The wintertime southern hemisphere split jet: structure, variability and evolution

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A persistent feature of the Southern Hemisphere upper-level time-mean flow is the presence of a split jet across the South Pacific east of Australia during the austral winter. The split jet is composed of the subtropical jet (STJ) on its equatorward branch and the polar front jet (PFJ) on its poleward branch. The NCEP–NCAR reanalysis is used to investigate the structure and evolution of the split jet. Results show that the presence/absence of the PFJ determines the degree of split flow, given that the STJ is a quasi-steady feature. A split-flow index (SFI) is developed to quantify the variability of the split jet, in which negative values represent strong split flow and positive values nonsplit flow. Correlations with teleconnection indices are investigated, with the SFI positively correlated to the Southern Oscillation index and negatively correlated to the Antarctic oscillation.

The SFI is used to construct composites of heights, temperature, and wind for split-flow and non-split-flow days. The composites reveal that relatively cold conditions occur in the South Pacific in association with non-split-flow regimes, and split-flow regimes occur when relatively warm conditions prevail. In the latter situation cold air bottled up over Antarctica helps to augment the background tropospheric thickness gradient between Antarctica and the lower latitudes with a resulting increase in the thermal wind and the PFJ. It is surmised that frequent cold surges out of Antarctica moving into the South Pacific are associated with non-split-flow regimes. In this context, the variability of the split jet responds to large-scale baroclinic processes and is further modulated by synoptic-scale disturbances.