Geophysical Research Abstracts
Vol. 18, EGU2016-762-1, 2016
EGU General Assembly 2016

Uncertainty of the Linear Trend in the Zonal SST Gradient across the Equatorial Pacific since 1881

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The zonal sea surface temperature gradient (ZSSTG) in the equatorial Pacific, represented by the SST difference between the eastern equatorial Pacific and the western equatorial Pacific, is important for understanding how the tropical Pacific climate responses to the anthropogenic greenhouse gas in history. However, researchers cannot agree on what the changing ZSSTG was in either near-term time scale (from 20 to 90 years) or long-term time scale (longer than 90 years). In this study, the uncertainty of the linear trend in the ZSSTG for different periods starting from 1881 was examined using four interpolated reconstruction datasets and four un-interpolated datasets. It was found that at the near-term time scale the linear trends in the ZSSTG could be significantly influenced by the phase of the El Niño-Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO). However, the ENSO and PDO in these datasets are quite different, in terms of phase and magnitude, resulting in large uncertainty in linear trend. At the long-term time scale, the sign of the linear trend, namely, whether the ZSSTG was strengthened or not, depends on the dataset used. In particular, no unified conclusion can be drawn about the linear trend in the ZSSTG from these eight datasets used, because the linear trend in the ZSSTG is very sensitive to both the period and the type of dataset used for determining the trend. This finding suggests that the existing statements on the changing ZSSTG in recent history should be re-examined.