

Monitoring the deep western boundary current in the western North Pacific by echo intensity measured with LADCP

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Formation of iron-manganese nodules is considered to be related to the lower circumpolar deep water (LCDW). The LCDW is transported by the deep western boundary current (DWBC) in the Pacific Ocean. Because the dissolved oxygen (DO) concentration of the LCDW is high, oxidation of iron and manganese is considered to be predominant in the DWBC. We assumed that by the faster removal of particulate iron hydroxide and manganese oxide, densities of the particulate matters are lower in the DWBC than the interior region. To detect the density variation of suspended particles between the DWBC and interior regions, we analyzed echo intensity (EI) measured in the western North Pacific with a 300 kHz lowered acoustic Doppler current profiler (LADCP) in a whole water column. At depths greater than 3000 m, EI is almost uniformly low between 12N and 30N but increases sharply from 30N to 35N, reaching a maximum north of 35N. In comparison with the background EI distribution, EI in the DWBC is found to be remarkably low. The DWBC pathways are identifiable by the low EI and high DO. This finding may be useful in various geoscience applications. For example, this method is applicable to seismology. The variations of the DWBC are associated with the bottom pressure variations and obscure seismic signals. LADCP EI data and other acoustic instruments may be used to observe the variations of the DWBC and to detect seismic signals.

Keywords: LADCP echo intensity, Deep western boundary current, Lower circumpolar deep water