Abstract View

Volume 27, Issue 8 (August 1997)

Journal of Physical Oceanography
Article: pp. 1547–1565 | Full Text | PDF (821K)

The Relation of Seafloor Voltages to Ocean Transports in North Atlantic Circulation Models: Model Results and Practical Considerations for Transport Monitoring*

Á. H. Flosadóttir and J. C. Larsen

Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, Washington

J. T. Smith

Department of Geophysics, University of Washington, Seattle, Washington

(Manuscript received May 1, 1995, in final form November 8, 1996)

DOI: 10.1175/1520-0485(1997)027<1547:TROSVT>2.0.CO;2

ABSTRACT

Motionally induced voltage differences offer one of the few observational methods sensitive to changes in large-scale ocean transports. They present a useful contrast to most oceanographic data by virtue of their natural spatial integration, temporal continuity, and potentially long duration. However, widespread oceanographic use of the voltages observable with seafloor cables has been impeded by uncertainties of interpretation. Interpretation in terms of volume transport fluctuations has proved successful in the Straits of Florida and for a short cable in the easternmost part of the Bering Strait. Still, a number of older experimental studies resulted in disappointment, the Bering Strait work has been little known, and the Florida success might be a special case. The question considered in this paper is: Does a linear relationship between net transport and voltage difference fluctuations hold for long, open-ocean cables? This question is addressed by using a numerical model based on two years of results from the WOCE Community Modeling Effort, which simulated the wind-driven and thermohaline circulation in the North Atlantic using mean monthly winds and realistic topography with a resolution sufficient to permit mesoscale eddies. The model includes the effects of spatial and temporal variations of seawater temperature and salinity, electric current loops, the effects associated with the meandering of ocean currents over realistic topography and sediment thickness, realistic earth conductivity, and the spatially varying geomagnetic field. The main result is that the relationship between voltage and net cross-cable transport fluctuations can be remarkably linear over long distances. In view of the difficulties of long-term, large-scale transport monitoring by other methods, the implication of this work is that well chosen and carefully interpreted voltage observations hold great promise. This should be explored through renewed modeling, observation, and interpretation efforts.

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.