

Interactive comment on “The remote response of the South Asian Monsoon to reduced dust emissions and Sahara greening during the middle Holocene” by Francesco S. R. Pausata et al.

Anonymous Referee #3

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Comments on the manuscript of Pausata et al.

In this paper, the authors used model experiments to evaluate the response of Indian monsoon to Sahara land cover and dust aerosol in Holocene. They found a significant remote effect of Sahara greening, which is a useful work and helps to understand the evolution of Indian monsoon under astronomical forcing. My major comments is as follows,

I wonder how and why the experiment of reduced dust is designed as in this study. From Gaetani et al 2017, it seems that the prescribed dust concentration over Sahara and Middle East is reduced by 20%. Am I right? How did they deal with the dust out-

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side Sahara, for example, the Asian inland? Kept as PI? I understand that it is just a sensitivity run which focused on the Sahara dust effect and a prescribed 20% reduction is acceptable. But, I still wonder why they did not use a “real” dust distribution given by mid-Holocene experiment of PMIP. Does this choice of experiments affect the arguments in this paper? If the Asian dust included, does the Sahara dust intensify the Indian monsoon? This study merely considered the direct radiative effect of dust. So the simulated temperature difference is the most direct response of atmosphere. From Figure 4C, the reduced dust leads to strong warming over Middle East, Central Asia and Tibetan Plateau. It is difficult to understand such a response of surface temperature. Please explain it. Especially, the dust is simulated to cool the surface atmosphere over Middle East, which seems to contradict with most modeling studies focusing the radiative effect of Sahara dust (e.g., Albani et al., 2014). They simulated a surface warming over Sahara and Middle East because the dust is a kind of absorptive aerosol. In addition, the Sahara land cover can also warm the central Asia and Tibetan Plateau. Why? A previous modeling work (Shi et al., 2019) indicate that the radiative effect of dust can intensify the Indian monsoon, which seems opposite to this study. In that work, the dust warms the surface over Middle East, strengthens the heat low and Indian monsoon precipitation. However, this study found reduced dust could strengthen the heat low and monsoon. Does these results dependent on different models and radiation parameterization? I think the authors better give a discussion on these differences. Refs: Albani et al., Improved dust representation in the Community Atmosphere Model. JAMES, 2014. Shi et al., Snow-darkening versus direct radiative effects of mineral dust aerosol on the Indian summer monsoon onset: Role of temperature change over dust sources. ACP, 2019.

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