Session: B7 Oral presentation

Scale dependency of the 20th Century experiments by CMIP5 and CMIP3 Models: Do reliable scales become smaller?

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We previously analyzed the surface air temperature trends over several moving window time scales (10, 20, 30, 40, and 50 year trends) and averaged over spatial scales (5^ox5^o, 10^ox10^o, 15^ox15^o, 20^ox20^o, 30^ox30^o, 30^o latitudinal bands, hemispheric, and global) from the 20th century experiments by three global climate models from CMIP3 archive (GFDL CM2.0, GISS-EH, and NCAR CCSM3.0) in comparison with two observational data sets (HadCRUT3 and NOAA-NCDC)(Sakaguchi et al., 2011; submitted to J. Climate). The agreement between the simulated and observed trend is generally improved by increasing scales and by ensemble averaging. The improvement with greater scales and Monte-Carlo simulations with the pre-industrial control experiments showed that the temperature trends in the 20th century runs achieve high performance statistics with the error approaching the uncertainty range in the observed data sets and are well distinguished from those in the pre-industrial experiments, at 30^o or larger spatial scales and over 40 years or longer temporal scales. We will extend this systematic analysis of scale dependency of climate model performance using CMIP5 archive. In addition to the new generation of the above three models, other available ensemble members from all the participating models in CMIP5 will be analyzed to quantify the temporal and spatial scales with robust model performance on temperature (and precipitation) trends and their improvement relative to CMIP3 models. Our analysis of temperature (and precipitation) trends as a function of time and space will also be able to pinpoint the regions or time periods where the performance is improved or degraded. Depending on the data availability, the fidelity of the 20th century experiments from CMIP3 and CMIP5 will also be compared to the decadal hindcasts experiments in order to understand the uncertainty range caused by natural climate variability as well as the improvement made by the initialization with the observed climate state. Additional results may be presented from another follow-up study by analyzing the coupled biogeochemical cycle simulations to provide the first-order picture on how the model performance will be changed by incorporating this important cycle.