Abstract View

Volume 17, Issue 4 (April 1987)

Journal of Physical Oceanography
Article: pp. 470–482 | Abstract | PDF (982K)

Planetary Shock Waves

William K. Dewar

Department of Oceanography and Supercomputer Computations Research Institute, Florida State University, Tallahassee, FL 32306

(Manuscript received May 27, 1986, in final form September 26, 1986)

DOI: 10.1175/1520-0485(1987)017<0470:PSW>2.0.CO;2

ABSTRACT

A number of general circulation models have recently been proposed that compute the steady-state structure of the general circulation. Observation of 18°C water formation, on the other hand, suggest the need for a study of the time-dependent large-scale structure of the oceans. In this paper, the planetary geostrophic equations are used to compute the evolution of large thermal anomalies with a view toward understanding the variability in the general circulation caused by water mass formation events.

The evolution of a thermal anomaly is considered in the absence of wind forcing. In this case, the planetary geostrophic equations can be reduced to a first-order equations, the Planetary Geostrophic Wave Equation (PGWE). Arbitrary initial conditions governed by the PGWE tend to steepen and, under an assumed diffusive closure, from shock waves. The evolution of an initially columnar eddy is obtained, and four different phases of shock propagation are identified. The implications for heat transport, potential vorticity transport and thermocline ventilation are discussed.

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