Atmospheric aerosol at Princess Elisabeth station, East Antarctica: what those tiny particles can tell us about the Antarctic atmosphere

Aerosols play an important role in atmospheric physics and chemistry. They attenuate, scatter and absorb solar radiation, influencing by this way the temperature at the surface and within the atmosphere and exerting a positive or negative radiative forcing. Also, they influence cloud formation and properties such as cloud particle phase and size and their ability to produce precipitation. The aerosol amount in Antarctica is extremely low and aerosols are mostly carried to Antarctic via long-range atmospheric pathways. However, also minor local aerosol sources exist.

Since 2010, several complementary ground-based instruments for the long-term monitoring of the composition of the Antarctic atmosphere have been operated at the Belgian Antarctic research station Princess Elisabeth in the framework of a common project of the Royal Meteorological Institute of Belgium, the Belgian Space Aeronomy Institute, and University of Ghent. The station is manned from November to end of February and operated under remote control during the other months.

Measured properties comprise aerosol size distribution, total aerosol number, total aerosol mass concentration, mass concentration of light-absorbing aerosol and absorption coefficient and total scattering coefficient. All instruments have been installed for continuous operation. Besides these instruments, a sunphotometer provides total aerosol optical depth (AOD) during austral summer since February 2009. A Brewer ozone spectrophotometer provides total ozone, spectral UV and AOD in the UV-A during austral summers. In addition, a cloud condensation nuclei counter (CCNc) has been operated in austral summers 2013/14 and in 2014/15.

Seasonal variations of mass concentration of light-absorbing aerosol, aerosol number and size, or of aerosol optical properties have been observed. Combined measurements of aerosol number, size and of the concentration of cloud condensation nuclei reveal specific periods of increased numbers of very small particles, indicative of new particle formation events. In the presentation, an overview of gathered results will be given and links with atmospheric dynamic processes will be discussed.