[JJ] Evening Poster | A (Atmospheric and Hydrospheric Sciences) | A-CC Cryospheric Sciences & Cold District Environment

[A-CC29]Ice cores and paleoenvironmental modeling

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Analyses of ice cores from polar and mountain regions have contributed to the reconstruction and understanding of the past environmental changes on timescales from years to several hundred thousand years. In this session, we welcome paleoenvironmental studies using ice cores and paleoclimatic modeling. Studies on reconstruction methods, recording processes and new paleoenvironmental proxies, technical aspects of paleo-modeling are also welcomed. Studies with marine sediment cores, terrestrial sediment cores and tree-rings on similar timescales are also important and welcomed, in order to discuss past environmental changes from multidisciplinary viewpoints.

[ACC29-P09]Last Glacial Maximum and Last Millennium experiments towards CMIP6/PMIP4 using MIROC-ES2L and preliminary analyses

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We have started preparing the Last Glacial Maximum (LGM) and Last Millennium (LM) experiments to contribute Coupled Model Intercomparison Project Phase 6/Paleoclimate Modelling Intercomparison Project Phase 4 (PMIP4) using an Earth System Model MIROC-ES2L. The model version has horizontal resolution of T42 with vertical 40 layers for the atmosphere. The oceanic coordinates are tri-polar 360 x 256 grids horizontally with vertical 63 layers. The model is capable to calculate carbon and nitrogen cycles explicitly. We present status of the experiments and preliminary analyses.

The LGM experiment requires most of the efforts and long spin-up on performing the PMIP4 experiments because of the different land sea mask and different oceanic thermohaline circulation state from pre-industrial control (PI) (Kageyama et al. 2017). We started spin-up experiments using the physical core of MIROC-ES2L during the model development in order to have long integration length. As a first step, greenhouse gas levels are reduced to the LGM level from PI and integrated for 2640 years. As a second step, the land-sea mask is modified following to ICE-6G_C (one of the choices of LGM configuration in PMIP4) and integrated for 300 years. After that, the altitude difference relative to PI is implemented and integrated for 2000 years. Then, the Earth orbit is modified to the LGM state and under integration. Global mean temperature change at 2 m height at the LGM is about -3.7 degree Celsius after 5240 years integration deviated from PI. This is consistent with an estimate using multi-proxy and General Circulation Models (Annan and Hargreaves 2013). Although the general temperature drop from PI is in reasonable range, more cooling over the polar regions is needed compared to the ice core data (Stenni et al., 2010, Uemura et al., 2012). We keep extending the integration and are going to include ecosystem in land and ocean modules. Offline spin-ups for the land and vegetation modules MATSIRO and VISIT are going on, firstly defining plant functional types according to the LGM climate. Offline spin-up for oceanic biogeochemical module COCO-OECO is also going on to obtain consistent distribution to the

LGM climate field. They will be coupled asynchronously to the physical core of MIROC-ES2L and integrated until quasi-equilibrium state.
The LM experiment has integrated using the physical core of MIROC-ES2L to test the model performance following the PMIP4 protocol (Jungclaus et al. 2017). Beforehand, a control experiment forced with the condition at 850 CE was performed 200 years and the LM transient experiment was branched and integrated for 1000 years. The time varying Greenhouse gases, volcanos, land-use, orbital, and solar forcing are implemented following the PMIP4 protocol. We will repeat this procedure with full MIROC-ES2L after the model version and the provided forcing are prescribed. The annual mean temperature at 2 m height averaged over the northern hemisphere shows the evident negative spikes after huge eruptions of volcanos. Further analyses will be presented.