Mass loss of the Antarctic ice sheet under the influence of ice-ocean interaction

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The Antarctic ice sheet covers 8.3% of the global land surface with a mean ice thickness of 1937 m. The mass of the ice accounts for ~90% of freshwater on the earth and has a potential of 58.3 m sea level rise. Mass change of the ice sheet has a large impact on the Antarctic and global environment since meltwater discharge affects not only sea level, but also ocean circulation and marine ecosystems. Therefore, quantification of ice sheet mass balance and understanding the driving mechanisms are crucially important.

Our understanding of the Antarctic ice sheet mass balance has been greatly improved over the last two decades. Novel satellite measurement techniques enabled us to quantify year to year variations in the mass balance, as well as to investigate key processes such as ice speed, calving and ice shelf basal melting. These new observations have shown a trend of ice sheet mass loss since 1990s. The most significant changes are observed at fast flowing glaciers and ice shelves along the coast in West Antarctica. More detailed studies strongly suggest that the mass loss is due to increasing ice shelf basal melting and ice flow acceleration. To clarify the mechanism of the observed changes, further investigations are in progress on the ice sheet and in the ocean. Study results indicate that the ice sheet is losing mass under the influence of changing ocean, and meltwater discharge is affecting the ocean environment in turn.

In this presentation, we review progress in understanding of the Antarctic ice sheet mass balance and mechanisms driving the recent mass trends. Based on the existing knowledge, we discuss future research directions required for satellite and in-situ measurements as well as numerical investigations.

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