Abstract View

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Temporal Variations in Regional Models of the Sargasso Sea from GEOS-3 Altimetry

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ABSTRACT

The dense coverage of short-pulse mode GEOS-3 altimeter data in the western North Atlantic provides a basis for studying time variations in sea surface height (SSH) in the Sargasso Sea. Two techniques are utilized in this study: 1) the method of regional models and 2) the analysis of overlapping passes.

In the regional model analysis, monthly models of the Sargasso Sea are produced for the period July–November 1975 and April–August 1976. The pooled estimate of the sample root-mean-square discrepancy of the heights occurring in the same 20 km (0.2°) square between the different monthly solutions is ±61 cm. Approximately 28 cm of this is due to the average variation in geoid slope across 0.2° squares. The residual discrepancy is due to instabilities introduced by variable pass geometry, unmodeled ocean tides and mesoscale variations in dynamic SSH. Short-wave maxima and minima in the regional sea surface models are examined for correlations with surface and remote sensed infrared temperature data supplemented with available subsurface expendable bathythermograph (XBT) data of Lai and Richardson (1977). Allowing for differences in the quantities being compared, an 88% correlation is obtained between the location of cyclonic eddies (obtained from infrared imagery reported by the National Weather Service and where possible corroborated by the *in situ* XBT data) and SSH minima in the altimeter models. This figure drops to 59% in the case of correlations with maxima and minima of surface temperature fields.

The analysis of overlapping passes provides a better picture of instantaneous SSH variability through wavelengths >30 km. The resolution obtained is significantly higher (±33 cm on average) though the areal representation is limited to 32 selected profiles based on a total complement of 219 satellite passes. The variance in SSH of the Sargasso Sea through wavelengths between 50 and 1500 km is estimated at ~ 540 cm^2. On considering the magnitude of

unmodeled orbital error this value is in reasonable agreement with oceanographic estimates of structure functions and intensifies of eddy fields in the North Atlantic (Dantzler, 1976). Correlation studies with cyclonic and anticyclonic ocean eddies from infrared imagery and XBT data indicate satisfactory agreement being obtained with equivalent SSH features 98% of the time if time-varying factors are allowed for.

An approximate estimation technique shows that the quasi-stationary SSH maintaining the Gulf Stream is present in the GEOS-3 data but cannot be estimated with confidence in the absence of an adequate geoidal model.

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