Abstract

The Soya Warm Current (SWC) flows through the Soya (La Pérouse) Strait from the Sea of Japan to the Sea of Okhotsk and plays an important role in the water mass exchange between the two seas. In order to continuously monitor the spatial structures and temporal variations of the SWC, five High Frequency (HF) ocean radars were deployed in the northern coast of Hokkaido in 2003.

Wind drift current was estimated by using data from the three HF ocean radars deployed around the Soya Strait. Surface current observed by the HF ocean radars contains the wind drift component, which must be removed in order to evaluate the intensity of the SWC with a higher accuracy. The wind drift parameters, speed factor and turning angle, were derived from the surface current measured by the HF radars, the vertical current profile measured by a bottom-mounted Acoustic Doppler Current Profiler (ADCP), and wind data from the numerical weather analysis system operated by the Japan Meteorological Agency (JMA) from October 1, 2006 to July 24, 2008. The ensemble-mean turning angle and speed factor from the entire data period (excluding August 2007) were estimated to be 28° and 0.66%, respectively. No significant seasonal variations were discernible in the wind drift parameters. After removal of the wind drift current estimated from the wind with the ensemble-mean drift parameters, the correlation coefficient between the along-shore current speed and

sea level difference between the Sea of Japan and Sea of Okhotsk improved from 0.791 to 0.825. It was revealed that the magnitude of wind drift current reaches 45% of that of the interior current in winter and approximately 15% in summer, indicating the importance of wind drift current estimation in this region.

Sea ice drift velocity was derived from the raw data obtained by the HF ocean radar deployed in Mombetsu. The backscattered signal from sea ice yields direct measurements of position and radial velocity of sea ice. The sea ice radial velocity fields, derived from the HF radar raw data, captured the sea ice motions, which reflect the wind stress over sea ice and surface currents below sea ice. The results were compared with in situ measurements of sea ice velocities by ADCPs and a drifting buoy, and exhibited reasonable agreements. In nearshore, the root-mean-squared (RMS) difference and correlation coefficient between sea ice velocities from HF radar and ADCP were 0.21 m s^{-1} and 0.702, respectively. The RMS difference and correlation coefficient between sea ice velocities from HF radar and buoy were 0.21 m s^{-1} and 0.597, respectively. It was concluded that the HF ocean radars can provide reliable measurements of sea ice drift velocity.

In the present study, it is shown that the HF ocean radar observation was reasonably applied to estimation of the wind drift current and measurement of sea ice drift velocity. As the HF ocean radars can obtain the data of current and sea ice

continuously under all-weather conditions in real time with high spatial and temporal resolutions. These results indicate that the HF ocean radar is a powerful tool to monitor coastal regions in subpolar and polar marginal seas.