Recent quick changes of Antarctic Bottom Water off the Adélie Coast, Antarctica

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In the study, changes of Antarctic Bottom Water (AABW) off the Adélie Coast, Antarctica, were examined mainly with observations of deep floats for December 2012 to August 2014. AABW was observed to have disappeared rapidly in the order of the densest part and its thickness had decreased quickly by around 45 m yr^{-1}, several times of the rate for the recent decades. Temperature and salinity on isopycnals showed seasonal changes, but there were no clear trends. The results of the repeat hydrographies clarified that the rapid deepening would have begun around 2010/11, at the latest and that AABW were largely freshened by around 0.005 in 2011. The changes of AABW ought to have raised the sea level by around 4.7 (3.1-6.5) mm yr^{-1} for 1900-4000 dbar, which agreed well with the independent observations within errors; 5.8 mm yr^{-1} of Aviso, 0.5 mm yr^{-1} of Argo for 0-1900 dbar, and 1.8 mm yr^{-1} of the mass component at averages for 2011-2014. The collapse of Mertz Glacier Tongue in February 2010 was expected to lead the larger changes of AABW. Its rapid disappearance would be caused by the smaller supply of ALBW due to the smaller sea ice production there and it would continue for a longer time because the revolutionary change of the ocean conditions would hinder the supply of a locally formed coastal dense water from recovering to the similar level before the collapse. However, the “long-term” freshening might be changed less by the collapse; the “large” freshening in 2011 would correspond to the freshening due to the global warming for about 5-6 years, and then very small changes would follow for several years.

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