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Exploring sensitivity of regional information from global climate models to model resolution and structure

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We present results using Community Atmospheric Model (CAM) that explores the robustness of regional information from global climate models. We will show results from several large ensembles of "patch" experiments using two versions of CAM (CAM3.1 an CAM3.5) and for two resolutions (T42 and FV2x2.5). Following the experimental design in Barsugli and Sardeshmukh (2002), an individual "patch experiment" consists of running CAM forced by climatological SST fields with an additional SST anomaly "patch" added to specific locations. A 16-member ensemble is generated for a given patch location by running 16 warm- and 16 cold-anomaly cases starting from different initial conditions. The patch location is then moved to a different location and another 16 member ensemble is calculated. By moving the patches throughout the tropics, one can generate maps of the sensitivity of climate changes (for any region of interest - global or regional) to the location and strength of the SST anomaly. For a given model, these maps quantify the importance of simulating the "correct" (or realistic) SST distributions throughout the tropics for making regional predictions. In addition, these maps provide a tool for comparing atmospheric GCMs by using idealized forcing patterns to isolate the uncertainty due to the atmospheric model from uncertainty due to ocean model or other significant components and feedbacks. These additional effects on the regional information need to be analyzed separately. Although sensitivity to tropical SSTs is confined to specific regions, using methods like this are critical for characterizing model response on regional scales. On global scales, the community uses the standard 1%/year increasing CO_2 concentration scenario and the transient climate response (TCR) provides one metric for comparing the response of an AOGCM with others. At this time, such metrics are not being used in the regional climate modeling community to explore the sensitivity of regional information to model differences. This is one goal of this research effort and we encourage other modeling groups to run similar ensembles with these scenarios.