Impact of Southern Ocean and ice sheet of Antarctica on the global climate change system

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Related International Research Project

Description of the Program
Past changes in the thermohaline circulation and biogeochemical cycles recorded in marine sediments provide important information with which to predict future global climate change. Since a large part of the Southern Hemisphere is occupied by ocean, the Southern Ocean will have a significant influence on any future climate change there.

With the 2009 cruise of the R/V Mirai we will collect sediment cores at ten sites at least in the area of New Zealand plateau and off Adélie Coast (40°S-65°S, Fig. 1). We will intend to explore 5 of the most important themes in paleoceanography: 1) timing of expansion and reduction of Antarctic ice sheet and sea-ice distribution of adjacent area of Antarctic continent, 2) timing of south and north migrations of frontal zones, 3) production and reduction of Antarctic deepwater and Antarctic intermediate water, and relationship between intermediate and deep waters, 4) biogeochemical cycles; evaluation
of Southern Ocean as a role of sink of CO₂, 5) mechanism of production of Antarctic bottom water and changes of Antarctic bottom water temperature and 6) phase lag or synchronization of the sea surface environment between the Southern and Northern Hemispheres. There have been a number of hypotheses for each of these themes and our results will allow us to test them. On the basis of our findings, we expect to be able to define the past environmental changes throughout the whole of the Southern Hemisphere since the last deglacial period. Our results could also be used to construct a paleo climate model. The post diction of past events is an important test of models. If they can predict the past, then they could predict the future.