

Interactive comment on “A decadal cirrus clouds climatology from ground-based and spaceborne lidars above south of France (43.9 N–5.7 E)” by C. Hoareau et al.

Anonymous Referee #1

Received and published: 6 May 2013

Review of "A decadal cirrus clouds climatology from ground-based and spaceborne lidars above south of France (43.9 N–5.7 E)" by C. Hoareau and coauthors.

This manuscript describes the analysis of over 12 years of lidar observations of cirrus clouds using both ground and space based platforms. Cirrus are examined in reference to 3 regimes identified using clustering analysis of cirrus parameters. Cirrus macrophysical properties are discussed for each of the regimes and also for the total sample. Decadal trends in cirrus properties are also examined.

While the analysis techniques are not novel, the authors examine (to my knowledge) the longest lidar dataset of cirrus clouds over Europe, which adds merit to the scientific

C2079

content. The authors also relate the ground-based observations to the satellite-based CALIOP measurements helping to verify their findings. While the manuscript is well-written and organized, there are a several sections that require more description of their analysis approach and clarification of assumptions. I have listed these in detail below. I recommend that this manuscript be excepted with minor revisions.

Specific Comments:

Introduction: Liou, 1986 reference: There might be a more recent reference for cirrus cloud cover from space-borne radar/lidar (Stephens?) that could be added here.

Introduction, p 6381 line 8: I think that you mean passive satellite sensors. Active sensors will have better sensitivity than that. Suggest to clarify.

Section 2 Lines 10-15: Can you please clarify which lidar channels (elastic, raman scattered, nitrogen, water vapor) are used and for what purpose in this study? Also state what derived quantities are used and how they are computed (i.e. scattering ratio, optical depth etc.) How are cloud boundaries determined?

Section 3.1 Lines 7-8: "...identify the presence of clouds based on the optical thickness time series..." Don't you have to identify a cloud layer before you can retrieve the optical depth from the lidar? Seems backwards that you identify clouds from the optical depth time series. Can you explain?

Section 3.1 Line 10: I am not sure what is meant by "discontinuities" in this context. Are you trying to identify cloud objects? That is contiguous profiles of clouds and the "discontinuities" fall between the cloud objects? Please clarify this methods section to describe the operational procedures of the lidar system (see more comments on this below).

Section 3.1 Line 26: Suggest changing "hypotheses" to "assumptions".

Section 3.1 P. 6385, Line 1-2: "...too large extinction above cloud" It is not that the extinction is too large above the cloud, it is that the lidar signal becomes attenuation

C2080

limited in optical thick clouds. Suggest rewording to "lidar is attenuation limited"

Section 4 Lines13-14: "Although the data sampling is different. . . ." What is interesting about the comparison? Seems that you should provide some comments or insight about the differences and similarities for Fig 2 and 3 and also relate to previously published work related to cirrus climatologies from both ground-based and satellite data. There are other midlatitude studies that you can refer to.

Sec 4.1 Line 25-26: ". . .with two modes centered at $\sim 1\text{km}$ and 3km . . ." Fig. 4: I do not see distinct modes in the cloud thickness PDF. Also the two modes in the cloud top height are very subtle. I think that you should make some attempt at discussing the differences between CALIOP and OHP measurements in Fig. 4. For instance, the cloud base height PDFs are very different. Please provide some explanations and references if applicable.

Sec 4.1 P. 6388 Line 2: ". . .defined by the cirrus cloud parameters. . . ." Which cirrus cloud parameters are used? Please explain more specifically the inputs into the cluster analysis and how they relate to Figure 5.

Sec 4.1 P. 6389, Line3-4: "Class 1 corresponds to thin cirrus. . ." It is unclear to me how you draw the conclusion to classify the three classes as low, high-thick, and high-thin. It seems that most of the discussion in this section describes how you use the cluster analysis, but from your explanation the physical descriptions are not really apparent. Please elaborate.

Sec 4.2 Line16-18: I don't understand the difference between "total number of measurements (Goldfarb study) and "total measurements time" (this study). Can you please clarify? Why don't you normalize the OHP data in the same way as the Goldfarb study for a direct comparison? For OHP, what is the total measurement time? Is it only when the lidar is turned on? or across all years/months? Please clarify the difference. I think that it makes sense to normalize by the total number of profiles measured. I think that the operational considerations of the OHP lidar data is not well described in Sec

C2081

2. I am realizing now that the OHP lidar is not run continuously. I think that you need to be more clear in Sec 2 about when lidar data is collected (day time only? for how long? etc.) Operational procedures will make a big difference between climatologies. I believe that you are trying to make the fair comparison, but it is not clear exactly what is done based on the current description.

Fig 8: It is extremely difficult to read the axis labels and legends in Fig 8. Please make the font larger.

Sec. 4.3 P. 6391 Line 1-20: I think that this information would be better presented in a Table. It is hard to really grasp the information in paragraph form.

Sec 5.1 Line13: In the Fig 12 legend you say "integration time" rather than "acquisition time". I believe you mean "acquisition", correct? Is the meaning here the number of hours that the lidar was left operating at any given time? Integration implies that the profiles are summed up. Please clarify the text and suggest changing the legend of Fig. 12 to be consistent.

Fig 14: Suggest putting the slope of the regression line on each figure in Fig 14 for easy viewing.

Sec 6 Summary Line 23-24: Please remind the reader where the cloud temperature is defined (top, mid, etc).

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 6379, 2013.

C2082