Geophysical Research Abstracts
Vol. 13, EGU2011-10087, 2011
EGU General Assembly 2011

Vertical and horizontal structure of Fimbulisen, Antarctica. A synthesis of TerraSAR-X imagery and ground-based radar data

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This study is concerned with the internal and surface structure of the Fimbulisen, an ice shelf located in Dronning Maud Land, Antarctica. Tidal bending at the hinge zone between grounded ice stream and ice shelf creates crevasses. Furthermore, tensile stresses exceeding a critical limit cause additional cracks. These features are transported down-stream and experience new load situations. Subsequently, surface accumulation, as well as basal processes affect the vertical structure. Here we show a synthesis of TerraSAR-X imagery and ground based radar data that resolves the vertical structure of the ice shelf along transects.

The Fimbul-Team performed in austral summer 2009/10 an extensive glaciological and oceanographic field survey. We used a ground-based FMCW radar with a centre frequency of 350 MHz to assess the basal topography, the ice thickness and internal layering of Fimbulisen. Our results reveal that the bottom topography of the ice shelf is highly variable. Local thinning of the ice often aligns with locally higher accumulation. These sites are also visible in TerraSAR-X scenes in ScanSAR and stripmap mode. Strength of the radar reflection from the base of the ice shelf varies strongly, and is often lost at sites of local thinning. We discuss these findings in glaciological, fracture mechanical and oceanographic context with the aim to identify the origin of the local thinning. Additionally, we assess the applicability of the relation between surface structure and subsurface structure to other areas.