

Mixing process of dense shelf water on continental slope off Vincennes Bay

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Antarctic bottom water (AABW) is thought to be formed by mixing of dense shelf water (DSW) and modified circumpolar deep water (CDW) in the continental slope area. There are many unknown points in the mixing process because of few observations. The Vincennes Bay is located at the southern end of 110°E, and in recent years it has been shown that Antarctica bottom Water is formed originating from the Vincennes Bay polynya. To clarify mixing process on the shelf, we planned observations every year in the shelf area of the Vincennes Bay from 2014, but we could not do it. In January 2018, sea route to the shelf region just opened during observation cruises in that area, and observation from the depression in the western part of the polynya area to the continental slope was possible on the shelf. In this study, we introduce this observation data and discuss the mixing process.

We conducted CTD (SEB-9 Plus, MR6000) observation from the sea surface by ship to 10 m just above the seafloor at the four stations on the shelf, and water temperature and salinity observation up to the bottom by XCTD in the continental slope area. The slope of the continental slope in the sea area was very large, it was rapidly deepening from 500 m to 2000 m at 5 miles. We conducted XCTD casts in this region at 6 points approximately one-mile interval. As a result of the observation, it was confirmed that Density Shelf Water ($S > 34.50$, $T < -1.85$ °C) as expected by Kitade et al. (2014) was observed on the shelf and it have still existed at the shelf edge even in summer. In the continental slope area, it was found that water masses of low temperature and low salinity were distributed thinly just above the seabed. The water mass immediately above the sea floor shows the alteration from the Dense Shelf Water to the AABW, and it showed that the Vincennes area is unquestionably the formation area of the AABW. From the water temperature salinity profile, it was estimated that the thickness of the bottom boundary layer is 6 m, the thickness of the bottom mixed layer is 25 m, and the vertical viscosity coefficient is 10^{-3} (m^2/s). This observation result showed that the effect of double diffusive convection seemed not to be noticeable in the short distance. However, since the mixing ratio of the DSW and the CDW differed by about 1.4 times between the temperature and the salinity in the research previously, we are analyzing the process up to AABW and consistency with this observation result. At the time of presentation, we will also refer to the results of comparison with the vertical two-dimensional level model.

Keywords: Dense shelf water, Antarctic bottom water, mixing process