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Summertime Climatology of Mesoscale Convective Systems over West Africa from 24-years of METEOSAT observations

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The West African monsoon hydrological cycle and heat budget strongly depends on the Mesoscale Convective Systems (MCS). The analysis of the morphology of these tropical convective systems has received much attention in the past decades mainly thanks to the advent of geostationary infrared data. A number of definitions have been proposed yielding to a complex corpus of knowledge. In this context, a unique climatology of Mesoscale Convective Systems has been computed from the Meteosat IR observations, over tropical Africa, during the summer monsoon from 1983 to 2006 based on a simple definition of the MCS.

Using a brightness temperature threshold at 233°K, cold cloud clusters are detected every 30 minutes. Then, an overlap technique is used on these segmented images to determine the life cycles of all the clusters. This tracking algorithm computes morphological parameters of the cloud clusters like duration, velocity, size of the cold cloud shield, local time of genesis, distribution of brightness temperature, cumulated area ... A simple classification of the clusters is then developed based on the duration of the systems and their propagation speed. Four classes of Convective Systems are formed using threshold selected on a physical basis of 9 hour and 10 m/s. The climatological features of these 4 classes of systems are shown. In order to investigate the relationship between the convective systems variability and the seasonal rainfall, MCS distributions are then related to the rainfall thanks to the use of the Global Precipitation Climatology Project estimates. The analysis reveals that a linear combination of the occurrence of each class of systems can explain a significant part of the rainfall interannual variability over most of West Africa.