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Climate of the Past Discussions

Interactive comment on "Atlantic Hurricane response to Sahara greening and reduced dust emissions during the mid-Holocene" *by* Samuel Dandoy et al.

Anonymous Referee #2

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Review summary

This is well written and thorough study on hurricanes in the mid-Holocene. It should be published with minor corrections.

My main comment is about dust which is clearly a major factor in the results here. It is not clear that an ∼80% reduction in dust has the profound effect on the regional climate that is shown here and in the EC-Earth simulations (Pausata et al 2016). Most ESMs (including EC-Earth) are using OPAC dust measurements that are too absorbing (e.g. see discussion by Albani & Mahowald, 2019). This means that the radiative impact is likely strongly overestimated. Some discussion of caveats around this are therefore

needed.

General Comments

While the 80% reduction in dust is well established from mid-Holocene sediment core data, the radiative effect from this dust reduction is less obvious. Hopcroft & Valdes, 2019 showed that mid-Holocene dust reduction had a much smaller impact on the radiation balance in the HadGEM2-ES model. This is because HadGEM2-ES has more up-to-date physical dust properties which are significantly less absorbing than the OPAC dust data (Hess et al 1998) used in many ESMs. This means that the the strength of the modelled dust effect in the present study is probably too strong and this caveat should be discussed.

Also, related to this, Thompson et al 2019 showed that dust-cloud interactions can be important during the mid-Holocene. Would dust-cloud interactions impact the TC activity?

A general Climate of the Past reader may wonder how relevant the mid-Holocene can be for the future in terms of TC activity. I assume that the main effect in a future climate will relate to the warmer SSTs, whereas dust and WAM are secondary factors? Perhaps you can clarify this in the Discussion.

Specific Comments

Line 165: Do you mean in ERA5 itself? If Murakami and Hodges have questioned reanalysis why are you using it? Perhaps, this just needs some clarification?

Line 173: I think in this journal the units kt need to be explained.

Line 190: could you comment on the approximate magnitude of this SST bias?

Line 278: It may be worth noting some of these "other processes" here, or are these what is discussed in lines 281 onwards?

Line 336: It feels like a one or two sentence summary of your findings is missing here?

Line 344: "Furthermore, the displacement of TC activity is different in our study and most likely related to the fact that dynamical changes in ITCZ and AEW are not accounted for in Pausata et al. (2017)." I think this needs to be explained in a bit more detail.

Line 349: "These results support the findings of Patricola et al. (2018) who showed through a set of sensitivity experiments that the AEWs may not be necessary for TC genesis". Could you be a bit more specific?

Line 366: I'm not sure I agree with this statement. Surely, this is just a result from the model as are the projections for warmer climates? Maybe you mean that this warming-induced effect is consistent with the model-based projections for TC activity in a warmer future?

Line 373: "Additional paleotempestology records" - can you reference some?

Line 376: "our work suggests ..." yes but what about the surely much greater impact of SST warming from the CO2 rise? Or is this less important?

Technical corrections

line 26 population -> populations Line 191: delete "PNAS". Line 199: constrains -> constraints line 371 "as large" -> "as a large"

References:

Albani, S and Mahowald, N. (2019). Paleodust Insights into Dust Impacts on Climate. J Climate, 32, 7897-7913, doi: 10.1175/JCLI-D-18-0742.1.

Hess, M., P. Koepke, and I. Schult, 1998: Optical properties of aerosols and clouds: The software package OPAC. Bull. Amer. Meteor. Soc., 79, 831–844, https://doi.org/10.1175/1520-0477(1998)079,0831:OPOAAC.2.0.CO;2.

Hopcroft, P., & Valdes, P. (2019). On the role of dust-climate feedbacks during the mid-Holocene. Geophysical Research Letters, 46 , 1612-1621. doi: 10.1029/

2018GL080483

Thompson, A., Skinner, C., Poulsen, C., & Zhu, J. (2019). Modulation of Mid-Holocene African Rainfall by Dust-Aerosol Direct and Indirect Effects. Geophys Res Lett , 46 , 3917-3926. doi: 10.1029/2018GL081225

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