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PHYSICAL OCEANOGRAPHY

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ABSTRACT Subject :

Investigation of the recent salinity variations of High Salinity Shelf Water in the Terra Nova Bay Polynya, West Antarctica

Abstract 15/02/2023 01:39:49

Monitoring the property change in High Salinity Shelf Water (HSSW) in the Ross Sea is important as HSSW is a precursor for the Antarctic Bottom Water (AABW) that regulates the global overturning circulation. HSSW is formed by polynya activity in the coastal regions of the Ross Sea and 33% of HSSW is produced in the Terra Nova Bay Polynya. According to observational records in the Ross Sea (including Terra Nova Bay), salinity of HSSW has been decreasing for decades since the 1950s (~ -0.027 /decade) although 'Rebound' that dampens the freshening trend occurred in the mid-2010s. It was suggested that the 'Rebound' was caused by more active polynya activity due to stronger westerly wind and reduced sea ice import from the Amundsen Sea linked to the anomalous climate condition during 2015–2018. Therefore, after 2018 when the anomalous climate condition ended, it was expected that the salinity of HSSW in the Ross Sea would return to decrease. However, CTD dataset collected in Terra Nova Bay from 2019 showed that the salinity of HSSW continues to increase, maintaining the 'Rebound' trend. The salinity of HSSW increased about 0.023 kg/g from 2019 to 2022, indicating more HSSW approximately 0.7 Sv was produced. Moreover, the salinity of HSSW observed in 2022 was the highest ($S = 34.9980$ kg/g) among that observed over the past 15 years. It was found that such an active HSSW formation in 2022 would be related to the strongest wind in the austral winter of 2022 among the austral winter of the 2010s period and the delay in the sea ice melting period than usual. Our findings suggest that local conditions (i.e. wind and sea ice) still need to be carefully monitored to predict the future variations of HSSW and the AABW, although the effects of remote forcing on the change of HSSW salinity are expected to be significant due to climate change.

