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Characterization of the variability of the South Pacific Convergence Zone using satellite and reanalysis wind products

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The South Pacific Convergence Zone (SPCZ), the largest rain band worldwide during austral summer, is important to atmospheric circulation (including cyclone genesis) and ocean circulation. Previous studies of the SPCZ have focused on parameters such as outgoing longwave radiation or precipitation. However, wind convergence is fundamental causing the variations of these parameters. In this study, the SPCZ variability is examined using ocean surface wind products derived from NASA's QuickSCAT (1999-2009) and ESA's ASCAT (2007 onward) satellite scatterometers and ERA-Interim atmospheric reanalysis (1981 onward). From these products, indices were developed to characterize the SPCZ strength, area, and centroid location. Excellent agreement is found in terms of the temporal variations of the indices derived from the satellites and reanalysis wind products, despite some small differences in the time-mean SPCZ strength. The SPCZ strength, area, and centroid latitude have a dominant seasonal cycle. In contrast, the SPCZ centroid longitude is dominated by intraseasonal variability due to the influence by the Madden-Julian Oscillation. The SPCZ indices are all correlated with El Niño-Southern Oscillation indices. Interannual and intraseasonal variations of SPCZ strength during strong El Niño are approximately twice as large as the respective seasonal variations. SPCZ strength depends more on the intensity of El Niño rather than the central- vs. eastern-Pacific type. The longer ERA-Interim product is also used to examine decadal variations of the SPCZ indices. The change from positive to negative Pacific Decadal Oscillation phase around 1999 resulted in a westward shift of the SPCZ centroid longitude, much smaller interannual swing in centroid latitude, and a decrease in SPCZ area. This study improves the understanding of the variations of the SPCZ on multiple time scales and reveals the variations of SPCZ strength not reported previously. The diagnostics analyses can be used to evaluate climate models.