Abstract View

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Large-Scale Coherence of Sea Level at Very Low Frequencies

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ABSTRACT

The coherence of sea level is examined between a number of widely distributed stations chosen from those with the longest datasets, such as at San Francisco, where the data has been recorded since 1855. The sea-level signals in the eastern Pacific appear to be dominated by propagating Rossby waves, so that the variability, which has periods of 5–8 years, (e.g., between San Francisco and Honolulu), is coherent, but out of phase by several years. A surprising finding is that sea level is coherent on opposite sides of the Atlantic at periods near 6 years, but this is suspected to be the result of direct atmospheric forcing rather than of wave propagation. At the longest periods detectable—40–50 years—the sea-level signals have amplitudes of 5–15 cm and are “visually coherent" between the west coasts of the United States and Europe. The amplitude of these extremely long-period signals is the same as the apparent “rise of sea level over the the past century," although the rate of rise from these fluctuations is larger. Because there is so much variability at extremely long periods, the sea-level data must be treated carefully in space as well as in the time to avoid contaminating the “sea-level rise" signals with propagating signals. If the data were adjusted, or corrected for these signals, the signal-to-noise ratio might be substantially improved, allowing better estimates of the observed rise of sea level, but the forcing mechanisms are not well known at the longer periods. Until the data are so corrected, changes in the rate of rise of sea level on time scales of 10–50 years can not be distinguished from the background “noise.".