

Evaluation of CMIP3 and CMIP5 Simulations of Heavy Precipitation and its Associated Physical Mechanisms over North America

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Climate model simulations from the third and fifth phases of the Coupled Model Intercomparison Project (CMIP3 and CMIP5) were used in the evaluation of heavy precipitation over North America during the period 1979-1999. The models underestimate the intensity of heavy and extreme precipitation along the Pacific Coast, southeastern United States, and southern Mexico when compared to high quality precipitation observations from the Climate Prediction Center (CPC). In the CMIP5 models, underestimations in heavy precipitation over the southeastern United States are somewhat less severe. An evaluation of the simulated atmospheric dynamics and thermodynamics associated with extreme precipitation events was also conducted using the North American Regional Reanalysis. The models were found to capture the large-scale physical mechanisms that generate extreme precipitation realistically, although they tend to overestimate the strength of the associated atmospheric circulation features in some places. There is very little difference between CMIP3 and CMIP5 in simulating the atmospheric circulation features associated with extreme events, suggesting that improvements in heavy precipitation in CMIP5 are not strongly related to the large-scale physical mechanisms associated with extreme events. Our results suggest that other climate model deficiencies, such as insufficient spatial resolution, inadequate representation of convective precipitation, and overly smoothed topography, may be more important for biases in simulated heavy precipitation than errors in the large-scale circulation during extreme events.