

**Report of the IASC Workshop on Effects and Extremes of High Latitude Dust, 13-14 FEB 2019, in co-operation with the IceDust Aerosol Association, IBA-FIN-BCDUST-project of MFA of Finland, and EU COST InDust Action**

7 March 2019

by

Outi Meinander (Finnish Meteorological Institute) and Pavla Dagsson-Waldhauserova (Agricultural University of Iceland), together with the IASC members of Halldór Björnsson and Guðrún Nína Petersen (Icelandic Meteorological Office), Kent Moore (University of Toronto), Joan Nymand Larsen (Stefansson Arctic Institute), and Lassi Heininen (University of Lapland)

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*(Report has a total of 19 pages)*

**Abbreviations**

AUI Agricultural University of Iceland

COST European Cooperation in Science and Technology

FMI Finnish Meteorological Institute, Finland

HLD High latitude dust

IASC International Arctic Science Committee

IBABaltic Sea, Barents and Arctic region co-operation funding of the Ministry for Foreign Affairs of Finland

MFA Ministry for Foreign Affairs of Finland, https://um.fi/frontpage

# Background

High latitude dust (HLD), originating from cold high latitudes (≥ 50 °N and ≥ 40 °S), affects the cryosphere, oceans, air quality and safety, and in Europe both the High Arctic and the European mainland. Extreme HLD related events include unexpected, unusual or unseasonal events with exceptional magnitude, duration, severity, or extent, such as most severe wind erosion events, storms, dust storms, snow-dust storms, heat waves, cold weather, and extreme snowfalls, for example. Topics of interest of this workshop included, but were not limited to:

* Observing effects and extremes and their precursors related to HLD
* Sources of HLD
* Modelling of HLD
* Satellite detection of HLD
* Forecasting HLD
* HLD and climate change
* Relevance of HLD for society/users.

The overarching aim of the interdisciplinary atmosphere-cryosphere workshop was to review our understanding of effects and extremes of High Latitude Dust in the past, present and future, and to identify future research needs.

# Organizing the workshop

This interdisciplinary IASC workshop on Effects and Extremes of High Latitude Dust, 13-14 Feb 2019, was most of all an outcome of the Finnish-Icelandic co-operation of Outi Meinander from FMI and Pavla Dagsson-Waldhauserova from AUI.

The overall organizing committee of this IASC WS was:

* Outi Meinander (Finnish Meteorological Institute, IASC grant holder of the WS; grant holder of IBA-FIN-BCDUST-project, MC member of InDust, member of IceDust)
* Pavla Dagsson-Waldhauserova (Agricultural University of Iceland, host of the IASC workshop, MC member of InDust, convener of IceDust)
* Halldór Björnsson (Icelandic Meteorological Office, IASC member)
* Guðrún Nína Petersen (Icelandic Meteorological Office, IASC member)
* Kent Moore (University of Toronto, IASC member)
* Joan Nymand Larsen (Stefansson Arctic Institute, IASC member )-
* Lassi Heininen (University of Lapland, IASC member)

The WS was organized in co-operation with the ICEDUST Association (<https://icedustblog.wordpress.com>), IBA-FIN-BCDUST-project of MFA of Finland (<https://en.ilmatieteenlaitos.fi/iba-project>), and EU COST InDust Action (<https://cost-indust.eu/>).

The information channels for the WS were: 1) IASC webpages, 2) Twitter/FMI\_snow, and 3) ICeDust webpages. The registration received 43 registrations for the event via webropol.fi-questionnaire (<https://webropol.fi/>). The signatures in the name lists of Day 1 and Day2 include 38 names. In addition some Icelandic participants were present a shorter time in the WS and did not sign the forms. After the workshop, the book of abstracts ‘Effects and Extremes of High Latitude Dust - Book of Abstracts’ will appear with the ISBN number 978-9979-881-86-5. The workshop could be followed remotely as follows:

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Germany: +49 692 5736 7317

Ireland: +353 16 572 651

Italy: +39 0 230 57 81 42

Netherlands: +31 207 941 377

New Zealand: +64 9 280 6302

Norway: +47 21 93 37 51

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First GoToMeeting? Let's do a quick system check:

<https://link.gotomeeting.com/system-check>



*Figure 1. Group photo of IASC WS on Effects and extremes of HLD.*

# Travel support to ECS

We received nine ECS travel support applications. Three early career scientists (registered PhD students or PhD degree gained within 5 years) were selected for IASC travel grant of 750 eur (Table 1).

*Table 1. The ECS travel grant (750 eur) receivers.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Affiliation | Country | Talk topic | ECS |
| Isatis M. Cintron Rodriguez | Rutgers University/TU Wien | Austria/US | Measurements of light absorbing particles impact and ice nucleation activity in Svínafelljökull | Yes |
| Keyvan Ranjbar | Centre d’Applications et de Recherches en Télédétection, Université de Sherbrooke | Canada | Remote sensing of local dust over the Canadian Arctic | Yes |
| Alberto Sanchez-Marroquin | University of Leeds | UK | Ice nucleating ability of high latitude airborne dust collected from an aircraft | Yes |

# 4. Final agenda



**AGENDA (Final Agenda, 4 Feb 2019)**

**IASC WORKSHOP ON EFFECTS AND EXTREMES OF HIGH LATITUDE DUST**

 **13-14 FEB 2019** Agricultural University of Iceland, Reykjavik, *Iceland,* in co-operation with the **ICEDUST Association, IBA-FIN-BCDUST-project of MFA of Finland**, and **EU COST InDust Action**

**Venue:** Agricultural University of Iceland (**AUI**), Arleynir 22, Keldnaholt, Reykjavik, Iceland

**Confirmed invited workshop keynote speaker: Joanna Bullard, UK**

###### **Confirmed invited speakers**:

Liane Benning, Germany**: Dust feed bugs and helps speed up ice melt in the Arctic**
Zongbo Shi, UK: **Dust mineralogy: impact on ocean biogeochemistry and climate**
Marek Lewandowski, Poland**: Dust over Svalbard: first results on mineral assemblages, deposited in the firn of selected glaciers of the Southern Spitsbergen**
Slobodan Nickovic, WMO SDS-WAS**: SDS-WAS and InDust initiatives in support of better understanding high latitude dust effects**
Darius Ceburnis, Ireland: **Studying dust events by synergistic observations**
Bojan Cvetkovic, Serbia: **DREAM atmospheric dust transport model simulations – case study results of Icelandic mineral dust transport**
Jan Kavan, Czech Republic: **Aerosol concentrations and Aeolian sediment deposition on selected glaciers on James Ross Island, Antarctica in 2018**

**ECS grantees of the workshop: USA:** Isatis M. Cintron Rodriguez, Rutgers University/TU Wien, **USA/Austria**, Measurements of light absorbing particles impact and ice nucleation activity in Svínafelljökull, **Canada**: Keyvan Ranjbar, Centre d’Applications et de Recherches en Télédétection, Université de Sherbrooke, Sherbrooke, Remote sensing of local dust over the Canadian Arctic, and **UK:** Alberto Sanchez-Marroquin, University of Leeds, UK, Ice nucleating ability of high latitude airborne dust collected from an aircraft.

**DAY 1**

|  |  |  |
| --- | --- | --- |
| **Session 1: 10:00-12:00****Chairs:** **Outi Meinander and Pavla****Dagsson-Waldhauserova** |  | **What do we know about HLD?** |
| 10:00 – 10:05 | Outi Meinander andPavla Dagsson-Waldhauserova | Welcome and introducing the Workshop organizing team  |
| 10:05 – 10:10 | Snorri Baldursson, Dean of the AUI | Welcome speech |
| 10:10 – 10:50 | Joanna Bullard, UK | Workshop Keynote: High‐latitude dust in the Earth system |
| 10:50 - 11:20 | Throstur Thorsteinsson, Iceland | Icelandic HLD: Natural and un-natural sources of PM10 causing exceedances of health limits in Iceland |
| 11:20 – 11:45 | Slobodan Nickovic, Serbia | SDS-WAS and InDust initiatives in support of better understanding high latitude dust effects |
| 11:45 – 12:00 | Keyvan Ranjbar, Canada | Remote sensing of local dust over the Canadian Arctic |
| 12:00 – 12:15 | Darius Ceburnis, Ireland | Studying dust events by synergistic observations |
| **12:30 – 13:15** | **Lunch** |  |
| **Session 2: 13:15 - 15:00****Chair: Mary Butwin** |  | **Effects, observation and modeling of HLD I.**  |
| 13:15 – 13:45 | Liane G. Benning, Germany | Session Keynote: Dust feed bugs and helps speed up ice melt in the Arctic  |
| 13.45-14:00 | Bojan Cvetkovic, Serbia | DREAM atmospheric dust transport model simulations – case study results of Icelandic mineral dust transport |
| 14:00 – 14.15 | Isatis Cintron, Austria | Measurements of light absorbing particles impacts and ice nucleation activity in Svínafelljökull |
| 14:15-14:30 | Edyta Kalińska, Poland | Understanding a mineral matter from cryoconite holes: a scanning electron microscopy study |
| 14:30-14:45 | Konrad Kandler and Kerstin Schepanski, Germany | HiLDA project plan: Iceland as a model for high-latitude dust sources – a combined experimental and modelling approach for characterization of dust emission and transport processes |
| 14:45-15:00 | Dividing into small groups for the Session 3 |  |
| **Session 3: 15:00-17:00** |  | **Bringing us together in one HLD map** |
| 15:00-16:00 | **Coffee, introducing ourselves and Day1 Discussions while circulating at 3 Points with “**Professors as Chairs”: 1. Joanna Bullard (General Understanding on HLD), 2. Liane Benning (Climatic Effects of HLD vs BC), 3. Throstur Thorteinsson (role of Icelandic Dust versus unnatural dust) | Give your individual input in the map of HLD sources and move along in small groups to give your input in the points. Everyone visits 15 minutes in one point.*(some pre-prepared material provided by OM & PD-W for the session Chairs)* |
| 16:00-17:00 | Putting Day1 Discussion together |  |
| 17:00 | Pavla Dagsson-Waldhauserova and Outi Meinander | Briefing on Workshop Dinner |
| **19:00** | **Workshop Dinner (partly supported by IBA-FIN-BCDUST-project)** |  |

**DAY 2**

|  |  |  |
| --- | --- | --- |
| **Internal IceDust Association meeting: 8:00-9:55** | **(IceDust members only)** |  |
| **Session 4: 10:00-12:00****Chairs: Konrad Kandler and Kerstin Schepanski** |  | **Effects, observations and modeling of HLD II.** |
| 10:00-10:30 | Zongbo Shi, UK | Session Keynote: Dust mineralogy: impact on ocean biogeochemistry and climate |
| 10:30 – 10:45 | Ottmar Möhler, Germany | High-latitude dust as efficient ice-nucleating particles - a case for Icelandic dust |
| 10:45-11:00 | Alberto Sanchez-Marroquin, UK | Ice nucleating ability of high latitude airborne dust collected from an aircraft |
| 11:00-11:15 | Mary Butwin, Iceland | Defining Icelandic dust and volcanic ash |
| 11:15-11:30 | Sverrir Guðmundsson, Iceland | Impact of tephra on the albedo of ice caps in Iceland derived from MODIS albedo product |
| 11:30-11:45 | György Varga, Hungary | Giant Saharan quartz particles in Iceland |
| 11:45-12:00 | Jill Bachelder, Canada | Characterization of wind-blown dust after river piracy event in the Canadian North |
| **12:30 – 13:15** | **Lunch** |  |
| **Session 5: 13:15- 15:10****Chair: Slobodan Nickovic** |  | **Extremes and Observations and Modeling of HLD III.** |
| 13:15-13:45 | Marek Lewandowski, Poland | Session Keynote: Dust over Svalbard: first results on mineral assemblages, deposited in the firn of selected glaciers of the Southern Spitsbergen |
| 13:45-14:00 | Dragana Đorđević, Serbia | Can volcanic dust suspended from surface soil and deserts of Iceland be transferred to central Balkan? |
| 14:00-14:15 | Pavla Dagsson-Waldhauserova, Iceland | New High Latitude Dust sources and pathways: Dust storms in Iceland and Antarctica |
| 14:15-14:30 | Jan Kavan, Czech Republic | Aerosol concentrations and Aeolian sediment deposition on selected glaciers on James Ross Island, Antarctica in 2018 |
| 14:30-14:45 | G.W.K. Moore, Canada  | Synoptic scale and mesoscale characteristics of an east Greenland wind driven dust event |
| 14:45-15:00 | Outi Meinander, Finland | About cryospheric effects of HLD versus BC in the Arctic |
| 15:00-15:10 | Short presentations on posters (1-3 min each)  |  |
| **15:00-15:40** | **Coffee and posters** |  |
| (possible to continue until 17:00) |  |  |
| 15:50 – 16:00 | Outi Meinander and the organizing team | Closing comments |
| **16:00 (or 17:00)** | **Workshop Closing** | Thank you for being with us! |
|  |  |  |
| **Posters/****Presenter** | **Title** |
| Aleksandra Mihajlidi-Zelić, Serbia | Influence of marine aerosol from North Atlantic Ocean on continental urban aerosol in Southeast Europe (Central Balkan area) |
| Eduardo Erazo Acosta, Colombia | The power of the Sumak kawsay (buen vivir) ancestral philosophy in the indigenous movements of Colombia – Ecuador vs exclusion by mining mega- development, defense of High Mountain, contributions to the rights of the nature from the global south |
| Kerstin Schepanski, Germany | Atmospheric circulation patterns fostering the development of dust plumes over Iceland |
| Konrad Kandler and Kerstin Schepanski, Germany | HiLDA: Iceland as a model for high-latitude dust sources – a combined experimental and modelling approach for characterization of dust emission and transport processes |
| Nasim Hossein Hamzeh, Iran | Synoptic analysis and simulation of dust storm in Feb 2016 in Khuzestan province |
| Outi Meinander, Finland and Pavla Dagsson-Waldhauserova, Iceland | Snow melt and light absorbing impurities of soot and dust in Iceland and Finland |
| Sarah Barr, UK | The sources and activity of ice nucleating particles in the high latitudes |
| Sara Basart, Spain | InDust COST Action |

**More information:**

**Updates to the agenda here:** [twitter.com/FMI\_snow](http://twitter.com/FMI_snow), and <https://icedustblog.wordpress.com/2018/10/31/effects-and-extremes-of-high-latitude-dust-iasc-workshop-in-co-operation-with-the-icedust-association-13-14-feb-2019-reykjavik-in-iceland/>, and <https://iasc.info/upcoming-iasc-events>

**Participant’s questions and replies related to IASC-2019 Iceland (doodle link):** https://fmi.doodle.com/poll/u352duviyae6cueh?utm\_campaign=poll\_added\_participant\_admin&utm\_medium=email&utm\_source=poll\_transactional&utm\_content=gotopoll-cta#table

We look forward to welcoming you!

**Organizing team:** Outi Meinander (Finnish Meteorological Institute, contact: firstname.lastname@fmi.fi), Pavla Dagsson-Waldhauserova (Agricultural University of Iceland, contact: firstname@lbhi.is), together with IASC members of Halldór Björnsson and Guðrún Nína Petersen (Icelandic Meteorological Office), Kent Moore (University of Toronto), Joan Nymand Larsen (Stefansson Arctic Institute), and Lassi Heininen (University of Lapland), and in co-operation with the IceDust Association, Iceland



# 5 Submitted Abstracts

IASC-2019 Workshop on Effects and Extremes of High Latitude Dust, 13-14 Feb 2019, Iceland

ABSTRACTS

**Liane G. Benning: Dust feed bugs and helps speed up ice melt in the Arctic.** Impact of tephra on the albedo of ice caps in Iceland derived from MODIS albedo product

**Simon Gascoin 1, Sverrir Guðmundsson 2,3, Guðfinna Aðalgeirsdóttir 3, Finnur Pálsson 3, Louise Schmidt 3, Etienne Berthier 4, Helgi Björnsson** 3 1 Centre d’Etudes Spatiales de la Biosphère, Université de Toulouse, CNRS/CNES/IRD/UPS; Toulouse, France, simon.gascoin@cesbio.cnes.fr 2 Veitur Utilities, Reykjavík, Iceland, sg@hi.is 3 University of Iceland, Institute of Earth Sciences, Reykjavik, Iceland; gua@hi.is 4 Laboratoire d’Etudes en Géophysique et Océanographie Spatiales, Université de Toulouse, CNRS/CNES/IRD/UPS; Toulouse, France; etienne.berthier@legos.obs-mip.fr Albedo is a key variable in the glacier mass balance because it defines the amount of solar radiation absorbed by the glacier surface. It depends on various factors including the content of impurities in the surface layer. Over large glaciers and ice caps, mid-resolution satellite remote sensing observations enables monitoring of the albedo with a reasonable frequency. Information about seasonal and inter-annual evolution of albedo is important for improvement of surface energy balance models embedded in climate models. Here we present a comprehensive evaluation of the MODIS (Aqua/Terra combined) broadband shortwave albedo product MCD43A over two Ice caps in Iceland. We compared these data with in situ daily albedo data from five automatic weather stations located on the Vatnajökull and Langjökull ice caps during the period 2009-2012. There is remarkable large variability in the albedo on Icelandic glaciers due to the mixing of fresh snow with dark tephra layers. We further quantify the impact of tephra deposition on the glacier albedo following the eruption of Eyjafjallajökull in April 2010 and Grímsvötn in May 2011. We show a widespread albedo drop of 0.4 over all Icelandic ice caps following these eruptions

**Dragana Đorđević, Ivana Tošić, Sanja Sakan, Srđan Petrović, Jelena Đuričić-Milanković, David C. Finger, Pavla Dagsson-Waldhauserová. Can volcanic dust suspended from surface soil and deserts of Iceland be transferred to central Balkan?** We use chemical fingerprints as characteristics ratios of specific crustal elements Ca/Al, Fe/Al, K/Al, Mg/Al, Mn/Al, Ca/Fe, and Mg/Fe to investigate the long-range transport of volcanic aerosols from Iceland. Backward trajectories from Belgrade (=44°48’; =20°28’) in 2012 and 2013, simultaneous with atmospheric aerosols measurements, were calculated by using the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model. We found that about 17% of air masses passed over Icelandic territory and arrived to Balkan area. We found that central Balkan area is under influence of Icelandic dust originating from resuspended volcanic particles at least 3 % of total air masses.

**Dust over Svalbard: first results on mineral assemblages, deposited in the firn of selected glaciers of the Southern Spitsbergen** **Lewandowski, M.1, Kusiak, M.A.2, Nawrot, A.1, Barzycka, B.3, Laska, M.3.** Eroded Svalbard mountain ranges are an effective source of dust, which sets on and is preserved in the local glaciers. 1 Institute of Geophysics, Polish Academy of Sciences, Ks. Janusza St 64, 01-452 Warszawa, Poland

2 Institute of Geological Sciences, Polish Academy of Sciences, Twarda St 51/55, 00-818 Warszawa, Poland

3 Faculty of Earth Sciences, University of Silesia, Będzińska St 60, 41-200 Sosnowiec, Poland

The glaciers of Svalbard are also an excellent repository for allochthonous eolian dust, originating from Iceland or other, yet poorly recognized sources. Here we report the first results from analyses of the dust particulates, collected from shallow (0.5-1m long) firn cores of Hansbreen, Storbreen, Flatbreen, Recherchebreen and Werenskoildbreen (Southern Spitsbergen). The cores, acquired during the Spring of 2018, were divided in ca. 1.5 kG specimens, which were melted and filtrated, using polycarbonate membranes with 0.45 μm pore size. Using standard geochemical methods (SEM, BSE, ASEM), we identified a range of mineral phases as to pyrite, iron oxides, quartz, K feldspar, or rutile. Zircon and monazite were also present, with grains size promising for geochronological investigations. Coarser grains probably deriving from nearby areas, whilst those, up to few micrometers in size, may be transported from more distant sources. Among the findings, there is one multielemental, unidentified phase that could be of anthropogenic origin, generated due to technological processes and blown away from industrial waste deposits. Black carbon particles (BCP) have been found in prevailing number of analytical specimens. A phase of Ni+Fe composition may represent a micrometeorite grain. These results point to possible potential to utilize the dust mineral composition for glaciostratigraphy, glacitectonics, recognition of dust load density distribution including cosmogenic source or degree of antropogenic dust contamination over the region. During forthcoming seasons, we are planning to continue these studies on longer (up to 10m) cores and over broader areas of Spitsbergen. With a bigger dataset, a correlation of dust fallout with glacier facies or seasonal snowfall/rainfall will be sought.

**Edyta Kalińska: Understanding a mineral matter from cryoconite holes: a scanning electron microscopy study.** Both organic and mineral matter constitute a cryoconite, which is a peculiar sediment type occurring in holes of the supraglacial zone. A great attention is given to the biological components of the cryoconite, whereas morphology of mineral grains is still poorly known. A scanning electron microscope (SEM) technique helps to better understand the origin, transportation regime and depositional processes of mineral grains from the supraglacial environment. To fulfill this, samples from a set of glaciers from the Alps, the Caucasus, the Svalbard and Greenland is studied.

**Mary Butwin: Defining Icelandic dust and volcanic ash**. The definition for dust varies depending on the field, but when one thinks about dust in the atmosphere they typically picture mineral dust that is composed mostly of quartz and feldspar. However, the source areas for Icelandic dust is not mineral, it is basaltic. The volcanic origins of the surface material in Iceland change its physical properties, as well as its appearance. In addition to the sandy source areas, during volcanic eruptions volcanic ash is deposited onto the surface. Past research has stated that volcanic ash may be more hazardous to human health than dust, depending on the structure and the age. However, the previous dust studies focused on mineral dust and not basaltic dust that is present in Iceland. To determine if dust in Iceland differs greatly from mineral dust, size distribution, and shape analysis were completed for the surface material in dust source areas, as well as volcanic ash. These were then compared to each other as well as to properties from mineral dust source areas. The major difference that was found was the structure of the grains. For particles greater than 20 μm volcanic properties were evident. Whereas, particles less than 20 μm were crystalline and blocky in nature. Much like the structure of mineral dust. As a result, it was determined that fine grained dust from Iceland will behave in the atmosphere and pose similar risks to that of mineral dust.

**Kerstin Schepanski: Atmospheric circulation fostering dust uplift in Iceland**

**Alberto Sanchez-Marroquin, I. T. Burke1, J. B. McQuaid, B. J. Murray. Ice nucleating ability of high latitude airborne dust collected from an aircraft.** High-latitude emitted dust is known to have an effect on ice albedo, melt rates and providing nutrients to the marine ecosystem. It has also been suggested that high-latitude dusts may influence clouds through ice-nucleation, however its ice-nucleating ability is unknown. A small concentration of ice-nucleating particles has the potential to remove shallow supercooled clouds, dramatically altering radiative transfer (Vergara-Temprado et al., 2018). These high-latitude sources have the potential to be importance since the low-latitude arid dust sources are remote. In order to determine the ice-nucleating ability of high latitude dust we have sampled dust onto filters from the UK’s BAe-146 FAAM research aircraft. We determine the ice-nucleating ability using a droplet freezing based technique (Price et al., 2018) and determine the size resolved composition (including mineral dust) using a Scanning Electron Microscopy (SEM) technique (Sanchez-Marroquin et al., In Prep.). The combination of the ice-nucleating particle analysis with the dust size distribution allows us to estimate the ice-nucleating activity of the dust. Samples from Iceland and Alaska have been analysed with these techniques (as well as Cape Verde and the UK), but we focus here on the Icelandic case . The Icelandic samples were collected between about 100m and 3000m around the South and South East areas of the island. The dust surface area and ice-nucleating particle concentrations varied from the limit of detection to values comparable with the dust laden tropical Atlantic. We find that there is a correlation between the INP concentration and the surface area of dust, implying that the dust dominates the ice-nucleating activity of the aerosol (i.e. the activity is not defined by another aerosol type). Using both the ice-nucleating particle concentration and dust area measurements, we calculated the ice-nucleating activity (temperature dependent active site density) of the Icelandic dust. This Icelandic dust has a comparable ice-nucleating activity to that of desert dust sampled in the tropical Atlantic. In order to assess how important this sources is for clouds, we need to combine these results with the spatial variation in dust surface area to determine ice nucleating particle concentrations in regions of the atmosphere where supercooled clouds form.

PRICE, H. C., BAUSTIAN, K. J., MCQUAID, J. B., BLYTH, A., BOWER, K. N., CHOULARTON, T., COTTON, R. J., CUI, Z., FIELD, P. R., GALLAGHER, M., HAWKER, R., MERRINGTON, A., MILTENBERGER, A., NEELY III, R. R., PARKER, S. T., ROSENBERG, P. D., TAYLOR, J. W., TREMBATH, J., VERGARA-TEMPRADO, J., WHALE, T. F., WILSON, T. W., YOUNG, G. & MURRAY, B. J. 2018. Atmospheric Ice-Nucleating Particles in the Dusty Tropical Atlantic. Journal of Geophysical Research: Atmospheres, 123, 2175-2193. SANCHEZ-MARROQUIN, A., HEDGES, D. H. P., PARKER, S. T., ROSENBERG, P. D., TREMBATH, J., WALSHAW, R., BURKE, I. T., MCQUAID, J. B, MURRAY, J. B., In Prep., Characterising the size-resolved composition of atmospheric aerosol sampled from a research aircraft using Scanning Electron Microscopy. VERGARA-TEMPRADO, J., MILTENBERGER, A. K., FURTADO, K., GROSVENOR, D. P., SHIPWAY, B. J., HILL, A. A., WILKINSON, J. M., FIELD, P. R., MURRAY, B. J. & CARSLAW, K. S. 2018. Strong control of Southern Ocean cloud reflectivity by ice-nucleating particles. Proc Natl Acad Sci U S A, 115, 2687-2692.

**Throstur Thorsteinsson: Natural and un-natural sources of PM10 causing exceedences of health limits in Iceland.** The health limit for PM10 (50 μg/m3, 24-hour average) is exceeded in urban areas of Iceland due to anthropogenic sources, typical as traffic and less common fireworks, and natural sources, mainly dust storms, and ash storms following eruptions. The PM10 exccedences due to ash storms, resuspension of ash, can be severe 900 μg/m3 (24-h) and 8000 μg/m3 (10-min) in Vik, immediately following the Eyjafjallajökull 2010 eruption, and reaching over 2000 μg/m3 (10-min) in Reykjavik. Dust storms cause about 23% of the exceedence of the health limit in the capital area for the past decade. Local resuspension is responsible for about 32%, and traffic 40%. The record level in the capital area so far is though due to fireworks, where the peak was 4000 μg/m3 (10-min) and 400 μg/m3 (24-h). PM10, which includes finer particulates, causes various adverse health effects, such as cardiovascular and respiratory diseases. Knowing the source material allows studies of the potential differences on health outcomes.

**Jill Bachelder: Characterization of wind-blown dust after river piracy event in the Canadian North** Airborne mineral dust emitted in Arctic regions can significantly alter the energy balance of the Northern atmosphere through scattering and absorption of radiation; dust also plays an important role in the biogeochemical cycling of metals and can have deleterious effects on air quality and public health. The impact of northern dust sources on the atmosphere and environment may change rapidly, as warming temperatures in the North can increase mineral dust production and source regions. However, at present, the impact of such changes is difficult to evaluate because there are very few scientific studies that perform direct measurements of mineral dust in Arctic regions. To address this knowledge gap, we performed a dust measurement campaign in May 2018 near the Ä’äy Chù (Slims River), a known site of strong dust emissions in the Canadian Yukon. During the spring and summer, dust storms are regularly produced from the soils surrounding the river. Furthermore, the rapid retreat of the Kaskawulsh glacier, whose meltwaters once fed the Ä’äy Chù, recently routed waters away from the river valley, leaving the riverbed exposed and thus potentially increasing its dust-producing erodible surface area. We have collected air samples both directly in the dust source and at several sites in the surrounding area, to observe variations in the transport and quantity of the dust emitted from the Ä’äy Chù Valley. Weather data, such as temperature, relative humidity, and wind speed/direction, were also recorded to establish a link between these factors and the emission of dust. Using Raman microscopy and SEM/EDS, we have determined the mineralogy of the collected dust particles. We have also employed an efficient, quantitative method for analysis of trace metals in mineral dust via inductively coupled plasma mass spectrometry (ICP-MS), and have successfully validated our chosen methodology using certified reference materials. In addition, we have studied the physical characteristics of the dust – such as particle size distribution, morphology, and surface characteristics – using microscope imagery and data collected by an optical particle counter. Ours is the first field campaign to provide a physico-chemical characterization of dust emitted directly from a high-latitude dust source in Canada. ICP-MS analysis has revealed enrichment of minor and trace element content in ambient air samples as compared to soil and dust deposition samples, generally by a factor of 1.5 to 2. SEM/EDS analysis has

demonstrated that the emitted dust primarily consists of non-spherical particles composed of silicates, carbonates, sulphates, and mineral aggregates. Finally, we have calculated the vertical flux of particulate mass and specific elements, notably Fe, As, and Pb, emitted into the atmosphere from the dust source; we are currently working to parameterize this flux in terms of significant meteorological factors such as wind speed and shear stress.

**Influence of marine aerosol from North Atlantic Ocean on continental urban aerosol in Southeast Europe (Central Balkan area). Aleksandra Mihajlidi-Zelić1, Dragana Đorđević1, Dubravka Relić2, Ivana Tošić3, Maria Angela Stortini4, Ljubiša Ignjatović5, Andrea Gambaro6,7.** 1Centre of Excellence in Environmental Chemistry and Engineering,ICTM - University of Belgrade, Institute of National Importance for Republic of Serbia, Belgrade, Serbia (amzelic@chem.bg.ac.rs)2Faculty of Chemistry, University of Belgrade, Belgrade, Serbia3Department of Meteorology, University of Belgrade, Belgrade, Serbia4Department of Molecular Sciences and Nanosystems, University Ca’ Foscari of Venice, Venice, Italy5 Faculty of Physical Chemistry, University of Belgrade, Belgrade, Serbia6Institute for the Dynamics of Environmental Processes - National Research Council (CNR-IDPA), Venice, Italy7Department of Environmental Sciences, Informatics and Statistics, University Ca' Foscari of Venice, Venice, Italy. Size-segregated aerosol samples were collected in the city of Belgrade (Serbia) using six stage High Volume Cascade Impactor. Aerosol mass and water soluble ion concentrations were determined. The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model was used to study the origin of air masses arriving in Belgrade in the investigated period. The study focuses on the water-soluble ionic content of the size-segregated urban aerosol in the continental area of the Balkans and the influences of characteristic air masses that arrive at the study site.

**Remote sensing of local dust over the Canadian Arctic.K. Ranjbar1, N. T. O’Neill1, J. S. King2, P. L. Hayes3, R. Chang4.**1 Centre d’Applications et de Recherches en Télédétection, Université de Sherbrooke, Sherbrooke, Canada, 2 Département de Géographie, Université de Montréal, Montréal, Quebec, Canada

3 Département de Chimie, Université de Montréal, Montréal, Quebec, Canada, 4 Department of Physics and Atmospheric Science, Dalhousie University, Halifax, Nova Scotia, Canada. The effects of aerosols are acknowledged by the Intergovernmental Panel on Climate Change (IPCC) to be the greatest uncertainty in the climate change radiation budget. Climate change effects are magnified in the Arctic because of the surface-atmosphere system dynamics that are unique to that region. Dust is an important natural aerosol that directly and indirectly affects the atmospheric system. It impacts the Earth's radiative budget, biogeochemical cycling, ecosystems and even regional air quality. In general, Arctic dust is the product of springtime wind erosion in Asian deserts as well as local, summertime erosion. Local, low altitude, dust events from soil erosion have been recognized as a significant pan-Arctic aerosol contribution. We report on remote sensing investigations of dust events over the Arctic. Sunphotomery (polar summer) retrievals of coarse and fine mode aerosol optical depths (AOD), coupled with ground-based and satellite-based (CALIOP) backscatter and depolarization ratio profiles, satellite radiance imagery along with satellite retrievals of AOD and aerosol index (AI) as well as the predictions of a chemical transport model were employed to perform preliminary identification and characterization of both the extensive (mass dependant) and intensive per-particle) parameters of dust aerosols in the Canadian Arctic. The study was focussed on regional Arctic or sub-Arctic local dust events that were identified at Lake Hazen, Nunavut, Eureka, Nunavut and Kluane Lake, Yukon.

**Jan Kavan: Aerosol concentrations and aeolian sediment deposition on selected glaciers on James Ross Island, Antarctica in 2018**.Aerosol concentrations and local wind properties are described together with their linkages and typical synoptic situations. The highest aerosol concentrations of 57 μg m−3 for PM10 were detected during high wind speed events that exceeded 10 m s-1, which is also a threshold level for activating local mineral material sources.In addition, aeolian sediment depositions on four glaciers are analysed. Strong negative relationship between sediment amount and altitude of sampling site was found. This is most likely caused by higher availability of aeolian material in lower level of atmosphere. X-ray fluorescence (XRF) method was used to estimate relative contents of the main lithophile elements in sediment samples. Both sediment amount and XRF results are analysed in depth profile at each locality and compared among the glaciers suggesting long-range transport of fine mineral material. Distribution of aeolian sediment among the glaciers corresponds well with the prevailing wind direction on the Ulu Peninsula and long term wind directions. Surface deposition of dust particles can have significant environmental impacts such as changes in properties of atmosphere or enhanced snow melting.

**Pavla Dagsson-Waldhauserova: New High Latitude Dust sources and pathways: Dust storms in Iceland and Antarctica.**The Arctic and Antarctic regions include large areas of high latitude dust sources, from where dust is transported long distances. The first estimates are that all high latitude dust sources cover > 500,000 km2 and contribute to at least 5 % of global dust budget. Iceland is the largest Arctic as well as European desert with high dust event frequency (>135 dust days annually). Icelandic volcanic dust can be transported distances >1000 km towards the Arctic and deposited on snow, ice and sea ice. It is estimated that about 7% of Icelandic dust can reach the high Arctic (N>80°).We have measured dust plumes in Iceland in vertical high altitudes profiles, in situ, in transects, as well as implemented camera network around the most active dust sources. We measured extreme wind erosion events of volcanic ash, snow-dust storms, dust storms during moist and low wind conditions. Our experiments showed that volcanic dust is reducing snow albedo and increases snow melt similarly as Black Carbon.Icelandic dust was compared to local dust sources in Ny-Alesund, Svalbard, showing that it contains of large fractions of fine dust. Metal oxide particles and volcanic glass are the most representative markers to identify Icelandic dust. In 2011, Icelandic dust reached Svalbard and deposited in Ny-Alesund. Measurements in Antarctic Peninsula showed that the air is polluted by local dust sources, as well as due to long-range transport from Patagonia. The PM10 concentrations in Antarctica are higher than in natural areas of the Northern Europe. We present newly identified HLD sources as well as the first evidence that Icelandic volcanic dust reached Svalbard Islands.

**Zongbo Shi: Dust mineralogy: impact on ocean biogeochemistry and climate** I will firstly look at the mineralogy of dust in general and then more specifically on iron minerals. I will then explain how the mineralogy of dust affects its optical properties and thus climate, including some recent results on the Iceland dust. Finally, I will how the iron mineralogy changes during dust formation and during its transport in the atmosphere and how this transformation affects the ocean biogeochemical cycles.

N**asim Hossein Hamzeh: Synoptic analysis and simulation of dust storm in Feb 2016 in Khuzestan province.**Today dust storm makes damage to people lives and causes many financial problems. Dust storm is one of the most important natural phenomena and a kind of severe natural disaster that influence Middle East and Iran as part of it. Also every year dust storms causes many problems in our country especially in Khuzestan province. The location of this province in neighbor of Iraq (dust sources in Iraq) and dust particles with internal sources makes this problem more complicated in this area. Also Khuzestan affected by Syria and Saudi Arabia dust particles. So synoptic analysis of dust storms and their simulation will be helpful to investigate it sources and dust transportation in this area. In this research, we investigate the occurrence of rain on dust that happened in Ahvaz from 7 to 10 Feb 2016 and cut offing electricity and water happened in that duration for 2 days. Also telecommunication lines and internet were discounted in Ahvaz in that time. Dust concentration increased drastically in Ahvaz and some flights canceled due to bad weather conditions. In 8 Feb 2016 , visibility in Ahvaz is reduced to less than 100 meters.

**Isatis Cintron: Measurements of black carbon and dust impacts and ice nucleation activity in Svítnafelljökull**

 **High-latitude dust as efficient ice-nucleating particles - a case for Icelandic dust**.

**Nsikanabasi Silas Umo1, Caroline E. Schaupp1, Pavla Waldhauserová2, Peter G. Weidler3, Kristina Höhler1, Olafur Arnalds2, and Ottmar Möhler1** 1 Institute of Meteorology and Climate Research, Atmospheric Aerosol Research, Karlsruhe Institute of Technology, Hermann von Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany 2 University of Iceland & Agricultural University of Iceland, Keldnaholt, 112 Reykjavik, Iceland 3 Institute of Functional Interfaces, Karlsruhe Institute of Technology, Hermann von Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany Presenting Author: ottmar.möhler@kit.edu The emission of natural dust particles into the atmosphere from the high-latitude/cold regions is fast-becoming more important than previously thought. Due to land use and climate changes, a vast expanse of land surfaces previously covered by ice is getting exposed; hence, leading to an increase in dust emissions from these regions. Currently, an estimated 500,000 km2 land surface area is contributing up to 100 Tg of dust annually1.Aside from the direct impact of this dust on the air quality and direct solar radiation budget, it can also influence the cloud glaciation processes. Many studies have clearly established that mineral dust aerosol particles are generally good ice-nucleating particles2. However, most of these ice nucleation studies have been conducted on dust from deserts and mid-latitude regions. At present, our understanding of the ice-nucleating abilities of dust from high-latitude regions is highly limited. Here, we report first comprehensive quantification of ice-nucleating properties of dust obtained from a typical high-latitude region – Iceland. We engaged two laboratory set-ups for this investigation – the Aerosol Interactions and Dynamics in the Atmosphere (AIDA) cloud simulation chamber, and the Ice Nucleation Spectrometer of the Karlsruhe Institute of Technology (INSEKT). Based on the INAS density calculations which we adopted in quantifying the Icelandic dust ice-nucleating efficiencies, our current results show that dust from Iceland nucleates ice effectively in the range of ~ 103 – 1012 m-2 in the temperature range studied (266 K - 238 K). A preliminary assessment shows that from ~ 250 K its ice-nucleating abilities can compete with that of desert dust and agricultural soil dust. Currently, work is ongoing to understand the role that mineral composition plays in the ice nucleation behaviour. Potentially, our new results suggest that the high-latitude dust source could contribute to the INP budget of clouds in the region and may influence precipitation and the climate conditions in high-latitude regions. 1. Bullard, J. E. et al. High-latitude dust in the Earth system. Reviews of Geophysics 54, 447–485 (2016). 2. Hoose, C. & Möhler, O. Heterogeneous ice nucleation on atmospheric aerosols: a review of results from laboratory experiments. Atmos. Chem. Phys. 12, 9817–9854 (2012).

**György Varga & Pavla Dagsson-Waldhauserova: Giant Saharan quartz particles in Iceland.** Our present knowledge of granulometric characteristics (grain size and shape) of Saharan dust particles can not be considered sufficient. Particle size characteristic of wind-blown dust is fairly divers, but in most case the dominant component of the transported material is fine- or coarse-sized silt, though clay and sand fractions can also be present. Present-day far-travelled North African dust samples collected in Europe compose almost totally from fine-grained silty material. Reported grain size values are in the range of 2 to 20-30 μm. However, these published grain sizes are from measurements made by totally different techniques. Our direct optical observations and measurements indicated that, episodically the grain size of transported Saharan dust material can be significantly larger. These giant mineral dust particles are standing in the focal point of recent investigations. An unusual Sahara dust event happened in April 2014, the dust material reached even the higher latitudes and resulted a dust depositional event in Iceland. The collected mineral material was analysed by automated static image analysis technique completed with Raman spectroscopy. More than 100 thousand individual particles were granulometrically characterized, and we were able to identify quartz particles larger than 100 micrometres. Giant particle transport from the Sahara towards the Arctic is an extremely rare event, previous studies did not mention similar episodes. Darius Ceburnis: Studying dust events by synergistic observations

**Eduardo Erazo Acosta:** The power of the Sumak kawsay (buen vivir) ancestral philosophy in the indigenous movements of Colombia – Ecuador vs exclusion by mining mega-development, defense of High Mountain, contributions to the rights of the nature from the global south. This research has been carried out in the last 7 years, with emphasis on the republics of Colombia, Ecuador, in the Indigenous Communities of Colombia CRIC, Regional Indigenous Council of Cauca and CONAIE Confederation indigenous of Ecuador, in comparative perspective. In addition to the Ecuadorian indigenous movement of Ecuador. Within the institutional policies, mega development is linked to the continuous depredation of mining-energy resources, which is also correlated to the development of the economy as a central element of the national development framework, this is a problem complex in middle of posconflict in Colombia, its true or false in middle of the social movements, indigenous movements, gender an exclusion historical groups?

In this aspect, the main objective is to present the experience of Sumak kawsay (in quechua language) – Buen Vivir - good living from the Andean perspective, as a possibility to consolidate inclusion and critiques of development, and secondly, to identify alternatives to development by recognizing experiences of Andean cosmovision, linked to the interrelation between connection between social agents of integral health promotion from the own health practices understood as well as how the political exercise to the Sumak Kawsay - buen vivir- good life of original communities. Within the discourse of modernity, legality appears here as the unilateral discourse of economic development protected by the government and large multinational multinationals that defend the great mining industry and with it in a chain: the great destruction of nature, drought of rivers, glaciers, effects on the biological chain in support of the so-called economic development and business The discourse of illegality, appears from the vision of the mega mega-mining business corporations, as the discourse of the indigenous communities that claim the territory through protests, claims of their own right (indigenous right), care of nature

**High Latitude Dust in the Earth System – overview, seasonality, and implications for understanding the archives. Joanna Bullard.** Loughborough University, UK. Estimates from field studies, remote sensing and modelling all suggest around 5% of global dust emissions originate in the high latitudes (≥50°N and ≥40°S), a similar proportion to that from the USA (excluding Alaska) or Australia. This talk provides an overview of contemporary sources of high latitude dust and considers their role within local, regional and hemispherical environmental systems. New data are used to highlight the seasonal variability of dust emissions from seven high latitude regions and demonstrate the range of drivers, suggesting there is no clear link between wind speed and dust emissions. The dominant surface geomorphologies of identified high latitude dust sources are also considered and compared with those that dominate at lower latitudes. Using new data from Greenland, the characteristics and temporal variability of modern dust storms are presented,

and the implications for these as modern analogues to interpret the Holocene variability of dust emissions are considered.

 **DREAM atmospheric dust transport model simulations – case study results of**

**Icelandic mineral dust transport. Bojan Cvetkovic (1), Slobodan Nickovic (1), Ana Vukovic (2), Slavko Petkovic (1), Goran Pejanovic(1), Pavla Dagsson Waldhauserova´ (3), O´lafur Arnalds (3), Lenka Lisá (4), Sigmundur Helgi Brink (3), and Jugoslav Nikolic (1).** (1) Republic Hydrometeorological Service of Serbia, Department of National Center for Climate Change, Belgrade, Serbia (bojan.cvetkovic@hidmet.gov.rs), (2) Faculty of Agriculture, University of Belgrade, Belgrade, Serbia, (3) Agricultural University of Iceland, Reykjavik, Iceland, (4) Institute of Geology, Czech Acad. Sci., Prague, Czech Republic. The Republic Hydrometeorological Service of Serbia, under the activities of the South East European Virtual Climate Change Center, is working on the research, focusing on atmospheric dust cycle modeling and aerosol remote sensing. Dust Regional Atmospheric Model (DREAM) was developed to predict the atmospheric dust cycle, including dust emission, horizontal and vertical turbulent mixing, long-range transport and dust deposition.Recent findings shows that the Icelandic topsoil sediments are the largest and the most

important European source of the mineral dust, representing also one of the best-studied highlatitude dust areas. This motivated us to design a numerical modeling system in order to

simulate, predict and quantify Icelandic mineral dust process, which could be used both as an operational forecasting system and as a reliable tool for examining various effects on environment and climate change.

For this study, we used DREAM model with numerous upgrades implemented, such

as: improved dust source specification with geographic distribution of Icelandic dust sources

based on detailed soil data of the Agricultural University of Iceland; variable particle size

distribution following corresponding local measurements; introduced active snow cover

instead of its climatological values. The fact that dust emission from several relatively small

dust hotpots is comparable to mass emitted from all other mineral dust sources in the Iceland

has been implemented, resulting in accordingly adjusted model dust emission scheme.

Modeled surface dust concentration has been validated against PM10 observations from

several air quality measurement stations located at Iceland, Faroe Islands and United

Kingdom. Forecasted Aerosol Optical Depth (AOD) has been validated using NASA MODIS AOD retrievals. Results from two intense dust episodes, each lasting for several days and transporting dust more than thousand kilometers away from Iceland source regions will be presented in this study.

The study has been partly performed through collaboration within the EU COST Action CA16202 “International Network to Encourage the Use of Monitoring and Forecasting Dust Products (inDust)”.

**About Cryospheric Effects of High Latitude Dust versus Black Carbon in the Arctic. Outi Meinander.** Finnish Meteorological Institute, Climate Research, Helsinki, Finland (outi.meinander@fmi.fi). Light-absorbing aerosols and other impurities in snow and ice are climatically important due to the albedo feedback mechanism. Black Carbon (BC) is the most absorbing at all wavelengths of 300-2500 nm, and it can either initiate or accelerate cryospheric melt processes. The absorbing properties of various dust types vary according to their origin. Black Icelandic dust particles can have absorbance properties that are similar to BC. Both dust and BC can also contain hydrophobic and hydrophilic particles, capable to accumulate on the surface during the melt or to be washed away with the melt water. In order to evaluate effects and extremes of these light absorbing impurities to cryospheric processes, it is essential to identify their sources, transport, and deposition, and the related temporal and spatial variability. For example, we have found high temporal variability in BC on surface snow of one location at Sodankylä, Finland, North of the Arctic Circle (Meinander et al. ACP 2013). There the highest concentrations were related either to air masses originating from an industrial source or accumulation during seasonal snow melt in spring time.

We have studied albedo and melt effects of dust and BC on snow and ice in laboratory and in field, and using radiative transfer modeling. We have also presented a hypothesis that soot can decrease the liquid-water retention capacity of melting snow and presented first supportive field and experimental results (Meinander et al., TC 2014). No relationship was found in case of natural non-melting snow and we also confirmed that Icelandic dust does not contain any BC.Our experimental results on Icelandic volcanic ash have showed that Eyjafjällajökull ash with grain size smaller than 500 μm insulated the ice below at a thickness of 9–15 mm (called as ‘critical thickness’). For the 90 μm grain size, the insulation thickness was 13 mm. The maximum melt occurred at thickness of 1mm for the larger particles, and at the thickness of < 1–2 mm for the smaller particles (called as ‘effective thickness’). Earlier, similar threshold dust layer thickness values have been given for Mt St Helens (1980) ash, and Hekla (1947) tephra, but our results were the first ones reported for the Eyjafjällajökull ash. In Iceland, the dust layers in the nature can be from mm scale up to tens of meters. A summary of these studies with the citations is available at Boy et al. ACP 2019 (accepted). We have included organic Carbon (OC) in our analysis, too, and more recently sampling for algae analysis as well as BC in snow deposition at SMEARIII in Kumpula, Finland. Our results clearly demonstrate how important it is in the Arctic to perform measurements of BC, OC, and dust in the snow and combining and comparing these to fully understand the effects of light absorbing impurities on the Arctic cryosphere.

**The sources and activity of ice nucleating particles in the high latitudes. Sarah Barr1, Ben Murray1, Jim McQuaid1, Richard Cotton2, Paul Field1,2.** 1 Institute for Climate and Atmospheric Science, University of Leeds, UK. 2 Met Office, UK. In the high latitudes, low and mid-level stratiform clouds commonly exist in a supercooled state, where cloud droplets persist well below the melting point of ice. These supercooled clouds are very sensitive to the presence of ice nucleating particles (INPs). The occurrence of INP can trigger the formation of ice through heterogeneous freezing. This process influences the cloud radiative properties, cloud lifetime and precipitation but is generally poorly represented in numerical models and remains a major limitation in our quantitative understanding of clouds in the climate system. An improved understanding of the interaction between ice nucleating particles and clouds is needed in order to improve the accuracy of both climate projections and short term weather forecasts. In addition, many global aerosol models do not take high latitude sources of INPs into account. In such regions the influence of mid latitude sources (such as potassium feldspar from desert dust) are reduced and local dust sources could be important for ice nucleation.The objective of this project is to improve the understanding of the sources and activity of the particles which trigger ice formation in clouds. The project makes use of the FAAM BAe-146 atmospheric research aircraft to measure and characterise the occurrence of INP during high latitude aerosol and cloud physics research campaigns. In addition the aim is to identify possible local sources of INP in the high latitudes and assess their significance. Local dust sources have been identified in high latitude regions such as Canada, Alaska and Greenland however there have been few studies to quantify the efficiency with which dust from such locations can nucleate ice. This project utilises a suite of instruments at the University of Leeds and the UK Met Office to characterise the activity of these dusts and identify possible high latitude sources of INP. The results will be used to develop and improve parametrisations of ice nucleation that can be used in numerical models.

**Snow melt and light absorbing impurities of soot and dust in Iceland and Finland. Outi Meinander (1) and Pavla Dagsson-Waldhauserova (2).** (1) Finnish Meteorological Institute, Helsinki, Finland (outi.meinander@fmi.fi), (2) Agricultural University of Iceland, Reykjavik, Iceland. We have sampled snow and ice in Iceland for their black carbon (BC) and organic carbon (OC) content analysis. The samples have been analysed at the Finnish Meteorological Institute. We also have earlier collaborative experimental results on BC and Icelandic dust on Arctic seasonal snow surface at Sodankylä, Finland, North of the Arctic Circle. Our findings on Finnish snow have also been confirmed by independent studies by other groups in science elsewhere. In Iceland, our sampling has included various locations and also the glacier Solheimajökull. The mass balance of this glacier is negative and it has been shrinking during the last 20 years by 900 meters from its southwestern corner. Icelandic snow and ice samples were not expected to contain high concentrations of BC, because power generation with domestic renewable water and geothermal power energy sources cover 80 % of the total energy consumption in Iceland. Our FMI laboratory results of filters analyzed with a Thermal/Optical Carbon Aerosol Analyzer (OC/EC) confirm this assumption. Other potential soot sources in Iceland include agricultural burning, industry (aluminum and ferroalloy production and fishing industry), open burning, residential heating and transport (shipping, road traffic, aviation). On the contrary to low BC, we have found high concentrations of organic carbon in the Icelandic samples. This can be partly connected to wind-blown organic material.

**Synoptic scale and mesoscale characteristics of an east Greenland wind driven dust event**

**G.W.K. Moore1,2, X. Xu2.** 1Department of Physics, University of Toronto. 2Department of Chemical and Physical Sciences, University of Toronto Mississauga. Although there exist sporadic reports of wind driven dust events in Greenland over the past century, detailed observations of the environment in which they form are limited as is information of their impacts. In September 2018, a number of satellites recorded evidence of such an event in the Scoresby Sund region of east Greenland. The event was characterized by a large plume of glacial flour that originated along the Schuchert Flod, the river that marks the boundary between Scoresby and Jameson Land. In this paper, we use nearby automatic weather station (AWS) data from the Danish Meteorological Institute as well as well as output from a suite of numerical weather prediction (NWP) models with horizontal resolutions ranging from 30km to 3 km to characterize the synoptic scale and mesoscale environmental conditions associated with this event. We show that the period of the dust event was associated with the passage of a deep extra-tropical cyclone. Indeed, sea-level pressures at the nearby AWS sites were 2 standard deviations below the long-term mean for this time of the year. Associated with these low pressures, wind speeds at the sites were 2 standard deviations above the long-term mean. The Scoresby Sund region has a complex mix of mountains, coastal planes and fjords that makes it a challenge to resolve regional flow features. We will use the suite of NWP products to show that the dust event was associated with strong northwesterly flow in the vicinity of the observed dust event with surface wind speeds on the order of 24 m/s. Resolution played an important role in representing the mesoscale features of the event with only the 3 km NWP product able to capture the localized wind speed maxima associated with the event. However even at 3km, there was an offset in the location of this maxima. These results suggest that the September 2018 dust event was anomalous in that it was associated with a highly unusual synoptic scale forcing and that representing the wind field in the region remains a challenge even at high spatial resolution