

OCEANIC TRANSPORTS OF MASS, HEAT AND SALT IN THE WESTERN NORTH PACIFIC

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At first, selected scientific results from the previous TOPEX/POSEIDON (T/P) mission activities by Japanese physical oceanographers under the same title are shown in this article. Then, planned studies for the T/P Extended Mission are described.

Measuring the Kuroshio with T/P

For the Kuroshio south of Japan, a time series of volume transport of the Kuroshio is obtained from the T/P altimetry data using a very tight relationship between the transport and sea level difference across the Kuroshio [Imawaki et al., 1997]. Figure 1 shows the three-year time series of transport. The relationship used has been found by combined use of moored current meter data and repeated hydrographic data along a line crossing the Kuroshio off Cape Ashizuri, Shikoku. Those in situ oceanographic observations were carried out by a group entitled "Affiliated Surveys of the Kuroshio off Cape Ashizuri (ASUKA)". Fluctuations of the Kuroshio axis are also detected by an approximated total sea surface dynamic topography (SSDT) profile along subsatellite tracks [Imawaki et al., 1996]; here the approximated total SSDT is the sum of the fluctuation SSDT derived from the altimeter data and the climatological mean SSDT.

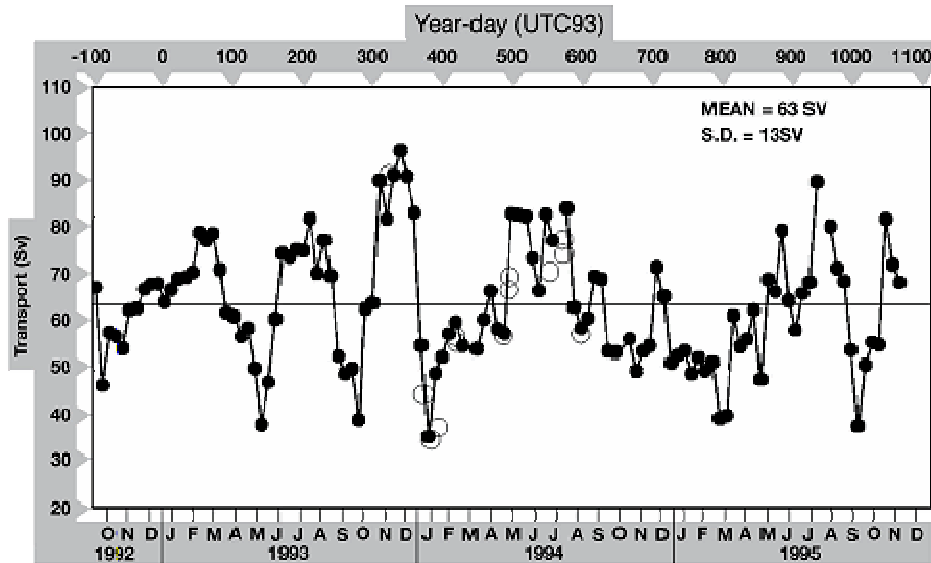


Figure 1

Time series of the absolute volume transport (solid line with dots; in $10^6 \text{ m}^3/\text{sec}$) of the Kuroshio south of Japan during 1992-1995, estimated from T/P altimetry data using an experimental relationship between the transport and sea surface height difference across the Kuroshio. Also shown are volume transports (circles) estimated from in situ data.

Mapping mean SST

A method to obtain the mean SSDT map is developed using T/P altimeter data, hydrographic data including expendable bathythermograph (XBT) and mooring data, and climatological mean temperature and salinity profiles [Kuragano and Shibata, 1997]. As an example, 1993 and 1994 annual mean SSDT maps for the Pacific are obtained. The accuracy of the maps is estimated to be less than 2 cm in most areas and 2.5 cm for oceanographic data sparse areas. Geostrophic velocities based on this method compare with surface currents analyzed from ship observations better than those based on a previous method using the climatological mean SSDT as a reference.

Wind driven circulation in the subarctic region in the North Pacific

Time-dependent wind-driven circulation in the subarctic region in the North Pacific is investigated using T/P altimeter data and European Centre for Medium-Range Weather Forecast (ECMWF) wind data for about two years [Isoguchi et al., 1997]. Empirical orthogonal functions of the sea level anomaly are found to be related to several oscillations, including:

- a basin-wide oscillation, which is associated with the spin-up and spin-down of the subarctic gyre,
- Oyashio current variations,

- basin-wide north-south oscillations associated with the Aleutian Low, and
- Sverdrup transport fluctuations estimated from the wind stress curl near 40°N.

These results suggest that SSDT variations in the subarctic North Pacific are approximately explained by the time-dependent wind-driven circulation.

Ongoing research

Under the next three-year term of the T/P Extended Mission, we will study the western North Pacific. Basically, the studies mentioned above will be continued using the altimeter data from the T/P Extended Mission and in situ oceanographic data. The following are initial plans which will be carried out during the Extended Mission. The monitoring of volume and heat transport of the Kuroshio off Cape Ashizuri, Shikoku will be continued for the Extended Mission by using inverted echo sounder (IES) data as well as altimeter data and repeated hydrographic data across the Kuroshio. The surface flow field of the Kuroshio will be regularly described in detail by combined use of the altimeter data and acoustic Doppler current profiler (ADCP) data. The surface flow field for the entire North Pacific will be mapped and widely distributed to the community operationally three times a month using altimeter data and XBT data. The surface flow field will also be described for the western North and South Pacific oceans and Indian Ocean to estimate the horizontal heat flux of the surface layer using the European Remote Sensing satellites ERS-1/2 as well as T/P altimeter data. Through these basic studies, we intend to better understand the circulation of the western North Pacific, especially its role in the transport of mass, heat and salt.

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