



On the relation between critical point and catchment organization

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In a previous work (Di Domenico et al., 2007), we have demonstrated the possibility to capture critical behaviour in soil moisture spatio-temporal dynamics on the basis of concepts of the Percolation Theory such as cluster size, percolation probability, and occupation probability.

Critical point denotes a sharp change in the phase transition of soil moisture, typical of its seasonal time dynamics, when changing from spatially random to spatially connected appearances as conditions become wetter.

The feeling that the critical probability is an intrinsic characteristic of a catchment is corroborated by the insensitivity of the value to renormalization (rescaling), as well as to model parameterization.

We have processed daily soil moisture data provided by the hydrological model TOPMODEL-based land-surface-atmosphere transfer scheme (TOPLATS) on the Red and Arkansas basins in the south-central United States (Crow and Wood, 2002), by choosing a quantity of sub-basins with areas ranging from few thousand to tens thousand km² located in different parts of the study area.

Since we have had the feeling that critical point of soil moisture dynamics can be seen as an indicator of catchment organization, following that one of river network, we have evaluated the interplay between critical probability and geomorphologic indices.

We found out that critical point tends to be lower for basins with more organized river networks, as evaluated by means of geomorphologic indices, allowing to couple river network morphology and soil moisture spatial patterns.