Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-463-RC2, 2021

Atmospheric Measurement Techniques Discussions

Interactive comment on "Identification of snowfall microphysical processes from vertical gradients of polarimetric radar variables" *by* Noémie Planat et al.

Anonymous Referee #2

Received and published: 18 February 2021

Identification of snowfall microphysical processes from vertical gradients of polarimetric radar variables

By Planat et al.

Identification of snowfall microphysical processes using radar observations is a challenging topic, because of the similarity of the radar signatures of some of the processes. Changes of radar variables as a function of altitude carry additional information. The authors are proposing a new method that can be used to advance our interpretation of radar observations of ice microphysical processes.

The manuscript is structured well and clear. I have listed a few comments that I would

like the authors to address before the paper can be accepted.

General comments: - I really like how the authors used the continuity equation to derive conditions which could be used to diagnose if vertical gradients of radar variables are driven by microphysics. Because this part is rather new, for the radar community, it would be good to explain in a few sentences what these conditions actually mean. For example, the condition 1 indicates that the reflectivity field is horizontally homogeneous.

Related to the continuity equation, have you checked if the conditions 1,2, and 3 are the same if you are using reflectivity and differential reflectivity. I wonder if the underlying sensitivity of these radar variables is different.

- Case studies. I miss a figure showing Z and Zdr HTI figures for the case studies. I wonder if they can be included, as a supplementary material for example.

- Sublimation. This is probably the most challenging class for my understanding and interpretation. In Fig. 5 and 6 you show the PIVS results. The SUB class is rather prevalent and sometimes its appearance is puzzling. For example, in Fig. 5 starting from the cloud top, PIVS shows CR then SUB then AR then SUB. I cannot figure out how the transition from CR to SUB and then to AR could happen. It would be very helpful to see radio sounding measurements and more discussion on what SUB actually means in this case.

Specific comments:

Lines 193-194: "as particles become more spherical (less oblate)" this is an incomplete statement, also changes in particle density would affect Zdr.

Lines 198-200: "Crystal growth by vapor deposition (hereafter CG) corresponds to an increase in particle size with decreasing height (∂z ZH < 0) and an increase in oblateness with decreasing height (∂z ZDR < 0) as particles generally grow along their longest dimension (Schneebeli et al., 2013; Andric ÌĄ et al., 2013; Grazioli et al., 2015)"

In some cases, ice crystal growth would also change density. For example, growing dendrites will become more oblate, but at the same time the density would decrease. These two processes affect dual -polarization radar signatures in opposite direction. I wonder if the statement that ZDR will increase as particle grow by vapour deposition is valid generally? Could you clarify this point.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-463, 2020.