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CAUSES: On the Role of Surface Energy Budget Errors to the Warm Surface Air Temperature Error Over the Central United States

Abstract

Many weather forecast and climate models simulate warm surface air temperature (T2m) biases over midlatitude continents. To better address this issue, a multimodel intercomparison project (CAUSES: Cloud Above the United States and Errors at the Surface) , which aims to evaluate the role of cloud, radiation, and precipitation biases in contributing to the T2m bias using short-term hindcasts from nine weather forecast and climate models during the spring and summer of 2011. Experiments analyze the relationship between these biases in the Contiguous United States (CONUS) domain and the Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Southern Great Plain (SGP) site.

This study examines the contributions of surface energy budget errors. All participating models simulate too much net shortwave and longwave fluxes (SWNET and LWNET) at the surface over the Central United States and SGP. Nevertheless, biases in the SWNET and LWNET as well as surface evaporative fraction (EF) are contributors to T2m bias. Radiation biases are largely affected by cloud simulations, while EF bias is largely affected by soil moisture modulated by seasonal accumulated precipitation and evaporation. An approximate equation based upon the surface energy budget is derived to further quantify the magnitudes of radiation and EF contributions to T2m bias. Analysis shows that a large EF underestimate is the dominant source of error in all models with a large positive temperature bias.

Keyword

Evaporative Fraction (EF)

Reference

Ma, H.-Y., et al. (2018). "CAUSES: On the Role of Surface Energy Budget Errors to the Warm Surface Air Temperature Error Over the Central United States." *Journal of Geophysical Research: Atmospheres* **123**(5): 2888-2909.