

Positive feedbacks between the Antarctic Circumpolar Wave and the global El Niño-Southern Oscillation Wave

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Abstract

Atmospheric and oceanic teleconnections link the Antarctic Circumpolar Wave (ACW) in the Southern Ocean [*White and Peterson, 1996*] and the global El Niño-Southern Oscillation (ENSO) wave (GEW) in the tropical Indo-Pacific Ocean [*White and Cayan, 2000*], both signals characterized by eastward phase propagation and 3- to 5-year- period variability. We extend the tropical standing mode of ENSO into the extratropics by regressing the Niño-3 sea surface temperature (SST) index against sea level pressure (SLP) anomalies over the globe, finding the Pacific-South America (PSA) pattern in SLP anomaly [*Cai and Baines, 2001*] straddling Drake Passage in the Southern Ocean. The amplitude of this PSA pattern is $\sim 1/3$ that of the ACW in this domain and thus cannot be considered its principal driver. On the other hand, suppressing the tropical standing mode of ENSO in interannual ST (surface temperature) and SLP anomalies over the globe allows the GEW to be observed much more readily, whereupon its eastward phase propagation across the Warm Pool is found to remotely force the ACW in the eastern Pacific and western Atlantic sectors of the Southern Ocean through atmospheric teleconnections [*Sardeshmukh and Hoskins, 1988*] which propagate along with it. Subsequently, the ACW propagates this imposed GEW signal throughout the remainder of the Southern Ocean as a coupled wave in covarying ST and SLP anomalies, whereupon entering the Indian sector 1.5 to 2.5 years later it spawns a northern branch which takes another 1.5 to 2.5 years to propagate the ACW signal equatorward into the Warm Pool south of Indonesia. There it interferes constructively with the GEW. Thus the two forms of teleconnection, one fast and directed from the tropics to the high southern latitudes via the atmosphere and the other slow and directed from the high southern latitudes to the tropics via the ocean, complete a global circuit of 3- to 5-year duration that reinforces both the ACW and GEW and influences the tropical standing mode of ENSO.

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