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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of mineral dust on cloud formation during the Saharan dust event in April 2014 over Europe" *by* Michael Weger et al.

Anonymous Referee #1

Received and published: 22 August 2018

The paper discusses the sensitivity of an upper-level cloud cover to two different microphysics schemes, with and without dust-cloud and dust-radiation feedbacks during a dust outbreak over Europe. It presents a comprehensive comparison between simulations and remote sensing observations of aerosol and cloud properties as well as in situ measurements from an aircraft campaign. The simulation with the dust-cloud and dust-radiation feedbacks provides the best results. This is attributed to enhanced deposition freezing. Different empirical ice nucleation parameterizations are then tested, which shows the importance of remaining uncertainties in the ice nucleating properties of mineral dust. Last, the best simulation is shown to be too dry in the upper troposphere, which is likely the main cause of underestimating the cloud cover. My suggestion at

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the end of the reading would have been to redo the work with more realistic values of specific humidity at the initial and boundary conditions. This would however be too much work and as stated in the text, it is beyond the scope of the paper. Despite this disappointing result on cloud cover prediction, the paper presents an in-depth discussion on the impact of dust on cloud cover. As such the paper deserves publication to ACP.

Minor comments

Page 3, line 56. Extra "is" between "homogeneous" and "nucleation"

Page 4, line 104. Typo on "microphyiscs"

Page 19, line 587. The lidar measurements show large values of extinction coefficient around 2-km altitude. You implicitly attribute this signal to black carbon aerosol that can absorb visible radiation. This radiative effect is not present in the simulation. Because it is a strong signal, it might have a big impact on the stability of the atmosphere. The consequence of the absence of black carbon radiative effect on the simulation should be discussed.

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