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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Supercooled Drizzle Development in Response to Semi-Coherent Vertical Velocity Fluctuations Within an Orographic Layer Cloud" *by* Adam Majewski and Jeffrey R. French

Anonymous Referee #1

Received and published: 13 November 2019

The paper uses insitu observations of dynamics and microphysics to link the formation of super cooled drizzle drops to specific dynamical conditions.

Main comment:

While the in depth interpretation of the flight leg data and back of the envelope discussion calculations were interesting, to me it seems that this qualitative investigation of this flight is the first part of the study. The hypothesis proposed is that scvvf are required to form scdd. I think it would be useful and necessary to generate some

quantification of the observations to test this hypothesis using the rest of the flight data available from the campaign.

Based on the qualitative hypothesis it would seem reasonable to try and define thresholds for the following conditions: 1. T<0 and T>Tmin 2. ice_conc < min_ice_conc 3. are scvvf present? Need some metric based on w' ? 4. are scdd present? Need some metric based on cloud probes.

and then combine these to quantify how well the scvvf-scdd hypothesis works. 1 and 2 have previously been suggested as controlling factors (as pointed out in the paper), while 3 is the new part explored here. So, if(1 & 2 & 3) is true, is 4 also true? This can be assessed for different thresholds and metrics across the flight campaign. Such an approach could also be used to assess the frequency and usefulness of the S anticorrelation seen to be indicative of scdd. I think this level of quantification would be very useful for other researchers and have application in aviation safety.

Other comments:

l46 - S* and CCN not defined

l55 - and riming....

line 68 - what mechanism? Is it shear induced turbulent enhancement?

line 85 - what gradient? Number concentration with temperature or horizontal distance?

l151 - could report the frequency (Hz) of the data here for the size distributions, concentrations and condensed water estimates.

l212 - confirmed by the 2dp - was shape recognition used for the 2dp, or was the 99th percentile based on a size threshold?

l218 - 'suggesting ice ' - can liquid be ruled out? The doppler velocity would seem to be a potential evidence stream, but the text following this line seems to suggest it would be ambiguous.

l232 - it seems that the plots and analysis could be passed through a high-pass filter to remove the terrain induced larger scale fluctuations and just concentrate on the smaller scale variations.

l271 - okay fig5b has w', but it is not clear what the nature of the filtering was of w to derive w'.

l274 - to me the correlation between Ncld and w' looks poor - can you plot scatter plots and give correlation coefficients - or even do lagged correlations given the discussion at the end of the paper?

fig5d shows the mvd and Ncld to have an almost linear anticorrelation, suggesting that Ncld is proportional to LWCˆ(-0.5). I don't know if that is a coincidence or if it means something significant...

l332 - the hypothesis was posed earlier on that the SCVVFs were responsible for the SCDD, but now this observation seems to counter that. See my main comment above.

l351 - can you quantify this S correlation pattern to use it automatically?

l373 Ncdp is this the same as Ncld ?

l407 - is it possible to show a figure like 13 but from the actual data? I find it difficult to identify this behaviour in the current figures. Its difficult to see, but do the doppler velocity and reflectivity fields also show this lag effect?

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