Sign in

AMERICAN METEOROLOGICAL SOCIETY
AMS Journals Online

AMS Home | Journals Home | Journal Archive | Subscribe | For Authors | Help | Advanced Search | Search | Go

Abstract View

Volume 15, Issue 6 (June 1985)

Journal of Physical Oceanography
Article: pp. 749–771 | Abstract | PDF (1.68M)

The Nantucket Shoals Flux Experiment (NSFE79). Part II: The Structure and Variability of Across-Shelf Pressure Gradients

Wendell S. Brown, Neal R. Pettigrew, and James D. Irish

Ocean process Analysis Laboratory, Department of Earth Sciences, University of New Hampshire, Durham, NH 03824

(Manuscript received July 2, 1984, in final form March 25, 1985)

DOI: 10.1175/1520-0485(1985)015<0749:TNSFEP>2.0.CO;2

Options:
- Create Reference
- Email this Article
- Add to MyArchive
- Search AMS Glossary

Search CrossRef for:
- Articles Citing This Article

Search Google Scholar for:
- Wendell S. Brown
- Neal R. Pettigrew
- James D. Irish

ABSTRACT

The Nantucket Shoals Flux Experiment (NSFE) was a collaborative effort to measure the alongshelf transport of mass, heat, salt and nutrients from March 1979 through April 1980 with a dense army consisting of moored current, temperature and bottom pressure instruments in an across-shelf and upper-slope transect south of Nantucket Island. The pressure component of that experiment is described here.

Bottom pressure recorders were deployed at stations N1 (46 m), N2 (66 m), N4 (105 m), and N5 (196 m) during two half-year periods. spring–summer 1979 (SUMMER) and fall–winter 1979/80 (WINTER). A synthetic subsurface pressure (*SSP*) record was formed from atmospheric pressure and sea level observations at Nantucket Island. The low-pass filtered (periods > 36 h) or subtidal pressures were used for the subsequent analysis. It was found that Nantucket *SSP* and *BP* are very nearly equivalent for fluctuation periods less than about 50 days if steric changes in sea level, due to density changes above the seasonal pycnocline, were removed from the *SSP* record. However, if coastal *SSP* and bottom pressures are to be contrasted on seasonal time scales, then an internal pressure (or equivalent dynamic height) correction to bottom pressure is required. An empirical orthogonal function (EOF) analysis of the pressure field shows that most of the pressure variance for periods between 2 and 40 days (WINTER, 91.9%; SUMMER, 83.5%) is contained in a mode that (a) is characterized by a decreasing amplitude and small phase-lag increase at successive seaward locations and (b) is coherent with local alongshelf (75°T) wind stress. Pressure differences between stations were used to compute across-shelf pressure gradients, whose fluctuation distribution exhibits a conspicuous intensification over the outer shelf during the WINTER in contrast to the relatively uniform SUMMER distribution.

The excellent comparison found between “geostrophic currents,” which were inferred from bottom pressure differences, and suitably averaged “observed currents” represents the first direct confirmation of the quasi-geostrophy of alongshelf flow. Subtidal fluctuations of geostrophic currents are highly coherent with observed currents and lag them by periods that are consistent with typical geostrophic adjustment times for shelf flow fields.

Frequency-domain EOF results indicate that most of the geostrophic current (pressure gradient) variance is contained in the primary mode, which is characterized by an outer-shelf amplitude maximum and an approximate two-day across-shelf phase lag. A variety of statistical results shows that most of the geostrophic current (pressure gradient) variance in the 2–14-day band is highly coherent with and lass alongshelf wind stress by 0–2 days in WINTER. SUMMER geostrophic currents (pressure gradients) show less coherence and phase lag with the considerably less energetic winds but larger response per unit stress than in WINTER. Such a response is consistent with a locally wind-forced shelf flow in which friction is important.

top

© 2008 American Meteorological Society Privacy Policy and Disclaimer
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.