The structure and organization of clouds under suppressed conditions observed by S-PolKa during DYNAMO

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The goal of the Dynamics of the MJO (DYNAMO) experiment (Oct 2011 – March 2012) was to improve simulation and prediction of the Madden-Julian Oscillation (MJO) by understanding the coupling between convection and the large-scale environment over the Indian Ocean.

**Goals of S-band:**
- Observe the convective population and transition from shallow to deep
- Provide details on airflow within the storm
- Provide highly resolved hydrometers information

**1. S-PolKa in DYNAMO**

- S-Pol sensitive enough to detect non-precipitating clouds (minimum detectable reflectivity of roughly -20 dBZ at 10 km range) so can be used to describe the organization and structure of boundary layer clouds during the build up phase

**2. Bragg scattering**

- Stratiﬁed layers with high refractive index gradients at their interfaces
- Moisture gradient layers (as in Devin et al. 2013)
- Low Z, near-zero ZDR (noisy or turbulence)
- Also observe non-precipitating shallow cumulus clouds

**3. Horizontal convective boundary rolls**

- Three active phases separated by periods of suppressed conditions
  - Shallower echo during suppressed periods, with gradual transitions leading up to Oct active period (more variable in Nov)
  - Less aggregates during suppressed phases (less stratiform, lack of MCSs)
  - Infrequent, relatively consistent presence of graupel

- Horizontal convective rolls are a common form of boundary layer convection, appearing as counter-rotating vortices about a horizontally oriented access where the clouds form atop the updraft regions of the rolls. Development and maintenance of these rolls depend on a combination of surface heat fluxes and low-level wind speed and shear (e.g., LeMone 1973).

**4. Cloud lines**

- On 6 Oct 2011, convective initiation was focused on long coherent lines oriented parallel to the wind during the late afternoon.

**5. Cold pools**

- On 5 Oct 2011, horizontal convective boundary rolls were observed in the radar’s northern domain. Stratus of low Z (< 10 dBZ) to the NNW of the radar were oriented parallel to the wind (from the northwest).

- On 5 Oct 2013, dry conditions prevailed with a few shallow cells initiating along the downwind edge of cold pool boundaries.

- On 9 Oct 2013, convective initiation at intersection of cold pool boundaries (more numerous than previous day, but echo top still < 6 km).

- On 10 Oct 2013, convection again formed along intersecting boundaries (more numerous, persistent, and deeper than previous days).

**6. Work in progress**

- Categorize all suppressed time periods by boundary layer features (cloud lines vs. cold pools, for example), relate to environmental conditions, and describe nature of convection, if it initiates

- Use KAZR observations to help fill in details for initial precipitation formation (e.g., with mantle echoes observed by S-Pol)

- Describe characteristics of the cold pools including radius, duration, polarimetric signatures, convective initiation and relate to observations of cold pools passing over ARM site on Gan (work with Zhe Feng/PNNL modeling component)

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