

Review of revised version of Bulatovic et al. following first review

The authors have done a good job of addressing the comments from the first review. I have just a few small further suggestions. The line numbers are from the original ACPD manuscript :-

Original comment :-

L432 – could the smaller IWP in the run with the larger LWP be due to the fact that there was lots of graupel in that run (Fig. 8i) so that graupel water path would actually be quite large (maybe around 5 g/m²). So if you combined the ice, snow and graupel to give a total ice water path it may be larger than the other runs? Does the IWP from the observations also include snow and graupel?

Author Response :-

The simulated IWP shown in Fig. 10b is the total IWP. Since the collection of cloud droplets by ice becomes less efficient in experiments with more LWP (i.e. when the cloud droplets are smaller in size), this process should be the main reason for the IWP decrease simulated in the experiments with a higher aerosol number concentration. We have now added to the Fig. 7 caption that both LWP and IWP are total values.

Additional comments :-

OK, but the text ("The reason is that the collection of cloud droplets by ice becomes more efficient in experiments with less LWP (i.e., when the droplets are larger; not shown). ") is a little confusing as it doesn't explain that when the LWP is lower we have fewer droplets, which are therefore larger (despite the lower LWP). I suggest "The reason is that in the experiments with less LWP there are also fewer droplets, so that the droplets are larger (the reduction in number dominates over the reduction in LWP) and therefore the collection of cloud droplets by ice becomes more efficient (not shown)."

Also, total IWP and LWP is not particularly clear - it would be good to specify that you mean ice+snow+graupel and liquid+rain (assuming that this is what you mean by total LWP).

Original comment :-

Fig. 5 – It's not quite clear what dN refers to and why the x-axis is the modal diameter. Is this instead showing dN/dlogDp with Dp being just the aerosol diameter? I.e., does the integral under the curves give the total number?

Author Response :-

The y-axis shows dN (dN/dlogDp multiplied with dlogDp). The modal integrals under the fitted curve correspond to dN values, which are the numbers used as the model input parameters (also shown in Table A1). Using dN/dlogDp would not correspond to the numbers we used in our simulations. We understand this was not explained well in the previous manuscript version. Thus, we have added: "Note that the dN values shown in Table A1 represent the modal integrals under the fitted curve in Fig. 5 (y-axis; dN/dlogDp multiplied with dlogDp) and are the numbers used as the model input parameters."

Additional comments :-

Ok, but perhaps the phrase "integrated particle concentration dN" in the caption would be better as "particle concentration in each size bin, dN".

"Note that the dN values shown in Table A1 represent the modal integrals under the fitted curve in Fig. 5 (y-axis; $dN/d\log D_p$ multiplied with $d\log D_p$)" seems to contradict what you just said. It would be better to call the values in Table A1 "N" rather than "dN" and to say that they "represent the total number of aerosols in each mode from the fitted curves in Fig. 5 (sum of dN values)..."