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The Tibetan Plateau Summer Monsoon in the CMIP5 Simulations

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Temporal variability within the Tibetan Plateau summer monsoon (TPSM) is closely linked to both the East and South Asian summer monsoons over several timescales, but has received much less attention than these other systems. In this study, extensive integrations under the CMIP5 historical scenarios from 15 Coupled General Circulation Models (CGCMs) and AMIP runs from 8 Atmospheric General Circulation Models (AGCMs) are used to evaluate the performance of these GCMs. Results indicate that all GCMs are able to simulate the climate mean TPSM circulation system. However, the large bias associated with precipitation intensity and patterns remains, despite the higher resolution and inclusion of the indirect effects of sulfate aerosol that have helped to improve the skill of the models to simulate the annual cycle of precipitation in both AGCMs and CGCMs. The interannual variability of the surface heat low and the Tibetan High in most of the AGCMs resembles the observation reasonably due to the prescribed forcing fields. However, only a few models were able to reproduce the observed seesaw pattern associated with the interannual variability of the TPSM and EASM. Regarding long-term trends, most models overestimated the amplitude of the tropospheric warming and the declining trend in the surface heat low between 1979 and 2005. In addition, the observed cooling trend in the upper troposphere, and the decline of the Tibetan High, were not reproduced by most models. Therefore, there is still significant scope for improving GCM simulations of regional climate change, especially in regions near extensive mountain ranges.