

Final report: Svalbard Science Conference Glaciology Flagship workshop: Models and observations of snow and glacier mass balance

PI:

Jack Kohler (Norwegian Polar Institute), chair of Glaciology Flagship, on behalf of the flagship.

Project description

This Ny-Ålesund Glaciology Flagship Programme workshop was supported by the Norwegian Research Council, and was held Nov. 6-8 2019, in conjunction with the Svalbard Science Conference at Fornebu, Oslo .

The primary aim of the workshop was to bring together researchers from the various international groups studying Svalbard glacier mass balance and snow accumulation and melt, to promote better collaboration and cooperation between the groups. The secondary aim was to compare results of Svalbard snow and mass balance models, both with each other and to field measurements.

Research challenges and opportunities were identified, with focus on data gaps and sources of uncertainty, identifying new techniques and instrumentation, and optimizing program methodology. We discussed unresolved modelling problems, and increased cooperation and coordination of field activities to reduce costs and environmental impact.

By drawing upon the collective expertise of this diverse group of experienced researchers, the workshop continues to forge long-lasting contacts, to enhance the interdisciplinary collaboration portfolio of the group, to encourage transfer of knowledge and expertise within Norway and internationally, and to reduce the environmental impact of research in Svalbard by improving and increasing collaboration between groups.

Results

While the number of participants was lower than the last Glaciology Flagship meeting, held in conjunction with the previous Svalbard Science Conference held in 2017, there were glaciologists attending with affiliations to almost all of the permanent research localities in Svalbard (Longyearbyen, Hornsund, and Ny-Ålesund).

Field-based mass balance monitoring continues around these settlements, as well as on Lomonosovfonna and Austfonna. This has been combined with monitoring of glacier dynamics and calving processes, which are thought to be as important to the mass balance of the archipelago as surface processes. Established methods, such as stake measurements, AWS observations, and GPS and GPR transects, are being supplemented by seismic monitoring, geodetic measurements, terrestrial lidar and radar scanning, and surveying by drones.

Photogrammetry and sediment coring are helping to place these contemporary observations in a longer-term perspective. Modelling is being used to expand mass balance estimates in time and space, to focus on individual glaciological processes, and to investigate the effects of glacier change on the wider environment. Interdisciplinary studies focus on the links between glaciology,

biology and oceanography, including the effect of glacial meltwater on the marine food web, and clues about glacier behaviour from seafloor and submerged calving front mapping.

In all, ice loss is widespread in Svalbard, with calving glaciers losing mass more rapidly than land-terminating glaciers, though larger, high elevation ice caps further from the influence of the West Spitsbergen Current are closer to balance. The loss of firn pore space and the deposition of black carbon may drive a large decrease in surface mass balance and an increase in sea level rise contribution in the future. The archipelago - with its diverse ice masses, established logistics and developing integrated research infrastructure - constitutes a natural laboratory for studying processes that are likely to be important for the future of the wider Arctic cryosphere, as well as an ideal location for training the next generation of polar scientists.

One of the main aims of the Symposium was to not only bring together researchers from the international groups studying Svalbard glacier mass balance, but to better integrate their activities. The direct output from previous workshops can be measured by the number of publications involving participants from the main groups carrying out field measurements and/or modelling in Svalbard (detailed below). Social interactions promoted in coffee breaks and collective dining allowed for a high degree of such interactions, and participants can attest to future plans for data exchanges and collaboration that arose directly as a result of the present workshop.

Schedule

Wednesday Nov. 6		
19:00-21:00	Dinner	
Thursday Nov. 7		
09:00-09:10	Jack Kohler	<i>Introductory remarks</i>
09:10-09:35	Jack Kohler	<i>Bedrock and bathymetry compilation for Svalbard</i>
09:35-10:00	Pierre-Marie Lefeuve	<i>High-temporal dynamic response of two Svalbard tidewater glaciers to changes in ocean dynamics and glacier melt</i>
10:00-10:40	Coffee	
10:40-11:05	Florian Tolle	<i>Snow cover, mass balance and sediment transport monitoring in the Austre Lovénbreen basin using Lidar and SfM-derived DEMs</i>
11:05-11:30	Małgorzata Błaszczyk	<i>Factors controlling terminus position of Hansbreen, Svalbard</i>
11:30-11:55	Shridhar Jawak	<i>Geospatial mapping of surface facies of glaciers from Svalbard</i>
11:55-13:00	Lunch	
13:00-13:25	Ashley Morris	<i>Spread of Svalbard glacier mass loss to Barents Sea margins revealed by CryoSat-2</i>
13:25-13:50	Andreas Alexander	<i>Sensing drifters for glacial hydrology measurements</i>
13:50-14:15	Jakub Malecki	<i>Mass balance research programme on Svenbreen, Central Spitsbergen</i>
14:15-14:55	Coffee	
14:55-15:20	Geir Moholdt	<i>Marine mass balance of Svalbard glaciers</i>
15:20-15:45	Emily Geyman	<i>Reconstructing Svalbard's historical ice cover through SfM techniques</i>
15:45-16:10	Thomas Schuler	<i>Glacier sliding beyond Iken's bound</i>
16:10-18:00	Break	
18:00-20:00	Dinner	
Friday Nov. 8		
09:00-09:20	Ward van Pelt	<i>Future climatic mass balance, snow conditions and runoff in Svalbard</i>
09:20-09:40	Veijo Pohjola	<i>Observations of the Lomonosovfonna firn aquifer: preliminary results</i>
09:40-10:00	Michał Cieplý	<i>Influence of marine factors on the process of Hansbreen calving</i>
10:00-10:40	Coffee	
10:40-10:50	Jack Kohler	<i>Impact of tidewater glacier retreat on the fjord system: present and future circulation in Kongsfjorden, Svalbard</i>
10:50-11:10	Dariusz Ignatiuk	<i>SIOS data management and glaciers core data.</i>
10:50-12:00	Discussion and summary	
12:00-13:00	Lunch	

Participants

Name	Country	Institution
Jack Kohler	Norway	Norwegian Polar Institute
Songtao Ai	China	Wuhan University
Andreas Alexander	Norway	University of Oslo
Małgorzata Błaszczyk	Poland	University of Silesia
Julie Brigham-Grette	USA	UMass Amherst
Michał Cieplý	Poland	University of Silesia
J.-C. Gallet	Norge	Norwegian Polar Institute
Emily Geyman	USA	Norwegian Polar Institute
Jon Ove Hagen	Norway	University of Oslo
Andrew Hodson	Norway	UNIS
Dariusz Ignatiuk	Norway	SIOS
Elisabeth Isaksson	Norway	Norwegian Polar Institute
Jacek Jania	Poland	Centre for Polar Studies, University of Silesia
Shridhar Jawak	Norway	SIOS
Nina Kirchner	Sweden	U. Stockholm
Tom Rune Lauknes	Norway	NORCE
Pierre-Marie Lefeuvre	Norway	University of Oslo
Jakub Malecki	Poland	Adam Mickiewicz University in Poznan
Josephine Maton	Norway	Norwegian Polar Institute
Geir Moholdt	Norway	Norwegian Polar Institute
Ashley Morris	Norway	Norwegian Polar Institute
Riko Noormets	Norway	UNIS
Veijo Pohjola	Sweden	Uppsala University
Louise Schmidt	Norway	University of Oslo
Thomas Schuler	Norway	University of Oslo
Astrid Tesaker	Norway	University of Oslo
Florian Tolle	France	Université de Bourgogne Franche-Comté
Ward van Pelt	Sweden	Uppsala University
Deniz Vural	Germany	University of Potsdam

Selection of publications arising from Glaciology Flagship workshops:

- Schuler, T.V., J. Kohler, N. Elagina, J.O. Hagen, A. Hodson, J. Jania, A. Kääb, B. Luks, J. Malecki, G. Moholdt, V. Pohjola, I. Sobota, & W. van Pelt. Reconciling Svalbard glacier mass balance. Accepted for publication, *Frontiers in Earth Science*.
- Schuler, T.V., A. Glazovsky, J.O. Hagen, A. Hodson, J. Jania, A. Kääb, J. Kohler, B. Luks, J. Malecki, G. Moholdt, V. Pohjola, & W. van Pelt. 2019. New data, new techniques and new challenges for updating the state of Svalbard glaciers (SvalGlac). Chapter in “*SESS report 2019*”, Van den Heuvel et al., Eds. Svalbard Integrated Arctic Earth Observing System, Longyearbyen, pp. 108-134.
- Kohler, J., T.V. Schuler, W. van der Bilt, & J. Bakke. 2019. Glaciers. Chapter in “*Climate in Svalbard 2100 – a knowledge base for climate adaptation*”. I. Hanssen-Bauer, E.J. Førland, H. Hisdal, S. Mayer, A.B. Sandø, A. Sorteberg, Eds. Norwegian Centre for Climate Services Report 1/2019. ISSN: 2387-3027
- Van Pelt, W., V. Pohjola, R. Pettersson, S. Marchenko, J. Kohler, B. Luks, J.O. Hagen, T.V. Schuler, T. Dunse, B. Noël, C. Reijmer. 2019. A long-term dataset of climatic mass balance, snow conditions and runoff in Svalbard (1957–2018). 2019. *The Cryosphere* 13, 2259–2280. doi: 10.5194/tc-13-2259-2019.
- Pramanik, A., J. Kohler, T.V. Schuler, W. van Pelt, & L. Cohen. 2019. Comparison of snow accumulation events on two High Arctic glaciers to model-derived and observed precipitation. *Polar Res.* 38 doi:10.33265/polar.v38.3364
- Deschamps-Berger, C., C. Nuth, W. van Pelt, E. Berthier, J. Kohler, & B. Altena. 2019. Closing the mass budget of a tidewater glacier: the example of Kronebreen, Svalbard. *J. Glaciol.* 65(249), 136-148. doi:10.1017/jog.2018.98
- Pramanik, A., W. van Pelt, J. Kohler, & T.V. Schuler. 2018. Simulating climatic mass balance, seasonal snow development and associated freshwater runoff in the Kongsfjord basin, Svalbard (1980-2016). *J. Glaciol.* doi:10.1017/jog.2018.80
- Möller M., & J. Kohler. 2018. Differing climatic mass balance evolution across Svalbard glacier regions over 1900–2010. *Front. Earth Sci.* 6:128. doi:10.3389/feart.2018.00128
- Østby T., T.V. Schuler, J.O. Hagen, R. Hock, J. Kohler & C.H. Reijmer. 2017. Diagnosing the decline in climatic mass balance of glaciers in Svalbard over 1957-2014. *The Cryosphere* 11, 191-215. doi:10.5194/tc-11-191-2017
- Köhler, A., C. Nuth, J. Kohler, E. Berthier, C. Weidle & J. Schweitzer. 2016. A 15 year record of frontal glacier ablation rates estimated from seismic data. *Geophys. Res. Lett.* 43. doi:10.1002/2016GL070589
- Van Pelt, W, J. Kohler, G. Liston, J.O. Hagen, B. Luks, C.H. Reijmer & V. Pohjola. 2016. Multi-decadal climate and seasonal snow conditions in Svalbard. *J. Geophys Res. Earth Surf.* 121. doi:10.1002/2016JF003999
- Aas, K. S., T. Dunse, E. Collier, T.V. Schuler, T.K. Berntsen, J. Kohler, & B. Luks. 2016. The climatic mass balance of Svalbard glaciers: a 10-year simulation with a coupled atmosphere–glacier mass balance model, *The Cryosphere* 10(3), 1089-1104. doi:10.5194/tc-10-1089-2016

Budget

Workshop venue, with coffee breaks, 2 lunches, 2 dinners	78,177.00 kr
Travel, Poland-Norway Jakub Malecki	8,659.46 kr
Administration fee	4,570.34 kr
Total	91,406.80 kr