Cloud Droplet Probe (CDP)

General Description

The cloud droplet probe, manufactured by Droplet Measurement Technologies, measures the concentration and size distribution of cloud droplets in the size range from 2-50 μm. The instrument counts and sizes individual droplets by detecting pulses of light scattered from a laser beam in the near-forward direction, using a sample area of 0.24 mm2 or a sample rate of 48 cm3 at a flight speed of 200 m/s. The probe is mounted in an underwing canister (see photo below) and is designed to operate at up to 200 m/s; the GV often exceeds this flight speed, but usually not in penetrations of clouds containing cloud droplets. Droplet sizes are accumulated in 30 bins with variable sizes, as specified in the header of the netCDF data files. Measurements are usually provided at a rate of 1 Hz in the standard data files but can be made available at 10 Hz in special high-rate processing. The instrument is similar to, and might be considered a high-speed replacement for, the Forward Scattering Spectrometer Probe. At high droplet concentration (>500 cm^{-3}), coincidence losses have been observed with this probe, and these are especially serious at GV flight speeds. The probe is designed for cloud droplets, and its response to ice crystals is not intended to be quantitative; measurements in ice clouds should not be used except as qualitative indications of cloud.

Data Products

The primary data products are CONCD (total concentration, cm^{-3}) and CCDP (the size distribution, cm^{-3} bin^{-1}, in 30 bins). These are recorded by the central GV recording system in the standard data files. There are many housekeeping variables also, including indications of rejected particles, laser power, instrument temperature, etc.

NCAR/RAF provides a program, ncpp, that can read the data files and display the size distribution produced by the CDP as well as other hydrometeor-size spectrometers. See this link to download the program.

References

- The manufacturer provides information on the probe at this URL.
- A description of laboratory studies of this probe and of its use in a flight program is available in this publication:

(link)S. Lance, C. A. Brock, D. Rogers, and J. A. Gordon, 2010: Water droplet calibration of the Cloud Droplet Probe (CDP) and in-flight performance in liquid, ice and mixed-phase clouds during ARCPAC. Atmos. Meas. Tech., 3, 1683–1706, 2010. doi:10.5194/amt-3-1683-2010.

Photo

CDP (foreground) mounted with the Small Ice Detector (SID-2H, background) on the right wing of the GV: