[EJ] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-IS Intersection

[M-IS06]Global climate change driven by the Southern Ocean and the Antarctic Ice Sheet

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The Southern Ocean and Antarctic ice sheet, which are the giant reservoirs of heat, water, and materials, have a potential to play central roles in long-term global climate change. This system is composed of the following sub-systems; ice shelf which is a place of the interaction of ice sheet and ocean, flowing iceberg, seasonal sea ice zone, Antarctic bottom water which drives the thermohaline circulation, active biological production and Antarctic Circumpolar Current. These sub-systems are interacted with each other and have significant impact on changes in the global environmental system. This session aim to summarize recent observational and simulation studies from various fields relating to the past and present changes in the Antarctic Ice sheet and Southern Ocean, which are essential elements for unraveling the changes in the global climate system. Further, future science plans for understanding of the environmental changes of the Antarctic Cryosphere is also discussed.

[MIS06-P10]Role of the Southern Ocean in the thermal threshold of the Atlantic meridional overturning circulation during the glacial climate

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Abrupt climate changes known as Dansgaard-Oeschger events (DO events) took place frequently in glacial periods. Many geological evidences support the idea that changes of the Atlantic meridional overturning circulation (AMOC) are related to these events, but question on what triggers the AMOC changes remains unsolved. Although the most of studies have regarded freshwater flux from melting ice sheet as a cause of the AMOC changes, we previously identified the existence of the thermal threshold of the AMOC during glacial climate (Oka et al. 2012, GRL). Here, we investigated the structure of the thermal threshold in glacial climate by conducting ocean general circulation model simulations under various thermal conditions in which degrees of sea surface cooling are systematically changed separately or simultaneously in northern and southern hemispheres. The results suggest that the threshold is located near the condition in which the climate is slightly warmer than the coldest glacial conditions as suggested in Oka et al. (2012). We also found that the amplitude of AMOC changes in crossing this threshold depends on thermal conditions in northern and southern hemispheres. This amplitude becomes the largest when the southern hemisphere is slightly warmer than the coldest glacial conditions. It is also demonstrated that gradual warming in the southern hemisphere from the colder glacial climate leads to crossing the threshold and can cause very large strengthening of AMOC. Therefore, the thermal threshold is a possible triggering mechanism of DO events accompanying the warming of southern hemisphere before their abrupt warming in northern hemisphere.

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