) as well as a climatological observation of the occurrence, duration and intensity of SDEs.

The identification of a SDE triggers a sampling procedure for air filter measurements at SBO.

During an SDE, quartz fiber filters will be sampled and are going to be analyzed **chemically** for the Total Carbon content (TC), the Elemental Carbon content (EC) as well as the Organic Carbon content (OC). The ionic composition (sulfate, nitrate, chloride, ammonium, calcium, sodium, magnesium and potassium) is determined via ion chromatography.

The filters will be also evaluated **optically** via transmissiometer measurements in the IR and UV.

Comparison of single SDEs



Based on the transmissiometer measurements performed with filters taken at SBO, we aim at establishing an optical method for the determination of SDEs on PM10 filter samples from other monitoring sites of the Austrian air quality networks.
Thereby, filters from SBO serve as comparison standards.

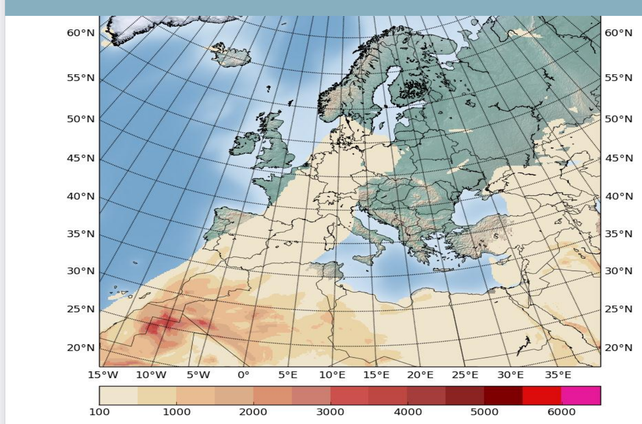
These results, together with backward trajectories as well as FLEXPART backwards calculations will be used to **identify regional differences** in the occurrence and intensity of SDEs.

The ZAMG provides WRFchem model forecasts of ground-level PM-concentrations as well as forecasts of the SD-concentration in the atmosphere.

Based on the filter measurements, we try to **evaluate and improve the model forecasts** especially during extreme events like SDEs.

The ground-level PM-concentrations are correlated with concentrations measured at elevated stations from the Austrian background network. Forecasts of the SD-concentrations in the atmosphere are evaluated in comparison with spectral UV-measurements and the resulting Aerosol Optical Depth (AOD).

SDE forecast evaluation



The model forecasts are also used to calculate the Common Air Quality Index (CAQI). Thus, **the influence of SDEs on the CAQI** can be estimated as well. This plays an important role, especially during extreme cases where also limit value exceedances for PM-concentrations occur, far away from the region of origin.

Literature

1. *M. Collaud Coen et al. (2004) Atmos. Chem. Phys. 4, 2465-2480*
2. *A. Kasper-Giebl, Poster presentation, European Aerosol Conference 2015 Milano , 6 - 11 September 2015*

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