GAW global site Hohenpeißenberg –how has the aerosol load changed over the years?

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It is well known that airborne particles have an impact on human health and influence the climate system of the earth and biosphere. Hence it is of great importance to monitor aerosols as done at Hohenpeißenberg, Germany, a global station of the WMO program "Global Atmosphere Watch".

The longterm TSP and PM10 measurements (since 1997) and their analysis on the watersoluble ions are assissted by PM1 measurements analysed with an Aerosol Chemical Speciation Monitor (ACSM, Aerodyne Research) since 2013. The results reflect typical characteristics of a rural site, low influence of traffic or industry. At Hohenpeißenberg the aerosol composition shows a yearly cycle. However, due to the low background concentration special events as volcano dust or wood burning can be clearly seen and determined. Long-term trends of aerosol background can be monitored. The supplementary measurements with the ACSM allow source apportionment of the organic fraction. Due to legislation the aerosol load has been decreased in the past years. This work studies how the aerosol composition has changed over the years at a background site.

The TSP average concentration since 2006 is 9.6 µg/m³, which is well below European PM10 regulations. TSP has a decreasing tendency of 0.4 µg/m³, which was found at several sites (Barmapadimos *et al* 2012). The components Cl^-, Na^+, NH_4^+ and SO_4^{2-} show clear decreasing trends, NO_3^- is only slightly reduced; on contrary the trends of Ca, K and Mg are rather stable since 1997. Sulfate producing emissions, especially from petrol and lignite combustion are reduced continuously in Germany since 2000 (EMEP, 2012). Lignite combustion is also a source of Cl^-, which accordingly decreased with time.

In Figure 1 the seasonal aerosol composition for PM2 (organics PM1) is shown for the different seasons in 2014 and 2015. The organics (OA) are analysed by positive matrix factorization to identify the sources. Oxygenated organic aerosol has a high share of OA and has its maximum in summer time. Contrary, NO_3^-, on average the second largest contributor to aerosol mass, has its maximum early in the year, when agricultural activity and the weather condition which support the accumulation of aerosol (e.g. temperature inversion) are coinciding. The seasonality of the chemical components exists and is independent of the reduction of the aerosol mass.

Differences in the seasonality of the composition are a consequence of natural occurences / biogenic sources of aerosol, typical are the transport of Saharan dust or sea salt aerosol. These air masses can change the average composition of PM, as seen in spring 2014, where a high load of Na^+ and Cl^- is detected. The occurrences of these phenomena are highly dependent on the prevailing weather situation.

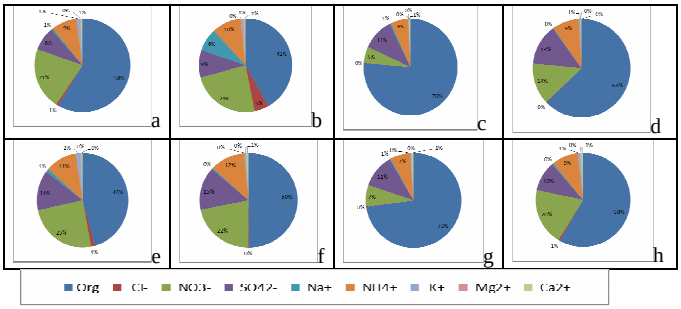

Figure 1. Average aerosol composition (PM_1, PM_2) at Hohenpeißenberg, for 2014 (a- winter, b-spring, c-summer,d-autumn) and 2015(e-winter, f-spring, g-summer, h-autumn).

Barmapadimos, I, Keller, J, Oderbolz, D, Hueglin, C, Prevot, ASH. (2012) *ACP*, ***12***, *3189-3203*

EMEP (2012) *Transboundary particulate matter in Europe*, Status report 2012 NILU