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Interactive comment on "Brief communication: Changing mid-twentieth century Antarctic sea ice variability linked to tropical forcing" *by* Chris S. M. Turney et al.

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This paper, has several internal inconsistencies in common with similar works invoking WKB or ray tracing theory to give a mechanistic underpinning to the correlation found between the tropics and mid to high latitudes of the Southern Hemisphere troposphere, largely in terms of stationary Rossby waves.

The role of stationary Rossby waves in connecting tropical variability to the South Pacific and the Pacific South American pattern has been loosely applied in many studies, often without sufficient regard for the seasonally dependent barriers to stationary Rossby wave propagation of the type identified by Ambrizzi et al. (1995) and more recently reexamined by Li et al. (2015). In particular, it is well known from ray tracing

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theory that, coincident with the establishment of the subtropical jet in during the austral spring through winter, Rossby wave propagation from the tropics to the midlatitudes in the South Pacific is largely blocked by the establishment of a reflecting surface poleward of the subtropical jet east of 60E and west of 120W (Ambrizzi et al. 1995; Ambrizzi and Hoskins 1997, Li et al. 2015). This surface occurs where the total wavenumber is imaginary due to a negative meridional gradient of vorticity (see Fig. 11 Li et al 2015). This barrier represents a major problem for studies that invoke the excitation of equivalent barotropic Rossby wave trains propagating from the tropics into the extratropics, initiated by diabatic heating anomalies in the tropical equatorial Pacific during the austral autumn, winter, and or spring, as an explanation for the establishment of the PSA pattern.

A recent study of Rossby wave sources and Southern Hemisphere mid-tropospheric variability by O'Kane et al (2016) find that local Rossby wave sources within the jet are far more important to the PSA development and variability than those due to tropical convection. They apply advanced nonstationary nonparametric methods for timeseries analysis capable of isolating causal relationships rather than simple correlations. Their work raises serious questions to the validity of WKB theory in an atmosphere that is inherently unstable. Consistent with dynamical mode theory (Frederiksen & Frederiksen 1993), O'Kane et al 2017 apply more standard methods to show that the PSA is a multiscale nonlinear dynamical mode with the major percentage of PSA variability occurs on time scales from synoptic to intraseasonal, is largely independent of persistent coherent tropical processes, and manifests via internal waveguide instabilities and dynamics. The small fraction of the total variability with a tropical signal arises entirely due to modulation of the SH midlatitude jets, via the zonal component of the thermal wind.

The recent study by Irving and Simmonds (2016), while confirming that the PSA pattern does indeed have a strong influence on observed warming over the Antarctic Peninsula during the austral autumn, shows only a very weak relationship between PSA variability and ENSO.

Rather than correlations (not causal), and in light of recent studies questioning the mechanisms leading to the PSA, direct calculation of Rossby wave source, wave activity flux and upper level divergence, as was done in the aforementioned studies of O'Kane et al 2015 and 2017, should be undertaken by the authors to clarify the role of tropical sources and to test their assertions.

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