BEDSAT:Antarctica

random writings

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Abstract

Antarctica has been losing ice mass over recent decades, contributing to rising sea levels, but there is significant uncertainty regarding the extent and timing of this ice loss due to unknown ice sheet properties and flow processes. One key factor influencing ice flow and loss is bed topography, typically derived from sparse airborne radar surveys with high uncertainties. These uncertainties impact simulations of the Antarctic Ice Sheet (AIS) evolution under climate change. Given the logistical challenges of surveying Antarctica, alternative approaches, including satellite data integration, are needed. Two common methods for estimating bed topography are the mass conservation (MC) method and geostatistics. The MC method uses satellite-derived surface velocity estimates and physical laws of mass and momentum conservation to calculate ice thickness and bed topography, but it is limited to regions where ice flow exceeds 50 meters per year, mostly near the coast. Its accuracy depends on the spacing of ice thickness measurements and uncertainties in ice velocity and surface mass balance. Geostatistical methods refine bed topography resolution using radar-derived measurements, but like MC, they are more effective near the coast. These methods have advanced our understanding of glacier dynamics and other processes but face limitations, especially in the continent's interior. This project proposes a new method, BedSAT, which leverages the mathematical relationship between ice surface elevation and bed topography to estimate bed topography using high-resolution ice surface elevation data, enhancing ice sheet models and reducing uncertainties in bed topography estimates.

notes 1

Numerical modelling, sedimentary sequence interpretation suggest cyclical periods of ice-sheet expansion and retreat [1]. use ice-penetrating radar data to generate a new basal bed topography of the Aurora Subglacial Basin (ASB) in east Antarctica is characterised by a fjord landscape (this land is under $\sim$ under $2 - 4.5$ km of ice). The ASB has a potentially significant influence on the east Antarctic ice-sheet (EAIS), however there is high uncertainty in estimates of past and present global sea level changes due to the scarcity of bed data [1]. This uncertainty also limits the accuracy of models used to predict future ice sheet growth or decay


40°0'0"W
20°0'0"W
0°0'0"
20°0'0"E
60°0'0"S
ANTARCTIC PENINSULA
Jutulstraumen
Stancomb-Wills
EAST ANTARCTICA
Bailey
Slessor
Recovery
Amery Ice
Evans
Institute
Rutford
Academy
Pine Island
Thwaites
WEST ANTARCTICA
Byrd
Ross Ice Shelf
Moscow Uni
David
Cook Ice Shelf
Mertz
140°0'0"W
160°0'0"W
180°0'0"
160°0'0"E
Ice divide
Ice stream
Mosaic of Antarctica
Grounding Line
Coastline
Ice velocity from Rignot et al., 2011.
m per year
3592
0
Kilometres
0 250 500 1,000
www.antarcticglaciers.or
Projection: South Polar

Figure 1.1

Unknown terms

- Channel incision
- Alpine style glaciation

TOOLS

- ICECAP aero geophysical programme
- BEDMAP

MATHS

- Lagrangian interpolation
- natural-neighbour interpolation

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Bibliography

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