

## Supplementary material

**Manuscript:** *Aerosol concentrations determine the height of warm rain and ice initiation in convective clouds over the Amazon basin*

**Authors:** Ramon Campos Braga, Daniel Rosenfeld, Ralf Weigel, Tina Jurkat, Meinrat O. Andreae, Manfred Wendisch, Ulrich Pöschl, Christiane Voigt, Christoph Mahnke, Stephan Borrmann, Rachel I. Albrecht, Sergej Molleker, Daniel A. Vila, Luiz A. T. Machado, and Lucas Grulich

Here we attach additional figures mentioned in the text that are not shown in the main paper. The additional figures are mentioned in sections:

- **Section 1 (Three dimension graphics with flights locations);**
- **Section 4.1 (Cloud droplet concentration at cloud base for flight AC19);**
- **Section 4.2 (Vertical velocities for each flight);**
- **Section 4.2.2 (Polluted regions);**
- **Section 4.2.2 (Very polluted regions);**

Supplementary material for Section 1 (Three dimension graphics with flights locations)

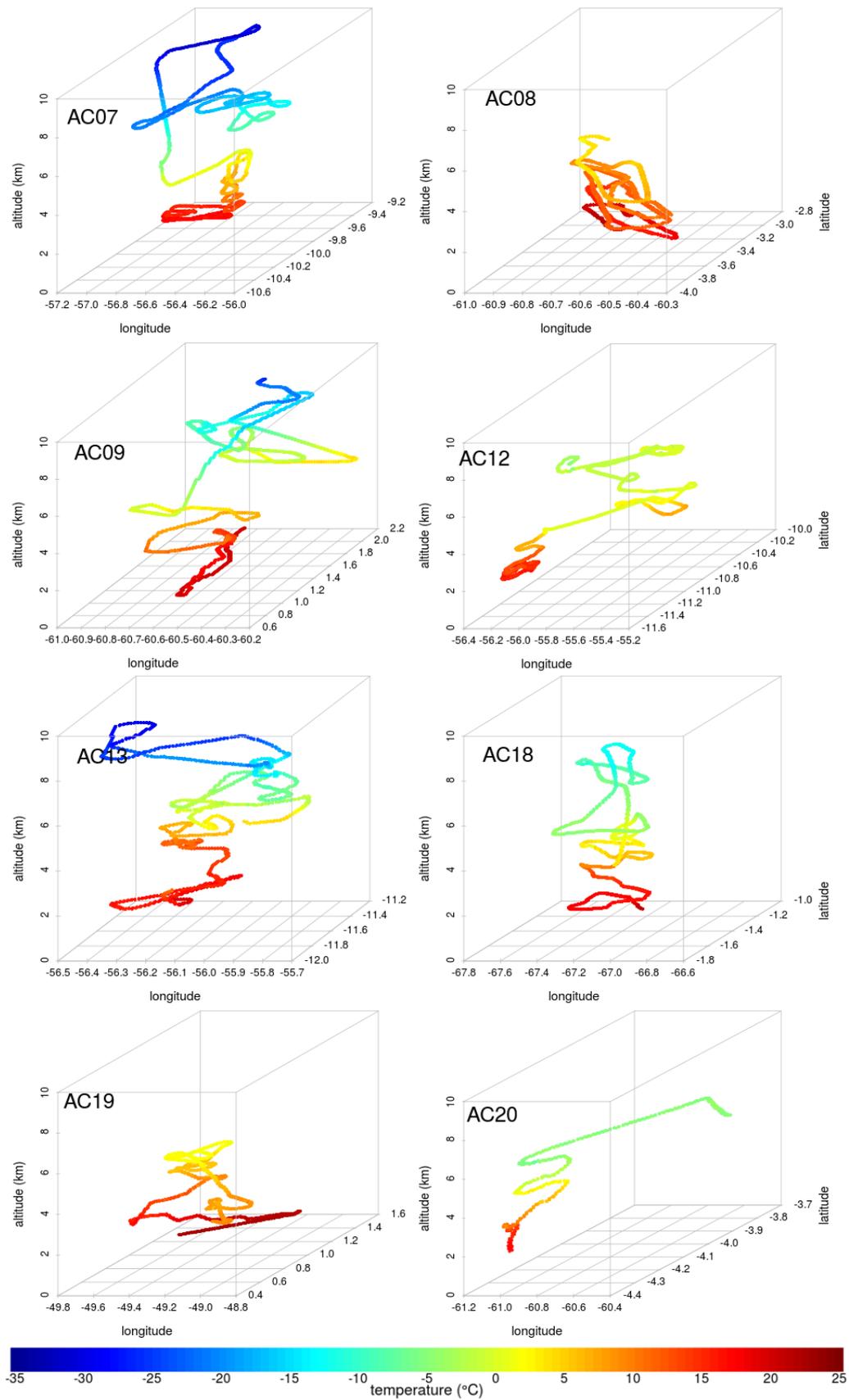


Figure 1- Three dimensional graphics for all flights. Colors indicate the air temperature.

Flight AC19 Date: 2014/09/30 N: 176 s

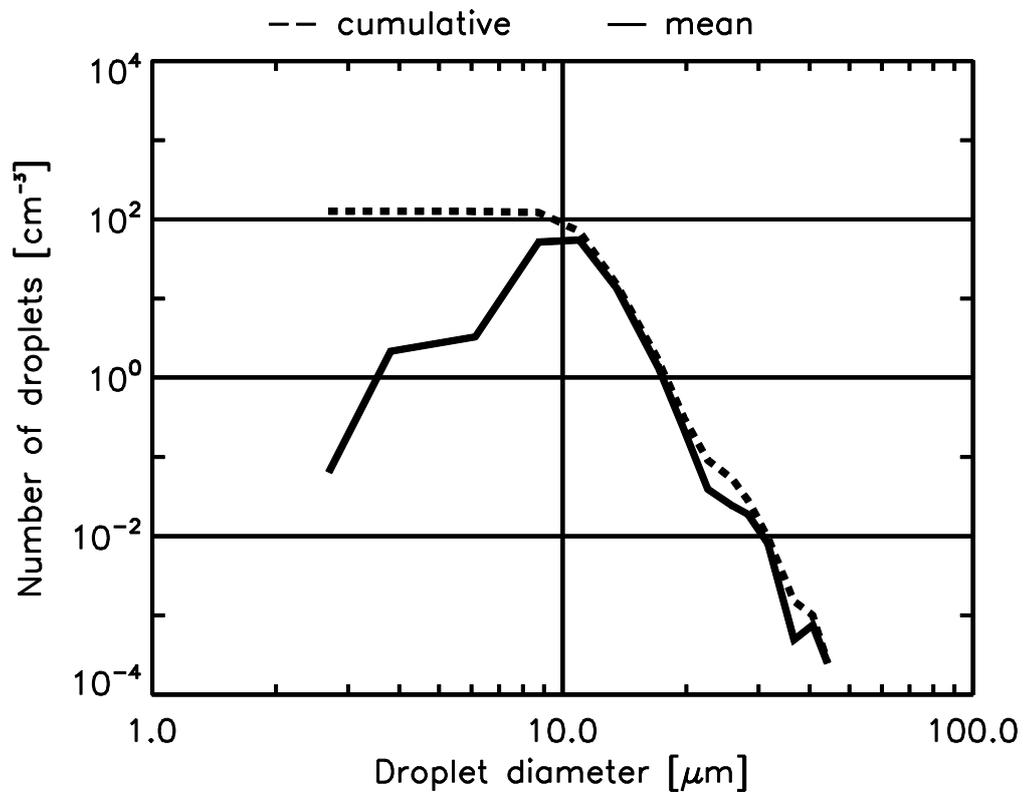
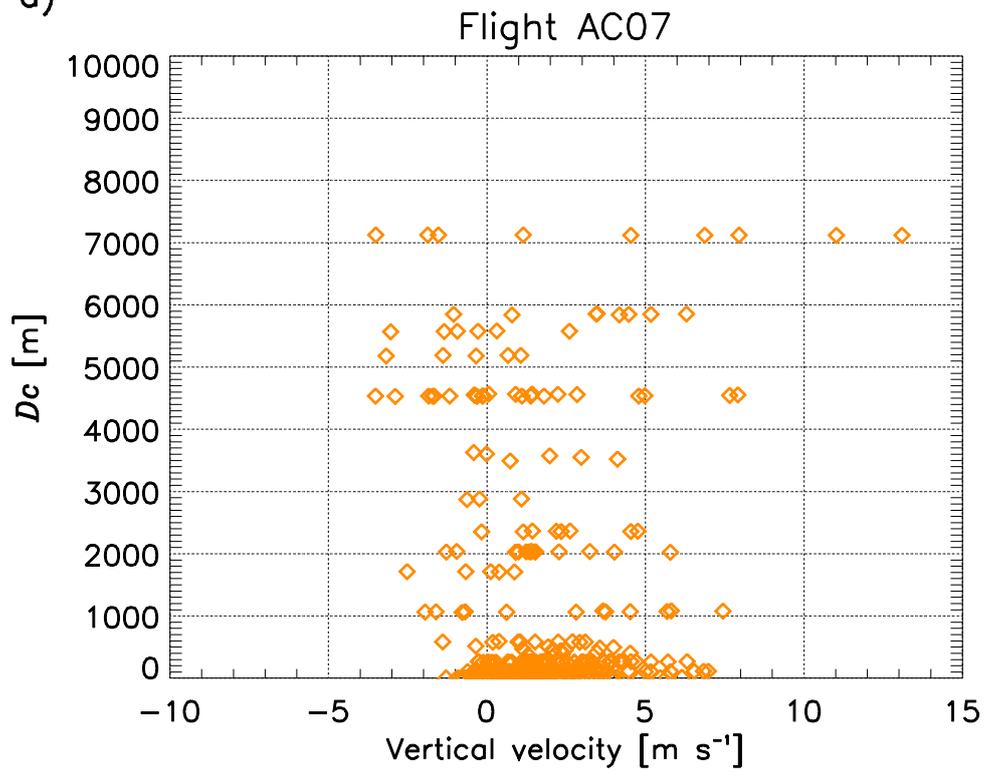


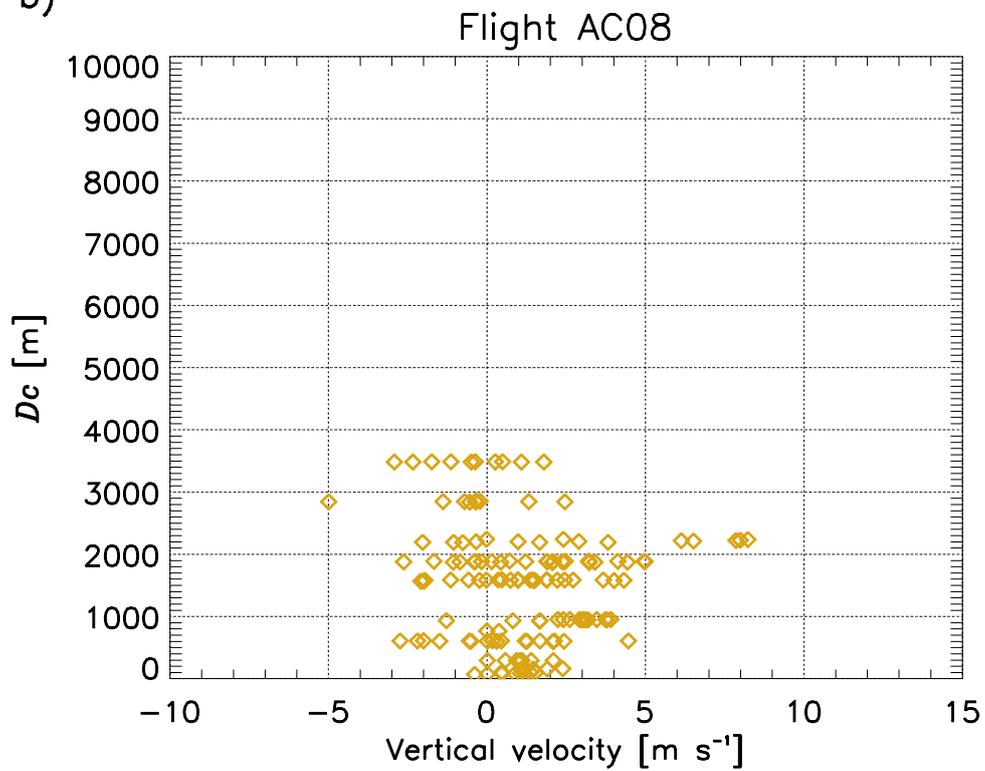
Figure 2 Cloud drop size distribution at cloud base calculated from the CCP-CDP probe (mean - solid line, cumulative - dashed line) for flight AC19 performed over Atlantic Ocean, averaged for all the 176 s of cloud base passes. The solid line is the drop size distribution ( $\text{cm}^{-3}$ ); the broken line is the cumulative drop concentrations starting from largest diameter ( $\text{cm}^{-3}$ ).

Supplementary material for Section 4.2 (Vertical velocities for each flight)

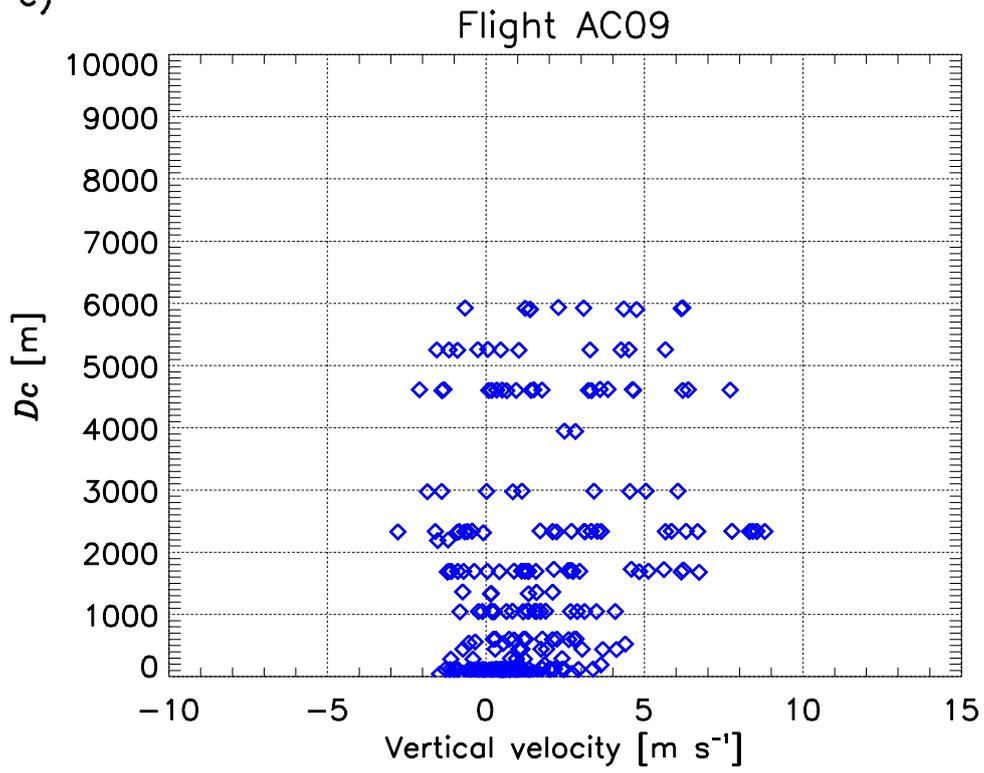
a)



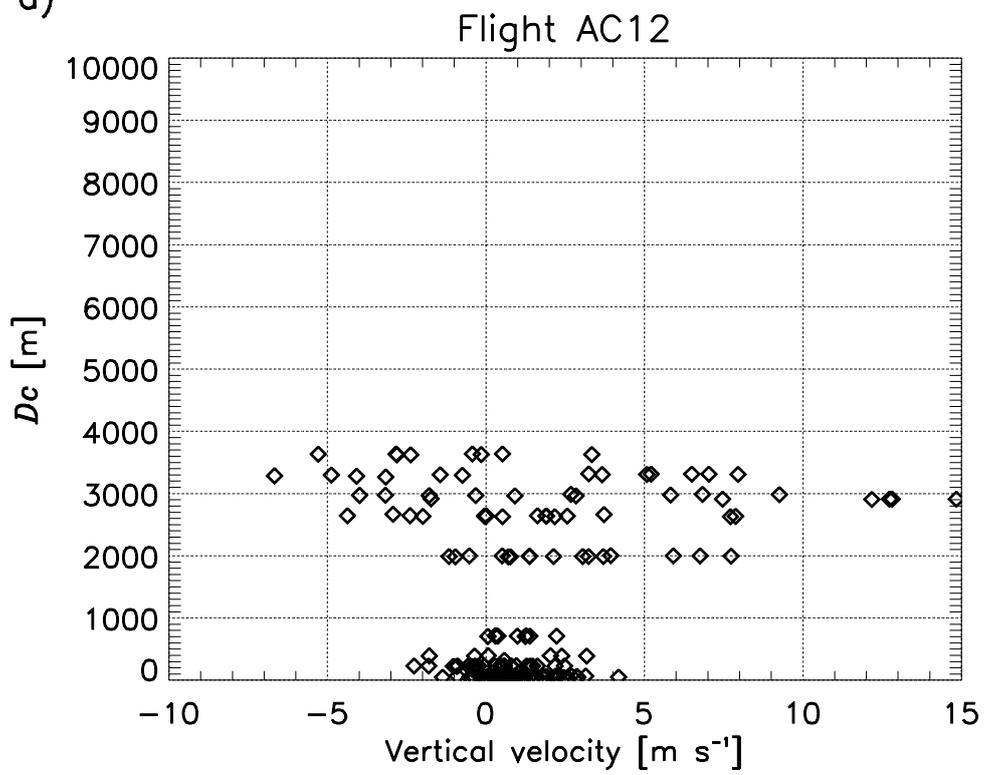
b)



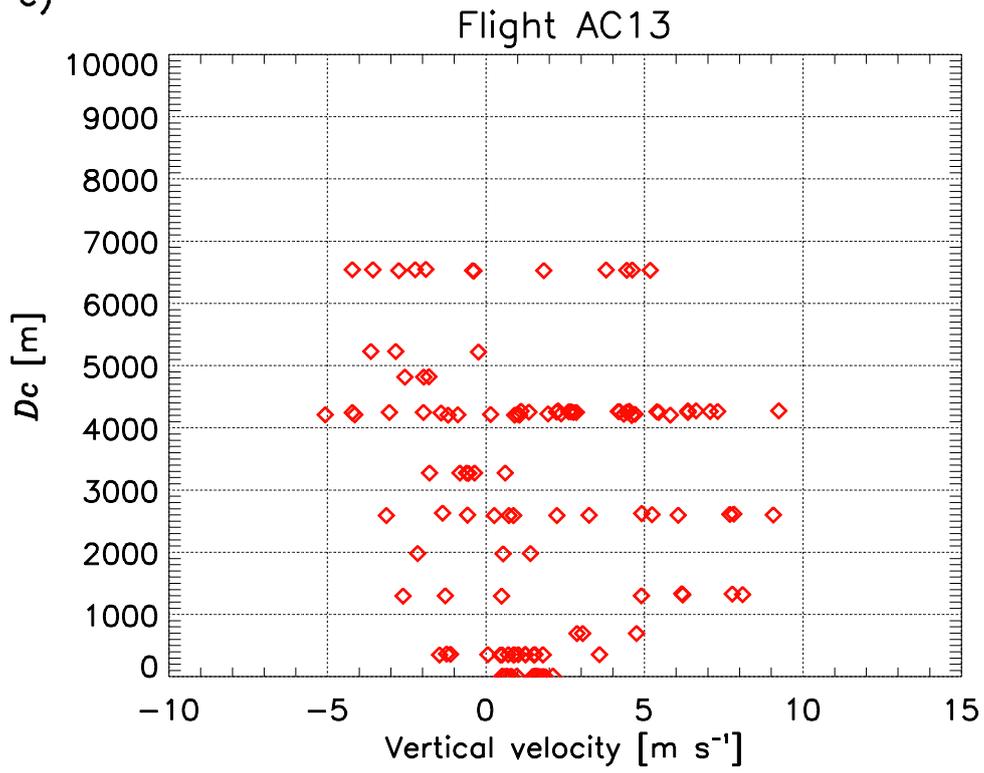
c)



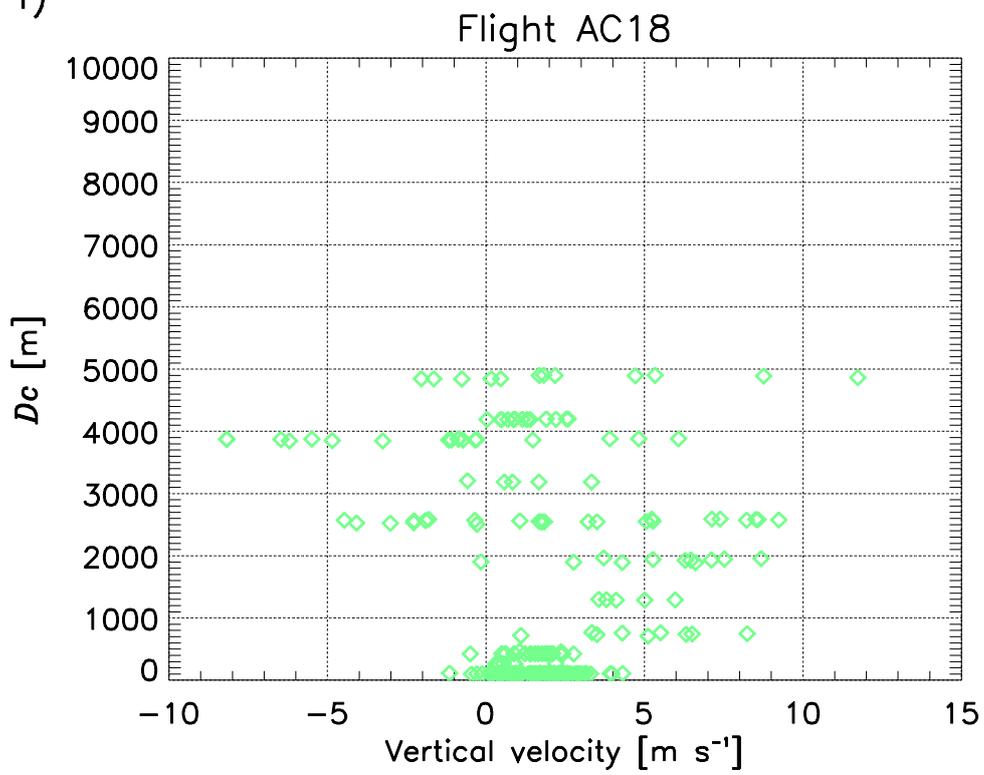
d)

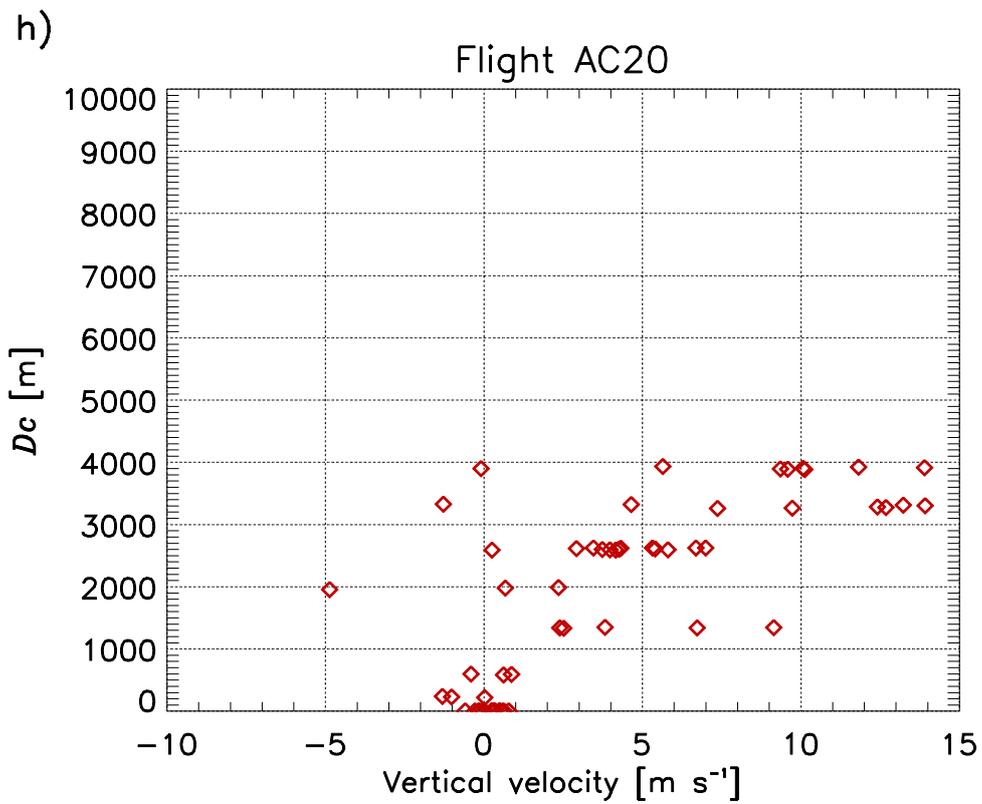
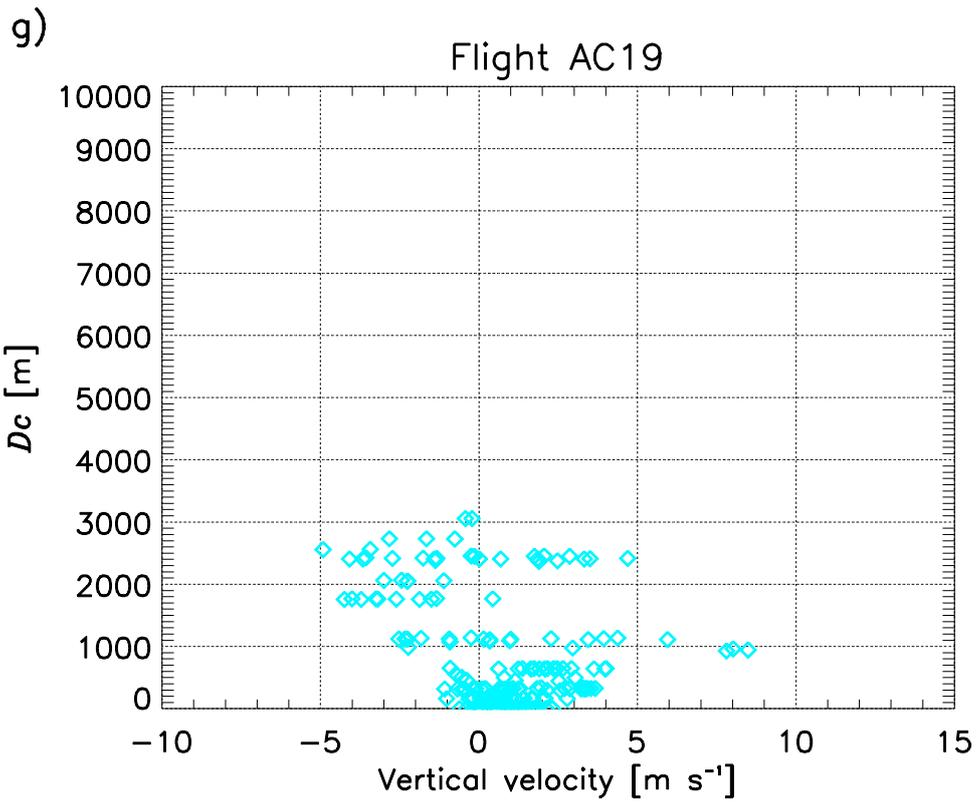


e)



f)





Figures 3a-h) Vertical velocities as a function of cloud depth ( $D_c$ ) for all flights. The flight number is indicated on the top of figures. Each dot indicates 1Hz average concentration.

Supplementary material for Section 4.2.2 (- Polluted regions)

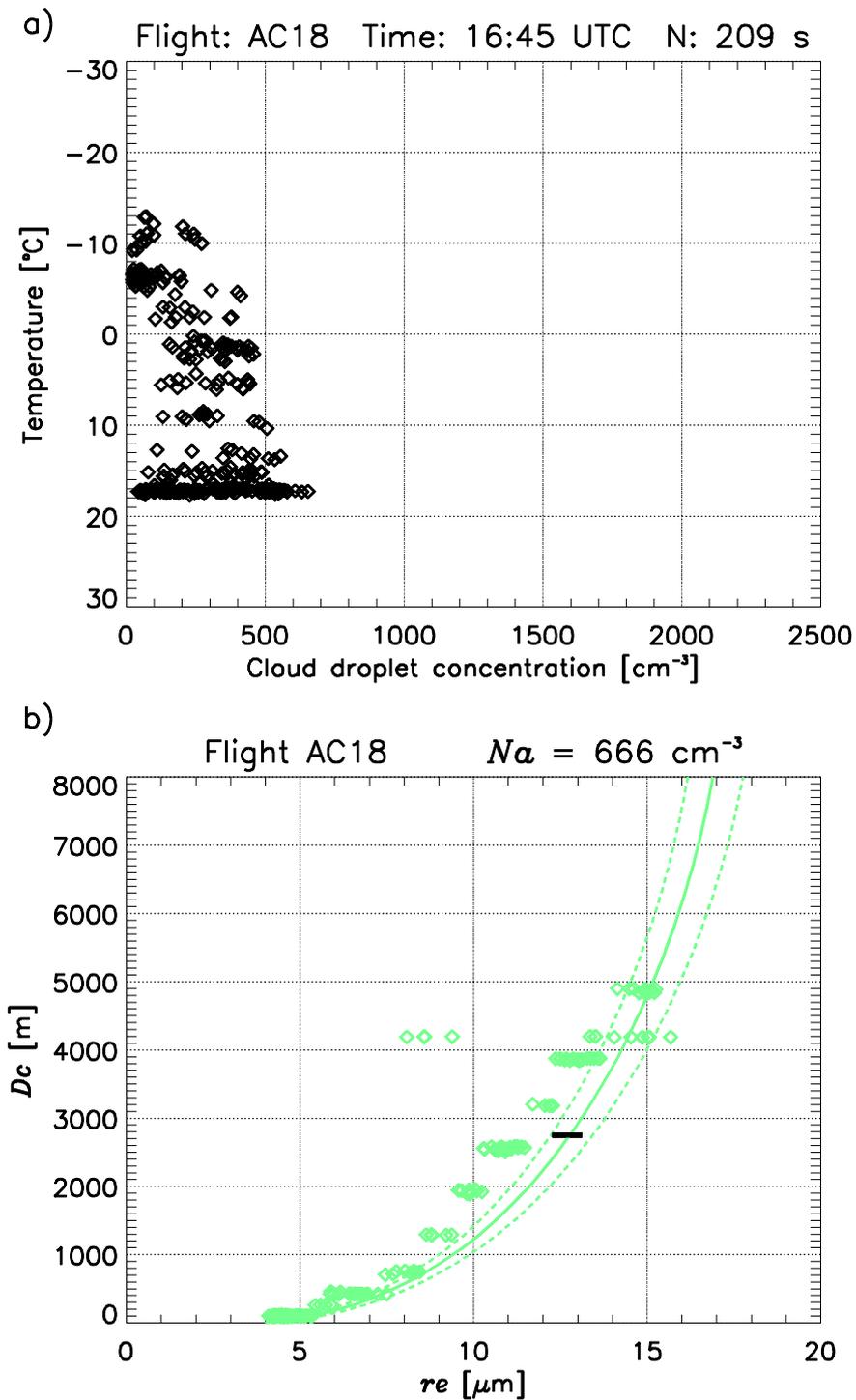


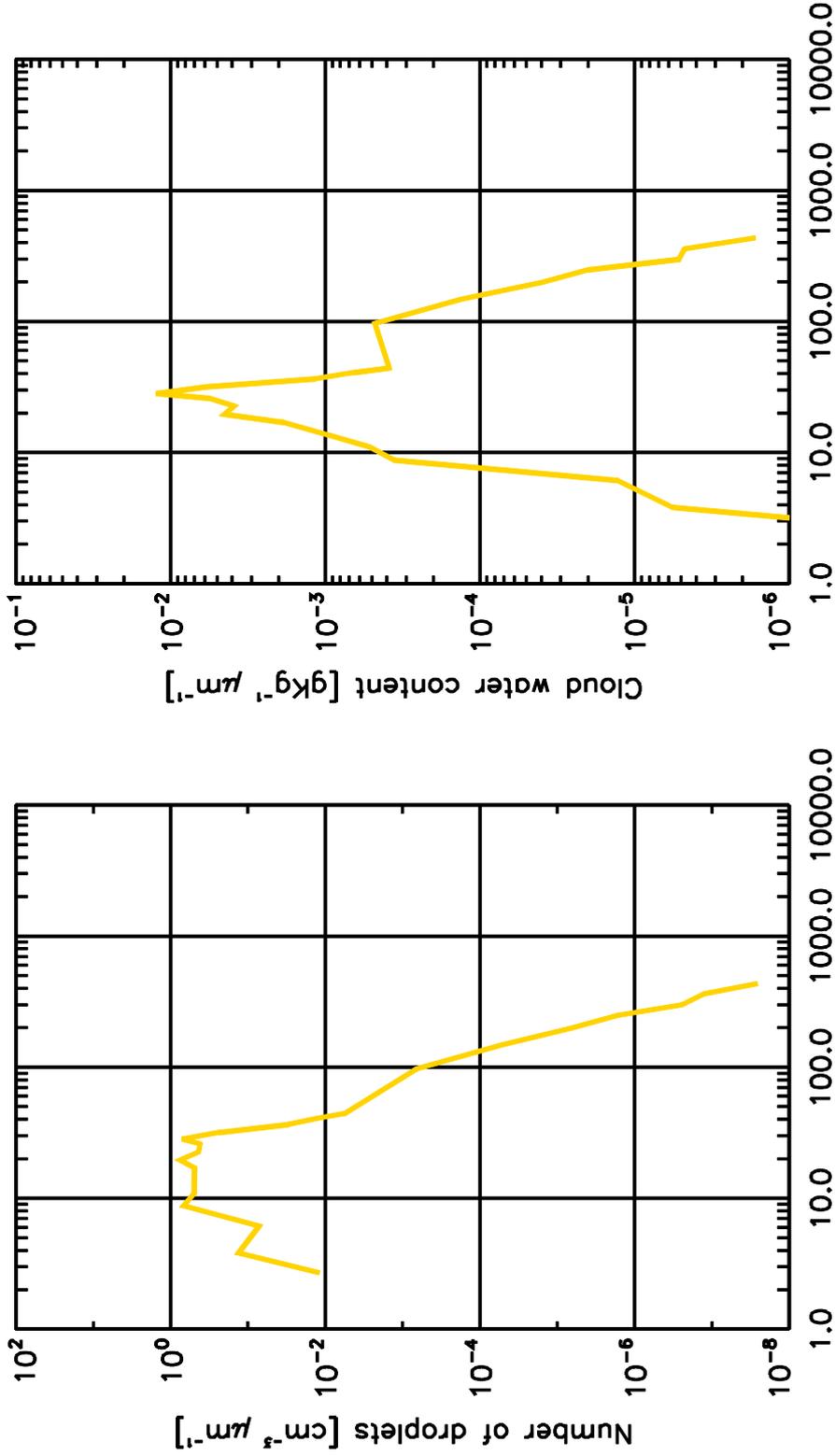
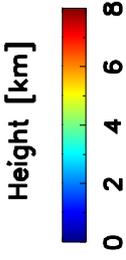
Figure 4 a) Cloud droplet concentrations measured with the CCP-CDP as a function of temperature for flight AC18. Each dot indicates 1Hz average concentration. The sample number in seconds (N) and the start time of the cloud profile are shown on the top of the panel; b) Cloud droplet effective radius ( $r_e$ ) as a function of cloud profile depth ( $D_c$ ) for flight AC18. The line indicates the  $r_e$  estimated for adiabatic growth ( $r_{ea}$ ) from cloud base (dashed lines indicate the  $r_{ea}$  values considering the uncertainty of the estimate). The height of 0 °C is indicated by a black horizontal bar across the  $r_{ea}$  line. The estimated adiabatic number of droplets ( $N_a$ ) at cloud base is shown on top of the figure.

a)

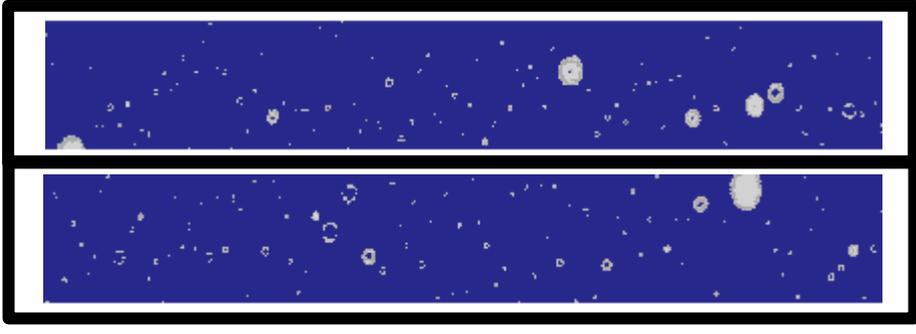
Flight: AC18 Date: 2014/09/28 17:46 UTC [06 s]

H=5466 m  
T=-5.7 °C  
N<sub>p</sub>=91 cm<sup>-3</sup>  
CWC=0.669 gm<sup>-3</sup>

DWC=0.05 gm<sup>-3</sup>  
RWC=0.00 gm<sup>-3</sup>  
r<sub>e</sub>=13.79 μm



CCP-CIP Images



b)

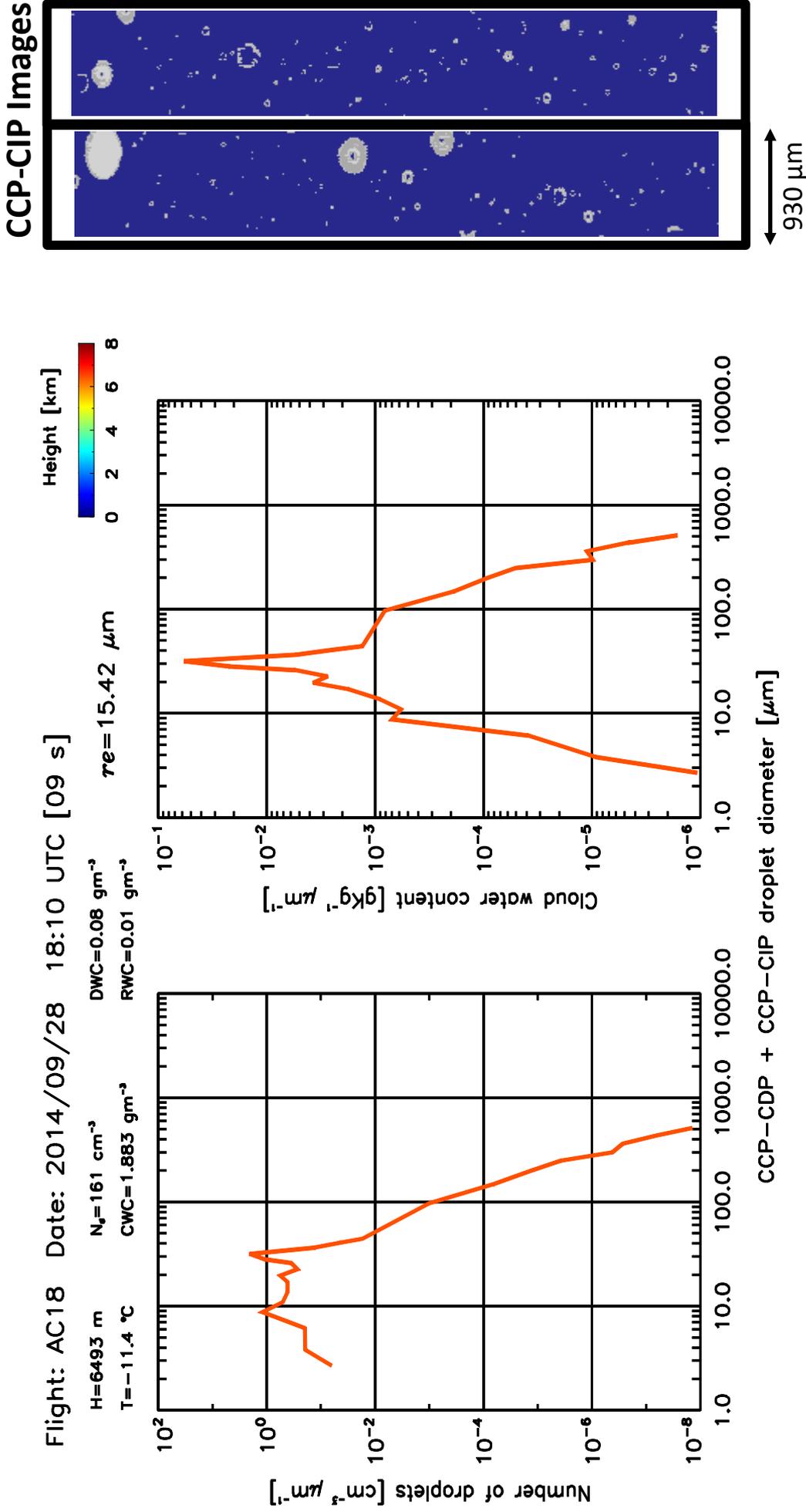


Figure 5a) Mean droplet size distribution composite from the CCP-CDP and CCP-CIP probes (left panel). Similar for indicated cloud water content in the right panel at the height where rain starts to form. On the top of the panels are indicated the HALO flight number, date, time of flight (UTC), duration of cloud pass in seconds, temperature(T) and altitude (H) above sea level, and the mean values for the total number of droplets ( $N_d$ ), CWC, DWC, RWC and  $r_e$ . The color bars indicate the height of HALO during the cloud pass. On the right side of the panels CCP-CIP images corresponding to the cloud pass are shown. B) Similar for the greatest height with measurements above cloud base.

Supplementary material for Section 4.2.2 (- Very polluted regions)

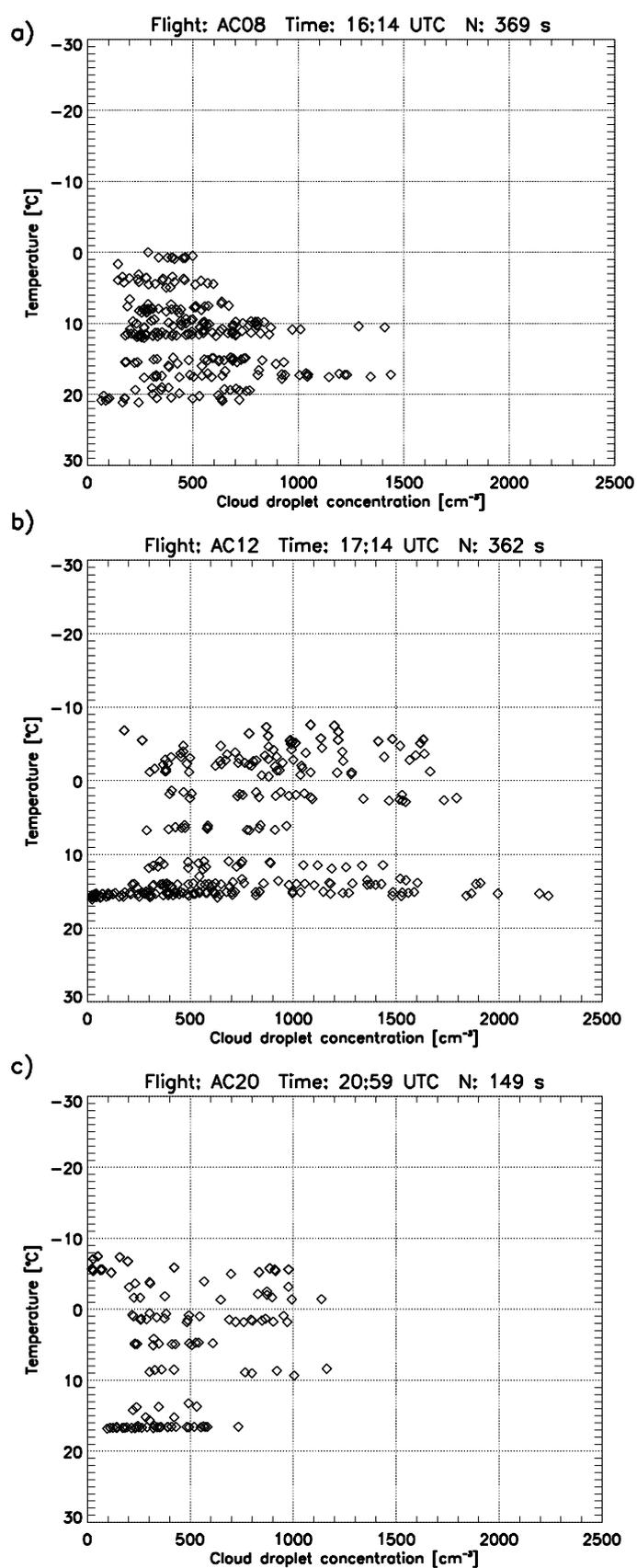


Figure 6 a) Cloud droplet concentration measured with the CCP-CDP probe as a function of temperature for Flight AC08. Each dot indicates a 1Hz average concentration. The sample number (N) and the approximate time of the cloud profile are shown on the top of the panel; b) Similar for Flight AC12; c) Similar for Flight AC20.

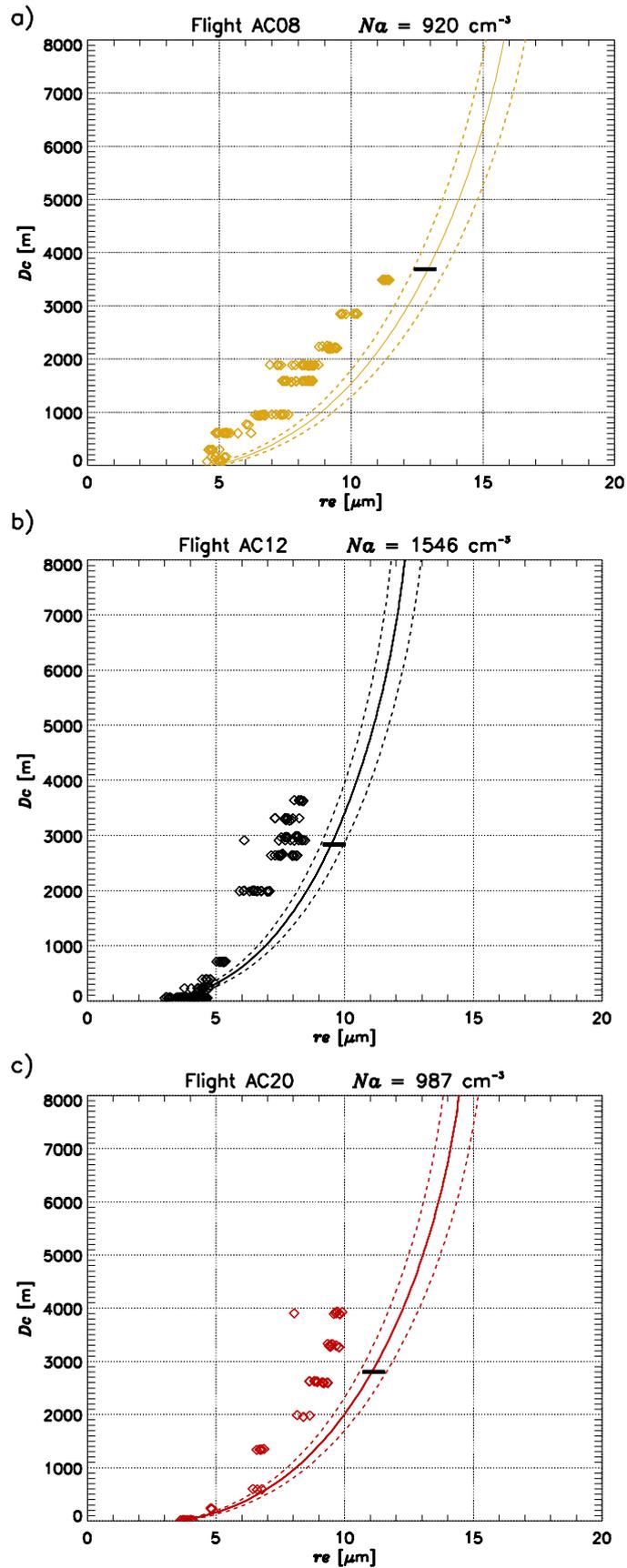


Figure 7 a) Cloud droplet effective radius ( $r_e$ ) as a function of cloud depth ( $D_c$ ) for flight AC08. The line indicates the  $r_e$  estimated for adiabatic growth ( $r_{ea}$ ) from cloud base (dashed lines indicate the  $r_{ea}$  values considering the uncertainty of the estimate). The height of  $0^\circ\text{C}$  is indicated by a black horizontal bar across the  $r_{ea}$  line. The estimated adiabatic number of droplets ( $N_a$ ) at cloud base is shown on top of the figure. b) similar for flight AC12 and c) similar for flight AC20.