Deglaciation & relative sea-level change on the Antarctic Peninsula in the last 10 000 years

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The recent disintegration of Antarctic Peninsula ice-shelves and the associated accelerated discharge and retreat of continental glaciers has highlighted the need to provide a longer-term perspective for present ice mass losses from Antarctica and individual ice sheets' contribution to future sea-level rise.

Observations of present-day ice mass change need to be corrected for ongoing glacial isostatic adjustment, a process which can only be constrained by field data.

Since relatively little terrestrial geological data constraining the geometry, volume and melt history of the former Antarctic Peninsula Ice Sheet from the Last Glacial Maximum-Holocene exists, the glacial isostatic correction needed to better assess present day satellite measurements of ice loss remains poorly constrained.

Focussing on recently published evidence from the north-eastern Antarctic Peninsula and the South Shetland Islands, we summarise new geological field constraints on the timing and rate of Antarctic Peninsula deglaciation and changes in relative sea-level (RSL) and compare field data with existing ice sheet models.

Holocene-age sedimentary records with clear and well-dated marine-terrestrial transitions were extracted from three isolation basins at different altitudes on Beak Island, providing quantified rates of Holocene RSL change for the north-eastern Antarctic Peninsula region.

Relative sea level on the north-eastern Antarctic Peninsula fell from a maximum of c. 15 m above present at c. 8000 cal yr BP, at a rate of 3.91 mm yr-1 declining to c. 2.11 mm yr-1 between c. 6900-2900 cal yr BP, 1.63 mm yr-1 between c. 2900-1800 cal yr BP, and finally to 0.29 mm yr-1 during the last c. 1800 years.

The new Beak Island and South Shetland Islands RSL curves presented improve the spatial coverage of RSL data for Antarctica, and imply significant thinning of the former Antarctic Peninsula Ice Sheet by the early-Holocene.

They are in broad agreement with some, but not all, glacio-isostatic adjustment models for each locality, and with work undertaken elsewhere on the Antarctic Peninsula.

Moreover, they provide key field-based data for the glacial-isostatic correction required by satellite-derived gravity measurements of contemporary ice mass loss, which can be used to better assess the future contribution of the continental ice derived from the Antarctic Peninsula to rising sea-levels.