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Understanding and explaining the trend in global mean sea level (GMSL) has important implications for future projections of sea level rise. While measurements from satellite altimetry have provided accurate estimates of GMSL, the modern altimetry record has only now reached twenty years in length, making it difficult to assess the contribution of decadal to multi-decadal climate signals to the global trend. Tide gauges, on the other hand, provide a much longer record albeit with very poor coverage of the ocean. By combining the two datasets, sea level reconstructions provide a possible solution to the respective shortcomings of the satellite altimetry and tide gauge datasets. Here, we use a sea level reconstruction relying on the use of cyclostationary empirical orthogonal functions (CSEOFs) to study the twenty-year trends in sea level since 1900. In particular, we show that the Pacific Decadal Oscillation (PDO) contributes significantly to the twenty-year trends in GMSL over the past 110 years. We estimate the PDO contribution to the GMSL trend over the past twenty years to be approximately 0.49 ± 0.25 mm/year, and find that removing this PDO contribution changes the estimated acceleration observed in GMSL. We discuss the implications of removing known climate variability like the PDO from the sea level record, and the extent to which it can improve the understanding of the underlying trends in global and regional sea level.
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