



Impact of pattern formation and intermittent precipitations on the stability of vegetation in semi-arid regions

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Around 6000 BP, Sahara had a transition from vegetated and wet conditions to non-vegetated dry conditions. This transition was due to a weakening in the Monsoon circulation and so a precipitation diminution. But, what is the type of the transition? At large scale, it seems to be a positive feedback between vegetation and precipitation. This feedback creates a so-called fold bifurcation from a fully vegetated state to a dry state. In this kind of bifurcation, the transition between the two states is very abrupt. However, two types of heterogeneity could modify the nature of this transition: 1) spatial patterns formation; 2) precipitation intermittency.

If we are looking at the vegetation in semi-arid region at small scale, spatial patterns can appear. Various small scale vegetation models, which take into account small-scale feedback are able to reproduce such patterns. The existence of these patterns allow for the presence of vegetation under lower precipitation regime and could smooth the transition between and fully vegetated state and a dry state.

The intermittent character of precipitation is also expected to increase the biomass under scarce precipitation, and currently this regime is modeled in spatially explicit vegetation models by Poisson process. However, intermittency can be generated with dynamical systems close to chaotic transition. Here, we discuss the interest of using different forms of intermittency for forcing spatially explicit vegetation models, and explore the consequences on the bifurcation structure of these models.