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Comment on acp-2021-360

Anonymous Referee #1

Referee comment on "Hemispheric contrasts in ice formation in stratiform mixed-phase clouds: disentangling the role of aerosol and dynamics with ground-based remote sensing" by Martin Radenz et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-360-RC1, 2021

Review acp-2021-360

This manuscript presents the role of aerosol and dynamics on ice formation in stratiform mixed-phase clouds based on the comparison of ground-based remote-sensing stations (one in the South hemisphere and two in the North hemisphere). The topic is well introduced. Despite the methodology is complex, the authors have made a good work, being quite easy to follow. Results and discussion sections are also well structured, helping to identify the main findings. Additionally, the paper is written in good English and, from my point of view, this paper makes an excellent contribution to the research field of aerosol-cloud interaction. Therefore, I suggest the acceptation of this manuscript with minor revisions.

Minor comments:

The title seems to attribute the contrasts in ice formation to the hemispheric location of the stations. Punta Arenas (South) vs Limassol and Leipzig (North). However, I would say that the contrasts can be finally attributed to 1) pristine vs 'dirty' atmospheric conditions and the gravity wave occurrences. I mean, a similar station (as Punta Arenas) but located in the North hemisphere would not show similar results?

P4 L114-L117: The phrase 'Afterwards, the methods for cloud selection and vertical velocity characterization are introduced.' Seems to be redundant.

P4 L120 (suggestion): Boundary layer coupling and vertical dynamics are discussed in Sec. 3.2.2 and Sec. 3.2.3, respectively.

P7 L169: Cloud Top Temperature is crucial in this paper. However, it is obtained from models (ECMWF's IFS analysis and GDAS) instead of from the microwave radiometer. Why? Which is the uncertainty of the Cloud Top Temperature? Since findings (chapter 5) are formulated at -5, -10, -15, -20ºC, the uncertainty should be below 5ºC…