

Comments from the editorial office and referees are in blue.

Our replies are in black.

Changes to the manuscript are highlighted in red both here and in the revised manuscript.

Reply to referee #2

Recommendation:

The authors present the experimental water adsorption data for 21 mineral dust samples, including 7 authentic mineral dust samples and 14 atmospherically relevant compounds. The motivation of the work is to improve our knowledge of hygroscopicity of mineral dust aerosol and reduce uncertainty of its hygroscopic parameters. The manuscript is well written and I recommend this manuscript to be published in ACP.

Reply: We would like to thank ref #2 for the very supportive review of our manuscript. His/her comments, which helped us largely improve our manuscript, have been carefully addressed in our revision, as detailed below.

Figures S1-S7 display very wide size distribution (often bimodal) of mineral dust particles. So the only average particle diameter presented in table 1 is not enough to characterize particles size in dust samples. Some parameter describing the distribution width (variance, uncertainty, quantiles, etc) should be added.

Reply: As suggested, in the revised manuscript (page 6) we have included standard deviations for average particle diameters in Table 1.

The measurement errors information should be presented in section 2.3 (accuracy of RH and mass measurements, temperature stability).

Reply: As suggested, in the revised manuscript (page 9) we have included a sentence to provide these information: “The sample mass could be measured with an accuracy of $\pm 0.1 \mu\text{g}$, and the uncertainties for temperature and RH were $\pm 0.1^\circ\text{C}$ and $\pm 1\%$.”

The mass stability criterion reporting in line 169 is doubtful. It is well known that achieving adsorption equilibrium may require several hours, especially at high RH. The figure 2 shows that in some measuring steps (blue line) the stability apparently has not yet been achieved. Reduction of measurement time may result in underestimation of water uptake.

Reply: Indeed it could take several hours to reach adsorption equilibrium in our experiments. In some of our measurements we also set stability criterion to “mass change was $< 0.05\%$ in 60 min”, and no difference in results was found for the two criteria. In the revised

manuscript (page 9) we have added one sentence to clarify this issue: "...the sample mass was considered to be stable when the mass change was $<0.05\%$ in 30 min. In some experiments the sample was considered to reach the equilibrium only when the mass change was $<0.05\%$ in 60 min, and no significant difference in results was found for the two equilibrium criterions." In line 499 "Figure 4b" seems to be replaced "Figure 11b". As reported in comment 1 the average diameter is not an informative parameter for the considered dust samples; therefore, the absence of size dependence of surface coverages is not justified.

Reply: The referee is correct, and we have changed "Figure 4b" to "Figure 11b" in the revised manuscript (page 32). We also agree with the referee that our dust samples exhibit a wide size distribution, and thus our conclusion on size dependence should be treated with caution. In the revised manuscript (page 32) we have added one sentence to further clarify it: "This conclusion should be used with caution since dust samples used in our work were far from being monodisperse (see Figures S1-S7)." A more detailed explanation of the discrepancy between the results of this work and previous studies is desirable. Especially this concerns the hygroscopicity parameterizations. The values of A_{FHH} differ by more than 10 times for CaCO_3 and 6 times for SiO_2 although the error of each coefficient is very small (table 6).

Reply: In the revised manuscript (page 29-30) we have included one sentence to further explain the difference A_{FHH} values measured by different studies: "...while larger differences were observed for A_{FHH} values, especially between our study and the work by Kumar et al. (2011a) for SiO_2 and CaCO_3 . One reason for such large difference is that Kumar et al. (2011a) carried out their CCN activity measurements at $>100\%$ RH whereas our work on hygroscopic growth was conducted at $<100\%$ RH."