How well do climate models simulate precipitation?

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This study compares three different methods to evaluate the ability of Atmosphere Ocean General Circulation Models (AOGCMs) to simulate precipitation. Currently, AOGCMs are the most powerful tool to investigate the future climate but how to evaluate them is a relatively new research field. Thus, no standardized metric for defining a climate model's skill has been defined so far. The common way to proceed is to evaluate the model simulations against observations using statistical measures.

However, precipitation is highly variable on both the spatial and temporal scales. We therefore suspect that metrics representing regional features of the modelled precipitation response to climate change are more suitable to identify the good models than statistical measures defined on a global scale. Here, we compare three different ways of ranking the climate models: a) biases in a broad range of climate variables, b) only biases in global precipitation and c) regional features of modelled precipitation in areas where future changes are expected to be pronounced. Surprisingly, the multimodel mean performs only average for the feature-based ranking, while it outperforms all single models in the two bias-based rankings. In the feature-based ranking, the models performing best can be different for each region or zonal band considered and identifying them each time newly depending on the purpose may allow for more reliable projections. Further, this study reveals that many models have similar biases and that the observation datasets are often located at one end of the model range. Our results suggest that weighting the models according to their ability to simulate the present climate might lead to more reliable projections than the "one model, one vote" approach that has been favored so far.