THE IMPACT OF FIRST MODE BAROCLINIC PLANETARY WAVES ON WESTERN BOUNDARY CURRENTS

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The objectives of this project, funded as part of the TOPEX/POSEIDON extended mission, are: (1) to characterize the first mode baroclinic planetary wave field in the North Atlantic and in the North Pacific, and (2) to examine the impact of fluctuations in these wave fields on the long term variability of meandering observed in each of the basin's western boundary currents, the Gulf Stream in the North Atlantic and the Kuroshio in the North Pacific. This effort has been proposed for three years and has just begun, hence there are no results to report at this time.

In previous work [Lee and Cornillon, 1995] we have examined the degree of meandering of the Gulf Stream between its point of separation from the continental margin and 65°W, approximately 2000 km downstream. (The degree of meandering is defined as the rms fluctuation of the path about a smoothed version of the path.) This analysis suggests that the degree of meandering varies quite dramatically (by a factor of two or more) over time (months to years). This has important consequences on the dissipation of energy in the western portion of the ocean basin as well as the mixing of biological, chemical and physical properties. Hypothesizing that variations in the potential energy of planetary waves arriving at the western boundary current upstream of the point of separation will affect the stability of the separated jet through their impact on either the transport or the baroclinicity of the current, we ask: How much does the variation in this energy contribute to the variability in the subsequent meandering of the current?

We will use sea surface temperature (SST) fields derived from the AVHRR/2 sensor to characterize the statistical variation of the meandering jets. We have already developed the methodology to characterize the degree of meandering of a separated jet and we have applied it to 8 years of Gulf Stream data (1982-1989) [Lee and Cornillon, 1995]. In the effort proposed here we will extend the period covered to the present and we will apply the method to the Kuroshio covering the period from January 1984 to present.

The planetary wave field will be obtained from TOPEX/POSEIDON and GEOSAT altimeter data and from the SST field. We have already characterized the planetary wave field for the North Atlantic with TOPEX/POSEIDON for September 1992 through April 1995 [Polito and Cornillon, 1996]. We have also shown that SST anomalies can be used to characterize the planetary wave field in the western Sargasso Sea [Halliwell et al, 1991a and b]. We will use the altimeter data to calibrate the SST observations, thus extending the temporal coverage of the wave field in the western subtropical convergence zone from the 6+ TOPEX/POSEIDON years to 17+ years.

References :

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