



Maximum Entropy Production, Optimality and Pattern Formation in semiarid Vegetation

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Feedbacks between water use, biomass and infiltration capacity in arid ecosystems have been shown to lead to the spontaneous formation of vegetation patterns in a simple model (Klausmeier (1999), *Science* 284: 1826-1828). Abrupt transitions between a homogeneous vegetation state, a patterned state and a bare soil state have been reported for varying rainfall rates in this and similar models. In the present study, we investigate the question what causes the formation of the patterns in general terms and how the transition points could be predicted a priori. Under conditions, where both the homogeneous and patterned states are stable, we find that time-averaged transpiration, biomass and entropy production rates of the patterned state exceeds those of the equivalent homogeneous state. We discuss the implications of this finding for the parameterisation of sub-grid variability and point to ways of predicting self-organised behaviour based on optimality principles and the hypothesis of Maximum Entropy Production (MEP).