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Atmospheric Measurement Techniques Discussions

Interactive comment on "HoloGondel: in-situ cloud observations on a cable car in the Swiss Alps using a holographic imager" *by* Alexander Beck et al.

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Figures 7-9 in the manuscript were replaced by updated versions. An error in the calculation of the sample volume increased the concentration by approximately 8

Figure 10 in the manuscript was replaced by an updated version. A larger number of holograms (400) was used for the plot to decrease the uncertainty in the vertical profiles of the ice crystals. This slightly changed the interpretation of the data. The following two paragraphs have been updated (p. 11 line 9):

The height profiles of the ICNC show a much higher temporal and vertical variability, varying from 0 to 75 L^{-1} between different runs and by a factor of three in the profile at

11:13. For the runs at 09:31, 09:53 and 11:31 the profiles of mean ice crystal diameter and ice water content (IWC) slightly increase with decreasing altitude below 2800 m. A growth of ice crystals at the expense of cloud droplets is expected in a mixed-phase cloud due to the Wegener-Bergeron-Findeisen process (Wegener, 1911; Bergeron, 1935; Findeisen, 1938). The vertical profiles have in common that the ice water content to total water content ratio (IWC/TWC) increases with decreasing altitude, suggesting a completely glaciated cloud. However, webcam pictures from the Fiescheralp suggest that cloud base was above the lower cable car station thus probably a few ice crystals fell out and were observed with the HoloGondel instrument.

An interesting feature is the high variability of ICNC (Fig. 10). Possible mechanisms for high variability of ICNC can be only discussed briefly, because meteorological parameters were not measured. Very localized high ice nucleation rates cannot explain the observed variability of the ICNC at the observed temperature of -5 C. An influence due to ground-based processes is not expected because the cable car is more than 100 m above the surface at 2700 m, where the highest ICNC was observed. A much lower ICNC was observed where the cable car was closer to the surface. Another possibility is a varying concentration of ice crystals that fall into the cloud from an ice cloud lying above, which was observed on satellite pictures. As no above-lying ice cloud was observed on 23 February 2016 and in the same temperature range a liquid cloud cloud was observed instead, this possibility is rather likely. Finally, the Hallet-Mossop process is a possible mechanism to explain very localized spikes of high ICNC, which is active at this temperature and can significantly increase the ICNC (Hallet and Mossop, 1974) .

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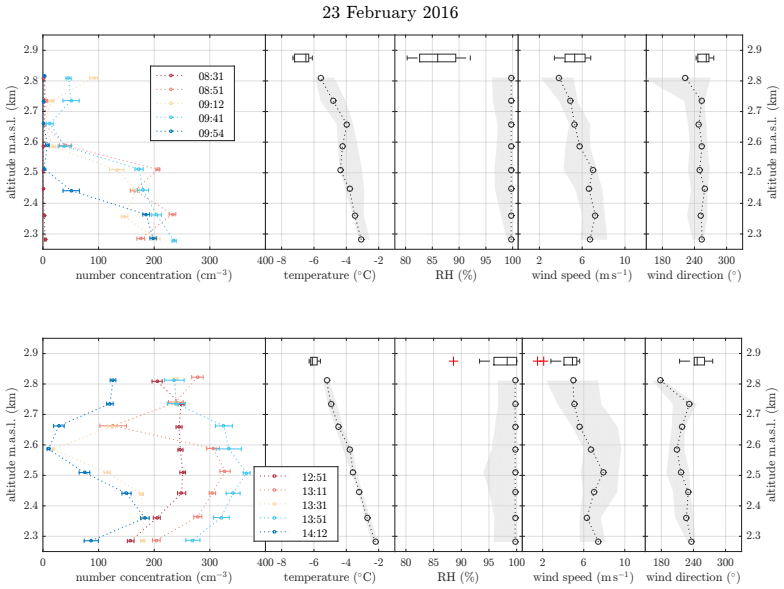

Fig. 1. Height profiles of the Liquid Case measured with the HoloGondel platform during the morning (top) and the afternoon (bottom) of 23 February 2016. The data is averaged over an altitude interval of 75m.

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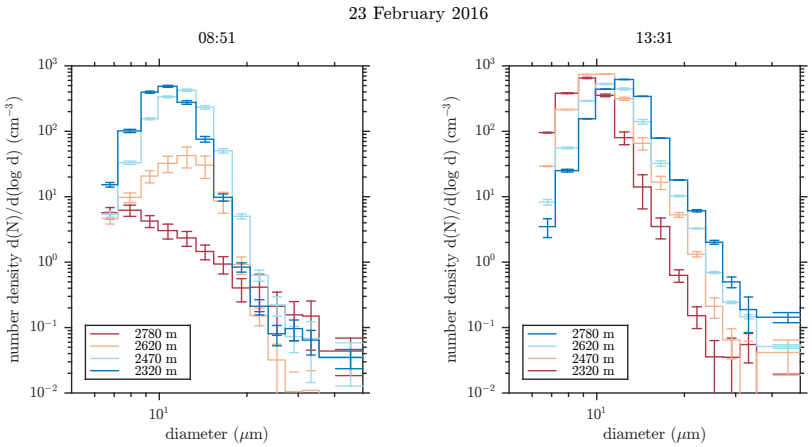

Fig. 2. Height resolved cloud droplet size distribution during the 8:51 run in the morning (left) and the 13:31 run in the afternoon (right).

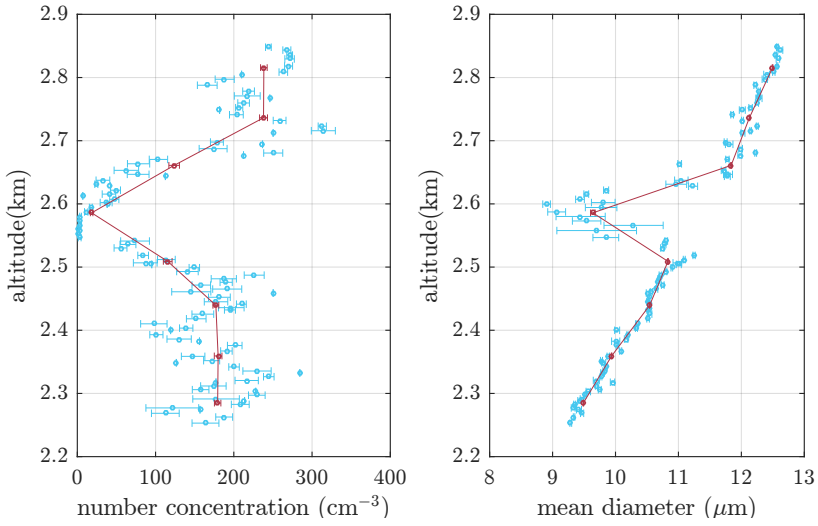

Fig. 3. Comparison of two vertical profiles for the cloud droplet number concentration (left) and mean cloud droplet diameter (right) for the run at 13:31 on February 2015.

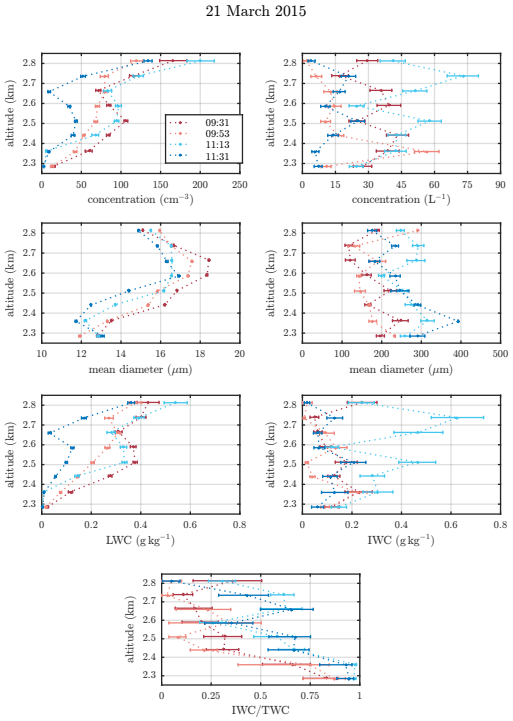

Fig. 4. Height profiles of the cloud droplet and ice crystal number concentration, mean diameter and water content (LWC and IWC) and the ratio of the ice water content to total water content (IWC/TWC) on 21 M