Synoptic and Cloud Regimes Over the Amazon Basin: Perspectives From the GoAmazon2014/5 Campaign

WANG, D.; **Giangrande, S. E.**; **Mechem, D. B.**; **Machado, L.**; **Biscaro, T.**; **Elsaesser, G.**

The primary source of uncertainty in global climate model (GCM) predictions of possible climate change is in the representation of clouds, cloud processes and associated feedbacks. As home to the largest tropical rainforest on the planet, the Amazon basin experiences complex and seasonal cloud conditions that promote local-scale cloud and precipitation changes, as well as larger-scale circulation feedbacks. The ongoing inability of GCMs to represent cloud conditions over this expansive tropical area recently motivated the 2-year US Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Observations and Modeling of the Green Ocean Amazon (GoAmazon2014/5) campaign. As part of this effort, ARM deployed its Mobile Facility (AMF) to the west of Manaus, Brazil in the central Amazon. The facility was equipped to continuously capture thermodynamic state, aerosol, cloud and precipitation properties in this unique location.

To isolate the potential controls on the cloud and precipitation conditions experienced over this region, a cluster analysis is performed on the routine radiosonde launches collected during the campaign. A Gaussian Mixture Model (GMM) technique applied to morning (12 UTC) launches during precipitation-free conditions is proposed to identify the primary thermodynamic regimes that are associated with the cloud and precipitation observations over Manaus. These thermodynamic states and spatiotemporal continuity are discussed in the context of traditional forms of Amazon 'wet' and 'dry' season definitions, including their relationships to composite larger-scale synoptic patterns and regional GCM-scale continuous forcing conditions. Multisensor ARM column cloud properties are projected into these states to consider the propensity for each state to promote different cloud types, congestus to deeper convection, and changes in bulk precipitation properties (rainfall rates, drop size distributions) therein. Emphasis is given to those states and conditions associated with organized convection

(mesoscale convective systems), including those that initiate local to the site or propagate into the region.

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