MOORING MEASUREMENT OF THE DEEP WESTERN BOUNDARY CURRENT OVER THE EASTERN FLANK OF THE KERGUELEN PLATEAU IN THE INDIAN SECTOR OF THE ANTARCTIC

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1. INTRODUCTION

Antarctic Bottom Water (AABW) affects the global climate since it drives the global thermohaline circulation. The region off Adelie Land (around 145°E) located at the eastern edge of the Australian Antarctic Basin is considered to be an important source of AABW in addition to the Weddell and Ross Seas (Rintoul, 1998). Over the eastern flank of the Kerguelen Plateau (65-85°E) located at the western edge of this basin (Figure 1), there is a deep western boundary current (DWBC), which is a part of the basin-scale cyclonic circulation. Since this DWBC plays an important role in transporting AABW originating from the region off the Adelie Land toward the north, there have been several studies to estimate its volume transport (Speer and Forbes, 1994; Donohue et al., 1999; Aoki et al., 2008). However, these studies are based on snapshot measurement by CTD and ADCP and temporal variability of the transport has not been well understood.

2. DATA

In order to estimate the equatorward volume transport of AABW and its temporal variability, Australia and Japan conducted a cooperative mooring experiment over the eastern flank of the Kerguelen Plateau (Figure 1). Eight moorings containing 31 current meters, 2 ADCPs, 33 conductivity-temperature recorders, and 2 thermistors (Figure 2) were deployed and recovered by RSV *Aurora Australis* during the Australian National Antarctic Research Expedition cruises in February 2003 and January 2005. Valid data were obtained by most of the instruments.

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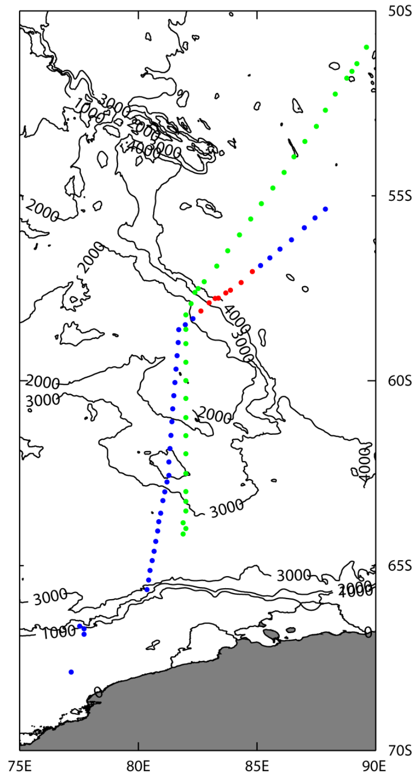

Figure 1: Mooring locations (red) and regional bathymetry. Blue and green circles denote CTD stations during the recovery cruise in 2005 and the WOCE I8S in 1994-1995, respectively.

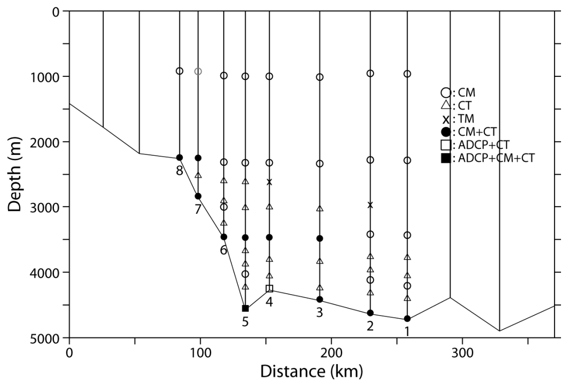

Figure 2: A schematic figure showing CTD and mooring locations (vertical lines) over the eastern flank of the Kerguelen Plateau. Moorings 1 to 8 were located from the northeast to southwest.

3. RESULTS

The vertical section of the mean northwestward velocity perpendicular to the mooring array during the entire duration shows the northwestward current over and near the slope and southeastward current away from the plateau (Figure 3a). There is a DWBC core exceeding 0.2 m s^{-1} over the slope. The vertical section of the mean potential temperature shows AABW (defined as potential temperature less than 0^{o}C here) layer thickness is about 1500 m beyond the continental rise. Despite the limited vertical resolution of the mooring measurement, these sections are similar to those obtained by the CTD/ADCP measurement during the RV *Mirai* cruise in January 2004 along the same section (Figures 4 and 2a in Aoki et al. (2008)).

Using the daily velocity and potential temperature data, the northwestward AABW transport is estimated. The northwestward AABW transport is integrated from mooring M8 over the plateau to the zero-crossing point from the northwestward to southeastward transport. The daily volume transport shows large variability from 0.1 to 30.2 Sv with the average value of 12.3 Sv (Figure 4). Seasonal

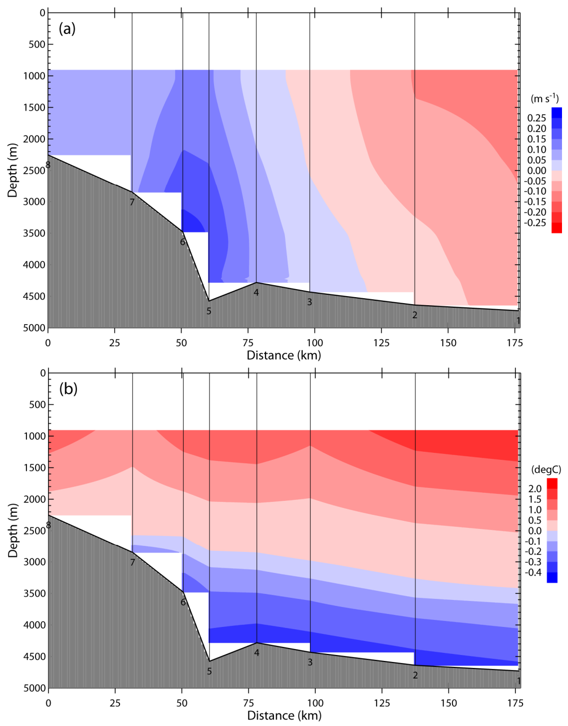

Figure 3: Vertical sections of (a) the mean northwestward velocity perpendicular to the mooring array and (b) potential temperature during the entire mooring duration.

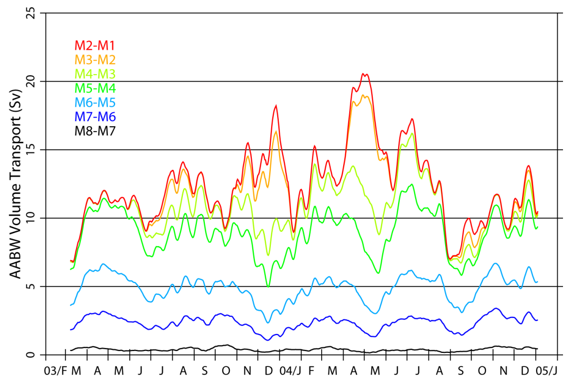

Figure 4: Daily AABW volume transport after 31-day running mean. Transports between adjacent moorings are shown in different colors in cumulative manner.

variability is not clear and variability with time scales of 20-30 days is dominant. The mean AABW volume transport is smaller than 15-26 Sv by Donohue et al. (1999) and 18.5-20.4 Sv (re-calculated with the same AABW definition of potential temperature less than 0^{o}C) by Aoki et al. (2008). The estimate from the mooring data during the *Mirai* cruise (February 2004), however, is 19.9 Sv, which is fairly close to those of Aoki et al. (2008). Considering the large variability, our volume transport estimate is not inconsistent with these previous estimates and indicates the importance of timeseries measurement.

References

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