Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-717-RC2, 2019

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 #2

Received and published: 1 December 2019

Review of "Supercooled drizzle development in response to semi-coherent vertical velocity fluctuations within a supercooled orographic layer cloud" by Majewski and French

This paper explores aircraft observations using a W-band radar and in-situ measurements of state parameters, wind motions, and cloud and drizzle drop size distributions within a supercooled layer cloud flowing over heterogeneous terrain. The authors find correlations between km-scale somewhat vertically coherent fluctuations in vertical motion and microphysical changes in the cloud. The measurements appear to support the idea that small scale fluctuations in such clouds may be sufficient to push an otherwise

non-drizzling cloud into a state whereby it produces precipitation.

I found the manuscript to be adequately well-written, although the authors should pay better attention to spelling (Rosemount is mis-spelled in several occasions), grammar, and precision in their scientific writing, The results, while interesting, are not particularly novel (see e.g. House and Medina 2005, who have already documented such correlations between small-scale vertical motions and radar-derived microphysical properties). It is a little unclear how the results presented would move our knowledge base forward. The authors need to work harder to make their results appealing to the broader cloud physics community.

The schematic diagram presented in Fig. 13 is interesting, but I believe that the condensational inertia theory of why the LWC and Nd estimates are not in quadrature is insufficient. As the authors argue, the condensational delay may be around 10 seconds (phase relaxation timescale), yet the time between wave crests is substantially longer than this (probably 100 s or more for wind speeds of 10-20 m/s and wavelengths of 1-2 km). More quantification of this would be helpful. Why isn't the removal of droplets by coalescence also playing a key role?

Why is there no map showing the synoptic conditions, horizontal flow pattern etc? Where are the Payette mountains?

I think the data here could be analyzed in a much more quantitative manner than is presented here. What is the vertical coherence of the small-scale vertical motions as seen by the WCR? This is why we have radars. Yet the radar here is underutilized.

Fig. 7 states that hydrometeor Doppler motions are show, but this implies that the vertical wind field is known. How can this be? This needs some correction to explain what is shown and what was done to remove the wind motions.

It is interesting that the clouds are ultra clean (very low cloud droplet concentrations). Yet this is barely mentioned later. Is there a real bottleneck for drizzle production given this? The authors could quantify the coalescence by running an SCE solver on their size distributions to quantify the degree to which the clouds could produce drizzle without vertical motion enhancing LWC.

It is hard for me to understand why it important that the cloud is supercooled. Wouldn't the same physics affect warm layer clouds?

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