

**Short report from the Open Side Event
Thursday 9. Nov. 2017 on
Atmosphere research in Svalbard
during the Svalbard Science Conference**



Program

- 09:00 Introduction and goals for the day
- 09:15 Establishment of today's discussion groups
- 10:30 Joint coffee break
- 11:00 discussion groups continued
- 12:00 joint lunch break
- 13:00 discussion groups continued
- 14:30 Coffee break
Individual discussions and wrap ups
- 17:00 Adjourn

This document contains the reports from the individual discussion groups as listed below:

Long term observations and trends, and radiation budget relevant parameters

Marion Maturilli, AWI

Boundary Layer meteorology (in situ + remote sensing) from small scale mass and energy fluxes to BL structure (in-situ + remote sensing)

Angelo Viola, CNR

Clouds and aerosol observations: what we can learn about aerosol-clouds and clouds-aerosol interactions from combining remote sensing and in-situ observations

Kerstin Ebell, Univ. Cologne and David Cappelletti, Univ. Perugia

Aerosol life cycle (remote sensing and in-situ observations, NyA & Zeppelin, special case of July 2015 biomass burning event)

Christoph Ritter, AWI and Radovan Krejci, U. Stockholm

Snow & Atmosphere (from removal to deposition and redistribution in snow and ice)

J.C. Gallet, NPI

Atmosphere Composition, green house and trace gases, O₃ & UV

Georg Hansen, NILU

GROUP 1

Long term observations and trends, and radiation budget relevant parameters

Reported by: Marion Maturilli, AWI

In the discussion group on „Long-term observations and trends, and radiation budget relevant parameters“, Boris Ivanov gave some insight to the Norwegian-Russian project “Isfjord – Past and Current Clima”, and the recovery and homogenization of historical data from Barentsburg and Pyramiden. He further announced a follow-up project that will provide similar processed long-term data for Franz-Josef-Land. All data will be made available via the eklima.no.

Furthermore, the existence of long-term measurements of aerosol optical depth by photometer as well as total ozone concentration by Dobson instruments from Barentsburg was mentioned, as potential contribution to the other working groups.

Another focus of the discussions was set on the various surface radiation measurements. It was pointed out that global radiation measurements are available from Barentsburg since 1958. While the Ny-Alesund measurements for the Baseline Surface Radiation Network (BSRN) are operated by AWI since August 1992, the Norwegian Polar Institute already started radiation measurements in 1975. These measurements faded out after a sufficient overlap period. In the meeting it was decided that the radiation data sets by AWI and NP should be merged and homogenized, to achieve a consistent radiation data set since 1975. As a joint effort, the combined dataset should be made available via the Pangea database, allowing e.g. the evaluation of radiation provided by reanalysis or climate models. A potential application in this context could be the new Svalbard region reanalysis NORA that is developed by met.no.

As it remained unclear which other parameters with long-term data record existed in Ny-Alesund, the need for additional information content in the Atmosphere Flagship parameter list was expressed. It is suggested to add another column, indicating the starting date of the observations. To highlight the quality of several datasets, it is further suggested to mark if a measurement is submitted to an international network (e.g. GAW, NDACC, BSRN, etc).

Finally, the discussion brought up a new approach to estimate the potential contribution of different parameters to the observed changes in radiation budget. Based on a radiative transfer model, it is planned to have scenarios analyzing the single effects of changing thermodynamic characteristics (e.g. increasing water vapour, different altitudes of temperature inversions) on the radiation budget. This activity should be realized by a joint master student supervised by AWI-Potsdam with support of University of Cologne.

GROUP 2 and 4

Boundary Layer meteorology (in situ + remote sensing) from small scale mass and energy fluxes to BL structure (in-situ + remote sensing)

Aerosol life cycle (remote sensing and in-situ observations, NyA & Zeppelin, special case of July 2015 biomass burning event)

Reported by: Christoph Ritter, AWI, Radovan Krejci, U. Stockholm, and Angelo Viola, CNR

Participants:

Angelo Viola, Radovan Krejci, David Cappelletti, Christine Böckmann, David Mateos, Alena Dekhtyareva, Christian Zdanowicz, Zhiyong Xie, Christoph Ritter, Angelo Lupi, Libo Zhou, Alexander Schultz.

The present summary merges the outcomes of the two WG meeting held in Oslo on the November 9 during the Svalbard Science Conference. In both WG a summary of discussion discussion points of the 2016 meeting in Kjeller, was also provided.

During the the Boundary Layer WG meeting the main discussion was focused on the result obtained by the of EC intercomparison at different sites of Ny-Ålesund (A. Schultz - AWI) and on presentation of new scientific installation to study the boundary layer above the Kongsfjord foreseen for the 2018 (Libo Zhou - CHINA).

In particular the EC intercomparison has shown the importance of defining a protocol of measurements to characterize the boundary layer structure in the area of the Kongsfjord. This would turns out very well into the activity foreseen within the SIOS pilot project submitted by the atmospheric flagship community of Svalbard.

About the plan of new installations in Ny-Alesund that should include wind lidars, radiometers, UAV and other innovative instrumentation the discussion pointed out the need of a scientific link and integration with the existing activities. It was suggested to submit the full plan to NySMAC for an approval before to proceed with the preparation of the campaign.

Some publications are in preparation for what concern the boundary layer: the vertical profiles of wind and temperature, the turbulence behaviour for different wind regime, and the EC intercomparison. A much deep interaction between different research groups is expected to link the aerosol vertical distribution with dynamics of the boundary layer. This aspects have also been discussed within the aerosol WG.

The Aerosol WG resumed the discussion points of the 2016 meeting in Kjeller, the progress the ongoing activity and some of the result achieved :

- 1) *Aerosol Size Distribution analysis using simultaneous measurement series at Zeppelin and Gruvebadet. (CNR, SU) :*
finnish group joined the activity by setting instruments for nucleation measurements at Gruvebadet

- 2) *Joint publication on the characteristics of CCN at the Zeppelin (KOPRI, SU)*
A paper on CCN has been submitted to Tellus
- 3) *Joint publication on the contribution of DMS to the particle formation and growth in the Arctic Environment (KOPRI, SU, CNR)*
KOPRI has several years of data already. Paper by Dall'Osto et al. on NPF is ready
- 4) *Combining in situ and remote sensed cloud microphysics with in situ observations of aerosols and cloud residuals at Zeppelin (SU, KOPRI, NIPR, AWI)*
David Cappelletti visited Potsdam (AWI; Univ. Potsdam) in Sep 2017 via an Erasmus funding. A strategy and some common dates for a joint evaluation of balloon-borne and lidar data has been discussed. Progress on this topic is expected in the near future. Moreover, a Spanish group from Valladolid installed a new sun- moon- and sky-photometer in Ny-Ålesund from which also aerosol microphysical properties can be derived, strengthening the expertise of the community in this field. Further it was mentioned that more and more data are accessible online.
- 5) *Aerosol microphysics observed in-situ and with lidar: July 2015 BB event (AWI, IOPAN)*
The evaluation of the intense 2015 BB event has been continued. Papers by Markowicz et al. and Moroni et al. are already published, papers by Ritter et al., Moroni et al. (2) and Lisok et al. are submitted or finalized.

The merged WG have discussed the activity performed during the 2017 as well as the plan for the 2018

During the 2017 season some new instruments have been installed and new activities started:

- Installation of a new sun- moon- sky-photometer by Univ. Valladolid (capable of determining AOD from the moon in the 2 weeks around full phase)
- Start of a Finnish project on size distribution of aerosol at Zeppelin station
- Installation of a scanning wind lidar at CC Tower by KOPRI

The following plans are scheduled for 2018:

1 Feb to 31 Mar: 4 radiosoundings per day in frame of YOPP (opportunity to study hygroscopic growth of aerosol and aerosol -BL interaction (intensive lidar campaign mid Feb to mid March)

5 Feb to 8 Mar: UNIS field course of Marius Jonassen on tethered balloons, possibility to link to Ny Alesund activity

End Feb: beginning of aerosol measurements at Gruebadet observatory

March: use full moon beginning of March for retrieval of aerosol properties from remote sensing; installation of Lidarino (532nm) at Gruebadet; start measurements by sodar at CC Tower; AWI PAMARCMiP campaign in Station Nord on aerosol, BC in atmosphere and snow: possibility to link to Ny Alesund

March to May: snow sampling by Italian groups

April: tether balloon project by Perugia, CNR also with new payload; TROPOS UAV campaign on aerosol and BL (mid Apr to mid May)

May: snow / water sampling by GKSS, this group will connect to Hornsund

Apr to Jun : Academy of China will launch project mainly on BL by temp & humidity lidar, wind lidar, additional eddy covariance, UAV

Summer: CNR: ISSAR project on aerosol and trace gases

1 Jul to 30 Sep: YOPP campaign with 4 radiosondes per day

Jul-Aug scheduled project by Alena Dekhtyareva on ship emissions around Longyear with contributions (aerosol trace gas, meteorology) from Hornsund and Ny

Further points: new nephelometer by Univ. Stockholm, installation of a moon photometer by CNR later this winter

During the discussion it became clear that the environmental impact of aerosol, as studied by Zhijong Xie from HZG, was previously not highlighted sufficiently in the aerosol working group. Collaboration between this group and Gruvebadet and Zeppelin in situ measurements can be increased in the future e.g. for source apportionment.

Univ Perugia will consider dust as an aerosol source more seriously, need to study local soil. Importance of linkage to snow groups was mentioned. Possibly their campaigns can be used for sampling.

Concerning a 2018 on-site seminar a doodle link will be set up.

Further common publications:

- 1) Univ. of Warsaw submitted on BC in Haze season from balloon and remote sensing
- 2) Andrea Spolaor et al. on BC on Glaciers

GROUP 3

Clouds and aerosol observations: what we can learn about aerosol-clouds and clouds aerosol interactions from combining remote sensing and in-situ observations
Kerstin Ebell, Univ. Cologne and David Cappelletti, Univ. Perugia

Participants: David Cappelletti (University of Perugia), Kerstin Ebell (University of Cologne), Hans-Christen Hanssen (Stockholm University), Sang-Woo Kim (Seoul National University), Jihyun Nam (Seoul National University), Tatiana Nomokonova (University of Cologne), Sang-Jong Park (Korea Polar Research Institute; KOPRI)

When presenting our specific research interests, it became very clear that we use diverse methods to improve our understanding of aerosol, clouds and the associated microphysical processes including in-situ observations of aerosol and clouds, remote sensing and also modelling. We need to make use of all observational datasets/approaches to study in a collaborative way these phenomena. All the studies within the flagship should be transparent and open for any of the groups in Ny-Ålesund to participate in. In a long-term perspective, we should target coordinated activities together with the “Multidisciplinary drifting Observatory for the Study of Arctic Climate” (MOSAIC) taking place 2019/2020.

Some general scientific questions were raised:

- Which are the key cloud parameters?
- How are they controlled?
- How does aerosol influence these?
- What is the thermodynamic impact?

Some specific questions/topics were raised/discussed:

- How can we combine in-situ cloud observations from the Zeppelin Observatory with the cloud remote sensing observations in Ny-Ålesund?

Cloud microphysical properties which are impacting the atmospheric and surface radiative fluxes and heating rates are the vertical distribution of liquid and ice water content and the corresponding effective radii. Information on these microphysical properties are often very uncertain when retrieved from remote sensing techniques. In-situ observations can help to constrain such retrieval algorithms and also help us to better quantify the corresponding uncertainties. Exploiting the collocated in-situ and remote sensing measurements would thus be very beneficial. Having gained confidence in the remote sensing retrieval methods, we can learn more about the vertical distribution and variability of cloud properties within the cloud which is difficult to know from in-situ measurements alone.

In order to be able compare in-situ observations with the cloud remote sensing instrumentation located at AWIPEV, appropriate cases (e.g., homogeneous cloud conditions, wind flow coming from the fjord not the mountains) need to be identified. It has been decided to establish a collaboration between KOPRI (in-situ observations) and University of Cologne (remote sensing) in this respect.

- How affected are the measurements (aerosol/clouds) by the mountain?
- How representative are the cloud observations at Ny-Ålesund?
The Seoul National University currently performs studies to analyze the spatial variability of Arctic clouds using Cloudsat/Calipso. How do cloud properties for example change over open water and sea ice? For a smaller domain and a shorter time period this will be also analyzed by University of Cologne using the aircraft measurements taken during the (AC)3 ACLOUD campaign in combination with high-resolution modelling approaches.
- Role of ice nucleating particles (INP)
Corinna Hoose and her group at the Karlsruhe Institute of Technology perform model studies on stratus Arctic clouds. They showed that the INP number concentration plays a crucial role in the development of these clouds. A combined in-situ/modelling/remote sensing approach was discussed: if observed INP number concentrations were available, this information could be used in model simulations. The result of these model simulations could then be coupled to a forward operator simulating the remote sensing observations (cloud radar). In this way, Arctic stratus clouds could be analyzed in an integrated approach.

Upcoming activities:

- For spring next year, University of Perugia is planning to perform tethered balloon measurements for aerosol properties. A dedicated payload for cloud properties would be very beneficial. It is planned to analyze these measurements also in combination with the cloud remote sensing observation from University of Cologne. University of Cologne will also support this activity with near-real time vertical cloud information.

GROUP 5

Snow & Atmosphere (from removal to deposition and redistribution in snow and ice)

Reported by: J. C. Gallet, NPI

People present in the group discussion with their respective expertise

C. Zdanowicz, Univ Upsalla, Sweden, Transport of atmospheric contaminants and deposition on snow, and trace elements in the cryosphere

E. Barboro, Univ Venice, CNR, Italia, Aerosols compositions and chemical markers for sources of aerosols in snow

A. Spolaro, Univ Venice, CNR, Italia, Chemistry and deposition on snow surface of aerosols and chemical compounds: deposition processes and signal recorded in ice cores (paleoclimate)

B. Luks, Polish Academy of Science, Poland, Hornsund station: Glacier monitoring and snow distribution on tundra site, precipitation monitoring for major ions, fresh snow on glaciers

Ilaria Baneschi, CNR, Italia, Melt and dynamic work since 2015: glacier water from different glaciers, monitoring work at Bayelva station (inorganic and organic carbon, stable isotope, influence on sea water) and snow samples in May on glaciers and land

Zhiyong Xie, Helmutz Center, Germany, Air and snow sampling, Emerging organic compounds in the Arctic, work supported by AWI, on going monitoring (sampling close to the Amudsen mast)

Pascal Morin, IPEV, Research coordinator

J.C. Gallet (group leader), NPI, Norway, Snow physic and impurities in snow

A round table was done to introduce the people as some were new in this group. We talked about our current project and monitoring activities. Since a lot of people are also sampling snow or melting snow at different area or are interested in getting more sample to get more spatial coverage, we discussed and will try for the next field season to collaborate more and help each other.

First, the Gruvebadet project was presented: The coming winter, NPI and AWIPEV will sample snow once a week to determine the BC content, the snow structure and the chemical and microbiological content in the snow, over the winter and the spring. This is a new initiative and people seemed also interested by this. We do not include more than what is originally planned so far.

However, researchers on site (JC and Andrea) agreed to take extra samples when they are in the field to include sampling for Baneschi and Xie, in Gruvebadet. This only involve our own time, and no time from the stations people. Discussion will be made during the winter to get the info and the sampling instruments and protocols. The entire cost regarding the logistic of the samples to be sent, or analyses, is at the own responsibility of the PI of the project, we only commit some of our time in the field (once a week, as planned for Gruvebadet). We estimate an extra hour of work max/week, fairly reasonable. We also to go sampling together when the respective PI will be on site. They will come but often for shorter time than we used to do and at different period. The goal is to provide them a longer sampling period, and increase the amount of collected data at the same for a better understanding of the role of snow in general. The larger idea is to really develop Gruvebadet in a more collective field snow sampling, with hopefully larger project to be developed there in the future.

We also discussed on doing some more experiment next year and sampling aerosols in snow and air simultaneously, as we did in 2017. We have currently plans for two papers to be written with the data collected in 2017 (NPI/CNR/Univ Boulder), work that was supported by the SSG grant through travel support in 2017 September (D. Cappellitti/A. Spolaor/A. Khan/JC Gallet and others).

A SSG/SSF proposal is on development and will be led by D. Cappellitti, Univ Perugia, Italy, and will be looking on improving the sampling platform we developed last year for BC sampling in air and snow, and also duplicate the work in Hornsund. We will also include tethered balloon measurement in Ny-Ålesund. The work will also include potentially a modeling component to better understand the dynamic of the boundary layer above glacier and the deposition of aerosols. The group will include Italy, Norway, Germany, Austria so far.

Activities, ideas and discussion for the future:

- If the work is successful in Gruvebadet, we discuss on the possible extension of Gruvebadet work later on in Hornsund, 18/19 maybe. Funding and discussion/agreements should be thought for that.
- Dust and organic signature of Carbon is a topic of future research, in snow and in the air.
- Looking into the contribution of biomass burning and fossil fuel to the carbon mass in the snow, future plan or pilot studies

GROUP 6

Atmospheric Composition, Greenhouse and Trace Gases, Ozone & UV
Reported by: Georg Hansen, NILU

Participants: G. Hansen (NILU, convenor), O. Hermansen (NILU), J. Krzyszin (IGF-PAS), P. Sobolewski (IGF-PAS), Z. Xie (HZG), A. Dekhtyareva (UiT)

Topics dealt with:

- (1) Opportunities for new trace/GHG measurements in Hornsund
- (2) Coordinated transport of instruments and equipment
- (3) Coordination of pollution measurements in Ny-Ålesund
- (4) Inter-comparison of GHG measurements with Picarro instruments in Ny-Ålesund
- (5) Preparation of UV-ICARE inter-comparison campaign
- (6) Cooperation on local pollution in Ny-Ålesund and Longyearbyen

Ad (1): An opportunity of an extension of GHG measurements as a cooperation between NILU and IGF-PAS was discussed. There is a need for methane measurements close to the ocean as a complement to the free-troposphere measurements at Zeppelin Observatory. Hornsund Station would be well-suited for such measurements. The Picarro instrument used in Ny-Ålesund works practically automatic and can be maintained by engineers/technicians. Proposed site: separate, T-stabilized container at some distance from the Polish Polar Station (no local pollution), ca. 400 m from shore. Other options for the future might be the Southeast Coast of Svalbard (Storfjorden), where there have been registered 10 x more earthquakes in recent years than before; these might trigger more methane releases from sub-ocean-floor reservoirs.

Possible funding option: RCN open call on Norwegian –Polish research cooperation in May 2018

Ad (2): challenge with Hornsund regarding logistics and coordination with international transport, ship transport limited during the year. Otherwise helicopter and snowmobile. Proposed step to improve coordination: utilize SIOS Knowledge Centre as service centre

Ad (3): Z. Xie informed about their work in the frame of the iCUPE project, where HZG is responsible for the WP “In-situ component for organic contaminants, mercury and other heavy metals”. The participants see great potential for closer cooperation between HZG and NILU on pollution monitoring in Ny-Ålesund. Regarding quantification of long-range transport of pollution, additional sampling should be envisaged in Hornsund, which shows marked differences in BC/OC concentrations compared to Ny-Ålesund.

Possible funding options:

- RCN open call on Norwegian –Polish research cooperation in May 2018 for possible Hornsund activities
- NILU – HZG cooperation: SSG (deadline 22 November, 2017)

Ad (4): There are 4 Picarro instruments to monitor GHG/trace gases in Ny-Ålesund (NILU on Zeppelin Obs. and in the settlement, NIPR at Japanese Station, KOPRI at Korean Station). So far, no inter-comparison with, e.g., standard gases have been performed. The group agreed that such an activity is highly recommended

Ad (5) In the frame of the ongoing SSG project UV-ICARE, an inter-comparison campaign of UV monitoring instruments from all stations on Svalbard is planned in April 2018. P. Sobolewski informed that the relevant instrumentation from Hornsund will be transported to Longyearbyen during the winter, awaiting further transport to Ny-Ålesund. The practical preparation of the campaign is urgent.

J. Krzyszin proposed a follow-up of the planned/ongoing activities in the frame of UV-ICARE on assessing contributions of ancillary parameters (clouds, aerosols, albedo) on Arctic UV levels. G. Hansen will contact A. Kylling on the issue.

Ad (6) A. Dekhtyareva informed about her initiative for a SSF Science Grant addressing international cooperation in the field of (local) air pollution research in Svalbard, including a pilot study in Longyearbyen in 2018 and 2019. Participants are institutions from Norway, Italy, Spain, Russia, and Germany. The application will be sent to RCN/SSF before 22 November, 2017.