Global Monsoons in the Half Degree CCSM4 for Current and Future Climates
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Motivation and Poster Design
Global monsoons play a critical role in the earth’s hydrological balance by producing seasonal precipitation maxima local to each regime. Understanding how these regimes change in a future, warmer world is important from both meteorological and economical standpoints. Here we examine global monsoons using a high resolution version of the Community Climate System Model, Version 4 (CCSM4). This work builds on Meehl et al., 2012 and Cook et al. 2012 by comparing the standard version (FV1x1) to a high resolution version (FV0.5x1, ~0.5° resolution atmosphere/land and ~1° ocean) in the context of 20th Century and RCP8.5 future climate simulations. Time averages and climatologies were computed using the last 20 years of each simulation. Given the number of global monsoons (Asian-Indian, Australian, African, South American, North American), instead of documenting each monsonal regime, we approach this poster by providing examples that highlight our main points which include 1) model validation comparing 20th Century simulations to observations, 2) model improvements due to resolution, and 3) projected climate change and how resolution affects the results.

Validation with Observations: Topography improves Results

Moderate improvements can be found in the FV0.5x1 version of CCSBM mainly due to increased resolved topography. We show figures from the JJA5 Indian/Asian and DJF Australian regimes. The west coast of India, Indo-China, and the Philippines compare better with observations in the FV0.5x1. Over Australia, it is debatable which resolution performs best, although regionally there are some improvements with higher resolution including a more defined southern extent to the monsoon. For reference, topography for FV0.5x1 and FV1x1 is shown below (right panels).

Validation with Observations: Seasonal Cycle and Intraseasonal Variability

Examples of daily precipitation climatologies are plotted for area averaged monsoons and include the “Top End” of Australia (10°-15°S/129°-137°E), the Western Amazon (0°-10°S/65°-75°W), and Ethiopia (10°-20°N/45°-55°E). All figures use a 10 day running mean. Both resolutions compare reasonably well to the TRMM satellite data with respect to seasonality. Over the “Top End” of Australia, the FV0.5x1 does a slightly better job capturing daily rainfall intensity and a noticeably better job representing intraseasonal variations in the months of January through May. This can also be seen in the western Amazon where the FV0.5x1 more closely matches observations in seasonality, intensity, and intraseasonal variations. Over the Ethiopian region, both FV1x1 and FV0.5x1 produce too much rainfall during the rainy season, although the FV0.5x1 improves the seasonality and captures the peak rainfall months.

References and Acknowledgments