

Interactive comment on “Physical and chemical properties of deposited airborne particulates over the Arabian Red Sea coastal plain” by Johann Engelbrecht et al.

Johann Engelbrecht et al.

johann@dri.edu

Received and published: 1 August 2017

Atmos. Chem. Phys. Discuss. <https://doi.org/10.5194/acp-2017-231-RC3>, 2017 © Author(s) 2017. This work is distributed under the Creative Commons Attribution 3.0 License Interactive comment on “Physical and chemical properties of deposited airborne particulates over the Arabian Red Sea coastal plain” by Johann Engelbrecht et al. Anonymous Referee #2 The manuscript presents information on monthly resolved dust deposition rates as well as the mineralogical, chemical, and elemental composition of the deposited dust. The data are based on monthly accumulated samples over 13 months from six sites on the campus of King Abdullah University of Science and

C1

Technology (KAUST), located on the Saudi Arabian coastal plain near the Red Sea. These are new data from an understudied region, and the provided information is very valuable for other researchers. It will help with a better assessment of the effects of dust from this region on the environment and human health as well as for the evaluation and constraining of dust simulated with models. The manuscript is clearly written and well structured. It should be published after taking into consideration following few minor points.

1. Page 4, lines 19-25: Information should be provided where the climatological data were sourced.

Authors Response: Data sources added.

With the exception of the area around Jazan in the south, which is impacted by the Indian Ocean monsoon, the Red Sea coastal region has a desert climate characterized by extreme heat. Temperatures measured at the KAUST campus reach 43° C during the summer days, with a drop in night-time temperatures on average of more than 10° C. Also, although the extreme temperatures here are moderated by the proximity of the Red Sea, summer humidity is often 85 % or higher during periods of the northwesterly Shamal winds. Rainfall diminishes from an annual average of 133 mm at Jazan in the south to 56 mm at Jeddah, and 30 mm at Tabuk in the north <http://worldweather.wmo.int/en/city.html?cityId=699>.

2. Page 5, line 7: Add Scanza et al. (2015) as reference.

Authors Response: Reference was added.

3. Page 8, lines 13-24: The authors should mention a possible bias in the results from applying the X-ray diffraction (XRD) technique. XRD is most effectively detecting crystalline material. This could lead to an overestimation of the abundance of those dust mineral types that tend to have a regular crystal structure, like tectosilicates, relative to other minerals such as phyllosilicates whose mass can have a significant and varying

C2

amorphous fraction (Formenti et al., 2008; Kandler et al., 2009).

Authors Response: Added text following line 24.

A likely bias in the results from applying the X-ray diffraction (XRD) technique together with the RIR method is widely recognized, and therefore our methodology is considered to be semi-quantitative at best. Chung (1974) recognized that if the RIRs of all the crystalline phases in a mineral mixture are known, the sum of all the fractions should add to 100%. However, XRD is effective at measuring crystalline phases such as quartz, calcite, and feldspars, and less so for partly crystalline and amorphous phases including some layered silicates such as clays as well as many hydrous minerals. This could lead to an overestimation of the abundance of the crystalline mineral types in the dust, compared to partly crystalline and amorphous phases (Formenti et al., 2008; Kandler et al., 2009). Other discrepancies could occur from preferred orientation of layered silicates in the sample mounts, and the dust samples were loaded into side-mount holders to minimize this effect.

4. Page 8, line 25: "Northwesterly Shamal winds prevailed during all twelve months of 2015 (Fig. 3)" What about November? It looks like from Figure 3, as an exception, that northeasterly winds were more frequent in that month, although they didn't quite reach the maximum strength of the northwesterly winds.

Authors' Response: Sentence added.

Although the northeasterly winds were more frequent in November, they did not reach the strength of the northwesterlies.

References Formenti, P., J. L. Rajot, K. Desboeufs, S. Caquineau, S. Chevaillier, S. Nava, A. Gaudichet, E. Journet, S. Triquet, S. Alfaro, M. Chiari, J. Haywood, H. Coe, and E. Highwood (2008), Regional variability of the composition of mineral dust from western Africa: Results from the AMMA SOP0/DABEX and DODO field campaigns, *J. Geophys. Res.*, 113, D00C13, doi:10.1029/2008JD009903.

C3

Kandler, K., L. Schütz, C. Deutscher, M. Ebert, H. Hofmann, S. Jäackel, R. Jaenicke, P. Knippertz, K. Lieke, A. Massling, A. Petzold, A. Schladitz, B. Weinzierl, A. Wiedensohler, S. Zorn, and S. Weinbruch (2009), Size distribution, mass concentration, chemical and mineralogical composition and derived optical parameters of the boundary layer aerosol at Tinfou, Morocco, during SAMUM 2006, *Tellus B*, 61 (1), 32-50, doi:10.1111/j.1600-0889.2008.00385.x.

Scanza, R. A., N. Mahowald, S. Ghan, C. S. Zender, J. F. Kok, X. Liu, Y. Zhang, and S. Albani (2015), Modeling dust as component minerals in the Community Atmosphere Model: development of framework and impact on radiative forcing, *Atmos. Chem. Phys.*, 15, 537-561, doi:10.5194/acp-15-537-2015.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2017-231>, 2017.

C4