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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 #1**

Received and published: 2 December 2015

The manuscript by Egerer et al. use simulations with the ECHAM6-HAM2.1 model to explore the possible causes of changes in dust deposition between the mid and late Holocene, as recorded by marine sediment cores in the North Atlantic. The motivation of this work is relevant to Climate of the Past, and the study is well conceived. The manuscript is generally well organized and well written, and the figures are clear. The study could be an interesting addition to the relatively small set of paleodust modelling papers focusing on the Holocene, but at the present stage the manuscript still has a few limitations that should be taken care of before the work could be published.

General comments

C2555

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The observational dataset used for this work is not the state-of-art. Recent work on paleodust compilations has a better temporal resolution, and showed the importance of particle size distributions for the interpretation of deposition data. The analysis should be updated by comparing to this type of information that has become readily available.

Potential model biases in the simulation of the physical climate may be relevant to the discussions, but they are not reported here. This aspect should be taken into account in the interpretation of the results.

## Specific comments

5271, 16-17: how would those affect dust emissions?

5271, 22: The reference should be to the final version of papers rather than the discussion, when available. i.e. Albani, S., Mahowald, N. M., Winckler, G., Anderson, R. F., Bradtmiller, L. I., Delmonte, B., François, R., Goman, M., Heavens, N. G., Hesse, P. P., Hovan, S. A., Kang, S., Kohfeld, K. E., Lu, H., Maggi, V., Mason, J. A., Mayewski, P. A., McGee, D., Miao, X., Otto-Bliesner, B. L., Perry, A. T., Pourmand, A., Roberts, H. M., Rosenbloom, N., Stevens, T., and Sun, J.: Twelve thousand years of dust: the Holocene global dust cycle constrained by natural archives, *Clim. Past*, 11, 869-903, doi:10.5194/cp-11-869-2015, 2015.

5272, 3-5: With reference to this work, the study by Sudarchikova et al. (2015) uses a vegetation map for 6k with a lower LAI index over the Sahara, as shown in their work. On the other hand the study by Albani et al. (2015) accounts for vegetation changes as far as dust emission is concerned, but use PI vegetation as a base. In both cases, it is not conclusively possible to say that those models underestimate vegetation cover

5272, 10-11: global? Rather regional

5273, 12-13: are the aerosol other than dust prescribed too to pre-industrial levels?

5273, 24-25: how do you account for that? Dry in which climate conditions?

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5277, 9-16: what is the point of this segment?

5277, 17-26: the study by Albani et al. (2015) cited by the authors provides an updated observational dataset with temporal (and size resolution) the study period. This also raises the question of the meaning of comparing model vs observed deposition rates over different size ranges. Please add a description of the model's particle size treatment and review the analysis on those bases. The comparison should be updated using those results.

5278, 21-25: to which region do these budgets refer to? Are they global, or rather limited to the study region depicted in one of the plots (and for instance the area is different in figures 6 and 7)? Regional budgets should be more appropriate, but the region should be clearly defined and indicated

5278, 23-28: how do the AO simulated conditions compare to observational evidence? Are there any biases in CMPIM5 runs with this model? This aspect is very relevant to the discussion of the relative importance of different conditions to changes in dust emissions. If biases are present in the simulations of the physical climate, their effects on this work and interpretations should be discussed

5279, 16-27: again, please report explicitly to which regions the budgets refer to. As a note, globally one would expect emission and deposition to be the same in equilibrium conditions

5281, 21-25: you may add something like “in our simulations”

5283, 1-3: the un-mixing of riverine versus aeolian components, as well as focusing factor corrections thanks to the thorium profiling method are discussed for those sites in McGee et al. 2013. Please add the reference here.

5285, 10: “Though, ” should be “Nonetheless”?

Figure2: maybe use a finer colour scale for the right panel

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