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The impact of South Pacific extratropical forcing on ENSO and comparisons with the North Pacific

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Previous studies suggest that North Pacific extratropical atmospheric variability influences ENSO via the seasonal footprinting mechanism (SFM). This study confirms that quadrapole sea surface temperature (SST) variability in the extratropical South Pacific triggered by mid-latitude South Pacific atmospheric variability may also have an additional influence on ENSO. The response of the evolution of the ENSO-related zonal wind and SST anomalies in the tropics to the South Pacific extratropical forcing is consistent with the SFM hypothesis. That is, the Pacific-South American (PSA) pattern of the South Pacific extratropical sea level pressure (SLP) anomalies imparts an SST footprint (i.e. a quadrapole SST pattern) onto the ocean during austral summer. This SST footprint subsequently forces the zonal wind anomalies along the equator in the following austral winter that ultimately result in ENSO events during the following austral summer via ocean–atmosphere coupling in the tropics. The present study demonstrates that the influences of extratropical atmospheric variability in the South Pacific and North Pacific on ENSO are different and relatively independent. It is possible that they may, together or separately, influence the occurrence of ENSO events, and the importance of the South Pacific forcing in initiating ENSO events is comparable with that of the North Pacific forcing. An empirical model was established to predict the Niño3.4 index based on the combined South Pacific and North Pacific signals, and results show that it can be used to produce skillful forecasts of the Niño3.4 index with a leading time of up to 1 yr.