

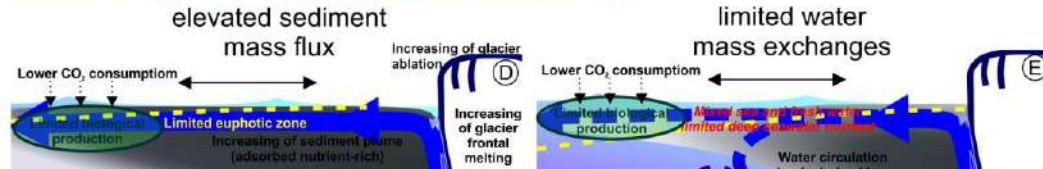
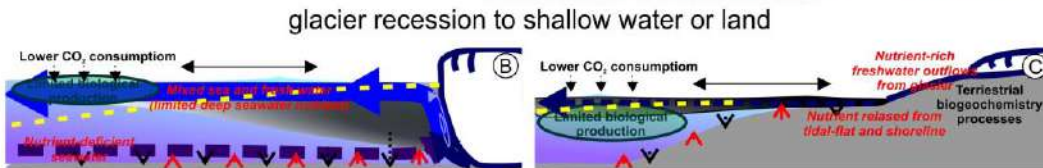
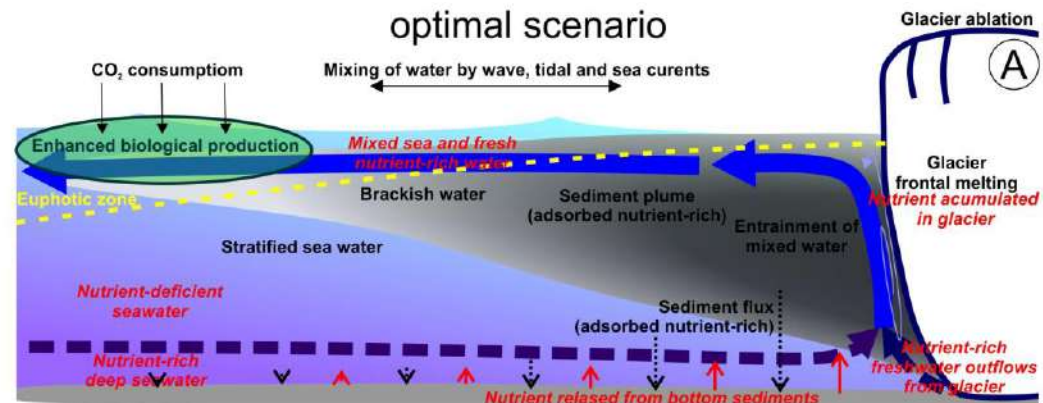
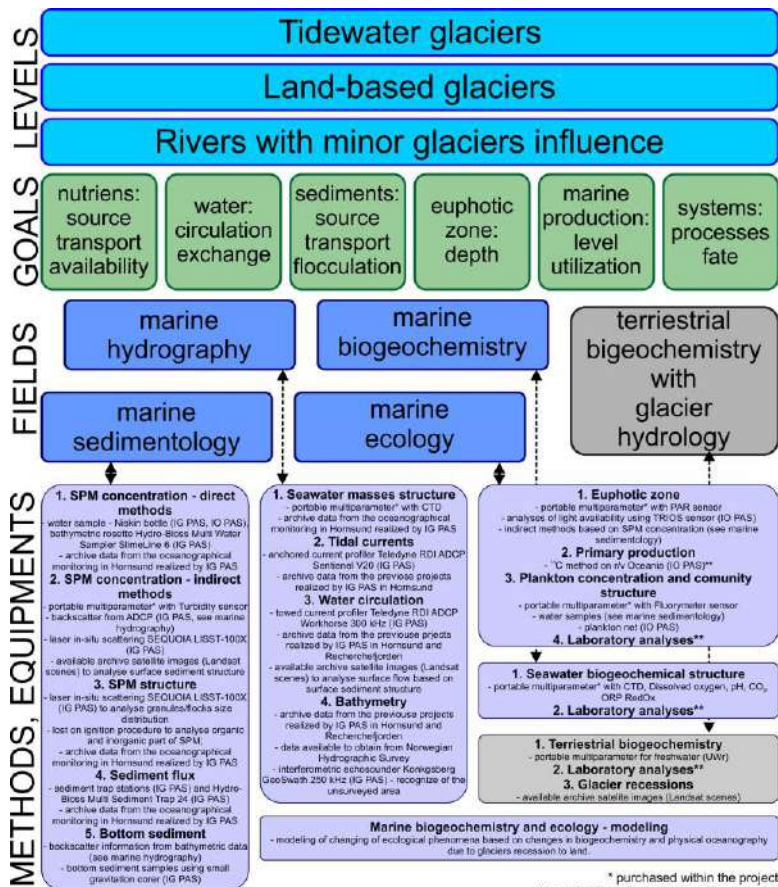
Glacio-hydrological behaviour of the Gasbreen, a debris-covered glacier from high Arctic

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Presentation outline

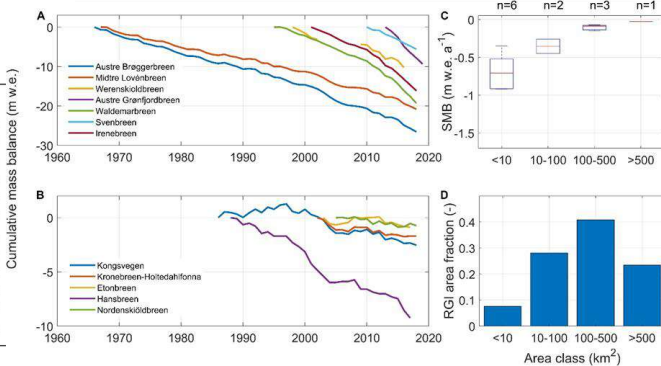
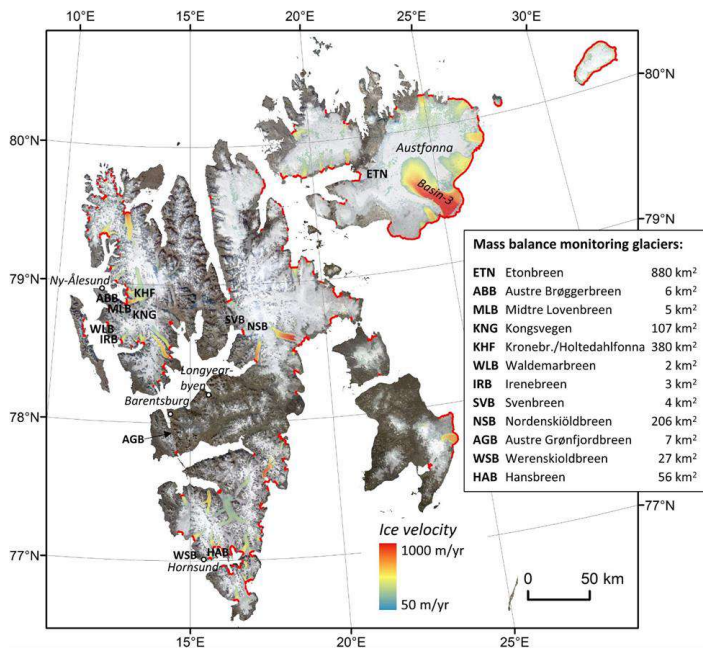
- **RAW project**
- **Background**
- **Debris-Covered glacier**
 - Global distribution (extent and thickness)**
 - Debris-cover processes and control**
- **Gasbreen Glacier: Hornsund Svalbard**
 - Characteristics**
 - Melting pattern**
 - DEM Differencing**
 - Debris-cover control**
 - Glacio-hydrological modelling**
- **Conclusions**
- **Questions**

Head of the Project: Mateusz Moskalik



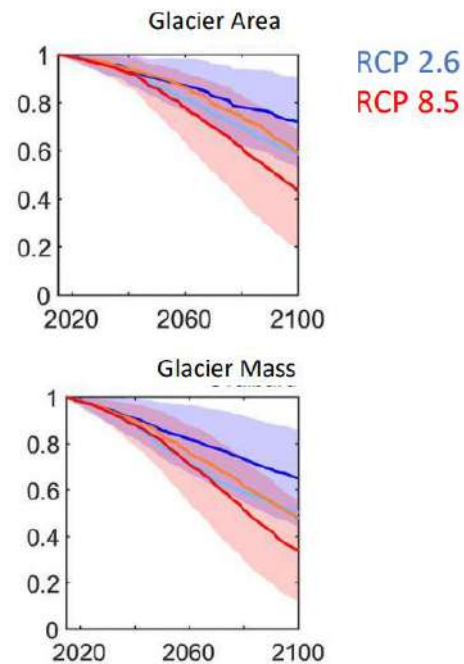
* purchased within the project
 ** more information about methods in text

Background

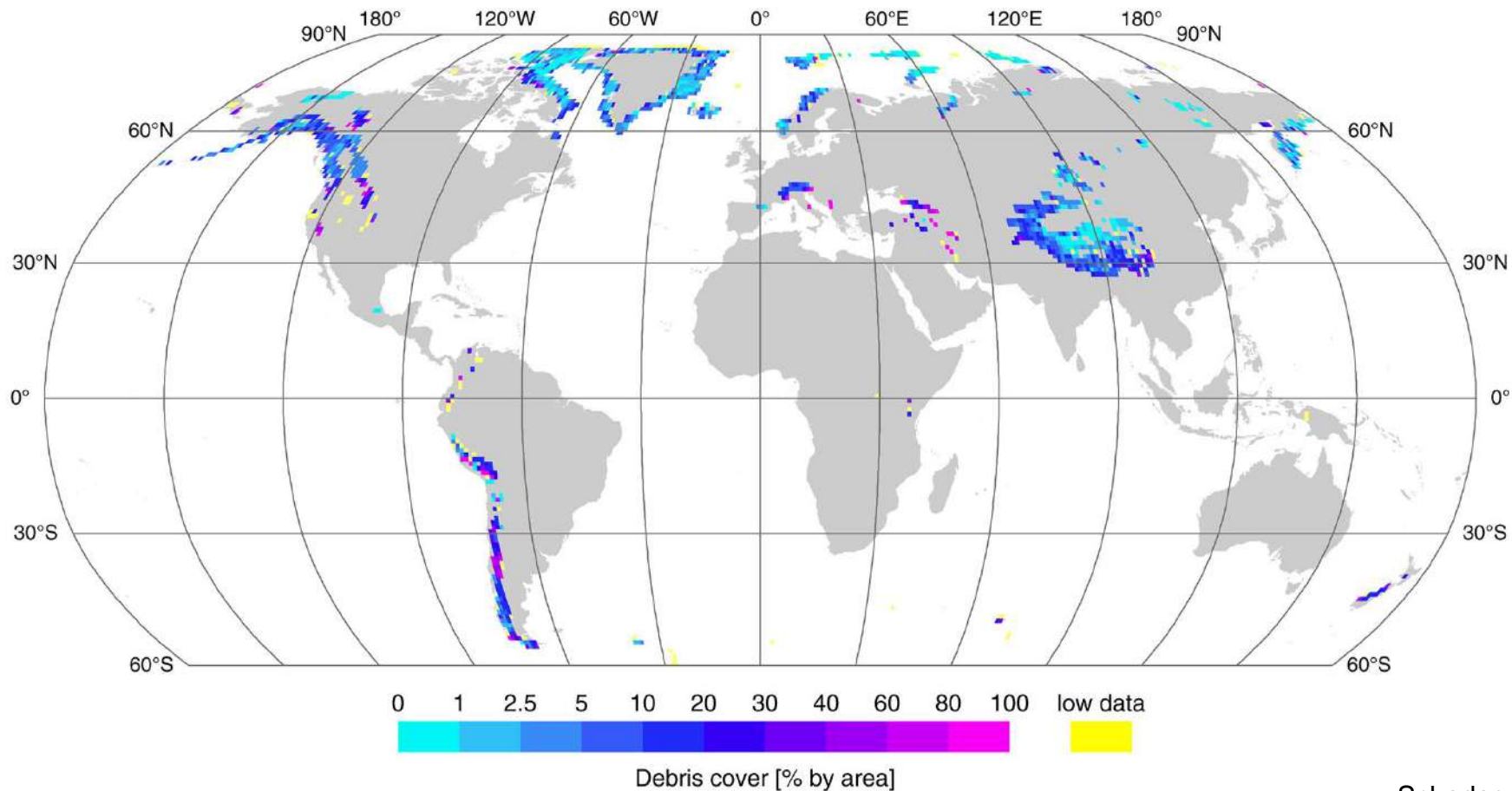


Schuler et al 2020

Projected changes in glacier area and mass balance on **Svalbard** (Marzeion et al, 2020)

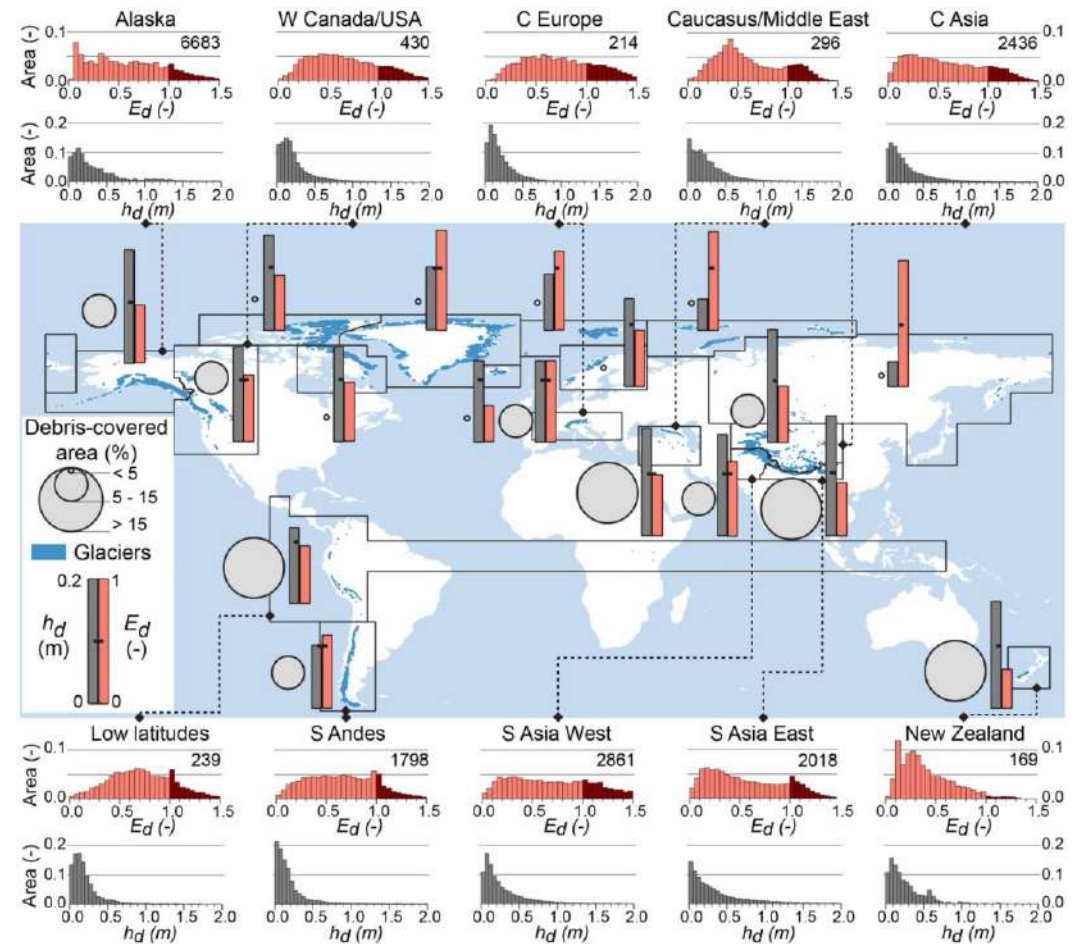
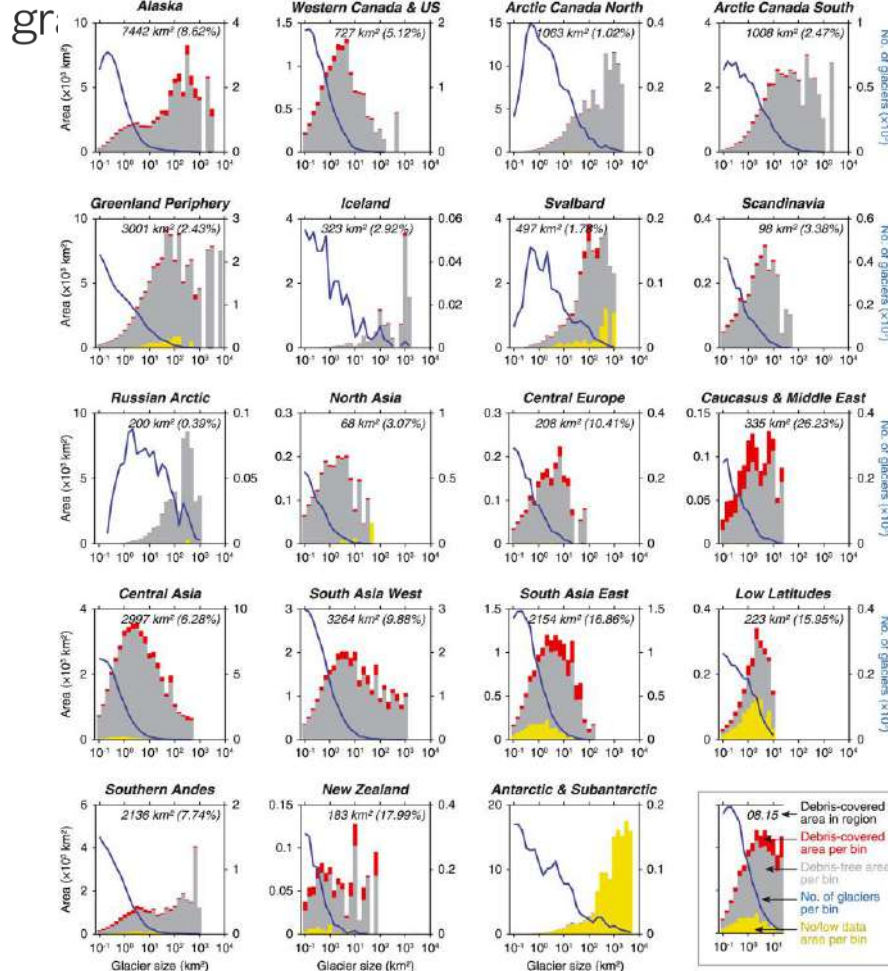


Debris-covered glaciers: Global distribution





Norway Debris-covered glaciers: Global distribution and Svalbard



Debris-covered glaciers: Debris-cover processes and control



Group	Thickness (cm)	No. of stakes	Observed average ablation in case of debris cover (cm. w.e.d ⁻¹)	Calculated average ablation in case of debris free (cm. w.e.d ⁻¹)	Control (multiple)
A	<2	4	-1.7	-4.6	2
B	2 to 5	2	-1.4	-5.0	3
C	5 to 25	2	-1.0	-6.5	6
D	25-50	3	-1.0	-6.3	6
E	>50	3	-0.7	-7.1	10

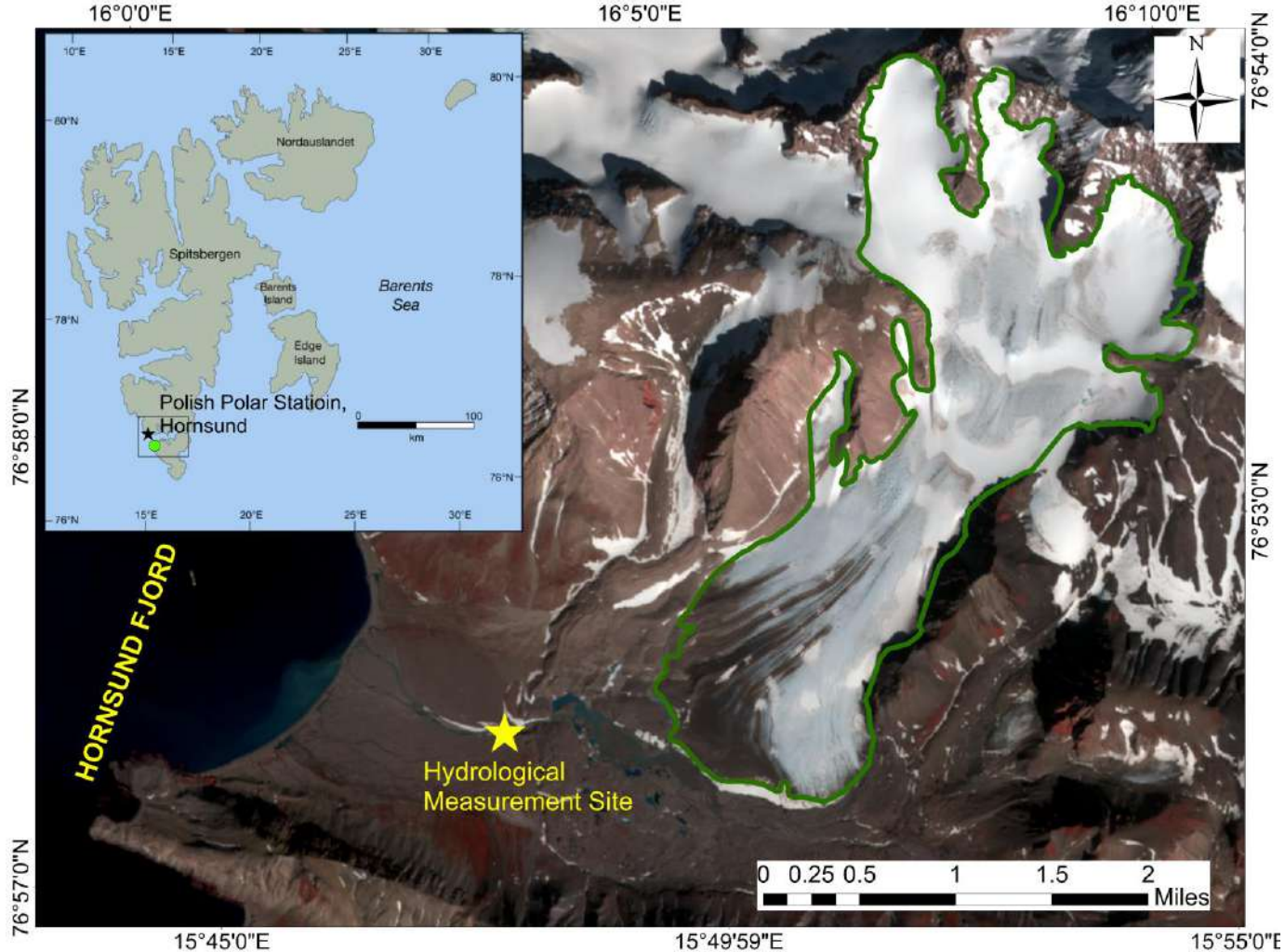






Norway

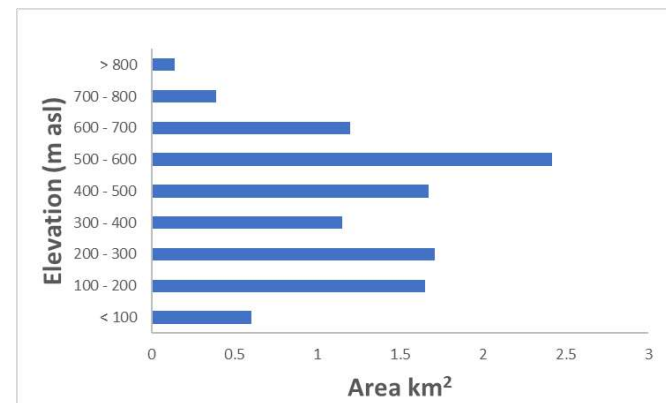
Gasbreen Glacier:



Catchment area: 27.93 km²

Glacier area: 10.93 km²

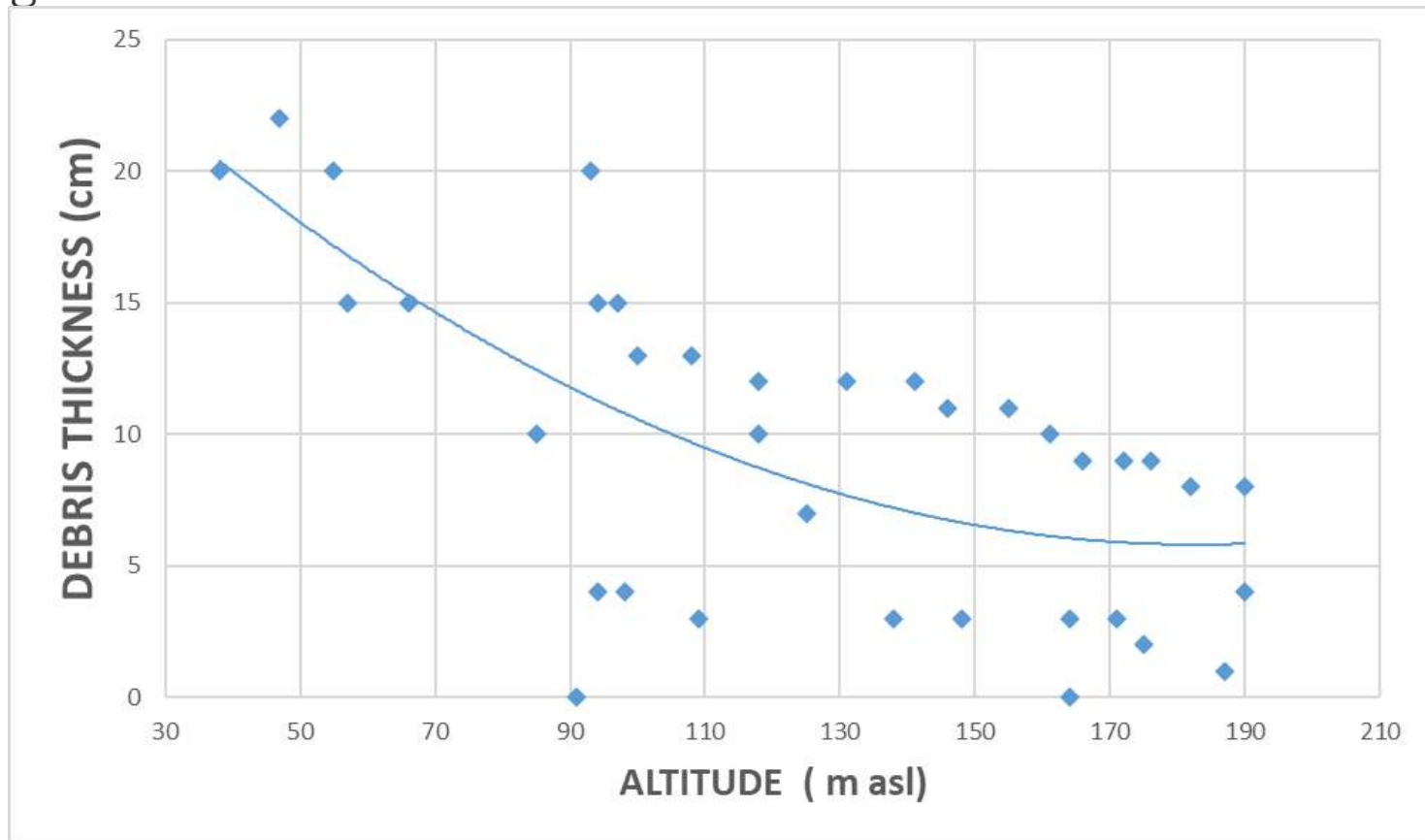
Debris cover area: 1.93 km²





Norway
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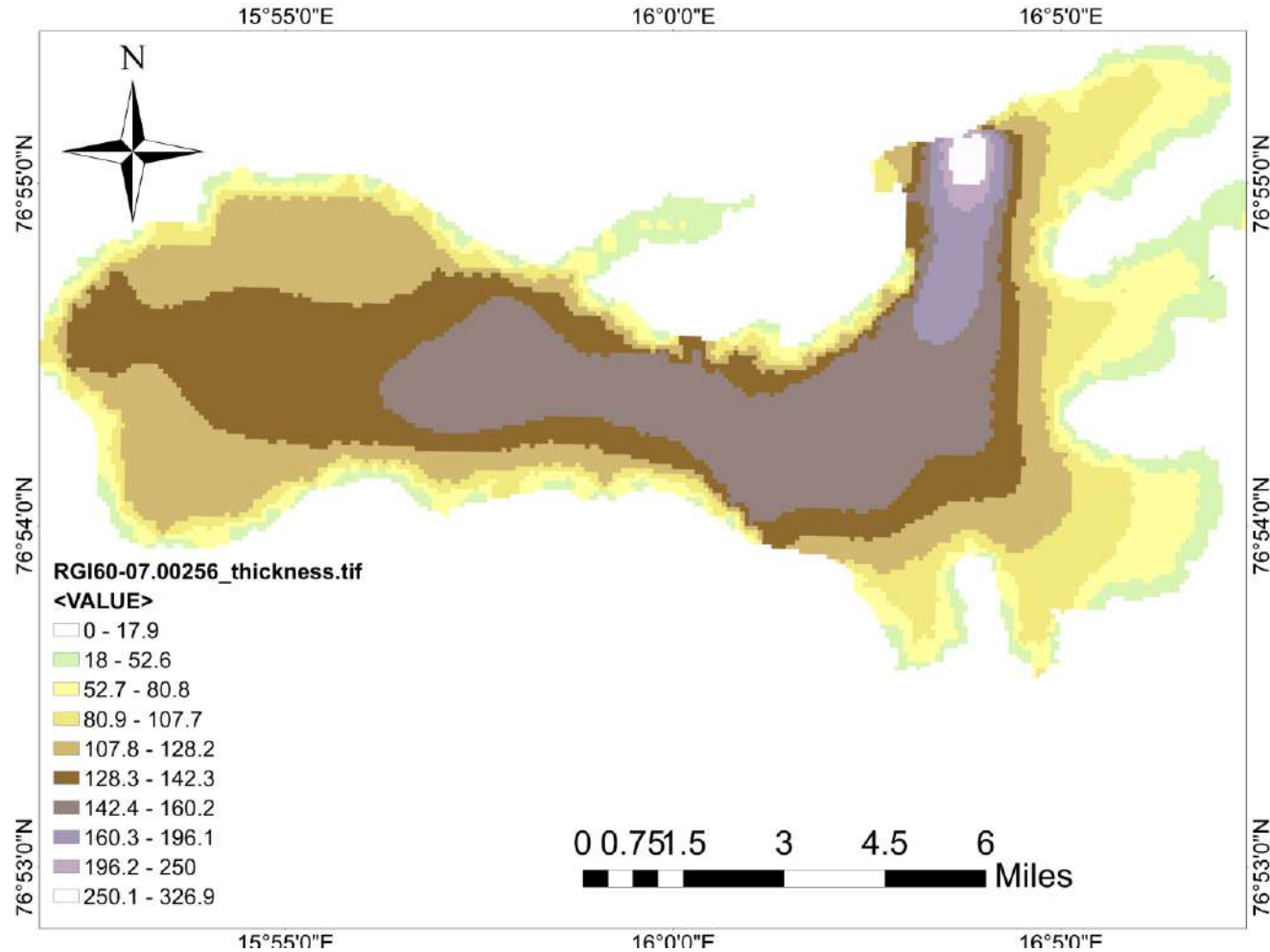
Gasbreen: Debris-cover thickness



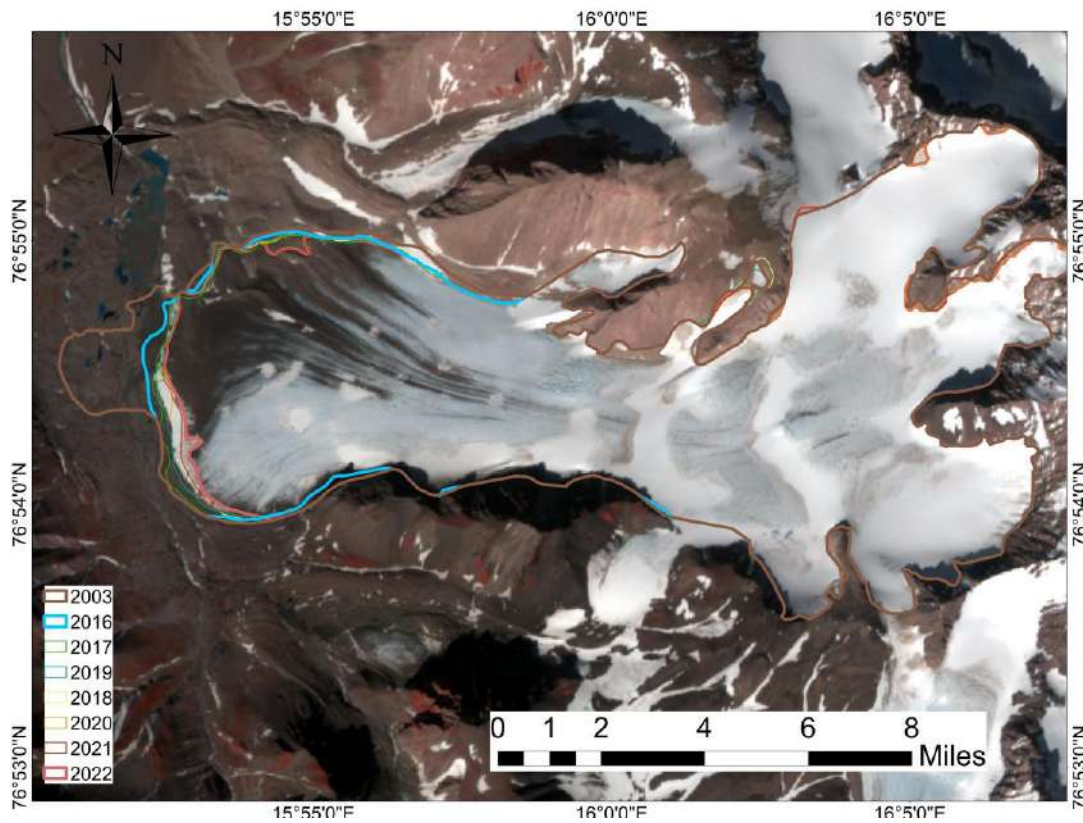


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Gasbreen Glacier: Glacier Ice-thickness



Gasbreen: Glacier retreat (Vertical thinning)



Glacier area loss: $0.52 \pm 0.05 \text{ km}^2$ ($0.03 \text{ km}^2 \text{ a}^{-1}$)

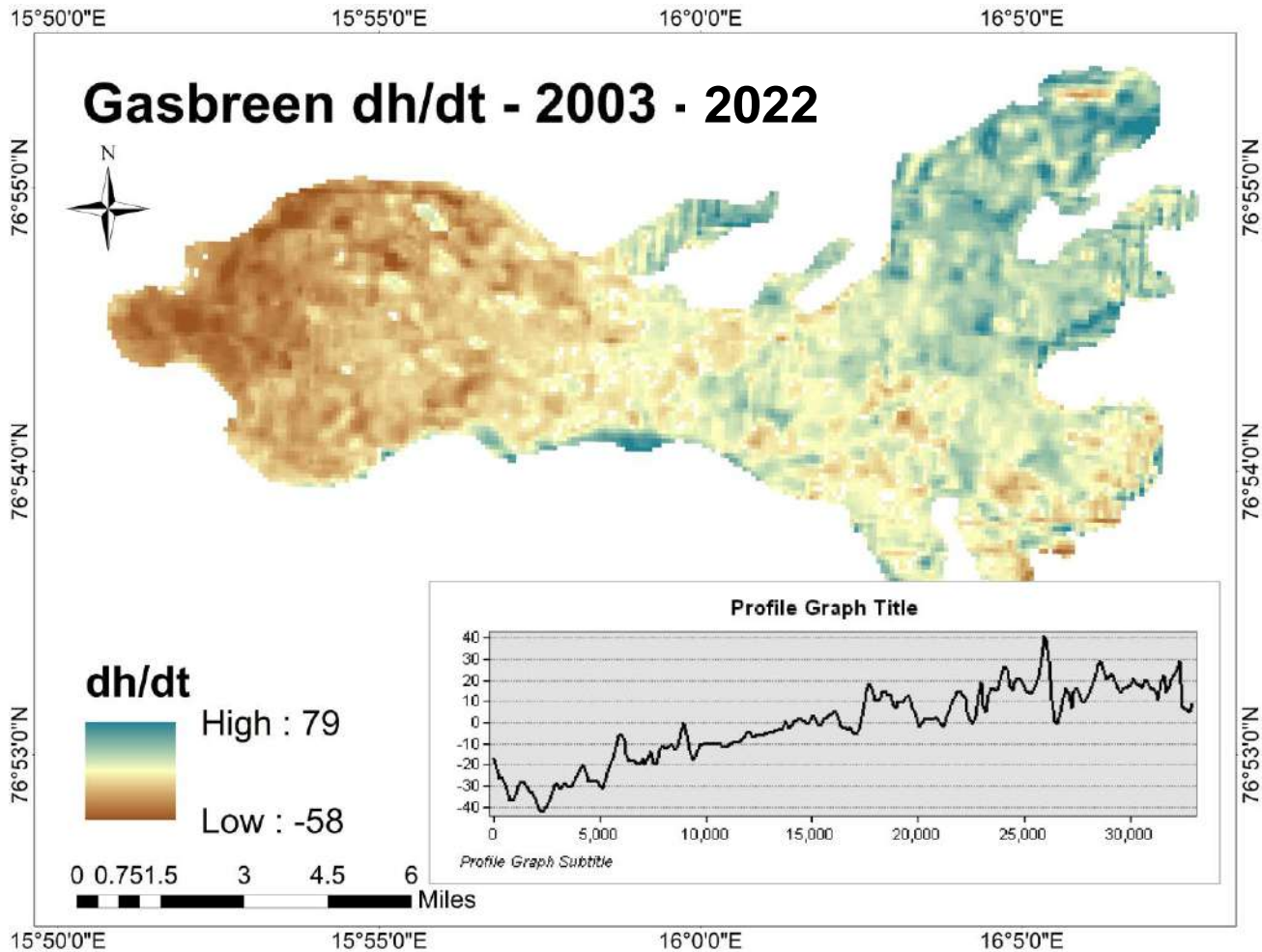
Terminal retreat: approx. 406 ± 15 ($21 \text{ m}^{\text{a}-1}$)

Average Glacier retreat in Hornsund region (Blaszczyk et al 2015)

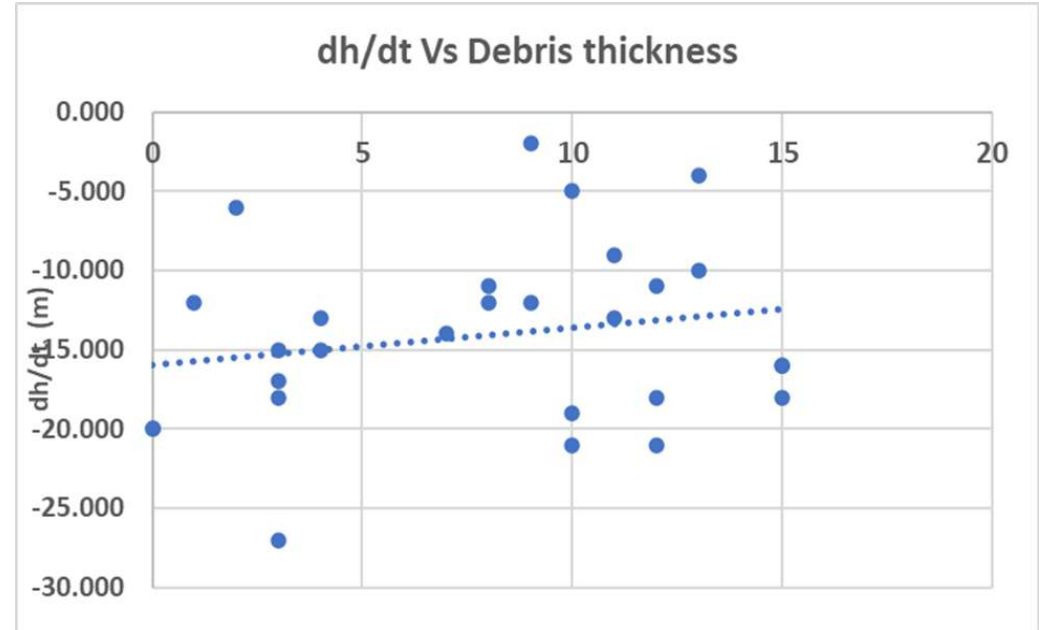
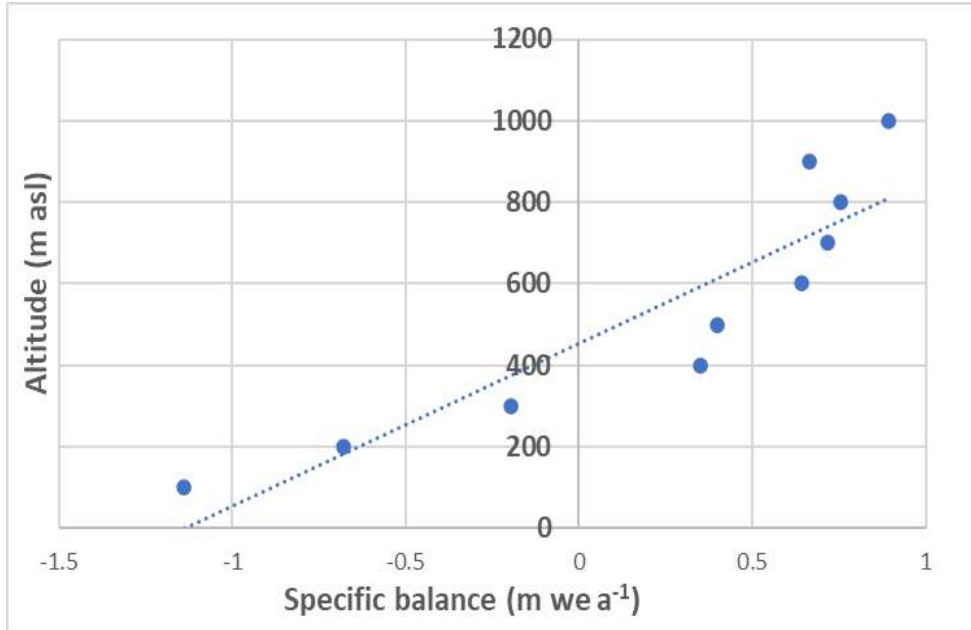
Glacier area loss: $1.6 \text{ km}^2 \text{ a}^{-1}$)

Terminal retreat: approx. $45 - 70 \text{ m}^{\text{a}-1}$)

Gasbreen: Glacier retreat (Vertical thinning)

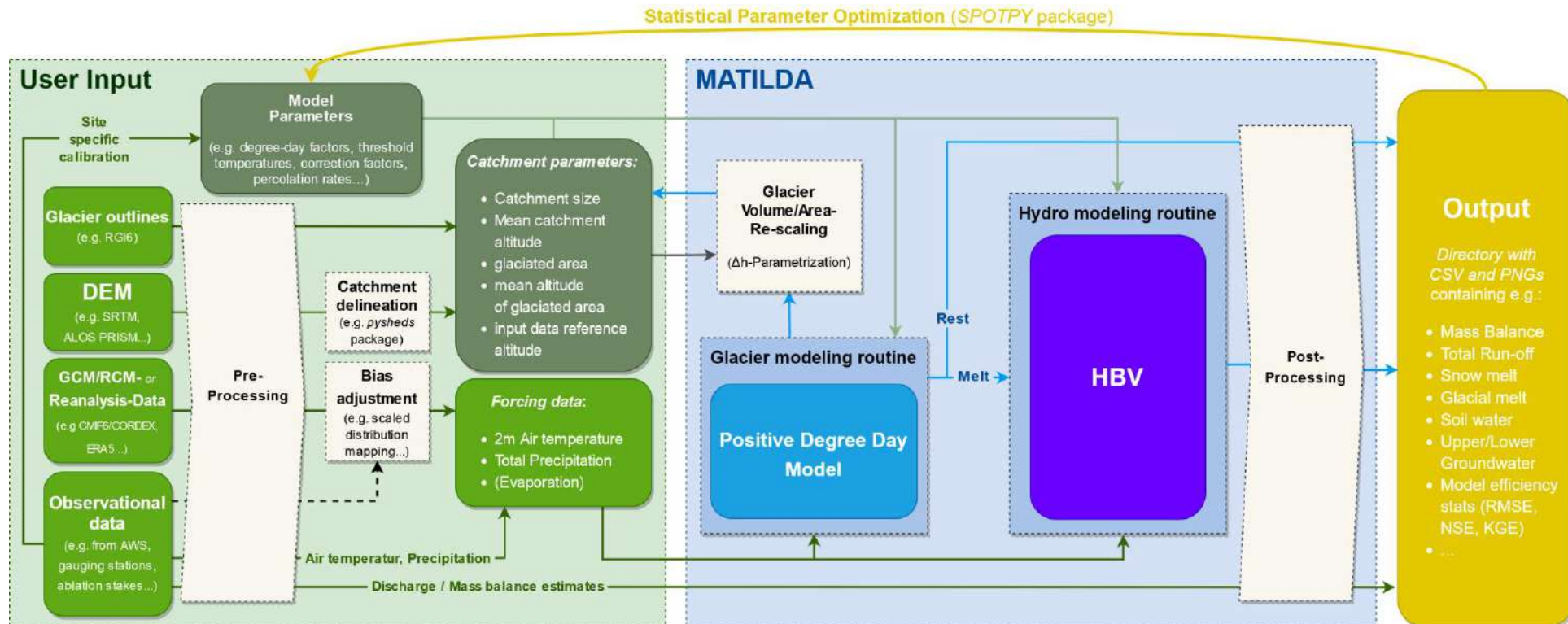


Gasbreen: Debris-cover control

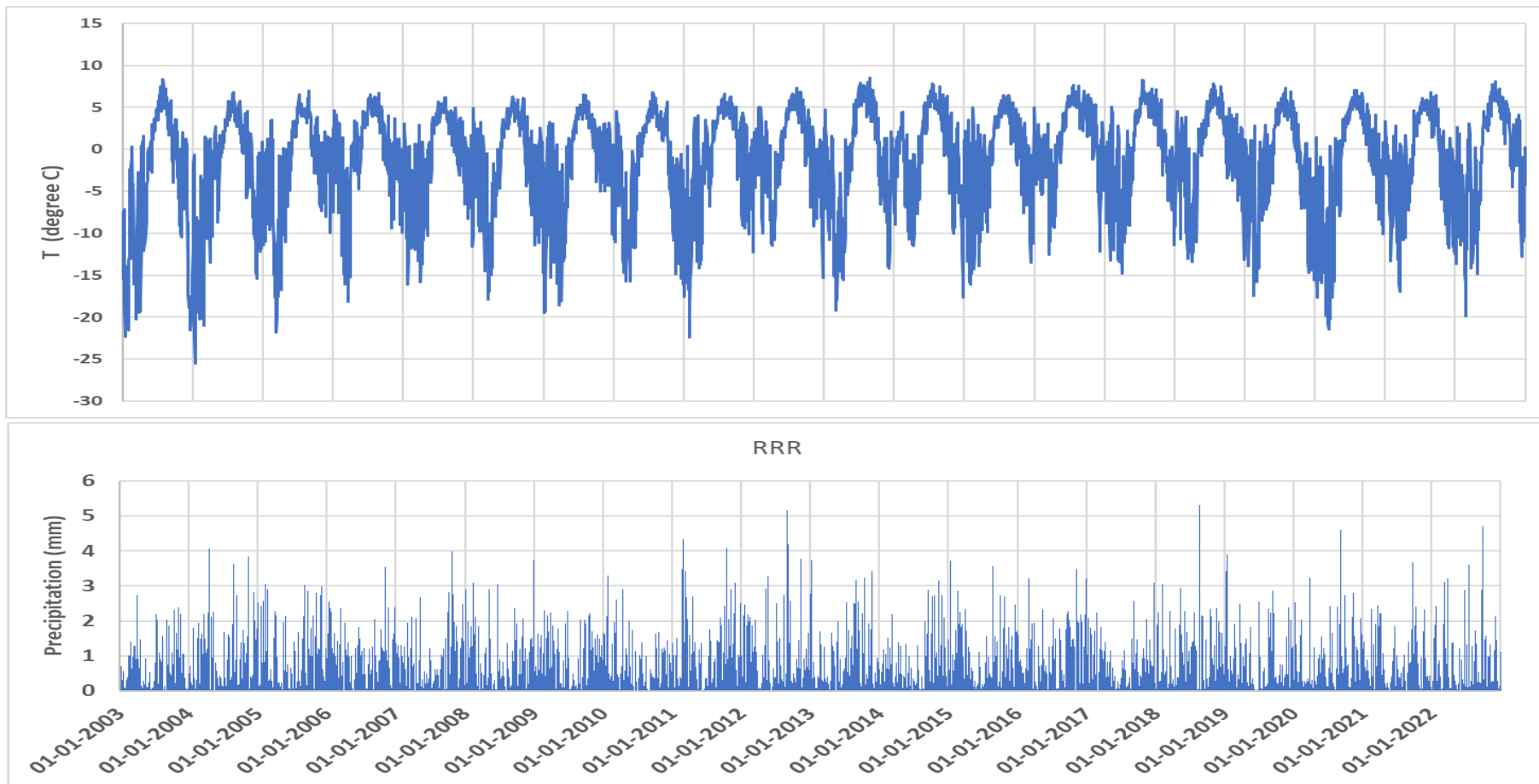




MATILDA - Modeling Water Resources in Glacierized Catchments



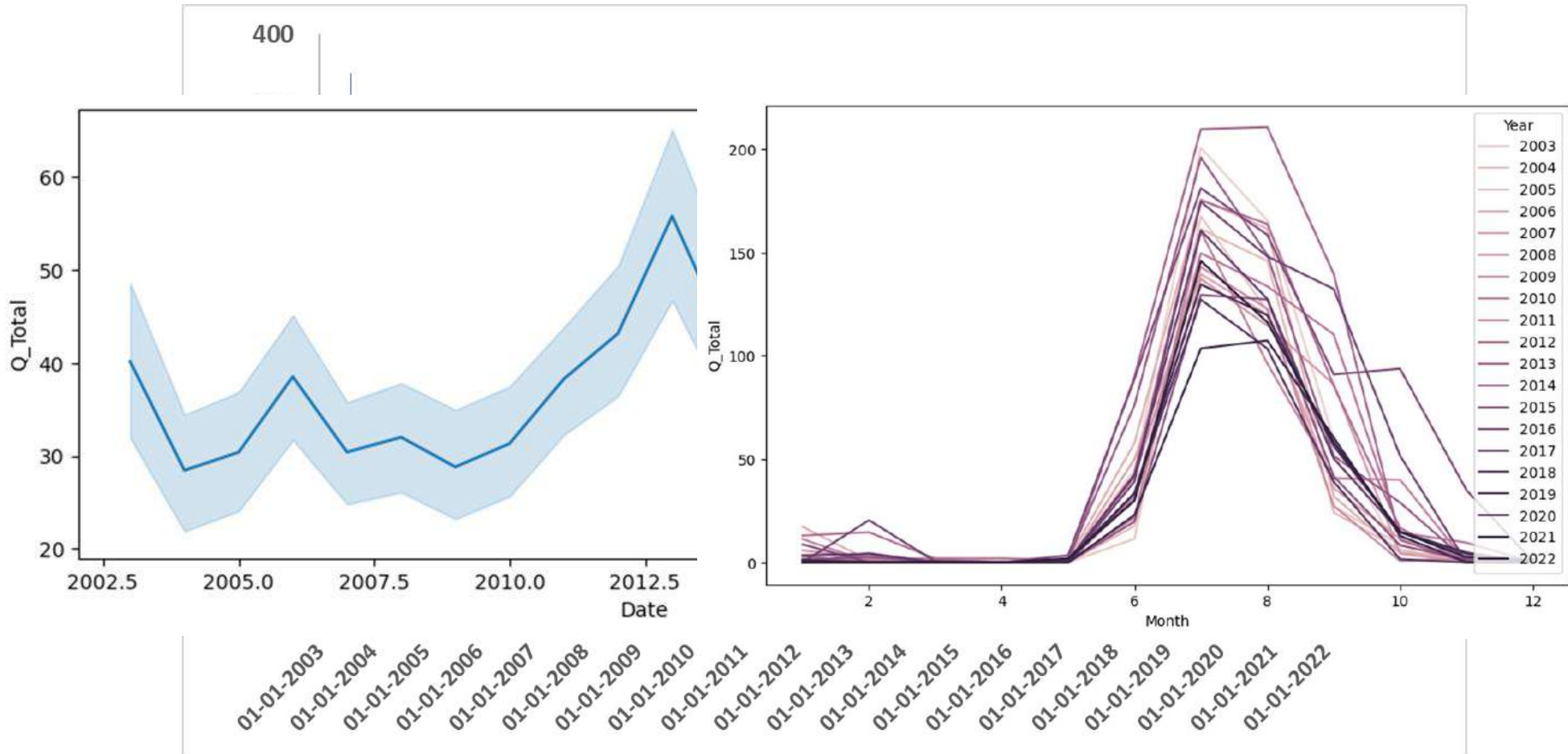
ERA5 Reanalysis data: Temperature/Precipitation





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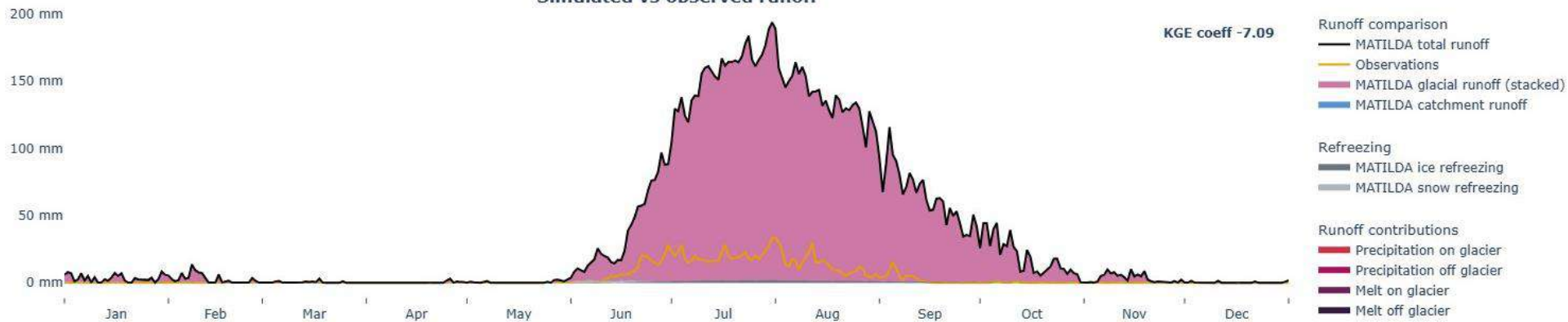
Glacier-discharge



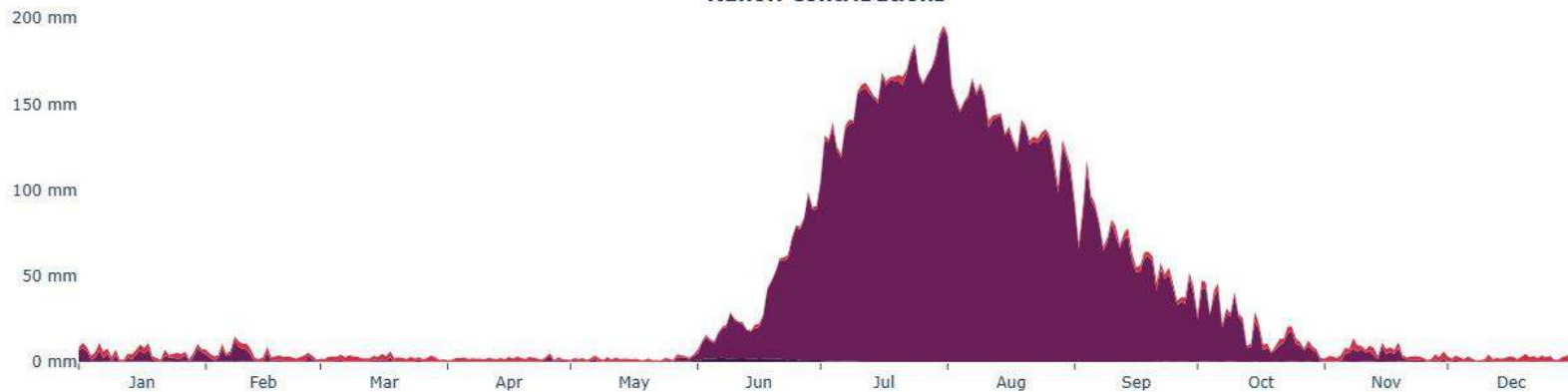


Norway grants

Simulated vs observed runoff



Runoff contributions





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Conclusions:

- The glacier has lost significant glacial mass (vertically and horizontally) during the period 2003-2020.
- The observations showed that the debris thickness over the glacier ablation zone varied between 3 and 20 cm and debris cover over Gasgreen Glacier has been increasing annually.
- The increasing debris-cover over the glacier have affected the glacier ablation.
- The glacier melt has majorly contribution in the melt-runoff.
- It has been observed that the glacio-hydrological properties of debris-covered glaciers differ between clean ice from land/marine terminal glaciers, although they are within the same climatological, geological, and geomorphological setting.
- Incorporation of detailed in-situ measurements for River discharge, Mass-balance and energy balance models.



Thanks
&
Questions ?