Abstract View

Volume 7, Issue 2 (March 1977)

Journal of Physical Oceanography
Article: pp. 171–181 | Abstract | PDF (840K)

Predicting Changes in Tidal Regime: The Open Boundary Problem

Christopher Garrett

Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4J1

David Greenberg

Marine Environmental Data Service Branch, Department of Environment, Ottawa, Ontario, Canada K1A OH3

(Manuscript received July 15, 1976, in final form October 29, 1976)

DOI: 10.1175/1520-0485(1977)007<0171:PCITRT>2.0.CO;2

ABSTRACT

Attempts to predict the impact on a tidal regime of large engineering structures are generally based on the use of a numerical model which is calibrated to reproduce the natural tidal regime and then rerun with the structures in place. It is usually assumed that the “input” tide at the open boundary is unchanged by the structures, though this is clearly wrong in principle.

We show how errors in this procedure can be corrected for, or at least estimated, using output from the numerical model and estimates of the impedance of the exterior ocean. The ocean impedance can be expressed as an infinite series in terms of the normal modes of the ocean, with some terms allowing for near-resonant enhancement of particular modes, and the infinite tail corresponding to a local source-like behavior which can be estimated independently.

Application of the technique to the problem of predicting the impact of Fundy tidal power suggests that any predicted change may be uncertain to about ±25% of the change in mass flux across the open boundary. This uncertainty could amount to ±4% of the tidal range for a large tidal power development.

It is clear that numerical models used in this type of problem should generally extend to the edge of the continental shelf. The role of side boundaries from the coast to the edge of the shelf is uncertain, although in the Fundy problem there is little mass flux across them so that they appear not to be important.

We also estimate that the impact of Fundy tidal power development on global ocean tides would be a change of a few millimeters in M_2.

top

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
Allen Press, Inc. assists in the online publication of *AMS* journals.