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Low-Frequency Fluctuations in the Strait of Gibraltar from MEDALPFX Sea Level Data

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ABSTRACT

Thirteen months of hourly sea level data from four stations in the Strait of Gibraltar, along with appropriate atmospheric pressure data, are used to investigate tidal and low-frequency fluctuations in the strait. Apparent recording errors in the data weaken a study of the tides on their own, but low-passed and complex demodulated (at M_2) time series show that nonastronomical variations in the alongstrait M_2 sea level slope are correlated with the varying phase lag from Tarifa to Gibraltar. More importantly, regression of the low-passed sea level difference across the strait on the varying tidal amplitude suggests that the mean surface inflow is only about 10% different from what it would be in the absence of tides.

Correlation and cross-spectral analyses also show significant connections between the three time series representing the slowly varying surface inflow, subsurface pressure gradient along the strait, and atmospheric pressure gradient along the strait. Correlation between the first and third suggests a role for direct wind forcing in the strait, but the most important result of the paper is that the ratio of fluctuations in the first two series is consistent with the basic state having been one of maximal rather than submaximal exchange during the observation period.

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