

Master of Science thesis project

Field:

Environmental science/Atmospheric Science

Title:

Arctic aerosols physico-chemical properties

Start:

Earliest spring 2014 or autumn 2014

Problem formulation, methods, aims:

Aerosol particles are emitted via “natural” (e.g. by plants or the ocean) and “anthropogenic” (caused by human activities) processes. A good example for natural processes are sea spray particles produced over the ocean, dust particles emitted by the deserts or biogenic aerosols emitted by terrestrial vegetation. Anthropogenic particles are predominantly emitted by combustion processes as e.g. in combustion engines or during processes for energy production.

In addition to the current discussion of air pollution and corresponding health effects aerosol particles are most important with respect to global climate change as they absorb and scatter the incoming sunlight and serve as condensation nuclei for cloud droplets of ice crystals. This way, aerosol particles can contribute to cooling or warming the climate.

Within this project data from two measurement sites the high Arctic: Station Nord (Northern Greenland) - Villum Research Station – and Zeppelinfjället, (Ny Ålesund, Svalbard) will be evaluated together to assess differences and similarities in aerosol properties between both sites located 600 km from each other. These two sites are among the most northern measurement stations for aerosol research in the world and represent the key infrastructures in studies of the long-term changes in the Arctic environment. The Arctic is nearly free of local pollution sources and long-range transport of air pollution from lower latitudes is the major perturbation in the Arctic. In contrast to greenhouse gases, aerosol particles, thanks to shorter lifetime in the atmosphere, exhibit larger variability in space and time and therefore it is of high importance to understand representativity of individual measurement sites for extrapolation in a large Arctic domain.

The main task in this Master of Science project will be analysis of aerosol observations from both sites on various temporal scales from days to annual cycles and compare the observed values, their magnitudes and trends. In the interpretation part role of air mass transport and influence of various sources at both sites will be studied.

The data analysis in this project will focus predominantly on particle number size distributions of submicrometer particles (diameter < 1µm) or on the chemical composition of the observed particles or on aerosol optical properties including the concentration of black carbon (“soot”).

The data from both stations will be linked to air mass back trajectories and further be analyzed by the use of simple model tools. This way information is provided to estimate the origin of the observed air masses. For climate change considerations it is highly important to know if the aerosol particles are of natural or anthropogenic origin.

The project work will primarily include data analysis work. There might be the possibility to visit one of the stations within the project period. The project itself will be carried out in collaboration between Aarhus University and Stockholm University (ITM, www.itm.su.se). Both locations can be chosen as host for the master student during the project period.

Contact:

Interested candidates should be motivated to carry out data analysis of large data sets and being interested in atmospheric sciences. A good background in physics, chemistry, or physical and/or chemical engineering is of advantage. The project is addressed to graduate students and is suitable for master thesis. You are most welcome to contact Andreas Massling (anma@dmu.dk) or Radovan Krejci (radek@itm.su.se, +46 706 341511) for more information.