

Network for the Collection of Knowledge on melt of Antarctic ice shelves (NECKLACE)

Principle Investigator

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Project Description

The aim of the project is to provide researchers into ice shelf-ocean interactions with a set of time series of basal melt rates from selected locations on Antarctic ice shelves. The goal would be for circum-Antarctic coverage over a time interval of about five years.

This would provide urgently-needed control and validation data for models of ice shelf-ocean interaction, and a source of ground truth for satellite-derived estimates of average ice shelf basal melt rates.

The proposal is to use ground-based phase-sensitive radar (pRES), a technique that has gained traction in recent years for the measurement of various aspects of the vertical motion of ice in an ice sheet, yielding estimates of compaction, vertical strain, and basal mass balance. In particular, the instrument has proved itself capable of delivering basal melt rate measurements at temporal resolutions approaching tidal periods. New developments have led to a version of the instrument that can be left recording over winter (auto-pRES), yielding extended time series of basal melt rates. The instrument is undergoing field trials on Ross Ice Shelf, and eight units will be deployed in the 2013-14 season at various locations on Pine Island Glacier as part of UK NERC's iSTAR programme. Those instruments will collect data for a period of twelve months; four will use a phased array of sixteen antennas to image the ice base, the remaining instruments will be range radars (non-imaging).

With the combined reach of all Antarctic research operators, it will be possible to establish a circumpolar network of these instruments, transmitting in real time a reduced dataset for processing at a processing centre. The full dataset (too voluminous to transmit) would be collected when the sites were revisited.

As a result of ice shelves' contribution both to Antarctic Bottom Water formation and to the stability of the Antarctic Ice Sheet, the SOOS themes addressed by this project would be principally Theme 2 ("The stability of the Southern Ocean overturning circulation") and Theme 3 ("The role of the ocean in the stability of the Antarctic Ice Sheet and its future contribution to sea-level rise").

Project Timeline

2015 – 2020

Key deliverables

The ultimate product is a database of time series of basal melt rates, but this project aims to provide a coordinating role, with many research groups contributing by procuring and deploying instruments. The project will provide assistance in procuring the necessary instruments, and establish the processing centre.

Funding

Not yet funded.

Linkages with other programmes

Various projects (so far, from the US, Germany, UK, France and Belgium), either plan to use this technique to generate time series of melt rates, or else are seeking funding to do so.

iSTAR is an example of a UK project that is already funded.

Data Management

Individual project scientists will have data protocols determined by funding agencies.

However, a requirement of participating in this project would be that a reduced melt rate time series be made available via a mechanism such as the SOOS data portal.

Various models could be adopted. The model proposed here is:

1. A reduced dataset is collected in near-real time via satellite link, and sent to a processing center for analysis.
2. The basic result (a basal melt rate) is made available to the community from the processing center via the data portal, with the full analysis (including vertical strain and surface compaction) being returned to the research group.
3. Once the full data sets are recovered from the instruments they are optionally processed at the processing center, and the basic melt rates made available to the community via the data portal. The full analysis is returned to the research group.