

南極大陸棚域における淡水供給 -その空間分布と近年の変化-
Sources of freshwater to the Antarctic continental shelf -distributions and multi-decadal changes-

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The Antarctic continental shelf is the gateway to the global ocean from the Antarctic Ice Sheet, the largest freshwater reservoir on Earth surface. Discharge of the freshwater occurs as the processes such as basal melting of ice shelves and calving of icebergs. On the other hand, sea ice formation and melting on the shelf redistribute the freshwater, affecting the overturning circulations of oceans. These two processes of freshwater transport are closely related to the surrounding oceanic and atmospheric conditions, and therefore estimating their contributions and clarifying their relationships with underlying environments are necessary to quantify the overall impacts to the ocean and its temporal change.

From observed salinity and stable oxygen isotope ratio of sea water with a few assumptions applied, meteoric and sea ice fractions in sea water are estimated on the shelf and their geographical distributions are studied. Meteoric ice fraction is largest in the surface layer of West Antarctica, but the water column inventory is largest in the Ross Sea and surprisingly uniform around Antarctica. The column inventory of meteoric ice retains the broadly consistent signature of ice shelf basal melting, which is proposed by the recent studies, but its oceanic stock is rather homogenized due to the effects such as oceanic advection and basin-scale circulation. Sea ice fraction contributes large production in the areas of strong katabatic wind and shows negligible production/net melting in the West and central East Antarctica. The vigorous vertical mixing due to high production also distributes the meteoric fraction to a wider depth range.

Observed salinity trend suggests a possibility of temporal change in these freshwater transports. The salinity trend at the bottom of the shelf for the recent four decades reveals the salinification in the West Antarctica and freshening in the Ross Sea. Repeated observations on the shelf region off the Adélie Land Coast indicate freshening for the recent two decades. These signatures might be consistent with the accelerating discharge of the west Antarctic ice sheet. The signatures are consistent with the structure of the recent salinity change of Antarctic Bottom Water, suggesting the on-going impact of the Antarctic shelf on the global scale.