Near-surface temperature biases in weather and climate models near the Southern Great Plains

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Many general circulation model (GCMs) have a warm bias in two-metre temperature (T2M) predictions over the American mid-west in summer. In order to understand the physical processes leading to this bias, we have set up the "Clouds Above the United States and Errors at the Surface" (CAUSES) project. Eleven 11 GCMs have produced simulations over this area and have produced to allow the models to be evaluated against observations from the Atmospheric Radiation Measurement (ARM) site in the Southern Great Plains (SGP). We first focus on SGP. In many models, the diurnal range of the bias is comparable to its mean, so daily-mean values of the error hides much of the details of the model behaviour. The evolution of the bias over 5 days of lead-time is studied and is shown that many models have significant growth of their bias. The T2M bias in each model is also evaluated over the whole of the US and regions of statistically significant 1) bias and 2) bias change are identified. The time when the bias is at its largest is also found. Some models have their largest bias shortly after local noon, while other have it shortly before sunrise. In the former cases, this is likely to be due to insufficient cloud and too much insolation, for the latter, it suggests that models are not cooling quickly enough at night. The magnitude and diurnal phase of the bias seen in each model at SGP, is also seen in each model over a much wider portion of the mid-west. Ultimately, the detailed understanding of the causes of the bias will help develop improved physical parametrization schemes which should help alleviate the bias.