

Integrated multidisciplinary study on change in the Southern Ocean and the Antarctic ice sheet

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The Antarctic ice sheet holds 90% of ice and is the largest fresh water reservoir on the Earth, which is equivalent to 70 m height of sea level. On the other hand, the Southern Ocean produces densest seawater, called the Antarctic bottom water, which is huge negative heat reservoir occupied 30-40% of whole seawater on the Earth, and is also giant reservoir of carbon dioxide. Consequently, the Antarctic ice sheet and the Southern Ocean are giant reservoirs of heat, water and material on the Earth, and the most significant components that control global climate and sea level changes. The changes in the Antarctic ice sheet and the Southern Ocean most likely indicate the precursor and driving force of the global environmental changes, and these changes are essential for future projection of Earth system. However, the Antarctic ice sheet and the Southern Ocean are the mostly unknown components in the Earth system due to the difficulties of the observation in these areas. Especially, studies on the East Antarctic area are very poor, and are behind in understanding of the ice sheet and the ocean behavior.

The interaction among the atmosphere, ice sheet, solid earth and ocean is vital to understand the Antarctic ice sheet, because the status under ice shelf around the boundary between ice sheet and ocean is essential factor. The physical, biological and chemical processes in the Southern Ocean are extremely important for understanding the carbon cycles which affect the global climate. Moreover, the impact on the ecological system in the Southern Ocean with huge biological production, followed by fluctuations in ocean circulation and sea ice has to be elucidated. Therefore, the primary processes and the mechanism of the interactions should be made clear in the context of the global environmental changes driven by the Antarctic ice sheet and the Southern Ocean throughout the various kinds of the interactions, and the integrated multidisciplinary study is required with the different fields of the observation data from geological to present time scale together with modeling studies. Furthermore, the developments of the observation instruments are important element to obtain the field observation data in the unexplored under and edge of sea ice, that is a key area to understanding the interactions. The program and the framework of the integrated multidisciplinary study focused on the Southern Ocean and the Antarctic ice sheet from the viewpoints of giant reservoirs of heat, water and carbon dioxide, which drive changes in the global climate and ecological system, are introduced, and the future direction and the prospects of this program are discussed.

Keywords: Southern Ocean, Antarctic ice sheet, ocean circulation, ecological system, carbon cycle