

Sea Ice Thickness and Snow Depth in the Weddell, Bellingshausen and Amundsen Seas from IceSAT and IceBridge Data Sets

Principle Investigator

Xianwei Wang (Sun Yat-Sen University, China)

Contact: wangxw8@mail.sysu.edu.cn

Other key participants

S. Ackley (University of Texas, San Antonio, USA)

H. Xie (University of Texas, San Antonio, USA)

H. Huang (Sun Yat-Sen University, China)

Project Description

For circumpolar mean sea ice thickness in the Antarctic region, current practice uses ship observation data (ASPeCt data)(Worby, 2008). But, mean data derived from vessels uses data from different years in different regions masking interannual variability, even for the same region. Therefore, satellite and airborne data derived from platforms such as IceSAT and IceBridge provide the best opportunity to derive long-term sea ice thickness in the circumpolar sea ice zone. IceSAT1 was launched in early 2003 and stopped working in 2009 and IceSAT2 is scheduled for launch in 2016. The interval between IceSAT1 and IceSAT2 is being covered by IceBridge airborne elevations over the ice sheets and sea ice covers of the Weddell, Bellingshausen and Amundsen Seas. Meanwhile the Weddell, Bellingshausen and Amundsen sector has shown a significant and the only reduction in the sea ice cover in the Antarctic regions (Comiso and Nishio, 2008; Zwally et al 1998). Therefore the expectation of a climate signal in ice thickness and/or snow depth is greater there than elsewhere in the sea ice zone. We propose that the relatively long time series from 2003-2015 on snow freeboard and derived ice thickness from combined IceSAT and IceBridge analyses are critical variables in untangling interactions and feedbacks between atmosphere, ice and ocean. Therefore, our proposed objectives are:

1. Develop an automated method to convert IceBridge altimeter (ATM) data into sea level height reference, snow freeboard and ice thickness.
2. Construct the sea level height reference and its spatiotemporal variation features for the Weddell, Bellingshausen and Amundsen Seas from IceBridge elevation data from 2009-2015.
3. Compute and analyze snow depth and ice thickness data from IceSAT1 and IceBridge and buildup long time series data from 2003-2015 in the Weddell, Bellingshausen and Amundsen for use in IPCC AR6 modeling studies, SOOS monitoring of the sea ice cover, and other climate models.

The product of these analyses will be gridded ice thickness and snow depth data sets for IceSAT from 2003-2008 and IceBridge airborne data from 2009-2015 for the Weddell, Bellingshausen and Amundsen seas and will be archived in the SOOS data center and NSIDC, where present and future raw altimeter data is archived and is planned for the archiving of future IceBridge flights. (NSIDC is a partner in the SOOS data network.) These gridded data sets will be available for the IPCC AR6 modeling studies and other climate models in these open systems.

Project Timeline

June 2013 – May 2016

Key deliverables

Gridded ice thickness and snow depth data sets will be provided over the repeated flight lines of the IceBridge Airborne altimeter in the Weddell, Bellingshausen, and Amundsen Seas for both the IceSAT and IceBridge periods extending from 2003-2015. Data sets will also be provided over wider areas of these seas and other regions of the Antarctic sea ice zone over the shorter period of IceSAT circumpolar coverage, 2003-2008.

Funding

This project is funded by the National Science Foundation of China

Linkages with other programmes

Linkages are established with the Antarctic Sea Ice Processes and Climate (ASPeCt) programme of SCAR, where coordinated vessel, airborne and satellite lidar Cal/Val experiments are undertaken. Participation in the NASA IceBridge meetings to consult on flight lines and processes of Antarctic sea ice has been done over the past three years by the co-investigators and NASA funding for development of altimeter algorithms for Antarctic sea ice was previously obtained, (this project has been completed). Endorsement by NASA IceBridge will be sought when funding for this present project is confirmed.

Data Management

Altimetric data for analysis is presently available for both IceSAT and IceBridge altimeter data is presently freely available through NSIDC, a cooperating partner of the SOOS data network. The gridded ice thickness and snow depth data sets will be archived in the SOOS and NSIDC data centers with reference to the archived raw data from which they were derived. Appropriate metadata with reference to publications on analysis methods, calibration, and validation will be supplied with the gridded data sets.