Advancing Models and Evaluation of Cumulus, Climate and Aerosol Interactions Final Report

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This project was successfully able to meet its' goals, but faced some serious challenges due to personnel issues. Nonetheless, it was largely successful.

The Project Objectives were as follows:

1. Develop a unified representation of stratifom and cumulus cloud microphysics for NCAR/DOE global community models.

2. Examine the effects of aerosols on clouds and their impact on precipitation in stratiform and cumulus clouds. We will also explore the effects of clouds and precipitation on aerosols.

3. Test these new formulations using advanced evaluation techniques and observations and release

The basic goals have been met. With our partners we were able to develop a unified representation of cloud microphysics for cumulus and stratiform clouds. This parameterization was developed by our collaborators (Song and Zhang), and we have been able to integrate it into the Community Earth System Model (CESM). The project took some significant rewriting of the code. This accomplishes our first objective.

We then used this code with a series of Single Column Atmosphere Model (SCAM) cases to examine the effects of aerosols on clouds. This necessitated developing a series of SCAM IOP cases, which we intend to release to the community, along with an updated version of SCAM, in the next release of CESM2. A paper on this is currently in review to J. Geophysical Research. This largely accomplishes our second objective.

We got some work done on our third objective, with some new forecast model scripts. This was not completed, but we will pick up the project next year for related purposes. We will be able to partially complete this objective by releasing the updated convective microphysics code.

The project currently has one paper that is in review (Su et al, ingle Column Simulations of Cloud-Aerosol-Precipitation Interactions in Convective Clouds. J. Geophys. Res.). The work contributed to several other papers (e.g., Song, Xiaoliang, Guang J. Zhang, and J-LF Li. "Evaluation of microphysics parameterization for convective clouds in the NCAR Community Atmosphere Model CAM5." *Journal of Climate* 25.24 (2012): 8568-8590.).

Furthermore, we expect several more publications on this code once the code is integrated with CESM2. This will happen in the next few months, and the code is to be released (SCAM and convective microphysics code) in July 2016.