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Interactive comment on "Marine sediment records as indicator for the changes in Holocene Saharan landscape: simulating the dust cycle" *by* S. Egerer et al.

Anonymous Referee #2

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General comments:

The paper submitted to CP quantitatively examines the relative importance of different surface cover characteristics to dust emission in the Sahara. This is achieved by modeling dust emission fluxes in two time periods. The importance of the paper is that it separates two surface characteristics that are known to control dust emission (lakes and vegetation) and also separates the control of (estimated) atmospheric conditions. According to the model used in this paper, increasing both the area covered by lakes and the vegetation fraction leads to dramatic decrease in dust emission and deposition fluxes. In this sense, the findings are very relevant to studies that model paleo-climate.

Yet, the paper needs to better address and explain the model assumptions and the validation dataset. A more in-depth discussion is needed (errors of the model, comparison with previous studies, etc.). Also, the paper needs to be re-arranged, as currently methods, results, discussion and conclusions are partly mixed.

Specific comments:

Model:

The authors should give more details on the nature of the dust emission process that is modeled, and on the specific dust sources that the model uses (these issues are only briefly mentioned in section 2.1). For example, does the model assumes preferential geomorphic sources or uses some grain size criteria to determine from where the dust will be emitted? Does the model assume that sandblasting is the major/only active dust emission process?

The model assumes a uniform vegetation fraction at 6k over large areas in the Sahara (Fig. 1, upper right panel). Obviously, this is not realistic, as the Sahara is composed of different geologic, geomorphologic and soil units. Although it is clear that the authors don't have enough information to produce a more detailed map, they should discuss the potential effect of variable vegetation fraction on their results. Using a uniform vegetation cover might partly explain why their modeled dust fluxes differ from calculated ones.

Validation dataset:

The authors should describe in more detail the validation dataset that they are using (Table 4). How the fluxes where calculated? Are all fluxes comparable (i.e., carbonate was dissolved or not?) For example, McGee et al. (2013) used grain size end member modeling to separate different sediment populations and calculated the dust flux only on the identified eolian end member. Was this procedure done for all other data?

Discussion:

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In the current paper the discussion is relatively limited, and simply repeat sentences that appear in the results. Thus, the section “discussion and conclusions” seems more like a conclusions section. On the other hand, some important discussion sentences are scattered in the results section. I suggest writing a separate discussion section by gathering the discussion sentences that appear in the results and discuss in detail the findings of the study. For example, what are the reasons that the modeling approach estimated a 0k:6k ratio of 2-3, about a half of the ratio calculated by McGee et al. (2013)?; what are the possible errors of this examination (see comment above) and how these might effected the results?; The issue of the north-south trend in dust fluxes; implications of the findings.

Re-arrangement:

Part of the results (e.g., 5277-5278) consists of methodology and discussion issues. Try to keep only the results in this section; move other parts to their relevant sections. 5280, Section 3.3: the first part of this section belongs to the method section and not to the results.

Technical corrections:

5272, 13: Add “more” before “realistic”.

5276, section 3.1 and in Figure 4: I think that the authors forgot to add “V” to the name of the different climate scenarios (i.e., AO0kLV0k instead of AO0kL0k).

5277, 24: Replace “estimate” by “calculated”.

Interactive comment on Clim. Past Discuss., 11, 5269, 2015.