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Maritime Continent seasonal climate biases in AMIP experiments of the CMIP5 multimodel ensemble

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The fidelity of 28 Coupled Model Intercomparison Project phase 5 (CMIP5) models in simulating mean climate over the Maritime Continent in the Atmospheric Model Intercomparison Project (AMIP) experiment is evaluated in this study. The performance of AMIP models varies greatly in reproducing seasonal mean climate and the seasonal cycle. The multi-model mean has better skill at reproducing the observed mean climate than the individual models. The spatial pattern of 850 hPa wind is better simulated than the precipitation in all four seasons. We found that model horizontal resolution is not a good indicator of model performance. Instead, model's local Maritime Continent biases are somewhat related to its biases in the local Hadley circulation and global monsoon. The comparison with coupled models in CMIP5 shows that AMIP models generally performed better than coupled models in the simulation of global monsoon and local Hadley circulation but less well at simulating the Maritime Continent annual cycle of precipitation.

To characterize model systematic biases in the AMIP runs, we performed cluster analysis on Maritime Continent annual cycle precipitation. Our analysis resulted in two distinct clusters. Cluster I models are able to capture both the winter monsoon and summer monsoon shift, but they overestimate the precipitation; especially during the JJA and SON seasons. Cluster II models simulate weaker seasonal migration than observed, and the maximum rainfall position stays closer to the equator throughout the year. The tropics-wide properties of these clusters suggest a connection between the skill of simulating global properties of the circulation and the skill of simulating the regional scale of Maritime Continent precipitation.