

Boreal Summer Monsoon Simulations in the Present Climate and Global Warming Scenario from the MRI/JMA 20-km Mesh AGCM

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The boreal summer monsoon is basically a convectively coupled phenomenon. An important question is about likely changes in monsoon convection and large-scale circulation due to global warming? Changes in the South Asian monsoon rainfall due to global warming, estimated from the AR4 climate model simulations, reveal major uncertainties due to wide variations among the models in capturing the mean monsoon rainfall and its variability. Reliable assessments of future changes in the monsoon climate require that the present monsoon climate is realistically captured by the models. In the present study, the authors have examined monsoon simulations based on time-slice experiments using the ultra high-resolution MRI-20 km mesh global model for the present-day climate and the future climate corresponding to the end of 21st century based on the A1B scenario. Several aspects of the mean boreal summer monsoon simulation are quite realistically captured by the model. Despite increases in the summer monsoon precipitation over South Asia, the change in the low-level monsoon cross-equatorial flow is found to weaken in the global warming scenario. Detailed analyses indicate that increase of moisture, in a globally warm climate, occurs at a significantly higher rate as compared to precipitation increase. Based on energy balance, it is argued that the weakening of the monsoon cross-equatorial flow in a globally warm climate can arise from stabilization of the thermally-direct monsoon Hadley circulation and a reduction in the convective activity over the Indian region.