Session: C26 Poster: W169B

How important is the model resolution for reducing biases in mean and variability in climate model?

Shuting Yang[†];
[†] Danish Meteorological Institute, Denmark
Leading author: shuting@dmi.dk

Reliable climate predictions of intra-seasonal to decadal time scales relies to a large extend on the ability of a climate model in reproducing both the climate state (i.e., the long time mean) and the variability (i.e., distribution of the deviation from the 'mean state'). The later often manifests itself as limited number of dominant large-scale modes of intra-seasonal to inter-annual time-scales. Two of such climate modes are of particular strong impact on the climate, i.e., the North Atlantic Oscillation (NAO) and the Pacific North American (PNA) pattern. Studies have demonstrated that these modes are to some degree self-maintaining by positive feedbacks of small-scale eddies on large-scale flow through up-scale energy cascade (Ren et al. 2009). Limited horizontal resolution in current climate models thus likely contributes to the bias in reproducing the variability modes. Other studies suggested that in addition to resolution effect, the mean state error in climate models could also results in errors in model variability (Scaife et al. 2010). Current study is to assess the impact of horizontal resolution on the biases in both the mean state and the variability of a climate model. We use the atmospheric GCM of the recent established climate model EC-Earth. The atmospheric module of the EC-Earth is based on the Integrated Forecast System (IFS) developed at ECMWF. A number of AMIP-type experiments were made at five resolutions, TL63 (~ 180 km), TL159 (~ 125 km), TL319 (~ 60 km), TL511 (~ 40 km) and TL799 (~ 25 km) (where L indicates linear grid). Objective metrics defined as model performance index and pdf-skill score are applied to assess the simulated time-mean climate variables and their variability in comparison with the observation and the recent ECMWF reanalysis, ERA-40/ERA-Interim. The differences in the simulated climate modes such as NAO, PAN as well blockings are analyzed. Particular efforts are made to distinguish the resolution impact on the mean state from its impact on the time-varying modes. References Ren, H.-L., F.-F. Jin, J.-S. Kug, J.-X. Zhao, and J. Park, 2009: A kinematic mechanism for positive feedback between synoptic eddies and NAO. Geophys. Res. Lett., 36, L11709, doi:10.1029/2009GL037294. Scaife, A.A., T. Woollings, J. Knight, G. Martin and T. Hinton, 2010: Atmospheric Blocking and Mean Biases in Climate Models, J. Clim., 23, 6143-6152.