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Variability and change in sea level in the tropical Pacific

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Sea level rise observed in the past 100 years and projected by climate models shows its relationship to the anthropogenic climate change. In addition to the global mean, regional sea level rise has a crucial impact on islands and countries face the ocean. Furthermore, regional sea level varies on a variety of time scales from interannual to multi-decadal and closely relates to natural climate variability. In the Equatorial Pacific (EP), zonal gradient of sea level anomalies has a positive long-term trend (eastern EP $>$ western EP) from 1950s to 1990s century and a negative trend from the late 1990s. Subtropical cell in the North Pacific weakened in the second half of the last century and strengthened at the late 1990s, which is associated with multi-decadal variability in the trade wind over the tropical Pacific. These variations are consistent with those of the Pacific Decadal Oscillation (PDO) whose phase reversal occurred in 1976/77 and near 2000. However, mechanisms of the decadal-to-multi decadal variability are still unclear. Recent increasing occurrences of a new type of the El Nino/Southern Oscillation(ENSO)(Central Pacific ENSO/ENSO Modoki) also influence the decadal variability of the sea level in the equatorial Pacific. Walker circulation weakened during the 20th century, which leads to a positive trend of zonal gradient of the sea level anomalies and accelerates (decelerates) sea level rise regionally in the eastern (western) EP. It also should be noted that a negative trend of zonal gradient of sea level anomalies observed in the last two decades is a part of the multi-decadal variability of the sea level in the tropical Pacific. Future projections associated with the global warming by climate models show that the Walker circulation could weaken in the 21th century. Regional sea level variability and change in the tropical Pacific and its relationship to climate variability and change are discussed using observed data and model simulations for the present and future climates.

Keywords: sea level, tropical Pacific, ENSO, Pacific Decadal Oscillation, global warming