

# **Ice Velocity Mapping in Antarctica – Achievements, Challenges and the Way Forward**

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Ice sheets are acknowledged by the World Meteorological Organization and the United Nations Framework Convention on Climate Change as an Essential Climate Variable needed to make significant progress in the generation of global climate products and derived information. Ice velocity is a crucial geophysical parameter that can be measured using spaceborne Synthetic Aperture Radar (SAR) data. Here, we report on a NASA funded effort to generate Earth System Data Records (ESDR) of ice velocity in Antarctica based on data from a suite of spaceborne SAR sensors and provide analyses results based on these products.

Building on the first complete mapping of the flow of ice surface over the Antarctic continent using data predominantly acquired during IPY, we are now working on a series of regional time series by processing available data from several different epochs. The analysis of velocity changes between discrete measurements requires even more careful data processing in order to be able to accurately measure subtle changes. We provide example results of several studies we conducted. Results on Ross Ice Shelf show for the first time the spatial extent of the more subtle changes in the region. Our analysis of velocity changes in the Amundsen Sea Embayment region between 1996 and 2013 shows changes propagating over a large portion of the drainage basin. Using ice velocity amongst other information we evaluated ice shelf melt water production of Antarctic ice shelves and compared it to iceberg calving. Our results indicate that basal melt exceeds a calving flux, making ice-shelf melting the largest ablation process in Antarctica.

In an effort to improve our ice velocity ESDRs, we also request feedback from the community on the products already available. Data continuity is a crucial aspect to our work, particularly in light of the fact that four SAR missions have ceased operations since IPY and all available missions have a primary mandate that is not scientific data collection. We are working with the science community and the Polar Space Task Group (PSTG), a coordinating body of international space agencies. In 2013 the Canadian Space Agency committed RADARSAT-2 to a large scale Antarctic data acquisition campaign. In addition, the German Space Agency and the Italian Space Agency acquire high resolution SAR data in high priority sites.

Data analysis and ESDR production is conducted at the Department of Earth System Science, University of California Irvine under a contract with the National Aeronautics and Space Administration's MEaSUREs program. Spaceborne SAR data are made available for this project courtesy of the Polar Space Task Group.