The effect of horizontal resolution on simulation quality in the Community Atmospheric Model, fvCAM5.1

Michael F. Wehner, Kevin Reed, Fuyu Li, Prabhat, Julio Bacmeister, Cheng-Ta Chen, Chris Paciorek, Peter Gleckler, Ken Sperber, William D. Collins, Andrew Gettelman, Christiane Jablonowski, Chris Algieri

We present an analysis of version 5.1 of the Community Atmospheric Model (CAM5.1) at a high horizontal resolution. Intercomparison of this global model at approximately 0.25°, 1° and 2° is presented for extreme daily precipitation as well as for a suite of seasonal mean fields.

In general, extreme precipitation amounts are larger in high resolution than in lower resolution configurations. In many but not all locations and/or seasons, extreme daily precipitation rates in the high-resolution configuration are higher and more realistic.

The high-resolution configuration produces tropical cyclones up to category 5 on the Saffir-Simpson scale and a comparison to observations reveals both realistic and unrealistic model behavior.

The US CLIVAR Hurricane Working Group
- Climatological SST, 330ppm CO2
- Climatological SST plus 2°, 330ppm CO2
- Climatological SST, 560ppm CO2
- Climatological SST plus 2°, 660ppm CO2

In the absence of extensive model tuning at high-resolution, simulation of many mean fields is degraded compared to the tuned lower resolution public released version of the model.

Higher resolution leads to larger extreme precipitation rates.
- Generally more realistic.
- Biased high in regions/seasons where cumulus processes are significant.
- This is partly due to a mismatch in time scales in parameterizations.

Annual storm days

The US CLIVAR HWG: Annual tropical storm counts
- Fewer total TS, more intense TC in a warmer world

Tropical cyclones last longer in a warmer world

Funding for "CASCADE: CALIBRATED AND SYSTEMATIC CHARACTERIZATION, ATTRIBUTION, AND DETECTION OF EXTREMES," PI: William D. Collins, PM: Renu Joseph was provided by the Climate and Earth System Modeling Program of the Office of Biological and Environmental Research in the Department of Energy Office of Science under contract number DE-AC02-05CH11231.