



Contribution ID: 44

Type: **not specified**

Early indicators of abrupt desertification transitions

Wednesday, 9 December 2015 18:00 (30 minutes)

Regime shifts in ecosystems can imply relevant economic and social effects. This is especially true when they involve abrupt transitions occurring on a relatively short timescale [1-2]. A special case of regime shift is given by desertification transitions of semi-arid ecosystems which can be strongly affected by climatic or anthropogenic factors [1-3]. A crucial issue in this field concerns the identification of early and reliable transition indicators, providing not only an estimate of the desertification risk, but also a tool to monitor the effectiveness of actions devoted to contrast it [1]. To this purpose, several new transition indicators have been proposed [2,3]. In particular, at increasing values of the mortality rate (control parameter of the transition) very early indicators have been recently identified in the case of continuous or nearly continuous transitions (where the order parameter of the transition is the fraction of vegetation covered surface). These new early indicators are associated with a change in the skewness sign of the fluctuation distribution of the size of both the biggest clusters: the vegetation covered and the non-vegetated one [3]. On the other hand, numerical simulations based on a stochastic cellular automaton model [2,3] showed that several physical and ecological parameters, like in particular the colonization rate and the aridity parameter, can affect the character of the transition: from continuous to abrupt or vice versa [3,4]. Here we discuss the possibility of extending the new indicators to the case of abrupt transitions.

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Session Classification: Session 2