Geophysical Research Abstracts
Vol. 21, EGU2019-10361, 2019
EGU General Assembly 2019

Aircraft-based measurements of aerosol chemical composition and processing in the outflow of Asian and European megacities during EMeRGe

Katharina Kaiser (1,2), Johannes Schneider (2), Stephan Borrmann (1,2), and the EMeRGe-Team ()

(1) Institute for Atmospheric Physics, Johannes Gutenberg University, Mainz, Germany (k.kaiser@mpic.de), (2) Particle Chemistry Department, Max Planck Institute for Chemistry, Mainz, Germany

The aim of the EMeRGe (Effect of Megacities on the transport and transformation of pollutants on the Regional to Global scales) project was to explore the atmospheric transport and processing of emissions from Asian and European megacities. Two field missions were conducted with the German research aircraft HALO: In summer 2017, an intensive measurement campaign with seven research flights took place over Europe; in spring 2018, the region above the East and South China Sea was investigated by twelve scientific measurement flights out of Tainan, Taiwan.

We operated a compact time-of-flight aerosol mass spectrometer (C-ToF-AMS), measuring the composition of non-refractory submicron aerosol particles. In addition, number concentration and size distribution of particles between 250 nm and about 3 μm were measured using an optical particle counter.

The flight patterns of the individual research flights were chosen according to the chemical weather forecast using a range of model prediction tools. The outflow from selected target regions, as for example London, Paris, Rhine-Ruhr-Area, Pearl River Delta, Yangtze River Delta, Manila, and Taipeh were predicted and could be successfully probed during several flights. Besides, biomass burning outflow from Asia and Europe was encountered in both campaigns. Although the main focus was set to lower altitudes (below 3 km), vertical profiles were conducted up to 12 km, where occasionally stratospheric influenced air masses (characterised by high ozone values) were found.

Sulphate seems to be the main component of Asian emissions with maximum values up to 10 $\mu g/m^3$, although organics and nitrate also contributed to the aerosol, depending on air mass and pollution source. For example, coal power plant emissions at Taiwan's west coast contributed more sulphate than organics to the submicron aerosol, whereas urban emissions from Manila contain more than 50 percent organics.

The maximum total aerosol mass concentration over some European cities lies around 15 $\mu g/m^3$, which is considerably lower than for example the maximum mass concentration above Thailand with 30 $\mu g/m^3$. Furthermore, the organic content to the aerosol composition above Europe is more pronounced than in East Asia and nitrate occurs in a similar amount as sulphate.

On the basis of specific mass to charge ratios, the degree of photochemical aging of the aerosol can be derived. Freshly emitted aerosol particles close to the source region are younger and less oxidized than transported and more oxidized aerosol at long distance to the source.

This presentation will show first results on aerosol properties, emission types, and atmospheric processing especially of the organic aerosol, with emphasis on possible differences in photochemical processing between East Asian spring and European summer conditions.