

## Authors' Response to Reviewers Comments

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Title: New developments in the representation of Saharan dust sources in the aerosol-climate model ECHAM6-HAM2

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### Anonymous Referee #2

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The authors have revised the manuscript according to reviewers' comments. They did not follow my suggestion of major revisions, but have justified their position satisfactorily, so I recommend publication, possibly with minor revisions if the two points below require them. I remain of the opinion that adding an analysis of on-going free-running simulations would enhance the value of the paper, but the authors seem to have other plans so I will not pursue the matter further.

In the authors' reply, two aspects could have led to modifications of the paper, which I still recommend.

The clarifications about the status of the development presented within the ECHAM development cycle, and the discussion about how roughness length could be improved in the future, are interesting and relevant. So it may be a missed opportunity not to mention those discussions in the paper. After all, GMD is about model development, and this kind of considerations should be of interest to the readers.

*Again, we also think that surface roughness is an important parameter in the dust emission process, and there is still potential for dust model improvements by using a more sophisticated description of roughness length.*

*In Section 2.1, we therefore add the conclusion that: "Still, there is further potential for dust model improvements in a more sophisticated representation of surface roughness."*

*And in the Summary, as a concluding remark, we note that:*

*"The current update is not exhaustive, and in particular the surface roughness, which is an important parameter in the dust emission process, requires a more sophisticated consideration. The challenge of future model developments, therefore, may be to describe the surface roughness at process scale, for example, by computing subgrid-scale dust emission fluxes at the resolution level of high-resolved roughness length data from satellite remote sensing."*

Regarding the issue of different sampling between model and satellite retrievals, the authors write in their response that they "account for the difference in sampling [...] by using the model output only at times when satellite observations are available". I may have missed it, but I could not find an equivalent statement in the paper. Could the authors check?

*The reviewer is right. This information was given only for the AERONET measurements, but unfortunately not for satellite observations. So, we add the following to the description of satellite AOD retrievals in Section 2.3:*

*"The MISR data is provided [...] over land and ocean, but only at a daily temporal resolution as result of the orbit pattern of MISR, with daytime equator crossings at around 1030 LT.*

*In the model evaluation, only those time periods are considered when satellite observations are available in order to account for the difference in sampling between satellite retrievals and model. On the satellite sampling side, the high temporal resolution of SEVIRI is worth being mentioned again, which means that it can very flexibly be used to match with both MISR and the model, at least during daylight hours."*