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A new methodology for the detection and tracking of mesoscale convective systems in the tropics using geostationary infrared data

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In the tropics most of the rainfall comes in the form of individual storm events embedded in the synoptic circulations (e.g., monsoons). In the Sahel, up to 80% of the annual rain yield is due to intense organized convective systems. Understanding the rainfall and its variability hence requires to document these highly contributing storms. These cloud systems are spanning a wide range of spatial scale and degree of organization. But whatever their degrees of organization, Convective cloud systems are composed of a convective core characterized by heavy rainfall at typical scale of 10-100 km associated to a stratiform anvil with lighter precipitation as well as non-precipitating cirriform cloudiness (100-1000 km). The advent of geostationary infrared data allowed to improve the analysis of the morphology of tropical convective systems. More than two decades of such observations yield to a large corpus of information on the degree of organization of convection, on the occurrence of this type of system, on the evolution of the cold cloud shield life cycle, etc… all over the inter-tropical belt. However, automatic tracking algorithms previously developed to detect and track convective systems suffer from limitations in depicting coherent convective systems life cycles. In particular, these algorithms give rise to split and merge artefacts affecting the characterization of the convective systems life cycle. To overcome these issues, a new algorithm called TOOCAN (Tracking Of Organized Convection through a 3 dimensional segmentatioN) has been developed and works in a time sequence of IR images to identify and track MCS in a single step. This algorithm is based on an iterative process of 3D segmentation (2D+time) of the IR imagery. The objective of the new tracking algorithm is to associate the convective core of a MCS to its anvil cloud in the spatiotemporal domain. The main idea relies on the fragmentation of High cold clouds in several convective systems in the spatiotemporal domain. The technique is applied on the IR images of geostationary satellites for the summer 2009 over the West African, Indian and South American regions. The result of the new tracking method is then compared both statistically and on some individual case studies to previous techniques. The statistics for the season (life cycle, propagation speed, occurrence, etc…) will be shown and analyzed for the three regions of interest. The emphasis will be put on the improvements brought up by the use of the 3D clustering methodology in the identification of individual systems all along their life cycle whatever the region of insterest.