Abstract View

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Kelvin-Type Coastal Surges Generated by Tropical Cyclones

C.B. Fandry and L M. Leslie

Australian Numerical Meteorology Research Centre, Melbourne, Victoria 3001

R.K. Steedman

R.K. Steedman & Associates, Subiaco, Western Australia 6008

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ABSTRACT

Measurements of sea level along the coat of Western Australia during the period 1969 to 1982. when 12 southward moving tropical cyclones occurred, showed distinct peaks with amplitudes of about 1 to 2 m propagating southwards with speeds ranging between 400–600 km day^{-1}. Similar observations of sea level along the east coast of Australia during the period 1971 to 1980, of 7 southward moving tropical cyclones, showed no such peaks. These data suggest that the large peaks occurring on the west coast are a result of a resonance phenomenon when the southward component of the cyclone speed is close to that of southward propagating shallow-water Kelvin waves.

11 is shown that the coastal response to moving atmospheric forcing fields may be described by a Kelvin-type disturbance, which at any instant is confined to a localized coastal region dependent on the Kelvin wave speed and the longshore speed of the tropical cyclone. This region expands in the longshore direction at a rate equal to the difference between these two speeds. The maximum coastal peak at any instant occurs at one of the edges of this region depending on the ratio of the decay time scale of the cyclone to the time it takes for the cyclone to travel a Rossby-radius distance towards the coast. The position and propagation speed of this peak along the coast are predicted and shown to be quite variable. In particular, different responses occur on coastlines where cyclones propagate in the same direction as the Kelvin mode compared with those where cyclones propagate in the opposite direction.

A preliminary comparison of the results with observations of cyclone induced surges on the west and east coasts of Australia is carried out.

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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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