# Understanding the Evolution of MJO Precipitation Structures Using Cloud Models with Radar Validation

**Background:**

The Dynamics of the MJO (DYNAMO) field campaign (Oct. 2011 – March 2012) was conducted in the central Indian Ocean to study MJO convective processes. This is a case study of the November MJO event using three different cloud-resolving models (i.e., GCE, SAM, and WRF) compared with three different radar observations (SPol, C-band, and the TRMM/PR) using radar-site-specific large-scale forcing (i.e., the Gan site for SPol, the Revelle site for C-band, and the NSA site for TRMM).

**Significance:**

Precipitation structures are closely related to diabatic heating and the moisture budget, which are the key processes for MJO propagation. This study takes advantage of the rich datasets produced by multiple radar observations and matching large-scale forcing during DYNAMO and uses the observed subtle differences in precipitation structures to perform more stringent model comparisons and validation.

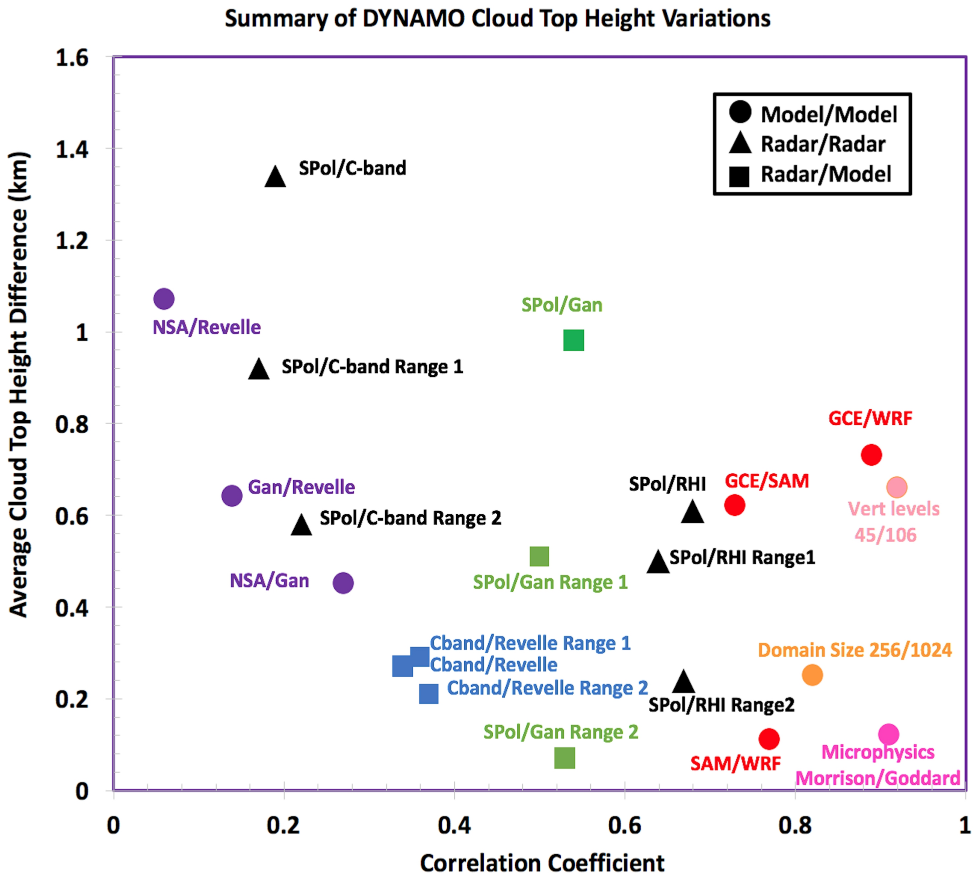
**Analysis:**

Precipitation structures are represented by the distributions of 0-dBZ echo top heights in the vertical and the contiguous areas of 17-dBZ radar reflectivity in the horizontal. Convective/stratiform separations/processes are also studied.

**Findings:**

Temporal variations of MJO precipitation features are well correlated in both horizontal and vertical variations. The Goddard Cumulus Ensemble (GCE) model is able to capture subtle differences observed by different radars. This study also identifies a common deficiency in CRMs wherein they underestimate echo-top heights for the strongest convection within large, organized precipitation features.

Li, X., Janiga, M. A., Wang, S., Tao, W.-K., Rowe, A., Xu, W., et al (2018). Evolution of precipitation structure during the November DYNAMO MJO event: Cloud-resolving model inter-comparison and cross validation using radar observations. *J. Geophys. Res.*, 123. https://doi.org/10.1002/2017JD027775




Cloud echo-top height variations during the DYNAMO November MJO event using three different radar observations and model simulations. The x-axis is correlation coefficients of the median cloud top height time series; the y-axis is their mean differences. Each data point represents a pair of simulations/observations. For observations, ranges 1 and 2 represent sub-sampling of the original data to identify errors in radar data interpolation. Warm-colored dots are model simulations with the same large-scale forcing, whereas purple dots are for different forcing.