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Wind-driven variability of the Subtropical Pacific Ocean.

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Wind-driven fluctuations in the circulation and temperature structure of the oceanic subtropical gyres have impacts on marine ecosystems and potentially on climate through ocean-atmosphere feedbacks in the western boundary current regions. Also, because of the long time-scales of oceanic response, the changes in large-scale ocean circulation are sensitive diagnostics of changing patterns in the noisier atmospheric forcing. Previous studies of subtropical variability have mostly been limited to altimetry and other surface ocean data or to western boundary current regions. The Argo array provides a unique dataset to explore variability of the subsurface ocean interior during the period of good Argo coverage since 2004. AVISO altimetry is used to extend the analysis farther into the past, along with the ECMWF wind stress to provide maps of the atmospheric forcing. Two distinct patterns of surface wind stress are observed during 2004-2010. In phase 1, 2004-2005, wind stress and Ekman upwelling anomalies are consistent with observed steeper isopycnals in the subtropical North Pacific ocean interior and hence indicate a stronger gyre circulation. In phase 2, 2007-2009, reversed anomalies in the wind forcing suggest a weaker gyre. The opposite occurs in the subtropical South Pacific in each phase but with a weaker signal. Evidence is shown in ocean maps of geostrophic velocity and pressure anomaly on isopycnals. Also, a horizontal movement of the gyre is detected in these two different phases. Earlier observations of the wind forcing and SSH indicate that a phase similar to phase 2 occurred after the strong El Niño event in 1997-98. Phase 1 mentioned above followed, beginning prior to the Argo period. The relation between different phases and the Pacific Decadal Oscillation is also explored.