Ocean Circulation Simulated With 2-Day and l-Month Mean NSCAT Wind Velocity Data

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Ocean currents are primarily generated by horizontal variations of surface wind stress, which are related to the near-surface wind field, A goal of biological and physical ocean sciences has been the accurate determination of the surface wind field. A wind-measuring scheme must not only be accurate in regards to the quality of each measurement but also must resolve the rich space and time spectra of wind motions. For many oceanographic applications, the desired accuracy would be 1 m/s for the east-west and north-south wind components (or 1.5 m/s and 4 degrees for speed and direction), l-day resolution, and 25-km horizontal scale.

In August 1996 the U.S. National Aeronautics and Space Administration (NASA) Scatterometer (NSCAT) was launched on the Japanese Advanced Earth Observing Satellite (ADEOS). NSCAT yields an unprecedented quantity of high-quality, high-resolution 19.5-m height wind velocity vectors. Wind vectors are measured with a 25-km x 25-km footprint every 2 days (sometimes more often) over 98% of the global ocean. An experiment with NSCAT data is described to illustrate differences in wind-driven ocean circulation derived from 2-day and 1-month mean data. A time scale of l-month has typically been used in oceanography because of the sparcity of data. For this report, data from the Arabian Sea are employed because of an ongoing research project.

Three components of wind-driven circulation of the Arabian Sea were computed: vertical transport of water across the bottom of the Ekman layer north of 8°N, which is related to wind stress curl and zonal component of Ekman transport; north-south component of Ekman transport along the southern boundary at 8.5°N, which is related to zonal wind stress component; Sverdrup transport along 8.5°N, which is related to wind stress curl. Using preliminary NSCAT data for September and October 1996, differences between a ten 2-day data set and a single 20-day data set (same days were used) were 30%, 44%, and 7%, respectively, for vertical transport, Sverdrup transport, and north-south Ekman transport. Differences were large for transports computed from wind stress curl because large wind stress curls occurred for short time intervals. Additional results obtained with reprocessed NSCAT data will be described.

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