Re-Processing of ERS-1/2 SAR data for derivation of glaciological parameters on the Antarctic Peninsula

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1) Background
With a documented surface temperature rise of up to +0.53°C (decade⁻¹) from 1951-2006, the Antarctic Peninsula (Fig. 1) is one of the world's most affected regions by Climate Change.

Long term spaceborne synthetic aperture radar (SAR) data plays a central role for characterization of the resulting glaciological changes in this sensitive region.

One of the tasks of a newly established Junior Research Group at the German Remote Sensing Data Center (DFD) at the German Aerospace Center (DLR) is the application of European Remote Sensing Satellite (ERS-1 and ERS-2) SAR data for glaciological investigations on the Antarctic Peninsula.

Some of the results presented here are part of a master theses written at the Friedrich Alexander Universität, Erlangen-Nürnberg (FAU) and the DFD (DFR) with the goal of conducting first parameter adjustments for automated ERS-SAR data processing.

2) Data
For setting up and testing an automated processing chain (Fig. 2) 24 ERS-SAR scenes in single look complex format (SLC), recorded in 1994, 1995, 1996 and 2011, during periods when the satellites orbited in short repeat cycles (1 day and 3 days), were used.

The scenes cover parts of the Scar Inlet (Larsen B Ice Shelf) and the northern Larsen C Ice Shelf as well as parts of the former Wordie Ice Shelf (Fig. 1). All SAR data which had been acquired over the 20 years' life span of ERS-1/-2 (1991 – 2011) for the Antarctic Peninsula, had been received at DLR's Antarctic station GARS O'Higgins (Fig. 1) and is archived at the DFD in Oberpfaffenhofen on behalf of the European Space Agency (ESA).

Reference

3) Methods
Interferometric synthetic radar (InSAR) and differential interferometric synthetic radar (DInSAR) methods as well as the intensity tracking technique were applied to create four different value-added glaciological SAR-products, such as coherence maps, interferograms, double-difference interferograms and glacier velocity maps (Fig. 3).

All products were geocoded from range-Doppler imaging geometry to map coordinates (terrain corrected) with the help of the Radarsat Antarctic Mapping Project Digital Elevation Model (RAMP-DEM) Version 2 with 200 m spatial resolution (Liu et al. 2001).

The products are suitable for glaciological applications, such as determinations of glacier extend, grounding line position (Fig. 4), glacier and ice-stream velocities (Fig. 5) and glacier mass balance calculations with the flux-gate approach.