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Lithospheric deformation associated with fast ice melting

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The ongoing ice loss from Antarctica and Greenland is usually constrained by land-based or satellite geodetic observations which need to be corrected for the contribution of the solid Earth deformation, routinely evaluated by Glacial Isostatic Adjustment (GIA) models. These have been traditionally oriented to estimate the Earth's mantle global response to the surface mass redistribution, either adopting classical 1D models or taking into account for the presence of 3D lateral variations and, sometimes, including composite rheological laws. In most cases, the lithosphere is extremely simplified, being modelled as a homogeneous layer elastically transferring the stress exerted by the surface load; furthermore, the topography is not taken into account. This approach is suitable for loads of large size compared to Earth's radius: in this case both lithosphere and topography are essentially transparent. However, this assumption can be inappropriate for smaller loads like the glaciers surrounding the ice sheets of Antarctica and Greenland. Our aim here is to evaluate whether the response of the mantle due to fast ice mass melting can be affected by considering realistic rheological properties for the lithosphere and accounting for surface topographic features. To this purpose, we have developed a numerical model representing a 2D cross section of the Antarctic Peninsula, where the glacier mass loss is well documented by GPS observations and the topography is characterised by steep contrasts with respect to the surrounding ocean floor.