Tropical convective systems life cycle characteristics from geostationary satellite and precipitating estimates derived from TRMM and ground weather radar observations over the South American region

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Abstract

In the tropics, most of the rainfall comes in the form of individual storm events embedded in
the synoptic circulations (e.g., monsoons). Understanding the rainfall and its variability hence
requires to document these highly contributing tropical convective systems (MCS). Our knowledge of the MCS life cycle, from a physical point of view mainly arises from individual observational campaigns heavily based on ground radar observations. While this large part of
observations enabled the creation of conceptual models of MCS life cycle, it nevertheless does not reach any statistically significant integrated perspective yet. To overcome this limitation, a composite technique that will serve as a Day 1 algorithm for the Megha-Tropiques
mission is considered in this study. This method is based on a collocation in space and time of
the level-2 rainfall estimates (BRAIN) derived from the TMI radiometer onboard TRMM with
the cloud systems identified by a new MCS tracking algorithm called TOOCAN and based on
a 3-dimensional segmentation (image + time) of the geostationary IR imagery. To complete this study, a similar method is also developed collocating the cloud systems with the precipitating features derived from the ground weather radar which has been deployed during the CHUVA campaign over several Brazilian regions from 2010 up to now.

A comparison of the MCSs life cycle is then performed for the 2011-2012 summer season over specific South American regions. On the whole region of study, the results show that

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temporal evolution of the cold cloud shield associated to MCSs describes a symmetry between the growth and the decay phases. It is also shown that the parameters of the conceptual model of MCSs are strongly correlated, reducing thereby the problem to a single degree of freedom. From the microwave observations, the evolutions of the precipitating properties associated to MCSs indicate that the life cycle of these systems can be described by three phases: initiation, mature and dissipation. This pattern is robust across the entire South American region and the scale factors of this idealized model indicate complex regional specificities.

To complete this study, the observations of the ground weather radar deployed during the CHUVA campaign in Sao Jose Dos Campos between November 2011 – March 2012 will be used in order to validate the precipitating composite.