Recipient name	Recipient insitition	Host name	Host institution
Tymon Zielinski	Institute of Oceanology Polish Academy of Sciences	Mauro Mazzola	National Research Council (CNR)
1) Yutaka Tobo, 2) Naruki Hiranuma	1) NIPR, and 2) West Texas A&M University (WTAMU)	Mauro Mazzola	National Research Council (CNR)
Alia Khan	National Snow and Ice Data Center, University of Colorado, Boulder	Jean-Charles Gallet	NPI
Nuncio Murukesh	NCAOR	Christoph Ritter, Marion Maturilli	AWI
1) Andrea Spolaor, 2) David Cappelletti	1) CNR, 2) University of Perugia	Jean-Charles Gallet	NPI
Konstantinos Eleftheriadis	N.C.S.R. "Demokritos"	Kjetil Tørseth	NILU
Hans-Werner Jacobi, Camille Rogeaux,	Institute for Geosciences and Environmental Research (IGE), Université Grenoble Alpes	Mariele Wolff	MET Norway

Guest visit reports

Recipient: Tymon Zielinski, Institute of Oceanology Polish Academy of Sciences
Host: Mauro Mazzola, ISAC-CNR, Bologna, University of Milan

Dates of the visit: 15 –22 November 2017

During his visit professor Zielinski took part in a number of professional meetings and gave two lectures, on 17 November, at the University of Milan: Arctic – not so pristine. Aerosol studies within the framework of the Institute of Oceanology Polish Academy of Sciences activities, and on 20 November, at the ISAC-CNR in Bologna: Studies of aerosol physical properties around Svalbard. Both lectures generated discussions and further topics for cooperation.

On 16 November, a joint meeting was organized in Bologna, which was attended by researchers from University of Florence, University of Milan and ISAC-CNR, during which plans for 2018 campaigns have been made and plans for two joint publications were discussed and accepted. During his visit to Milan, along with the lecture, professor Zielinski further discussed joined activities within the cooperation with the university and especially within the ERASMUS program. As a result, as part of the joint research plan, a university student, Marco Cataldi will take part in the research cruise of r/v Oceania in summer 2018.

In the remaining days plans for joint conference presentations and for a visit of Dr. Luca Ferrero (University of Milan), Marco Cataldi (University of Milan) and Dr. Mauro Mazzola (ISAC-CNR) to Poland in January 2018 were made. This visit is a follow up of the current cooperation, and ship visit and tests for scientific instruments onboard are planned.

Recipient: Naruki Hiranuma, West Texas A&M University, US
Host: M. Mazzola, CNR; Italy

Objectives and interim achievements:
During October 17-19, 2017, a group of ten scientists from four different institutes, including the National Research Council of Italy (CNR, M. Mazzola, A. Lupi, F. Belosi, M. Rinaldi, M. Paglione, A. Viola), West Texas A&M University (WTAMU, N. Hiranuma), University of Florence (R. Traversi) and University of Perugia (B. Moroni, D. Cappelletti), conducted the data workshop at CNR in Bologna, Italy. We met to discuss the results from our recent collaborative field campaign carried out at the Gruvebadet atmospheric observatory in Ny-Ålesund in March 2017. Some preliminary results from this collaborative research were presented. In particular, our science topics included:

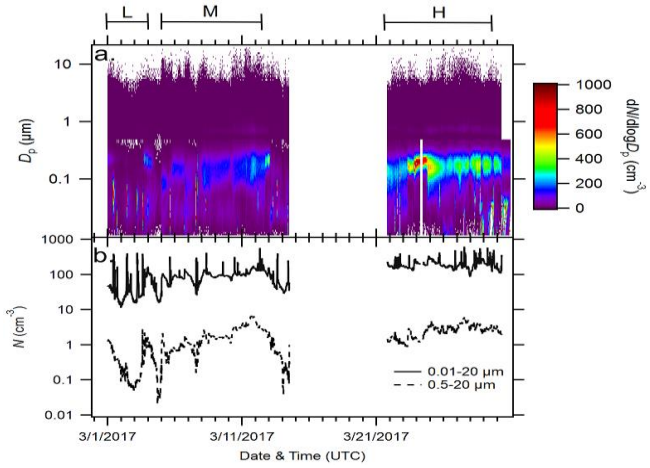
- Aerosol physical and chemical measurements at and from Gruvebadet, Ny-Ålesund
- Aerosol optical/physical properties at the Gruvebadet laboratory during various measurements campaigns at Ny-Ålesund
- Ice nucleating-particle (INP) research at the Gruvebadet observatory in Ny-Ålesund during Spring 2017
- INPs and ice crystals scavenging
- Marine INP measurements
- Morphochemical characteristics and mixing state of aerosol particles at Ny-Ålesund
- Determination of black carbon and nanoparticles along glaciers in the Spitsbergen region exploiting a mobile platform

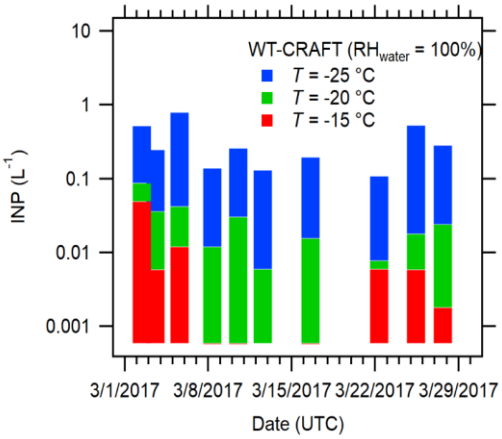
Overall, we made stimulating discussions regarding the nanoscale physical properties and elemental/molecular compositions of ice particles as well as the total aerosol samples from Ny-Ålesund to identify and classify any specific mineral and organic inclusions that may have promoted atmospheric ice nucleation. More personally, my participation in the Ny-Ålesund Atmosphere Flagship Program has contributed to my long-term research goal, which is elucidating the role of INPs in atmospheric processes (e.g., cloud/precipitation formation). The INP research is generally of timely interest, considering climate change around the Polar region presumably due to the Arctic amplification. Further, this travel opportunity contributes to public awareness of collaborative interdisciplinary work at CNR/WTAMU. In turn, providing public visibility and increasing the diverse awareness of INP research is important to resolve the knowledge/enthusiasm gap between scientists and the public. In addition, the collaborative discussion conducted within this proposal has created new collaboration opportunities to promote scientific immersion with other research institutes and set the basis of long-term research collaboration (e.g., sample exchanges and sharing for multiple off-line analyses).

The data obtained from this study will be used in the future modeling studies, advancing comprehensive knowledge of INP research. We also plan to publish the obtained data in peer-reviewed journals and present at well-recognized scientific conferences. I fully expect that our scientific findings and products will lead to a more comprehensive understanding of aerosol-cloud-climate interactions, which is beneficial to the climate science community to improve knowledge of atmospheric ice nucleation processes and its formulation in the atmospheric weather and climate models. This endeavor substantially has benefited all institutes by helping to build a long-term, multidisciplinary research program. Yet, we identify the necessity of several follow-up data analyses. To complement our discussion and further fill the knowledge gap, N. Hiranuma (or his student) plans to re-visit CNR in the 2018 summer to continue discussing the data with above-mentioned collaborators.

Summary of preliminary scientific findings:
As can be seen in **Figure 1a**, based on the observation, we have preliminarily identified three distinct periods of different aerosol concentration levels, including low- (L), moderate- (M) and high (H) particle concentration periods. On average, the measured aerosol concentrations in these individual periods, L = 3/1 0:00 – 3/3 0:00, M = 3/4 0:00 – 3/12 9:00 and H = 3/21 19:30 – 3/30 7:30, were 47.0

cm^{-3}, 93.0 cm^{-3} and 195.2 cm^{-3}, respectively. **Figure 1b** represents the time series of INP concentrations measured using the WT-CRAFT system (i.e., offline droplet supercooling method to assess immersion freezing, *Tobo*, 2016, Sci. Rep.). Here, we present INPs per liter of air estimated and measured by diluting the suspension until our measurements collapse onto the background water freezing spectrum, resulting in the immersion freezing spactra in the temperature range higher than -25 °C. Overall, our preliminary results exhibit that the average cumulative INP concentrations (± standard error) measured at -25 °C in March, 2017 is 0.32 ± 0.07 L^{-1}. This value is interestingly comparable to the FRIDGE measurements of 0.32 ± 0.03 L^{-1}, which represents the average ± standard error values over May 2015 to June 2016, indicating that our campaign period is representative of the typical conditions observed in Ny-Ålesund. In addition, a subset of our measurements show a unique aspect of ice nucleation behavior at relatively high temperatures in comparison to the freezing temperature of other typical INPs (T > -15 °C). For instance, as apparent in the ice nucleation **Figure 1c**, our INP spectrum for the sample collected over 3/2/2017 10:15 – 3/3/2017 13:42 (UTC) show bimodal activation temperatures, where marine biogenic aerosols (microlayers) may be responsible for the high T onset (*Irish et al*., 2017, ACP; *Wilson et al*., 2016, Nature). In summary, our data suggest that the INP concentration in Ny-Ålesund from March 2017 is less than one in millions of ambient aerosols (~100 cm^{-3}). Likewise, the probability of finding high T INPs (<0.1 INPs L^{-1}) deems small (less than one in million probability). There seems no notable correlation between INP concentration and ambient aerosol concentration for our March 2017 dataset. Regardless, further investigation is necessary to examine the seasonal variations of INP concentrations and correlation with meteorological parameters as well as cloud residual chemical properties that, when filled, will dramatically enhance the credibility of our experiments to evaluate the aerosol-cloud interactions in the Arctic region.





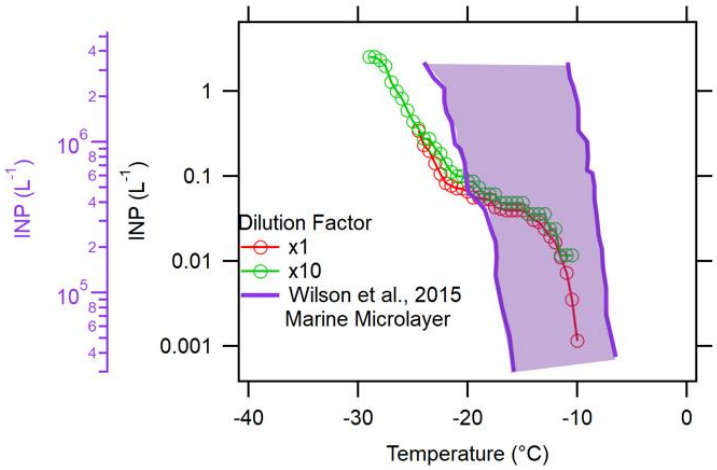


Figure 1. (a) 10 minute averaged aerosol number size distributions measured at the Gruvebadet atmospheric observatory during March, 2017 are shown in (a). The aerosol size is represented by the particle diameter, denoted as D_p. The time series of aerosol number concentrations (N), a total concentration in the solid line and subset of >0.5 µm particles in the dotted line, are shown in (b). The color scale for the top panel represents the logarithmically size-scaled aerosol number concentration ($dN/d\log D_p$). (b) INP time series measure using the WT-CRAFT system. Cummulative INP concentrations measured at -15, -20 and -25 °C are shown. (c) Ice nucleation spectrim for the sample collected over 3/2/2017 10:15 – 3/3/2017 13:42 (UTC) as a representative of the samples containing bimodal freezing temperatures. The reference ice nucleation spectra of marine microlayer (maximum and minimum) are retrieved from *Irish et al*. (2017, ACP).

Recipient: Alia Khan, National Snow and Ice Data Center, University of Colorado – Boulder, US
Host: JC Gallet, NPI, Norway

With the support of the guest traveler funds from the Ny-Ålesund Atmosphere Flagship Program, I, Alia Khan, was able to meet with my collaborator, JC Gallet from the Norwegian Polar Institute (NPI) at the NPI office in Longyearbyen, Svalbard. We met for five days to discuss the results of our Arctic Field Grant (AFG), which was funded by the Svalbard Science Forum. The overall aim of the AFG was to further our understanding of, 'Pre and Post Deposition Processes of Black Carbon in Snow around Ny-Ålesund, RIS ID: ES583897'. The AFG, which included 3 weeks of collaborative fieldwork resulted in a robust dataset of measurements comparing the thermal-optical Elemental Carbon/Organic Carbon EC/OC technique and the laser incandescence technique, the Single Particle Soot Photometer (SP2). During the field campaign, samples were collected from the accumulation regions of glaciers surrounding Ny-Ålesund, along elevation transects on the glaciers, as well as around the Ny-Ålesund village (Sverdrup station) area where NPI is doing snow monitoring for BC and Brøggerbeen, a long-term monitoring glacier site. More than 100 samples were collected and analyzed with each technique.

The guest traveler funds enabled Co-PI's Khan and Gallet to meet in Longyearbyen, Svalbard to analyze data and begin preparing a manuscript. During this time we collated, organized, and discussed the best approaches to analyze and compare our data. We began comparing our observations of black carbon in snow, to atmospheric measurements, regional climate patterns and back trajectories of wind in order to delve into atmospheric processes that may influence deposition of BC in the cryosphere. We also began drafting a publication, which we are continuing to work on, with an aimed submission to a journal like Atmospheric Chemistry and Physics or the Journal of Geophysical Research – Atmospheres, early next year. We also discussed future research collaborations, funding opportunities, and existing knowledge gaps in the field of black carbon in

snow, as well as other light absorbing impurities in snow and ice. The opportunity to meet and discuss our data and results, after a successful field campaign together, and independent laboratory analysis, further solidified our collaboration and helped expedite the next steps, such as the publication of our results and our future collaborative proposal submissions.

Recipient: Nuncio Murukesh, NCAOR, India
Host: Christoph Ritter, Marion Maturilli, AWI, Germany

The visit was under the Ny-Ålesund Atmosphere Flagship travel grant to jointly analyse atmospheric data and to discuss possible areas of cooperation. During the visit, data sets from microwave radiometer installed at Ny-Ålesund was analysed along with the wind lidar data collected from AWI.

During 2014 September, there was three warming events recorded by the radiometer, on 13th 16th and on 25th. (Figure.1). The warming extended the entire troposphere.
On 16th the wind ross obtained from wind lidar showed southwesterly through out the day. However the wind direction was northerly in the lower 500m early morning and southerly above 500m (Figure 2a). On 25th September wind was mostly southerly and easterly.

The response of the radiometer to winds on these two days are different (Figure 3). On 16th the temperature in the northern direction showed a conspicuous shift from warmer to colder temperature, especially above the boundary layer. While the other two direction recorded a gradual shift.

On 13th September the warming occurred early morning with the southerly winds and the atmosphere cooled by the evening with northerly winds (Figure. 2c)

Thus the atmospheric temperature at Ny-Ålesund showed conspicuous variability with wind direction during 2014 September. Southerly winds raised the atmospheric temperature. The response of radiometer with different scanning direction differs. For example on 16th the temperature in the northern direction showed a faster cooling that southern and zenith temperature profiles. At present, we are studying the dynamical reasons if any, for such differences.

Future work
Apart from the radiometer data analysis, few possible areas of cooperation were identified, 1) moisture and heat flux to arctic using long term radio sonde data collected by AWI and radiometer data collected by NCAOR 2) Polar tropical teleconnections, with an emphasis on the Madden Julian Oscillation and its impact in high latitude. With the following years field work more interactions and combined campaigns are planned if needed to address the atmospheric variability in Ny-Ålesund.

Ackowledgements:
Travel grant from Ny-Ålesund Atmosphere Flagship made this visit and work possible. Efforts from NysMac, especially, Drs, Christina Pedersen (NPI) and Roland Neuber (AWI) is greatly acknowledged. The author thank director NCAOR for his Keen interest and encouragement for this visit. Drs, Christoph Ritter and Marion Maturilli were the hosts and they spend their valuable time discussing Atmospheric science research in Ny-Ålesund, the author thank their sincere efforts

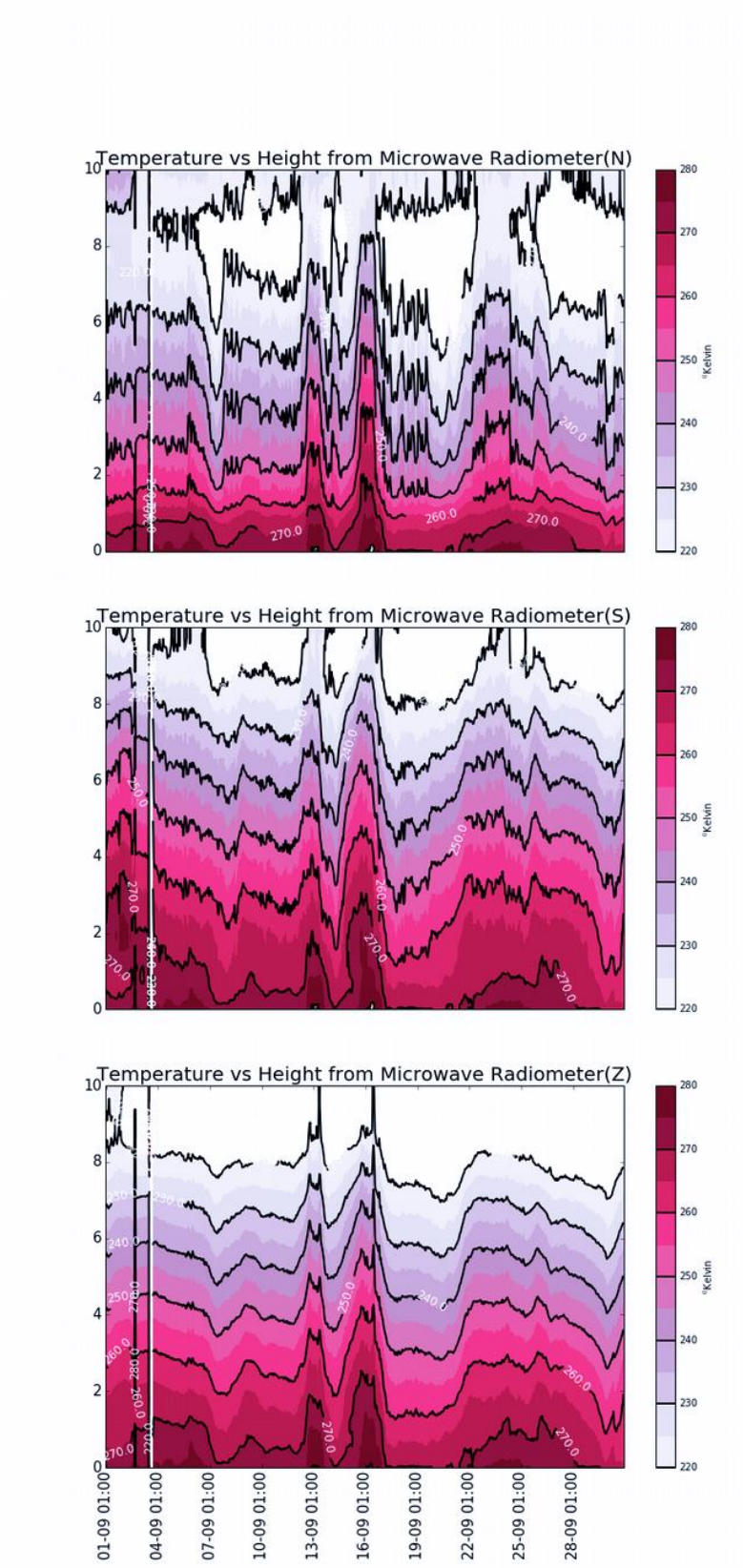


Figure.1 Radiometer temperature profiles for September 2014, NS &Z shows the direction of scanning (North, South and Zenith).

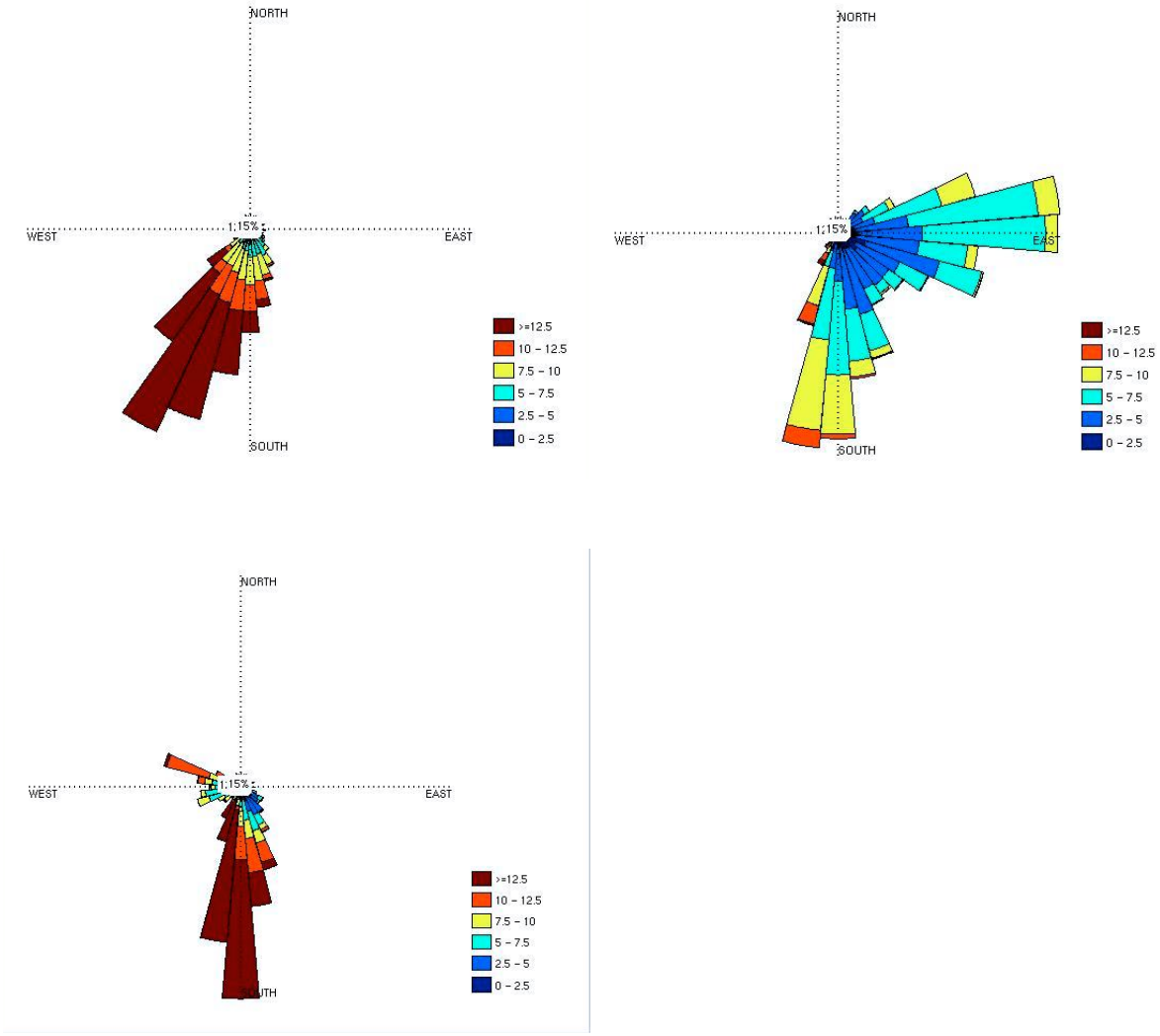


Figure.2. (a) Wind direction from wind lidar on 16th September 2014. Winds were mostly southeasterly during the day. (b) Wind direction from wind lidar on 25th September 2014. Winds were mostly southerly and easterly during the day. (c) Wind direction from wind lidar on 13th September 2014. Winds were mostly southerly during the day.

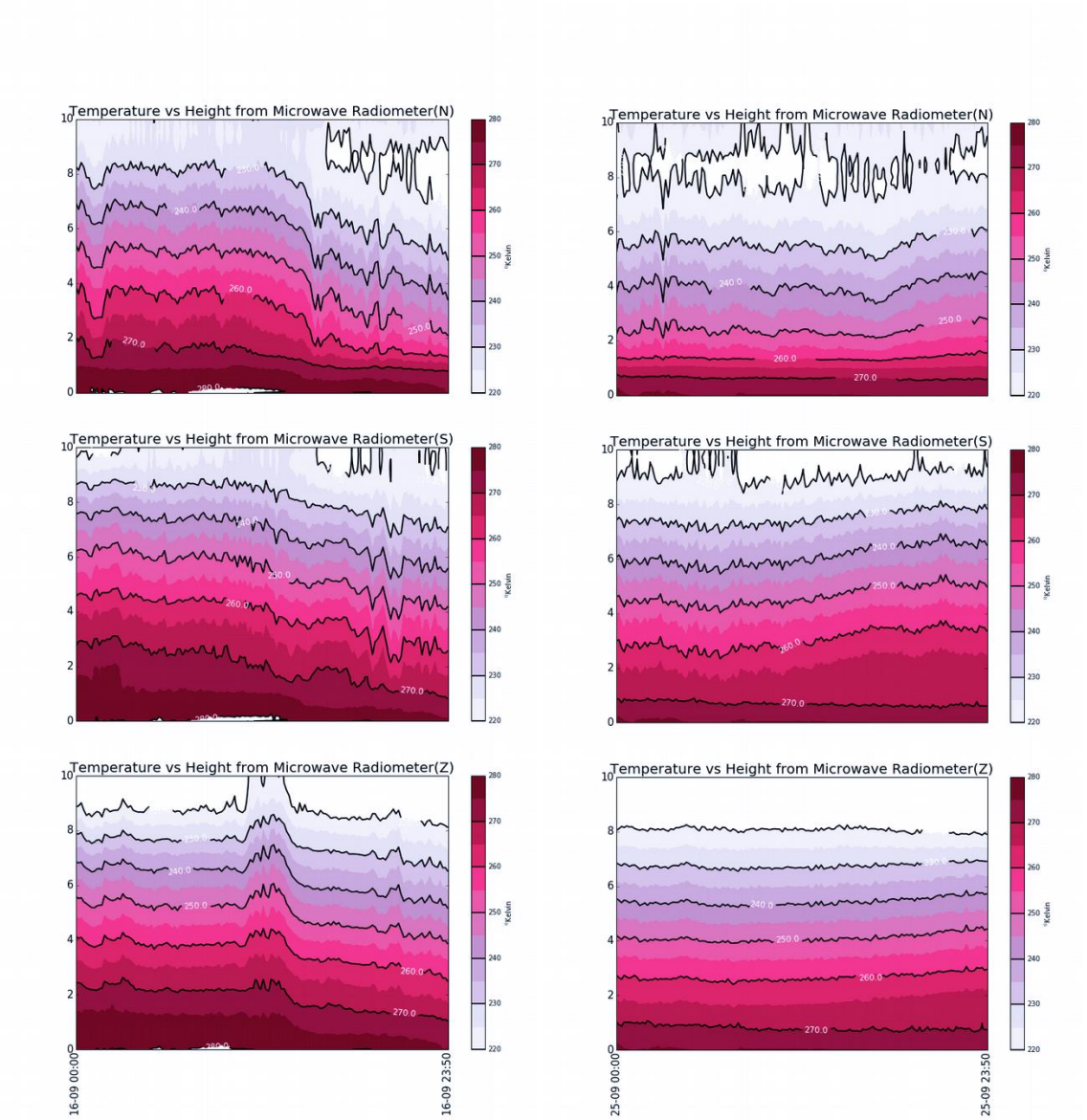


Figure.3. Same as for figure.1 but during 16th (left) and 25th (right) of September 2014.
On 25th though the winds were southerly, the temperature profiles were relatively cool compared to 16th.

Recipient: David Cappelletti, University of Perugia, Italy
Host: JC Gallet, NPI, Norway

This visit was conceived during a joint field activity in April 2017 at Ny-Ålesund, which brought us together on the Spitsbergen glaciers probing for BC in air and in snow. The results of this exploratory campaign were sufficiently interesting to plan for future organized campaigns and joint papers and thus the idea of this visit come out. Most of time spent in Longyerbyen was dedicated to an in depth analysis of the results of the April 2017 field campaign. This is a very important practical result of the visit: you never have time at home, due to the many duties, to get really focussed onto the data. This is particularly necessary for exploratory campaign, such the one we had, which required a non standard approach to the results. A joint research paper was planned on these results (expected submission in the next spring). Furthermore, we had time to plan for future research work and

decided to write a joint proposal to SSG (2017 call). The proposal was successfully submitted recently. In conclusion I think the visit was very fruitful.

Recipient: Konstantinos Eleftheriadis, N.C.S.R. "Demokritos"
Host: Kjetil Tørseth, NILU
Dates of the visit: 23 –30 October 2017

The scientific visit was planned and implemented at NILU, Norway. NILU and NCSR Demokritos have established a long term collaboration regarding atmospheric measurements at Zeppelin Observatory centred around the long term observation of Black Carbon and related aerosol species, their properties and sources.

Objectives and Research topics covered during the visit.
The current topic of the collaboration and work achieved during this visit was as follows:
1. Establishment and exploitation of the 18 year old time series of Equivalent Black carbon measured by the NCSR Demokritos aethalometer.
2. Evaluation and assessment of current state of the art on the technology of aerosol absoprtion and equivalent black Carbon by Aethalometers
3. Comparison of common co-located data of NILU and Demokritos Aethalometers at Ny Aalesund. Zeppelinfjellet
4. Planning of instrument service and standard operating procedures as well as data processing and reporting
5. Assessment of noise and uncertainty with respect to Near Real Time Reporting (NRT)
6. Planning of intensive campaigns in light of parallel activities namely the iCUPE project during 2018

Presentations and discussions
A presentation was given at the NILU seminar room attended by several researchers of the ATMOS section under the title: "The story of two decades of (almost) continuous Black Carbon measurements at Zeppelinfjellet. Exploitation of results and future prospects"

Discussions were mainly organized by the senior scientist in charge of the Visit Dr. Markus Fiebig, but also included:
The Director of NILU ATMOS, Kjetil Tørseth,
The atmospheric modelling scientists: Andreas Stohl, Nikolaos Evangeliou, Sabine Eckhardt,
The Atmospheric measurements and data analysis scientists: Markus Fiebig, Karl Espen Yttri, Stephen Platt, Ove Hermansen, Wenche Aas, Cathrine Lund Myhre and others

Future prospects
It was decided that the collaboration will continue centered on the data products arising from the atmospheric measurements. Several issues remaining can improve the quality and dissemination of the data and the production of peer reviewed publications and data products for the scientific and international community.

A number of recent publications which reflect the on going research are given below:

- Backman, J., Schmeisser, L., Virkkula, A., Ogren, J. A., Asmi, E., Starkweather, S., Sharma, S., Eleftheriadis, K., Uttal, T., Jefferson, A., Bergin, M., Makshtas, A., Tunved, P., and Fiebig, M.: On Aethalometer measurement uncertainties and an instrument correction factor for the Arctic, Atmos. Meas. Tech., 10, 5039-5062, https://doi.org/10.5194/amt-10-5039-2017, 2017
- Gwennolé Guyot, Frans Olofson, Peter Tunved, Christophe Gourbeyre, Guy Fevbre, Régis Dupuy, Christophe Bernard, Gérard Ancellet, Kathy Law, Boris Quennehen, Alfons

Schwarzenboeck, Kostas Eleftheriadis, and Olivier Jourdan Characterization of the cloud microphysical and optical properties and aerosol-cloud interaction in the Arctic from in situ ground-based measurements during the CLIMSLIP-NyA campaign, Svalbard Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-672, 2017
- Lauren Schmeisser, John Backman, John A. Ogren, Elisabeth Andrews, Eija Asmi, Sandra Starkweather, Taneil Uttal, Markus Fiebig, Sangeeta Sharma, Kostas Eleftheriadis, Stergios Vratolis, Michael Bergin, Peter Tunved, and Anne Jefferson, 2018, Climatology of aerosol optical properties in the Arctic, Atmos. Chem. Phys. (under review)

Recipient: Hans-Werner Jacobi, Camille Rogeaux, Institute for Geosciences and Environmental Research (IGE), Université Grenoble Alpes, France
Host: Mariele Wolff, MET Norway

Participants in this visit were Camille Rogeaux (Master Student Hydrology, Institute for Geosciences and Environmental Research (IGE) at the University Grenoble Alpes / CNRS) and Hans-Werner Jacobi (IGE). Our host at the Norwegian Meteorological Institute in Oslo was Mareile Wolff. The visit took place from 18 to 20 May 2017 and included two seminars on 19 May: *Snow properties and processes linking snow to radiative forcing in high latitudes and altitudes* by Hans-Werner Jacobi and *Analysis of snow melting processes at Ny-Alesund* by Camille Rogeaux.

Liquid and solid precipitation are important climatic variables in the Arctic that are expected to have undergone significant changes in the past and will undergo further changes in the future due to the changing climate. However, only few quality-controlled data sets of these variables are currently available in the Arctic since corrections for the serious and well-known undercatch of the standard gauges mainly in the case of solid precipitation are rarely applied. Due to the monitoring activities of the Norwegian Meteorological Institute daily precipitation measurements are available in Ny-Alesund since 1974, which have been accompanied since 1994 by hourly precipitation measurements obtained with a so-called Geonor instrument. However, corrections for the undercatch were only performed during a limited period of two years in the frame of a research project. During the visit a strategy for the correction and analysis of the available precipitation data was developed involving the following steps: (1) processing of raw Geonor data, (2) comparison of daily measurements with uncorrected Geonor data for the overlapping period from 1994 onwards, (3) correction of the Geonor measurements applying different published equations taking into account wind speed, temperature, and precipitation intensity, (4) development of a correction method for the daily measurements using averaged meteorological data to extend the corrected data set back to 1974, (5) comparison of the corrected time series based on daily and hourly observations.
Steps 1 and 2 have been initiated and will form part of the work of the Ph.D. student Foteini Baladima at IGE, who started her project in October 2017. The information about the attempt to develop a correction method for precipitation measurements was shared with other partners involved in research in Svalbard, who are interested in applying similar methods. This initiative led to a poster presented at the Svalbard Science Conference 2017 in Oslo.

References:
Jacobi, H.-W., F. Baladima, C. Rogeaux, M.A. Wolff, K. Isaksen, R. Brækkan, E. Førland, H.M. Gjelten, A.V. Urazgildeeva, P.N. Sviashchennikov, B.V. Ivanov, E. Łupikasza, M. Osuch, and T. Wawrzyniak, How to get reliable precipitation data in the Arctic? Poster presented at The Svalbard Science Conference 2017, Oslo, Norway, November 2017.