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Statistical analysis of the time and space characteristic scales for large precipitating systems in the equatorial, tropical, sahelian and mid-latitude regions.

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Precipitation plays a key role in the management of sustainable water resources and flood risk analyses. Changes in rainfall will be a critical factor determining the overall impact of climate change. We propose to analyse long series (10 years) of daily precipitation at different regions.
We present the Fourier densities energy spectra and morphological spectra (i.e. probability repartition functions of the duration and the horizontal scale) of large precipitating systems. Satellite data from the Global precipitation climatology project (GPCP) and local pluviometers long time series in Senegal and France are used and compared in this work.
For mid-latitude and Sahelian regions (North of 12°N), the morphological spectra are close to exponential decreasing distribution. This fact allows to define two characteristic scales (duration and space extension) for the precipitating region embedded into the large meso-scale convective system (MCS).
For tropical and equatorial regions (South of 12°N) the morphological spectra are close to a Levy-stable distribution (power law decrease) which does not allow to define a characteristic scale (scaling range).
When the time and space characteristic scales are defined, a "statistical velocity" of precipitating MCS can be defined, and compared to observed zonal advection. Maps of the characteristic scales and Levy-stable exponent over West Africa and south Europe are presented.
The 12° latitude transition between exponential and Levy-stable behaviors of precipitating MCS is compared with the result of ECMWF ERA-Interim reanalysis for the same period. This morphological sharp transition could be used to test the different parameterizations of deep convection in forecast models.