Abstract View

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Wind-Induced Sea-Surface Slopes on the West Florida Shelf

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ABSTRACT

Tidal and meteorological records at stations in the eastern Gulf of Mexico have been studied. The sea-level response is a maximum for winds along the coast and varies symmetrically with angle. The coherence is maximum at periods of 4–10 days. The horizontal coherence of sea level is high out to 500 km for 4–10 day periods. The horizontal coherence for wind (measured at coastal stations) is high out to at least 500 km. The amplitude of the response of sea level to winds is larger by a factor of 4 here, on a broad shelf, than on the Oregon coast, which is more narrow by about the same ratio. A response of $\sim$ 16 cm is induced by $\sim$ 4 m s^{-1} wind. This response, or transfer function, is uniform over the spectral range (4–100 days). The sea-level response to the longshore wind stress is not linear, but to the power 0.8 ± 0.1, and is attributed to the relatively low tidal currents in this region. The large horizontal coherences of wind and sea level imply broad longshore flows extending 500 km or more along the coast. Over 85% of the variance between 4 days and 3 years is contained in fluctuations with periods less than 3 months. A longshore slope of sea level is observed; in the 4–10 day band this slope can be explained by longshore variation in the width of the shelf. A mean longshore slope of $\sim 0.6 \times 10^{-7}$ is found, and it may be caused by the (weak) mean winds. Freely propagating coastal trapped waves are found in a narrow band near 0.18 cpd.