MODIS Algorithm Adjustments for Collect 6
Menzel et al.

A: Use "top-down" method with channel pairs 36/35, 35/34, 34/33 in that order to select CTP.

B: Restrict CO2 channel pair solutions to the appropriate portion of troposphere (determined by their weighting functions – 36/35 less than 450 hPa, 35/34 less than 550 hPa, and 34/33 less than 650 hPa).

C: Prohibit CO2 slicing solutions for water clouds; use only IRW solution. Avoid IRW solutions for ice clouds; use CO2 slicing whenever possible.

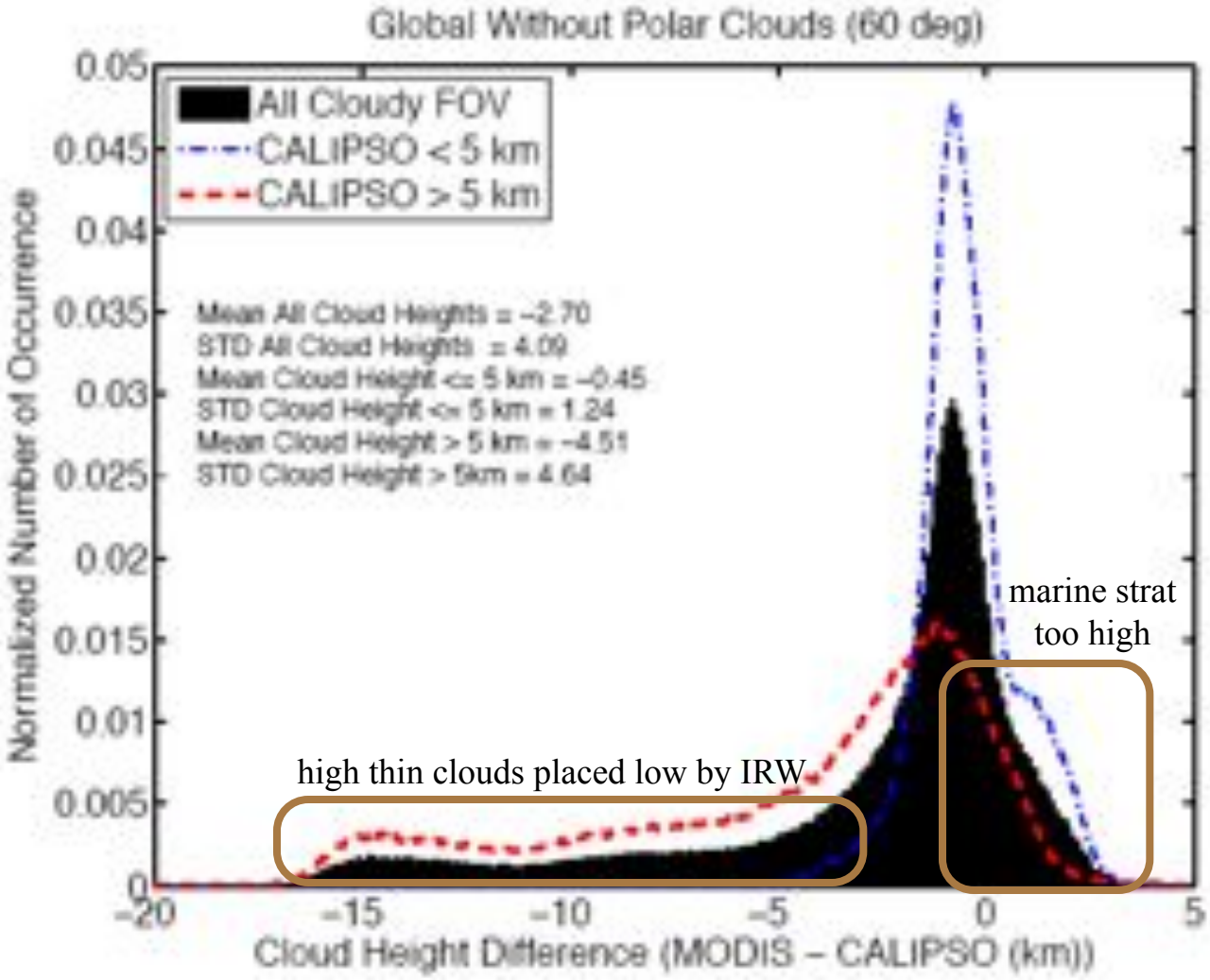
D: Lower the "noise" thresholds (clear minus cloudy radiances required to indicate cloud presence in bands 33 to 36) to force more CO2 slicing solutions for high thin clouds.

E: Adjust ozone profile between 10 and 100 hPa to GDAS values instead of using climatology (so that CO2 radiances influenced by O3 profiles are calculated correctly).

F: Implement Band 34, 35, 36 spectral shifts suggested by Tobin et al. (2005).

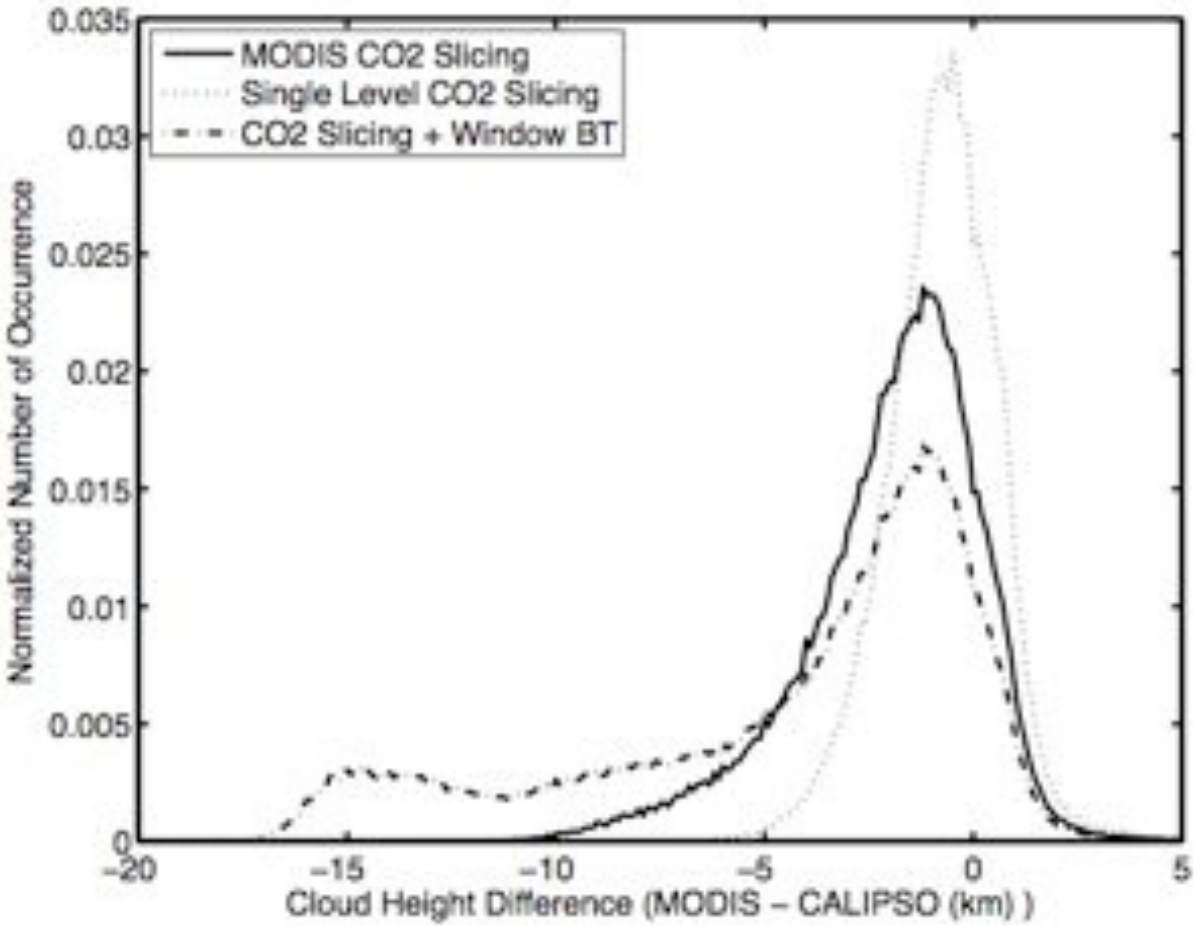
G: Add marine stratus improvement where a constant lapse rate is assumed in low level inversions – lapse rate is adjusted according to latitude region.

MODIS and CALIOP Cloud Properties Comparison

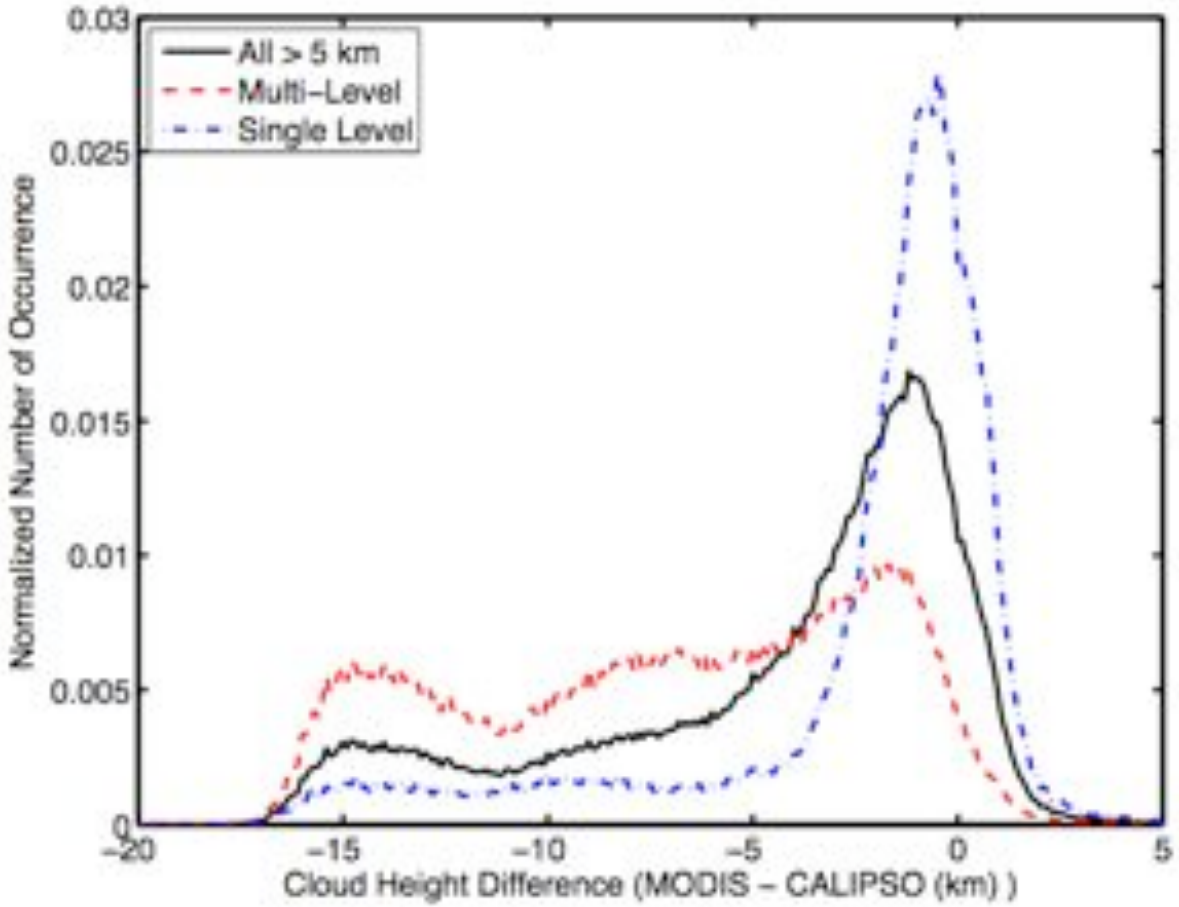


August 2006

Collect 5 Single Level CO2 Slicing CTHs

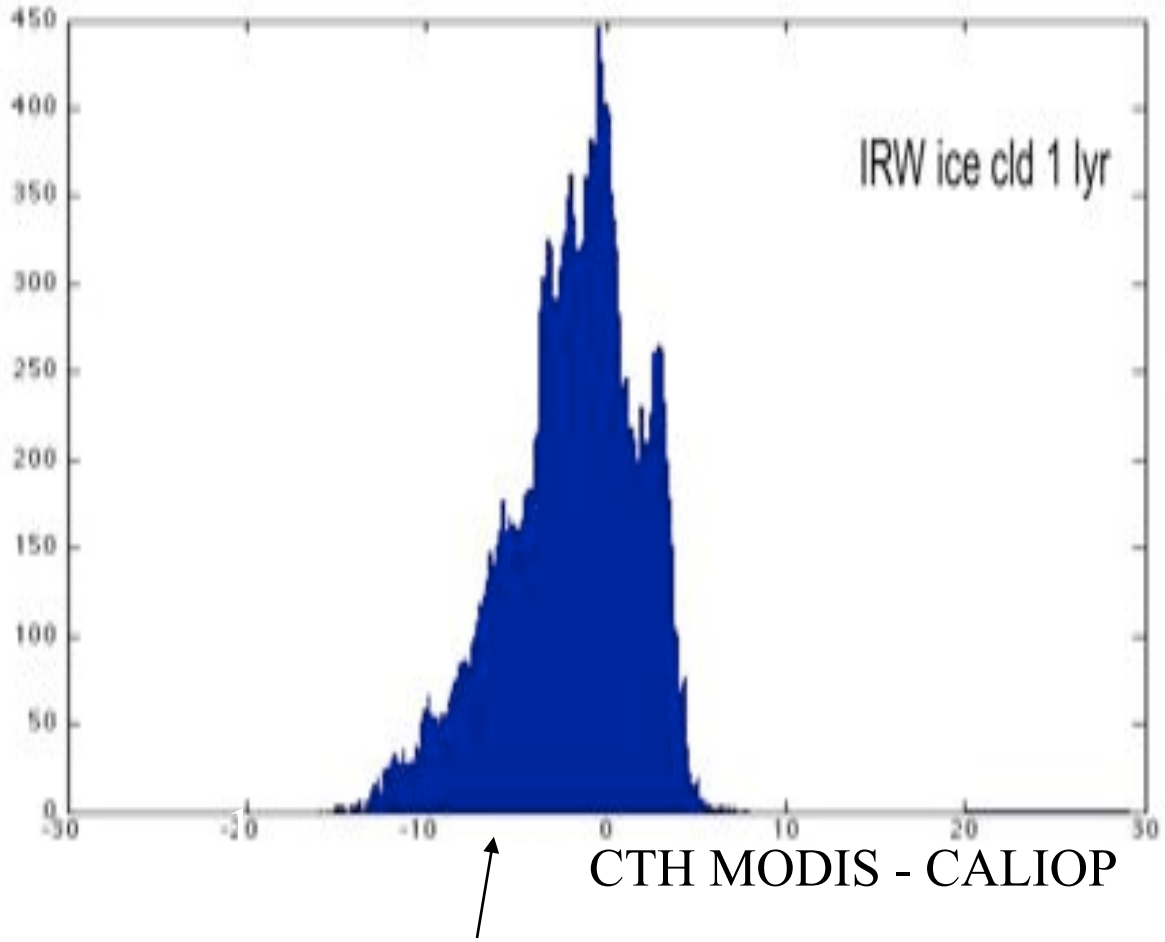


Collect 5 Impact of Multilevel Clouds



Avoid IRW solutions for ice clouds

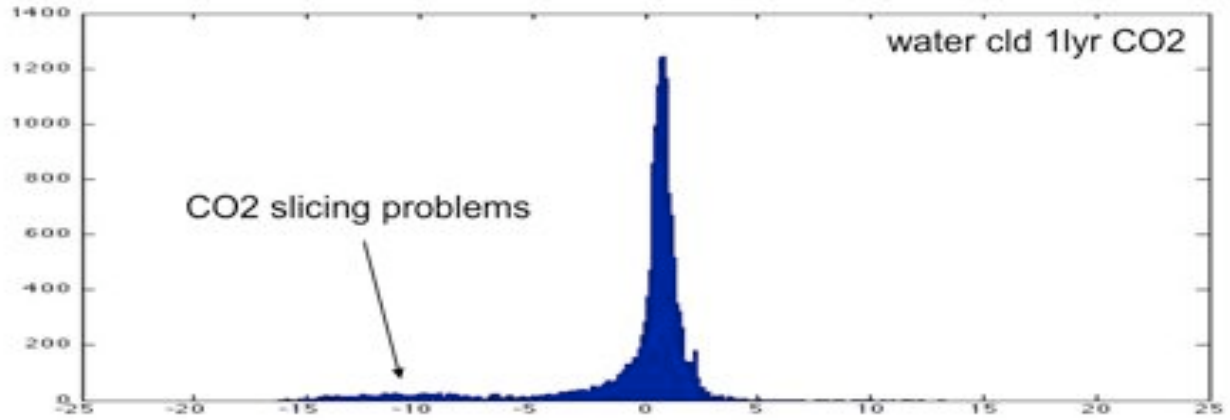
Number for Aug 2006



IRW CTHs are too low for ice clouds

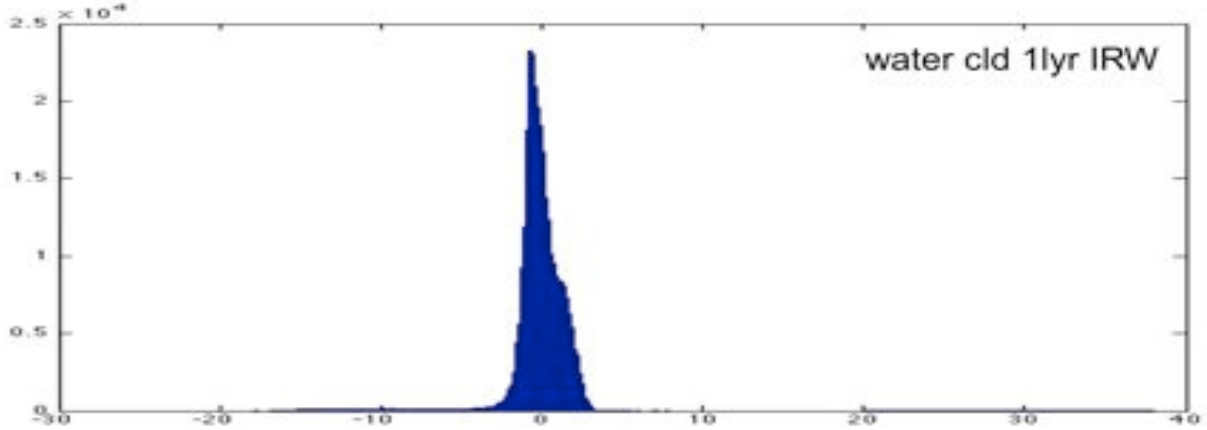
Avoid CO2 slicing solutions for water clouds

Number for Aug 2006



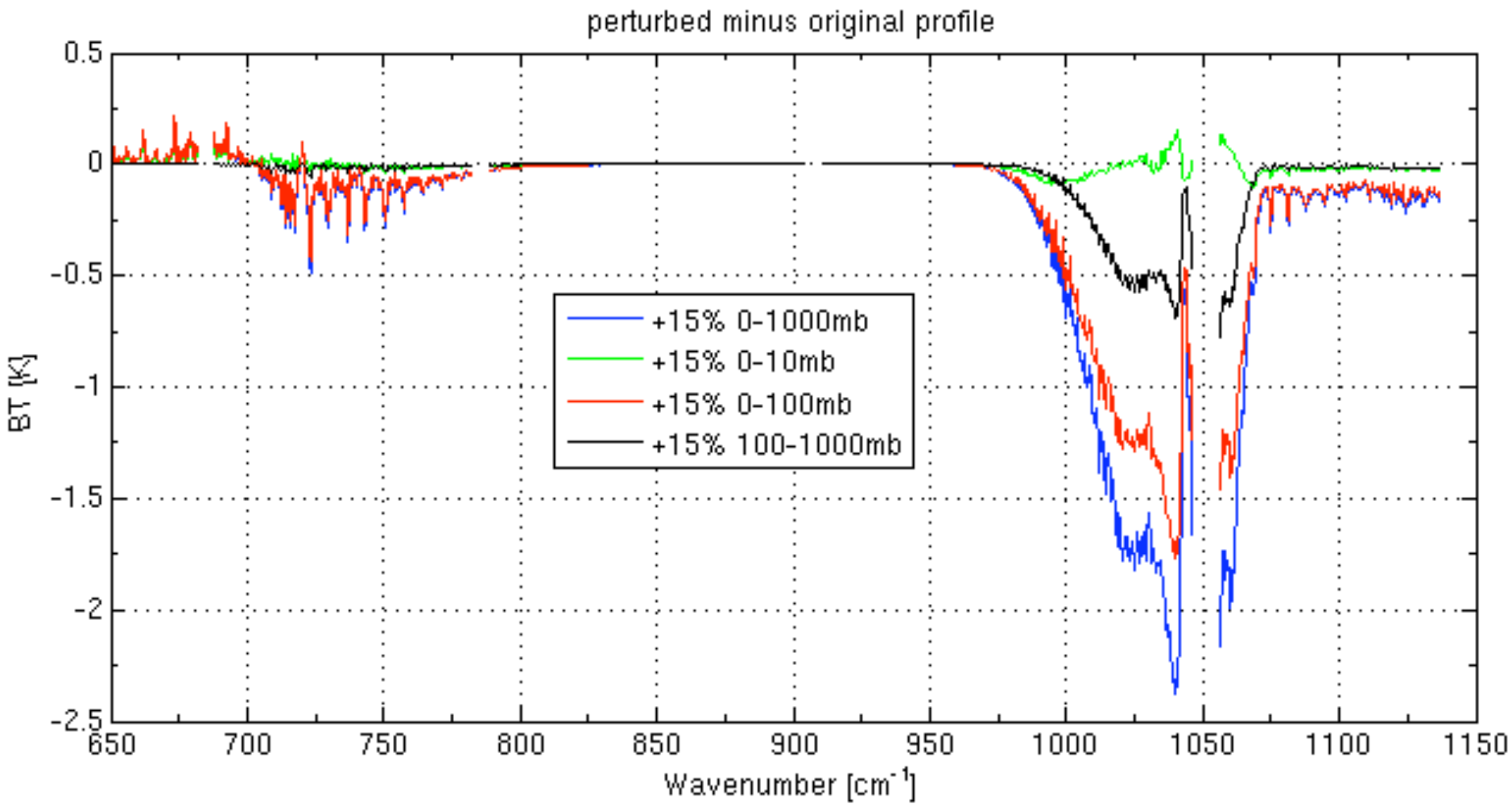
CTH MODIS - CALIOP

Number for Aug 2006

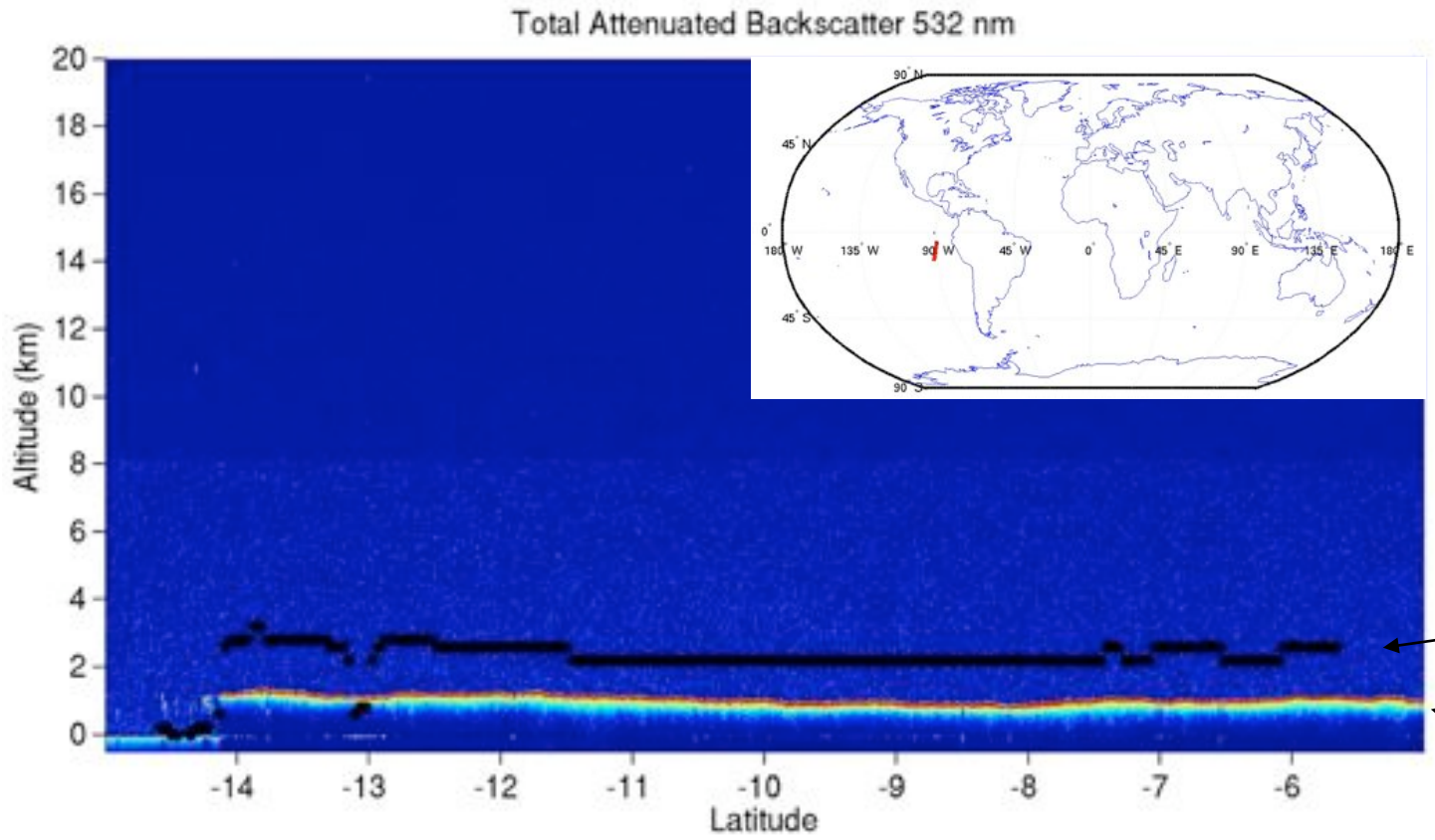


CTH MODIS - CALIOP

O3 affects CO2 bands

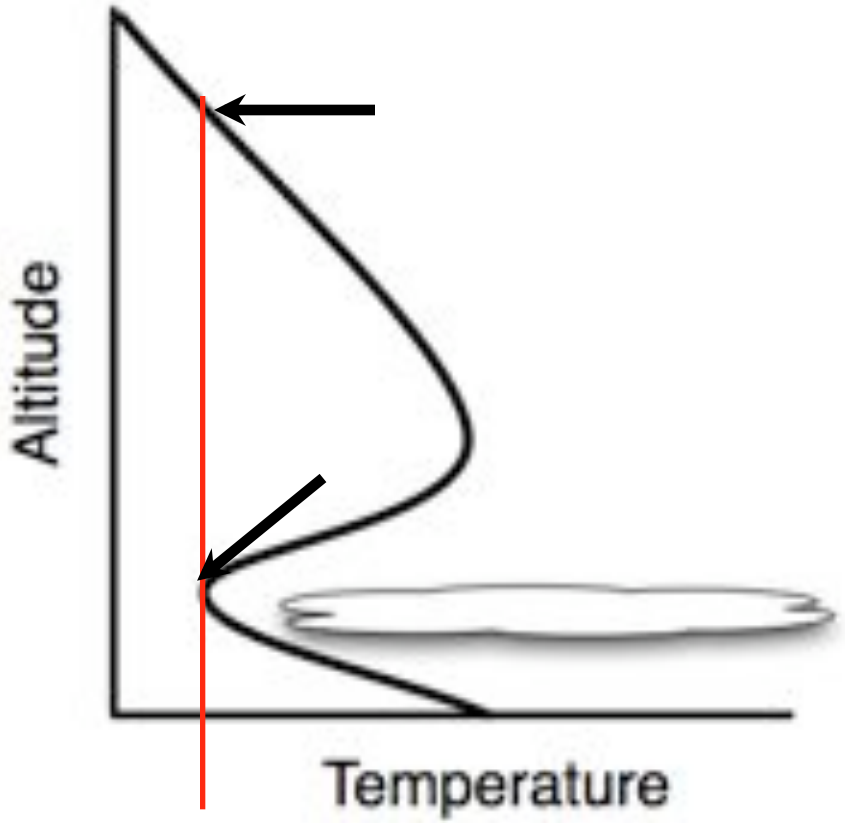


Marine Stratus CTH Over-Estimated

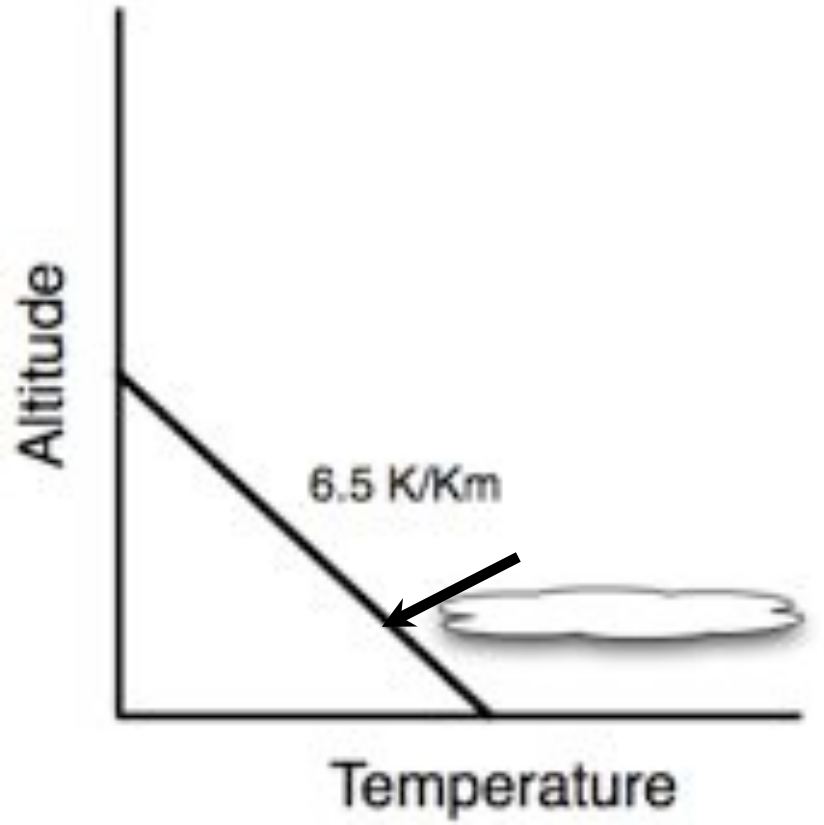


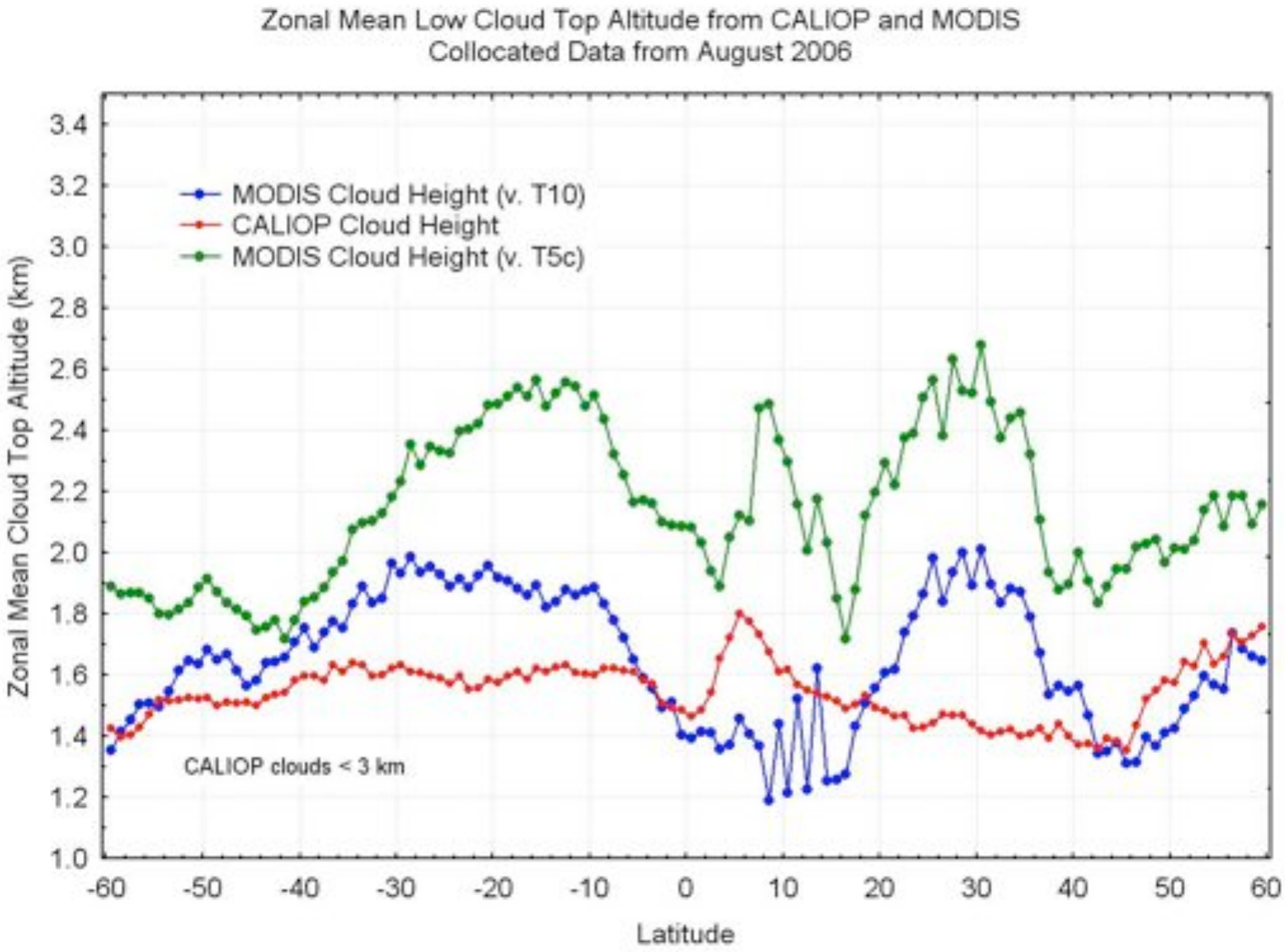
Marine Stratus Correction for Low Level Inversion

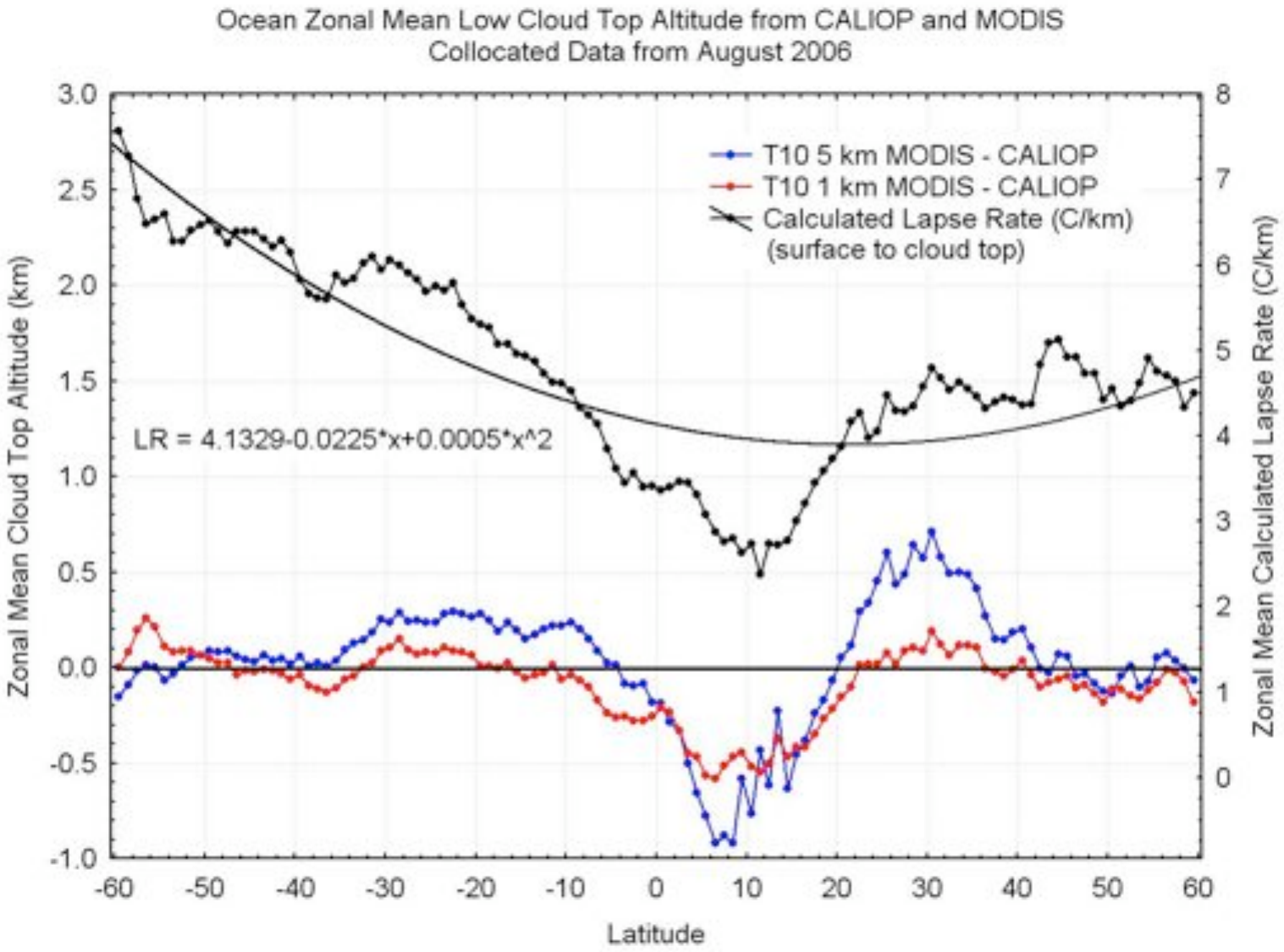
Current

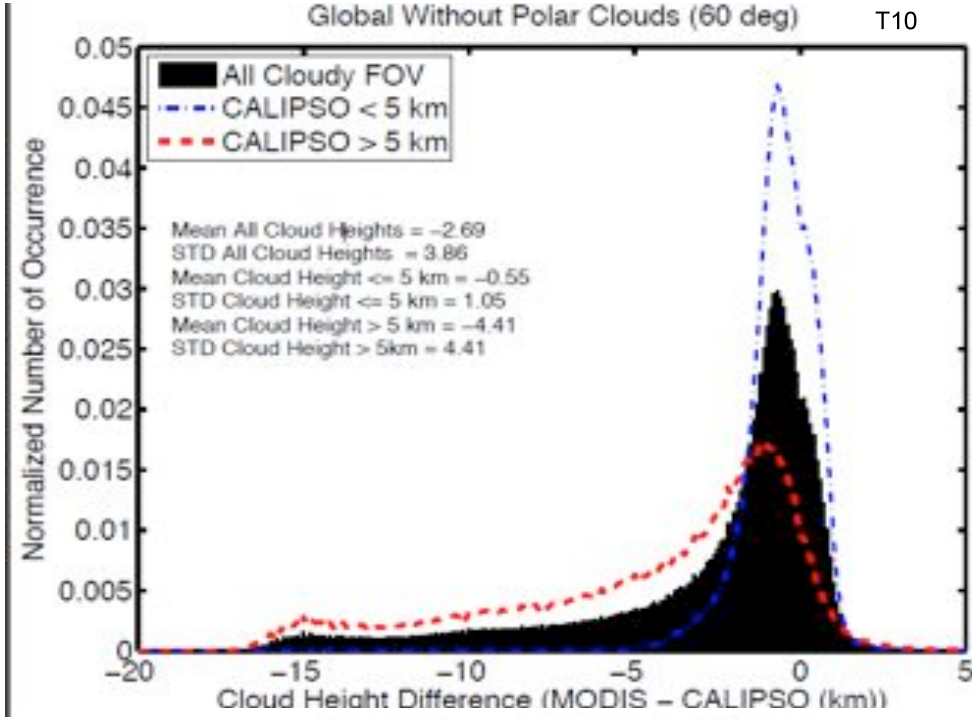


Modified (Minnis 1992)

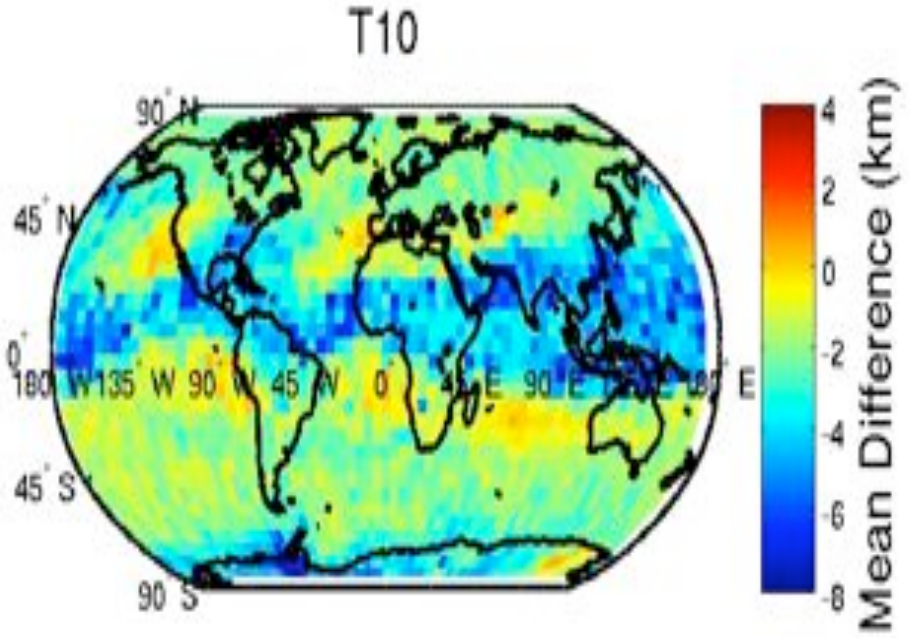


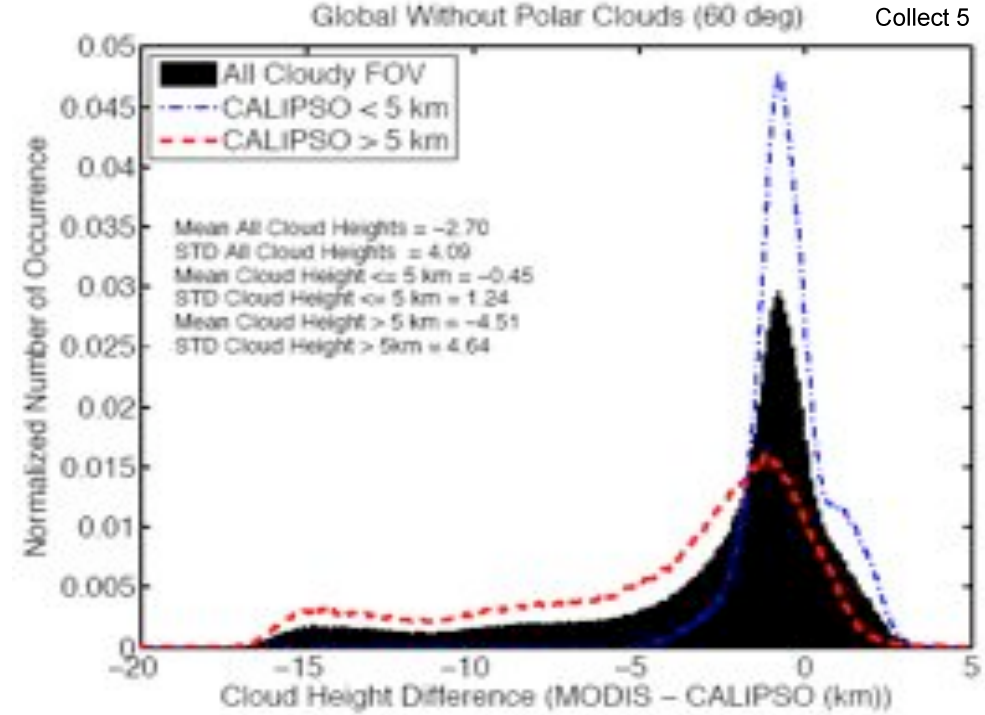

Zonal Mean Low Cloud Top Altitude from CALIOP and MODIS
Collocated Data from August 2006
MODIS Cloud Height (v. T10)
CALIOP Cloud Height
MODIS Cloud Height (v. T5c)
CALIOP clouds < 3 km
Zonal Mean Cloud Top Altitude (km)
Latitude
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60


Ocean Zonal Mean Low Cloud Top Altitude from CALIOP and MODIS
Collocated Data from August 2006
T10 5 km MODIS - CALIOP
T10 1 km MODIS - CALIOP
Calculated Lapse Rate (C/km)
(surface to cloud top)
LR = 4.1329-0.0225*x+0.0005*x^2
Zonal Mean Cloud Top Altitude (km)
Zonal Mean Calculated Lapse Rate (C/km)
Latitude
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
8
7
6
5
4
3
2
1
0
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60

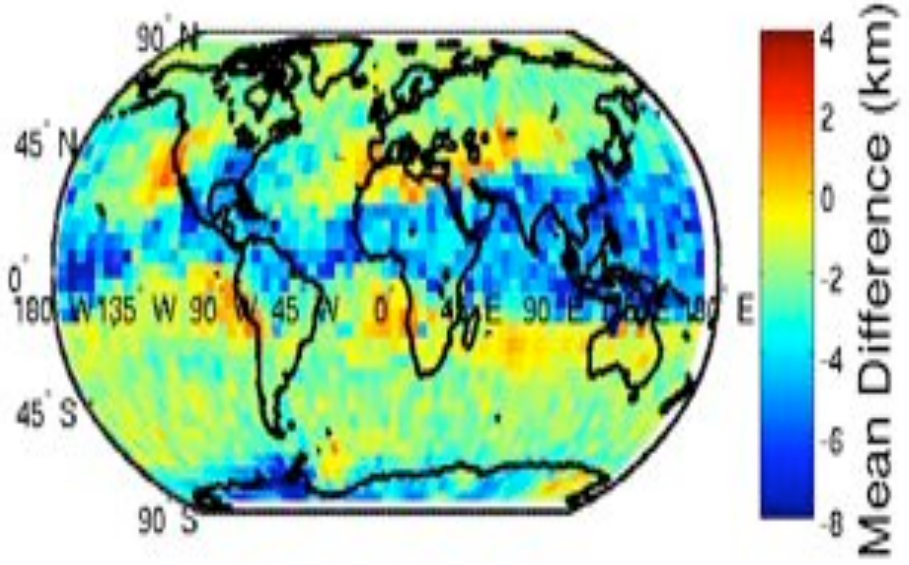


T10





Collect 5



Conclusions on CO2 Slicing CTH Algorithm Adjustments

- The largest cloud height differences results from not using CO2 slicing (>15 km)
- Reducing the cloud detection threshold produced more high thin cloud retrievals, but also produced erroneously high CO2 CTH retrievals for low water clouds in the southern Pacific
- CO2 slicing (IRW) heights should be avoided for water (ice) clouds
- A high bias in marine stratus was identified in the MODIS retrievals; CTH algorithm problems in inversions will be mitigated assuming a wet lapse rate
- Adjusting the spectral response of the CO2 bands reduced CTH errors
- Selecting the spectral radiance ratio using a top down criteria improved high cloud detection
- Making multiple passes through large data sets was necessary
- Using CALIOP as a reference was invaluable
- Collect 6 Cloud Products should be the ten year reference