

## ***Interactive comment on “The impact of Sahara desertification on Arctic cooling during the Holocene” by F. J. Davies et al.***

**Anonymous Referee #1**

Received and published: 5 May 2014

The authors present a theoretical study in which they explore the impact of the expansion of the Sahara on the cooling of the Arctic at the end of the African Humid Period. They use a model to perform a number of sensitivity experiments to isolate the effects. The set-up of experiments is suitable for this exercise. However, I have some doubts whether the model used is really suited to address the problem in question.

As the authors explain themselves, a major weakness of their model is the assumption of constant, present-day pattern of cloudiness. The authors try to give an estimate of the consequences of this assumption on their results by modifying cloudiness over the Sahara only. They argue in terms of changes in albedo and near-surface temperature in this region. But that is only a small part of the problem. What about changes in near-surface heat fluxes, moist static energy, precipitation and the atmospheric energy-cycle

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in general? Does the model allow for changes in precipitation without any change in cloud cover? This would imply decoupling of the atmospheric radiation budget and the atmospheric energy cycle. Hence, I doubt that the experiments presented allow for any sensible conclusions regarding changes in the global energy cycle – unless the author can convincingly demonstrate that moist thermodynamics is not important in this case.

Regarding style, the paper reads a bit technical. Data and other model results are considered rather uncritically. For example, Jolly et al., 1998 did not claim that the Sahara was covered by grass and shrubs. They suggested that vegetation migrated perhaps as far north as 23 °N. In the same direction, comparison of the simulated extent of Saharan greening with results of another coarse-resolution model (p 1659 | 20 – 25) to conclude that the model over- or underestimated Saharan greening is not very reasonable.

Minor comments:

The term “desertification” is used in relation to anthropogenic overexploitation of marginal land. Using “aridification” or just “expansion of the Sahara” would be less confusing.

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Interactive comment on Clim. Past Discuss., 10, 1653, 2014.

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