

Decadal Changes in the East Australian Current system – the relationship to changes in the South Pacific Gyre.

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The Tasman Box sections are used to determine a 20-year time series of the volume transport associated with each of the main inflows and outflows within the South Pacific boundary current system. Three eddy-resolving XBT sections enclosing the Tasman Sea make up the Tasman Box. Each of the sections has been regularly sampled at eddy-resolving scales on precisely repeating locations in order to separate temporal from spatial variability of properties. The quarterly sampling of the XBT transects is supplemented by estimates of the geostrophic transport from satellite altimetry. The method is validated by comparison with independent CTD sections. The transport time series (relative to a 2000-m level) resolve the full suite of temporal signals from eddy scale, seasonal, interannual to decadal and are used to investigate the nature and mechanism of decadal variability in the East Australian Current (EAC) system and south Pacific subtropical gyre. The main EAC flow separates into an eastward component (Tasman Front) and a poleward flow (EAC Extension) just north of Sydney. At decadal timescales these components are anti-correlated. This decadal variation confirms the EAC response to a spin-up of the South Pacific circulation forced by changes in the basin-wide winds and matches the changes in oceanic properties observed in the Tasman Sea. While the 20-year time series are too short to draw firm conclusions this behavior is also present in much longer (50-year) ocean state estimates. The spatial structure of the decadal signals is investigated using a sea surface temperature dataset. An EOF decomposition shows 2 main patterns with Pacific wide extent. Local features are centered on New Zealand (N) and Tasmania (M). The N mode is directly associated with the decadal variations in the EAC/Tasman Front system and leads the mode M by periods of 6-18 months. This mode is linked to decadal changes of ENSO-like variability. An SST reconstruction extends results from station data at Maria Island – temperatures show decadal variations back to 1854.