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The influence of Antarctic topography on jet streams and Rossby waves in the Southern Hemisphere.

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Eddy-driven jets are sustained through momentum transport by Rossby waves, which propagate along potential vorticity (PV) gradients. In the atmosphere, spatial variations in time-mean PV are mostly dominated by the variation of the Coriolis parameter with latitude. However, at high southern latitudes, a significant perturbation to the distribution and mixing of PV is provided by the Antarctic Plateau, which rises up to 4km above sea level. It is therefore possible that this orography affects Rossby wave propagation and hence affects the circulation in mid-latitudes.

We show through a set of semi-realistic and idealised experiments, that Antarctic topography plays a fundamental role in shaping the structure of the Southern Hemisphere extratropics. In particular, we perform runs with and without the Antarctic Plateau and demonstrate that the Plateau alters Rossby wave structure and propagation, thereby changing the momentum fluxes. Removal of the Plateau weakens the Indian Ocean jet and has a substantial effect on the flow downstream over the South Pacific. Here, the characteristic split jet pattern is destroyed and the flow at high latitudes stagnates. This also illustrates the prevalence of downstream development in the Southern Hemisphere and the strong connections between the flow over the South Pacific and Indian Oceans.