FSSP / DMT SPP-100 / DMT CDP

Processing

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RAF Algorithm Review

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BACKGROUND

Three probes for measuring and counting cloud droplets

1. Original FSSP=100 (PMS)
2. SPP-100 (DMT)
3. CDP (DMT)

Common Features

- Counts per channel
- Specified sample area
- First/last bins
- Specified cell boundaries
- Housekeeping

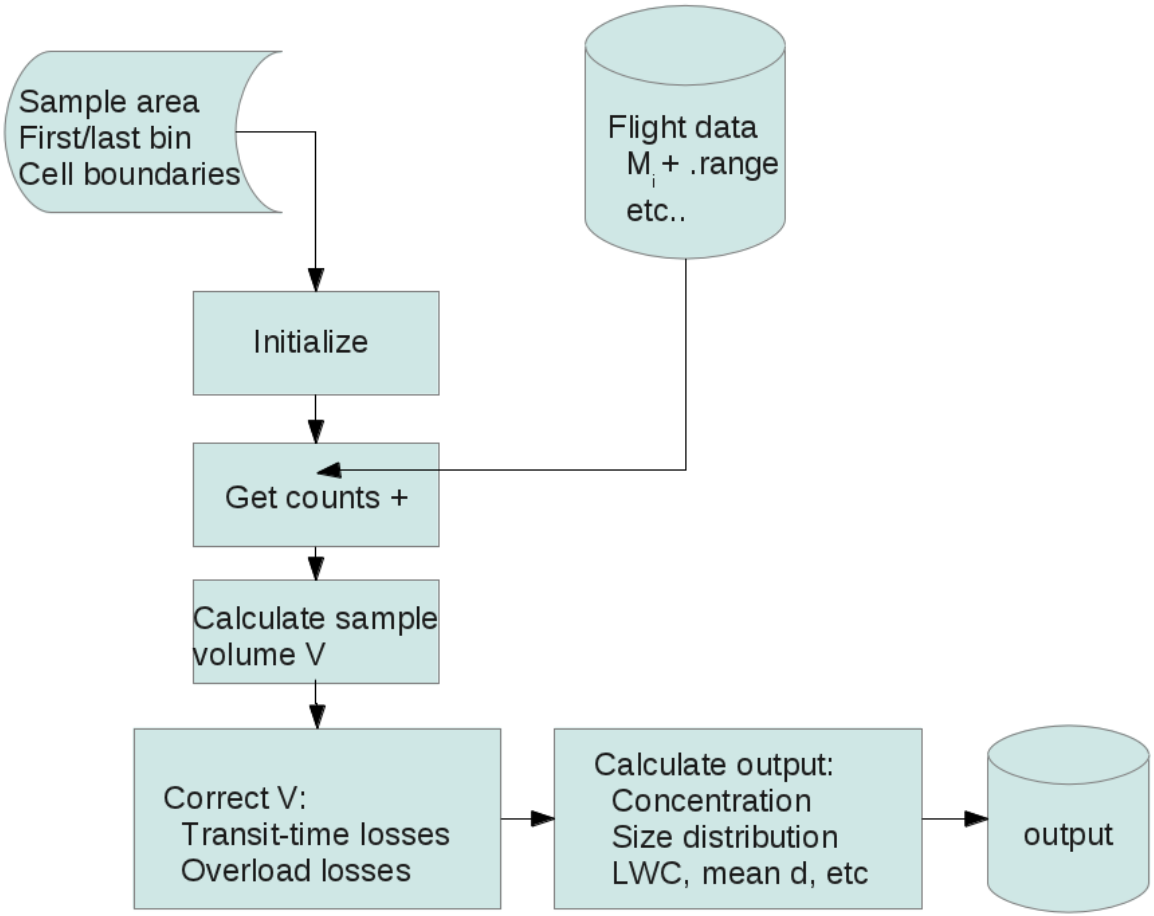
Special Features

FSSP: activity, strobes, fast resets

SPP: transit-time rejects, overflow counts, DOF rejects

CDP: average transit time, DOF rej, (transit-time rej)

PROCESSING FLOW



SOME DETAILS

Equations Used:

1. Uncorrected sample volume in terms of sample area A, airspeed TAS, and sample rate R:

$$V = \frac{A * TAS}{R}$$

2. Correction for velocity reject (SPP): with $M = \sum_{FIRST\_BIN}^{LAST\_BIN} m_i$ and rejAT the velocity-reject count,

$$V' = V \frac{M}{(M + rejAT)}$$

3. Calculate derived quantities like liquid water content, radar reflectivity factor, mean diameter, etc.

MORE DETAILS

Equations Used:

SPP-100 only: An additional correction is applied for the reduction in sample volume caused by particles counted while the probe is unable to size them or the pulse exceeds the maximum level of the A/D converter (OVFLW):

$$V'' = V' \frac{M}{(M + oflow)} = V \frac{M^2}{(M + rejAT)(M + oflow)}$$

This is not applied to the CDP or FSSP, and is skipped of oflow>5000 (which I don't understand).

MORE DETAILS

Equations Used:

FSSP-100 only:

$$V' = V \frac{M}{NSTROB}$$

$$FACT = NSTROB * \tau_1 + FRESET * \tau_2$$

$$V'' = V'(1 - 0.71 * FACT)$$

SUGGESTIONS

Suggested Changes:

1. Change the sums used to calculate the velocity-reject correction so that the total ranges over all available ranges, not just FIRST_BIN to LAST_BIN.
2. Change the volume correction formula to be:

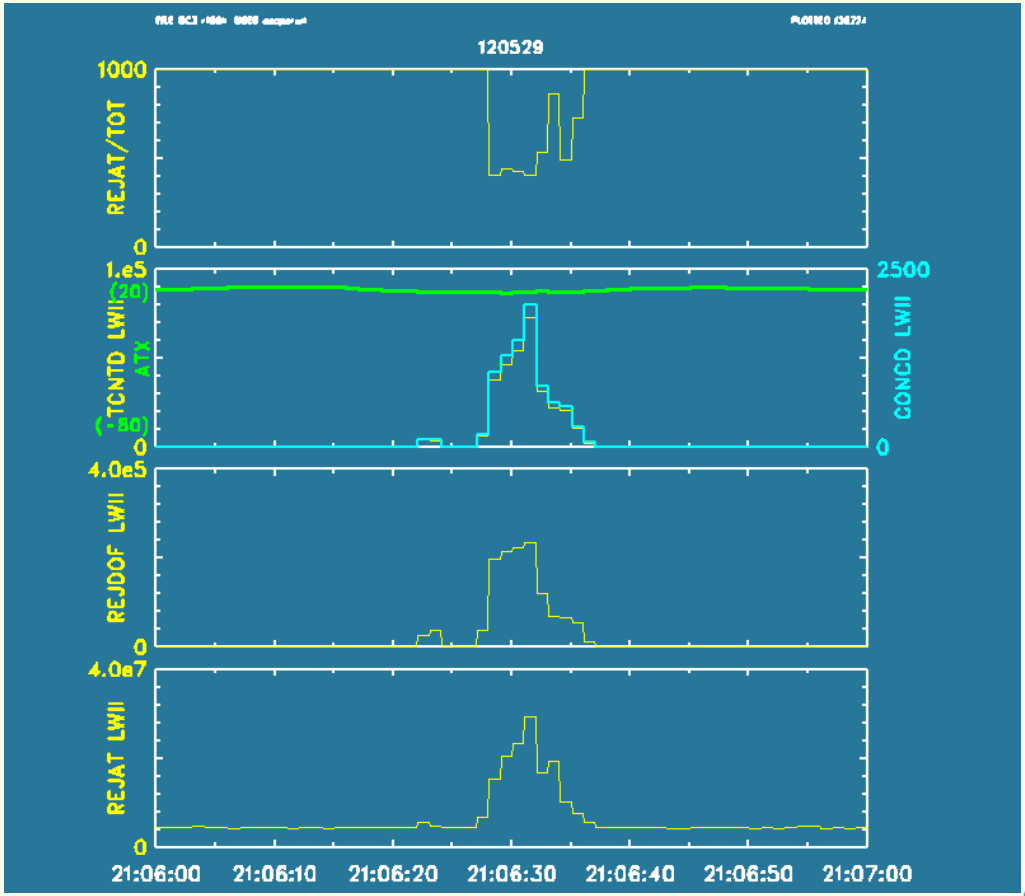
$$V'' = \frac{M}{(M + rejAT)} \frac{(M + rejAT)}{(M + rejAT + oflow)} = \frac{M}{(M + rejAT + oflow)}$$

3. Apply this correction prior to calling 'pms1d_rc' so that the sample volume is correctly applied to derived quantities like liquid water content.
4. Change variable rejAT from "xxx Average ..." to "xxx TOTAL Transit-Time-Rejected Particles"

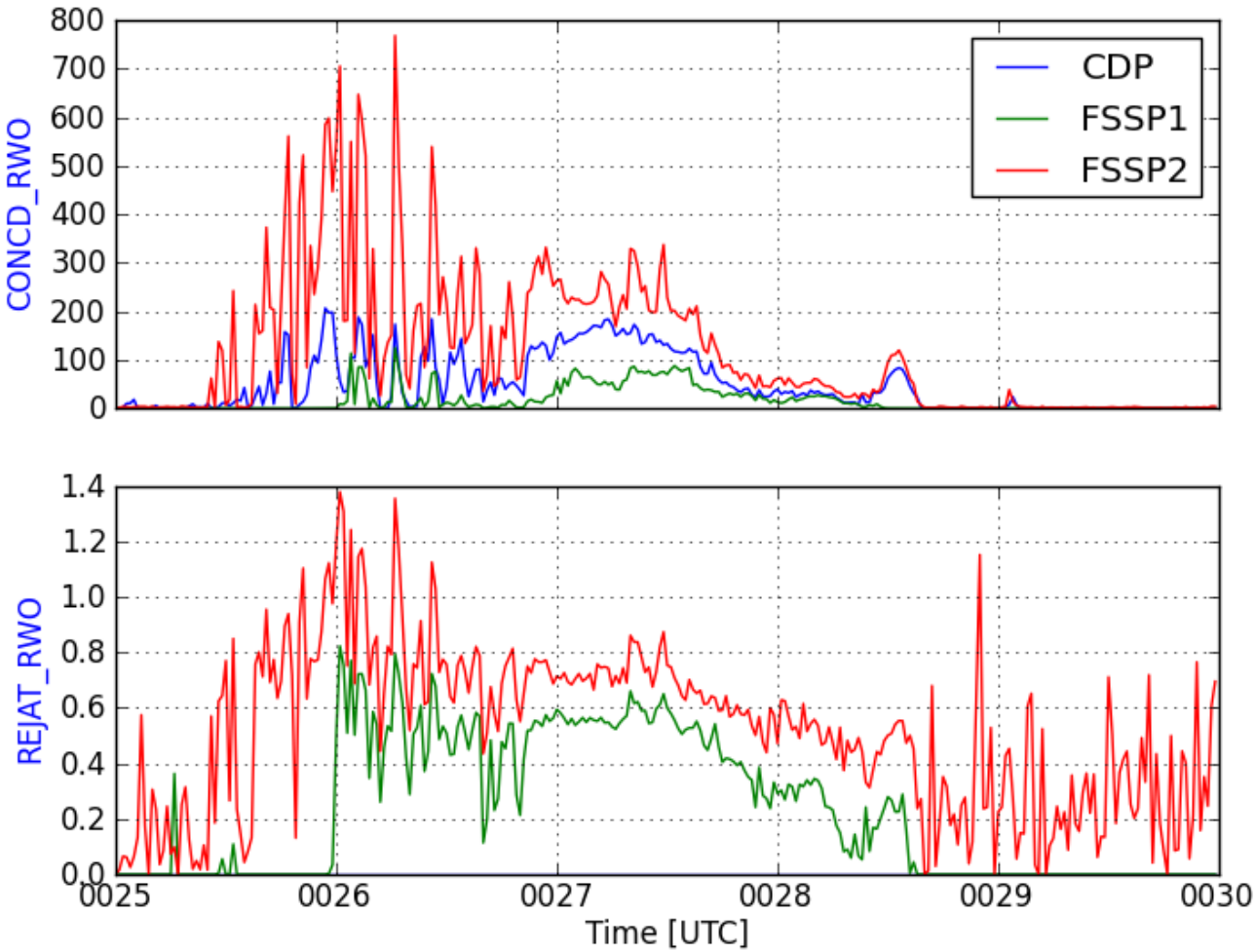
STUDY OF REJAT/REJDOF

Velocity Reject Counts for the CDP

This measurement is missing for PLOWS, IDEAS-4, and HIPPO; it is present for DC3 but the values are not reasonable.



PLOWS (2 SPP-100s, CDP)



More Information:

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