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Do winds control the confluence of subtropical and subantarctic surface waters east of New Zealand?

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The confluence region east of New Zealand is one of only a few places in the world where the Antarctic Circumpolar Current meets the strong southward-flowing boundary current of a subtropical gyre. The convergence of subtropical and subantarctic water creates strong fronts with clear signatures in sea surface height (SSH) and temperature. Here we investigate whether the location and strength of the confluence near New Zealand respond to changes in large-scale wind patterns, as has been observed in studies of other currents in the South Pacific, or whether highly energetic eddies, local winds, and the bathymetry are significant controls.
Analysis of the 18-year time series of SSH (1993-2010) from satellite altimetry was used to investigate the location and extent of fronts and eddy activity and relate these to the large-scale and local wind forcing.
The SSH gradients and the eddy kinetic energy in the confluence are intensifying concurrent with an increasing wind stress curl over the South Pacific. While these results suggest a connection between the strength of the fronts and the variability in the confluence with South Pacific winds, there is little change in the location of the confluence. The strongest fronts and eddies remain in a relatively small region northeast of Bounty Plateau and Bollons Seamount over the entire 18 years, likely indicating some bathymetric control of the front. The observed trends of increasing gradients and eddy activity at the front occur with increasing South Pacific wind stress curl suggest that the transfer of heat, energy and nutrients between subtropical and subantartic water has been enhanced over the last two decades.