Climate model study on the driving mechanisms for abrupt climate changes during glacial periods and the effects of climatic precessions on the stability of the AMOC

*Yuta Kuniyoshi[1], Ayako Abe-Ouchi[1], Sam Sherriff-Tadano[2], Wing-Le Chan[1], Fuyuki SAITO[3]

1. The University of Tokyo, 2. University of Leeds, 3. JAMSTEC

It is well known that abrupt climate changes with global-scale impacts, which are called Dansgaard–Oeschger (DO) events, occurred repeatedly during the glacial periods. These abrupt climate changes have been shown to be closely related to the changes in the strength of the Atlantic meridional overturning circulation (AMOC). In recent years, a few coupled atmosphere-ocean models have successfully reproduced the self-induced oscillation of the AMOC with periods shorter than 1000 years, and several mechanisms of the DO events have been proposed, mainly due to internal factors of the atmosphere-ocean system around the North Atlantic. Our recent experiments by using the coupled atmosphere-ocean model MIROC4m reproduce not only those short-period oscillations of the AMOC but also oscillations with a period of several thousand years. Furthermore, experiments using maxima and minima as boundary conditions for the climatic precession that produces seasonal changes in the high latitudes of both the northern and southern hemispheres show that oscillations with relatively short periods occur frequently when the precession is at its maximum. In this study, from the analysis of the precession experiments and additional sensitivity experiments in which the value of precession is divided by the northern and southern hemispheres, we investigated the effect of precession on the stability of AMOC and how the seasonality of the northern and southern hemispheres is involved in each of the several mechanisms of the AMOC oscillation.

