

Interactive comment on “Chemical aging of atmospheric mineral dust during transatlantic transport” by M. Abdelkader et al.

Anonymous Referee #1

Received and published: 25 August 2016

Chemical aging of atmospheric mineral dust during transatlantic transport Abdelkader et al.,

The authors used EMAC (The ECHAM5/MESSy2 atmospheric chemistry General Circulation Model) to evaluate transport and loadings of mineral dust particles during transatlantic transport. The study carefully considered aging mineral dust in the model and compared the results with non-aging mineral dust particles. They found some interesting results such as the removable efficiency and optical properties. These results will be potential useful for the future study on the ground base. On the other hand, the study carefully used the satellite data (AOD and CALIPSO) to calibrate the modeling results. They obtained the consistent results. The developed method is significant to improve the current model.

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The mineral dust particles are important for climate change, biogeochemical cycle, and heterogeneous atmospheric chemistry in global. Many studies found how the mineral dust changes in air. However, the modeling work is rare. The modeling work is useful to evaluate effects of mineral dust in the air. Although the modeling parameters are not based on measurements, the results and comparison is interesting.

I would like to recommend accepting this paper after one minor revision. In the introduction section, the authors should add some findings in field campaigns which have revealed the nitrate coatings on alkaline mineral dust particles in the worlds. For example, Tobo, Li, Sullivan et al., found mineral dust aging process in the air. Although the authors consider the mineral dust particles absorbing acidic gases transformed from SO₂, NO_x, or HCl. However, these field study all pointed out the nitrate coating determine particle hygroscopic properties ("Asian dust particles converted into aqueous droplets under remote marine atmospheric conditions." P Natl Acad Sci USA 107(42): 17905-17910./ "Observation of nitrate coatings on atmospheric mineral dust particles." Atmos. Chem. Phys. 9(6): 1863-1871/"Direct observations of the atmospheric processing of Asian mineral dust." Atmos. Chem. Phys. 7: 1213-1236.).

The authors should mention the aged mineral dust particles become hydrophilic and can act as CCN during the transport (Mixing state and hygroscopicity of dust and haze particles before leaving Asian continent. J. Geophys. Res. 119 (2), 1044-1059.). Page 1 line 16 miss blank after comma.

Figure 3 should be marked where is the Cribbean

Section 4.3 Why did not the authors consider the mineral dust as ice nucleation? It could be one removable pathway for mineral dust in air.

I recommend revising the current title. Because the study focused on the evaluation of mineral dust during transatlantic transport using model and other methods, it didn't study chemical aging of mineral dust. The current title seems that the study understand the chemical aging mechanism of mineral dust in the air.

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-470, 2016.

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