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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cirrus clouds triggered by radiation, a multiscale phenomenon" *by* F. Fusina and P. Spichtinger

Anonymous Referee #2

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General comments:

The paper discusses the influence of radiative cooling on the formation of cirrus clouds by triggering small scale turbulence. Using the EULAG model together with a radiative transfer code the destabilisation of a layer with high super saturation with respect to ice due to radiative cooling at the top of the layer is examined. The radiative cooling at the top of the layer leads to destabilisation and formation of small scale eddies. Within these eddies air-parcels reach the limit for homogeneous nucleation and cloud formation is triggered. The temporal development of the destabilisation by radiative cooling and formation of small scale eddies depends on the over-saturation with respect to ice, the stability of the layer as described by the Brunt-Vaisala-Frequency, vertical wind

shear, and Richardson number. The relevance of the different parameters on the formation of cirrus clouds is examined and presented.

The case study is of high scientific quality and is clearly structured, well documented and presented. It should be published in ACP. Before publication, there are some minor comments which should be addressed.

Specific Comments:

Page 1140, Line 13 ff: Current mean CO_2 and CH_4 and N_2O volume mixing ratios are higher (CO_2:ca 387 ppmv. CH_4: ca 1.7 to 1.85 ppmv, N_2O: ca 0.32 ppmv). And how does the O_3 profile look like does it represent the conditions at a similar time (approx mid 1970s)? Why was the atmospheric composition used as described? Would the influence of different (current) composition alter the the radiative transfer and the outcome of the study? A short sentence about the motivation why these conditions were selected would be helpful.

Page 1143 Line 22 ff: You mention 14.7 % of the measurements with a 500 m layer with a certain potential stability and 5% with stabilities lower than 0.4K/km. Could these stable layers be attributed to conditions where the existence of cirrus clouds were present or their existence was possible?

Technical Comments:

Page 1139, Line 9: "Theses ice classes.. " I assume this should be "These ice classes..."

Figure 4 and references in the text (Page 1142, e.g. line 7, 19, 27) apparently 4c and 4d have been mixed up.

page 1143 line 10: Reference to Figure 4. I assume this should rather refer to Figure 5.

Page 1142 line 25: IWP: the units should be consistent throughout the paper: g/m^2 or kg/m^2

Page 1146 line 23-25: “It follows ...” This sentence is confusing. Maybe rewrite for clarity.

Page 1147 line 22: “lower gradients” better use “weaker gradients”

Page 1148 line 3: Reference to Fig 10: Please mention which profile you refer to. (Profile 1?)

Page 1151 line 20: “..prop- erties..”: remove dash.

Figure 6 Caption: “... 5% wind speeds ...” it could be noted that this refers to vertical wend speeds.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 1135, 2010.