

Interactive comment on “Statistics of vertical velocities in supercooled cloud layers over Leipzig and Praia measured with Doppler lidar” by Johannes Bühl et al.

Anonymous Referee #3

Received and published: 30 June 2017

Dear Johannes Bühl and coauthors,

I agree that the vertical velocity statistics is worth to investigate. Effect of vertical air motion on cloud microphysical properties is a hot and challenging research topic nowadays, much better than the effect of vertical velocity on “ice formation”. You had valuable data and also did hard work on data analysis. Please be careful what scientific question you want to address in your revised version.

Some comments on the two papers you mentioned about:

Korolev and Field: If I understand correctly, they are interested in the activation of liquid cloud droplets in an ice cloud parcel. Sedimentation which is sensitive to vertical

velocity is ignored in their paper. Their research interest is quite different than what you want to investigate in Fig.1 (your paper). Their conclusion is that strong vertical velocity or fluctuation can activate cloud droplets in ice phase cloud, thus lead to the formation of mixed phase cloud. However Fig. 1 shows the fraction of ice containing clouds is quite different at two sites, and especially low at Praia and Punta Arenas. The main difference is that in their case, the cloud always contains ice, while in your case fraction of ice containing cloud is very low. If their hypothesis is true, the mixed phase cloud is all formed through the activation of liquid cloud droplets in ice cloud, fraction of ice containing clouds should be 1.

Hill et al.: This paper is actually using LES to test Korolev's hypothesis. Because it is designed to test it, the basic setup is suitable for the theory. For example, they "prescribed the ice number concentration throughout the domain and an ice mass mixing ratio of 0.1 g kg⁻¹. In the base simulation, ice is not permitted to sediment or growth in size, but ice mass and number are advected by the wind." Later, they allow ice to sediment. However, "an ice source is required so that sedimentation does not deplete all ice from the domain. . . at the top of domain ice mass and number are fixed so they are equal to the initial values. This provides a constant source of falling ice into the domain, which maintains the background ice number concentration and mass mixing ratio at approximately the same values as those in the base simulations." Therefore, in this paper, the liquid water cloud fraction is less than 1, but the ice containing cloud fraction is always 1, which is quite different than Fig.1 in your paper.

Best,

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-230>, 2017.

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Discussion paper

