CCG44

CMIP5 performance on precipitation and related physical processes over tropical South America and its future projections

Yin, L.[1], Fu, R.[1], Shevliakova, E.[2,3], Dickinson, R. E.[1]
yin@utexas.edu
1. Jackson School of Geosciences, The University of Texas at Austin, Austin, TX
2. NOAA/Geophysical Fluid Dynamics Laboratory, Princeton, NJ
3. Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ

Underestimating rainfall, especially during the dry season, over Amazonia is a common problem of the Coupled Model Intercomparison Project phase 3 (CMIP3) models. Such a dry bias is an important source of uncertainty in projecting global carbon-climate feedbacks. Our evaluation of the CMIP5 historical simulations shows that some models still tend to underestimate rainfall over Amazonia. During the dry season, GFDL-ESM2M and IPSL show notably more pentads with no rain. In the dry and transition seasons, models with more realistic moisture convergence and surface evapotranspiration generally have more realistic rainfall amounts. In some models, overestimates of rainfall all associated with the adjacent tropical and eastern Pacific ITCZs, whereas in other models, too much surface net radiation and a resultant high Bowen ratio, appears to cause underestimates of rainfall. During the transition season, low pre-seasonal latent heat and high sensible flux and a weaker influence of cold air incursions contribute to the dry bias. About half the models can capture, but overestimate, the influences of teleconnection. HadGEM2-ES outperforms other models, whereas GFDL-ESM2M has the strongest dry bias presumably due to its overestimated moisture divergence induced by overestimated ITCZs in adjacent oceans and high Bowen ratio from the surface. One common way to tackle with the projection uncertainty is using multi-model ensemble (MME). However, it might cause a shifted distribution of rainfall when the majority of the models tend to have dry bias on regional scale. Our study suggests the understanding of individual model performance on related physical processes can help us to put more weights on good models. Another way is to look at the underlying distribution of precipitation and reconstruct it based on all available models using parametric statistical methods. We will compare the results with observations and discuss them for future climate change.

Keywords: Amazon precipitation, rainfall seasonality, CMIP5 models, climate variability, ET, SST indices