Decadal Connections of Mesoscale Current Variability in the Ulleung Basin

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Data bases containing long term ocean measurements over large areas, such as from satellite altimetry, are required to understand ocean circulation because flow patterns during individual years may differ greatly from year to year and from climatology in important qualitative ways. However, in situ measurements are essential for the correct interpretation of remotely sensed measurements. Absolute geostrophic velocities are calculated along TOPEX/Poseidon (T/P) groundtracks located in the Ulleung Basin of the southwestern Japan/East Sea (JES) from a combined analysis of nearly a decade of T/P data and two years of pressure-gauge-equipped inverted echo sounder (PIES) data obtained during the United States Office of Naval Research's JES Program. Geostrophic velocities are calculated daily for the Ulleung Basin from June 1999 to July 2001 from a three-dimensional mapping of temperature and salinity produced by PIES data interpreted via the Gravest Empirical Mode technique combined with the Navy's Modular Ocean Data Assimilation System (MODAS). These velocities are then used to convert T/P velocity anomalies to absolute velocities for the T/P time period of 1993 to 2002. Current intensities and variabilities associated with the East Korean Warm Current, Ulleung Eddy, and Offshore Branch are examined. Spatial and temporal variations of the sea surface circulation are strong. Intensification of the currents generally occurred during the fall season. The flow pattern in individual years differed greatly from year to year and differed from climatology in important qualitative ways. Using nine years of T/P data provides the opportunity to view the two years of PIES measurements period in a broader temporal context and to examine the representativeness of the strong variability and of the circulation patterns inferred along the T/P tracks. The historically-accepted three-branch circulation pattern is neither a permanent nor a seasonally-repeating feature in the Ulleung Basin. Measurement systems (including both remotely sensed and in situ measurements) that continuously monitor ocean conditions are clearly needed to understand ocean dynamics and to establish connectivity.