

Atmos. Chem. Phys. Discuss., referee comment RC3
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Comment on acp-2021-97

M. G. Mlynczak (Referee)

Referee comment on "Ice and mixed-phase cloud statistics on the Antarctic Plateau" by William Cossich et al., Atmos. Chem. Phys. Discuss.,
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This paper presents a comprehensive analysis of four years of far-infrared and mid-infrared spectral measurements of downwelling radiation at the Dome C site in Antarctica. Nearly 88,000 spectra comprise the database. These spectra are analyzed with a machine learning code to identify scenes as clear or comprised of ice-phase or mixed-phase clouds. The method of training the machine learning algorithm using coincident lidar data is described.

The infrared spectral observations are automated and are taken throughout the year. Analyses of the occurrence of the different scene types are presented in various ways (by year, by time of year (season)). Comparisons against observations of cloud type made by satellites are also presented. The paper also presents an analysis of the occurrence of cloud type against the meteorological conditions.

The paper is very exhaustive in its analyses and I would recommend publication after these minor comments are addressed.

Line 101 – are the effects of the air in the 1.5 m chimney significant at any wavelength? My team found it necessary to account for the “chimney effect” in analysis of our ground-based, uplooking data. See <https://doi.org/10.1016/j.jqsrt.2015.10.017> and <http://dx.doi.org/10.1016/j.jqsrt.2017.04.028>

Line 116 – what is meant by (1928)?

Figure 2 – The 150 K brightness temperature in the red (clear sky) curve is interesting. This is at the very core of the 15-um band, the strongest part of the band, so the line

should be saturated almost immediately within the atmosphere, and thus, 150 K appears to be too small. Is there a suspected reason for this anomalous feature? Or is it perhaps a microwindow saturating in the polar summer mesosphere where the temperatures can be well below 150 K? These are January (summer) spectra, so the polar mesosphere is quite cold at that time.

Figure 5 – Similarly, the 300 K brightness temperature seem a bit high for such a saturated part of the spectrum. In the summer season the polar stratopause temperature can approach 300 K, but in the winter season this seems too warm. In addition, the brightness temperatures near 1300 cm^{-1} and the standard deviations approaching 350 K are non-physical. To what extent does the cloud classification system (CIC) depend on these regions of the spectrum in which the brightness temps appear to be incorrect?

Figures 8 and 11. The legends in these figures are difficult to read as the font is very small. I am looking at the figures on my computer screen that projects each manuscript page at full size. The labeling of the axes of these figures is also difficult to read. Please re-plot these figures with larger axis labels and please use a larger font on the figure legends.