

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 #4

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Egerer et al. present simulations of mid-Holocene and preindustrial dust emissions that aim to identify the drivers of observed changes in dust deposition in the North Atlantic. This is a timely study that has the potential to assist in unlocking the information contained in dust flux records.

Though I enthusiastically support the aim of the study, there are several ways in which the manuscript needs to be improved in my view. First and foremost is that the authors need to build confidence that the very small wind changes simulated by the model are realistic. Given the apparent underestimation of Holocene changes in North African precipitation by global-scale GCMs (e.g., Braconnot et al., 2007; Perez-Sanz et

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al., 2014), it seems possible that this and other models may also underestimate wind changes, and thus incorrectly attribute dust changes solely to land surface changes. Paleo SST and biogenic sediment data from the margin suggest very substantial reductions in coastal upwelling during the mid-Holocene; Holocene biogenic sediment fluxes correlate strongly with dust fluxes (e.g., Adkins et al., 2006; Fig. 9 of McGee et al., 2013). Are the very small differences in winds indicated by this model consistent with this observation? If not, the mismatch between observations of upwelling changes and unchanging model winds should at least be noted, and its significance discussed.

Related to this point, the authors should discuss and plot the changes in winds and precipitation that accompany their addition of estimated mid-Holocene vegetation and lake extent into the model – that is, how are winds and precipitation in the full 6ka simulation different from the AO6kaLV0ka simulation?

Second, the authors should make some important changes in how they compare to sediment core data. For ODP658C, they should compare to the flux data of Adkins et al., 2006 rather than the fluxes presented in deMenocal et al., 2000; the Adkins record accounts for sediment redistribution and gives a better estimate of vertical sediment rain rates. In addition, as pointed out previously by reviewer #1, the authors should ensure that the grain size of the dust being simulated and compared to fluxes along the margin is similar to that in the cores; McGee et al. (2013) report the grain size distribution of the eolian fraction, and eolian material deposited at these sites is quite coarse.

Page, Line

5270, 22 Is insolation here averaged over the entire hemisphere and the entire summer?

5270, 24 This could be stated more precisely. The land-sea temp gradient at 6 ka may have been high prior to monsoon onset in late spring, but after monsoon onset land surface temperatures should actually cool in North Africa due to more moisture

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availability and thus greater partitioning of absorbed radiation into latent heat.

5271, 12 Note that the timing of the mid-Holocene rise in dust in McGee et al. is estimated as 4.9 ± 0.2 ka rather than the 5.5 ka age estimated solely from the ODP658C record. It's still uncertain which is right, but the range should be noted.

5271, 17 Explain how changing SSTs are thought to impact dust accumulation. Do Adkins et al really state that the dust flux changes are solely driven by SSTs, and not other aspects of early/mid-Holocene climate?

5271, 19 Change "assure" to "test" or "explore"

5272, 8 Change "loose" to "lose"

5275, 25 Change "recaptured" to "captured"

5277, 1 deMenocal has a lowercase "d" as its first letter. As above, the comparison should be made to fluxes in Adkins et al., 2006 rather than in deMenocal et al., 2000.

5277, 9 Change "exceptional" to "exceptionally"

5277, 24 Change "monotonously" to "monotonically"

5279, 3 Change comma after "separately" to a colon

5279, 9 Change "contributed both and nearly" to "both contributed nearly"

5279, 18 Increased rainfall averaged over what area?

5281, 24 "Distraction" is not the correct word. Perhaps you could just say "Changes in dust transport. . ."

5283, 9-10 Remove one "only" from this sentence ("Atmosphere-ocean conditions. . .")

5285, 5 Remove comma after "cycle"

5285, 6 Remove comma after "year"

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5285, 10 Change "Though" to "However"

5285, 14 Change "what" to "which"

5306 Over what area is dust emission averaged?

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

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