In Situ Aerosol Parameter Measurements Aboard the DC-8 during SOLVE II

Bruce Anderson, Eddie Winstead, Lee Thornhill,
Charles Hudgins and Sandy Branham

Chemistry and Dynamics Branch, NASA Langley
Hampton Virginia

In Situ Aerosol Measurements

Measured Parameter	Instrument	Size Range (microns)	Response (seconds)	Precision
Total and Nonvolatile Aerosols	TSI 3760	0.012 - 1	1	10%
Dry Fine, Coarse Aerosol Size Distribution	PCASP	0.1 - 3	1	20%
Ambient Aerosol Size Distribution	FSSP-300	0.3 - 20	1	20%
Ambient Aerosol Size Distribution plus forward/backward scattering ratio	CAPS	0.6 - 44	1	20%
Precipation Particle Size Distribution and Images	CAPS	25 – 1550	1	20%
Total and Backward Scattering Coefficients at 450, 550, and 700 nm	TSI 3563 Nephelometer	< 3	1	0.2 Mm-1
Aerosol Absorption	PSAP	< 3	60	0.1 Mm-1
Liquid Water Content	CAPS TWC	> 5	1	.001 g/m3


CAPS Probe


Isokinetic Inlet for
Nephelometer
Shrouded Inlet for
CN Counters

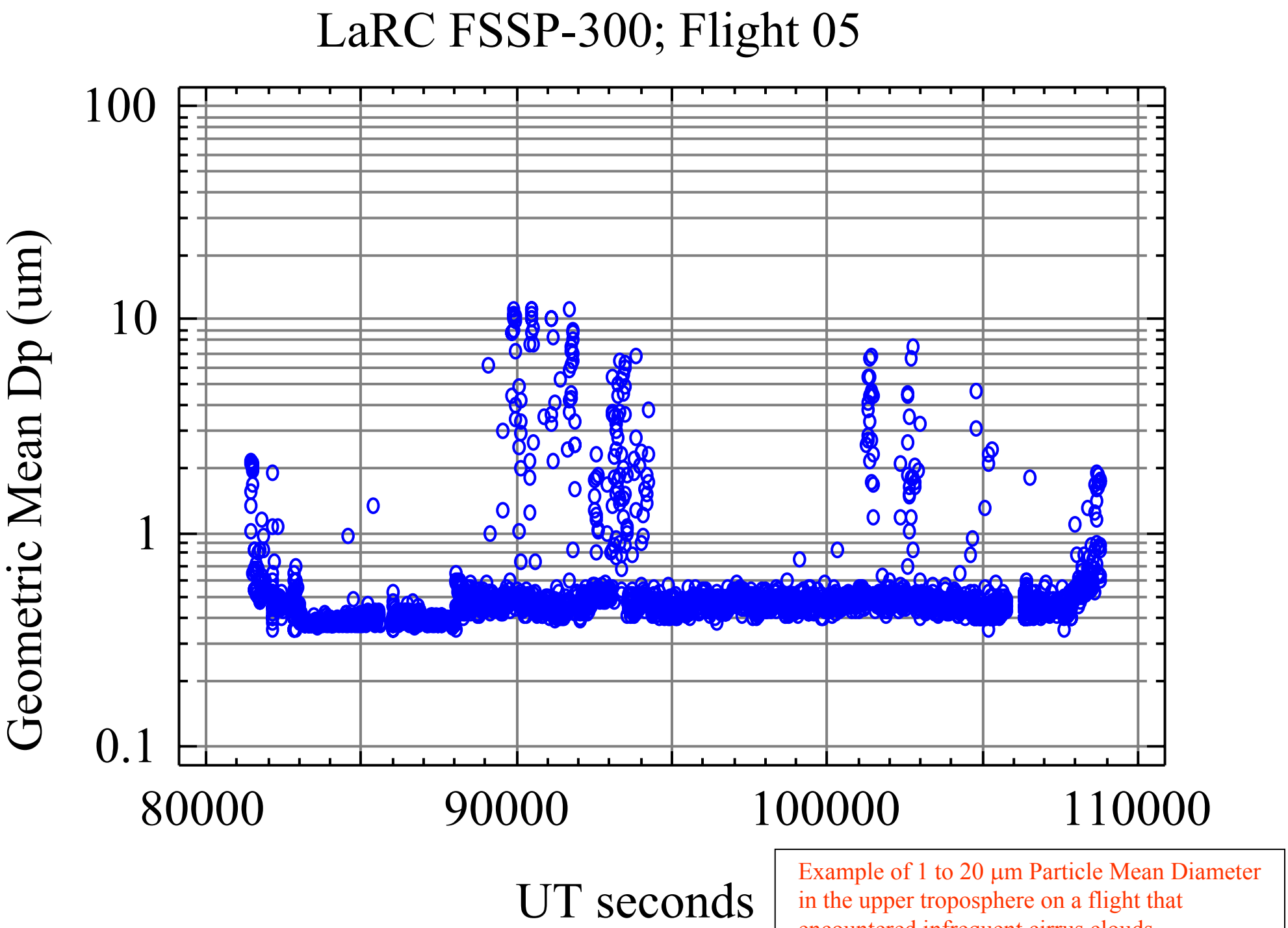

FSSP-300
PCASP
817

In Situ Aerosol Data Products

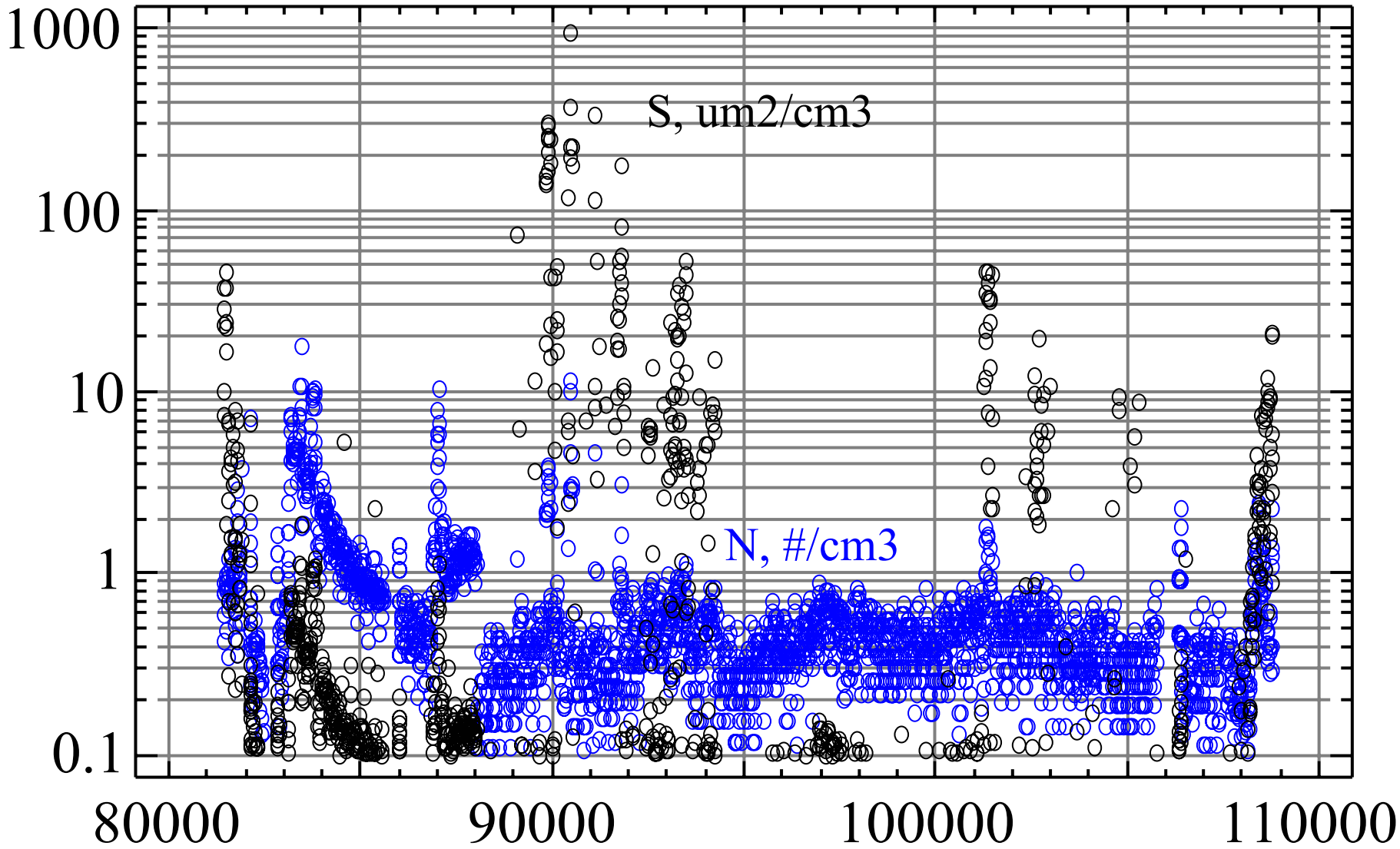
Primary Products	Secondary Products	Calculated Products
Total and Nonvolatile CN	Volatile CN Fraction	
Size fractionated number concentrations	Number, surface and volume distributions	Scattering Coefficients
	Integral aerosol number, surface area and volume densities	
Scattering Coefficients		Angstrom coefficients
Absorption Coefficient	Elemental Carbon Mass	Single scattering albedo, extinction, aerosol optical thickness
Backscattering Coefficients		extinction/backscatter ratio

Data to be Archived from the DC-8 In-Situ Aerosol Parameter Experiment Rack (DIAPER)

Parameter	units	Resolution (seconds)	Estimated precision	LOD
Total aerosols > 0.015 μm	cm^{-3}	1	10%	1
Nonvolatile aerosols > 0.015 μm	cm^{-3}	1	10%	1
Number density of 0.1 to 1 μm aerosols	cm^{-3}	60	20%	0
Surface area of 0.1 to 1 μm aerosols	$\mu m^{-2} cm^{-3}$	60	50%	0
Volume of 0.1 to 1 μm aerosols	$\mu m^{-3} cm^{-3}$	60	50%	0
Number of 1 to 5 μm aerosols	cm^{-3}	60	20%	0
Surface Area of 1 to 5 μm aerosols	$\mu m^{-2} cm^{-3}$	60	50%	0
Volume of 1 to 5 μm aerosols	$\mu m^{-3} cm^{-3}$	60	50%	0
Number of 5 to 25 μm aerosols	cm^{-3}	60	20%	0
Surface Area of 5 to 25 μm aerosols	$\mu m^{-2} cm^{-3}$	60	50%	0
Volume of 5 to 25 μm aerosols	$\mu m^{-3} cm^{-3}$	60	50%	0
Number of 25 to 1600 μm particles	m^{-3}	60	20%	0
Surface Area of 25 to 1600 μm particles	$\mu m^{-2} cm^{-3}$	60	50%	0
Volume of 25 to 1600 μm particles	$\mu m^{-3} cm^{-3}$	60	50%	0
Cloud Water Content	$g\ m^{-3}$	60	20%	0
Total Aerosol Surface Area	$\mu m^{-2} cm^{-3}$	60	50%	0
Total Aerosol Volume	$\mu m^{-3} cm^{-3}$	60	50%	0
Cloud Water Phase	-	60	-	-
Aerosol Scattering Coefficient (450 nm)	Mm^{-1}	10	10%	0.2
Aerosol Scattering Coefficient (550 nm)	Mm^{-1}	10	10%	0.2
Aerosol Scattering Coefficient (700 nm)	Mm^{-1}	10	10%	0.2
Aerosol Backscatter Coefficient (450 nm)	Mm^{-1}	10	10%	0.2
Aerosol Backscatter Coefficient (550 nm)	Mm^{-1}	10	10%	0.2
Aerosol Backscatter Coefficient (700 nm)	Mm^{-1}	10	10%	0.2
Aerosol Absorption (565 nm)	Mm^{-1}	60	20%	0.1
Black Carbon	$\mu g\ m^{-3}$	60	20%	0.01
Angstrom Coefficient (450-700nm)	-	10	-	-
Angstrom Coefficient (550-700 nm)	-	10	-	-
Angstrom Coefficient (450-550 nm)	-	10	-	-
Single Scattering Albedo	-	60	-	0.05



Example of 1 to 20 μm Particle Mean Diameter in the upper troposphere on a flight that encountered infrequent cirrus clouds.



Example of 1 to 20 μm aerosol number density and surface area in the upper troposphere on a flight that encountered infrequent cirrus clouds.

Data recorded within the Hekla Volcanic plume during SOLVE-I