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The Scotia Sea - no asthenosphere outlet from under the Pacific

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The Scotia Sea, which is wedged in between the South American Plate to the north and Antarctic Plate to the south, holds a prominent position in geodynamics. As neither continental roots nor active subduction zones are present on its western boundary, it has been proposed to be one of the few potential asthenosphere outlets from under the shrinking Pacific into the growing Atlantic. Such asthenosphere flux on the other hand has been proposed to be required to achieve mass balance between the Pacific and Atlantic mantle reservoirs. Other suggested outlets are the Caribbean and the gap between Australia and Antarctica (the Australian-Antarctic discordance).
With respect to the Scotia Sea, shear wave splitting and geochemical studies have previously tested these ideas, but they have led to equivocal results. In contrast to these studies, we present now a geodynamic approach to this issue. By reconstructing the plate kinematic history of the Scotia Sea, which is characterized by complex back-arc spreading processes active on a range of time scales, we calculate the residual (dynamically maintained) topography of the region by comparing present-day isostatically corrected topography with that predicted from our reconstructions. For this purpose, the derived oceanic age-grid from our reconstruction model is converted into the expected ocean basement depth based on a standard half-space cooling model. If asthenosphere flow exists at present-day, we expect to see a systematic trend in dynamic topography decreasing from west to east in response to a flow-related pressure gradient in the sublithospheric mantle. Our results do not indicate any systematic trend in dynamic topography, however, pointing to the absence of a present-day Pacific-to-Atlantic asthenosphere flux around the tip of South America via Drake Passage. We therefore conclude that the required material to achieve mass balance between the Pacific and Atlantic mantle domains must be supplied from elsewhere.