Developing the Large-Scale Forcing Dataset for AMIE-Gan

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The large-scale forcing fields (e.g., vertical velocity and horizontal advective tendencies) are required to run single-column models, cloud-resolving models, and large-eddy simulations, which are the key modeling frameworks widely used to link field data to climate model developments. In this study, we use an advanced objective analysis approach to derive the required forcing data for the ARM MJO Investigation Experiment (AMIE) on Gan Island in the Maldives in support of its cloud modeling studies. AMIE-Gan is the latest ARM major field campaign conducted during the period October 2011 to March 2012 in conjunction with the Dynamics of the Madden-Julian Oscillation (DYNAMO) and Cooperative Indian Ocean experiment on intraseasonal variability in the Year 2011 (CINDY2011) campaigns. The goal of AMIE-Gan is to collect necessary data for studies of the initiation, propagation, and evolution of MJO and the associated convective clouds.

In this study, we use the objectve constrained variational analysis method. A unique feature of this approach is to use domain-averaged surface and top-of-the atmosphere (TOA) observations (e.g., precipitation and radiative and turbulent fluxes) as constraints to adjust atmospheric state variables by the smallest possible amount to conserve column-integrated mass, moisture, and static energy. By doing so, the final analysis data is dynamically and thermodynamically consistent. Due to the lack of a sounding array, the AMIE-Gan forcing data is derived from the ECMWF operational analysis but is constrained with the field campaign surface and TOA observations, particularly with the ground-based radar retrieved precipitations. Uncertainties in these surface observations and their impacts on the derived forcing fields are discussed. The characteristics of the large-scale forcing structures for a selected MJO event observed during the campaign are analyzed. More details about this study will be presented in the meeting.