氷期間氷期の海洋深層循環と氷床変動のモデリング

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Modelling the Glacial Atlantic Overturning controlled by the Southern and Northern high latitude changes through CO2 and ice sheets

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Deep Ocean circulation indicated by geochemical tracers varied during the ice age cycle with climate and the Milankovitch cycle. Multiple tracer evidence at the Last Glacial Maximum (LGM) particularly show that the water originated from the North Atlantic (NADW) was shoaler than the present day ocean and the Atlantic meridional overturning circulation (AMOC) may have been weaker. Athough it is expected to be a good test for the fully coupled atmosphere-ocean general circulation models (GCM) which are used for future climate projection, many models forced with glacial condition, however, fail to simulate the glacial AMOC, which is an obstacle to understand the response of ocean to climatic forcings. Here we analyse multi-climate models including the latest CMIP5/PMIP experiments and show that most of the climate models show a stronger and deeper AMOC associated with the insufficient cooling in the LGM Southern Ocean. We further show that the models which fail to have shoeler glacial AMOC is even strengthened because of the feedback between the AMOC, sea ice and wind stress in the north Atlantic. Our additional study using MIROC AOGCM show that by eliminating the warm bias at southern ocean, which most of the climate models suffer from, the sufficiently vigorous Antarctic bottom water formation under glacial condition and proxies (MARGO and delta 13C) can be simulated. I will discuss the role of ice sheets and atmospheric CO2 in determining the AMOC in our MIROC AOGCM.