Re-Processing of SAR data for derivation of glaciological parameters on the Antarctic Peninsula: First results of a study at Wordie Ice Shelf

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The Antarctic Peninsula is one of the world`s most affected regions by Climate Change. Long-term remote sensing time series enable to study changes and to reveal information on the underlying processes of the cryosphere as well as the interlinkages with the atmosphere.

The German Antarctic Recieving Station (GARS) at O'Higgins operated by the German Remote Sensing Data Center (DFD/DLR) has acquired data from the two European Space Agency (ESA) European Remote Sensing satellite mission (ERS-)1/2 between 1991 and 2011. Data of other space borne SAR sensors such as ESA`s ENVISAT ASAR, JAXA`s (Japan Aerospace Exploration Agency) ALOS PALSAR, DLR`s TerraSAR-X and TanDEM-X or the European mission Sentinel-1 will complement to a dense time series of SAR measurements from the 1990s until today for several regions of the Antarctic Peninsula.

Differential interferometric synthetic radar (DInSAR) methods and intensity tracking are applied in order to derive important glaciological parameters such as grounding line positions, glacier velocities, surface elevations, ice mass fluxes and glacier mass balances. Additionally, calibrated SAR amplitude images as well as images taken by optical sensors (e.g. Landsat) are used to map glacier extends and to compute changes of glacier areas.

We represent first results of a case study at the Wordie Ice Shelf, located at the south-western side of the Antarctic Peninsula. This ice shelf disintegrated in a series of events during the 1970s and 1980s, so that already in the beginning of the 1990s only disconnected and retreating tidewater glaciers remained. Due to the loss of the buttressing effect of the ice shelf, an increased ice mass discharge has been observed. An increase of flow speeds and elevation decrease have been reported by previous studies – mainly on a bi-temporal basis. However, how long and how exactly in time this process of adaption to the new boundary conditions will last as well as how much ice mass loss and sea level rise is caused by this process is yet not well known. Thus we use dense SAR time series in conjunction with data on surface elevation from photogrammetry and laser/radar altimetry, ground penetrating radar as well as surface mass balance simulations to target more precise estimates as well as data sets that can be better compared with large-scale observations by the GRACE gravimetry mission.