

7H.30: Atmospheric Measurements of Hygroscopic Flare Aerosols

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Objective

To assess the aerosol size distribution produced in the atmosphere by the burning of hygroscopic flares and identify changes in the size distribution that occur with time in the atmosphere.



On August 4, 2008, an instrumented research aircraft followed a flare burning aircraft (see picture above) to sample the aerosol size distribution produced by hygroscopic flares. The data from the Passive Cavity Aerosol Spectrometer Probe (PCASP) was used to measure the spectrum of aerosols in the range of 0.1 to 0.3 μm .



King Air CJ-90 Aircraft with hygroscopic flares lit.

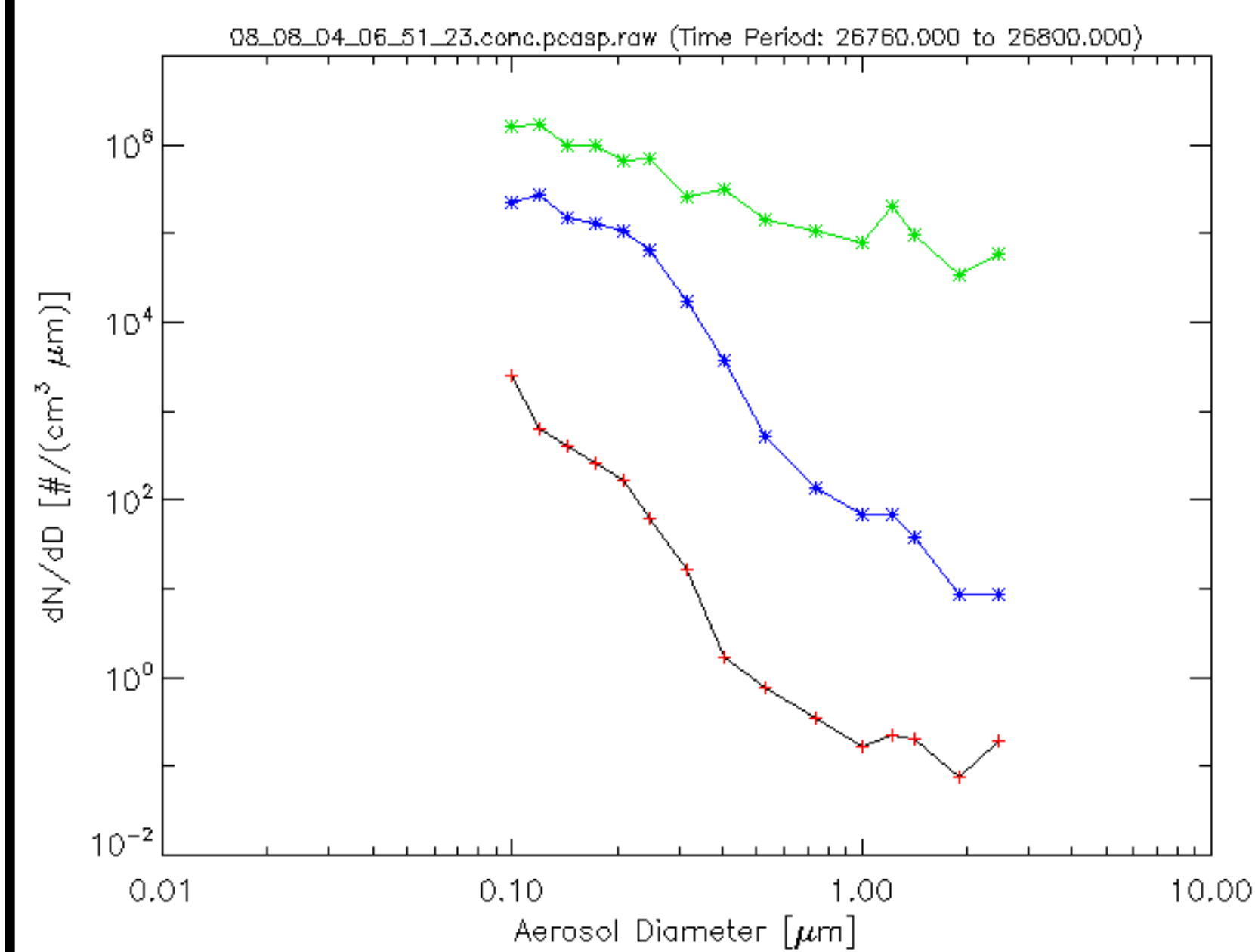


The PCASP mounted under the wing of a King Air 200 (N825ST) Research aircraft.

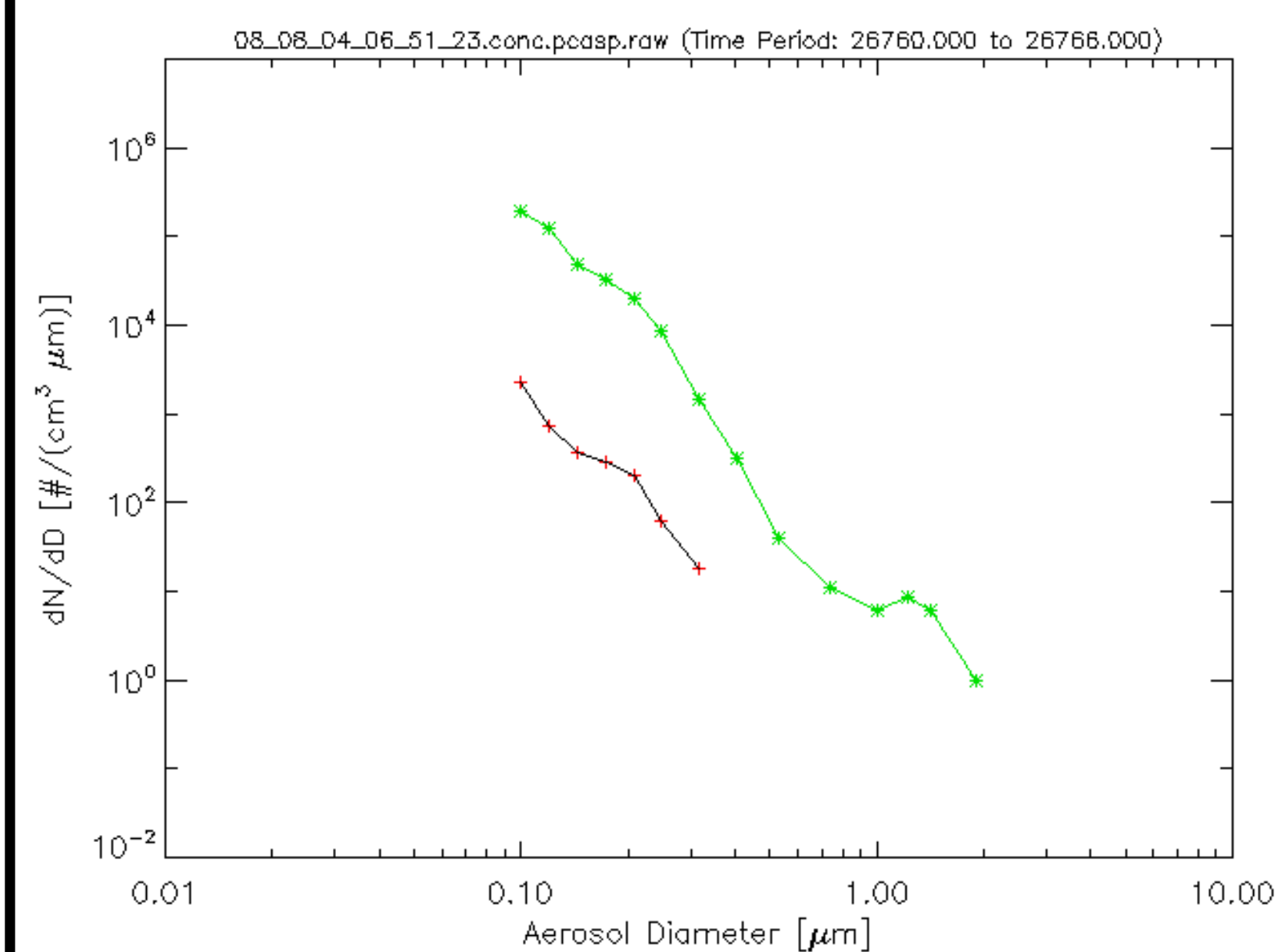


Burn-In-Place Flares (CaCl_2) mounted on an aircraft wing. Flares are manufactured by Ice Crystal Engineering LLC, for the application of rain enhancement.

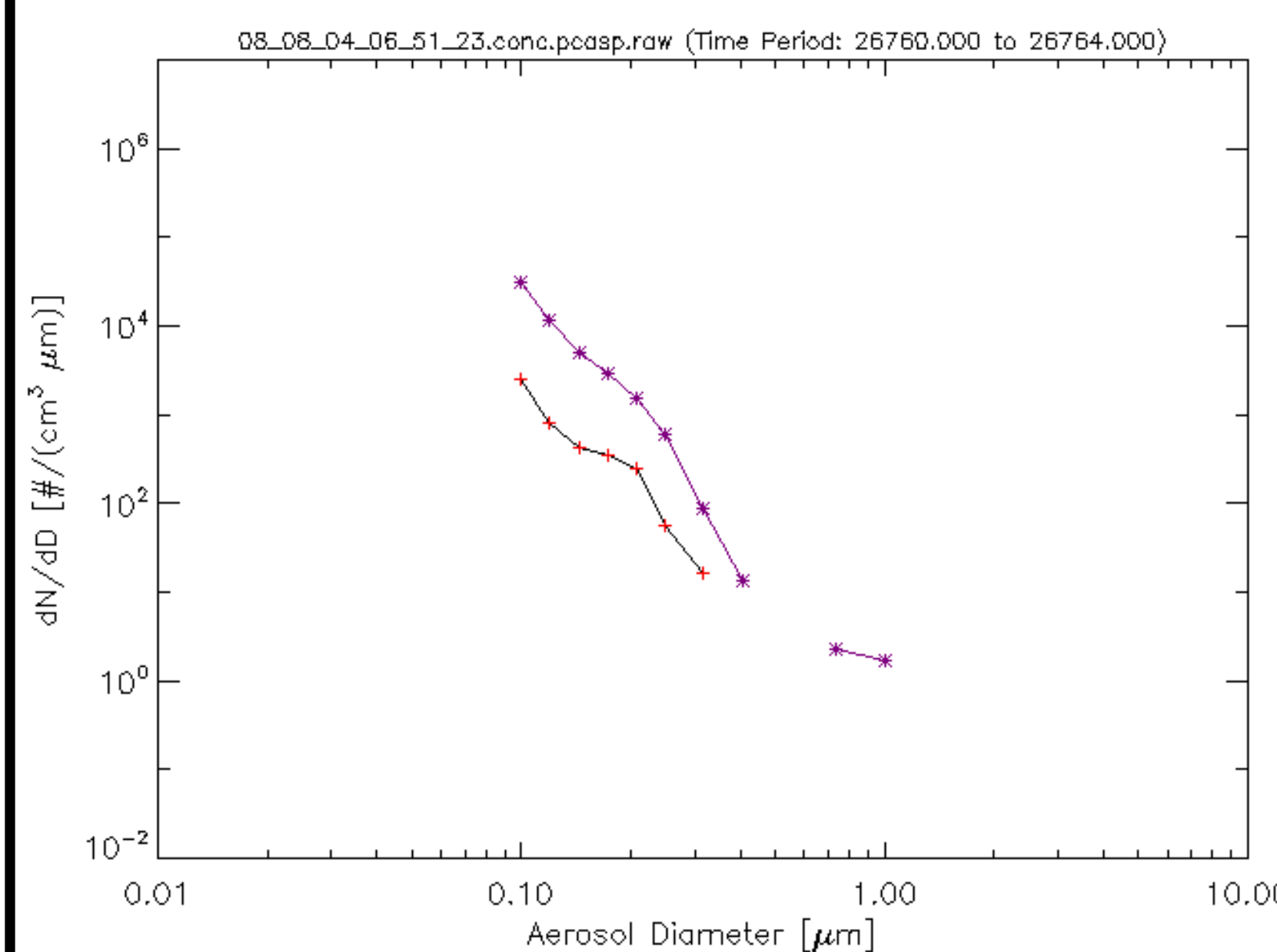
Analysis



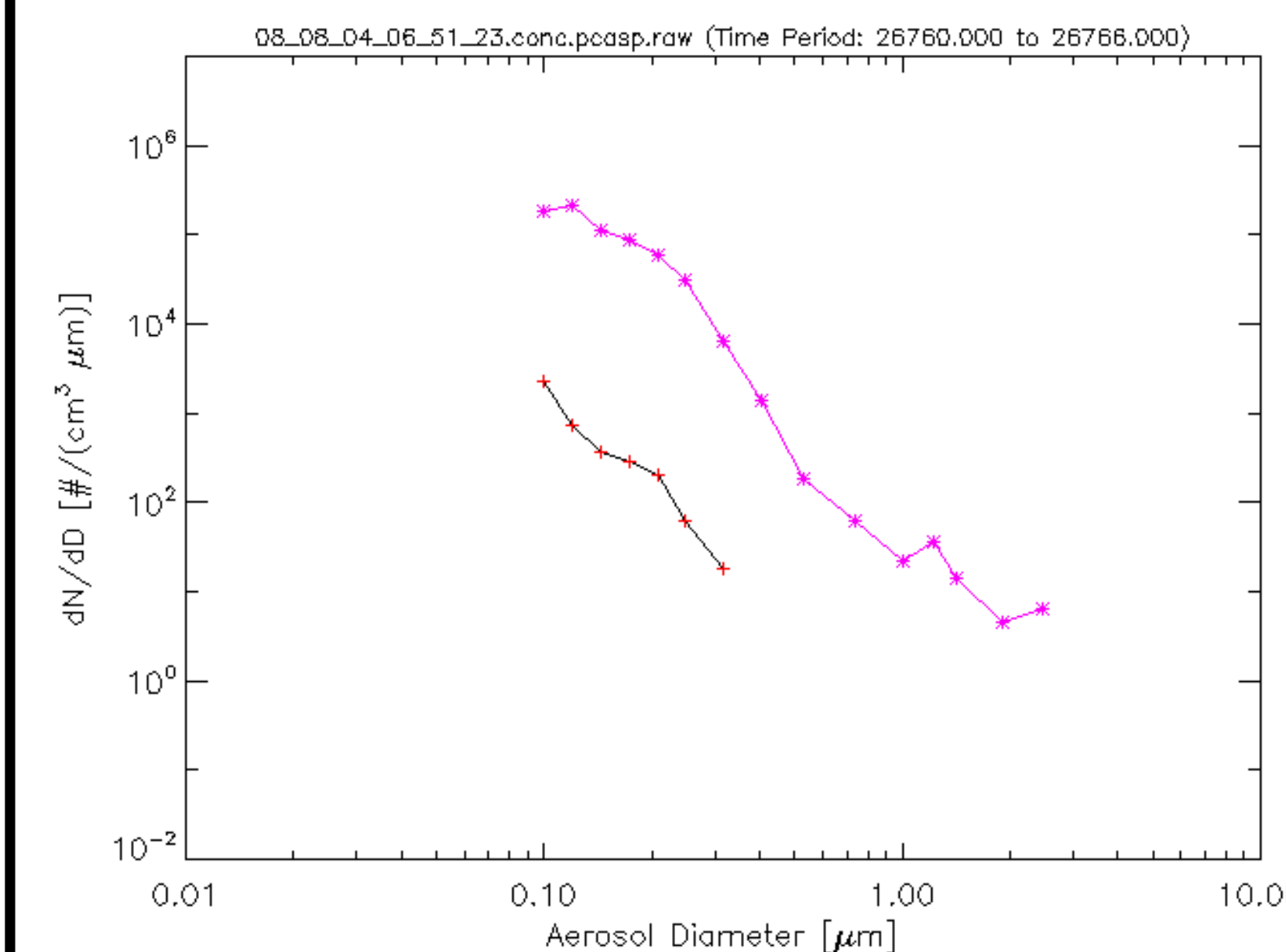
Aerosol size spectra produced from 40 second sample of 1 Hz PCASP measurements. Black line is the clean air sample (background). Green line is the close (~ 2 km) to flare spectrum while the blue line is from further back (~ 2.5 km).



Close Distance: The size distribution (green line) based on six second samples when the measurement aircraft was very close (~ 1.5 km) to the flare burning aircraft. The black line is a six second clean air spectrum.



Middle Distance: The size distribution (purple line) based on four second samples when the measurement aircraft dropping back (~ 2.3 km) from the flare burning aircraft. The black line is a four second clean air spectrum.



Farther Distance: The size distribution (magenta line) based on six second samples when the measurement aircraft was farther away (~ 2.8 km) from the flare burning aircraft. The black line is a four second clean air spectrum.

Conclusion

- In the 40 second close up sample, the instrument may have been saturated and not able to accurately count such high number concentrations, which resulted in a change in the shape of the size spectrum.
- Through the additional analysis at the three different distances the spectrum has a similar trend with variances only in the magnitudes of the concentrations, and not the slope of the size spectrum.
- An increase in the 1-3 μm size spectrum is evident in the flare aerosol samples which should have a positive affect on the cloud droplet size spectrum.

Future Work

- Analyze more flare sampling flights (19 March 2008 and 2 April 2009)
- Analyze a broader spectrum utilizing Differential Mobility Analyzer (DMA), Condensation Particle Counter (CPC), and Forward Scattering Spectrometer Probe (FSSP).
- Collect more airborne measurements

Acknowledgments

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