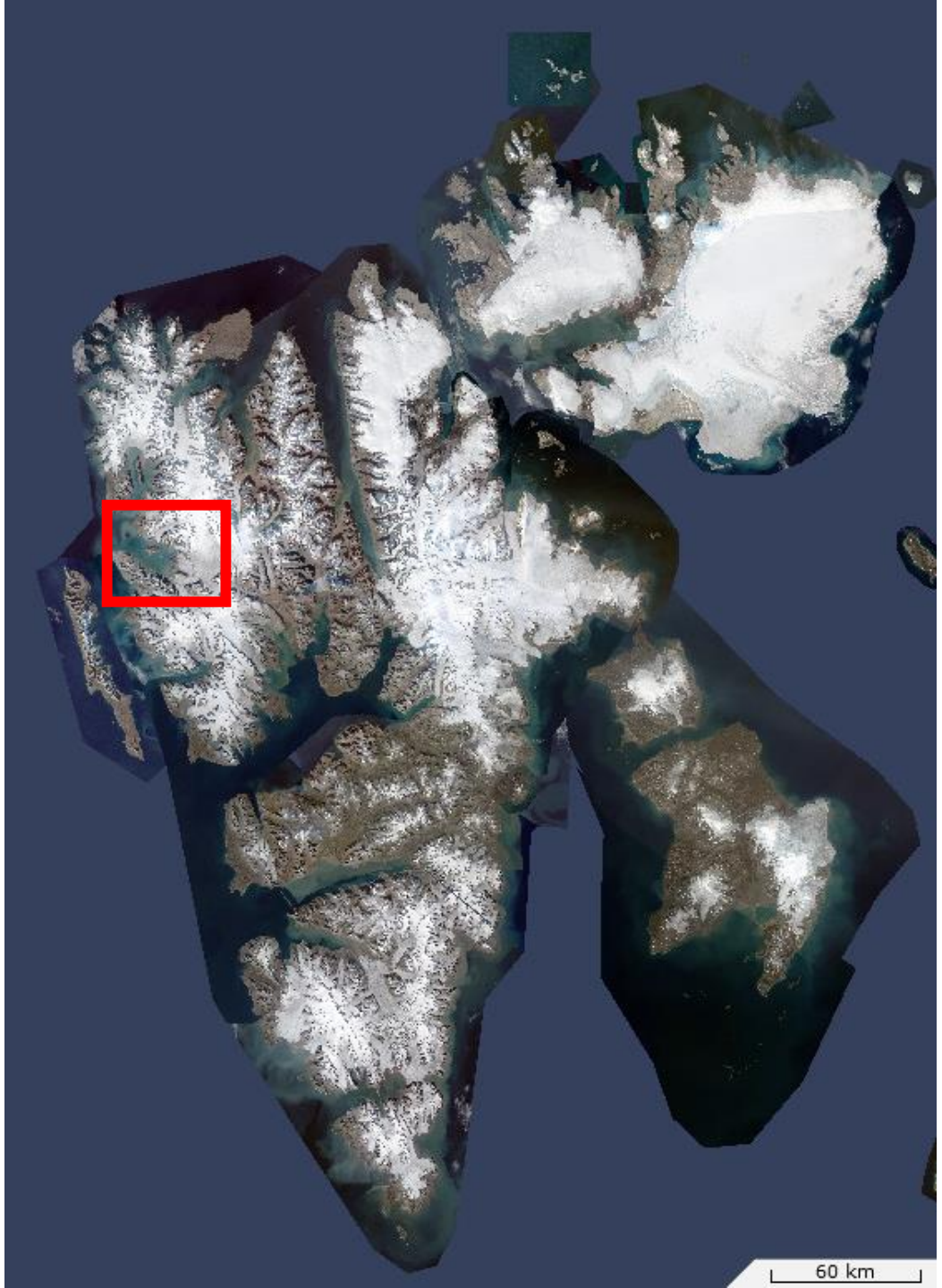
Glacier mass balance and associated fresh water flux in the Kongsfjord Basin, Svalbard

Ankit Pramanik, Jack Kohler, Ward van Pelt



~78.7º N to ~79.2º N

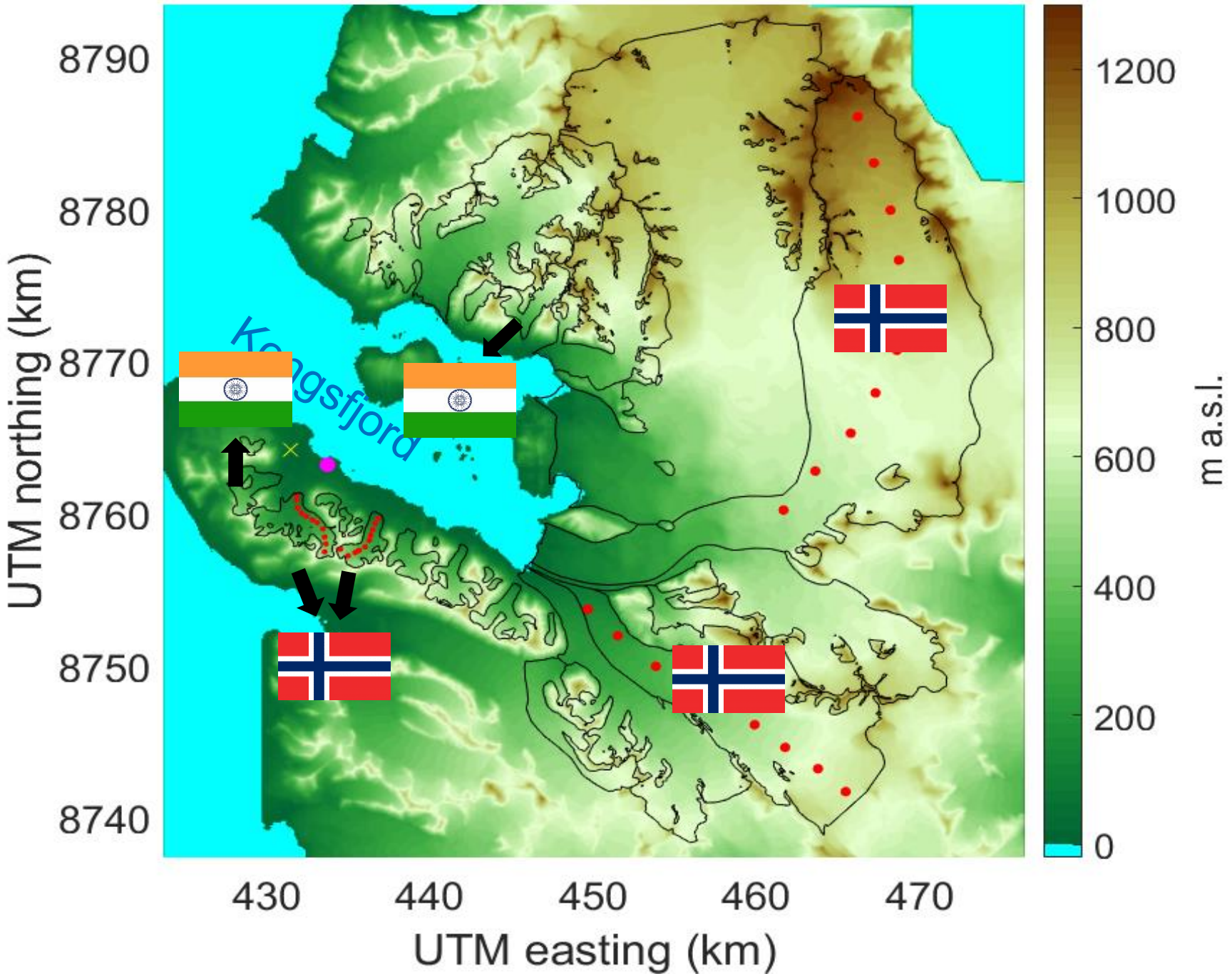
~11.4º E to ~14º E

Toposvalbard.npolar.no

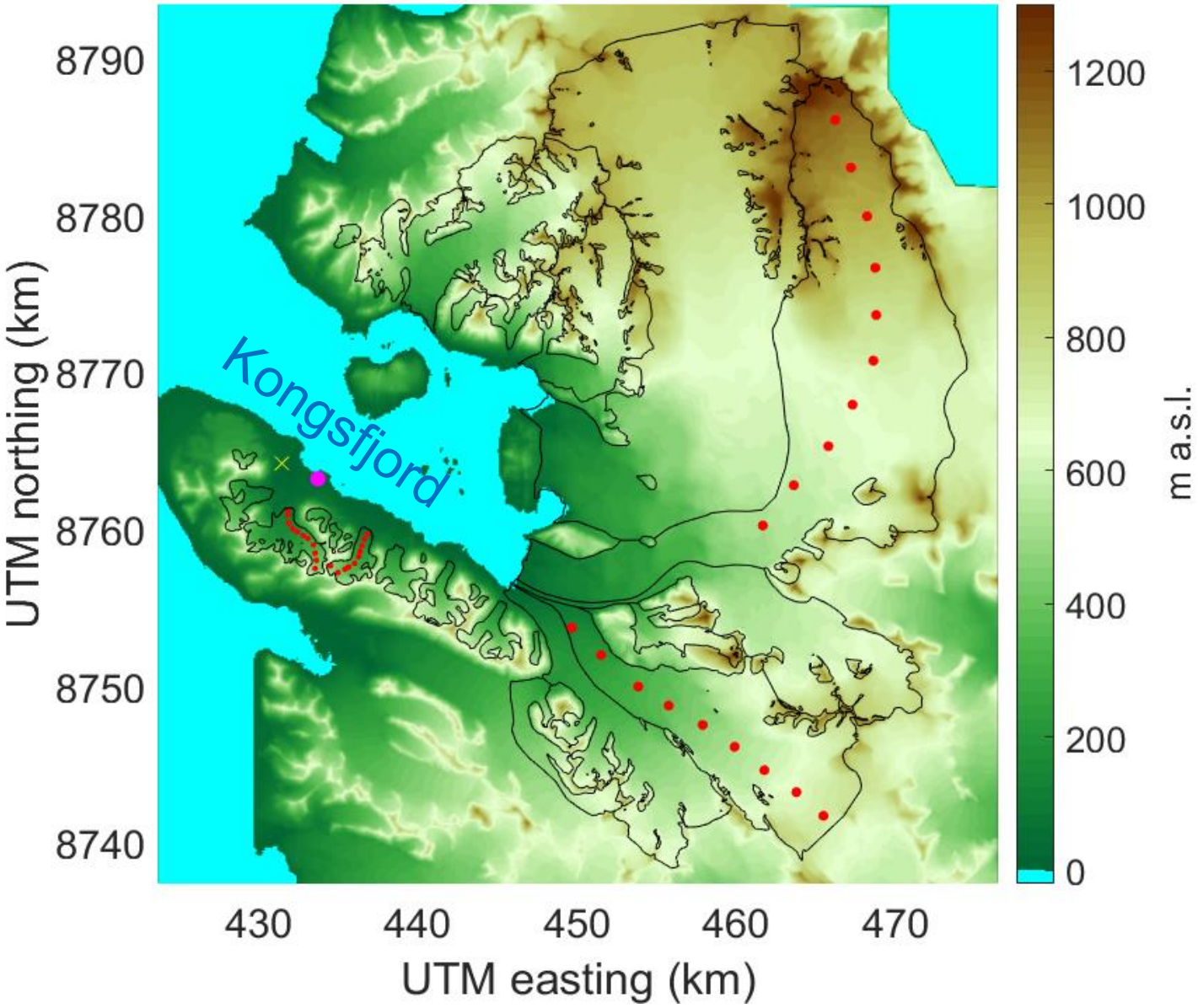
Map of Kongsfjord area

Toposvalbard.npolar.no
Landsat Mosaic

DEM of Kongsfjord area



DEM of Kongsfjord area

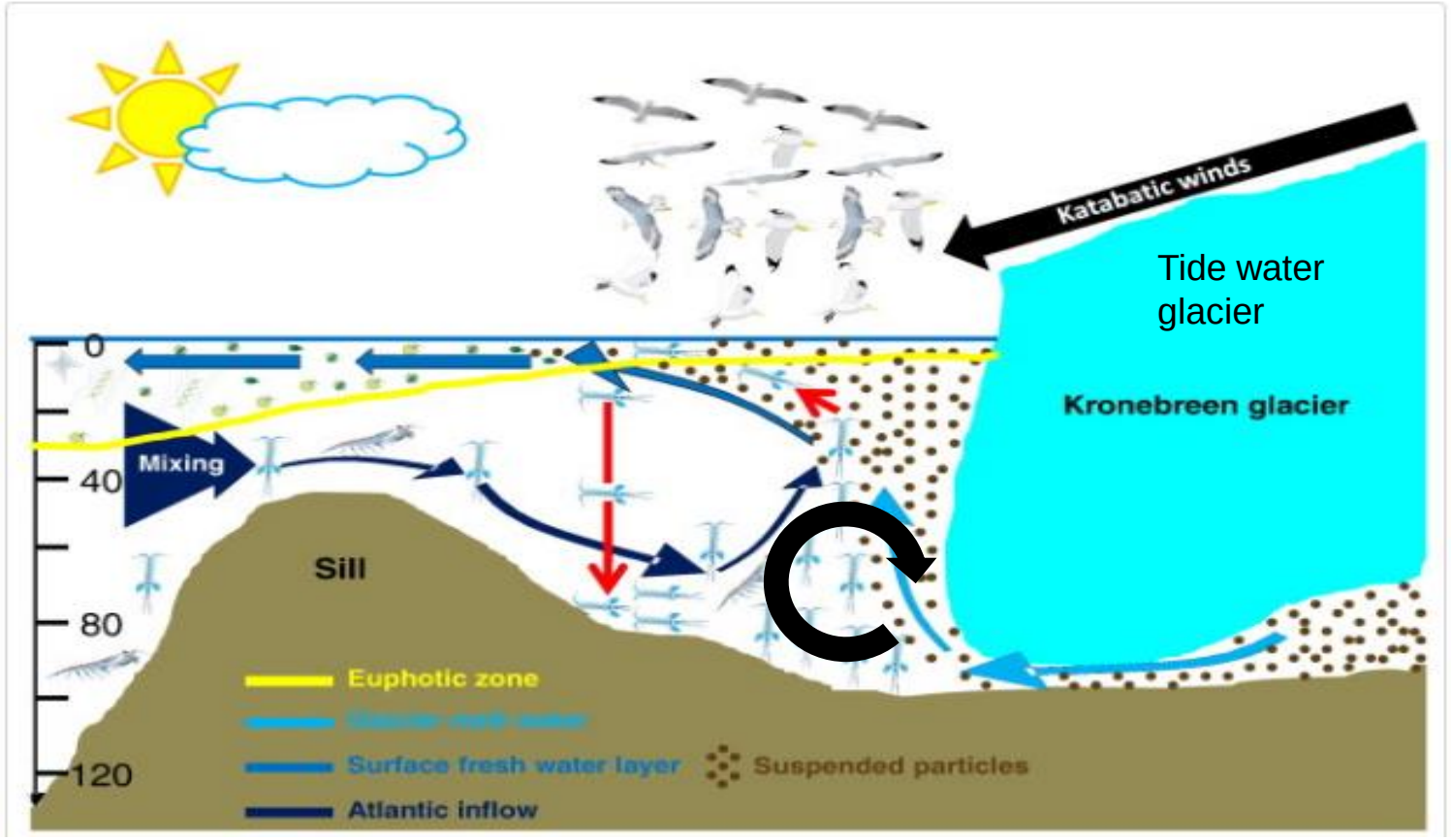


Total basin area ~1440 km^2

- Mass balance evolution of entire glacierized area (1980-2016)
- Quantify fresh water flux to the fjord

Motivation

- Total fresh water input to the fjord
- Impact on fjord eco-system
- Ocean cirulation modelling



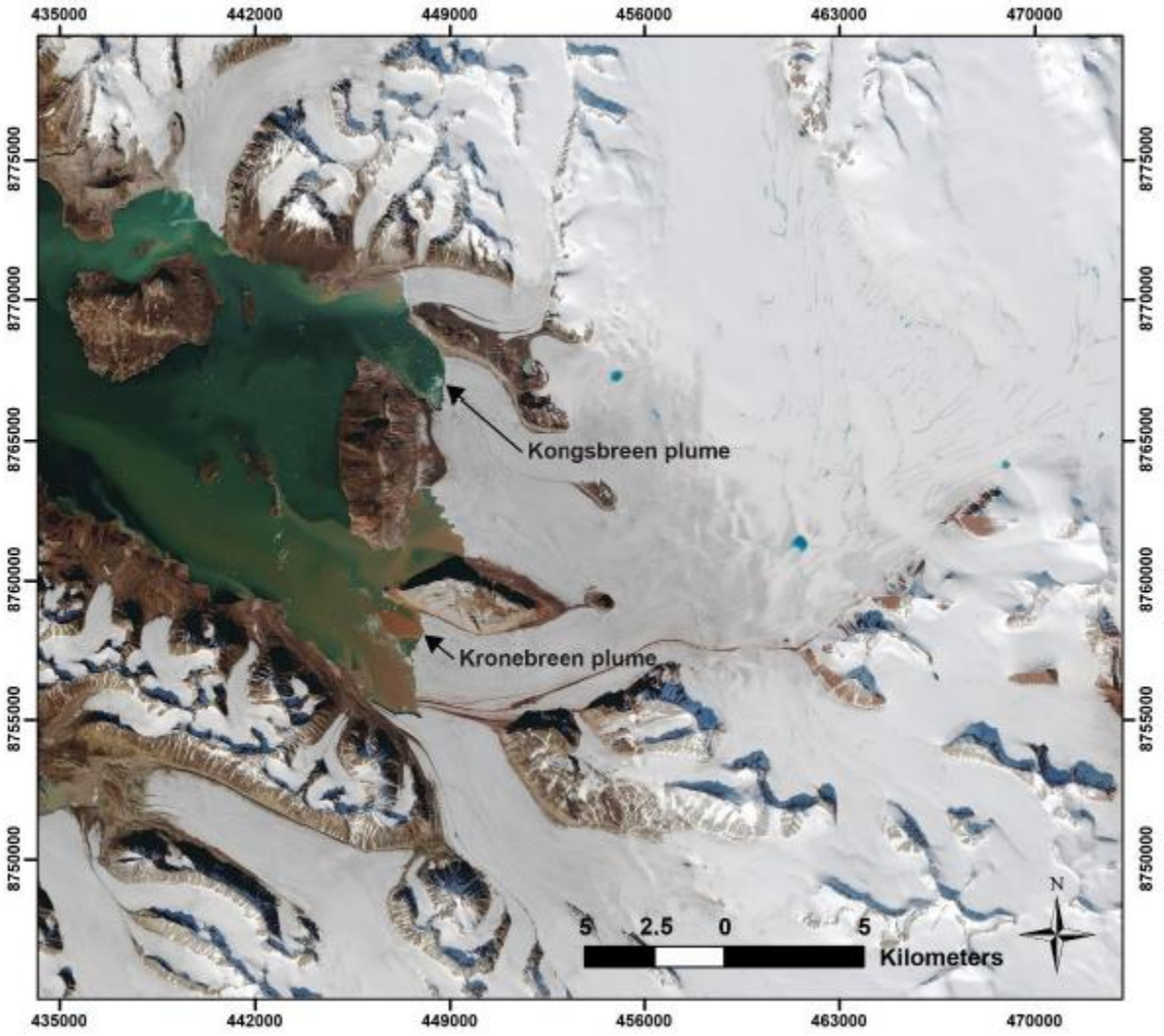
Glacier

Fjord

Ocean

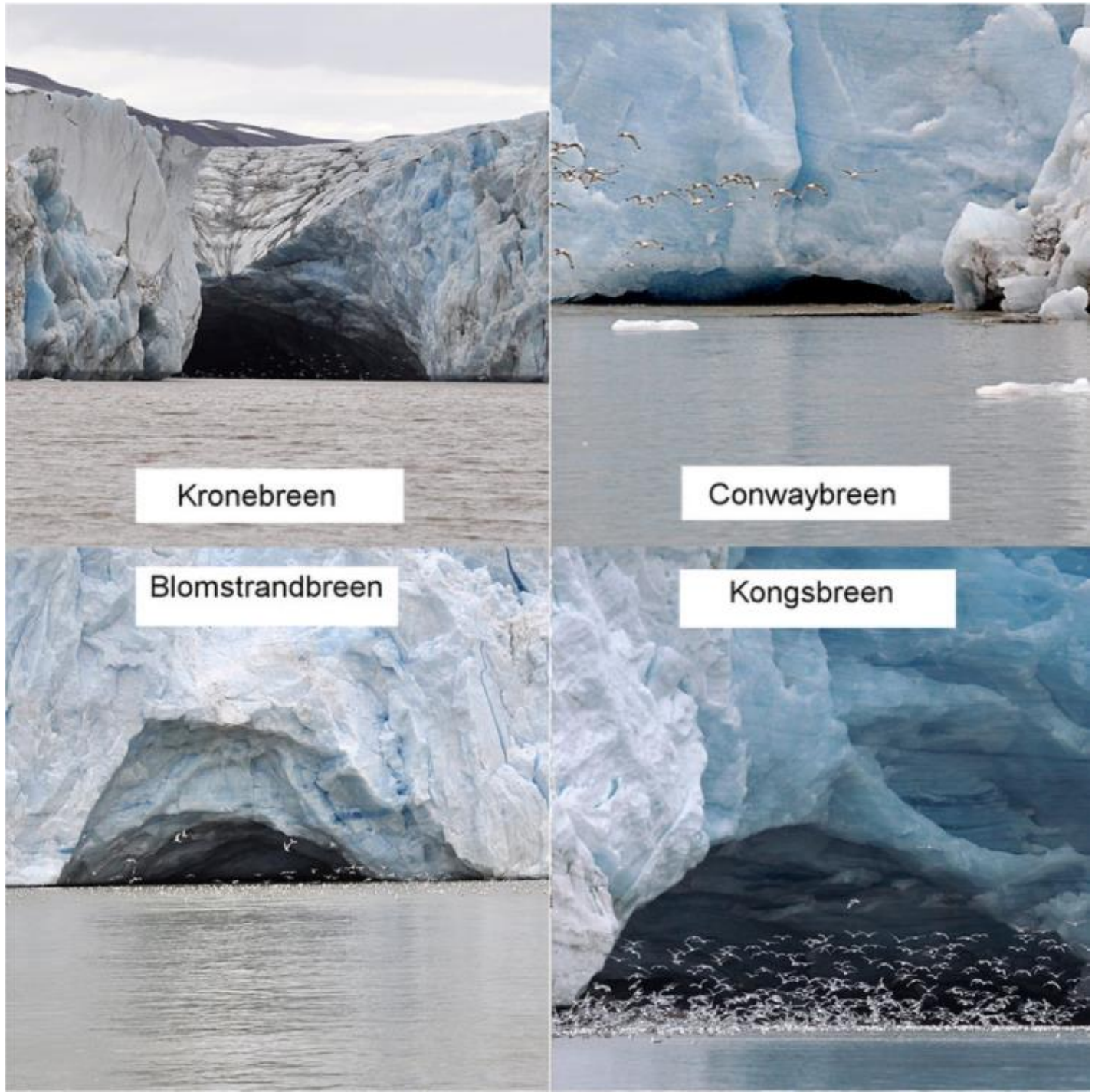
Lydersen et. al. 2014

Motivation



Sentinel-2 image over Kongsfjord 10 July, 2016

GIF Courtesy: Penny How



Urbanski et al. 2017

Confidential manuscript submitted to *Geophysical Research Letters*

Subglacial discharge plume behavior revealed by CTD-instrumented ringed seals

Alistair Everett[1], Jack Kohler[1], Arild Sundfjord[1], Kit M. Kovacs[1], Tomas Torsvik[1], Ankit Pramanik[1], Lars Boehme[2], Christian Lydersen[1]

[1]
[2]NERC Sea M

Climatic Change
February 2017, Volume 140, Issue 3–4, pp 533–548 | Cite as

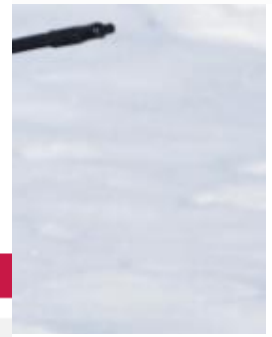
Marine birds and mammals foraging in the rapidly deglaciating Arctic fjord - numbers, distribution and habitat preferences

Authors Authors and affiliations

Lech Stempniewicz, Michał Goc, Dorota Kidawa, Jacek Urbański, Magdalena Hadwiczak, Adrian Zwolicki

Effects of glacier runoff and wind on surface layer dynamics and Atlantic Water exchange in Kongsfjorden, Svalbard; a model study

A. Sundfjord, J. Albretsen, Y. Kasajima, R. Skogseth, J. Kohler, C. Nuth, J. Skarðhamar, F. Cottier, F. Nilsen, L. Asplin, S. Gerland, T. Torsvik



OPEN

Subglacial discharges create fluctuating foraging *hotspots* for sea birds in tidewater glacier bays

Received: 06 July 2016
Accepted: 03 February 2017
Published: 07 March 2017

Jacek Andrzej Urbanski[1], Lech Stempniewicz[2], Jan Marcin Węsławski[3], Katarzyna Dragańska-Deja[3], Agnieszka Wochna[1], Michał Goc[2] & Lech Iliszko[2]

The importance of tidewater glaciers for marine mammals and seabirds in Svalbard, Norway

Christian Lydersen [a,*], Philipp Assmy [a], Stig Falk-Petersen [a,1], Jack Kohler [a], Kit M. Kovacs [a], Marit Reigstad [b], Harald Steen [a], Hallvard Strøm [a], Arild Sundfjord [a], Øystein Varpe [a,1], Waldek Walczowski [c], Jan Marcin Weslawski [c], Marek Zajaczkowski [c]

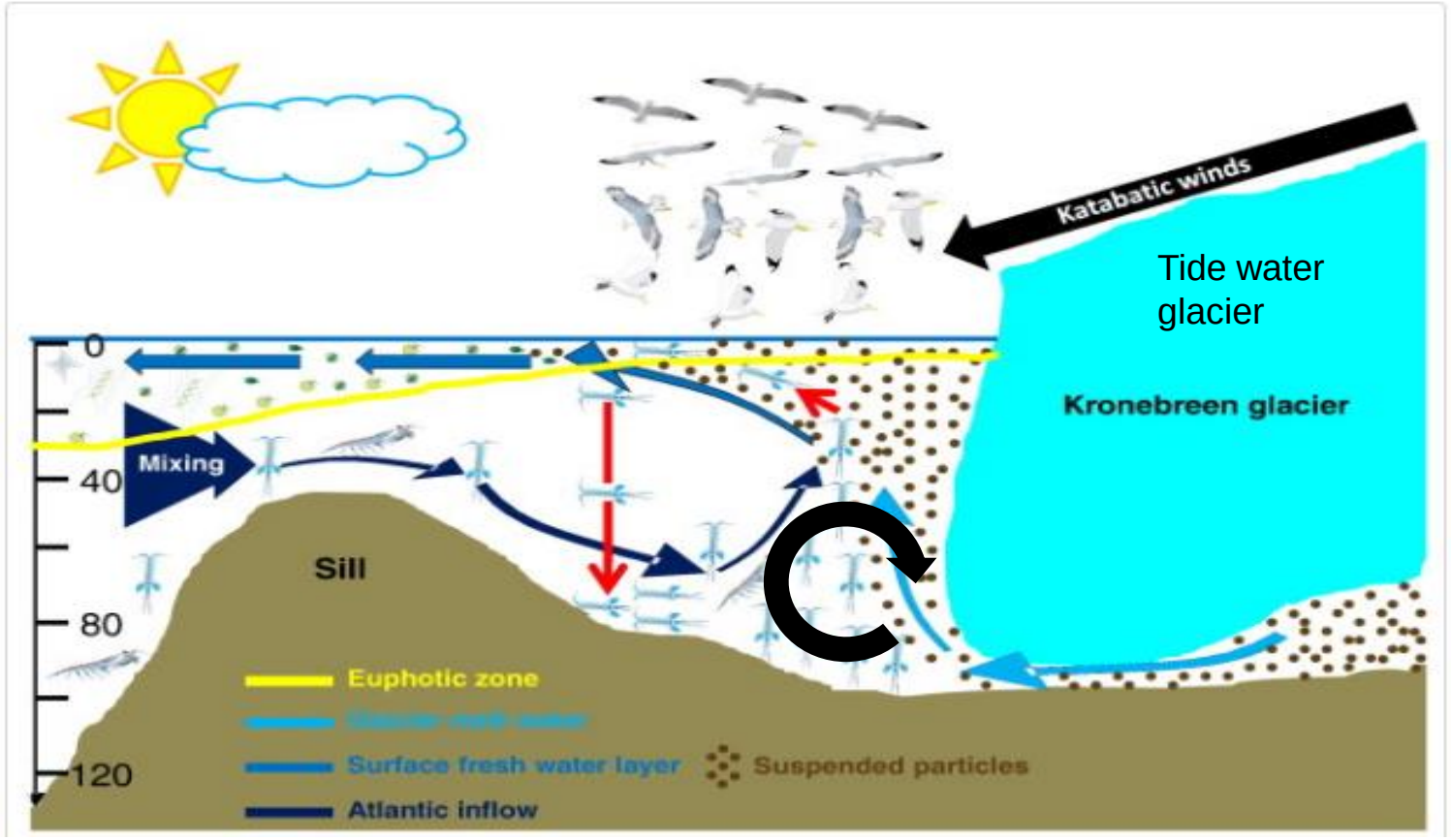
[a] Norwegian Polar Institute, Fram Centre, N-9296 Tromsø, Norway
[b] Department of Arctic and Marine Biology, University of Tromsø, N-9037 Tromsø, Norway
[c] Institute of Oceanology, PAN, Powstancow Warszawy 55, Sopot 81-712, Poland

Source: Twitter

Pic couresy : Daniel Costa, University of California

Motivation

- Total fresh water input to the fjord
- Impact on fjord eco-system
- Ocean cirulation modelling



Glacier

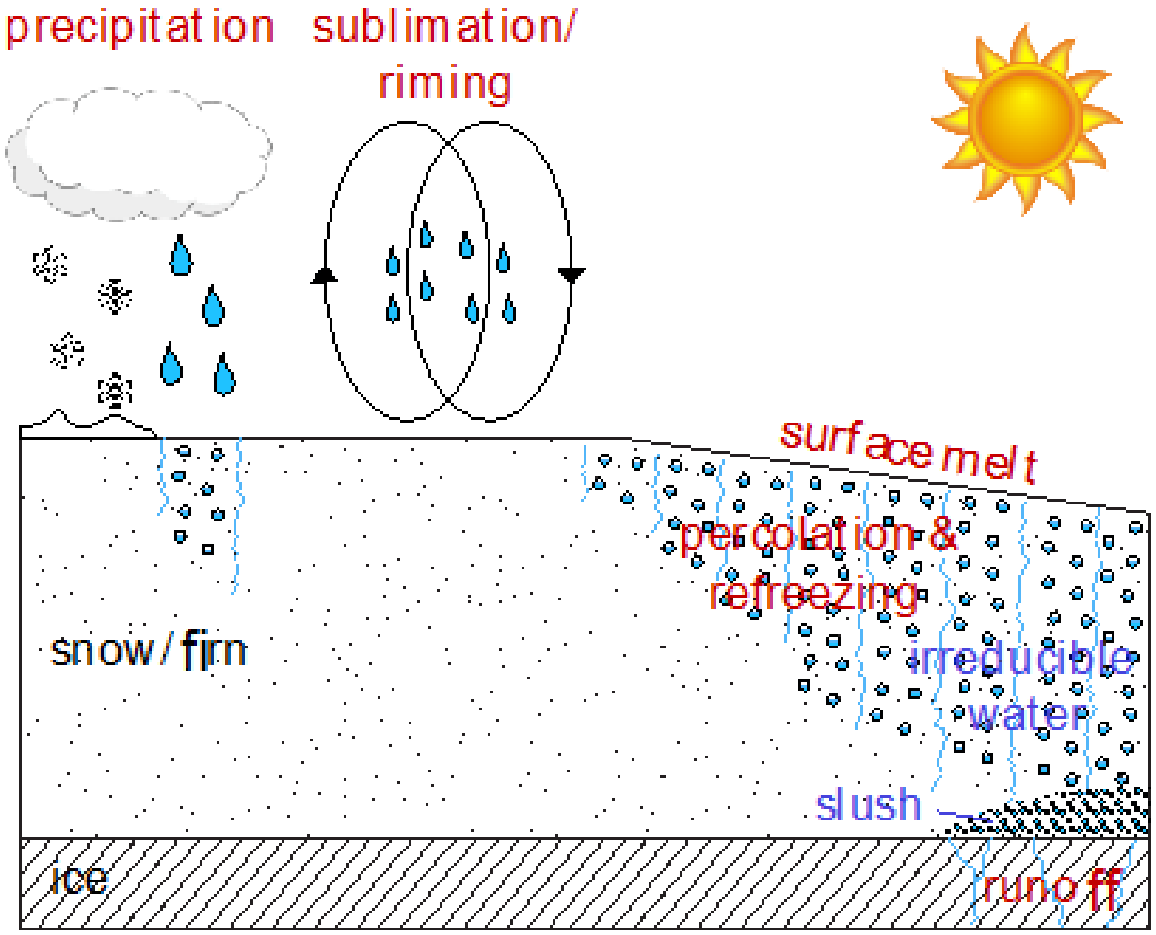
Fjord

Ocean

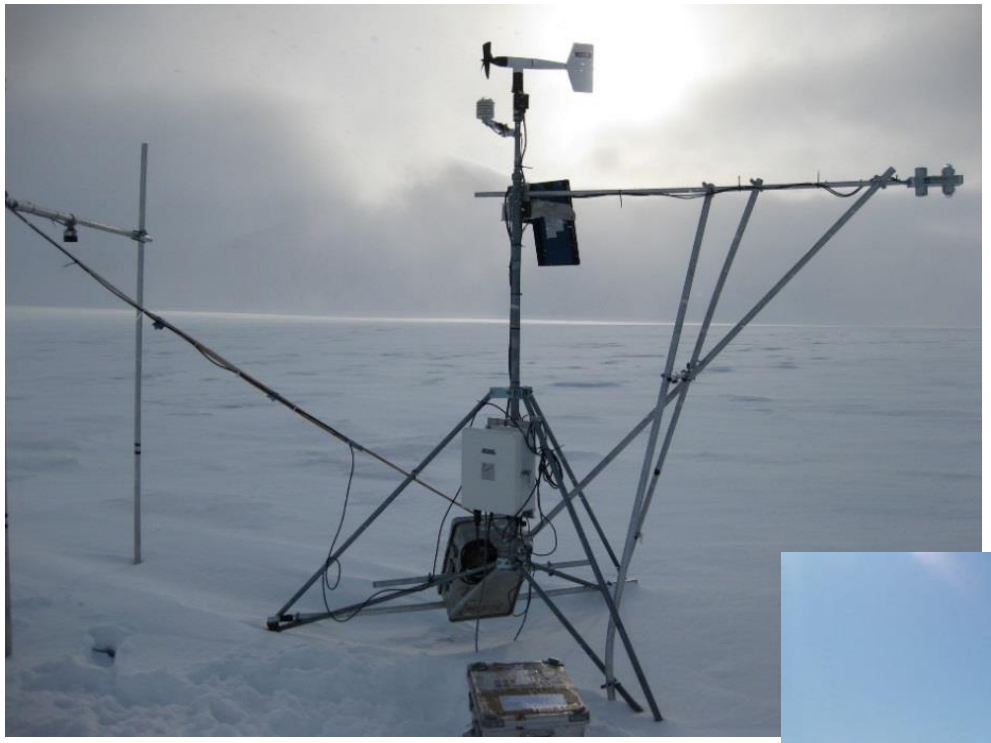
Lydersen et. al. 2014

Approach

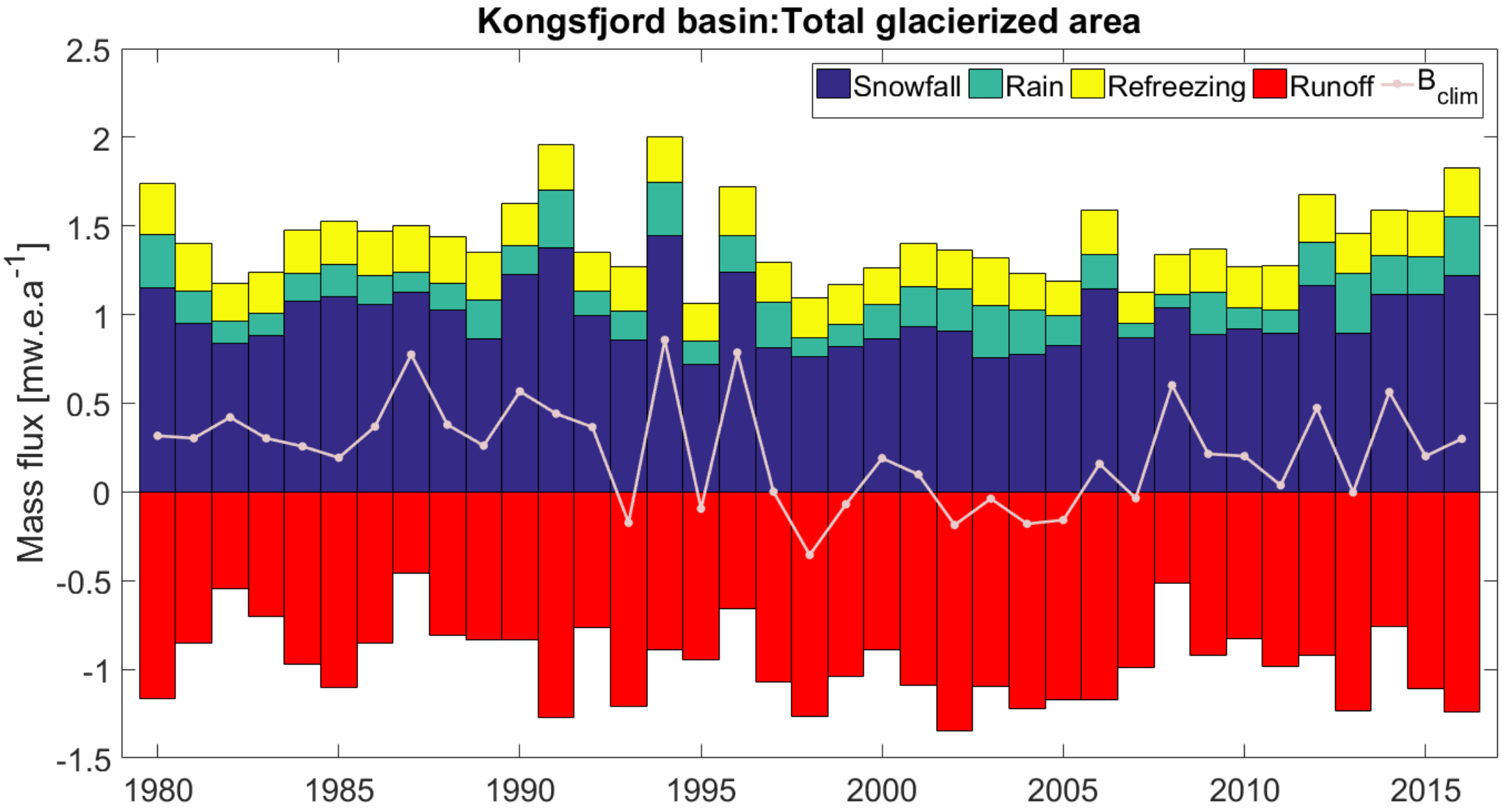
- Implement an energy balance model coupled with snow model
- Calculate mass balance and runoff
- Investigate hydrology and develop a runoff routing model to quantify discharge at the outlet.



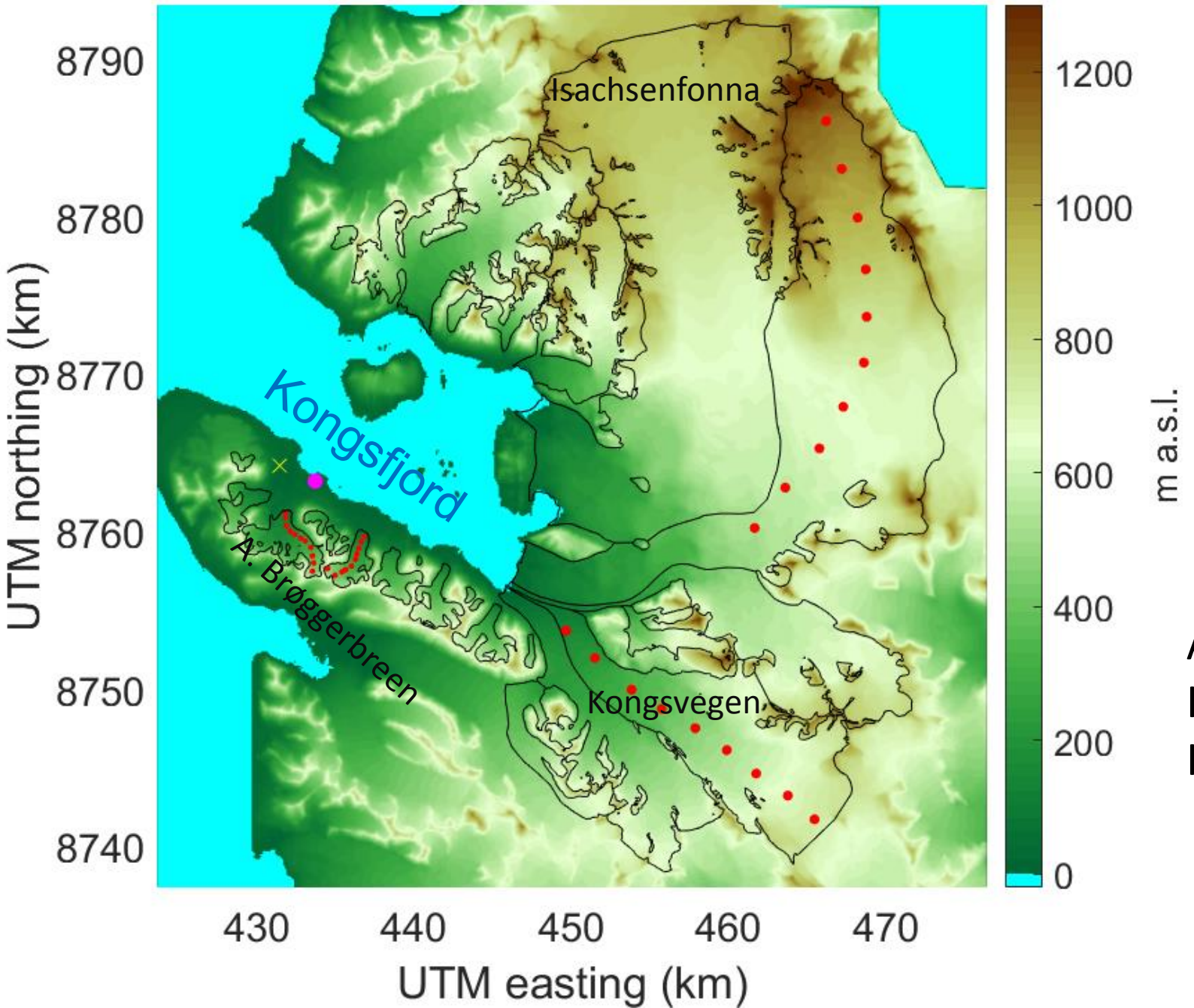
Field Data



Mass Balance and components

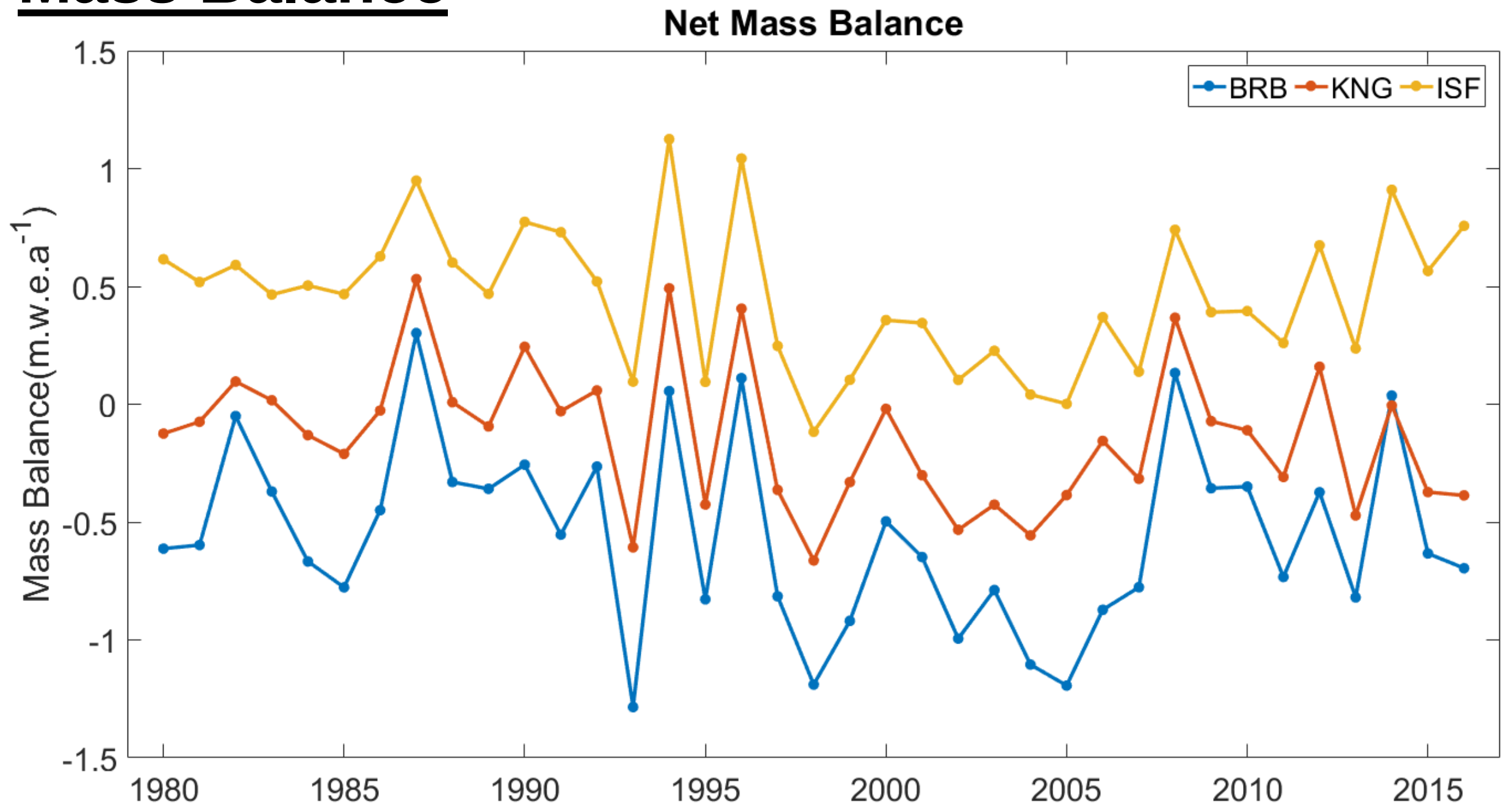


Mass balance over 1980-2016 +0.23 m.w.e.a^{-1}



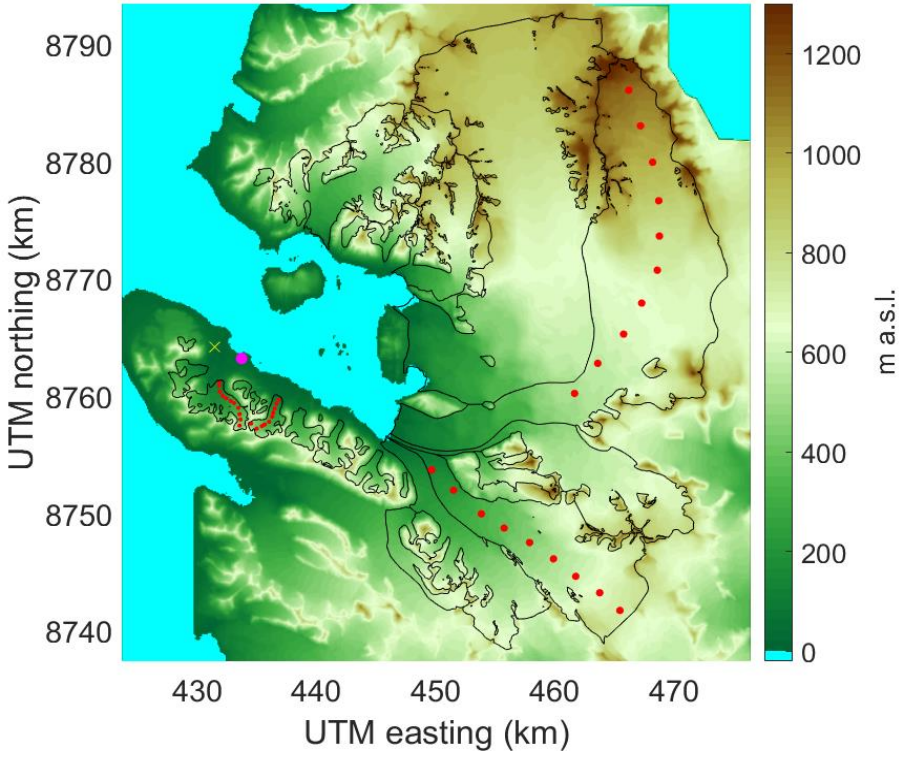
Austre Brøggerbreen (BRB)
Kongsvegen (KNG)
Isachsenfonna(ISF)

Mass Balance



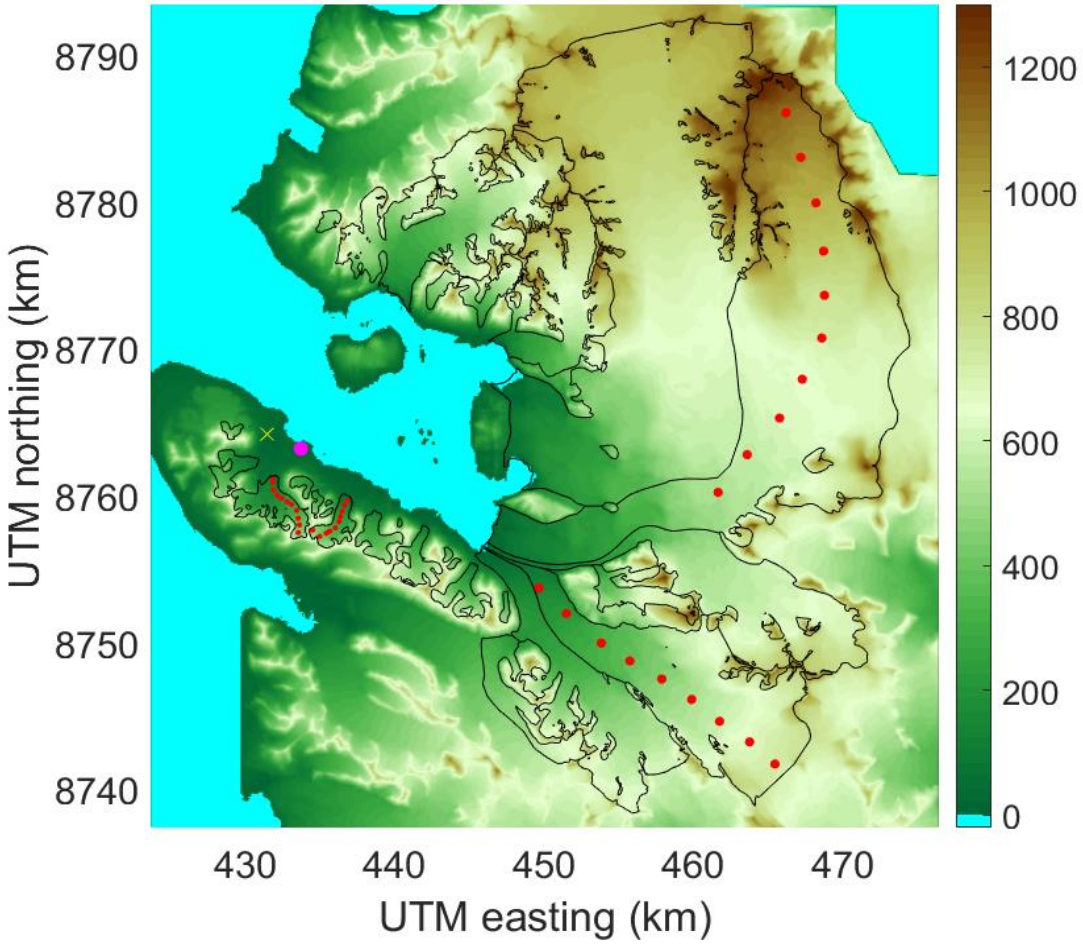
Fresh water flux

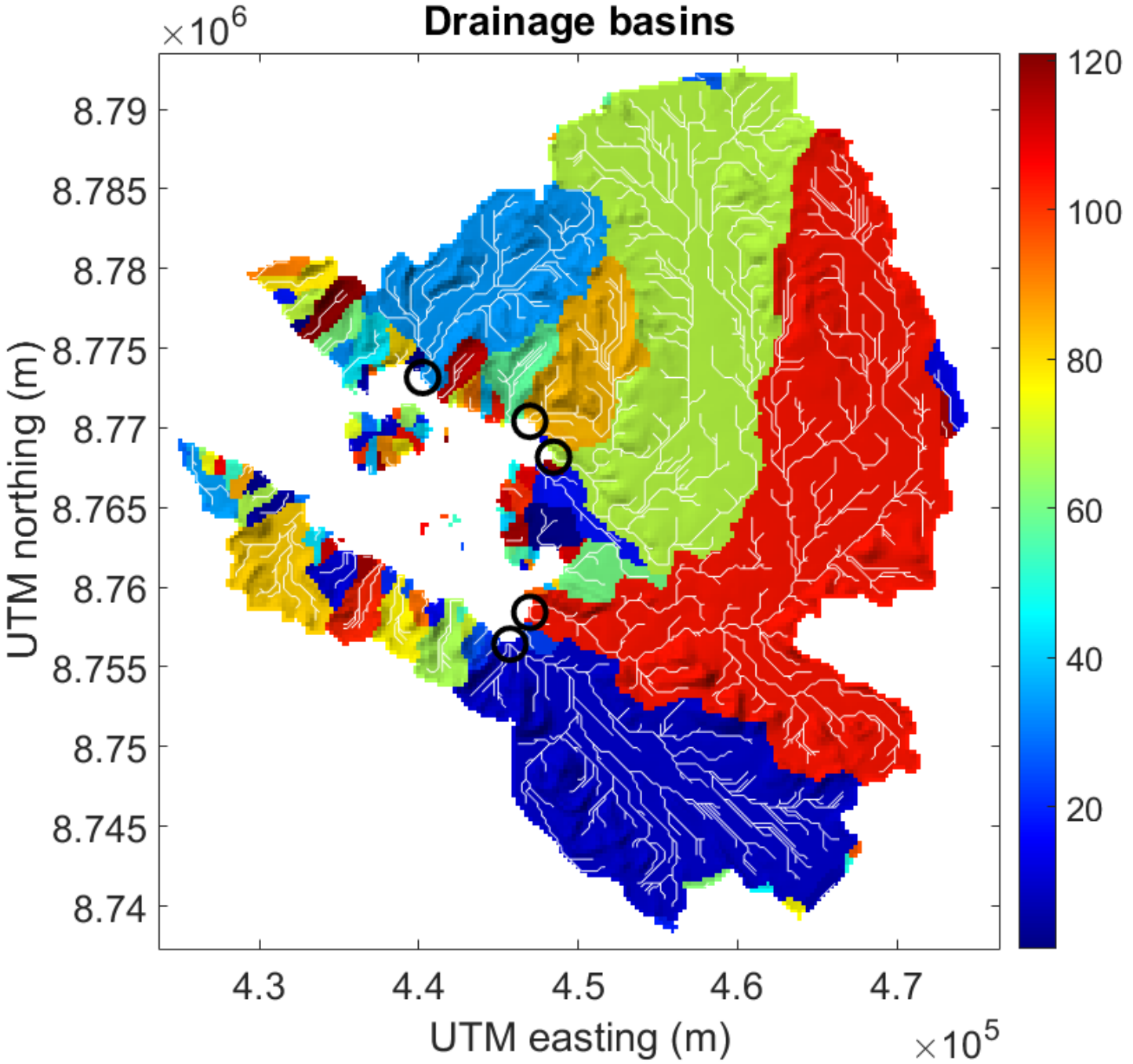
- Investigate Hydrology
- Use runoff routing model to simulate discharge hydrograph at the glacier outlet points.



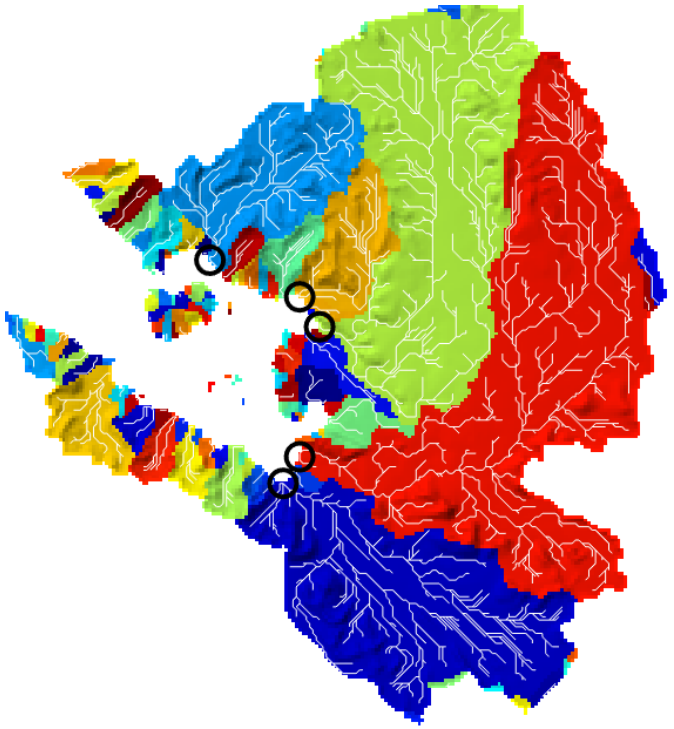
Runoff → Discharge at outlet

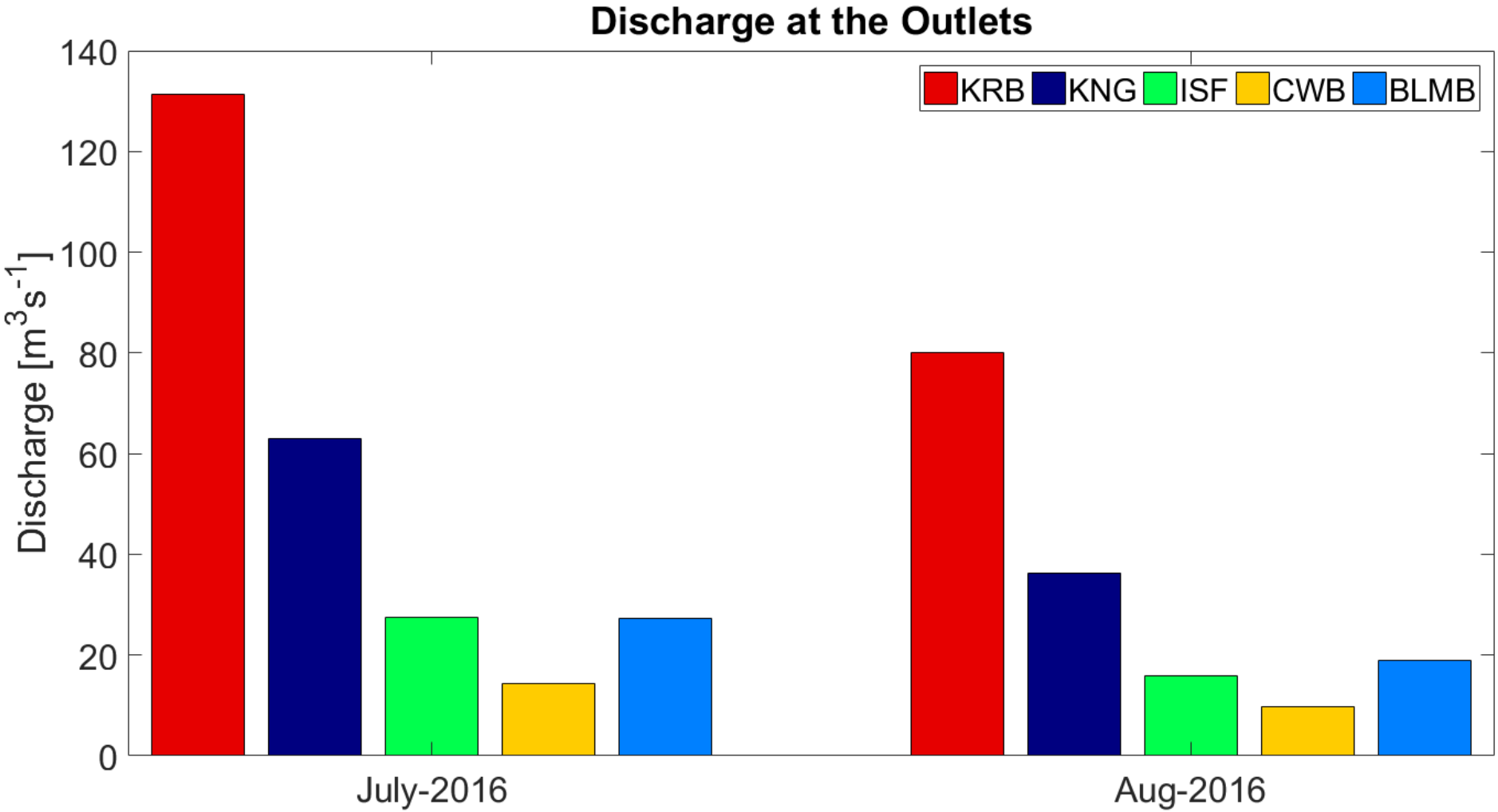
Fresh water flux





Fresh water flux





Summary:

- A coupled energy balance-snow model is used to simulate mass balance and runoff of glaciers around Kongsfjord.
- Model is calibrated with AWS and stakes measured winter and summer balance data.
- Glaciers in Kongfjord basin show variability in mass balance.
- Glaciers in south and east show more negative mass balance.
- We investigated hydrology and a runoff routing model to qunatify fresh water flux to the fjord.
- Kronebreen and Kongsvegen contributes maximum fresh water to the fjord.


Thank you