

Referee comments on "Radiative properties of mid-latitude cirrus clouds derived by automatic evaluation of lidar measurements" by Erika Kienast-Sjögren et al.

General Comments

This is an interesting paper describing cirrus cloud occurrence frequencies, vertical distributions, and optical depths derived from lidar measurements at Zurich and Jungfraujoch Research Station, Switzerland, and Jülich, Germany. These results are compared with those from some earlier studies and are also used in a simple radiative transfer model to compute shortwave, longwave, and net cirrus radiative forcings. The paper is generally well written and the results are presented rather clearly. I do have a number of specific comments that the authors need to address before the paper is published in ACP.

Specific comments

The authors either are not aware of or have ignored some earlier papers describing ground-based lidar measurements of cirrus clouds obtained during the ECLIPS (Experimental Cloud Lidar Pilot Study) program. These papers include Platt et al., *Bull.Amer.Met.Soc.*, 75, p.1635, 1994; Vaughan and Winker, *Atmos.Res.*, 34, p.117, 1994; and Pal et al., *J. Appl.Met.*, 34, p.2388, 1995. The authors should also mention how their new results compare with findings from these papers.

Pages 4-5: There is no discussion of the possibility of cross-talk between the co-polarized and cross-polarized channels of the lidar and the effect that might have on any results.

Page 5, line 26: The particulate lidar ratio can also be determined directly from high-spectral resolution lidar (HSRL) measurements.

Page 6, lines 17-18: It is not clear how the total uncertainty is computed. I don't think it should be the "sum" of the individual contributions as stated here. Is it the square root of the sum of the squares (RSS) of the individual contributions?

Page 7, line 1: Is the boxcar filter a moving average boxcar?

Page 7, line 24: What is meant by " a set of lidar ratios (5:5:40)"?

Page 7, line 31: Why is the temperature -38° C used to ensure pure ice clouds? Can the authors provide references?

Page 12, Table 2, footnote (6): The text is confusing as written. Did the authors intend to say that relative uncertainties in their mean optical depths are comparable to "monthly mean values of 10-20% from ISCCP"?

Page 14, lines 9-19: It would be good if the authors did some statistical analysis on the optical depth distributions in Figure 4 and could state whether the various distributions are significantly different from a statistical point of view.

Page 20, line 3: From Table 3, I conclude that CRF_{SW} at 50°N from ISCCP is about an order of magnitude than the present results, but the CRF_{LW} at 50° N from ISCCP is only a factor of 1.5-3 larger.

Page 23, lines 8-10: I don't understand what is meant by "radiative forcing of the lateral boundary" of cirrus clouds? It would be good if the authors could provide a brief explanation.

Page 23, lines 22-23: I don't understand the last sentence of this paragraph. What did the "close examination of CRF_{NET} " with respect to cloud τ show?

Technical Corrections

Page 1, line 2: It would be better to say that cirrus "...affect the water vapor budget ..." not determine it.

Page 1, line 15: Reword to say "... thus enabling lidar measurements of higher ..."

Page 2, line 3: The word "subvisible" is misspelled.

Page 20, line 9: Reword sentence to say "Cirrostratus clouds with $\tau < 3.6$ occur particularly in this altitude range."

Page 26, line 1: The word "subvisible" is misspelled again.