

Interactive comment on “The effects of aerosols on precipitation and dimensions of subtropical clouds; a sensitivity study using a numerical cloud model” by A. Teller and Z. Levin

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Reply to comments by reviewers 1 and 2.

We would like to thank the two reviewers for giving us the opportunity to improve our paper. All the comments that were raised in the reviews will be corrected and clarified in the final revised version. We would like to address the few main points raised by the reviewers:

Reviewer 1)

The reviewer asked that we provide a more detailed explanation of the treatment of the

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nucleation of drops. In addition to the reference of the paper by Yin et al (2000), which describes the nucleation process in detail, we elaborated in the present paper on the method used to nucleate drops on small CCN and on GCCN.

Point 1. Title corrected

Point 2. The reference to Yin et al, (2000) was added on page 7214

Point 3. Figure 1 refers to dry aerosols all of which are potential CCN composed of pure sea-salt with 100% solubility.

Point 4. The references to Yin et al. (2000) and Reisin et al. (1998) were deleted

Point 5. Should be changed to "In clean clouds, GCCN did not have significant contribution to the production of graupel particles (Fig. 7)".

Point 6. Figure 5 has been modified for a better quality of printing.

Point 7. fig 6-10 check labels. The clean clouds were run as 90 CCN per cm³. When giant CCN were added the number grew to 100 cm⁻³. Similarly, in the polluted clouds, the ones without GCCN were 1350 cm⁻³, once the GCCN were added, the number grew to 1370 cm⁻³. This point was clarified in the text.

Reviewer 2)

Following the comment about the model itself, we expanded the discussion of the model in addition to referring the reader to our previous work (Yin et al, 2000 and others).

a) 1) The grid space is defined in the paper as 300 x 300 m. This somewhat low resolution was tested by Yin et al. (2002) who performed a number of test runs with higher resolution and did not find any significant sensitivity of the results (except for a small delay in the cloud development). This point has been discussed in the revised version.

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2) The use of the 2D model simulations allowed us to concentrate on the cloud microphysics at the expense of detailed dynamics. At present all 3D models that deal with mixed phase clouds require gross parameterization to simulate the microphysical processes. In this way they tend to smooth over some of the details seen in a more detailed treatment of the microphysics as is done here. It is true that 2D models produce higher updrafts and probably higher LWC than a cloud in 3D. But we feel that the main features, namely the longer lifetime of the polluted mixed phase cloud and the reduction of rain in it, is a general feature that will be true in 3D simulation also.

b) The work by Yin et al, 2000 has been referred to for the explanation of the activation of the CCN and GCCN as well in the description of the model.

Following the comments by both reviewers 1 and 2, we included a discussion on the activation of these particles. The GCCN are assumed to grow based on the parameterization proposed by Kogan (1991), in which they grow to a fraction of their critical size (see Yin et al, 2000). Although, some of these "drops" are smaller than their critical size based on Kohler, they are large enough to start collecting smaller drops.

All the minor comments about the figures and re-wording of sentences were corrected and will be included in the final revised version of the manuscript.

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