Skill and reliability of climate model ensembles at the Last Glacial Maximum and mid Holocene

Julia C. Hargreaves (1), James D. Annan (1), Rumi Ohgaito (1), Andre Paul (2), Ayako Abe-Ouchi (1,3)

(1) Research Institute for Global Change, JAMSTEC, Global Warming Program, Yokohama City, Japan (jules@jamstec.go.jp, +81-(0)45-7785707), (2) University of Bremen, Bremen, Germany, (3) Atmosphere and Ocean Research Institute, Tokyo University, Japan

Paleoclimate simulations provide us with an opportunity to critically confront and evaluate the performance of climate models in simulating the response of the climate system to changes in radiative forcing and other boundary conditions. We use recent data syntheses for the land and ocean temperatures (MARGO Project Members, 2009; Bartlein et al., 2011; Shakun et al., 2012) to analyse the skill and reliability of the multi-model ensembles from the second Paleoclimate Modelling Inter-comparison Project (PMIP2) for the Last Glacial Maximum (LGM) and Mid-Holocene. As they become available, we include into the analysis the newly available models run for the LGM from the 3rd phase of PMIP.

Thus far, our results are predominantly positive for the LGM, suggesting that, as well as the global mean change, the models can reproduce the observed pattern of change on the broadest scales, such as the overall land-sea contrast and polar amplification, although the more detailed regional scale patterns of change remains elusive. In contrast, our results for the mid-Holocene are substantially negative, with the models failing to reproduce the observed changes with any degree of skill. One likely source of this problem is that the globally- and annually-averaged forcing anomaly is very weak at the mid-Holocene, and so the results are dominated by the more localised regional patterns. The root cause of the model-data mismatch at regional scales is unclear. If the proxy calibration is itself reliable, then representation error in the data-model comparison, and missing climate feedbacks in the models, are other possible sources of error.