

# TC<sup>4</sup> Science Objectives for CALIPSO

*Chip Trepte*

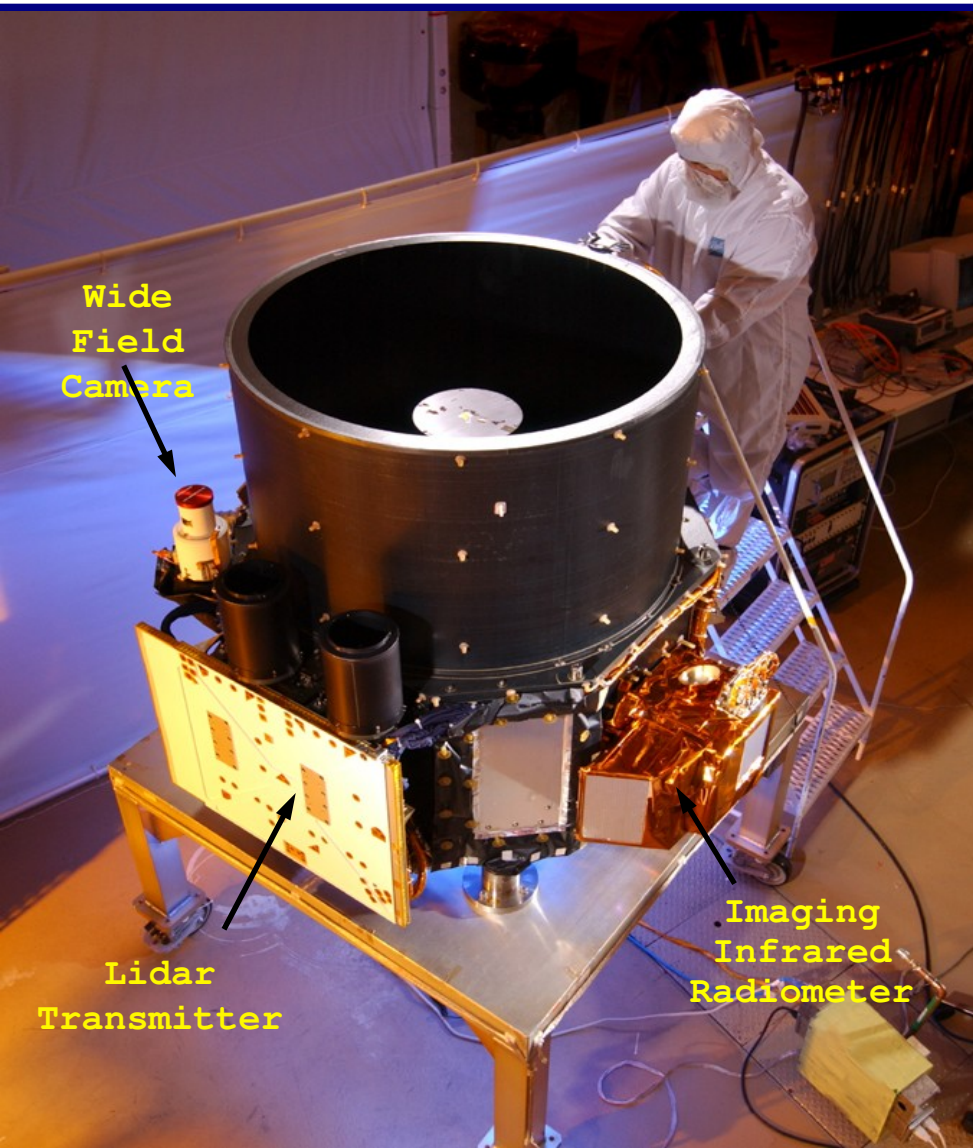
*NASA Langley Research  
Center*



with contributions from:

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# Payload Specifications



## CALIOP

Laser	Nd: YAG, 2x110 mJ
Wavelength	532 nm, 1064 nm
Repetition rate	20.16 Hz
Receiver telescope	1.0 m diameter
Polarization	532 ανδ ⊥
Φοοπιρ/ΦΟς	100 μ / 130 μραδ
ζεπιχαρεσολτιον	30 –60 μ
Ηοριζονταρεσολτιον	333 μ
Λιν. δψαμιχ ρανγε	22 βιτσ

## Wide-Field Camera (WFC)

Wavelength	645 nm
Spectral bandwidth	50 nm
IFOV / Swath	125 m / 61 km

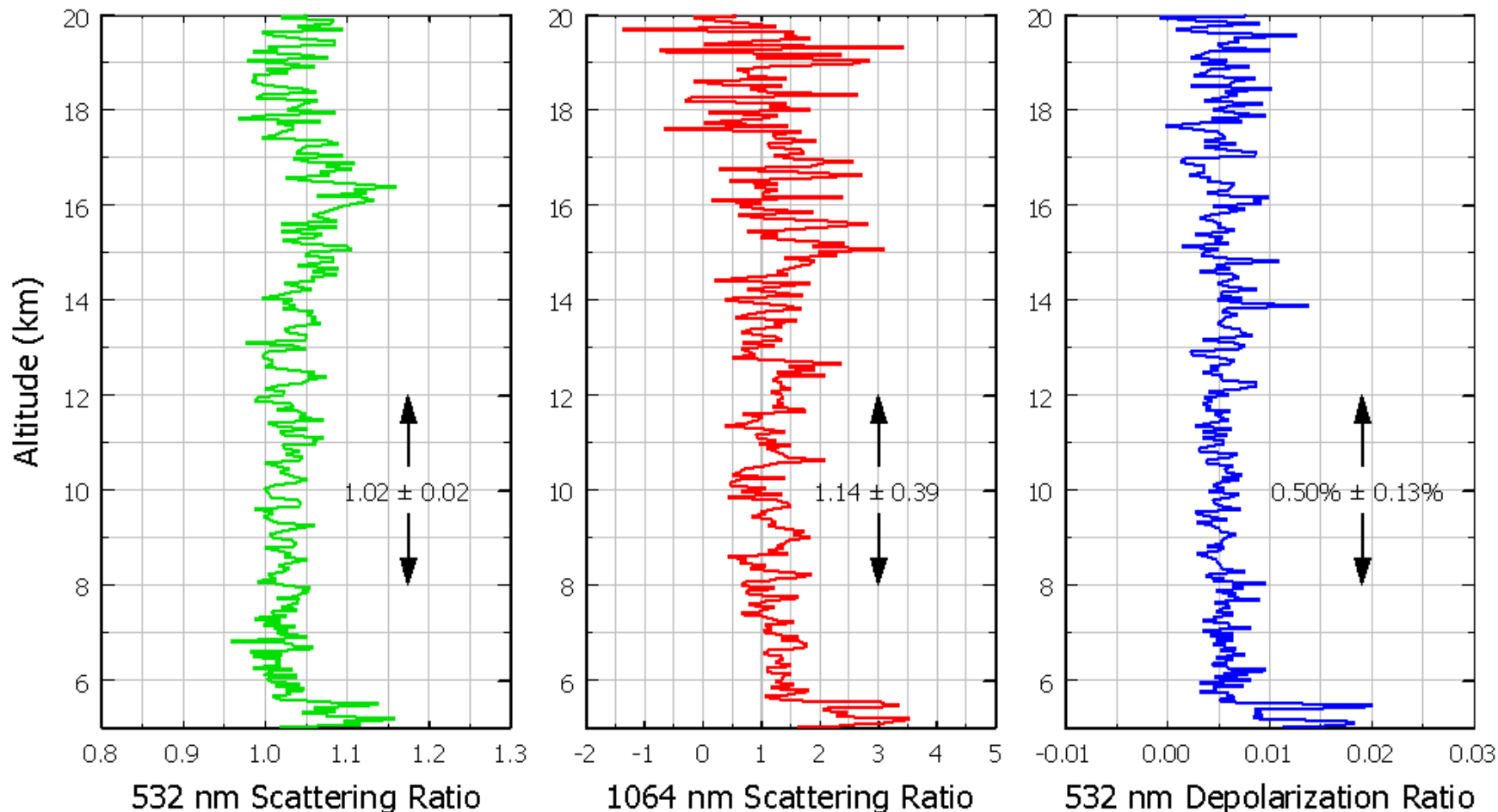
## Imaging Infrared Radiometer (IIR)

Wavelength	8.65, 10.6, 12.05 μm
Σπεχτραλεσολτιον	0.6–1.0 μm
ΙΦΟς / Σωαη	1 km / 64 km
NETΔ ≅ 210K	0.3 K
Χαλβρατιον	1 K

# Clear-air Profiles



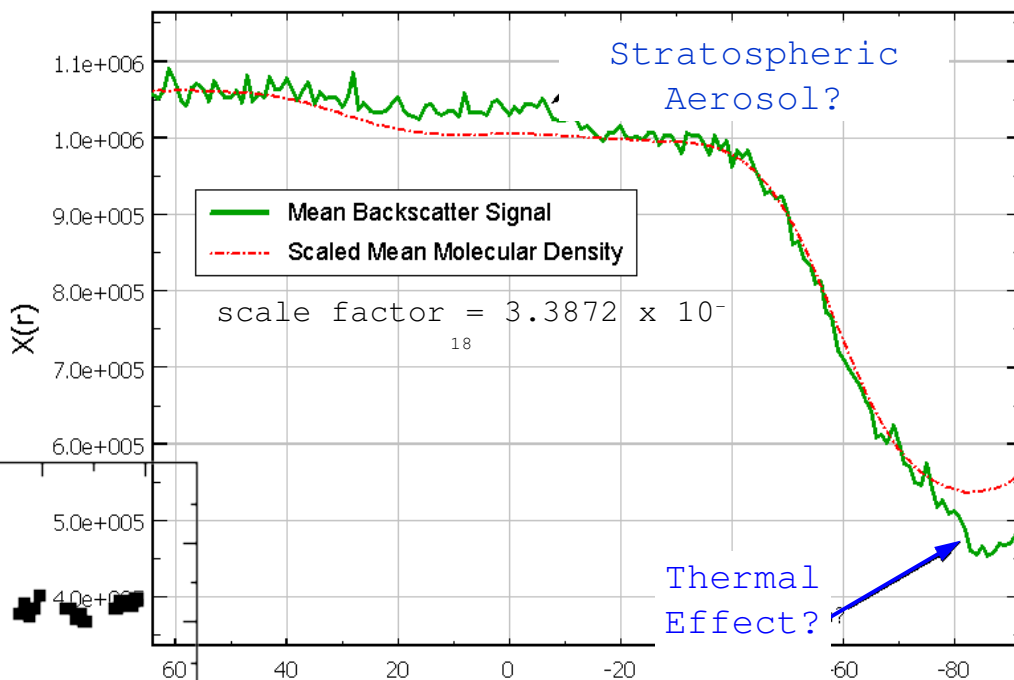
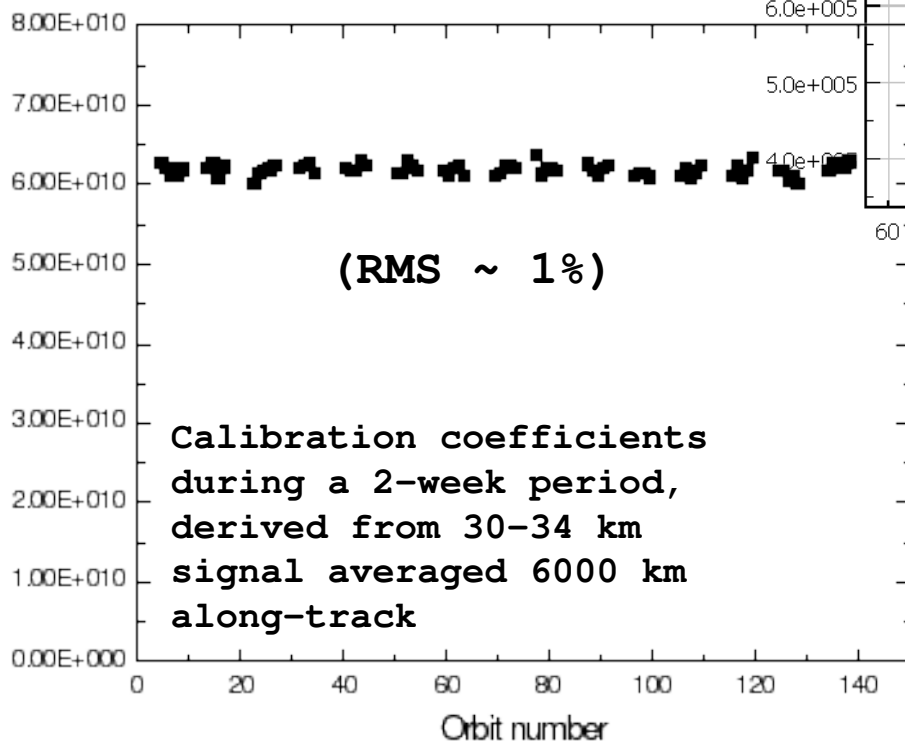
2006-06-14, 13:52:31 UTC: Average of 6000 profiles from 30.4° N, 179.3° W to 12.5° N, 176.4° W



# 532-parallel calibration



532-parallel channel calibrated by normalization of high-altitude returns (30-34 km) to molecular density  $X(r)$



RMS variability of calibration coefficients slightly larger than expected from signal noise alone

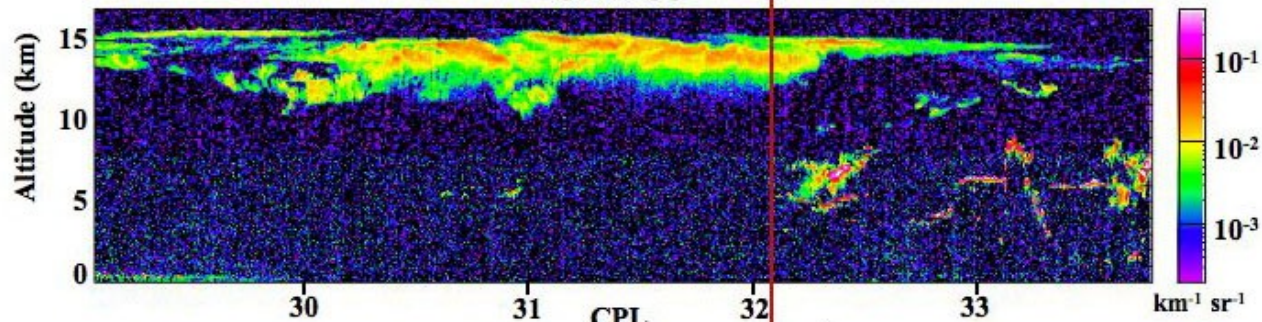
# Validation Intercomparisons: Clouds

August 12, 2006

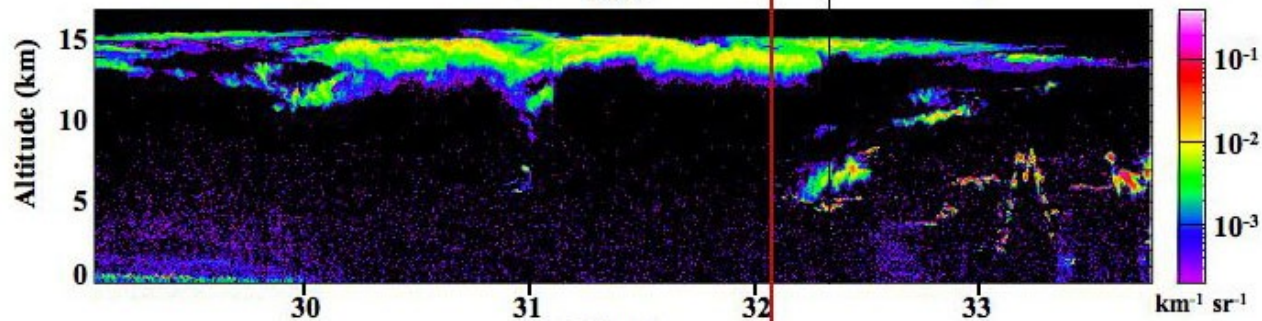


532 nm Calibrated Attenuated Backscatter

CALIPSO



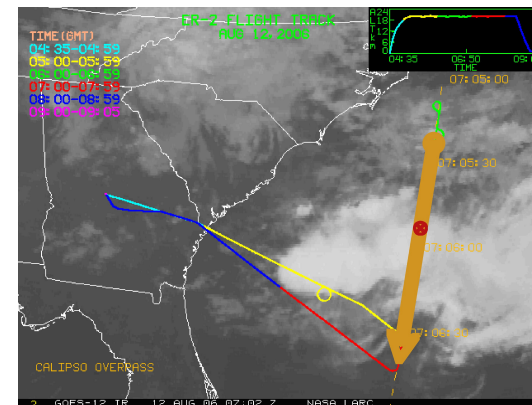
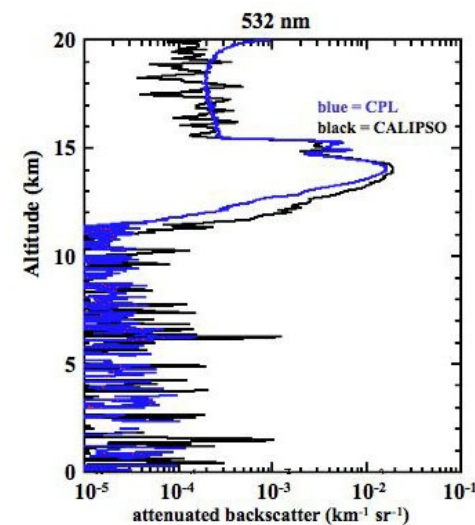
CPL



latitude

Coincidence

Coincidence



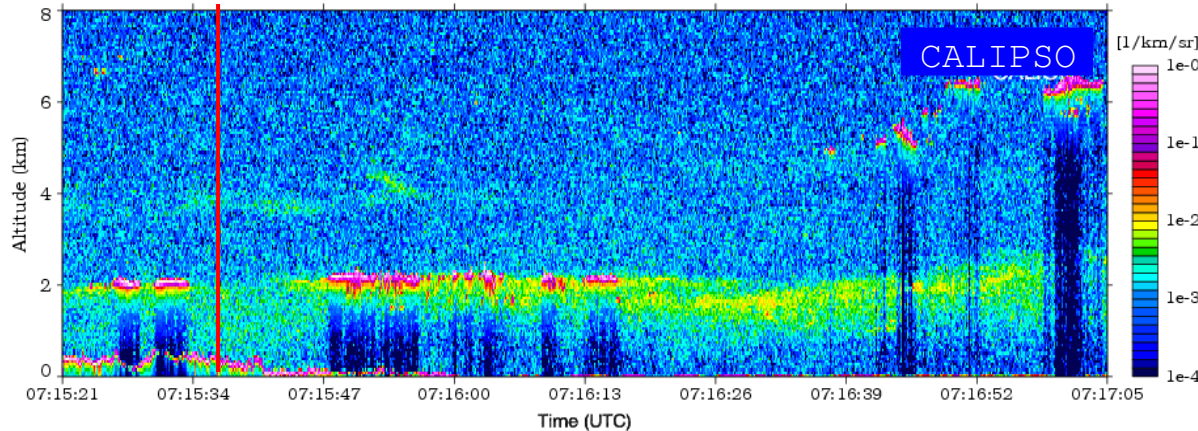
# Validation Intercomparisons:

## Aerosols

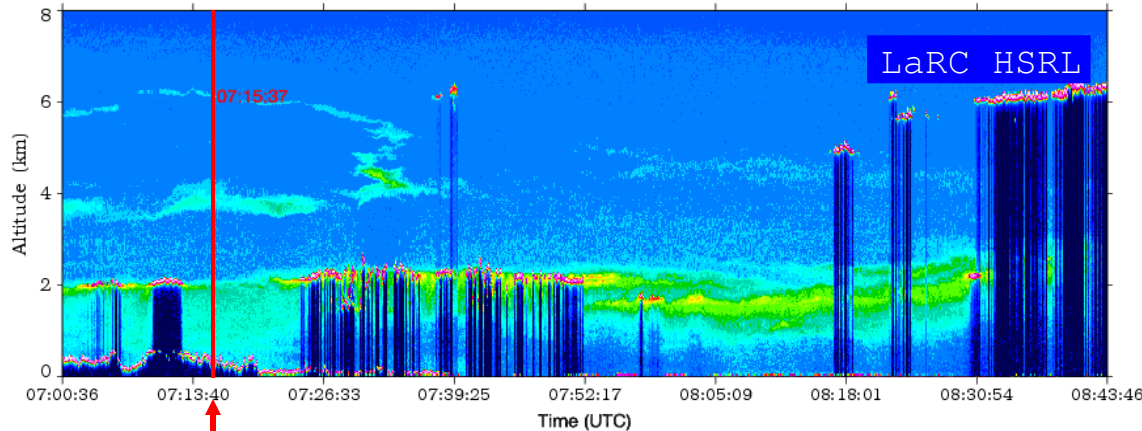
August 10, 2006



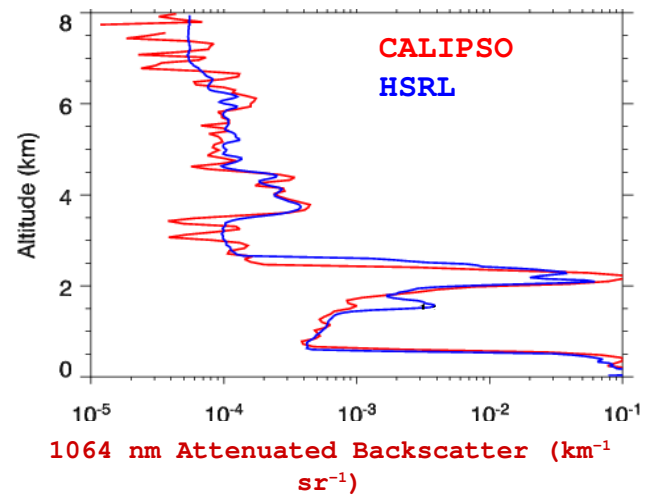
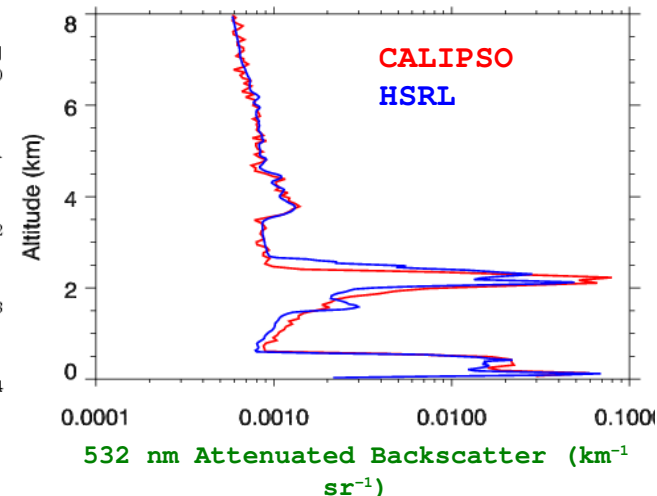
LAT	41.7674	40.9913	40.2145	39.4389	38.6603	37.8843	37.1060	36.3274	35.5496
LON	-75.5966	-75.8513	-76.1007	-76.3457	-76.5869	-76.8237	-77.0569	-77.2864	-77.5123



LAT	41.7675	40.9531	40.2031	39.4264	38.6291	37.8369	37.0584	36.2947	35.5412
LON	-75.5907	-75.8736	-76.1143	-76.3602	-76.6054	-76.8447	-77.0754	-77.2961	-77.5096



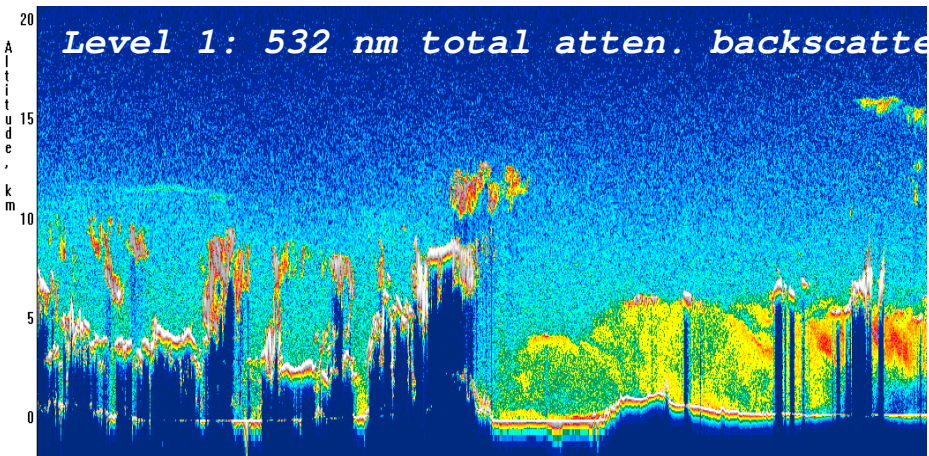
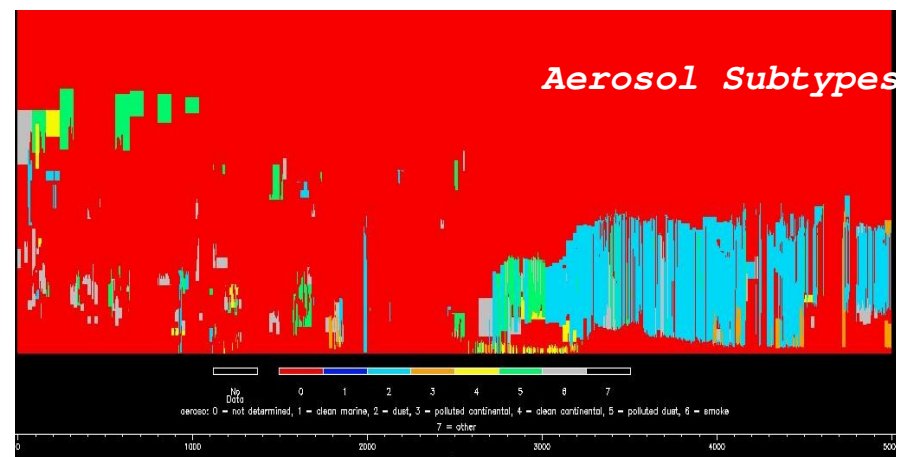
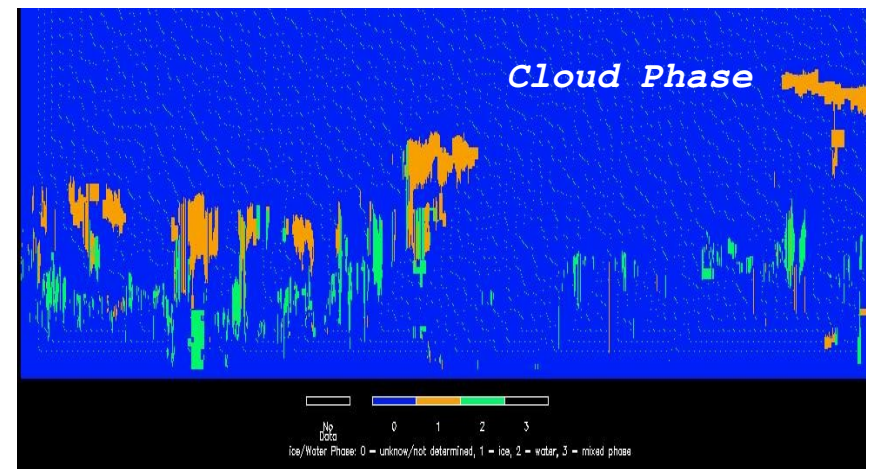
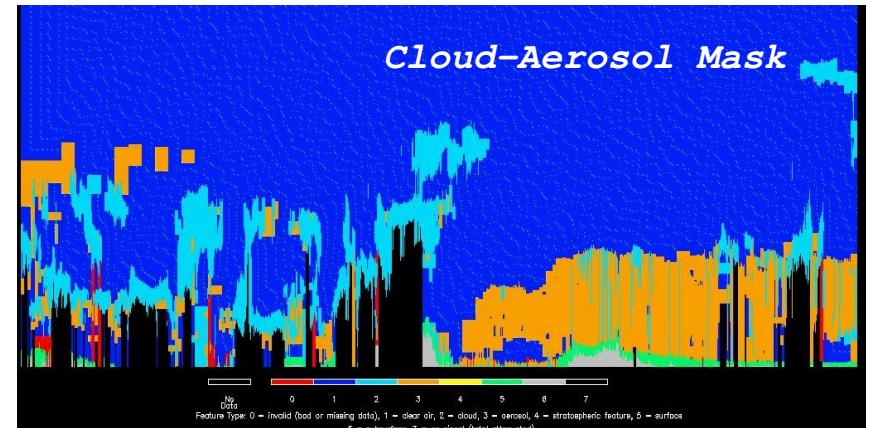
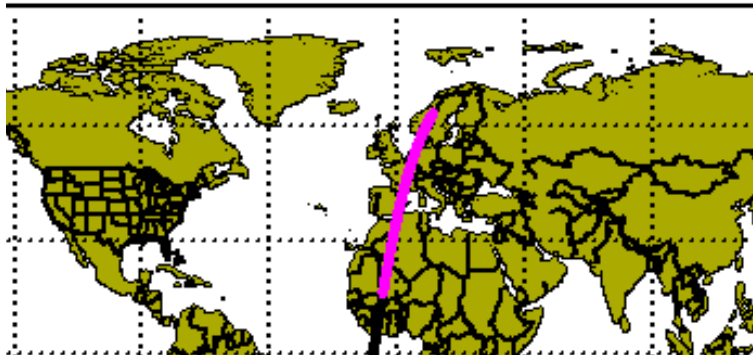
Coincidence



Coincidence

# CALIPSO Data Products

2006-08-12 02:00-17UTC Nighttime Conditions  
Version: 1.06 Image Date: 09/11/2006

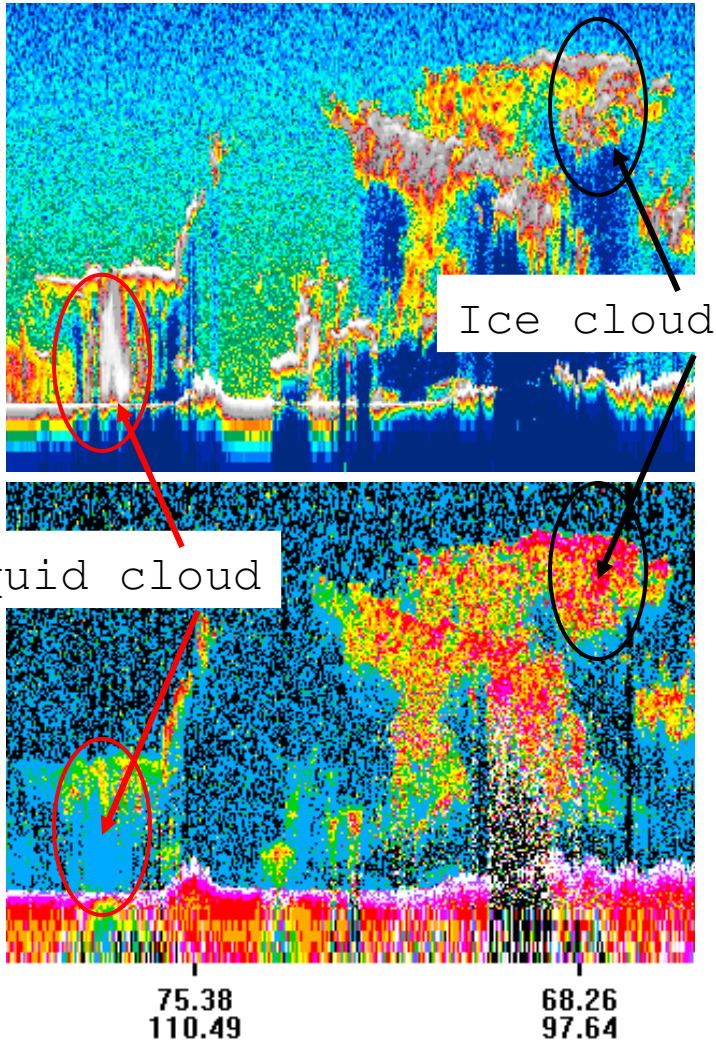


# Information from Depolarization



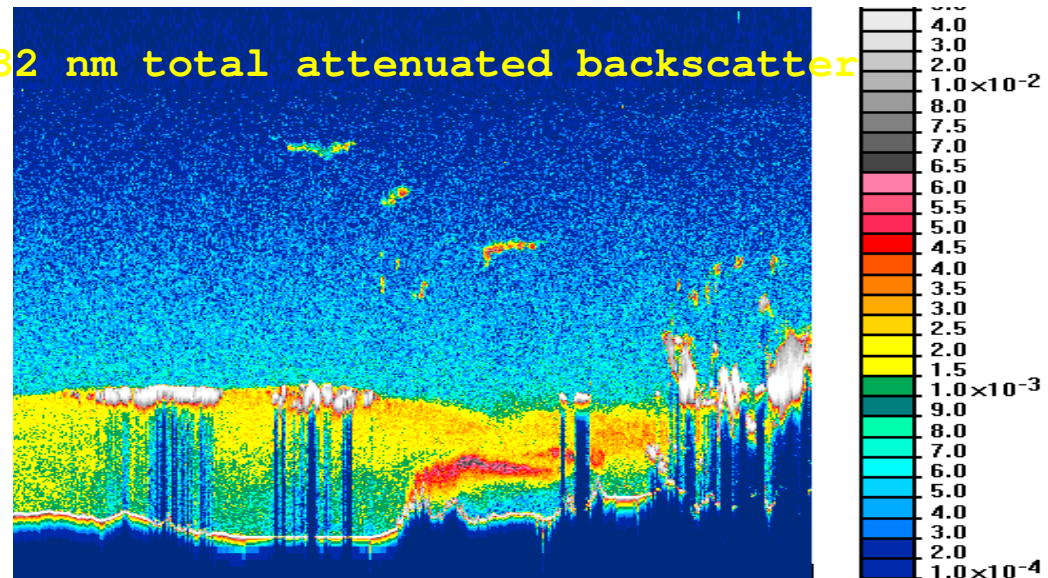
## Arctic clouds

identification of water,  
and both random and

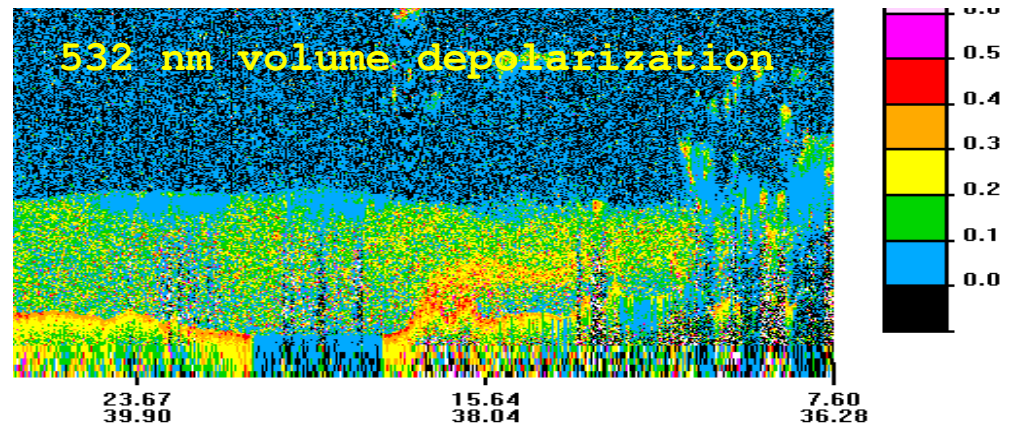


## Sahara dust with embedded water clouds

532 nm total attenuated backscatter



532 nm volume depolarization

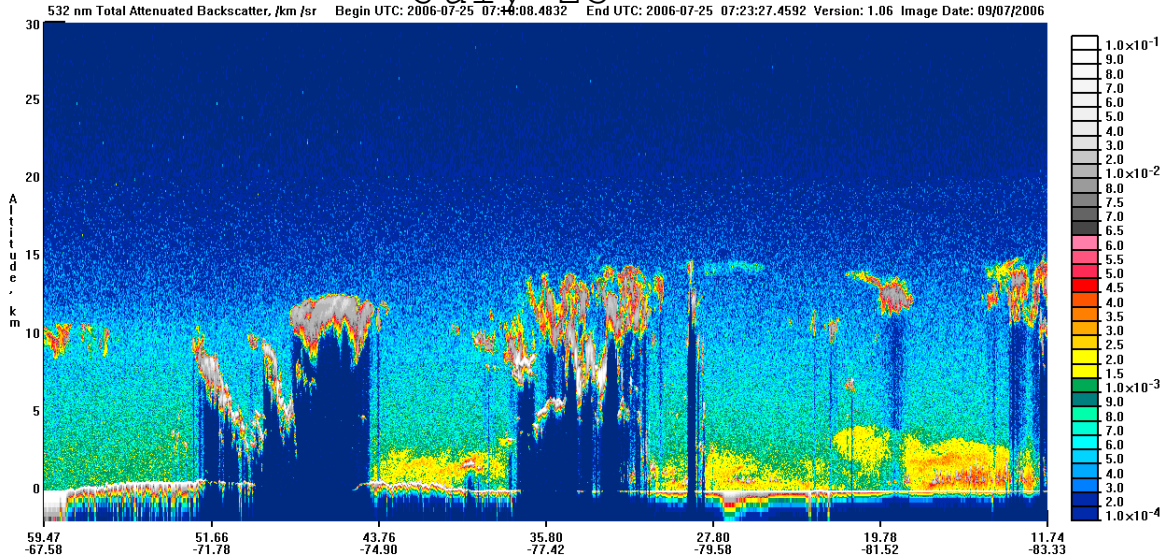
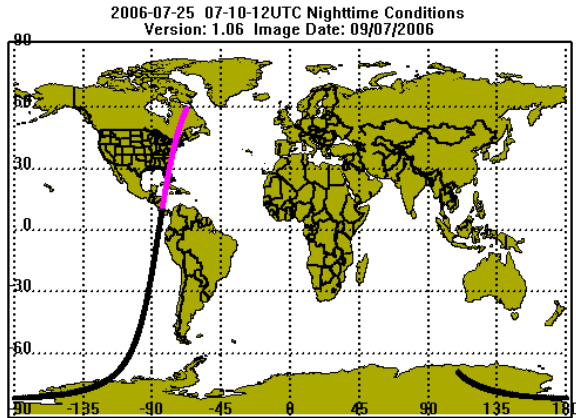




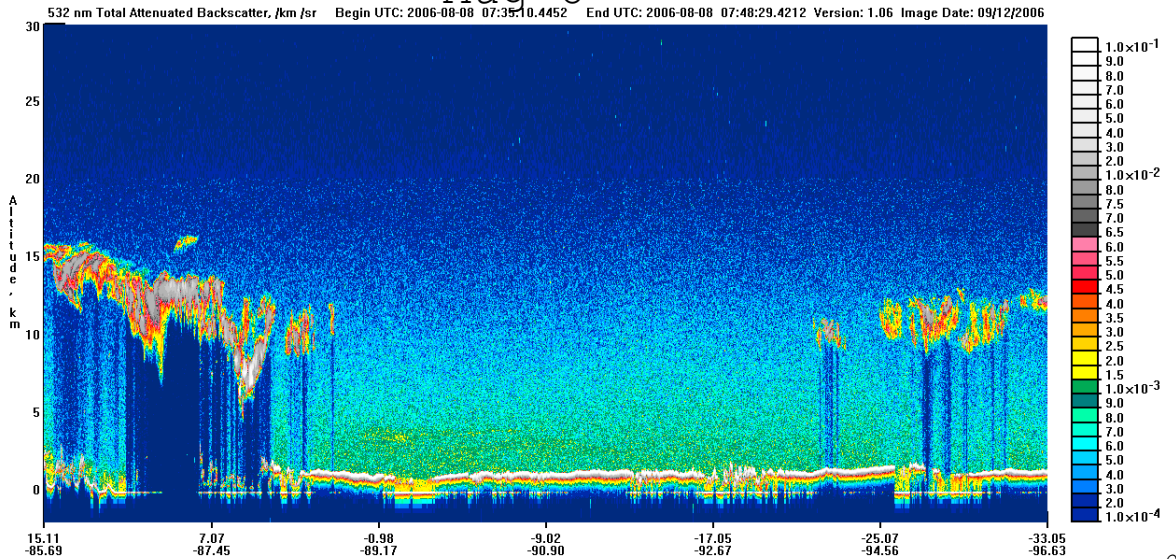
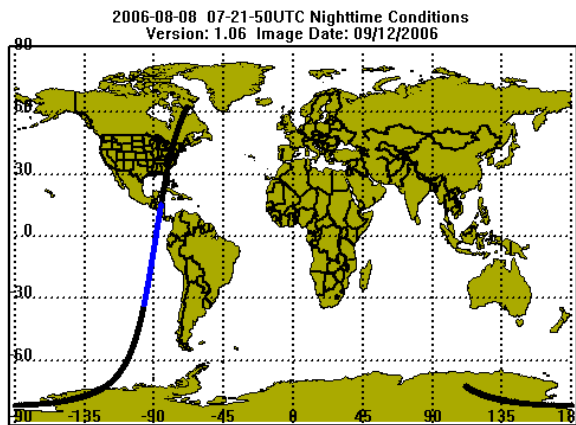
# CALIPSO Scenes over Panama Region



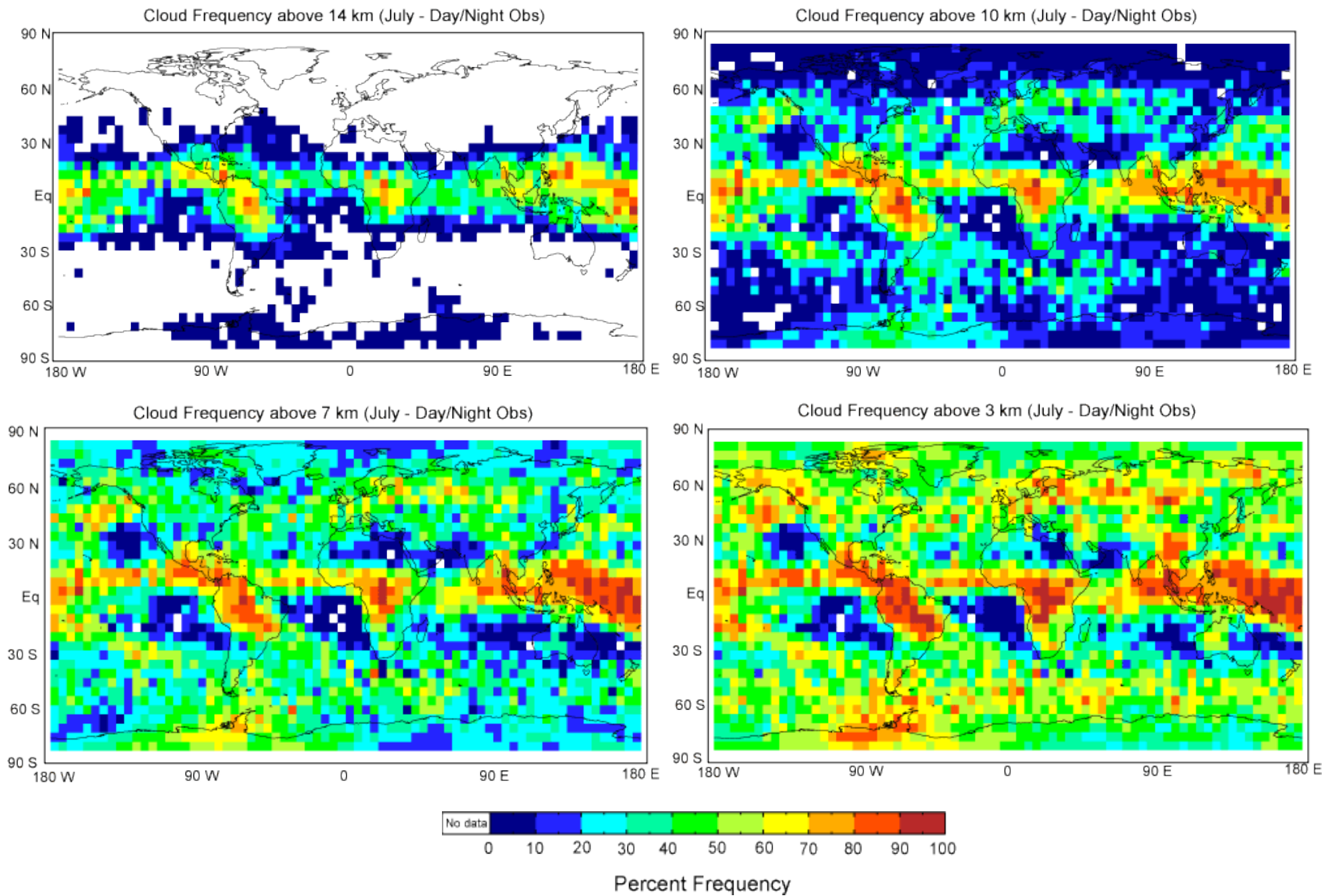
July 25



Aug 8

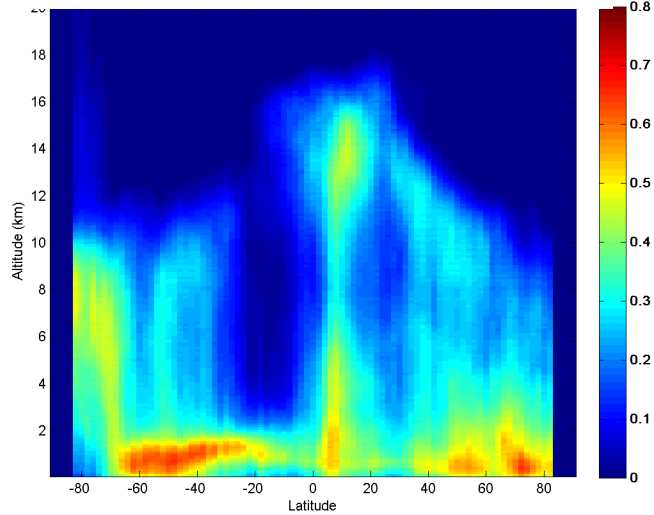


# CALIPSO Geographical Cloud Occurrence

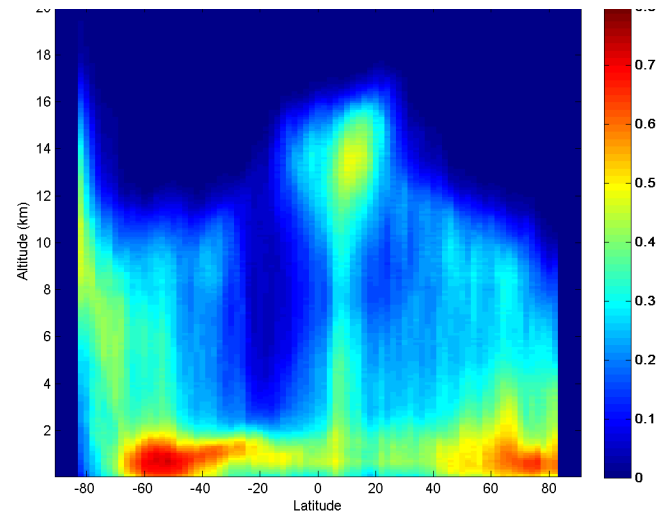


# CALIPSO Zonal Cloud Occurrence

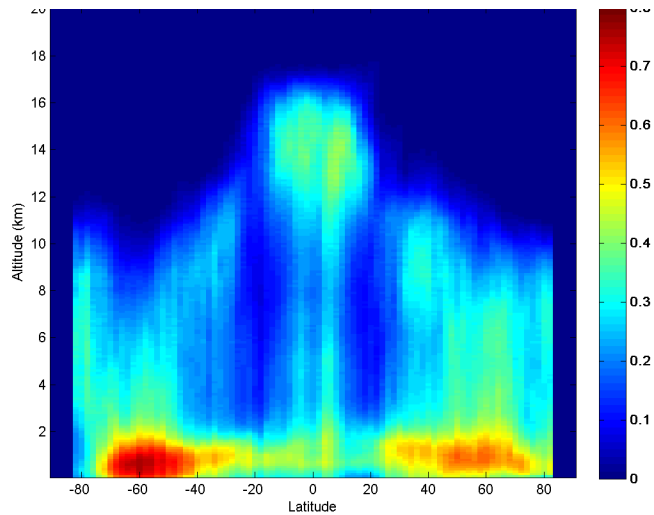
July 2006 Day-Night Cloud Fraction



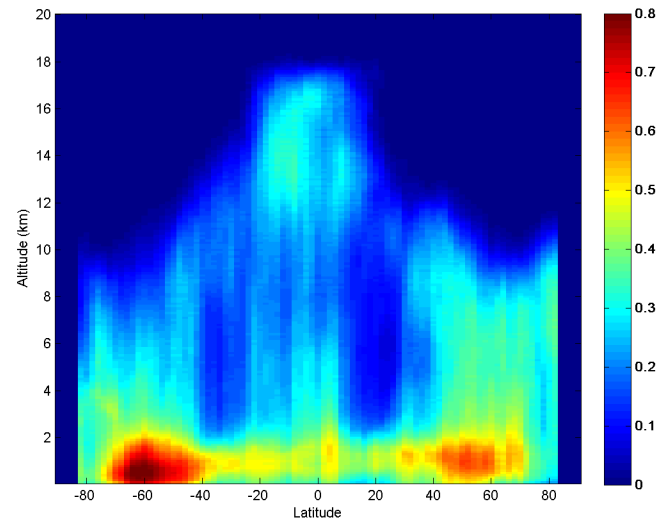
September 2006 Day-Night Cloud Fraction



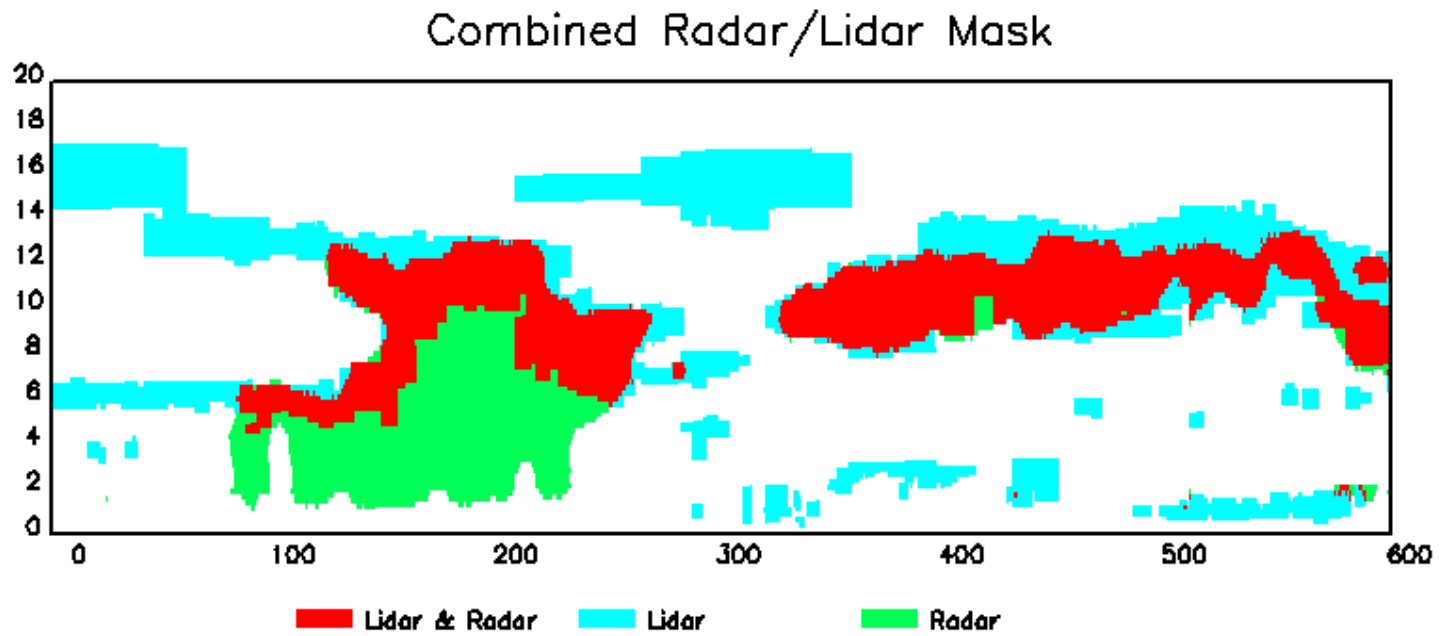
November 2006 Day-Night Cloud Fraction



January 2007 Day-Night Cloud Fraction



# ification of CloudSat/CALIPSO Joint Cloud Produ

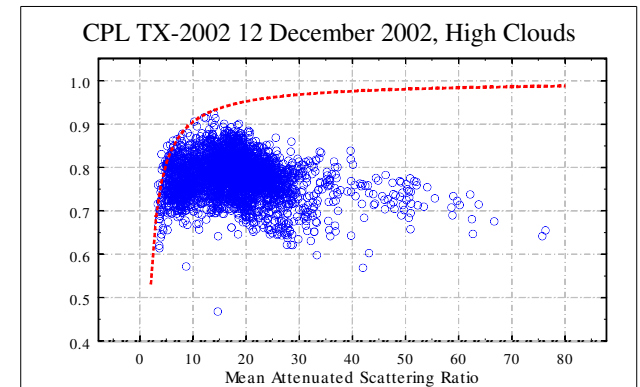
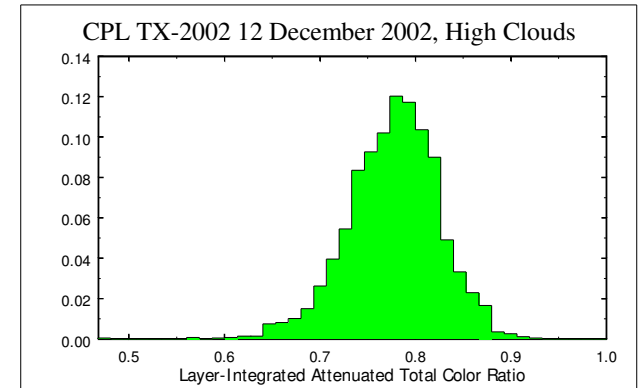


## CALIPSO 1064 Calibration Issues

532 nm attenuated backscatter profiles calibrated against molecular backscatter profiles

532 nm channel calibration is transferred to 1064 channel at the top of high altitude clouds where assumed backscatter color ratio (1064/532) = 1.

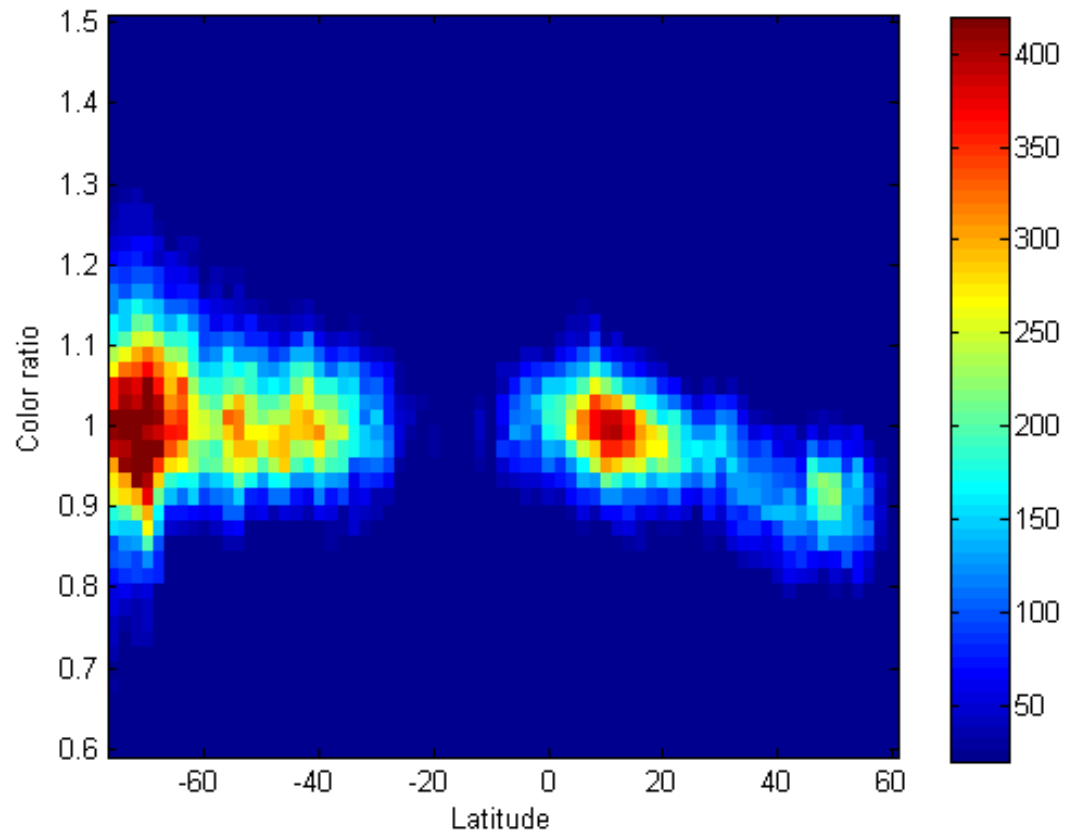
CPL observations, however, indicate that at times a shift of color ratios to lower values (mode near 0.8).



Courtesy of CPL Team

# Color Ratio Frequency Distribution

July 2007



*ure from unity suggests erroneous application of color ratio assumption*

# CALIPSO Validation Issues for T



## Clouds

- examine detection sensitivity of thin cirrus
- validate backscatter and extinction profiles
- verify multiple scattering correction and lidar ratio
- validate cirrus extinction profiles and examine IWC relationships
- validate cirrus habit and emissivity
- examine microphysical interpretation of backscatter color ratio
- verify cloud feature mask

## Aerosols

- verify aerosol lidar ratio and extinction profiles
- verify aerosol typing algorithm

*Much can be achieved through vicarious comparisons using combined aircraft observations*

*Direct comparisons are not essential*