南極大陸ケープダンレー沖陸棚端における海底境界混合の特徴

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Characteristics of bottom boundary mixing across the shelf edge off Cape Darnley, Antarctica

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The strength, energy sources, and vertical structure of the bottom boundary mixing associated with Antarctic Bottom Water (AABW) formation was investigated using microstructure, hydrographic, and current observations made off Cape Darnley polynya, East Antarctica from 21st-27th January in 2009 (Figure 1). Hydrographic and closely-spatial microstructure profiles showed that water mass property near the bottom was transformed from dense Shelf Water (SW) to AABW within few kilometers across the shelf edge, indicating that AABW was produced even during austral summer at our observation period. Except near the sea surface, enhanced turbulent energy dissipation rate, ε, greater than 10^{-8} Wkg^{-1} was confined around the bottom. Its magnitude decays exponentially with distance from the bottom up to 50m above the bottom, showing the characteristics of the bottom boundary mixing (Figure 2). The *e*-folding vertical length scale of the bottom boundary mixing, defined as distance from the bottom where ε were equal to e^{-1} times that of the bottom, was considered ~*O*(10m). Not only the Antarctic Slope Current but also trapped-type wave such as an internal Kelvin wave and a coastal-trapped wave were considered as the energy sources to induce the bottom boundary mixing on the shelf edge and continental slope regions. Based on a comparison of the buoyancy flux due to turbulence and double diffusive convection, the bottom boundary mixing was considered to be dominant mixing regime on the early stage of AABW formation process. Our observation results make us possible to interpret that SW mixed with Modified Circumpolar Deep Water above by the bottom boundary mixing across the shelf edge to produce AABW.

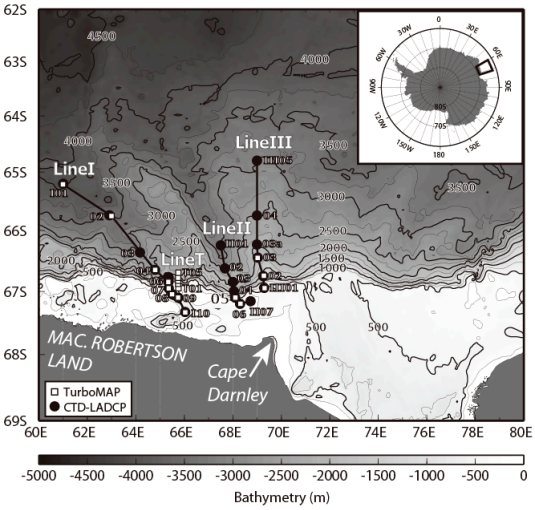

Figure 1. Bathymetry of the study area off Cape Darnley, Antarctica. Contours are from ETOPO2 bathymetric data. Black circles and white squares represent the locations of hydrographic (CTD with LADCP) and microstructure measurements (TurboMAP), respectively. Continuous 26 microstructure measurements stared on the shelf edge at Sta.II05.

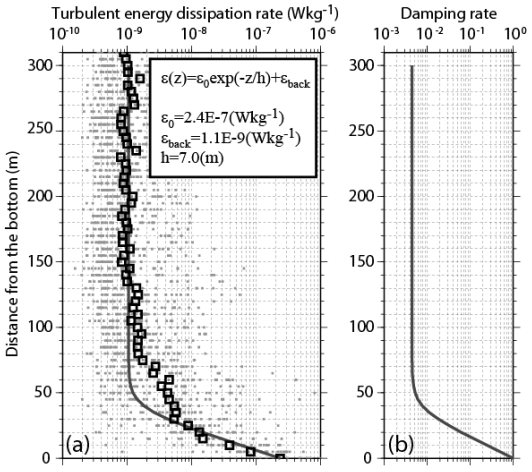

Figure 2. Fitted curve to express (a) exponentially decaying of observed ε and (b) damping rate at continuous microstructure measurements site across the shelf edge. Gray dots and black squares indicate all data and averaged ε at each distance from the bottom, respectively.