

***Interactive comment on* “Long-range transport of mineral aerosols and its absorbing and heating effects on cloud and precipitation: a numerical study” by Y. Yin and L. Chen**

Anonymous Referee #2

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The paper deals with the potential effects of heating due to dust layers at different levels in the atmosphere on the development of clouds and precipitation. The effects are investigated by modifying the initial conditions of the vertical temperature profiles to account for the heating by the dust. The results of the cloud microphysics and the total precipitation with and without the temperature changes are then compared.

The paper is certainly appropriate for publication in ACP because the subject matter is highly important to our understanding of the effects of dust on local and global climate.

However, before the paper is accepted for publication I think that it requires a great deal of revisions:

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The English grammar and style should be improved to make it easier to read.

I find the title to be somewhat misleading because it implies that calculations of heating rates due to absorption are being carried out. In fact the paper uses results from another paper to impose a temperature increase at a certain level, but does not do any radiation transfer calculations. A title such as: "The effects of heating by dust layers on cloud and precipitation: a numerical study" seems more appropriate.

In the abstract the first sentence could be changed to read: "Ice forming nuclei (IFN), and could lead to reduced cloud cover and precipitation in the region where it is present"

There are many places where the writing should be improved to make it clearer.

In the introduction there is a mention of long range transport, I suggest to add: "Israelovich et al, Desert aerosol transport in the Mediterranean region as inferred from the TOMS aerosol index, J. Geophys. Res., 107(D21), 4572, doi:10.1029/2001JD002011, 2002", which describes the transport of dust from the Sahara to the Mediterranean.

Later on the paper mentions the increase in rainfall due to dust and I would recommend adding: Teller and Levin, 2006, ACP.

In the section on numerical experiments the authors fail to mention the way they introduce the temperature increases due to dust. I assume that they introduce an increase in the temperature profile as initial conditions. This point has to be made clear, even with a figure.

The introduction of dust at different levels must affect the way ice is formed. I could not find an explanation in the text which describes the way ice is enhanced by the additional dust particles acting as IN.

Units should be added to Table 1.

Section 3.3 - The author refer to a paper by Cheng et al 2002. But this paper is in

Chinese, which I am sorry I cannot read. In the reference list it should be stated that the paper is in Chinese.

In the same section the authors state that the coating of the mineral dust with soluble material increases their scattering. Please provide a reference to this statement and explain why this should be the case.

In general, it is known that dust particles have very high single scattering albedo (very low absorption) [e.g. Dubovik, et al, Climatology of aerosol absorption and optical properties in key worldwide locations, J. Atmos. Sci, 59, 590-608, 2002.]. In China, Costa et al found much lower SSA and attributed it to pollution, probably soot. These points should be mentioned.

Section 4 -4.1 line 27 - please add how the lower concentrations in maritime clouds affect the development of ice particles.

Immediately after line 27 I suggest to modify the writing: As a result of the differences in development of raindrops and graupel particles, the rainfall intensity and precipitation amount on the ground are much larger in the maritime case than in the continental case, **** leading to more rapid dissipation of the maritime clouds. This latter effect results in higher optical depth and higher albedo in the continental clouds (see Fig 4)

Section 4.2 line 14 - you have to mention that you are comparing maxima values.

In many places in the paper the authors refer to the heating as "heating rate". This is wrong; it is heating that you should be referring to.

Section 4.4 - I think that Fig 8 is too difficult to follow and could be removed. The point that the authors are trying to make is demonstrated in Fig 9.

All the figures should be enlarged; otherwise it is difficult to read them.

Line number 3 above the Summary - you state that the hydrometeors develop earlier

in C5 and latest in C4 but you do not explain why. Is it possible that introducing a temperature increase at higher levels causes local convection higher up, which later on merges with convection from below which is generated by the release of latent heat?

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3203, 2007.

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