

## **Existence and inter-decadal changes of the Antarctic Circumpolar Wave during the last 142 years and its relationship to large scale modes of variability**

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The Southern Ocean is the region of the world ocean bordering on Antarctica over which important exchanges between the atmosphere, the ocean and the sea ice take place. Here, the strong and nearly unhindered eastward flow of the Antarctic Circumpolar Current (ACC) plays an important control on mean global climate as it transmits climate anomalies around the globe. Features of interannual variability have been often observed to propagate eastward around the Southern Ocean with the circumpolar flow in form of a system of coupled anomalies, known as the Antarctic Circumpolar Wave (ACW). In the present study, using a 142-year series of a composite dataset (850hPa geopotential height, sea level pressure, sea surface temperature, surface meridional wind, surface air temperature) spanning from 1871-2012, the presence of ACWs was investigated. Results show the presence of the ACW before the mid-1950s and interdecadal changes in its variability. Modifications in strength and speed of circumpolar wave have also been observed in connection with large-scale climate changes. CEOF analyses on the same period confirmed that the ACW becomes apparent when there is a constructive combination between the Pacific-South America pattern and the subantarctic zonal wavenumber-3 (ZW3). The analyses also quantify the role played by El-Niño Southern Oscillation (ENSO) teleconnections for the appearance of the ACW. The composite dataset and various climate indices have been also used to diagnose interactions among the Southern Annular Mode (SAM), ENSO and ZW3 circulation patterns on interannual and sub-decadal scales. Results show that SAM and ENSO patterns interact with each other modulating ACW anomalies in the western and central south Pacific Ocean on interannual scale.