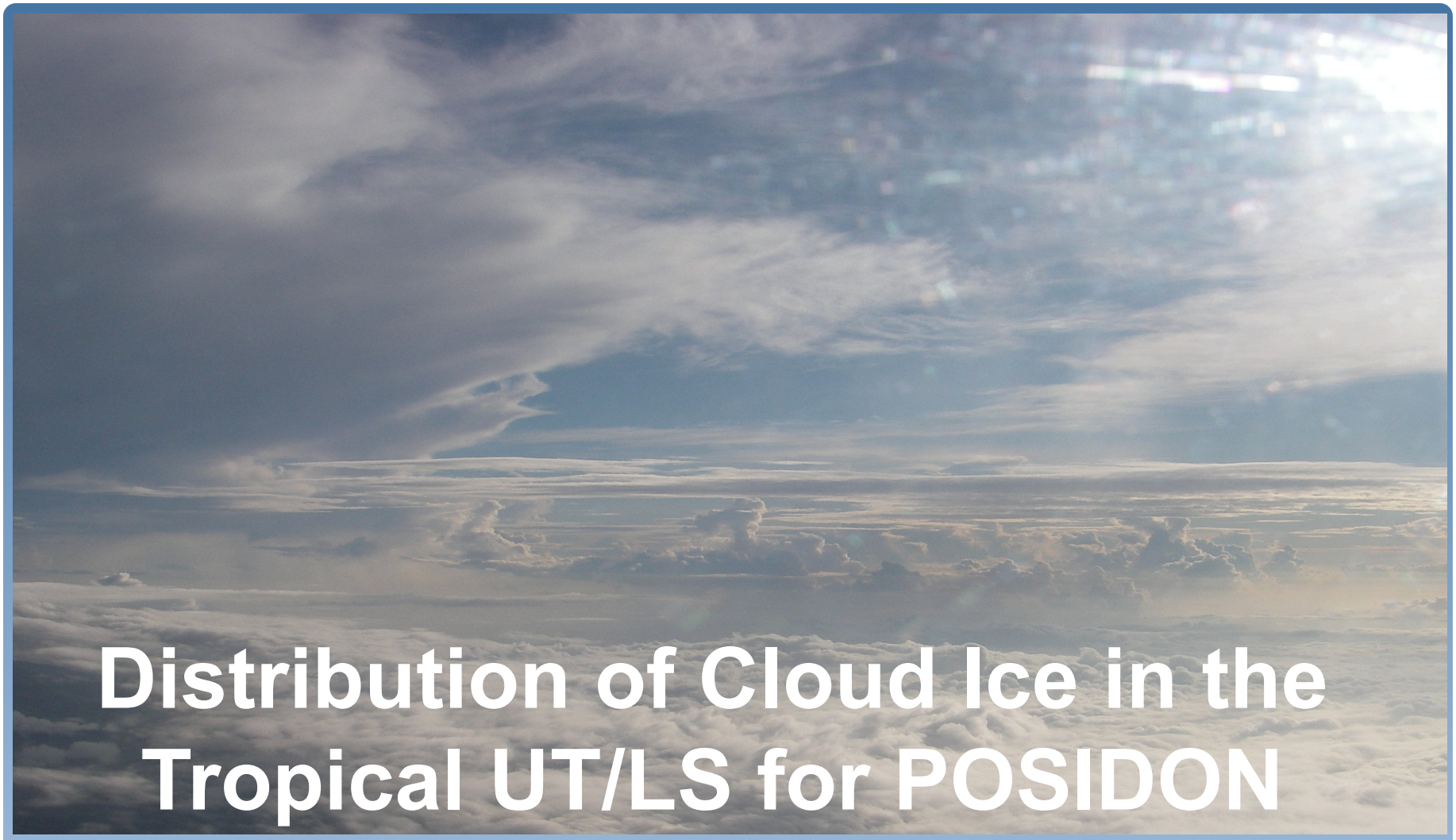


Distribution of Cloud Ice in the Tropical UT/LS for POSIDON

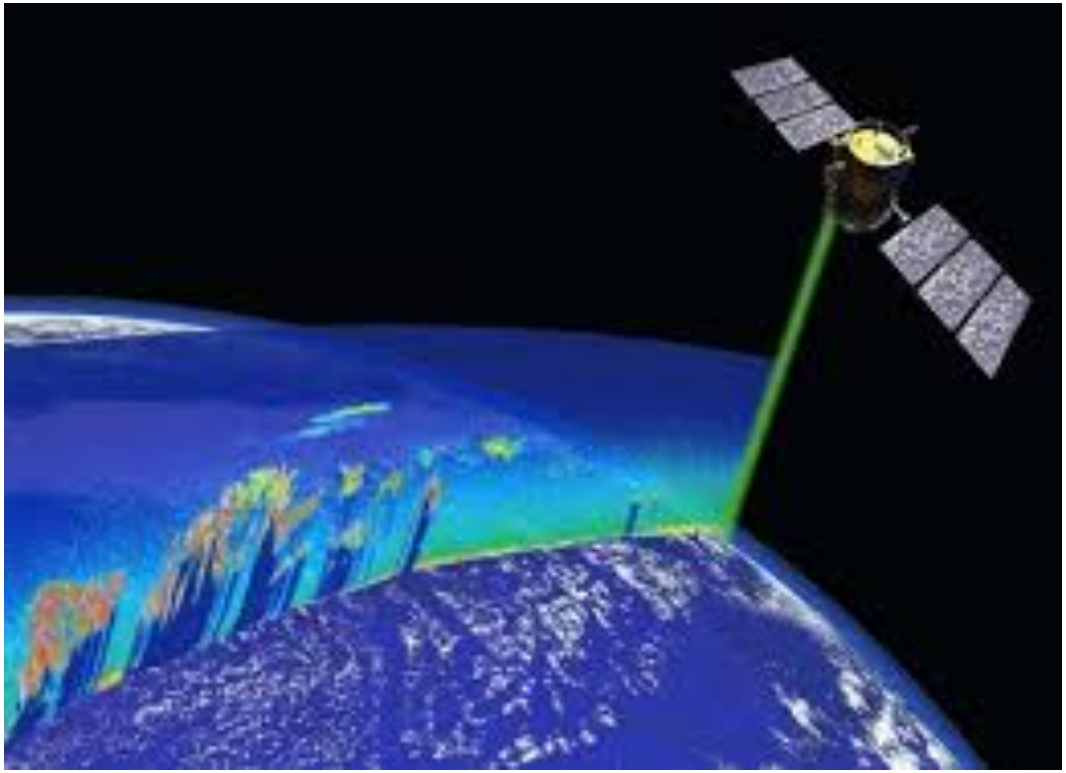
October 13, 2016

Melody Avery, CALIPSO Team

Quick CALIPSO Background

- 3 year mission is now a 10+ year mission
- Future outlook:
  - 2nd laser will begin to arc during summer-fall 2017
  - 1st laser will be turned on (p<arc)
  - Spacecraft fuel through 2017 in A-Train
  - After 2017, orbit will drift, CloudSat to follow.

Operational 06/2006 – present
CALIOP: Elastic Backscatter at 532 and 1064 nm;
Polarization at 532 nm
IIR (infrared radiometer) IR window channel
(8,10,12 μm) radiance, brightness temperature



CALIPSO Product Release, November, 2016

Version 4.1

Level 1:
Attenuated backscatter, depolarization ratio, color ratio

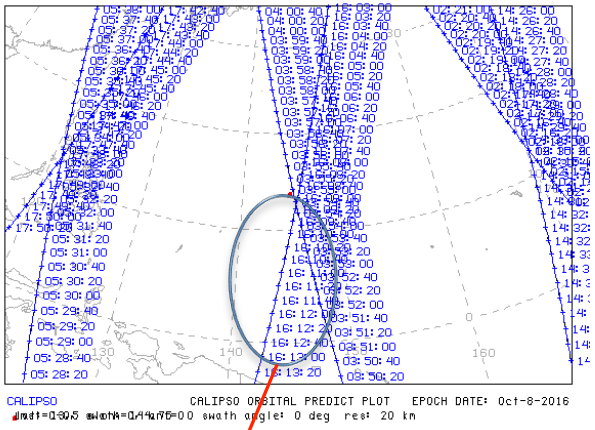
V4 Calibration with MERRA-2

Level 2:
Cloud and aerosol feature discrimination, optical properties, particulate backscatter, extinction, depol, color ratio
Cloud ice water content

5 km aerosol and cloud profiles
60 m vertical resolution,
8.2 – 20.2 km;
240 m from 20.2 – 30 km

333m, 1km, 5km+ combined cloud and aerosol layers.

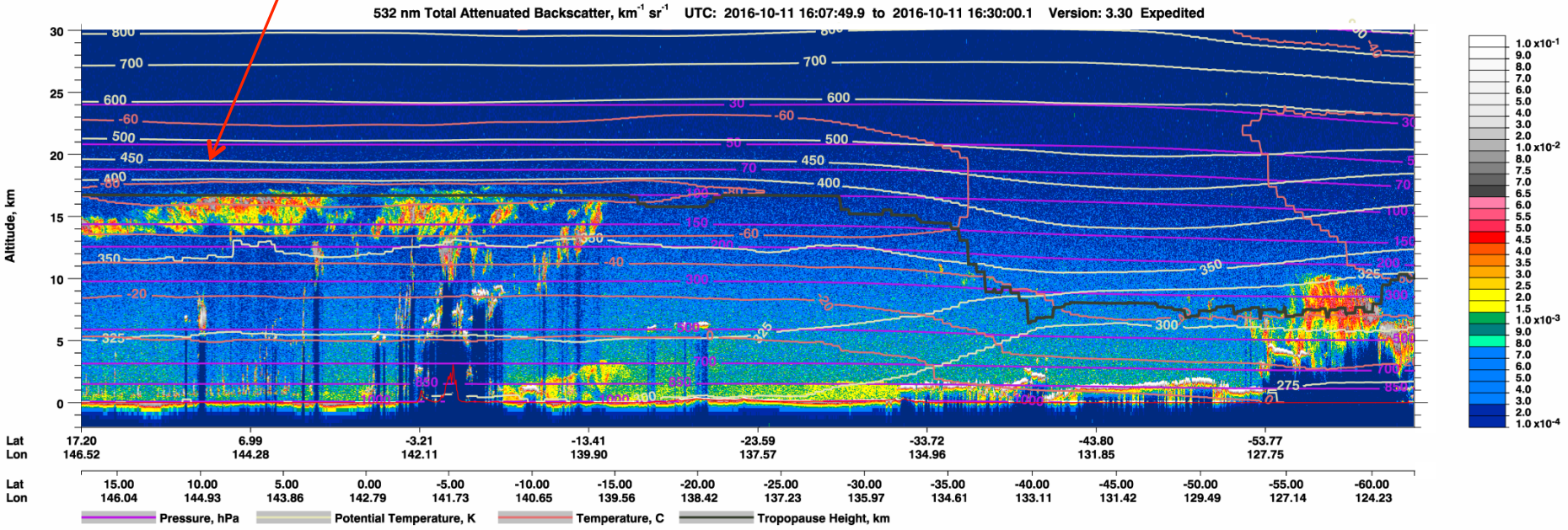
Oct. 11 Overpass near Guam



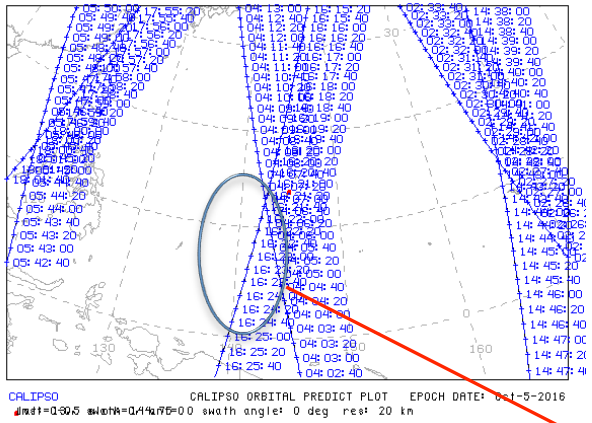
Browse Images are available at:

https://www-calipso.larc.nasa.gov/products/lidar/browse_images/show_calendar.php

There is a 3-4 day lag for the standard product,
For “Expedited Browse Images” there is a 2-day lag.

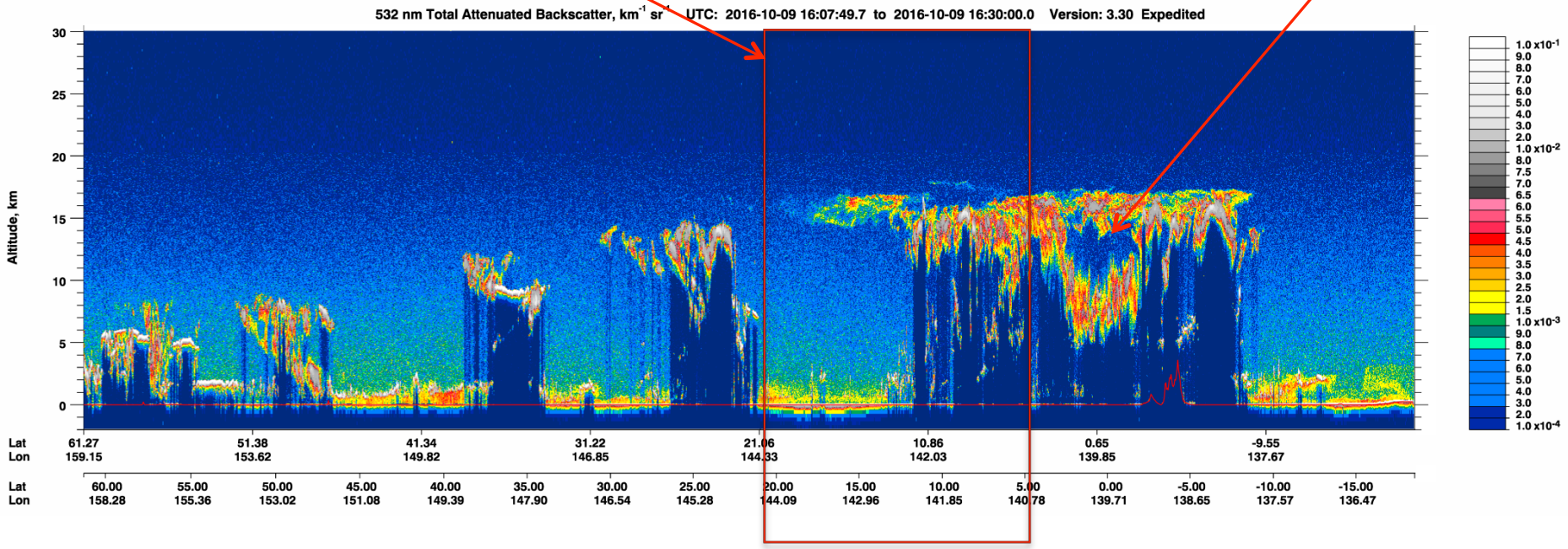


October 9 overpass

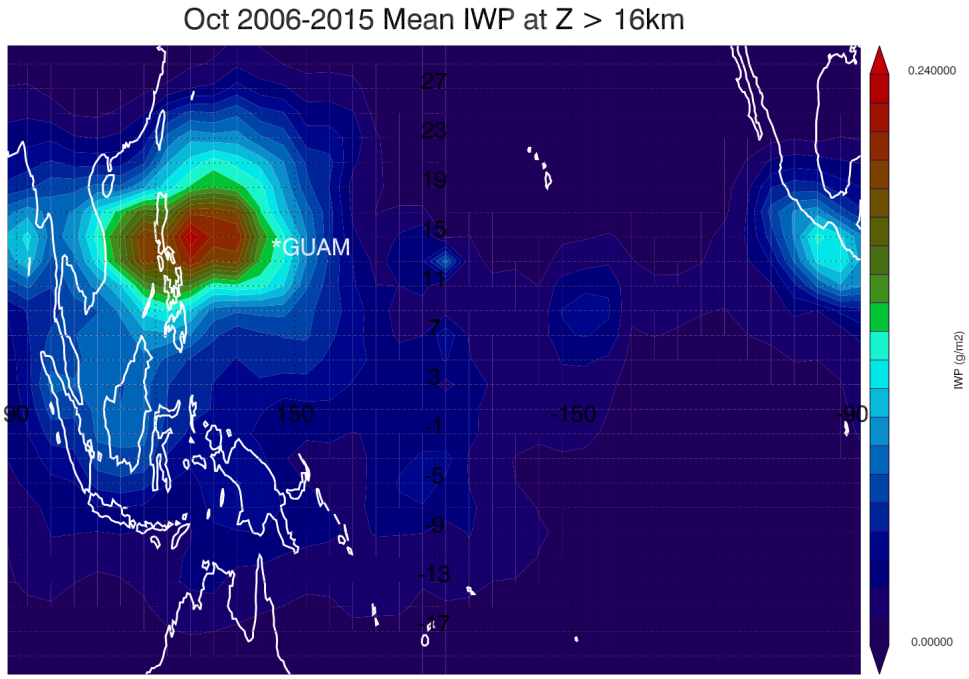


Convective system to the SW of Guam

"batman"?

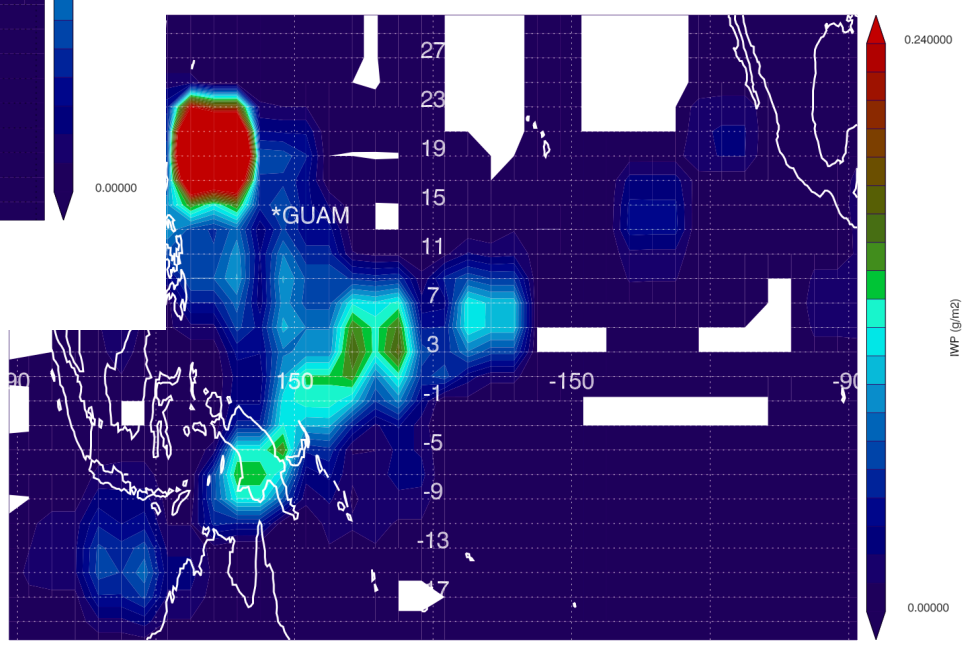


Ice Water Path > 16 km



10-year Climatology

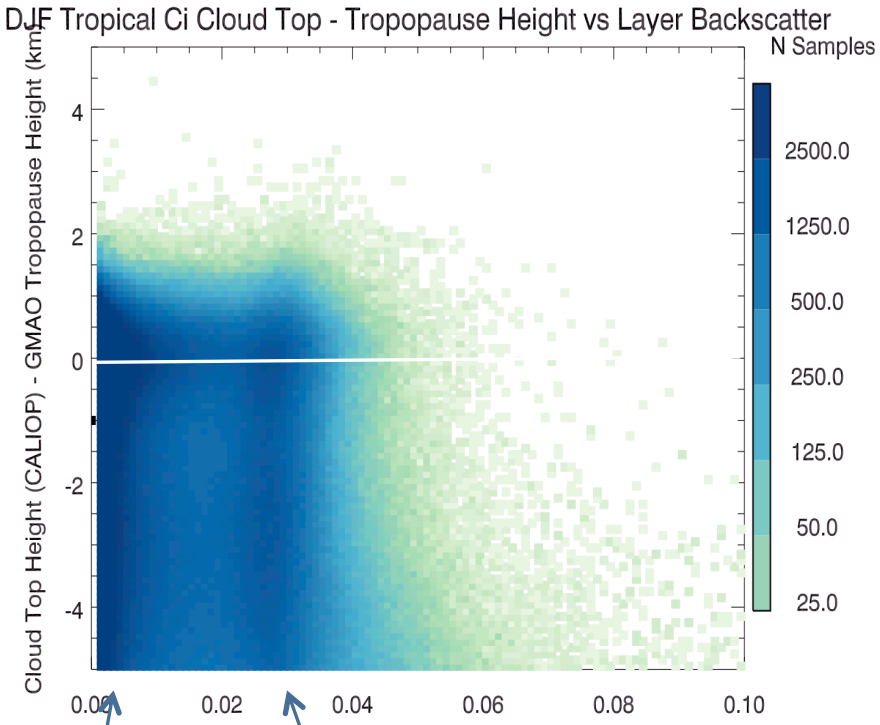
October 2016 – so far



What do we mean by “Overshooting Convection?”

Picking a delta Z above the tropopause seems arbitrary.

Two-Dimensional PDF – Tropopause-relative Cloud Top Height vs Lidar Backscatter

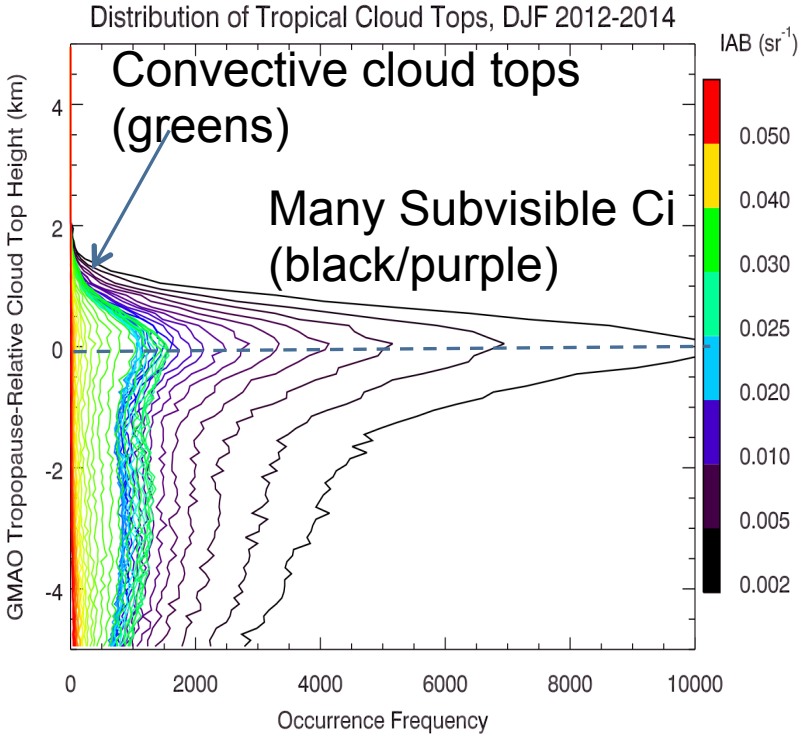


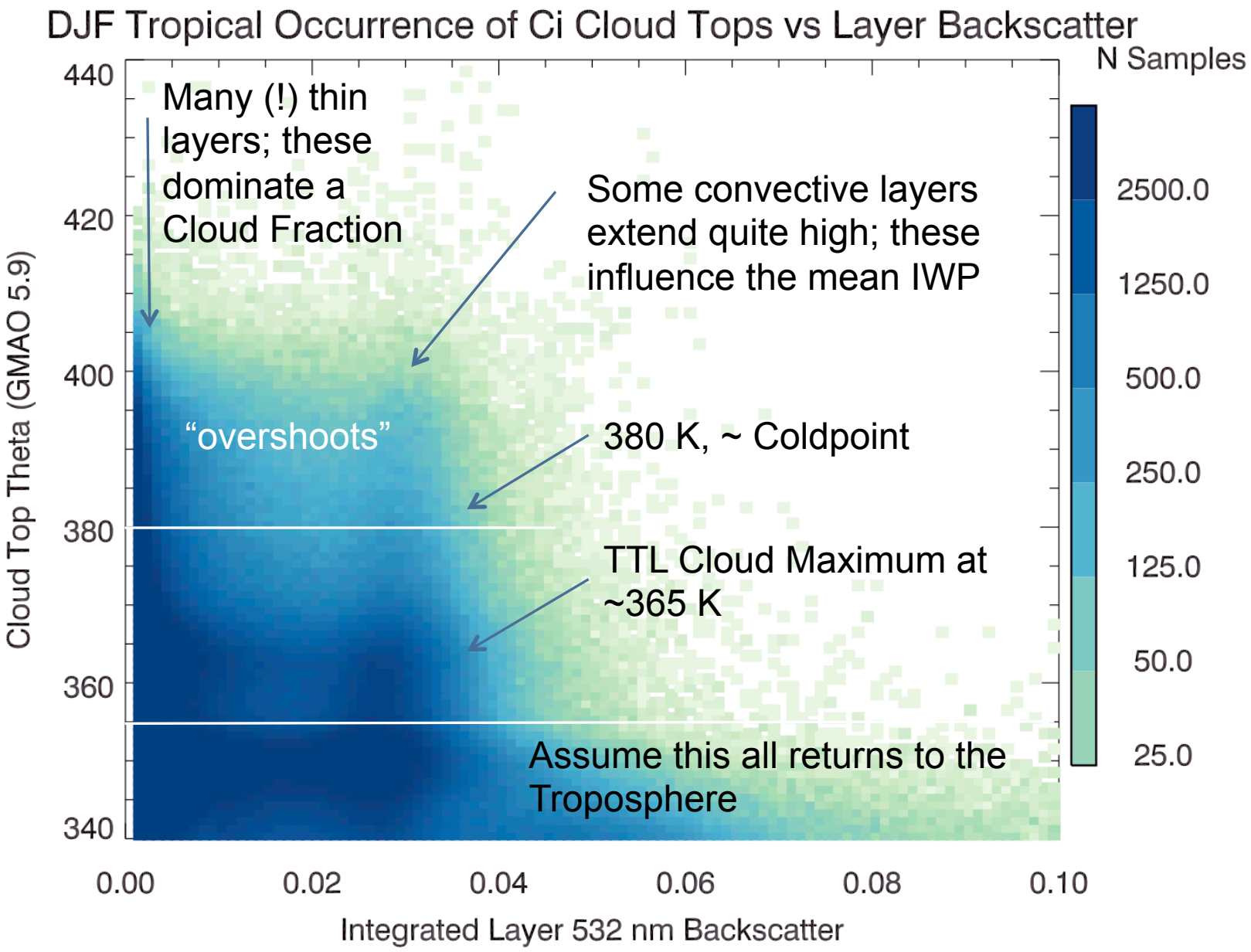
Sub-visible Ci

Optically thick (OD > 3) clouds; convection

Tropopause-Relative PDF

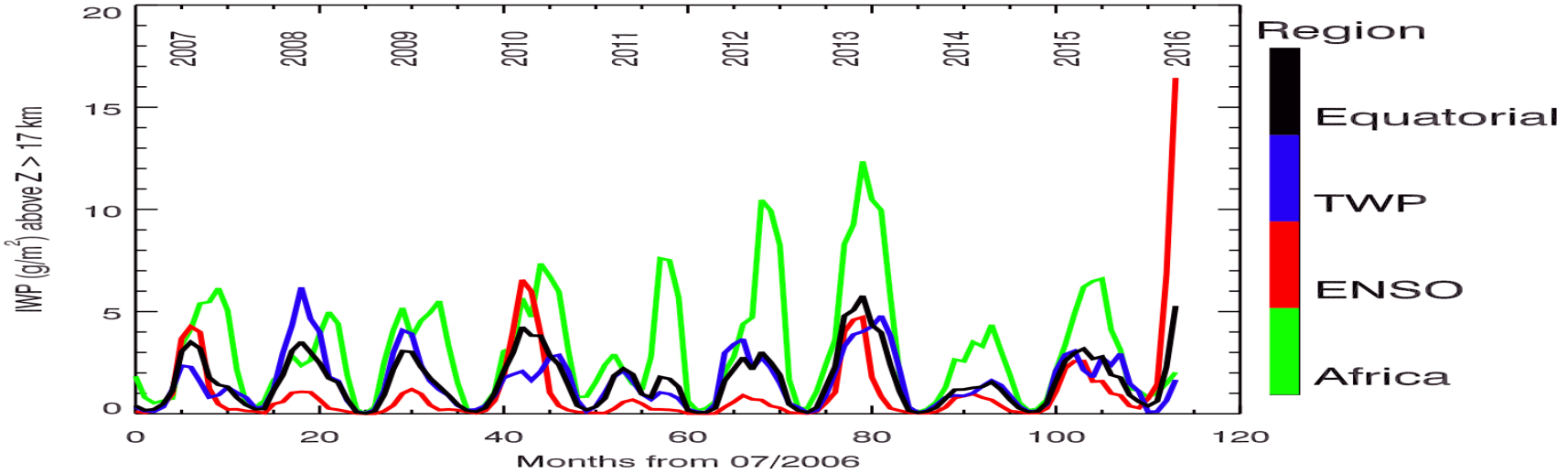
Using the synoptic-scale tropopause, can we tell what is locally overshooting?

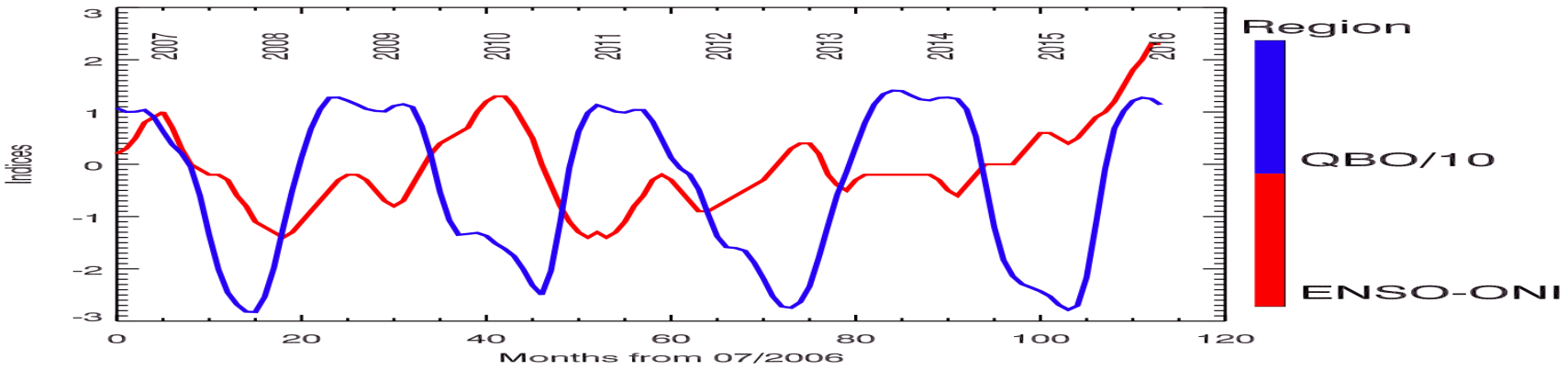



DJF Tropical Occurrence of Ci Cloud Tops vs Layer Backscatter
N Samples
2500.0
1250.0
500.0
250.0
125.0
50.0
25.0
Many (!) thin layers; these dominate a Cloud Fraction
Some convective layers extend quite high; these influence the mean IWP
"overshoots"
380 K, ~ Coldpoint
TTL Cloud Maximum at ~365 K
Assume this all returns to the Troposphere
Cloud Top Theta (GMAO 5.9)
440
420
400
380
360
340
0.00
0.02
0.04
0.06
0.08
0.10
Integrated Layer 532 nm Backscatter

Equatorial Time Series of IWP > 17 km; 10S – 10N

High-altitude cloud ice varies regionally; zonal averages obscure this.





Summary

Standard CALISO products are developed globally; Version 4 is better than Version 3; But not regionally tuned to local microphysics.

We are working on producing a specialized TTL data set.

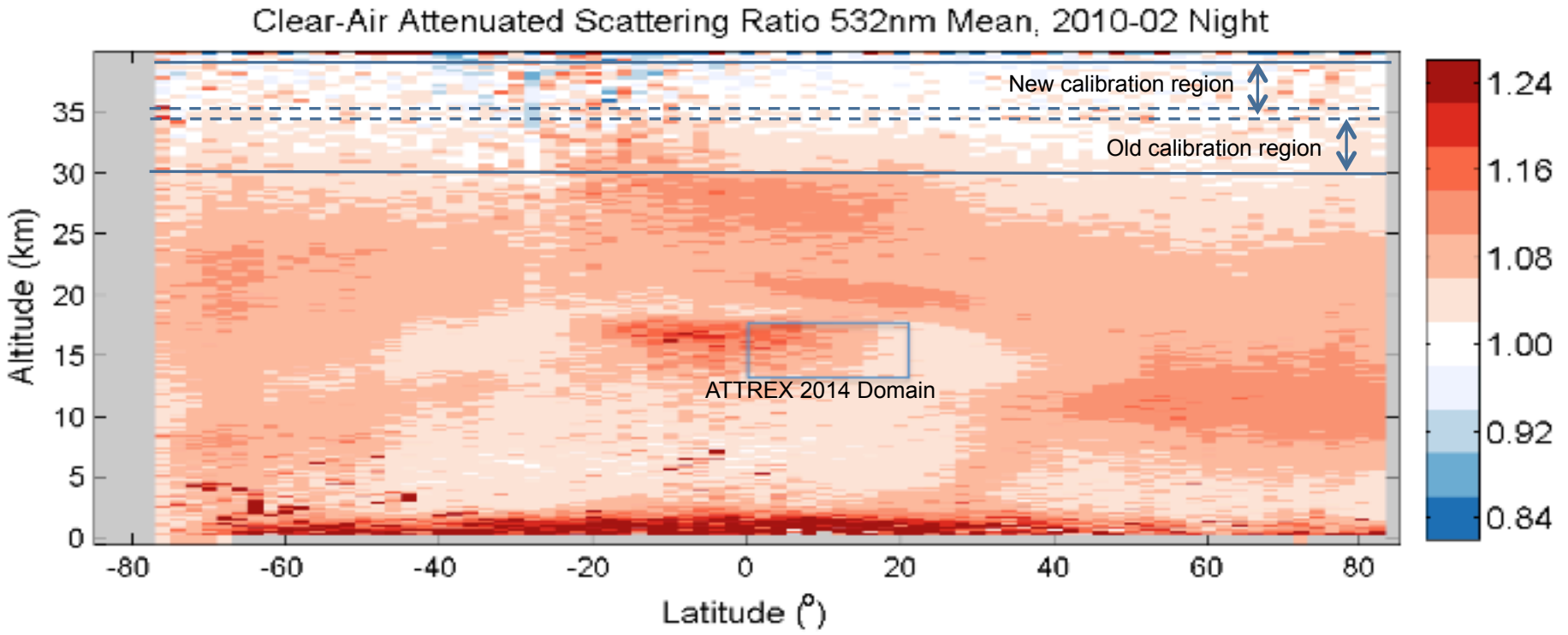
POSIDON data can help develop:

- Extinction to backscatter coefficients (through particle size distributions)
- Ice water content parameterization

extras

CALIOP Version 4 – Much Improved Calibration

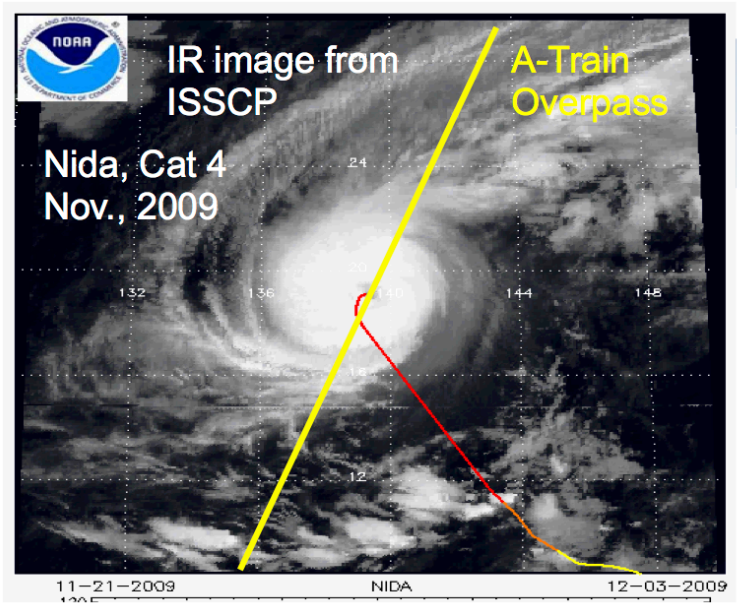
New Version 4 Level1 improves 532 nm night, day/ night agreement and 1064 calibrations.

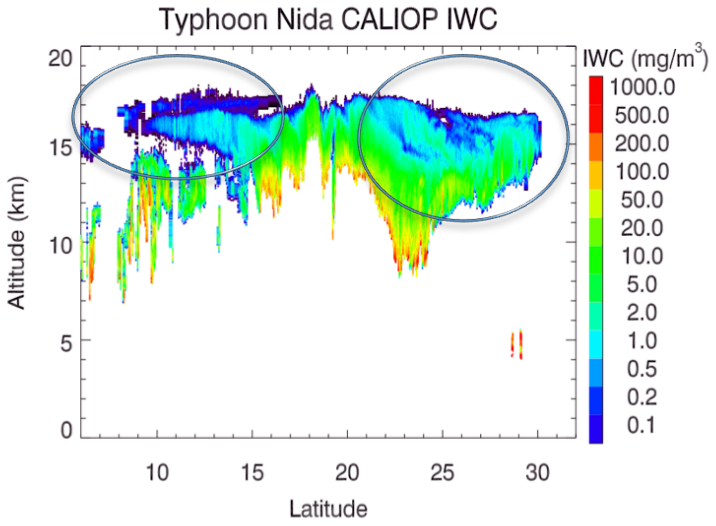


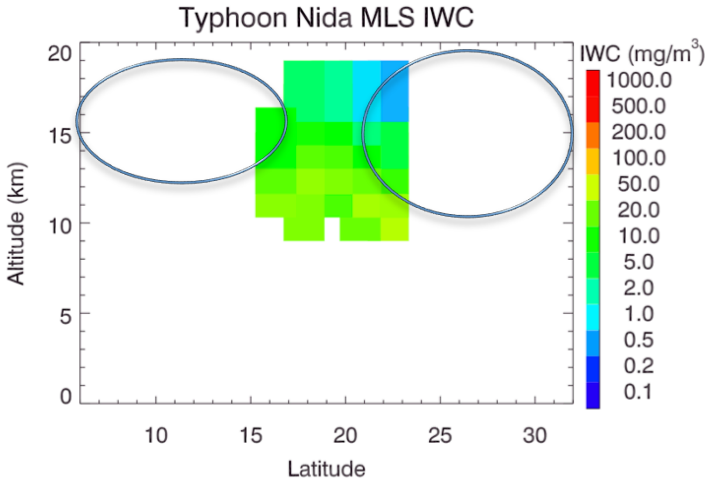
CALIOP 532 nm Nighttime channel clear air scattering ratios show that in the Tropics, CALIOP sees volcanic aerosols and ice particles with N too small to detect as layers.

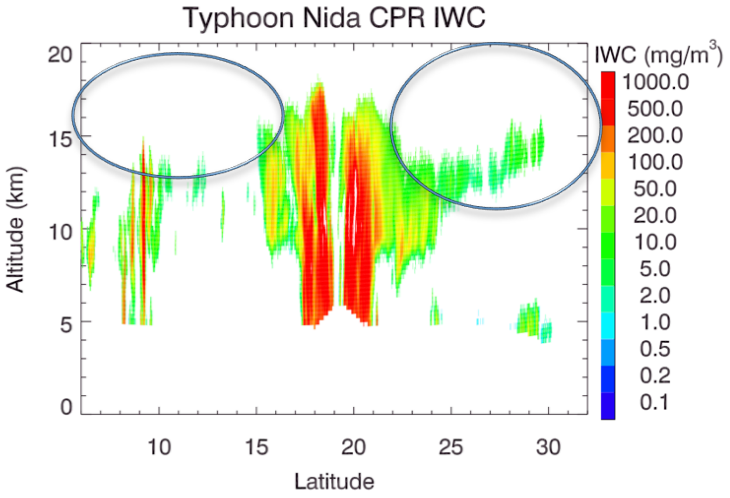
Example of Cloud Ice Water Content in a Cat 4 Typhoon

CALIPSO







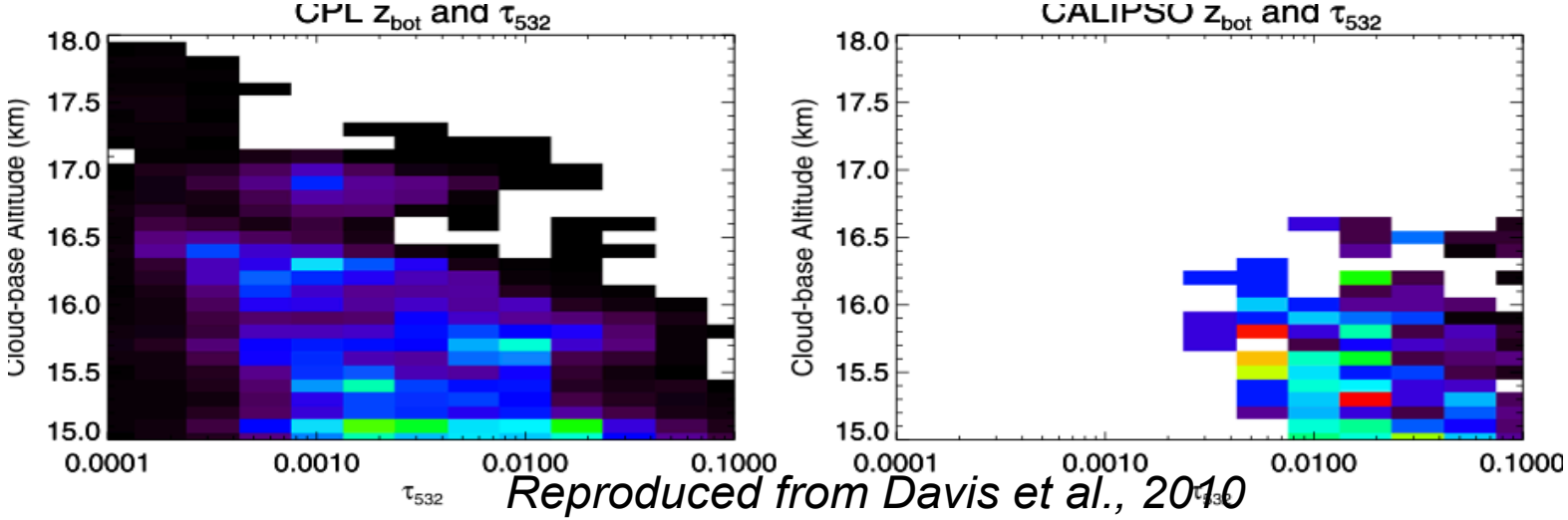


MLS

CLOUDSAT

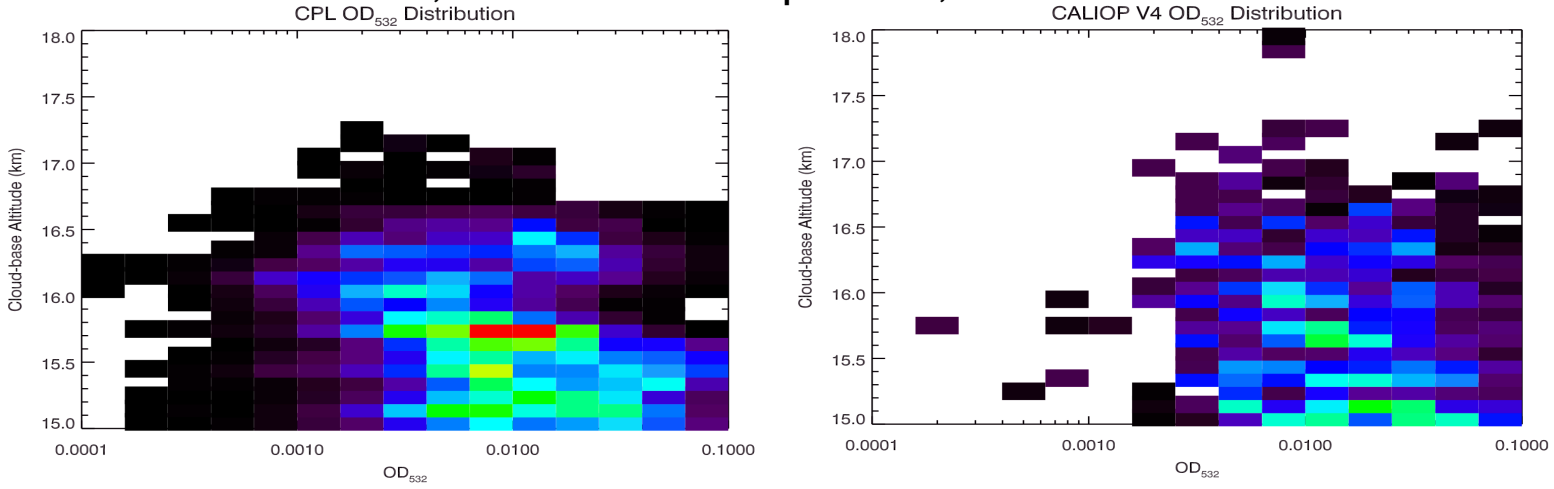
TC4 vs ATTREX, CPL and CALIOP Optical Depth

TC^4 CPL and CALIOP OD Comparison, Cloud Bases 15-18 km

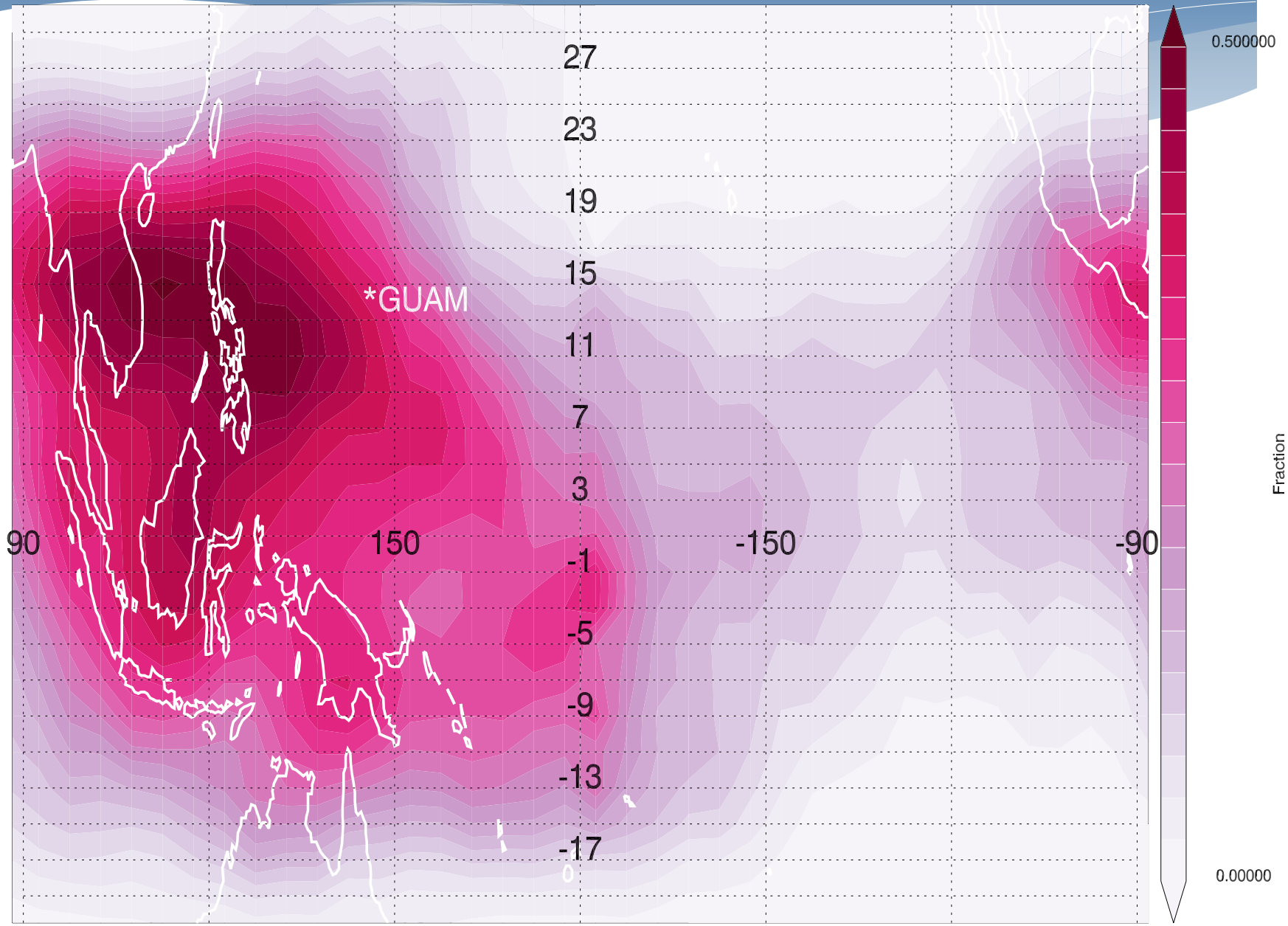


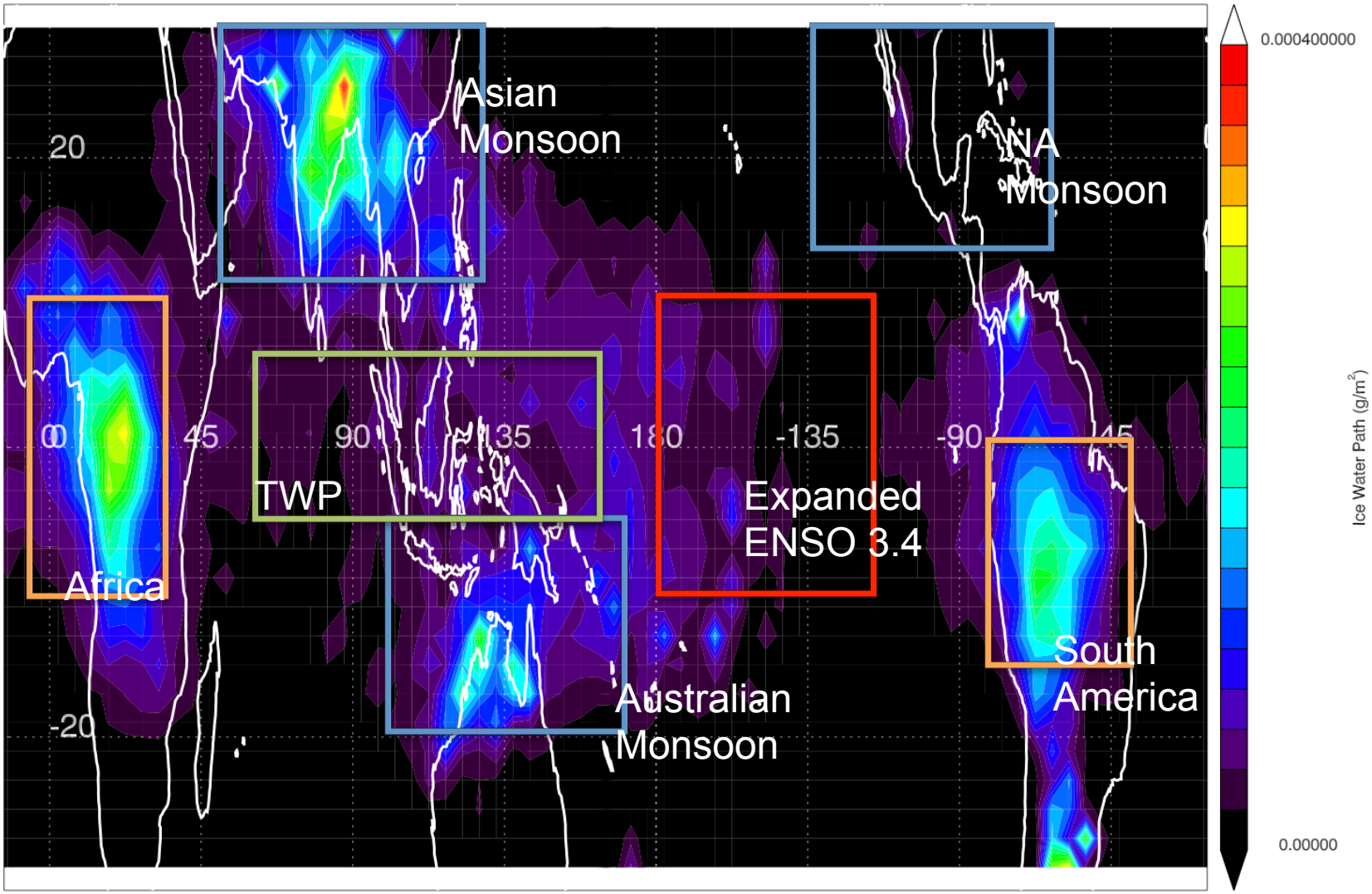
Reproduced from Davis et al., 2010

ATTREX – 2014, Guam OD Comparison, Cloud Bases 15-18 km



Oct 2006-2015 Cloud Frequency at Z > 16km




9-year Average, 12/2006-11/2015 >380K Ice Water Path
Asian Monsoon
NA Monsoon
Africa
TWP
Expanded ENSO 3.4
South America
Australian Monsoon
20
-20
0
45
90
135
180
-135
-90
0.000400000
0.00000
Ice Water Path (g/m^2)