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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A case study on the formation and evolution of ice supersaturation in the vicinity of a warm conveyor belt's outflow region" *by* P. Spichtinger et al.

Anonymous Referee #5

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General:

Congratulations to the authors of this paper. They succeeded to present their vast and rather complicated, interesting material in a style that is fluently to read and understand. Their thorough analysis of radiosonde and ECMWF datasets as well as METEOSAT infrared images is convincing and provides an important contribution to the field of upper tropospheric ice cloud development.

Nevertheless, I have some comments, few more important and several minor ones.

Major Comments:

1. The relative humidity with respect to ice (RH_{ice}) is a very sensitive parameter not easy to determine from atmospheric observations, particularly not on a synoptic scale as the authors present in their manuscript. RH_{ice} measurements are always afflicted with errors in the range of at least 10%. Errors in the measurement of absolute humidity as well as temperature propagate to the RH_{ice}, and especially even small temperature uncertainties can cause large fluctuations in RH_{ice} (Δ T = 1K can cause delta $RH_{ice} \approx$ 15%, Δ q = 10% can cause Δ $RH_{ice} \approx$ 10%)

   An example is seen in your Figure 3: Especially at 200-250 hPa no difference is seen by eye between ECMWF and radiosonde profiles for T and q, but RH_{ice} is supersaturated by 10-20% following the radiosonde and only nearly saturated with regard to the ECMWF data.

   I think to have this high sensitivity of RH_{ice} in mind is fundamental for the paper and should be discussed quantitatively at the beginning of the manuscript (a qualitative discussion is now somewhat hidden in section 4.3.2 and in the Appendix).

2. Figures 8 and 9:
   a) Because of the already mentioned uncertainty of RH_{ice} I suggest to use a shading in 5%- (or even 10%-) intervals, particularly since the information on the horizontal extension of the ISSR will not vanish (strong horizontal humidity gradient). Starting the first interval with middle blue (not black) would make this important plots much nicer.
   b) To find and follow the red star, the reader needs patience and a magnifying glass ... larger stars in a colour not used for shading may help.

3. It is fundamental to tell the reader in the Introduction why ISSRs are important.

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Minor Comments:

1. Page 2, lines 5-9: Are there other references than the authors own work?
2. Page 2, 3. paragraph: *'This observatory has developed a technique to gauge and correct humidity measurements from routine RS80A radiosondes such that the results are precise to 1.9% in RH even in the cold and dry tropopause region (Nagel et al., 2001).'* I can't believe this number, as far as I know no instrument exist operating with this precision, at least because of the uncertainty of the temperature measurement.
3. Page 3, section 2.1: *'...whether a recording that signals supersaturation is located in cloud free air or within a cirrus cloud.'* I don't understand this sentence.
4. Page 6, first sentence: Why are the temperature inversions due to cloud tops?
5. Page 7, line 5: *'... on model levels 29-36.'* To make it more easy for the reader, please say again which model.
6. Page 9, 2. paragraph, 1. line: *'In Fig. 5 the five trajectories starting at model level 30 (229hPa)* ?? and T = -36h ?? *are exemplarily shown, ...'*
7. Page 11, 2. paragraph, 2. line: *'The ISSR appears on trajectory Tr_31,1 at t=-18h relative to the radiosonde ascent, i.e. 28 November 2000, 12UTC.'* insert: (see Fig. 7)
8. Page 12, 2. paragraph of section 5: *' Since the radiosonde itself underestimates the true supersaturation, ...'* Is that already explained somewhere? If yes, make a cross reference, if no, please explain.
9. Page 13, last paragraph of section 5: *'Looking at Figs. 8 and 9 we get an impression of the complicated structure of the ISSRs. We have additionally calculated*

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the area and the perimeter of these regions for varying values of Delta RHi. This shows a fractal structure of ISSRs: When we plot log(area) vs. log(perimeter) the slope of the resulting line is less than 2 (not shown), which is typical for fractals.' If you want to present this (not shown) information (the reader already has to process a lot of material ...) move it behind the 2. paragraph of this page and show it.

10. Figure 3: Date and time of the radiosonde and ECMWF profiles? Would be nice to see altitude as right y-axis.

11. Figure 4: Caption: *'Infra red METEOSAT picture of the region "GermanyNE" at 0530 UTC. ...'* 0523 UTC ???

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 8245, 2004.