

**Report from the Ny-Ålesund Atmosphere Flagship Symposium,
as part of the Ny-Ålesund Seminar 23-25 September 2015 in Tromsø**



Image from the Ny-Ålesund Seminar 24. September 2015. Photo: Ann Kristin Balto, Norwegian Polar Institute

Background

The Ny-Ålesund Atmosphere Flagship programme comprises the atmosphere research activities at those stations, which have ongoing atmosphere science topics. They cover the whole atmosphere, from the surface including atmosphere – ice / snow – permafrost exchange processes, the free troposphere and its constituents (trace gases, aerosols, clouds), the middle and the upper atmosphere (ozone layer and ionosphere). The goal of the flagship programme is to foster cooperation and collaboration in order to achieve research goals beyond the capabilities of the individual stations or research groups.

After NySMAC had initiated the flagship programmes, SSF had supported the first and second atmosphere flagship meetings (in 2008 and 2014), as well as the symposium in 2015. The attendance and topics of the 2015 symposium reflects how the flagship has developed over the years. In addition to the research work performed in Ny-Ålesund, the flagship includes also joint work with researchers based in Barentsburg and Hornsund.

The symposium

The first Atmosphere Flagship Symposium took place during the Ny-Ålesund seminar at the Fram Centre in Tromsø, Norway, on 25. September 2015. The symposium had 50 participants which have been supported by SSF with respect to accommodation and meal costs. Symposium contributions were given as lectures, or during poster sessions on 23. and 24. September. The list of attendees, talks and posters is given as annex.

In addition to the symposium, there was a meeting of the flagship steering committee, as well as a side meeting for the boundary layer work group.

The symposium covered the following main science topics:

- Tropospheric aerosols
- Black carbon and atmospheric transport processes
- Trace gases, pollutants, and water vapour isotopes
- Results from long term observations of meteorological parameters
- The Atmospheric boundary layer
- Atmosphere – snow interaction processes
- Methane in the Arctic atmosphere
- Clouds above Ny-Ålesund
- Ionospheric research

A key part of the symposium was the discussion with all attendees about the further development of the atmosphere flagship programme.

Outcome

The symposium was particularly successful. It not only fostered many discussion among international participants, who often so far had not met on site before, although they have been working from the same location, namely Ny-Ålesund. Several papers presenting scientific results have been initiated or developed during the symposium.

A major outcome of the discussion about the flagship programme was the determination of the further progress the programme shall achieve. In particular, the participants agreed that the atmosphere flagship, in order to facilitate and encourage the cooperation within the flagship, should form smaller work groups focusing on specific scientific questions of common interest. However it was also stated that the formation of such work groups should be transparent and participation should be open to any of the Ny Ålesund research groups. The work groups should each have a clear focus and goals. New groups could be formed when so suggested by any group of Ny-Ålesund

scientists. The overarching goal is to enhance the possibility to study as well detailed scientific questions as getting better and deeper insight in broader more general scientific questions. So far the following working groups have been identified (more details on each WG given below):

- Clouds and local – regional short term processes
- Long-term observations and trends in temperature, precipitation, clouds, and radiation
- Boundary layer meteorology
- Aerosols (black carbon) and snow
- Atmospheric aerosols
- Variability in surface UV irradiance and ozone column

Following the positive development during the symposium, it was agreed to submit again a proposal to SSF to support the Atmosphere Flagship Programme through the Strategic Grants scheme. The proposal was submitted asking for support of the flagship programme and the above mentioned six work groups in particular. The lively contributions to formulating the proposal shows the high activity of this flagship programme and that it appears to be on a constructive development path.

More detailed plans for continued work within the working groups

(1) Work group on clouds, local – regional short term processes

This work group focuses on three scientific questions concerning local and near regional processes affecting the formation and type of clouds, and their impacts, namely: (i) How does the local orography affect cloud formation and type?; (ii) What are the regional driving forces for cloud formation and type?; (iii) How does the aerosol affect the local and regional cloud formation?

Detailed observations of clouds and aerosols that are already being made from Ny-Ålesund and Zeppelin Observatory will be used together with an expanding network of meteorological observations from a range of surface types in the region around Ny-Ålesund to investigate cloud processes over Ny-Ålesund and to learn to what extent they are representative of cloud processes over the broader region.

(2) Work group on long-term observations and trends in temperature, precipitation, clouds and radiation.

The scope of this work group is to put the various atmospheric observations in a broader temporal and spatial context. Focus activities will be (i) the analysis of atmospheric long-term measurements in terms of climate change, (ii) the combination of observations in the Svalbard region, (iii) the interpretation of Svalbard observations with regard to the broader Arctic. The expanded approach includes hind-cast studies of available local and regional observations of meteorology, clouds, and radiation fluxes to detect trends and to investigate possible driving forces and feedbacks causing observed trends. Relevant oceanographic records as sea surface temperature, salinity and sea ice properties (e.g. ice extent, sea ice thickness etc.) should also be included in the analysis.

(3) Work group on boundary layer (BL) meteorology.

This work group focuses on determining the processes and describing theoretically the local boundary layer. Current and near future research activities aim to improve the understanding of (i) the stable boundary layer, (ii) influence and occurrence of micrometeorological phenomena, (iii) influence of surface types and properties on the BL structure, (iv) coupling between local and synoptic processes. These efforts shall reduce the gap between boundary layer properties in models and the orographically influenced observations in Ny-Ålesund. Therefore this work group is linked to those of aerosol and clouds via the comparability of measurements at different sites (namely the Zeppelin Observatory to the column above the village) and also contributes to the understanding of the representativeness of Ny-Ålesund. Hornsund Station is performing corresponding systematic lidar sounding of the atmosphere. One of the focuses is the determination of atmospheric boundary layer height, which could be analyzed in comparison to the Ny-Ålesund observations.

(4) Work group on aerosols (black carbon) and snow, including snow albedo feedback.

Aerosols including black carbon (BC) in the Arctic are mainly due to long range transport, which is deposited onto the surface mainly through precipitation, but also through dry deposition. This work group will mainly focus on the effect on albedo of snow which can be a crucial climate feedback, and will combine measurements on (i) sources attribution (biogenic vs. fossil sources), (ii) deposition rate onto the snow surface, (iii) the amount of BC in the snow, including its vertical distribution. Several atmospheric and snow physical parameters are already recorded by different groups and institutes at different locations around Ny-Ålesund, Barentsburg, Svea, Pyramiden, and Hornsund. Atmospheric and snow BC content, as well as some chemical parameters have also been measured at several places and data will be collected and merged.

(5) Work group on atmospheric aerosols

Aerosol research both in-situ and via remote sensing has already a long tradition in Ny-Ålesund. Long-term data sets of chemical, optical and microphysical properties of aerosol exist and are being continued to monitor the temporal and spatial distribution of these, and to understand pollution pathways, removal processes and interaction with clouds, trace gases and radiation. From common campaigns and fieldwork a very good cooperation between the groups already exists, but a workshop in 2016 is urgently needed with the aim of writing jointly papers on existing data. A strong biomass burning event in Canada, which occurred over Ny-Ålesund during the week after 9. July 2015, provides a unique opportunity to gather all aerosol groups in Ny-Ålesund and the rest of Svalbard to prepare a joint publication. Such an effort will also stimulate more regular aerosol closure studies and, hence, increase our knowledge of the direct forcing of aerosol.

(6) Work group on Variability in surface UV irradiance and ozone column.

This work group will analyze the variations in the ozone column and solar UV irradiance observed at the ground. The enhanced variability in atmospheric conditions at Svalbard causes the corresponding variability in the air transparency that, combined with the specific surface features characterized by sea surface and complex relief of the snow-covered land, leads to significant changes in the solar UV irradiance reaching the Earth's surface. Svalbard provides a great opportunity for studying the short- and median-term variations in the ozone column since the polar day allows us to obtain continuous time series within a period of several months. The main goal of the planned study will be the relationship between the UV variations on one hand, and the changes in the ozone column and the meteorological factors, on the other. The field irradiance measurements will be analyzed together with the environmental parameters provided by different measurement techniques. The stations in Ny-Ålesund and the rest of Svalbard are equipped with diverse instruments measuring the surface UV irradiance and ozone column.

Programme Atmosphere Symposium Friday 25. September 2015

09:00-09:15 **Welcome**
Roland Neuber and Christina A. Pedersen

Chair: Jean-Charles Gallet, NPI

09:15-09:30 **Connecting Aerosol Size Distributions at Three Arctic Stations**
Eyal Freud, Radovan Krejci, Peter Tunved, Leonard Barrie

09:30-09:45 **Number size distributions and concentration during multiannual measurements campaign at Ny Alesund**
Angelo Lupi, M. Busetto, M. Mazzola, C. Lanconelli, F. Giardi, S. Becagli, R. Udisti, V. Vitale, A. Viola and H.C. Hansson

09:45-10:00 **Aerosol properties from the 2014 haze season derived by lidar**

- Christoph Ritter
- 10:00-10:15 **Insights from size distribution and chemical composition of aerosol collected at Ny Alesund during the 2010-2014 spring-summer campaigns**
Roberto Udisti, Italian Aerosol Research Group
- 10:15-10:30 **Aerosol physical and chemical properties measured during the 2014 iAREA campaign on Spitsbergen**
Tymon Zielinski, J. Lisok, C. Ritter, R. Neuber, K.M. Markowicz, I.S. Stachlewska, M. Chilinski, P. Makuch, P. Pakszys, P. Markuszewski, A. Rozwadowska, T. Petelski, T. Zielinski, S. Becagli, R. Traversi, R. Udisti, J. Struzewska, J. W. Kaminski, M. Jefimow, M. Gausa
- 10:30-11:00 *Coffee Break*
- Chair: Christoph Ritter, AWI*
- 11:00-11:15 **How does European aerosol emissions affect the Arctic climate?**
Acosta Navarro, H. C. Hansson, J. C., Varma, V., Riipinen, I., Seland, Ø., Kirkevåg, A., Struthers, H., Iversen, T., Ekman, A. M. L.
- 11:15-11:30 **Measurements of BC mass concentration, microphysical characteristics of near-ground aerosol and its chemical composition in Barentsburg (Svalbard) in 2011-2014**
Valerii Kozlov, D.G. Chernov, M.V. Panchenko, V.F. Radionov, L.P. Golobokova, O.I. Khuriganova
- 11:30-11:45 **Increase in elemental carbon values between 1970 and 2004 observed in a 300-year ice core from Høltedahlfonna (Svalbard)**
Meri Ruppel, E. Isaksson, J. Ström, E. Beaudon, J. Svensson, C. A. Pedersen, A. Korhola
- 11:45-12:00 **Quantifying influence of regional air pollution on atmospheric measurements in Ny-Ålesund**
Alena Dekhtyareva, K. Edvardsen, K. Holmén, O. Hermansen, H.-C. Hansson
- 12:00-12:15 **Understanding of the atmospheric methane evolution and change over the last decades with focus on the Arctic region**
Cathrine Lund Myhre, S. Dalsøren, O. Hermansen, G. Myhre, and I. Isaksen
- 12:15-12:30 **Long-term observations of air surface exchange of elemental mercury in the Norwegian Arctic**
Katrine A. Pfaffhuber, L. R. Hole, T. Berg, A. Ryjkov, A. Dastoor
- 12:30-13:30 *Lunch break (lunch served in the Arktika cantina)*
- Chair: Alena Dekhtyareva, UiT*
- 13:30-14:00 **Discussions within the Flagship Programme**
- 14:00-14:15 **Water vapor in Hornsund – comparison of lidar, sun photometer and satellite sensors data**
Magdalena Bloch, Grzegorz Karasiński, Piotr S. Sobolewski
- 14:15-14:30 **36 years of meteorological measurements in Polish Polar Station at Hornsund**
Grzegorz Karasiński, Tomasz Wawrzyniak, Bartłomiej Luks, Magdalena Bloch
- 14:30-14:45 **Arctic Warming, Moisture Increase and Circulation Changes Observed in the Ny-Ålesund Homogenized Radiosonde Record**
Marion Maturilli, Markus Kayser
- 14:45-15:00 **Precipitation in Arctic and associated synoptic atmospheric condition**
Sourav Chatterjee, Nuncio Murukesh, K Satheesan

15:00-15:30 *Coffee Break*

Chair: Angelo Viola, CNR

15:30-15:45 **Ny-Ålesund atmospheric boundary layer**

Alexander Schulz

15:45-16:00 **The next step for snow research in Ny-Ålesund: towards a coupled snow-atmosphere long term sampling site**

Jean-Charles Gallet, C. A. Pedersen, S. Gerland, E. Isaksson

16:00-16:15 **Interactions between snow and atmosphere in the Arctic**

Hans-Werner Jacobi

16:15-16:30 **Lidar Observations of Tropospheric Aerosols and Clouds over Ny-Aalesund**

Takashi Shibata, Koichi Shiraishi, Iwasaki, Masataka Shiobara and Toshiaki Takano

16:30-16:45 **A case study on microphysical characteristics of Arctic clouds based on simultaneous measurements with a polarized Micro-Pulse Lidar and a 95-GHz Cloud Radar at Ny-Ålesund, Svalbard**

Masataka Shiobara, T. Takano, H. Okamoto, Masanori, Yabuki, C. Ritter

16:45-17:00 **The interannual change of cloud and the radiative contribution at Ny-Ålesund**

Kyohei Yamada, T. Hayasak, M. Shiobara, M. Kuji, M. Yabuki, M. Maturilli

Atmosphere Flagship Posters (23. and 24. September 2015)

Ship Traffic Particulate Matter Emissions – First Results

Are Backlund, Matthias Karl, Ove Hermansen, Caroline Leck

Long-term monitoring of persistent organic pollutants (POPs) in air at Zeppelin station

Pernilla Bohlin-Nizzetto, Ove Hermansson, Athanasios Katsoyiannis, Lisa Melymuk, Petra Pribylova, Jana Klanova

Event-based observations of stable water isotopes in precipitation in Ny-Ålesund to support interpretation of Svalbard ice core data

Dmitry Divine, Elisabeth Isaksson, Tonu Martma

Vertical mixing of Aerosol in the Planetary Boundary Layer at Ny-Ålesund, Svalbard (Spitzbergen)

Oxana Drofa, C. Lanconelli, A. Lupi, M. Mazzola, F. Tampieri, A. P. Viola, V. Vitale, S. Becagli, F. Giardi, R. Udisti, M. Maturilli, A. Schultz

Halogenated and organophosphorus flame retardants on particles in the Arctic atmosphere

Mark Hermanson, Amina Salamova, Ronald A. Hites

An introduction to the Norwegian Mapping Authority's ionospheric research at high latitudes

Knut Stanley Jacobsen, Yngvild Linnea Andalsvik

Intrinsic chemical transformation in ice and its environmental effects – The fate of pollutants trapped in ice media

Kitae Kim

Direct observations of Arctic cloud particle content using a Counterflow Virtual Impactor

Radovan Krejci, Paul Zieger, Johan Ström, H-C Hansson, Peter Tunved

Annual variation of the cloud fraction and base height at Ny-Ålesund with ground-based observations

Makoto Kuji, Mayu Miyagawa, Masanori Yabuki, Masataka Shiobara

Troposphere halogens in Ny-Ålesund by DOAS measurements

Yuhan Luo

AGAP: an Atmospheric Gondola for Aerosol Profiling

Mauro Mazzola, D. Cappelletti, M. Busetto, C. Lanconelli, A.P. Viola, L. Ferrero, E. Bolzacchini, A. Lupi, V. Vitale

The roughness length evaluation at Ny-Alesund: a preliminary results

A. Pelliccioni, F.Tampieri, A.Viola, M.Mazzola

Variability in solar UV irradiance and atmospheric ozone column observed at Ny-Ålesund: current results of the U-VIVA RiS project

Boyan Petkov, Vito Vitale, Mauro Mazzola, Angelo Lupi, Christian Lanconelli, Angelo Viola, Kerstin Stebel, Georg H. Hansen

Sub-sea emissions of methane and light hydrocarbons from Arctic Ocean to atmosphere

Stephen Platt, Ove Hermansen, Norbert Schmidbauer, Anna Silyakova, Benedicte Ferré, Jürgen Mienert, Cathrine Lund Myhre

Seasonal variation of aerosol water uptake and its impact on the direct radiative effect at Ny-Ålesund, Svalbard

Narges Rastak, Sanna Silvergren, Paul Zieger, Ulla Wideqvist, Johan Ström, Birgitta Svenningsson, Marion Maturilli, Matthias Tesche, Annica Ekman, Peter Tunved, Ilona Riipinen

Monitoring of aerosol optical depth and water vapor content of the atmosphere in Barentsburg with the help of SPM and SP-9 sun photometers

S. M. Sakerin, Kozlov V., Kabanov D.M., Radionov V.F.

Ny-Ålesund atmospheric boundary layer

Alexander Schulz

Hygroscopicity and cloud forming properties of Arctic aerosol during one year

Sanna Silvergren, Ulla Wideqvist, Johan Ström, Staffan Sjögren, and Birgitta Svenningsson

Reconciling aerosol light extinction measurements from spaceborne lidar observations and in situ measurements in the Arctic

Mattias Tesche, Paul Zieger, Narges Rastak, Robert J. Charlson, Paul Glantz, Peter Tunved, and H-C. Hansson

Springtime atmospheric chemistry of Ny Ålesund, Svalbard

Roseline C. Thakur, Meloth Thamban

Organophosphate flame retardants and plasticizers in air and snow of the Arctic

Zhiyong Xie

Size resolved CCN concentration measurements in the Arctic – two case studies during summertime 2008

Julia Zabori, Narges Rastak, Young-Jun Yoon, Ilona Riipinen and Johan Ström

Participants for the Atmosphere Symposium

Name	Institution
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