CGD SEMINAR

NCAR

DATE: Tuesday, 6 December 2016

TIME: 11 a.m.

LOCATION: NCAR, 1850 Table Mesa Drive
Mesa Lab, Main Seminar Room

TITLE: Trade-wind clouds in climate models: How bad is good enough?

SPEAKER: Brian Medeiros, NCAR/CGD

ABSTRACT:

Low-level clouds predominate in the trade-wind regions, and the response of these clouds is linked to the spread in climate model estimates of cloud feedback and climate sensitivity in both comprehensive and idealized experiments from CMIP5. Observations and process-model simulations show that trade-wind regions foster multi-layered cloud structures with complicated relationships to their environment that manifest as different cloud variability near the cloud base versus cloud top as well as inhomogeneous horizontal distributions of cloud. The climate models show a disturbing spread in their cloud structures and generally fail to capture the observed correlations between clouds and environmental parameters, often showing the opposite sign compared to observations. CESM is among the best performers in the CMIP5 cohort, but exhibits many of the biases common among the models. What causes these biases? One hypothesis is that CESM, and climate models generally, inadequately parameterizes shallow convection. An alternate hypothesis is that models do not resolve small enough scales to capture the coupling between the clouds and circulation, leading to erroneous cloud statistics. Of course, the hypotheses are not mutually exclusive. We will begin to test these hypotheses using hindcasts with CAM. The hindcasts produce clouds that are similar to long-term, free-running simulations, but the large-scale circulation stays close to the observed circulation, facilitating comparisons. Sets of CAM5 hindcasts with 1-degree grid spacing are compared with a set using a regionally refined 0.25-degree mesh over the northern Atlantic trade-wind region. Two more sets of hindcasts are run with the same dynamical core and grid configurations but using a development version of CAM6 with updated parameterized physics that alter the representation of clouds, turbulence, and shallow convection. In all configurations, significant errors are apparent, raising questions about the prospects for accurately parameterizing shallow convection and how much it matters for climate model applications.

Live webcast: http://www.fin.ucar.edu/it/mms/mI-live.htm

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