

Influence of Density Field on *Kyucho* and Bottom Intrusion in the Bungo Channel

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Occurrences of two density currents (*kyucho* and bottom intrusion) are known in the Bungo Channel, located between Kyushu and Shikoku, Japan (Takeoka et al., 2000). A *kyucho* is an intermittent intrusion of warmer water into the upper layer from the Kuroshio. A bottom intrusion is an intermittent intrusion of colder water into the lower layer from the bottom layer of continental slope. A *kyucho* in the channel is formed by the collision of a warm filament generated along Kuroshio front with the southwestern coast of Shikoku. The *kyucho* can flow into the central region of channel during a neap tide and warming period when vertical mixing is weak. A bottom intrusion is observed during a neap tide when the Kuroshio approaches the east coast of Kyushu (Kaneda et al., 2002a, b), however; its physical process is not fully understood. Strong bottom intrusions were observed five times during mid-November and mid-December 2013 in the southwestern coast of Shikoku (Fukuura Bay, Ehime) when temperature in the lower layer dramatically decreased (maximum: $-4.0^{\circ}\text{C day}^{-1}$). In the present study, these bottom intrusions were analyzed using vertical temperature profiles along the coast of Shikoku measured by Ehime University and JF Ehime. Influence of density field inside the channel on *kyucho* and bottom intrusion was evaluated, using the observational data of Ehime Fisheries Research Center.

As the vertical temperature profiles were analyzed, we observed that both warmer and colder water alternately passed through the whole layer of Okinoshima Island, south of Bungo Channel. Strong bottom intrusions were seen when this colder water passed by Fukuura, the southernmost station in the channel. Temperature increases due to the *kyucho* were detected in the upper layer of Fukuura, after the warmer water passed through Okinoshima Island, however, the scale of increase was lower in Fukuura than in Okinoshima Island. As the bottom intrusions propagated into the central region, the strength dropped while the few *kyucho* propagated. The density field along the channel was analyzed to figure out a factor that only the bottom intrusions propagated into the central region. In the upper layer, the density was greater in the south than in the north in November 2013, and the water tended to move southward, thus the *kyucho* was interrupted. In the lower layer, the density was higher in the south than in the north, and the water tended to move northward, thus the bottom intrusions flowed into the central region. The previously observed data demonstrated that *kyucho* tended to be interrupted during October and November due to salinity increase in the upper layer of the south. Bottom intrusions tended to be interrupted between December and April of next year due to seasonal cooling in the north. Kaneda et al. (2002) only observed *kyucho* between December 1995 and April 1996 due to the density structure inside the Bungo Channel.

Keywords: Bottom intrusion, *Kyucho*, Bungo Channel, Kuroshio