Transient climate simulation of the last deglaciation

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Evolution of global climate from the glacial states to interglacial states presents an opportunity for understanding the transient response of climate to external and internal forcings. During the last deglaciation, a major global warming was punctuated by several abrupt climate changes likely related to Atlantic Meridional Overturning Curculation (AMOC) (Clark et al. 2012).

Transient deglaciation experiments for the periods of 21 to 9 ka has been adopted in the Paleoclimate Modeling Intercomparison Project (PMIP) 4 (Ivanovic et al. 2016). Model results show that glacial meltwater discharge into North Atlantic due to melt of continental ice sheet has substantial impact on abrupt climate change and bipolar seesaw response during the last deglaciation (Liu et al. 2009). However, there is significant uncertainty in the scenario of glacial meltwater, and the extent to which glacial meltwater brought abrupt climate changes is under debate (Ivanovic et al. 2016).

We conducted transient deglaciation experiments from the Last Glacial Maximum to the Holocene using an IPCC-class atmosphere-ocean coupled general circulation model (AOGCM), MIROC 4m. We applied time-dependent insolation, greenhouse gas concentrations, and glacial meltwater forcing based on ice sheet reconstructions (ICE6g, Peltier et al. 2015). As the simulated AMOC does not recover until the Holocene in contrary to ice core records, we conducted sensitivity experiments by modified the scenario of freshwater forcing to investigate the responses of polar regions to variations in AMOC.