

[Grant - in - Aid for Scientific Research on Innovative Areas(Research in a proposed research area)]
Interdisciplinary Area



**Title of Project : Giant reservoirs of heat/water/material :
Global environmental changes driven by
the Southern Ocean and the Antarctic Ice Sheet**

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【Purpose of the Research Project】

In recent years, mass loss of the Antarctic ice sheet, the largest freshwater reservoir of the Earth, has been reported, and consequent future sea level rise is a growing concern. The Southern Ocean is a heat reservoir that drives the ocean general circulation with bottom water formation, and is also the largest CO₂ reservoir. The meltwater from the ice sheet alters the ocean circulation and CO₂ uptake, leading to further enhancement of the ice melt. Thus, the Antarctic ice sheet and the Southern Ocean together act as a system to potentially cause major changes in the global environment. In our project, we endeavor to understand and predict this complex system through collaborative efforts by a team of scientists from various disciplines with the aim of establishing a new "Antarctic environmental system science".

【Content of the Research Project】

In the Antarctic, the continent is covered and surrounded by strongly interacting components — atmosphere, cryosphere, ocean, and biosphere. We strive to comprehend them as one system through understanding various processes by observation and modeling, and through describing the states and mechanisms of interactions. For the future projection of global change originating in Antarctica, we conduct coordinated observations of ocean, ice sheet, solid earth and ecosystem, with the focus in the East Antarctica. Ice cores, marine sediments and rocks samples will reveal the past state and variations of the ice sheet and ocean on centennial to hundred-thousand-year timescales. Numerical models will integrate the components including the atmosphere, ice sheet, sea ice, ocean

and solid earth, incorporating observational and analytical findings, and elucidate the role of the Southern Ocean and Antarctic ice sheet on global change (see Figure).

In situ observations (ice, geomorphology, crust, ocean, sea ice, biology) will be conducted mainly in the East Antarctica where the Japanese expeditions have a long history and logistic advantages. Ice cores, marine sediments and rock samples will reveal variabilities on centennial to million-year timescales. Simulation and satellite observations will cover the entire Antarctica and will connect our findings to global changes.

【Expected Research Achievements and Scientific Significance】

- Enabling observations of interactive boundary between the ice and ocean.
- Realizing unified analyses of the past ice sheet and ocean variations under precise age control.
- Improving credibility of models by incorporating the new data on the Antarctic past and present.

These, together with various in-situ and satellite observations, will reveal how the ice sheet, ocean and climate interact. Sea level rise due to Antarctic ice sheet changes will be projected using the improved numerical models.

This project will also have societal impact, through clarifying the conditions and mechanism of the "Tipping Point", the critical point for irreversible and drastic change of the Antarctic. We also develop international collaborative framework for monitoring the East Antarctic, apply new observational techniques, and nurture researchers with broad and interdisciplinary perspectives.

【Key Words】

Antarctic ice sheet: Ice covering the Antarctic continent. The volume of ice is equivalent to 60 m of sea level.

Southern Ocean: Ocean around the Antarctica, producing Antarctic Bottom Water, the densest seawater.

【Term of Project】 FY2017-2021

【Budget Allocation】 1,156,200 Thousand Yen

【Homepage Address】 <http://grantarctic.jp>

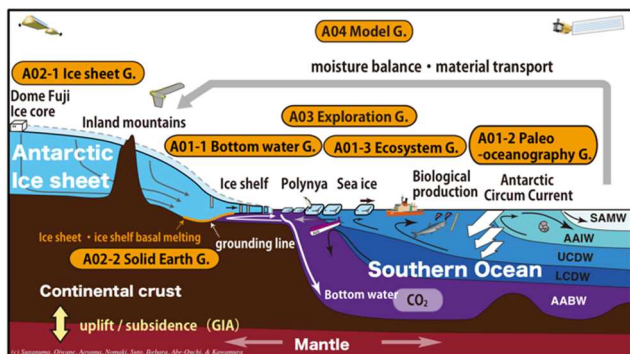


Figure: The Antarctic environmental system and our research groups.