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Development of the climate model MIROC and initialization system using LETKF for the next IPCC report

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We have been updating the climate model MIROC and developing a data assimilation and initialization system based on the local ensemble transform Kalman filter (LETKF) for reconstructing global centennial climate, understanding of mechanisms of climatic periodic changes, regime shifts, and extreme events, and improving skills in seasonal-to-decadal climate predictions. For the previous fifth assessment report of IPCC-AR5, decadal climate forecasts and retrospective predictions taking into account both of the global warming due to increase of anthropogenic green house gases and intrinsic variability of the climate system were performed using a series of MIROC with various resolutions and physics. As a result, for example, the mid-latitude SST signals in the North Pacific associated with the Pacific decadal oscillations, the abrupt stepwise climate shift occurred in the late 1990s, and the tropical cyclone activity over the western North Pacific are suggested to be predictable for a few to several years. After the experiments for IPCC-AR5, we additionally performed retrospective climate predictions on seasonal-to-interannual timescales focusing ENSO. Prediction skill of the equatorial SST in MIROC is as high as those in climate models of operational centers over the world. However, because MIROC has remarkable systematic climate biases of stronger equatorial trade winds and resultant deeper thermocline, more subtropical clouds in the lower troposphere and relating colder SST, weaker mid-latitude westerly jets, warmer SST and larger precipitations around Antarctica than observations, so-called anomaly assimilation technique is used in initializing the climate model, and thus the seamless climate predictions cannot be performed by the present system. Therefore, our modeling group is devoting effort to reduce the model biases and to realize the seamless predictions by MIROC based on full field assimilation. In my talk, recent update of MIROC will be introduced along with preliminary results from a newly developing initialization system.

Keywords: climate model, initialization, seamless climate prediction