Propagating and scattering processes of near-inertial internal waves calculated by high-resolution ocean model around Toyama Bay, Japan

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In the central part of Japan Sea, tidal currents are known to be weak, which result in weak turbulent mixing. Near-inertial internal waves (NIWs) that can contribute turbulent mixing are frequently generated. Since the NIWs have tend to propagate equatorward, hot-spots of the turbulent mixing are expected to be formed throughout their scattering processes along the main land of Japan. In this study, propagation and scattering processes of NIWs in and around Toyama Bay (TB) was investigated by using results calculated by high-resolution nested ocean model which is usually operated for fisheries. From analysis of time-space fluctuations of currents rotating clockwise, temperature anomalies and sea levels generated just after typhoon 1004 passing, development of near-inertial fluctuations (NIF) with 19-hour period were confirmed for about 3 days, and they were considered to have characteristics of internal waves. Spectral and harmonic analysis by using current and temperature data at depths deeper than seasonal pycnocline showed that the NIWs propagated clockwise in and around the TB. In this region, energy flux averaged vertically of NIF also circulated clockwise. Over continental shelf off the eastern coast of the Noto Peninsula (NP) which is located as the western boundary of the TB, co-phase lines were parallel to the coastal line and vertical-averaged energy flux made clockwise-circulation structure. Over continental slope off the eastern coast of the NP, beam-like structure of current which was slightly inclined downward were found around depth of 70m, and its inclination almost corresponded to that of characteristics slope of the NIWs calculated from averaged stratification condition around the TB. From interpretation of the above results by using characteristics of vertical modes of the NIWs, we considered the following processes: 1) After typhoon passing, the NIFs propagated with characteristics of the 1st vertical-mode NIWs toward the eastern coast of the NP, and they formed standing wave-like oscillation system propagating clockwise around amphidromic point located north off the TB by partial reflection at the continental slope; 2) the energy of the 1st-mode NIWs partially ran on to the continental shelf with scattering at the shelf edge, which result in in-phase NIFs around the eastern coast of the NP. These results suggest the NIWs can cause turbulent mixing at subsurface layer along the eastern coast of NP through the scattering process due to reflection around continental shelf break along the Japanese coast.

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