Geophysical Research Abstracts
Vol. 14, EGU2012-9578, 2012
EGU General Assembly 2012

The parallel flow assumption in Greenland outlet glaciers

N. Gourmelen (1), A. Shepherd (2), and J.W. Park (3)

(1) Université de Strasbourg, Institut de Physique du Globe de Strasbourg, France (ngourmelen@unistra.fr), (2) ICAS, University of Leeds, UK, (3) Yonsei University, Seoul, South Korea

Climate warming over the 20th century has forced dramatic changes in the Greenland Ice Sheet (GrIS). These changes have led to a reduction in the mass of the GrIS and a consequent rise in global sea level. Satellite observations have revealed an increased flow of the glaciers to the sea [Rignot et al., 2008], increased surface melting [Steffen et al., 2004], lowering of the Ice Sheet surface [Zwally and Giovinetto, 2001], retreat of the glaciers' fronts [Box et al., 2006], and gravity anomaly related to ice mass loss [Velicogna and Wahr, 2006].

When measuring the flow of ice from spaceborne sensors, it is often assumed that the direction and dip of flow follow the direction and dip of the ice surface [Rignot et al., 2011]; this is known as the surface parallel flow assumption [Joughin et al., 1996]. This assumption is often the only way to constrain glaciers' flow, as observation by spaceborne sensors in Polar Regions is limited. Departure from the parallel flow assumption means that the magnitude of ice flow and its changes will be misestimated. Departure from the ice parallel flow assumption also provides clues on the mechanisms leading to the flow pattern and to the change in flow magnitude.

Here we exploit 20 years of Synthetic Aperture Radar spaceborn missions to constrain the three-dimensional flow of marine terminating glaciers in the GrIS. We use datasets from past and present ERS1, ERS2, ENVISAT, ALOS and TerraSAR-X missions to construct 3-dimensional flow maps of selected outlet glaciers of the GrIS. This dataset is used to explore the relationship between flow patterns, its temporal evolution, and processes at play at the margins of the GrIS.