Cloud microphysical properties
Instructions for the asignment

Rain in Cumulus over the Ocean (RICO); trade wind cumulus clouds, shallow convection

Literature

Rauber, R., et al., 2007: Rain in shallow cumulus over the ocean—The RICO campaign, Bull. Am. Meteorol. Soc., 88, 1912– 1928.

Arabas, S., H. Pawlowska, and W. Grabowski, 2009: Effective radius and droplet spectral width from in-situ aircraft observations in trade-wind cumuli during RICO. *Geophys. Res. Lett.*, vol. 36, L11803, doi:10.1029/2009GRL038257.

Data

Data description: ReadMe_RICO.txt
Data files:

- RF06_hc0407_162400.0R0001
- RF07_hc0408_150000.0R0001

comment: The file name has a form hhmmss.dH0001, where hh, mm, ss, d denote the start time of measurements in hour (hh), minutes (mm), seconds (ss) and tenths of second (d). '0001' at the end of the file name means that data are registered with a frequency of 1Hz.

Measurements were performed by the Fast Forward Scattering Spectrometer Probe (FFSSP).

Tasks TODO

Do separately for each flight. Discuss results and compare between flights.

1. Plot vertical profiles of temperature and water vapor mixing ratio. Calculate the potential temperature and plot its vertical profile.
2. Plot a scatter plot of LWC versus height. Calculate a value of c_w (see instruction to the ACE2 exercise). Estimate the height of the cloud base. Plot a line $LWC=c_w \cdot h$
3. Plot a scatter plot of concentration (N) and mean volume diameter (d_v) versus height.
4. At each level calculate a mean value of the droplet concentration. Plot that value versus height. Calculate a mean value of the droplet concentration taking into account the whole set of measurements. Propose an interpretation of that relation.
5. In the plot d_v-h add a theoretical relations d_v-h ($LWC = c_w h$, $LWC = {}^{1}/_{6}\,\pi \rho_w N d_v^3$) where N is a mean of droplet concentration over the whole flight and concentration +/- 30% N.