Summary of the WG1 & WG5: "Aerosols & Clouds, Humidity and Precipitation"

NySMAC – Atmospheric flagship workshop, Kjeller, Norway 3 – 7 October 2016

Participation list:

Young Jun Yoon, Paul Zieger, Angelo Viola, Mauro Mazzola, Mario Schiavon, Elena Barbaro, Andrea Spolaor, Sang-Jong Park, Nuncio Murukesh, Masataka Shiobara, Radovan Krejci, Friedrich Obleitner, Hans-Werner Jacobi, Stephan Kral, Tjarda Roberts, Ove Hermansen, Manuel Dallosto, Roland Neuber, Christoph Ritter, Hans-Christian Steen-Larsen, Kerstin Ebel, Hans-Christen Hansson, Anderas Massling.

Talks summary

Join session of WG on Clouds, Humidity and Precipitation and WG on aerosols started with set of presentations on current ongoing experimental activities and data analysis.

"DMS-Aerosol-CCN: Interaction and climate feedbacks in Arctic atmosphere " Young Jun Yoon (KOPRI).

Group from KOPRI presented results on long term observations of aerosol activation using Cloud Condensational Nuclei (CCN) counter showing strong annual cycle in number of aerosol particles available for cloud formation following annual cycle of aerosol size distribution. Observations of DMS show close link with new aerosol formation and aboundance of ultrafine particles.

"Cloud and aerosol interactions in a warming Arctic - Upcoming experiments at Ny-Alesund and beyond" Paul Zieger (SU)

Stockholm University group summarized the long term observations of aerosol microphysical properties and related data analysis. With new instrumentation the work has been extended with measurements of cloud residual particles and their microphysicla and optical properties.

"The Arctic Clouds, Aerosols and Radiation Experiment (Arctic-CARE) planned in Japan's ArCS (Arctic Challenge for Sustainability) program" Masataka Shiobara (NIPR)

Long term observations of cloud fraction show least cloud occurence during Arctic spring and thus rise additional argument for aerosol cloud studies also during other seasons. Intensive field campaign in March 2017 will focus on in-situ studies of low level clouds with special focus on mixed phase between liquid and ice phase.

"Water soluble compounds in Arctic aerosol" Elena Barbaro (University Ca' Foscari, Venice)
"Determination of polar Black carbon and total aerosol concentration levels in non-free atmosphere: an innovative approach" Andrea Spolaor (University Ca' Foscari, Venice)

Analysis of detail size segregated aerosol speciation based on samples from Gruvbadet presented concentration levels of Rare Earth Elements (REE), aminoacids and levoglucosan. Amino acids in PM10 fraction are very similar to marine aerosol. Strong correlation between Vanadium and Nickel indicates influence of oil combustion. Black carbon in snow studies from glaciers were compared to balloon borne measurements.

"Biases in the simulation of the Arctic atmospheric hydrological cycle elucidated using continuous water vapor isotope observations" Hans-Christian Steen-Larsen (University of Copenhagen)

Studies of water vapour isotope composition can help us understand the cloud activation and how water is redistributed through the troposphere.

"Synergistic long-term observtions of vertically resolved cloud properties using a novel microwave radiometer/radar for Arctic clouds at AWIPEV" Kerstin Ebel (Köln University)

Newly installed set of cloud radars and radiometers will provide broad set of remotely sensed properties of Arctic clouds, their microphysical properties, phase and spatial and temporal variability.

Interplay between aerosols, clouds, water vapour: Ny Ålesund perspective Radovan Krejci (SU)

There is a link between the aerosol number size distribution and meteorological parameters at Zeppelin, mostly with relative humidity as well as water vapour concentration. .During events of a high concentration of small particles (dominating nucleation and Aitken mode), the water vapour concentration at both Zeppelin and down by the fjord were of the same magnitude. The largest amount of small particles (around 30 nm) connected to relative humidity was found in spring for relative humidity less than 50% and in summer for relative humidity in the interval of 80 – 96%. A high aerosol number concentration is also coinciding with low RH, implying the importance of clouds and precipitation as a sink of the larger particles.

"Climate change pattern observed at Ny Ålesund: External and internal forcings" Hans-Christen Hansson (SU)

Simulations with an Earth system model with aerosol physics and chemistry show that the sulfate aerosol reductions in Europe since 1980 can potentially explain a significant fraction of Arctic warming. The Arctic receives an additional energy and warms by 0.5 _C on annual average in simulations with declining European sulfur emissions. Arctic warming is amplified mainly in fall and winter, but the warming is initiated in summer by an increase in incoming solar radiation as well as an enhanced poleward oceanic and atmospheric heat transport.

"Continuous activities at the high Arctic Villum Research Station" Andreas Massling (Aarhus University)
Overview of observations and plans at Danish high Arctic station "Station Nord – Villum"
Now when several years of observations are available from station Nord, join analysis with observations at Ny Ålesund should be one of the priorities of future data analysis.

<u>Discussion on join data analysis and publications:</u>

1) *Aerosol Size Distribution analysis using simultaneous measurement series at Zeppelin and Gruvebadet. (Italian team, SU)*
2) *Joint publication on the characteristics of CCN at the Zeppelin (KOPRI, SU)*
3) *Joint publication on the contribution of DMS to the particle formation and growth in the Arctic Environment (KOPRI, SU, Italian team)*
4) *Combining in situ and remote sensed cloud microphysics with in situ observations of aerosols and cloud residuals at Zeppelin (SU, KOPRI, NIPR, AWI)*
5) *Aerosol microphysics observed in-situ and with lidar: July 2015 haze event? (AWI, Polish team)*