

Possible signs of convective self-aggregation in satellite and in-situ observations

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In this study, possible observational evidence for convective self-aggregation is sought in the infrared imagery from the Meteosat-7 satellite and the sounding-array measurements from Cooperative Indian Ocean experiment on Intraseasonal variability in the Year of 2011 (CINDY2011)/Dynamics of the Madden-Julian Oscillation (MJO) (DYNAMO)/Atmospheric Radiation Measurements (ARM) MJO Investigation Experiment (AMIE). A new observational measure, or the morphological index for convective self-aggregation (MICA), is developed to objectively detect the signs of self-aggregation on the basis of a simple morphological diagnosis of convective clouds in the satellite imagery. The precipitation peaks during the observational period are first classified by MICA into aggregation events and non-aggregation events. The large-scale thermodynamics implied from the sounding-array data are then examined with focus on the difference between the two classes. The composite time series show that a significant drying and an enhancement of radiative cooling proceed over 12-24 hours as precipitation intensifies in the aggregation events. These features are absent in the non-aggregation events although precipitation is virtually equal between the two classes before and during the peak. The moisture budget balance is maintained in very different manners between the two adjacent sounding arrays for the aggregation events, in contrast to the non-aggregation events which lack such apparent asymmetry. These results are consistent with the previous findings on convective self-aggregation, although the present work finds the self-aggregation features proceed on a shorter time scale than typically argued in the literature.

Keywords: Tropical meteorology, Convective self-aggregation