

# Observing the Disintegration of the A68A Iceberg from Space

Anne Braakmann-Folgmann  
Andrew Shepherd, Laura Gerrish,  
Jamie Izzard, Andy Ridout

26.5.2022



**British  
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL



**UNIVERSITY OF LEEDS**

# Motivation

- Iceberg calving accounts for ~50% of ice loss from Antarctica
- Icebergs affect the Antarctic environment

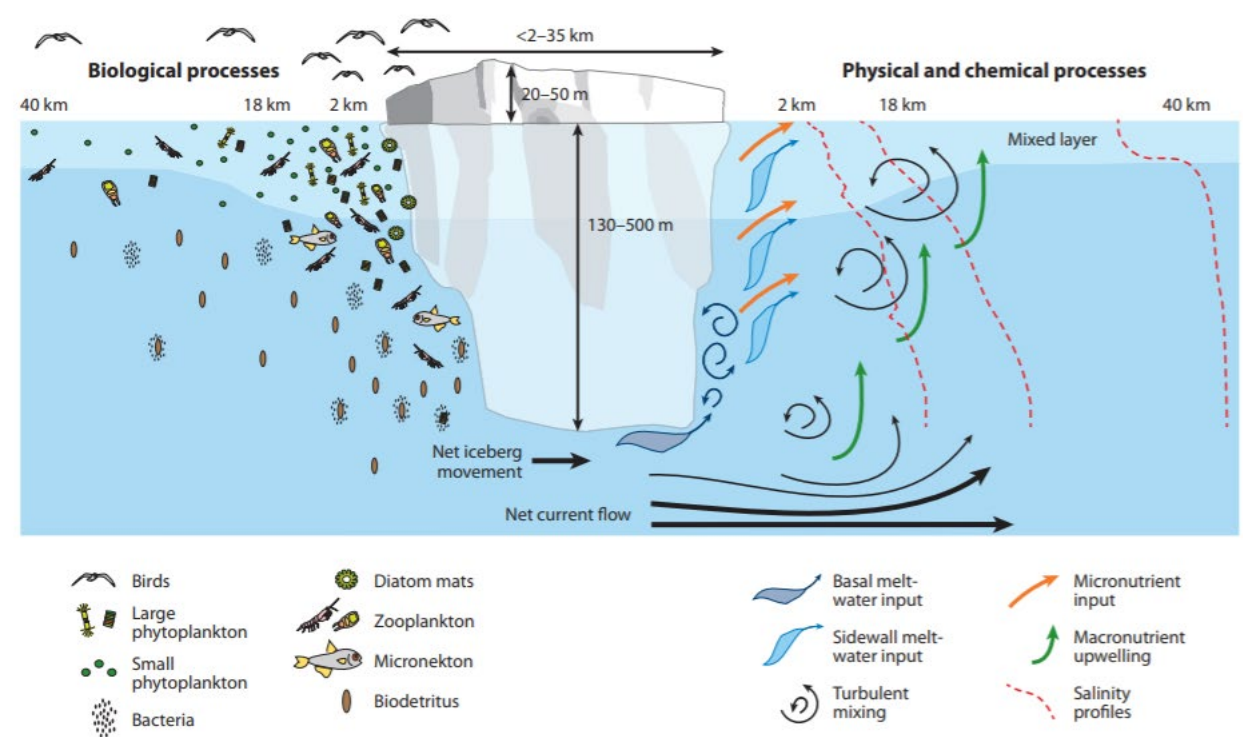
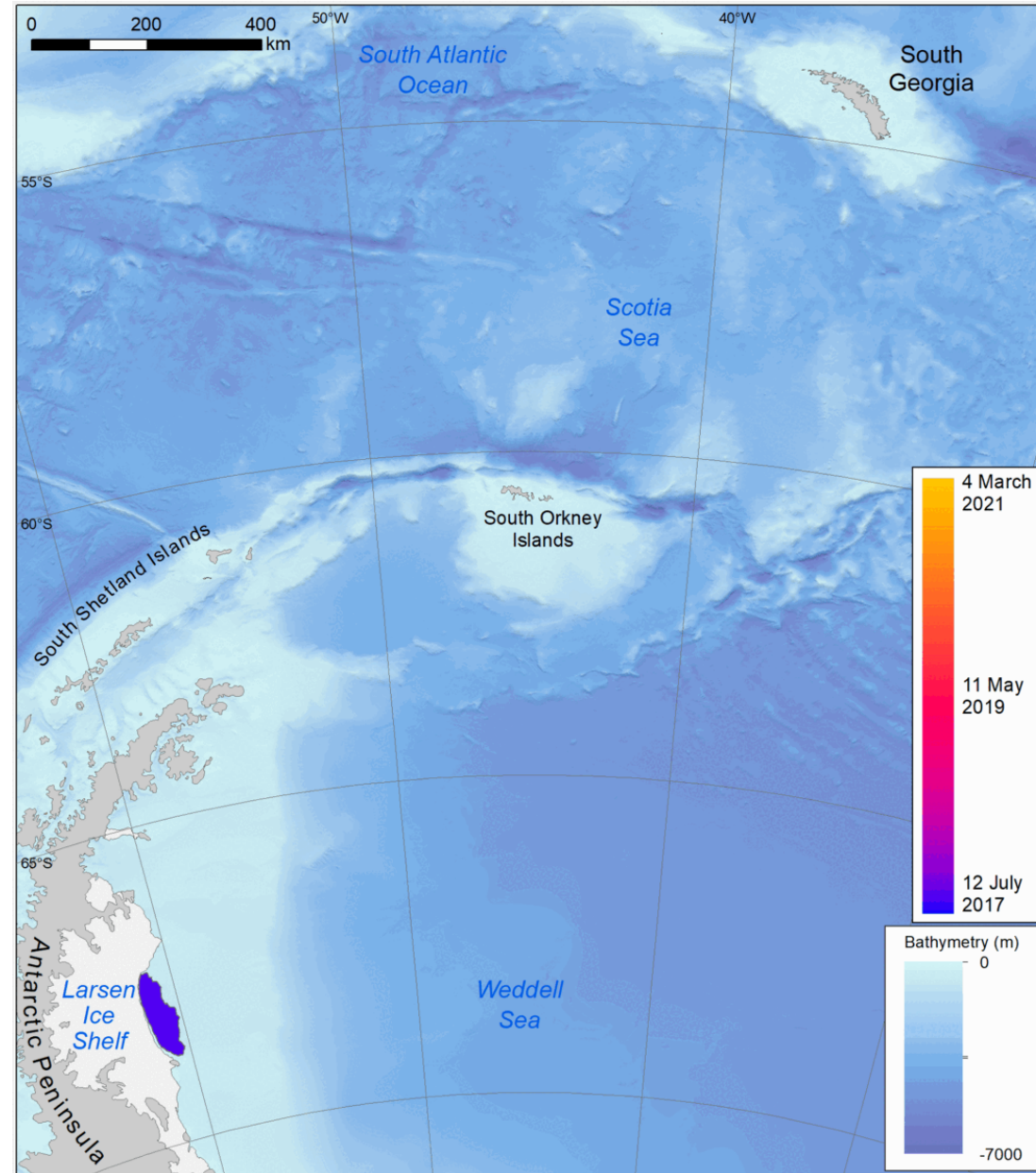


Figure: Smith et al (2013)



# A68A

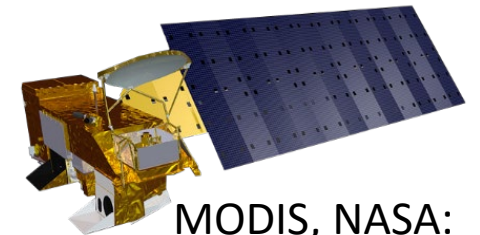
- Largest iceberg at calving
- Significantly reduced the area of Larsen-C
- Approached South Georgia up to 62 km and almost grounded there



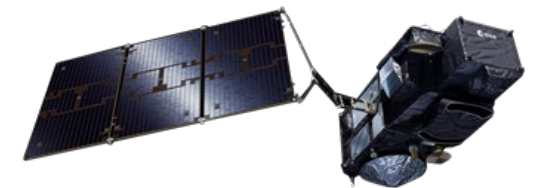
## Iceberg area



Sentinel 1,  
ESA: Synthetic Aperture  
Radar (SAR) imagery



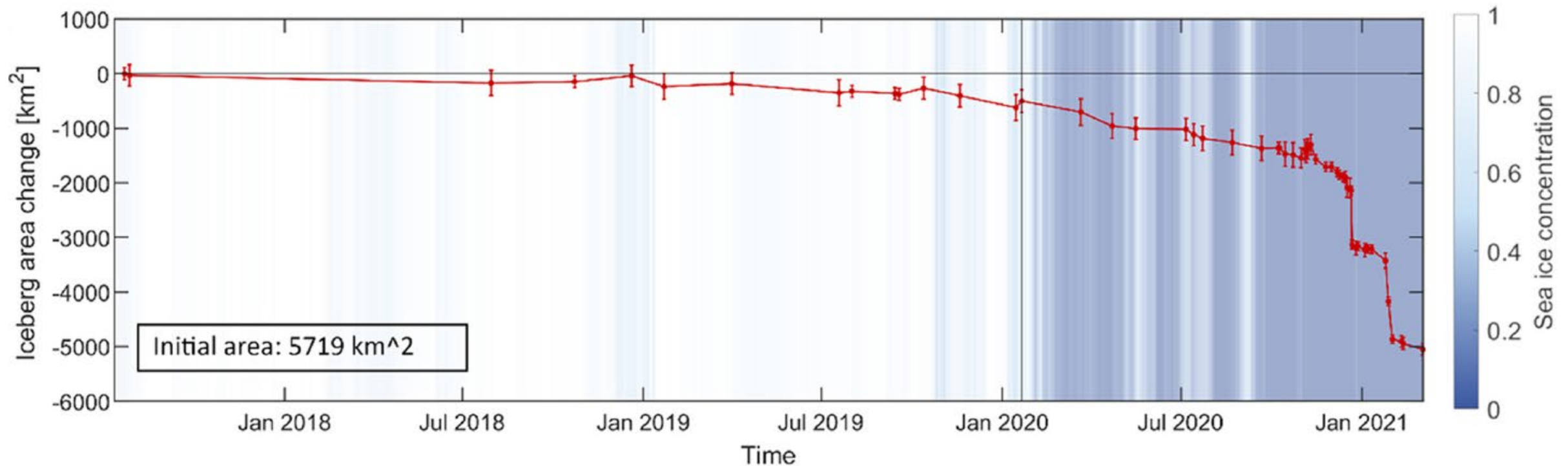
MODIS, NASA:  
Optical imagery



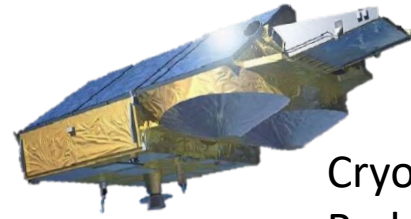
Sentinel 3 (OLCI),  
ESA: Optical imagery

# Area change

- Initial area: 5719 km<sup>2</sup>
- Total area loss: 5052 km<sup>2</sup> (88 %)
- 200 km<sup>2</sup>/year in the Weddell Sea
- 2807 km<sup>2</sup>/year in the Scotia Sea



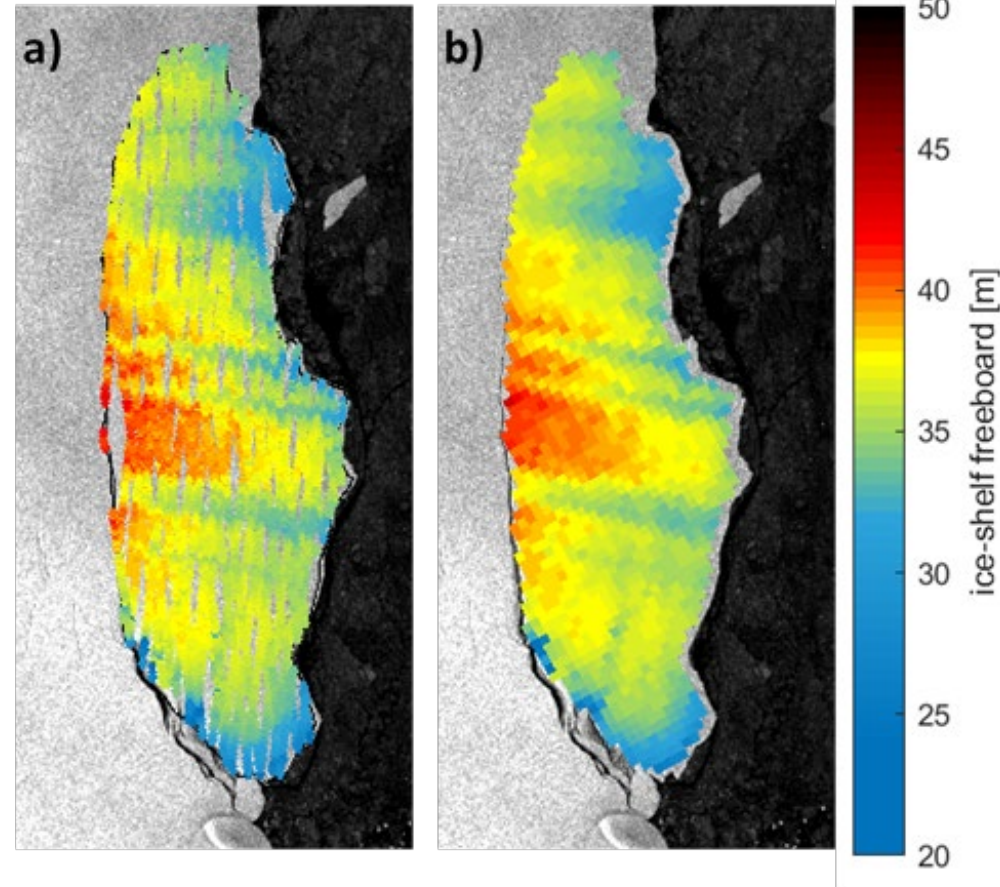
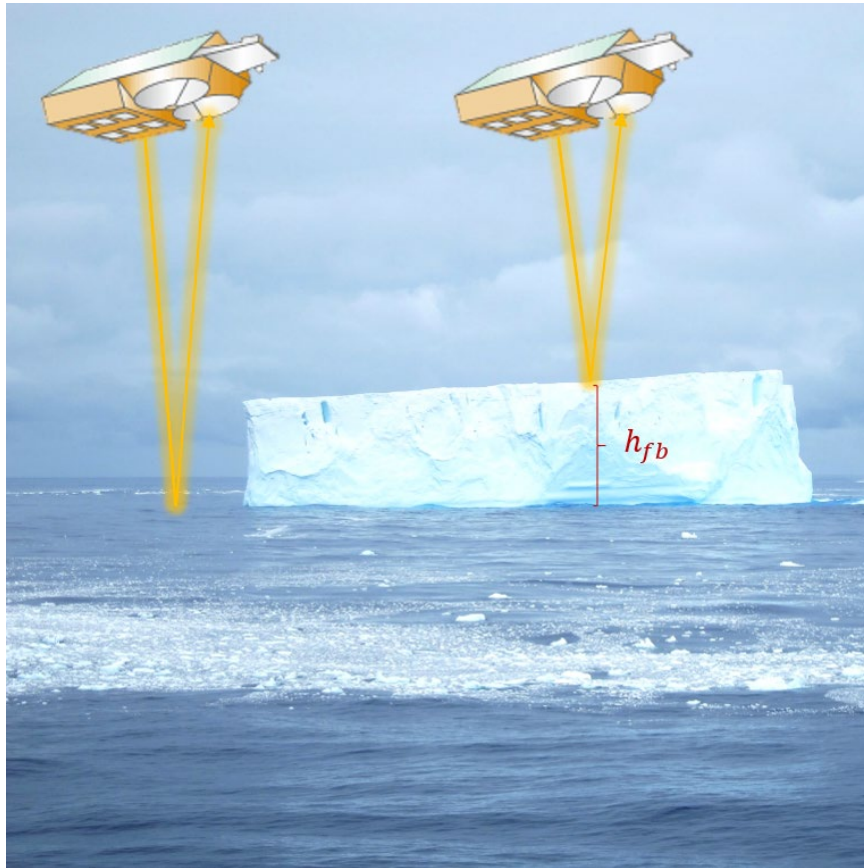
# Iceberg freeboard



CryoSat-2, ESA:  
Radar altimeter



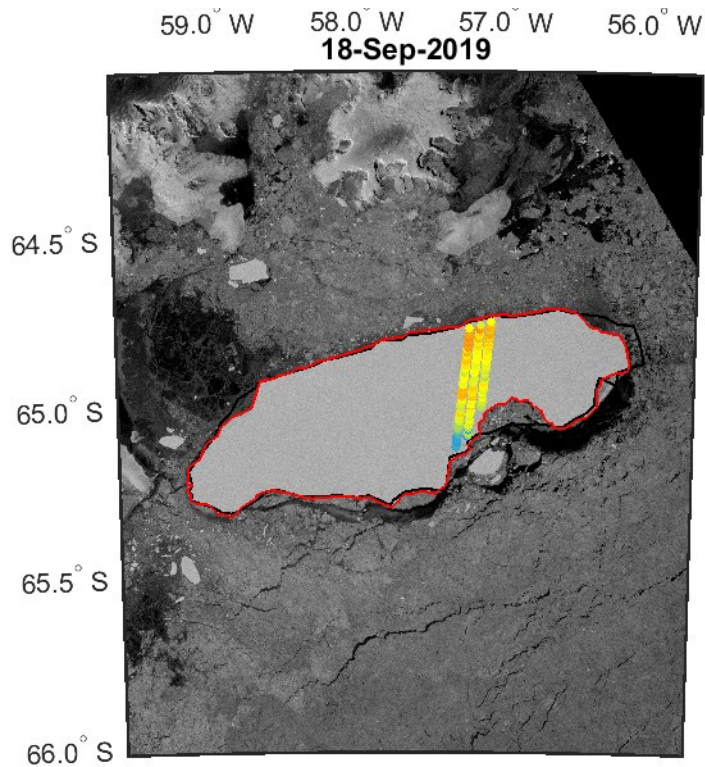
ICESat-2, NASA:  
Laser altimeter



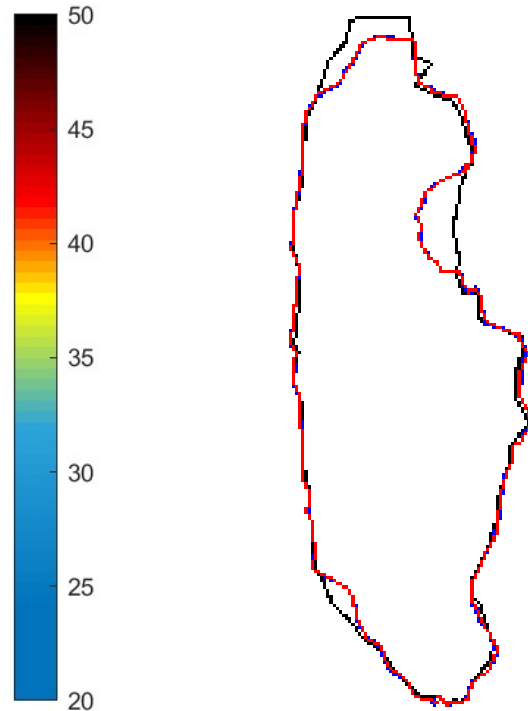


# Calculating freeboard difference

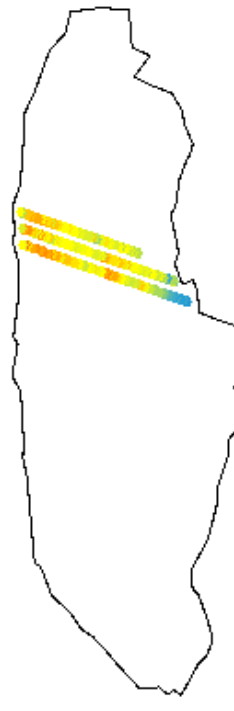
New altimetry overpass and coincident image



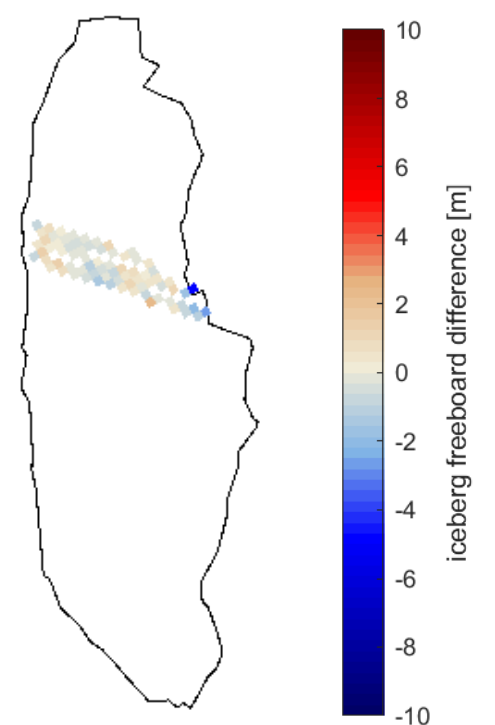
New outline geolocated with respect to previous and initial outline



New overpass transformed to initial outline

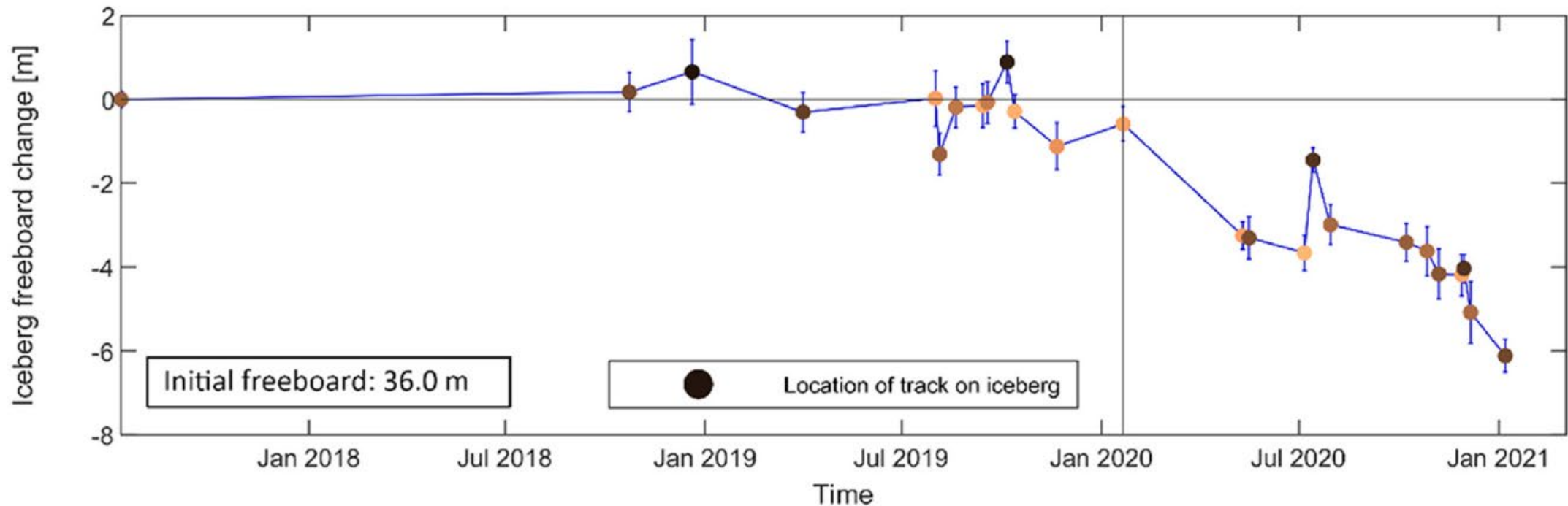


New overpass gridded and differenced to initial freeboard at same location

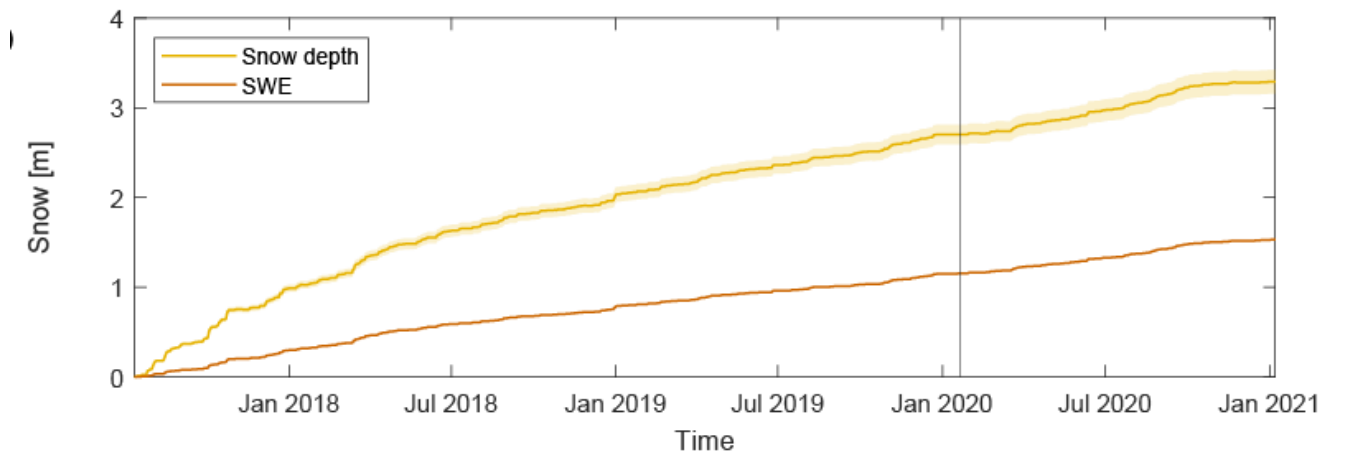
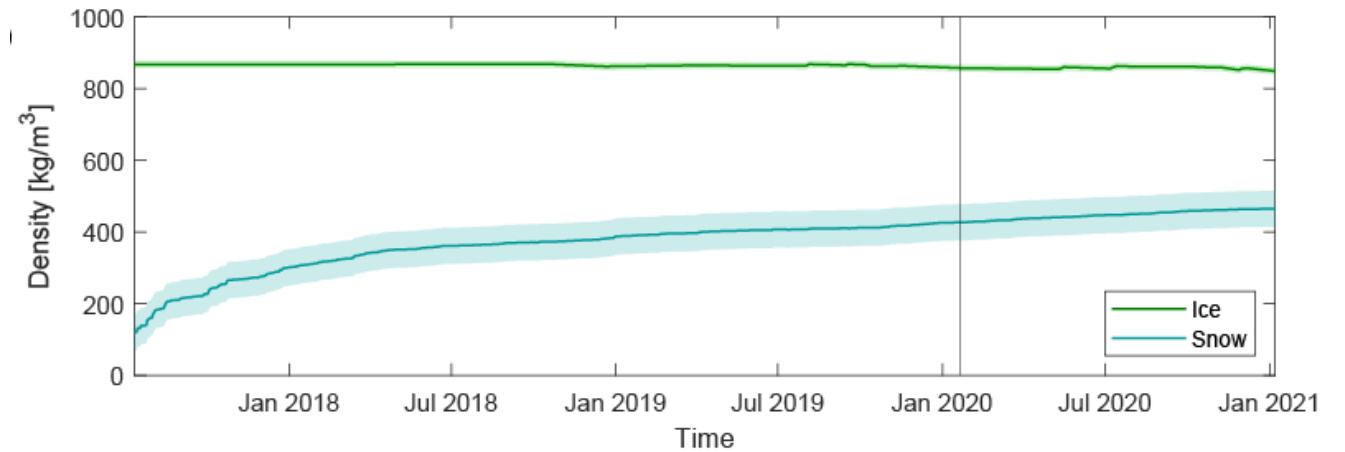
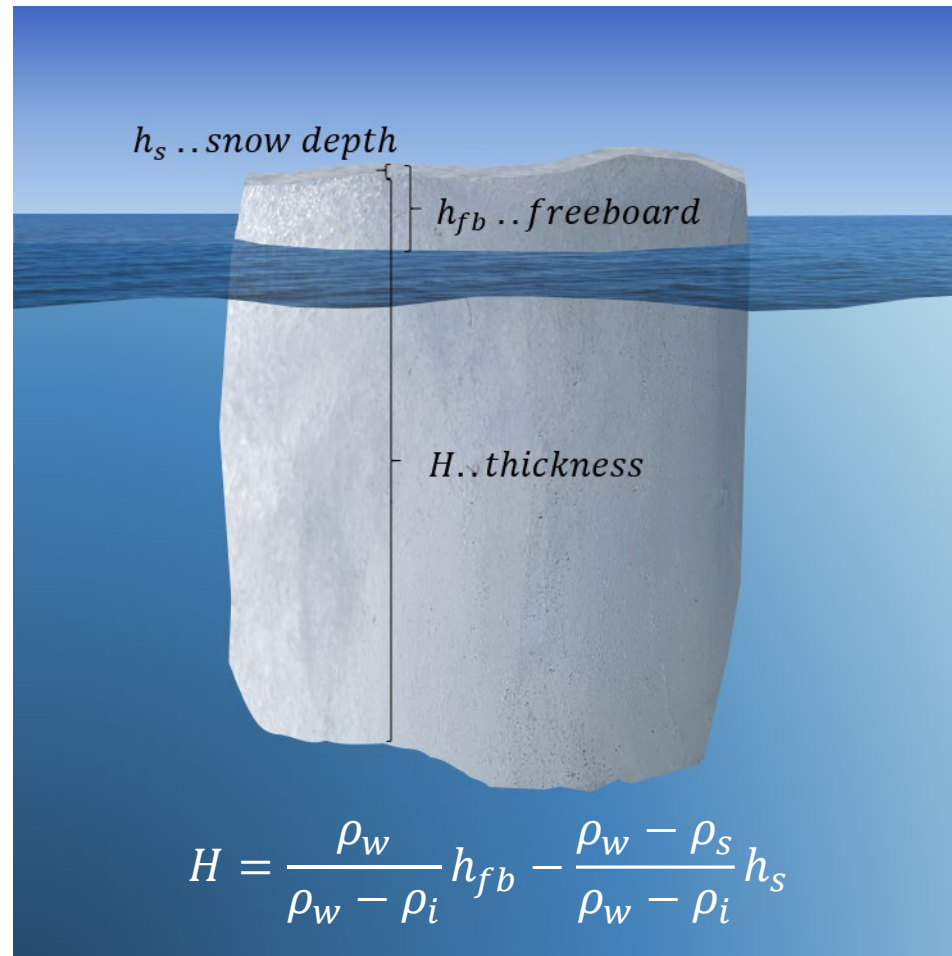


# Freeboard change over time

- 0.2 m/year in the Weddell Sea
- 5.7 m/year in the Scotia Sea
- Total freeboard loss: 6.1 m
- Initially southern part more stable



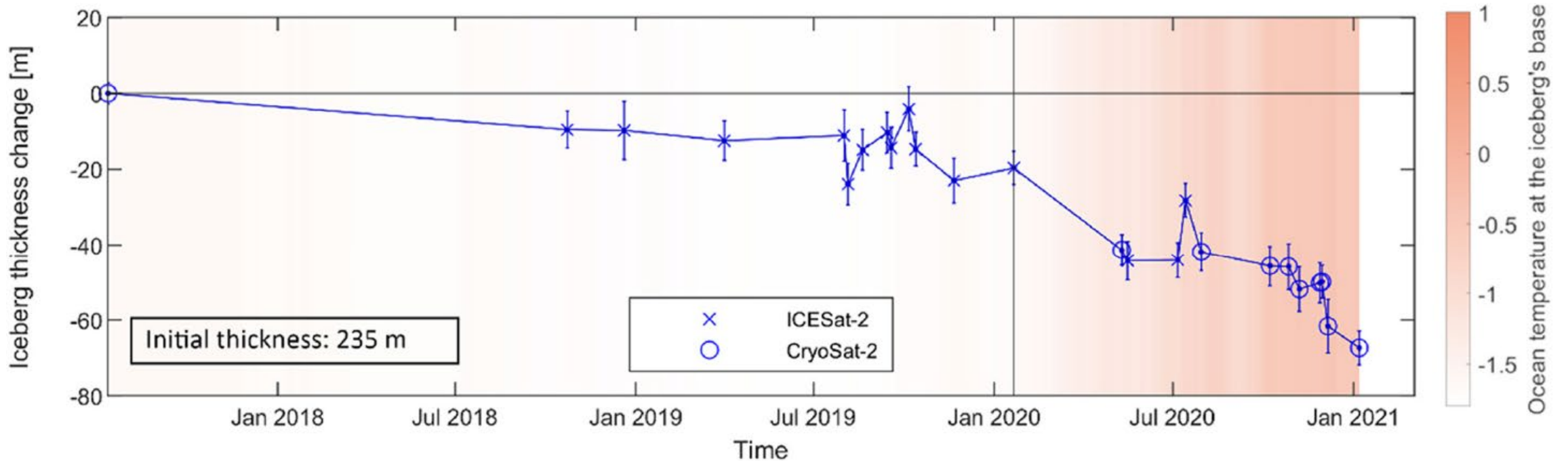
# Iceberg freeboard to iceberg thickness



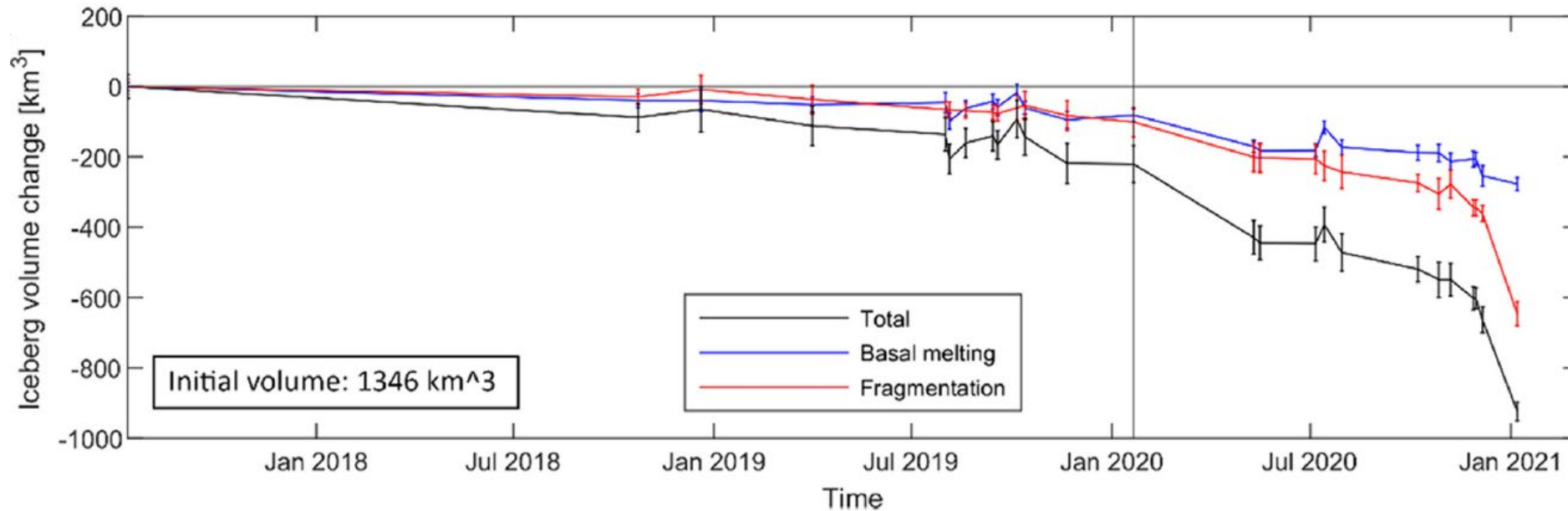


# Changes in iceberg thickness

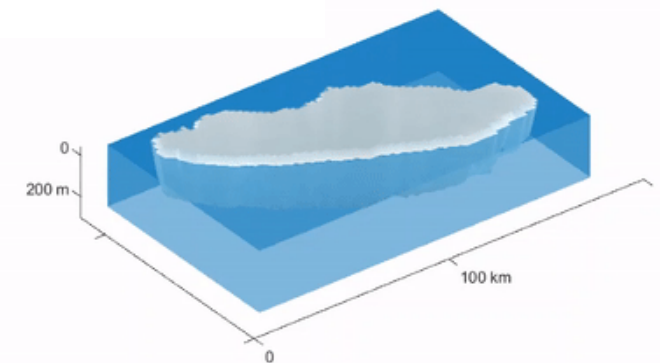
- 7.8 m/year in the Weddell Sea
- 49.5 m/year in the Scotia Sea
- Total thickness loss: 67 m (235 m to 168 m)



# Changes in iceberg volume & mass

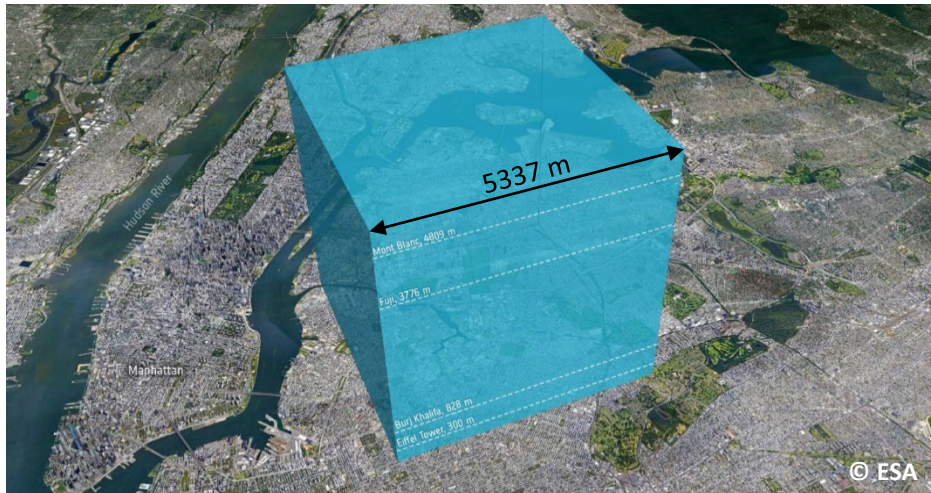
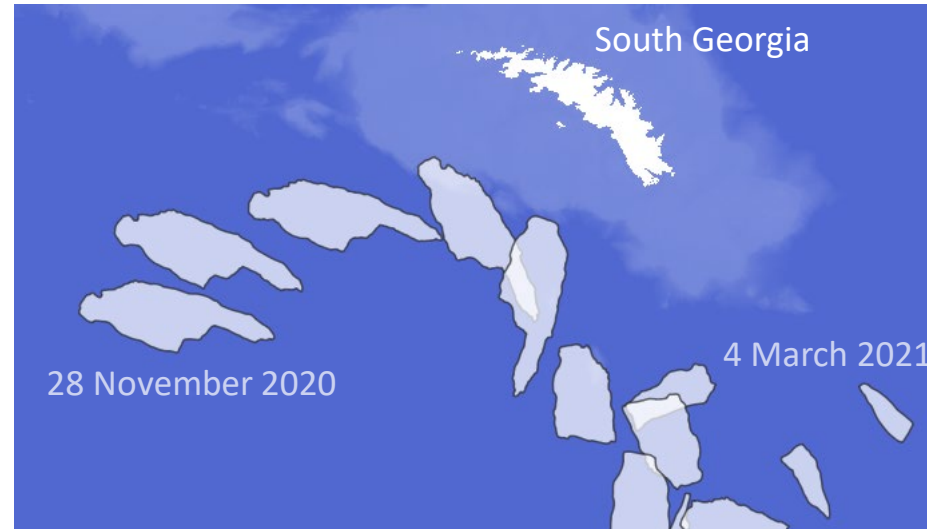


- Total mass loss: 802 G tons
- 68 % through fragmentation (area change)
- 32 % through melting (thickness change)
- 254 G tons basal melting



# Fresh water flux near South Georgia

- At least 96 days were spent within 300 km off the coast
  - $152 \pm 61$  G tons of fresh water released close to South Georgia
- Significant impact on ecosystem expected



Anne Braakmann-Folgmann

LPS 2022

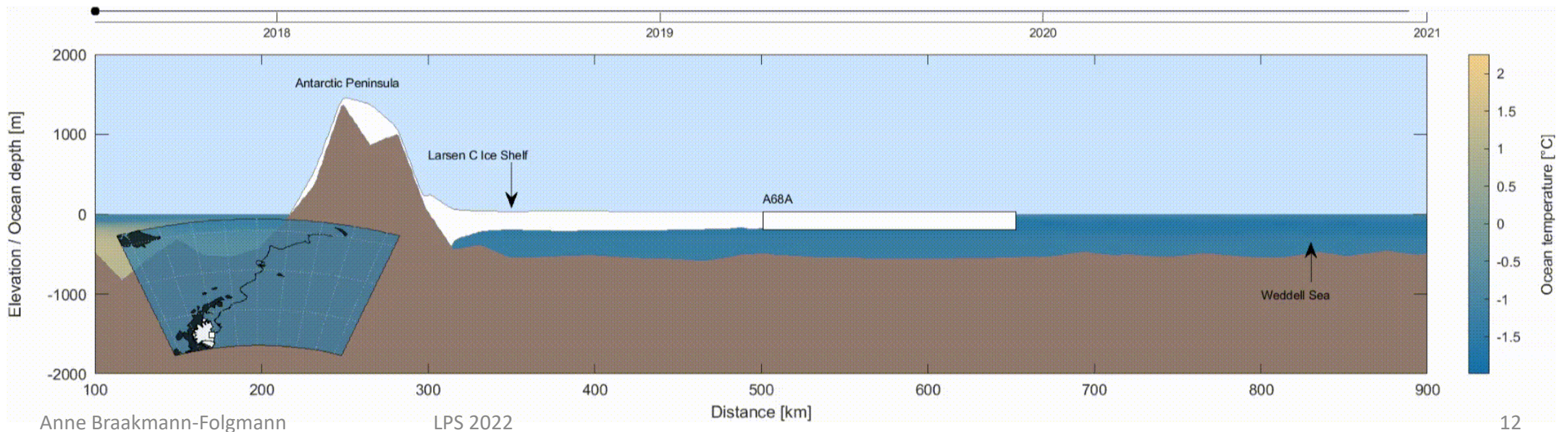


Photo: [https://commons.wikimedia.org/wiki/File:South\\_Georgia\\_Photo\\_by\\_Sascha\\_Grabow.jpg](https://commons.wikimedia.org/wiki/File:South_Georgia_Photo_by_Sascha_Grabow.jpg)



# Conclusions

- A68 was the 6<sup>th</sup> largest iceberg on record
- A68A thinned from 235 to 168 m, accounting for 32 % of its loss
- Basal melting peaked at 7.2 m/month in the Northern Scotia Sea
- The iceberg released 152 Gt of fresh water and nutrients near South Georgia



# Future work

- Impact of this calving event on the stability of the Larsen-C Ice Shelf
- Effects of meltwater and nutrients released in the vicinity of South Georgia
- Include impact of icebergs following a similar trajectory in ocean models

Thank you!

More details:



Remote Sensing of Environment 270 (2022) 112855

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: [www.elsevier.com/locate/rse](http://www.elsevier.com/locate/rse)

Observing the disintegration of the A68A iceberg from space

A. Braakmann-Folgmann<sup>a,\*</sup>, A. Shepherd<sup>a</sup>, L. Gerrish<sup>b</sup>, J. Izzard<sup>a</sup>, A. Ridout<sup>c</sup>

<sup>a</sup> Centre for Polar Observation and Modelling (CPOM), University of Leeds, Leeds LS2 9JT, UK  
<sup>b</sup> British Antarctic Survey, Cambridge CB3 0ET, UK  
<sup>c</sup> Centre for Polar Observation and Modelling (CPOM), University College London, London, UK

ARTICLE INFO

Editor: Menghua Wang

Keywords:  
Tabular icebergs  
Basal melting  
Satellite altimetry  
ICESat-2  
CryoSat-2  
Freshwater flux  
Mass loss  
South Georgia  
A68

ABSTRACT

Icebergs impact the physical and biological properties of the ocean where they drift, depending on the degree of melting. We use satellite imagery and altimetry to quantify the area, thickness, and volume change of the massive A68A iceberg from its calving off the Larsen-C Ice Shelf in July 2017 until January 2021, when it disintegrated. A68A thinned from  $235 \pm 9$  to  $168 \pm 10$  m, on average, and lost  $802 \pm 34$  Gt of ice in 3.5 years,  $254 \pm 17$  Gt of which was through basal melting (a lower bound for the immediate fresh water input into the ocean). Basal melting peaked at  $7.2 \pm 2.3$  m/month in the Northern Scotia Sea and an estimated  $152 \pm 61$  Gt of freshwater was released off South Georgia, potentially altering the local ocean properties, plankton occurrence and conditions for predators.