

PROCESS-BASED AND OBJECT-BASED INVESTIGATION OF BIAS IN THE SIMULATIONS OF THE PHYSICAL CLIMATE

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Progress Report: November 24, 2008

FY08 PROGRESS:

FY08 was the initial year of this new project. The focus of the work is to pursue new methods of diagnosing climate models based on the definition of like “objects” in both observations and models. The proposed strategy is based on idea that while models might not produce features, for example hurricanes, on an event by event basis, there are similar features in both observations and models. It is asserted that there are underlying physical principles that lead to the organization of the objects in the model. The object could be related to something as direct as topography, for example, a rain shadow. An object could also be related to a complex interaction between dynamical scales and physical processes. The proposal will, ultimately, focus on the [cloud-object data set](#) from the [Clouds and the Earth Radiant Energy System](#) (CERES) Instrument. Basic information for this proposal can be obtained [here](#).

The initial research followed from studies of precipitation regimes initiated by the PI, Rood. Within this project the work was performed primarily by graduate student Cedric Drui. This contributed to one publication [Bala et al. \(2008\)](#). Mr. Drui decided to leave school. A new graduate student, Soner Yorgun, was recruited and is fully supported by this grant. Mr. Yorgun will be continuing this research. In the short term we will investigate topographically forced precipitation. This line of work is scientifically interesting from both a numerical and geophysical point of view. Directly relevant to this proposal, this research will allow the development of object definition and analysis strategies with an intuitively accessible problem. Also, the data sets to be used in this study are the same as those for the cloud-object work. Initial studies will focus on both the dynamical formulation of the model and the impact of resolution.

[Derek Posselt](#) has been hired as an Assistant Research Scientist. Within the University of Michigan protocol, Dr. Posselt has been designated Co-PI. He is working with both the PI and Mr. Yorgun to define both the short-term and long-term research plan. Dr. Posselt has a background in statistical-physical approaches to model analysis. Three manuscripts in preparation, listed below, are being supported by this proposal.

Jerry Potter retired from the [Program for Climate Diagnosis and Intercomparison](#). Dr. Potter is now at the University of California at Davis. Originally, Dr. Potter was an unfunded co-investigator; the funding profile was amended to provide support for Dr Potter. Dr. Potter has acquired and continues to acquire model simulations at multiple resolutions for this proposal. His research will focus on the model representation of cloud organization during the 1997-98 El Nino. He also has been involved in the testing of the [workflow tool](#) developed at NASA Goddard to allow NASA’s [GEOS-5 model](#) to be configured and run on NASA computers. These tests have shown that the model can be run and output can be accessed. Performance and the ability to configure the code require more development. The future development path is being discussed with MAP managers.

The rest of the team continues to function in the early planning phase of the proposal. Notably, Bill Collins, who is now at University of California at Berkeley, has obtained a graduate student to work on this proposal.

FY09 PLAN

In the next year the research for this effort will be started in earnest; it will move past the initial and planning phases. Specifically, we will pursue the precipitation research (Yorgan, Posselt and Rood). This will develop tools and techniques for the longer-term cloud-object proposal. We anticipate the generation of a research paper focused on a novel analysis of the North American monsoon. Through different funds, Rood has started the development of a computational environment that will support this research. Design and implementation of this cyberinfrastructure will occur during the first half of 2009. Potter will continue to work with the workflow tool. The team will acquire the cloud-object data and will develop techniques to extract comparable objects from model simulations at multiple resolutions. The team will identify additional data sets that can supplement and complement the cloud-object data sets. Initial tasks will focus on an inventory of the sensitivity of model representation of the organization of tropical clouds as a function of resolution and physical parameterization.

Publications & Presentations

[G. Bala, R. B. Rood, D. Bader, A. Mirin, D. Ivanova, and Cedric Drui, 2008](#): Simulated Climate near Steep Topography: Sensitivity to Dynamical Methods for Atmospheric Transport, *Geophys. Res. Lett.*, **35**, L14807, doi:10.1029/2008GL033204.

Manuscripts in preparation

Posselt, D. J., T. S. L'Ecuyer, S. Lang, and W.-K. Tao: Objective Assessment of Cloud Resolving Model Sensitivity to Changes in Cloud Microphysical Parameters, In Preparation.

Posselt, D. J., T. S. L'Ecuyer, S. Saleeby, and W.-K. Tao: Object-Based Evaluation of Single- and Double-Moment Bulk Microphysics Schemes in a Cloud Resolving Model using TRMM Observations, In Preparation.

Posselt, D. J., and T. Vukicevic: Nonlinear Characterization of Model Physics Uncertainty and Implications for Ensemble-Based Prediction, In Preparation.

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