Abstract View

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Non-Tidal Variability in the Chesapeake Bay and Potomac River: Evidence for Non-Local Forcing

Dong-Ping Wang

Chesapeake Bay Institute, The Johns Hopkins University, Baltimore, Md. 21218

Alan J. Elliott

SACLANT ASW Research Centre, La Spezia, Italy

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ABSTRACT

Non-tidal variability in the Chesapeake Bay and Potomac River, and its relation to atmospheric forcing, is examined from two-month sea level and bottom current measurements. The dominant sea level fluctuations in the Bay had a period of 20 days. and were the result of up-Bay propagation of coastal sea level fluctuations generated by the alongshore winds. Consequently, water was driven out of the Bay by the northward/up-Bay wind and driven into the Bay by the southward/down-Bay wind, through the coastal Ekman flux.

There were also large sea level fluctuations at periods of 5 and 2.5 days. The 5-day fluctuations were driven by both the coastal sea level changes and the local lateral winds (Ekman effect). The 2.5-day fluctuations were seiche oscillations driven by the local longitudinal winds.

In the Potomac River, the sea level fluctuations were induced non-locally by motions in the Bay; the associated volume fluxes appeared to have been confined to the upper layer. The near-bottom currents were mainly driven by the surface slopes which were also set up non-locally, by the longitudinal wind over the Bay. In general, the near-bottom current and sea level/volume flux fluctuations were not coherent. A notable exception, however, was found for the 2.5-day fluctuations which were vertically coherent and showed significant upward phase propagation.

Because of the significance of non-local forcing, an adequate model for the non-tidal estuarine circulation would need to include the effects of interaction with the adjacent larger estuary or the coastal ocean. Also, site-specific experiments should be complemented by far-field measurements to determine non-local conditions.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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