

## ***Interactive comment on “Background albedo dynamics improve simulated precipitation variability in the Sahel region” by F. S. E. Vamborg et al.***

### **Anonymous Referee #1**

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Referee Report on Vamborg et al.: ‘Background albedo dynamics improve simulated precipitation variability in the Sahel region’

In their ms ‘Background albedo dynamics improve simulated precipitation variability in the Sahel region’, Vamborg et al. test the hypothesis that a higher degree of interactive coupling between atmospheric and land surface processes would deliver more realistic characteristics of precipitation variability in the Sahel region. By forcing the state-of-the-art coupled atmosphere-vegetation model ECHAM5-JSBACH with observed SST they can derive a positive result indeed. While the coupling per se would deliver a larger and hence more realistic precipitation variability, only after the addition of a dynamic background albedo, sufficient memory can be observed in the modeled precipitation

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time series.

The ms is well-written and delivers important insights in the potential causes of natural variability in the Earth system. Hereby the ms not only adds an important detail of knowledge on that complex system, but it discusses the results also in terms of more general concepts that are crucial for Earth system analysis: the relevance of coupling, interaction of time scales and memory effects. Hence the ms’s subject and results clearly qualify for publication in ESD.

I have no major objections, and only one general question that the authors may want to tackle a bit more carefully: to what extent can they rule out the possibility that external forcings not represented in the model were responsible for the observed phenomena? While they briefly discuss the potential role of an elevated carbon dioxide concentration, other forcings are completely neglected in the discussion – e.g. what about potential effects of a massive de-sulfurization policy in Europe in the 1980s that could have had an influence on the precip patterns – a hypothesis that was at least discussed for some time? Is this represented in the model set-up as part of the counterfactual scenarios? Would it matter at all? What are the societal implications of these possibilities and what of the hypotheses the authors defend? If the authors were right, the draught of the 80s (with dramatic societal consequences) were simply an expression of natural variability – but why was then the draught such a societal surprise at that time? Simply because society had forgotten about previous events? While the authors make an excellent job in substantiating their hypothesis, they stay a bit too silent regarding these potential societal implications of their findings, given ESD’s standards. At least one further §of interpretation would be in order along those lines.

In addition, the following changes might help to make the ms more accessible for a wider audience (although not absolutely necessary):

1. For the non-expert in vegetation dynamics, an influence diagram might be helpful, also including the crucial time scales of the relevant pools.

2. The introduction should clearly express the causal relation between vegetation and albedo dynamics. Presently, the wider audience might become confused.

3. p597, l14: ‘..range from’ – and then only 2 items are listed; at least a 3rd one would be in order.

4. p598, l4-6: It is not clear, which scenarios are compared. The unclear formulation allows for a multitude of interpretations. The most likely one seems to be that within a coupled atmosphere-vegetation set-up, introducing further couplings within the vegetation module would lead to intensified rainfall.

5. p604: The authors do not mention the fact (potentially not known to a certain fraction of readers) that the autocorrelation and the power spectrum are analytically related via a Fourier transformation. In that sense some of their subsequent statements might be redundant. Please consider making these facts transparent.

Typos (please use a spell-checker next time!!): 1. p598, l1: ‘furher’-> ‘further’

2. p613, l18: ‘wheather’-> ‘whether’

Otherwise congratulations on a very nice result and ms!

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Interactive comment on Earth Syst. Dynam. Discuss., 4, 595, 2013.