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A new 100-m Digital Elevation Model of the Antarctic Peninsula suitable for glacier morphology studies, using ASTER Global DEM

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A high resolution surface topography Digital Elevation Model (DEM) is essential for furthering glacier studies of the complex glacier system in the Antarctic Peninsula, by enabling delineation of ice divides and drainage basins, providing a boundary condition for mass balance analyses and as an input for further modelling. A complete DEM with better than 200 m pixel size and high positional and vertical accuracy would enable catchment area determination of all ice flow units and would provide an attractive tool for glacier morphology studies in this inaccessible region. Until now, there has been no DEM of the Antarctic Peninsula that has the resolution, spatial coverage and topographical accuracy required for such studies.

We present a new 100-m resolution DEM of the Antarctic Peninsula between 63° – 70° South, based on ASTER Global Digital Elevation Model (GDEM) data. GDEM has large errors on ice-covered terrain, with large spikes and sinks in the data, particularly on ice plateaus, but the data is extremely effective on the rugged terrain and coastal-regions of the Antarctic Peninsula, and has good spatial correlation with the Landsat Image Mosaic of Antarctica (LIMA). In order for it to be useful for analysing glacial landforms, the errors and artefacts must be minimised. Conventional data correction techniques do not work in this region, but we present a cartographic method that significantly improves the dataset, smoothing the erroneous regions and creating a DEM mosaic with a pixel size of 100 m that will be suitable for many glaciological applications. We compare elevation data from the improved DEM with ICESat-derived elevations, and perform horizontal and vertical accuracy assessments based on GPS positions, SPOT-5 DEMs and LIMA. The new DEM has a mean elevation difference of +3 m (26 m RMSE) from ICESat, and a horizontal error of less than 2 pixels, although the vertical RMSE significantly increases on mountain peaks and steep-sided slopes. The correction method is used as a means to reduce the errors on low surface slope regions and therefore the new DEM can be regarded as suitable for the purpose of measuring glacier geometry but would be unsuitable for elevation change studies. The poster also shows the drainage basins and topographic details that we have derived from the DEM.