Breakout Session Report
ARM/ASR User and PI Meeting
March 16-20, 2015

Session Title: Clouds Above the United States and Errors at the Surface (CAUSES)
Session Date: Tuesday, March 17, 2015
Session Time: 7:30–9:00pm
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Description

Clouds Above the United States and Errors at the Surface (CAUSES) is a joint GASS-RGCM-ASR model intercomparison project with an observationally-based focus, which evaluates the role of clouds, radiation, and precipitation processes in contributing to the surface temperature biases in the region of the central United States. These biases are seen in several weather and climate models.

Main Discussion

The aim of the CAUSES project is to use the observations made at the ARM Climate Research Facility Southern Great Plains (SGP) site to understand the reasons behind the warm surface temperature bias seen over the mid-west in the warm season, which is present in a number of global climate models (GCM). By understanding the causes of the bias, we aim to develop better representations for relevant physical processes, and hence, better parameterizations ultimately leading to a reduction in the surface temperature bias.

The past 12 months have been the pilot phase of the CAUSES project. This is now complete and results from it have been presented. As a proof of concept, two GCMs were run in weather-forecasting mode and all model variables were output for every time-step for the column over the SGP site. Results from a new analysis method, which uses GCM data and ARM observations, were presented. The method focuses, not on the surface temperature error, but on the surface temperature error growth, on a time-step by time-step basis and performs a series of increasingly detailed sub-period averages to identify when the errors grows the fastest. The method looks at the error growth when the surface energy balance is well captured and when it is not, and for those times when it is not, it determines the type of cloud responsible for the error. It then further determines whether the clouds are wrong or whether the issue is to do with cloud cover or condensate amount.

Key Findings

Both models that have been looked at so far (HadGEM3 and CAM5) exhibit a strong diurnal cycle in their surface temperature bias. Both models have issues with the representation of deep cloud, likely to be associated with deep convective system. Interactions with the land-surface also appear to be important and cancellation of errors between poor representation of physical processes in the land-surface and atmospheric parameterizations could lead to a worse bias overall if only some of the parameterizations are improved. This suggests that a continued collaboration between scientists with expertise in atmospheric and land-surface expertise would be beneficial.

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Decisions

Hourly maps of surface precipitation over a wide area around the SGP have been requested from participating models and it was decided that this data, along with some observations, should be used to investigate the contribution of the clouds and precipitation at SGP that could be associated with organized propagating systems rather than isolated convection. This would mean an investigation into not just the amount and accumulation of rainfall, but the characteristics of the convection from which it originates.

Issues

None.

Needs

None.

Future Plans

Aim for institutes participating in the CAUSES project to submit their model data over the course of the spring and summer 2015. Analyze some of these data and present results at the next ASR meeting in the fall of 2015. Analyze the rest of the data from all modeling centers, and hence provide feedback to the community, using a consistent analysis method, what the source of the surface temperature error growth is in each model.

Action Items

Continue to develop regime-average techniques to interrogate the model and observational data in novel ways. To extend the regime-average techniques used during the short 5-day weather forecast simulation for use in evaluating the longer seasonal and climate simulations.