Abstract View

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Slope of Sea Level from Miami to Atlantic City

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ABSTRACT

Results of land leveling do not agree with oceanographers' expectations concerning coastal slopes of sea level. Recent studies have shown that along the west coast of the United State this discrepancy can be explained by the vertical movement of leveling benchmarks. On the east coast, where the movement of benchmarks is not expected, land leveling suggests that sea level should rise as much as 30 cm from Miami, Florida, to Charleston, South Carolina. However, oceanographers find that sea level falls, from south to north, approximately 15 cm along the shoreward edge of the Gulf Stream. The discrepancy between these findings could be explained if oceanographic effects that support large alongshore slopes, and that arise primarily on the continental shelf, could be identified. We examine coastal wind stress and runoff as two such forcing mechanisms. To do this, we derive a statistical model of the alongshore change of sea level between tide gauges, based on the alongshore momentum equation. The computed mean sea level differences are only 1–2 cm between pairs of tide gauges, and the signs change from one pair of stations to the next. The conclusion is that the forcing mechanisms that we have studied cannot explain the slopes found by land leveling.

The model is able to predict the seasonal variation of slope between Charleston and Fernandina and between Atlantic City and Norfolk. The observed differences (~ 8 cm) compare well with the model-computed differences between these sites. Thus, along these sections of coastline, close to shore, we conclude that the seasonal variations of slope seem to be forced largely by coastal winds. On the other hand, only half of the seasonal range observed between Fernandina and Miami and between Norfolk and Charleston could be modeled as effects of wind stress and runoff. The effects of other forcing mechanisms may be more important in these areas.

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