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GPS vs. ICESat: a comparison of two elevation models in Dronning Maud Land, Antarctica

C. Wesche (1), W. Rack (1), O. Eisen (1,2) and D. Steinhage (1)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany, (2) Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie, ETH Zürich, Switzerland (cwesche@awi-bremerhaven.de)

Within the framework of the EPICA deep drilling project in Dronning Maud Land (DML), Antarctica, knowledge of the surface topography is essential for accurate interpretation and flow correction of the ice-core data. To this end we created an accurate high-resolution digital-elevation model (DEM) in the vicinity of the German Kohnen-Station (0˚, 75˚S). The DEM is based on three different data sets, namely kinematic GPS, airborne radar altimetry, and the Geoscience Laser Altimetry System (GLAS) onboard ICESat. The GPS-DEM is derived from kinematic differential GPS data, acquired from a GPS receiver mounted on a snow vehicle. This provides a highly accurate elevation model with distance of data points 3 m in profile direction and profile distance varying between 100 m and 1 km in a small investigation area of 10 x 10 km^2. The ARA-DEM covers an area of 172 x 110 km^2. The distances between data points is 100m in profile direction and profile separation varies. In direct vicinity of the Kohnen-Station, the profile separation is 1000 m and wider in the border areas. The two elevation models have been combined to one model. The GLAS-DEM uses data from the period 20 February and 18November 2003. We included information on clouds from MODIS data and ICESat over the investigation area for the same period for plausibility checks. Based on an analysis of crossover points, altitude difference between the combined GPS-ARA-DEM and the GLAS-DEM are 0,41 m on average, with a standard deviation of 1,68 m. The combined analysis of all three DEMs provides information on the surface topography of high spatial resolution. One application presented here is the localisation of the topographic ice divide, an important input parameter to ice-sheet models and necessary for palaeoclimatic interpretation of the EPICA-DML ice core.