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Interactive comment on "Modeling a typical winter-time dust event over the Arabian Peninsula and the Red Sea" *by* S. Kalenderski et al.

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This paper reports about regional simulations of mineral dust events. Of course, the dynamics are influenced by the optical properties of the dust aerosol particles. Thus, it is important to simulate them realistically. I would like to discuss the following:

1) The authors define three modes of the dust size distribution which are determined during a simulation based on an emission model. These size distributions then lead to certain optical properties. For their calculation a spectrally constant imaginary part of the refractive index of 0.006 is assumed. Why not using a more realistic spectrally variable (complex) refractive index? In the literature there are information available regarding this point. On other hand, variabilities in the index alone may lead to changes in the (total) heating rates as reported by the authors for the considered entire dust.

For instance, Otto et al. (2007) report dust heating rate changes of 1 to 2 K per day (their Fig. 14) which is comparable to the mean value of 1.68 K per day for dust in the authors paper. This means that, actually, for realistic modelling a spectrally variable (complex) refractive index is essential.

2) As also shown by, e.g., Otto et al. (2007), the coarse mode fraction affects significantly the optical properties. Depending on the presence of large particles (defined as particles of diameters larger than about 3 micrometers) the single scattering albedo (SSA) can vary strongly, both in the solar and thermal spectral range. The authors here report a mean value of 0.98 in the solar which is comparable to AERONET products and values derived from measurements (Osborne et al., 2008). However, is has been demonstrated that AERONET products for dust may be inconsistent resulting in too high SSA values (Müller et al., 2012) and the value reported by Osborne et al. is influenced by measurement limitations also resulting in too high values of the SSA (Ryder et al., 2012). Thus, the assumed value of 0.98 might not be realistic. On the other hand, if the authors simulate dust emissions, which lead to size distributions that result in high SSA values, I accept this, of course. However, the authors at least should present typical mean size distribution information (mode parameters) as simulated by the emission model which were the basis to calculate the optical properties, the radiative transfer and the heating rate as it was input to the dynamical part of the WRF. This is important in order to classify the model dust. Keeping in mind the relatively high above-mentioned imaginary part of 0.006 and the resulting high value of SSA close to 1, I expect that the coarse mode is hardly present in the simulations. But it is the coarse mode which is usually typical for mineral dust events. This should then be discussed in more detail in connection with the applied emission model compared to other independent models described in the literature. How realistic is the model dust? How realistic is the solar SSA of 0.98 as the stated in the conclusions?

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