Geophysical Research Abstracts
Vol. 19, EGU2017-2818, 2017
EGU General Assembly 2017

Dominant Drivers of GCMs Errors in the Simulation of South Asian Summer Monsoon

Moetasim Ashfaq
Oak Ridge National Laboratory, Knoxville, United States (mashfaq@ornl.gov)

Accurate simulation of the South Asian summer monsoon (SAM) is a longstanding unresolved problem in climate modeling science. There has not been a benchmark effort to decipher the origin of undesired yet virtually invariable unsuccessfulness of general circulation models (GCMs) over this region. This study analyzes a large ensemble of CMIP5 GCMs to demonstrate that most of the simulation errors in the summer season and their driving mechanisms are systematic and of similar nature across the GCMs, with biases in meridional differential heating playing a critical role in determining the timing of monsoon onset over land, the magnitude of seasonal precipitation distribution and the trajectories of monsoon depressions. Errors in the pre-monsoon heat low over the lower latitudes and atmospheric latent heating over the slopes of Himalayas and Karakoram Range induce significant errors in the atmospheric circulations and meridional differential heating. Lack of timely precipitation over land further exacerbates such errors by limiting local moisture recycling and latent heating aloft from convection. Most of the summer monsoon errors and their sources are reproducible in the land-atmosphere configuration of a GCM when it is configured at horizontal grid spacing comparable to the CMIP5 GCMs. While an increase in resolution overcomes many modeling challenges, coarse resolution is not necessarily the primary driver in the exhibition of errors over South Asia. These results highlight the importance of previously less well known pre-monsoon mechanisms that critically influence the strength of SAM in the GCMs and highlight the importance of land-atmosphere interactions in the development and maintenance of SAM.