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Atmospheric Infrared Sounder

A look at AIRS cloud retrievals: the testing of V6, the affects on the retrievals from different scan angles, and the potential affects on Temperature retrievals
2010-04-22

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1 Jet Propulsion Laboratory, California Institute of Technology

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V5 = v5.0.14
V6 = v5.6.0

The next few slides show how cloud retrievals differ from V5 to V6 and the improvements made in V6 so far.

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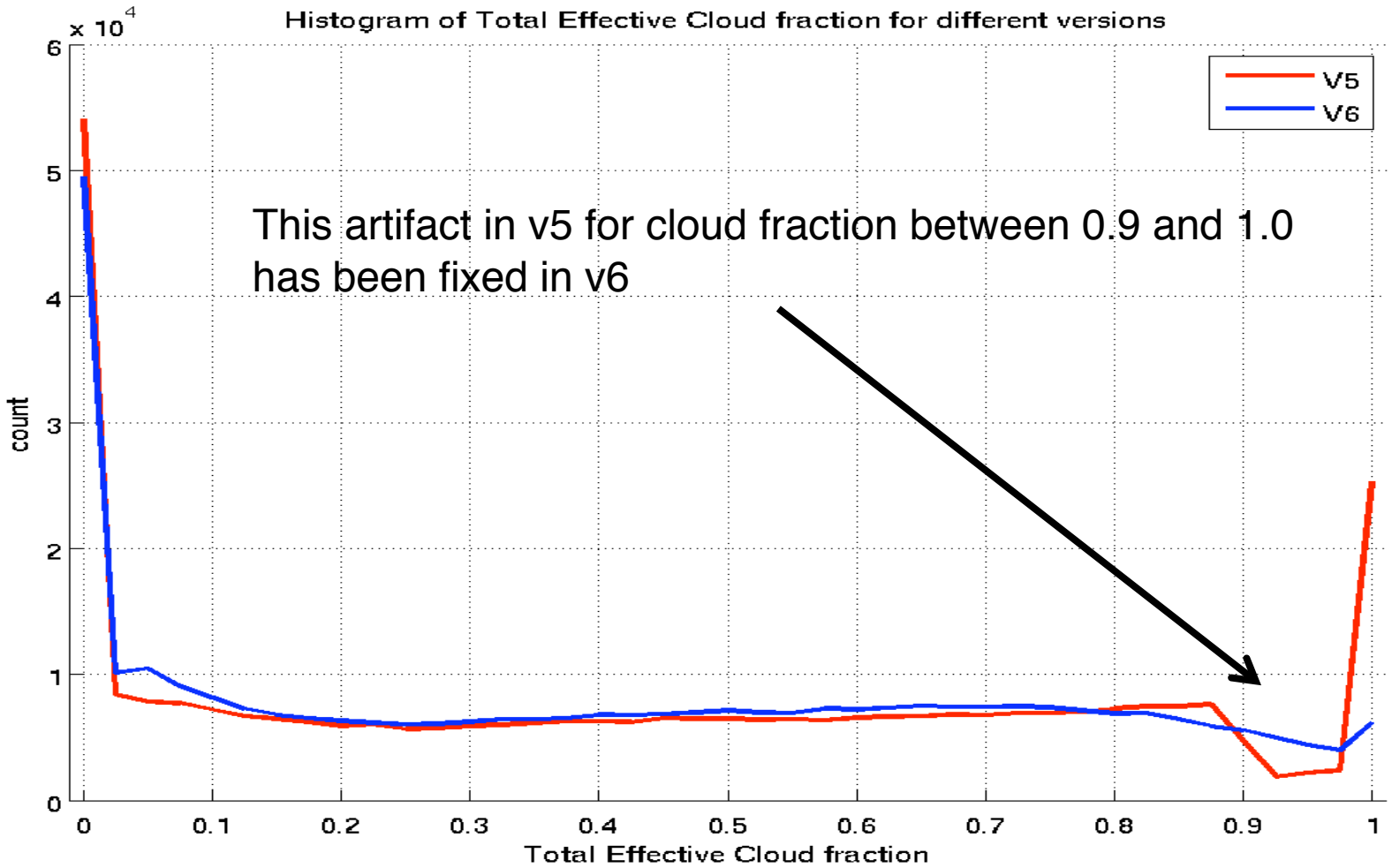

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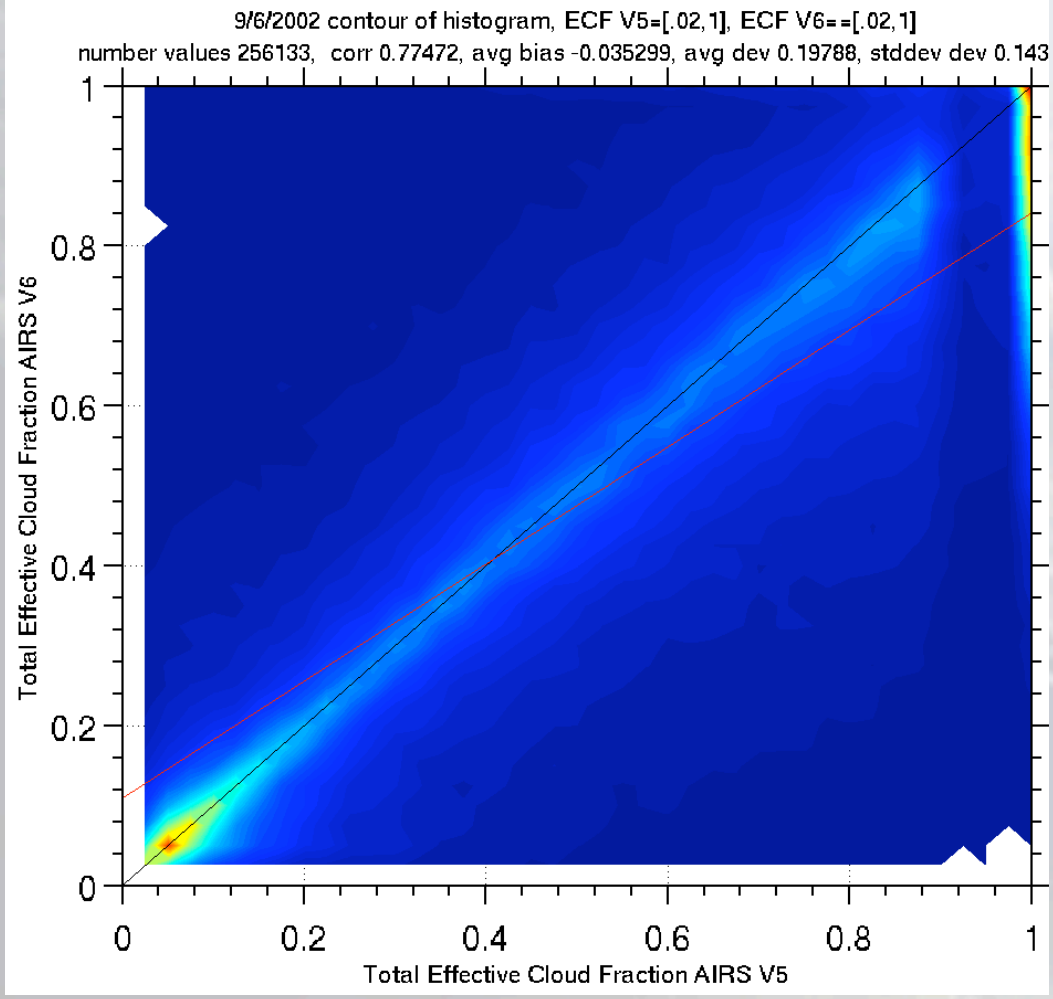
Contour Histogram of Effective Cloud Fraction v5 vs v6



- **Most cases have clouds at the same place in v6 as v5.**
- **V5 had a gap for 90-99.9% clouds but an excess at 100%**

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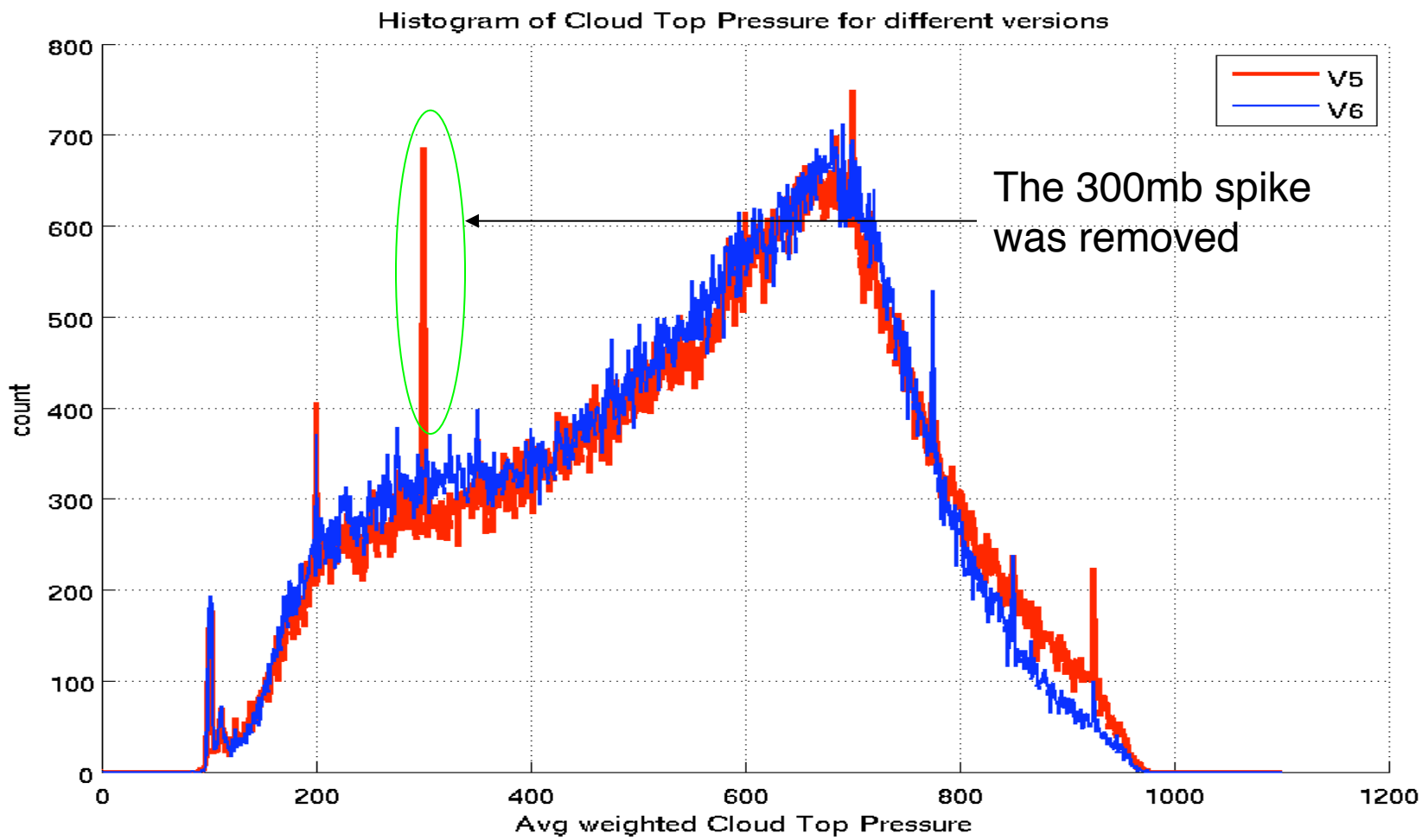
Histogram of weighted Cloud Top Pressure



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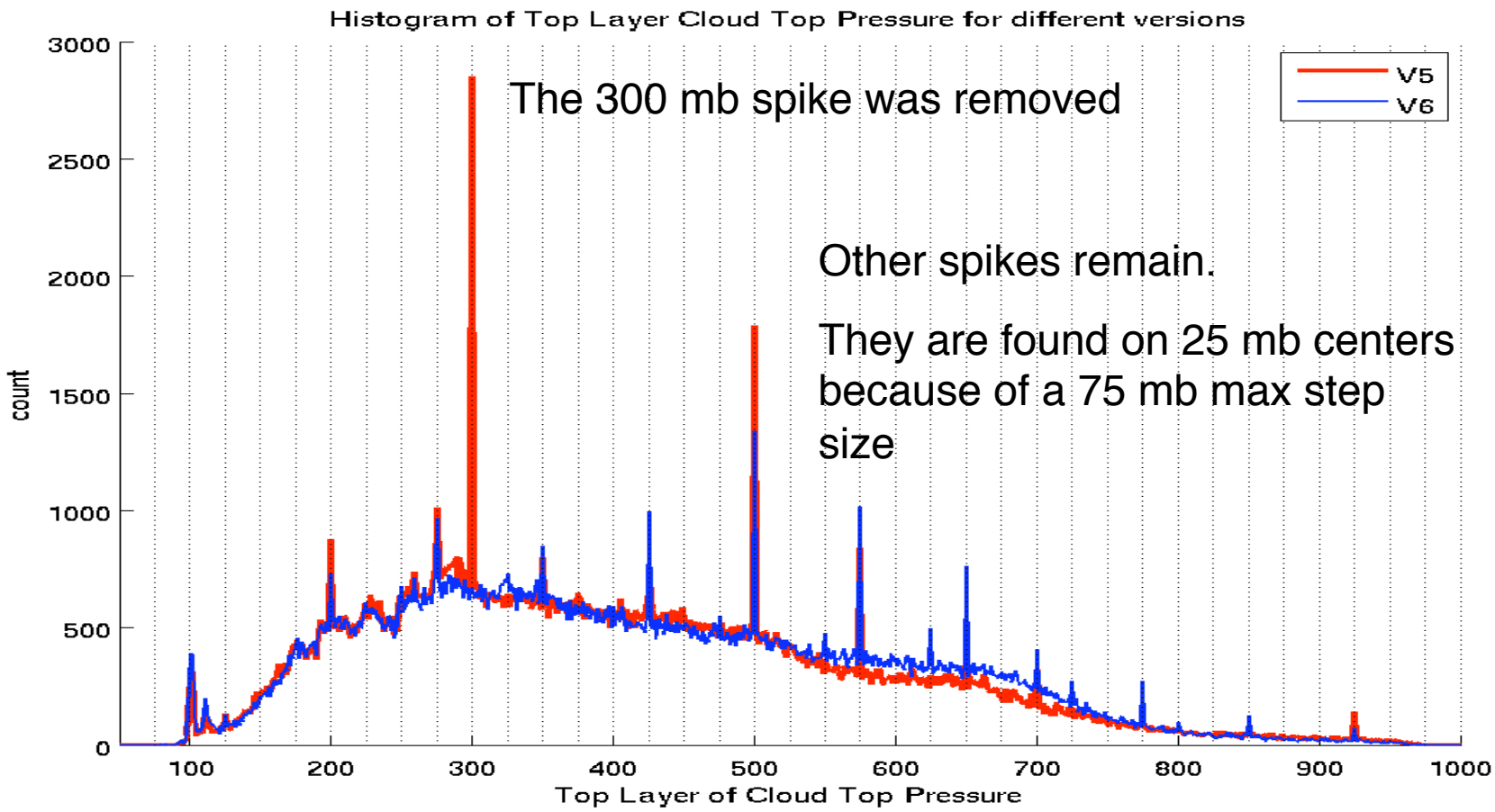
Histogram of Top-Layer Cloud Top Pressure



The 300 mb spike was removed

Other spikes remain.

They are found on 25 mb centers because of a 75 mb max step size

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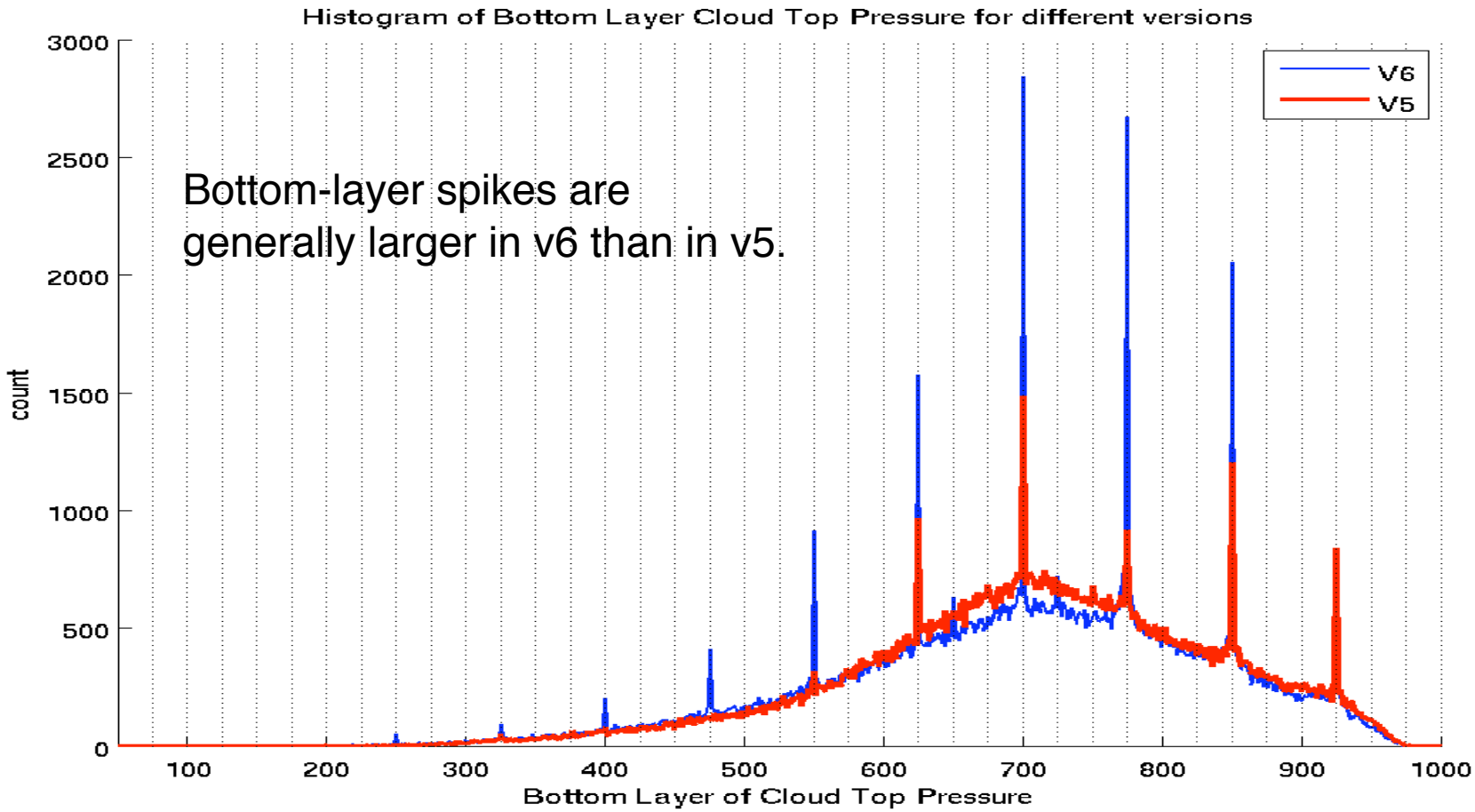
Histogram of Bottom-Layer Cloud Top Pressure



Bottom-layer spikes are generally larger in v6 than in v5.

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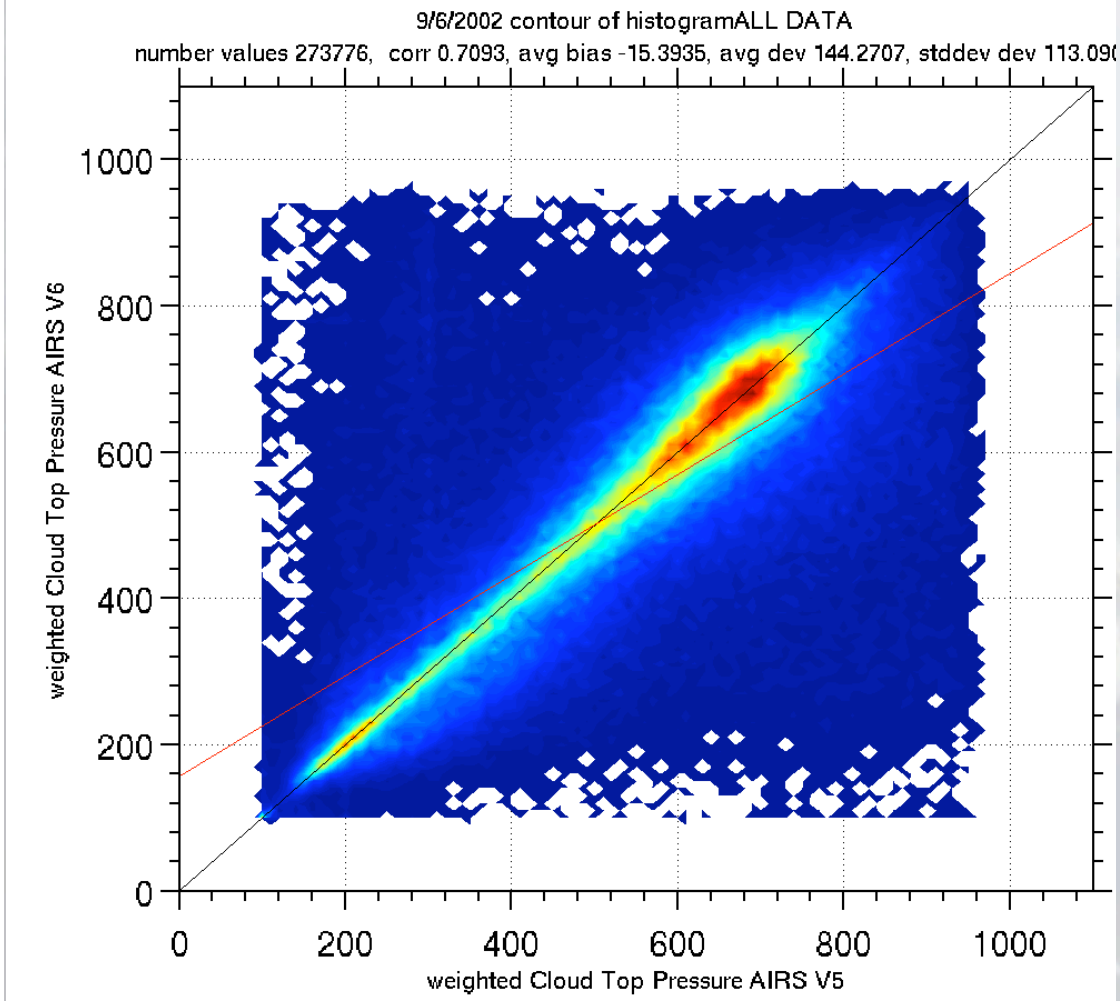
Contour Histogram of weighted Cloud Top Pressure v5 vs v6



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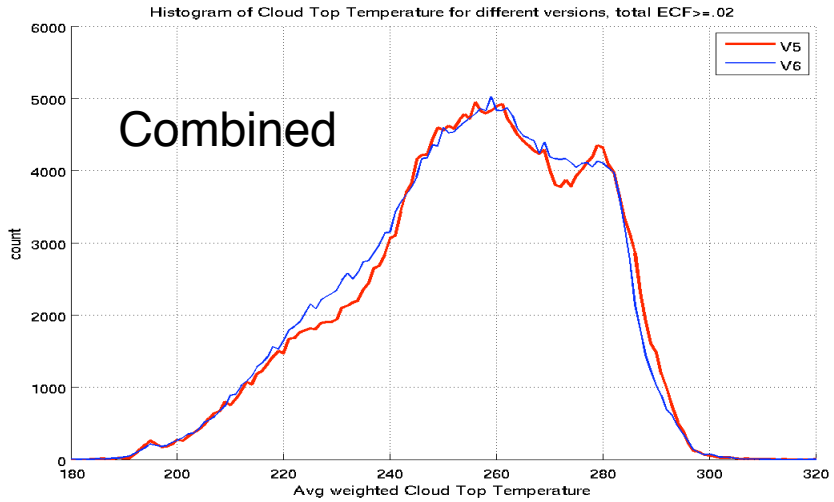
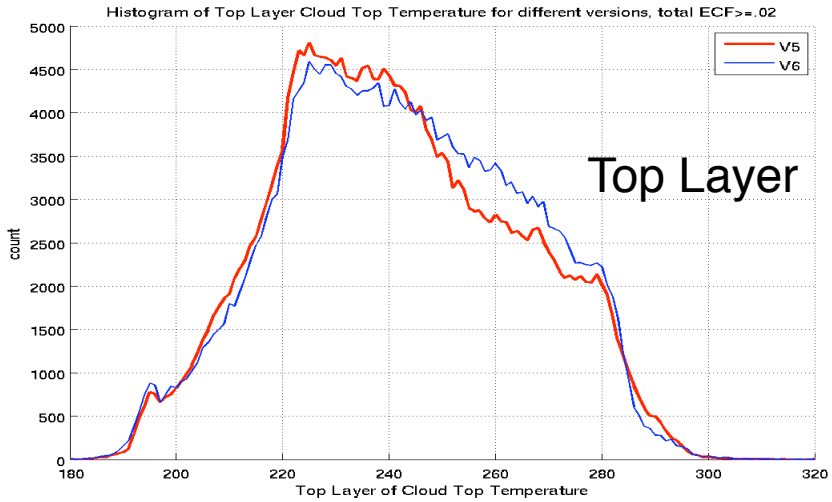
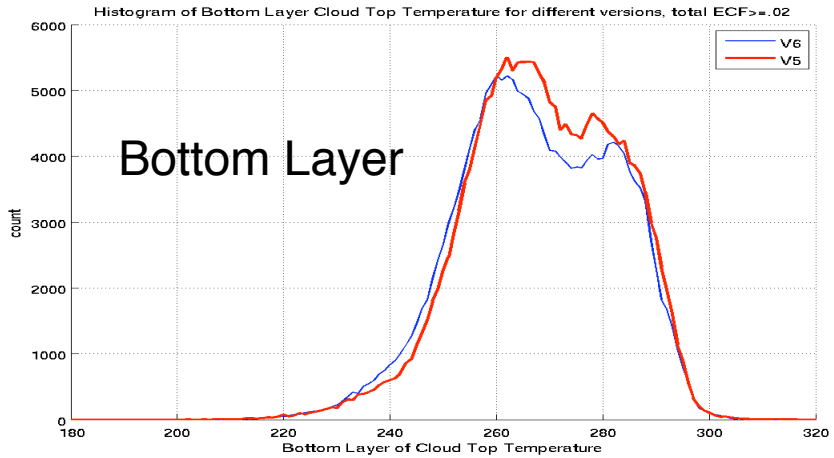
Histograms of Cloud Top Temperature







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Histograms of Cloud Top Temperature

- ***Cloud retrievals are affected by different scan angles as shown in the next few slides***
  - ***True cloud properties should not vary with scan angle***
  - ***There are some known geometric effects where higher coverage and higher cloud tops are seen at angle than at nadir***
  - ***These changes do not fit simple observational geometry models***

- ***FOVs 15 & 16 are "nadir"***

- ***FOVs 1 & 30 are called "off-nadir" or "high angle"***

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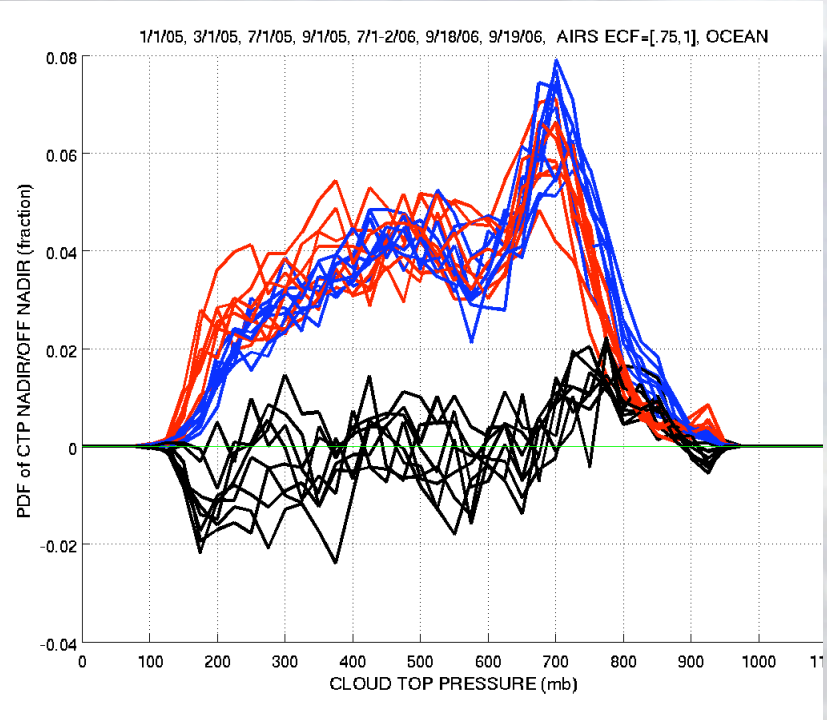
Cloud Top Pressure for high-coverage clouds – variation with scan angle



Red: High Angle

Blue: Nadir

Black: Difference

- **Histogram as a function of cloud top pressure**
- **This figure shows high-coverage clouds: effective cloud fraction (ECF) in [0.75, 1.0]**
- **This figure has lines for seven typical days**
- **More low clouds (700-900 mbar) are seen at nadir**

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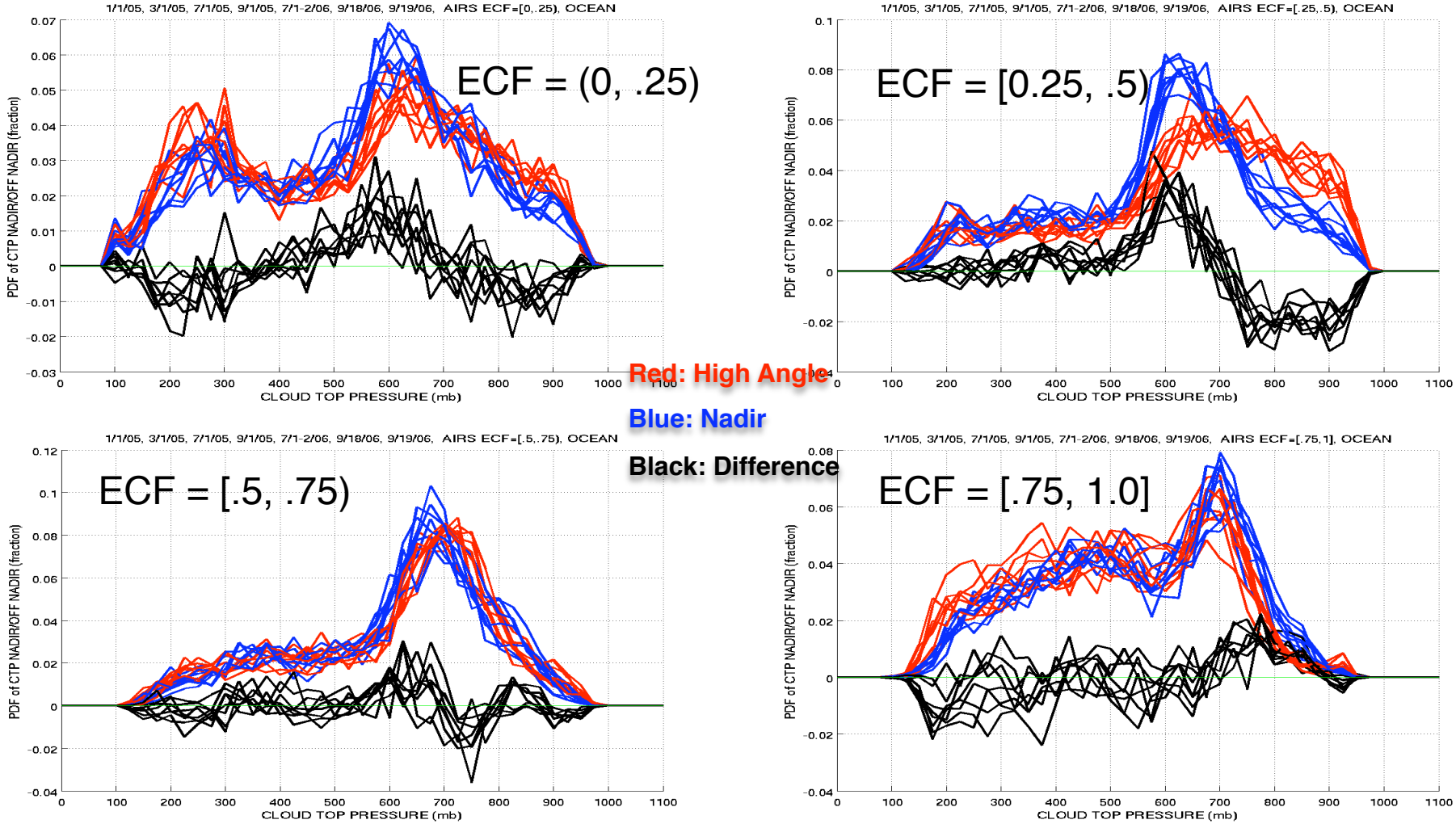
Cloud Top Pressure for clouds – variation with scan angle



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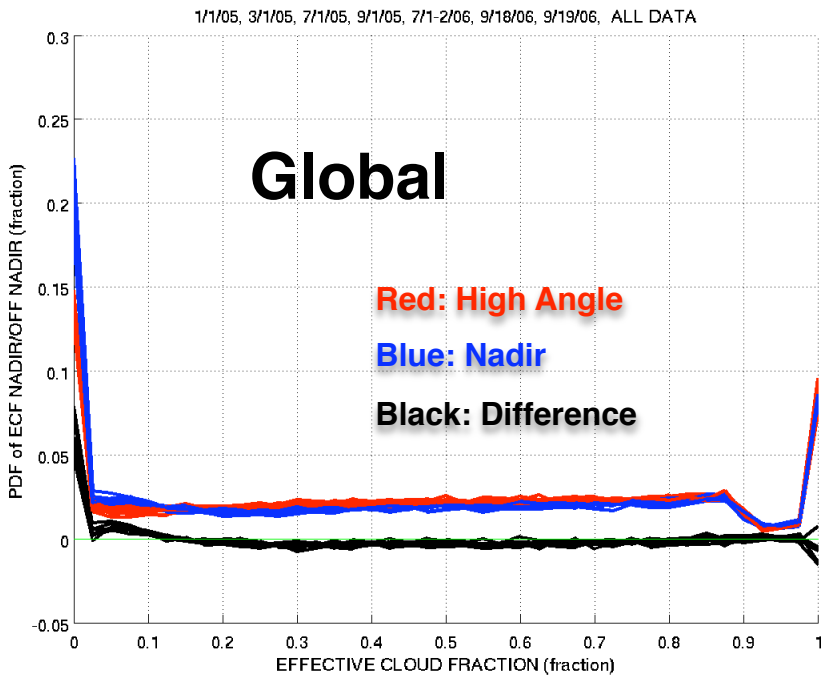
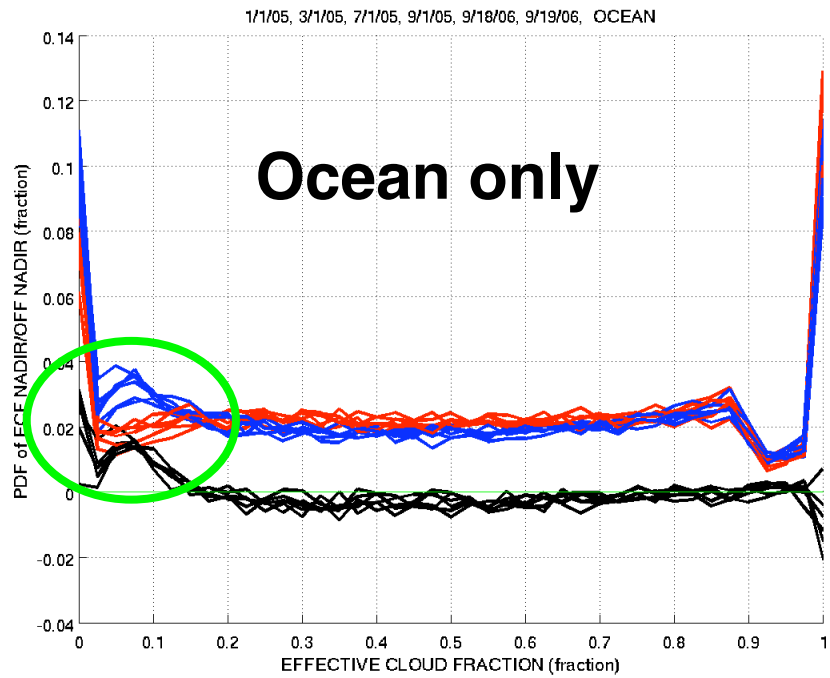
Histograms of Cloud Fraction – variation with scan angle





For ocean FOV's, nadir footprints have more thin clouds (effective cloud fraction of 0 to 0.1) than high angle footprints.

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Cloud impact on difference between regression and physical solutions

The next few slides show that the presence of certain types of clouds can have an affect on how the physical retrieval of temperature profiles (TAirSup) differ from the initial guess (TAir1Ret) gotten from regression.

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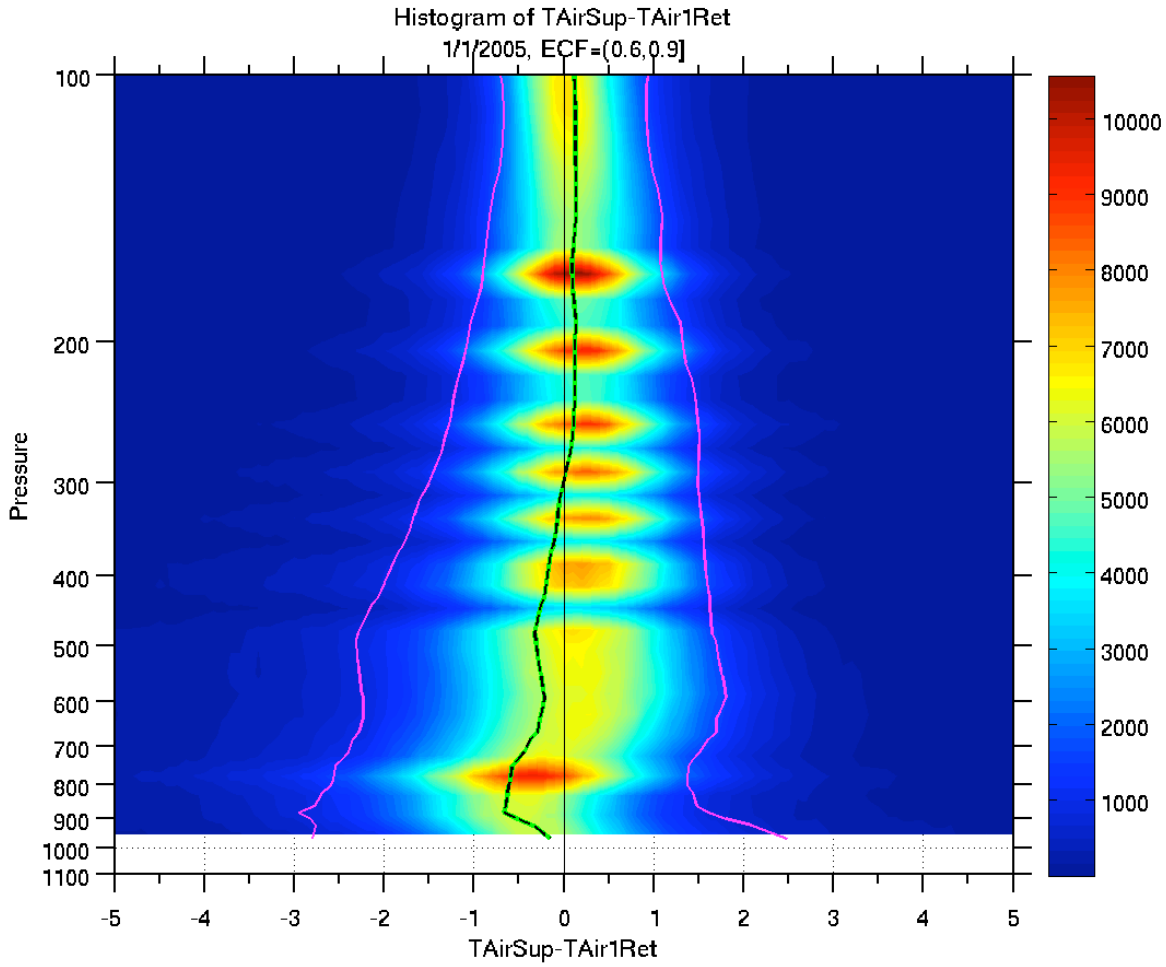
Difference between regression and physical T(p) for high coverage clouds



- When there are high coverage (60-90%) clouds, the physical retrieval is consistently colder than the regression below 300 mbar
- Cloud clearing is probably incomplete
- Regression can compensate for cloud contamination
- Physical retrieval always treats cloud-cleared radiances as clear

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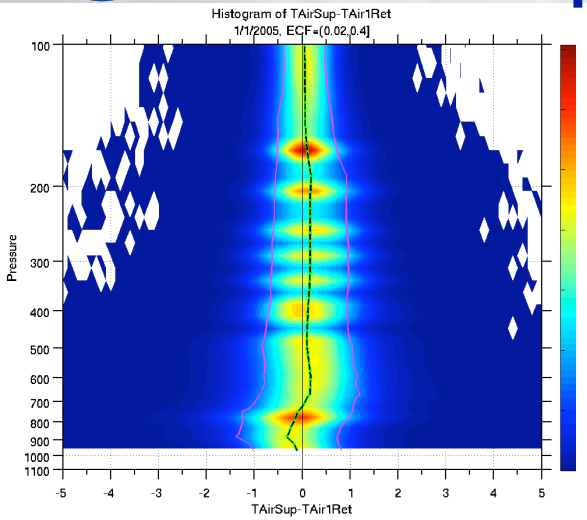
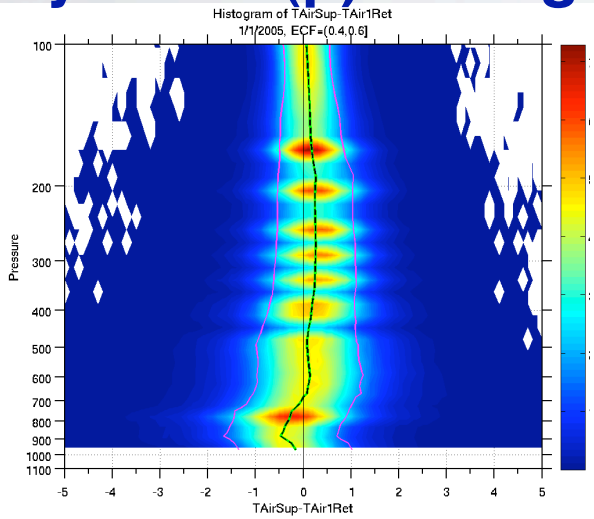
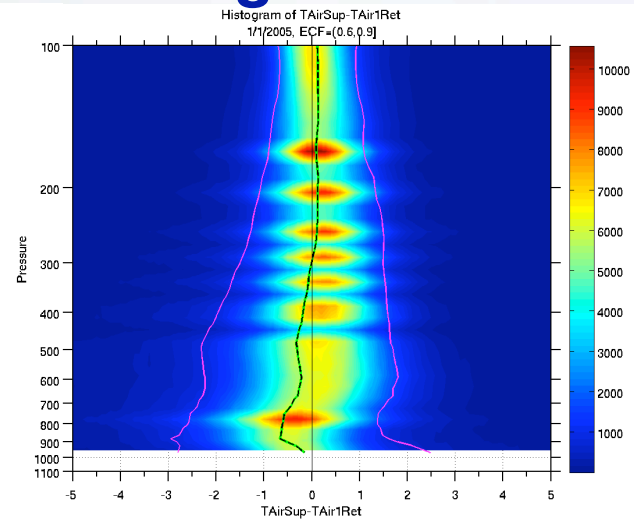
Difference between regression and physical T(p) for high coverage clouds



ECF = (0.02, 0.4]



ECF = (0.4, 0.6]



ECF = (0.6, 0.9]

- **The effect is much stronger seen with high cloud fractions**

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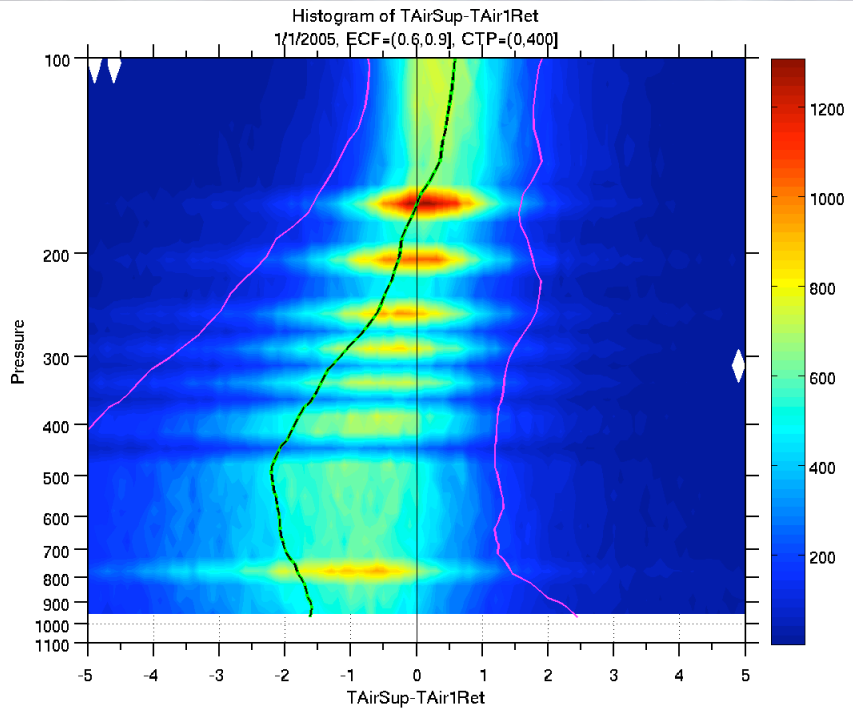
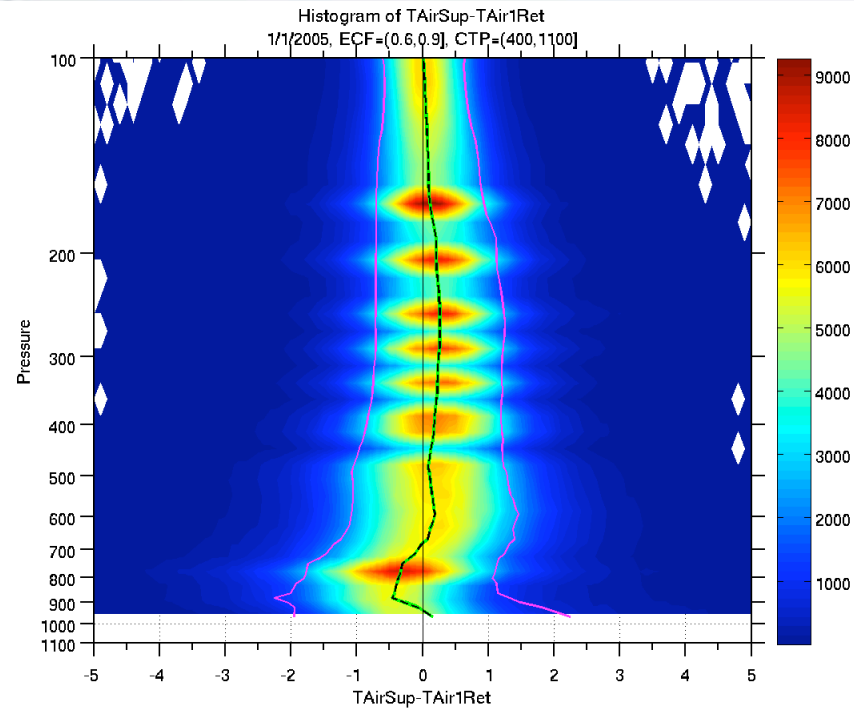
Difference between regression and physical T(p) for high coverage clouds and for varying pressure of cloud tops

ECF=(.6,.9], CTP=(0,400]



ECF=(.6,.9], CTP=(400,1100]



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Back up Slides

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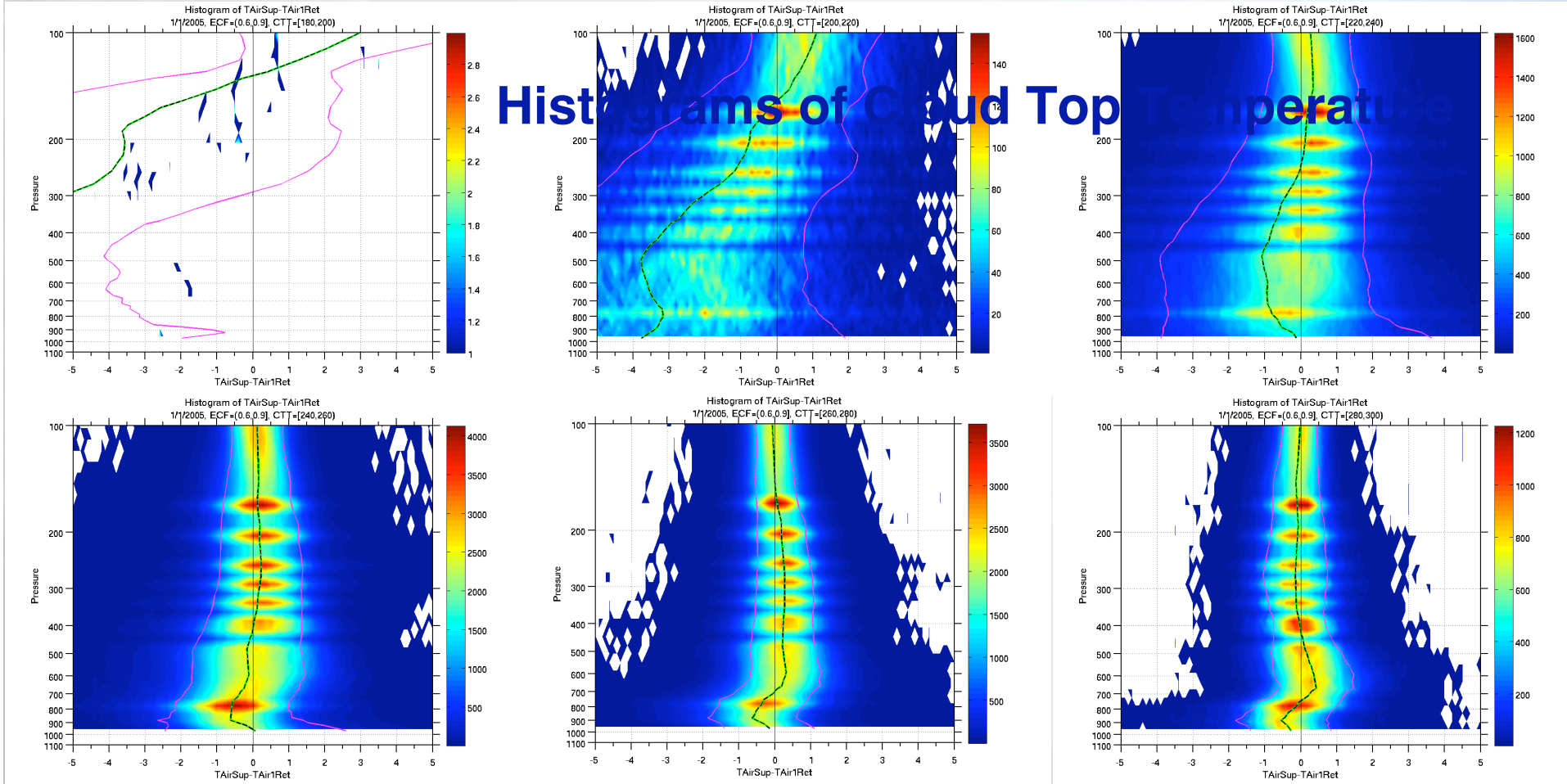
Histograms of Cloud Top Temperature



Lines of mean and standard deviation

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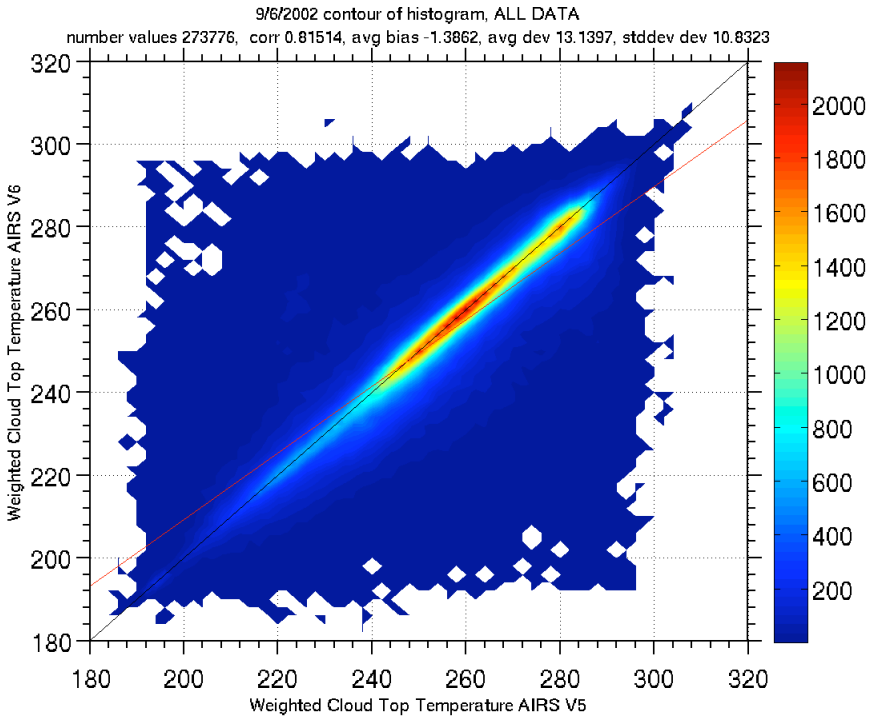
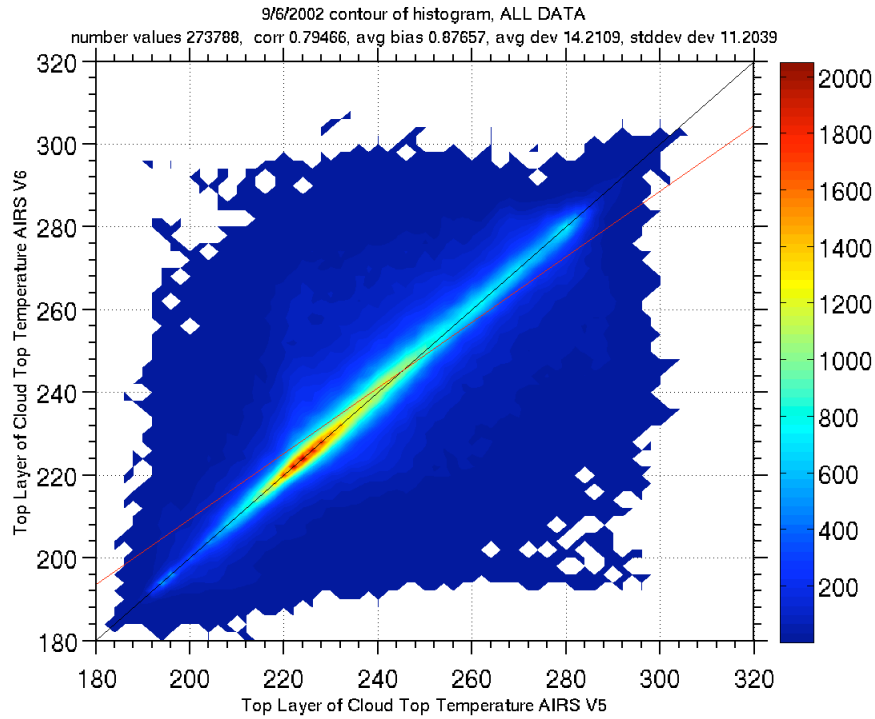
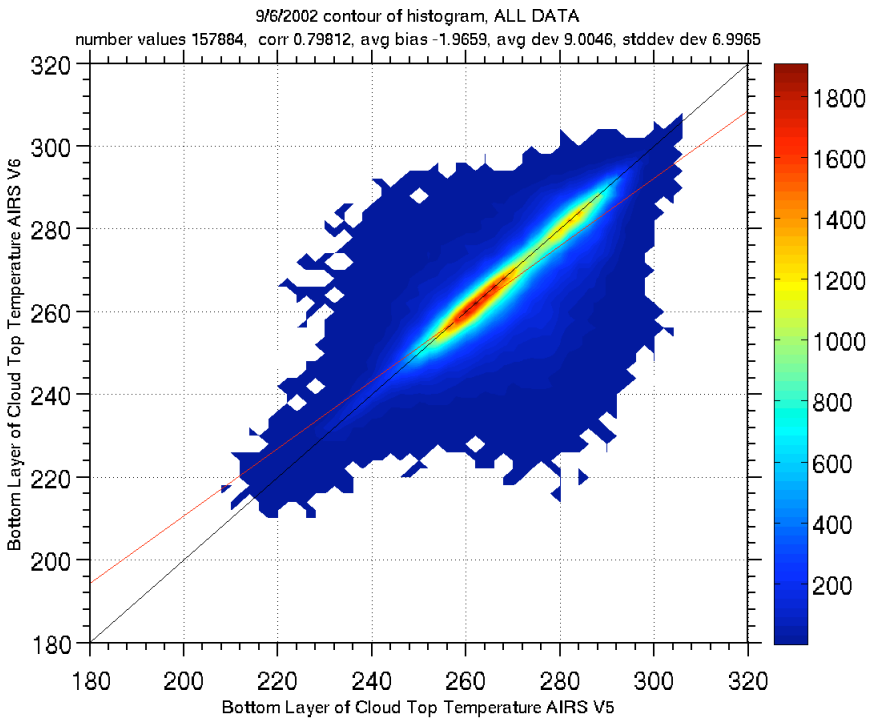
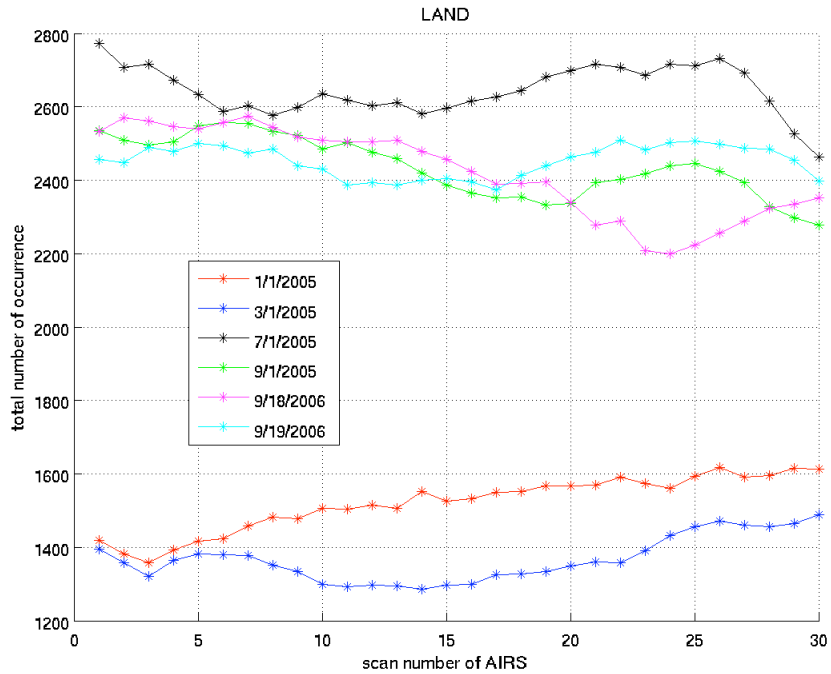
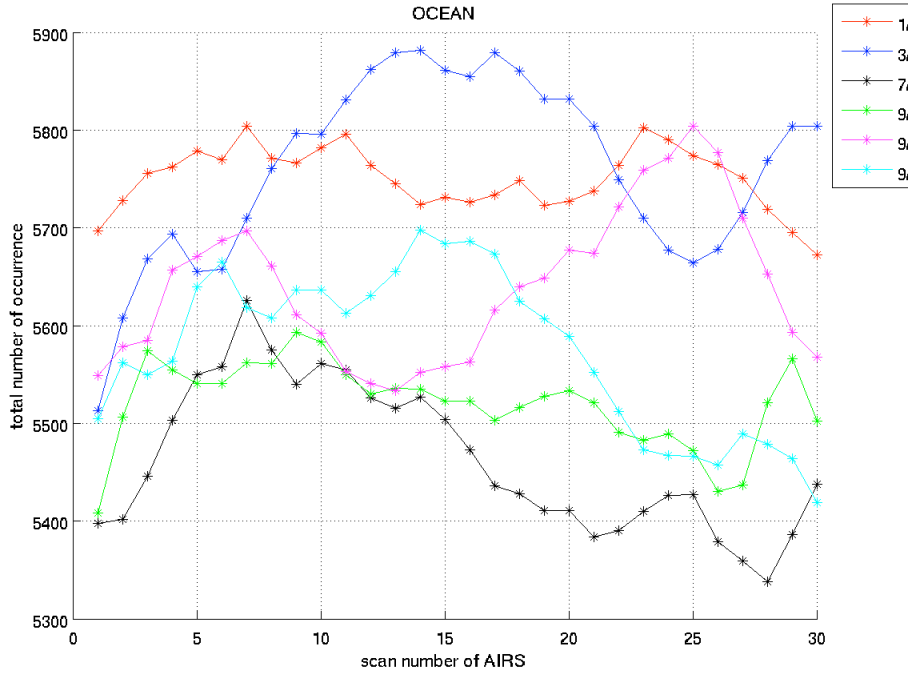
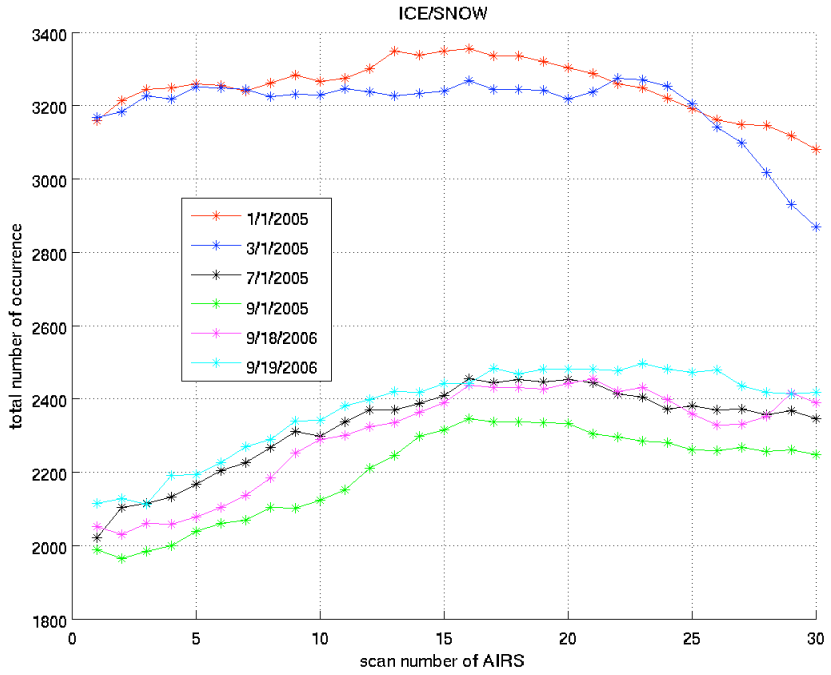

9/6/2002 contour of histogram, ALL DATA
number values 273776, corr 0.81514, avg bias -1.3862, avg dev 13.1397, stddev dev 10.8323
Weighted Cloud Top Temperature AIRS V6
Weighted Cloud Top Temperature AIRS V5
180 200 220 240 260 280 300 320
200 400 600 800 1000 1200 1400 1600 1800 2000


9/6/2002 contour of histogram, ALL DATA
number values 273788, corr 0.79466, avg bias 0.87657, avg dev 14.2109, stddev dev 11.2039
Top Layer of Cloud Top Temperature AIRS V6
Top Layer of Cloud Top Temperature AIRS V5
180 200 220 240 260 280 300 320
200 400 600 800 1000 1200 1400 1600 1800 2000

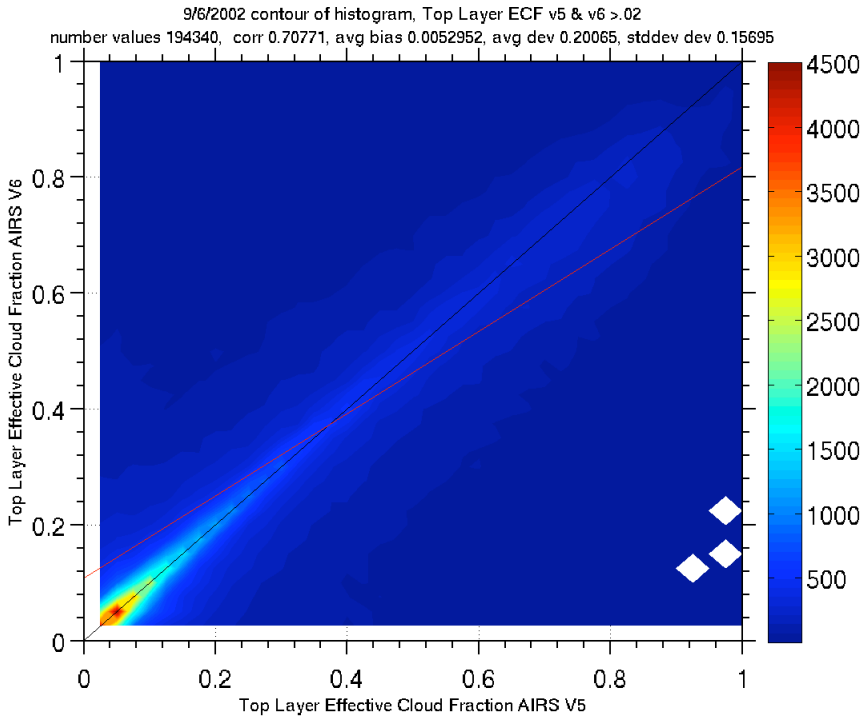

9/6/2002 contour of histogram, ALL DATA
number values 157884, corr 0.79812, avg bias -1.9659, avg dev 9.0046, stddev dev 6.9965
Bottom Layer of Cloud Top Temperature AIRS V6
Bottom Layer of Cloud Top Temperature AIRS V5
180 200 220 240 260 280 300 320
200 400 600 800 1000 1200 1400 1600 1800

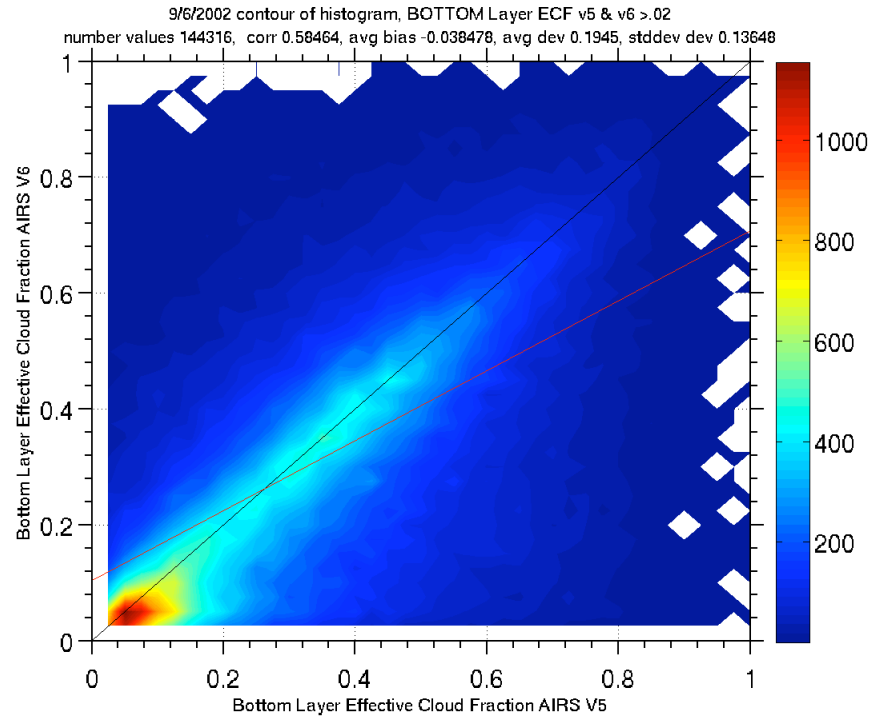






Categories based on MWSurfClass.





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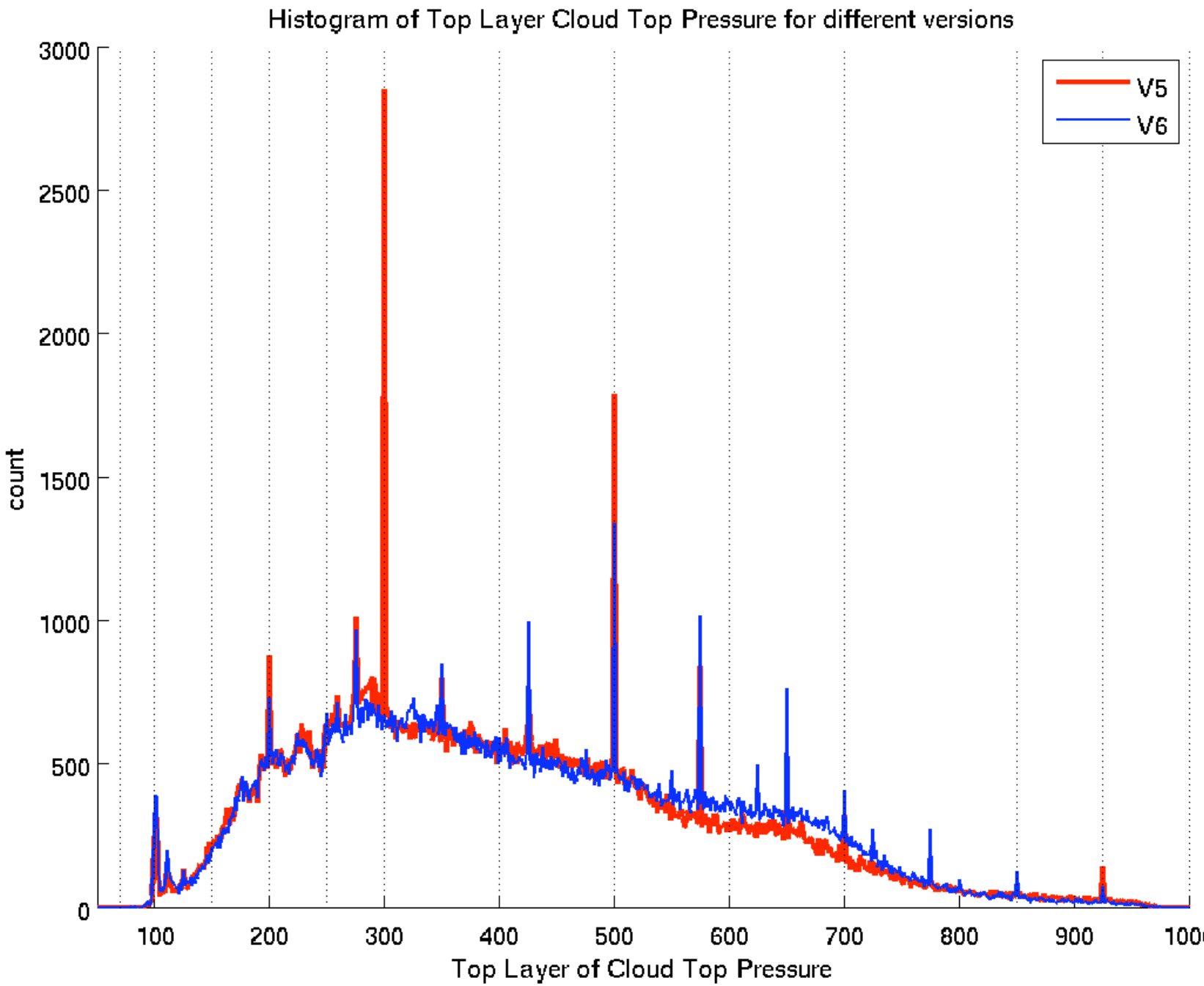
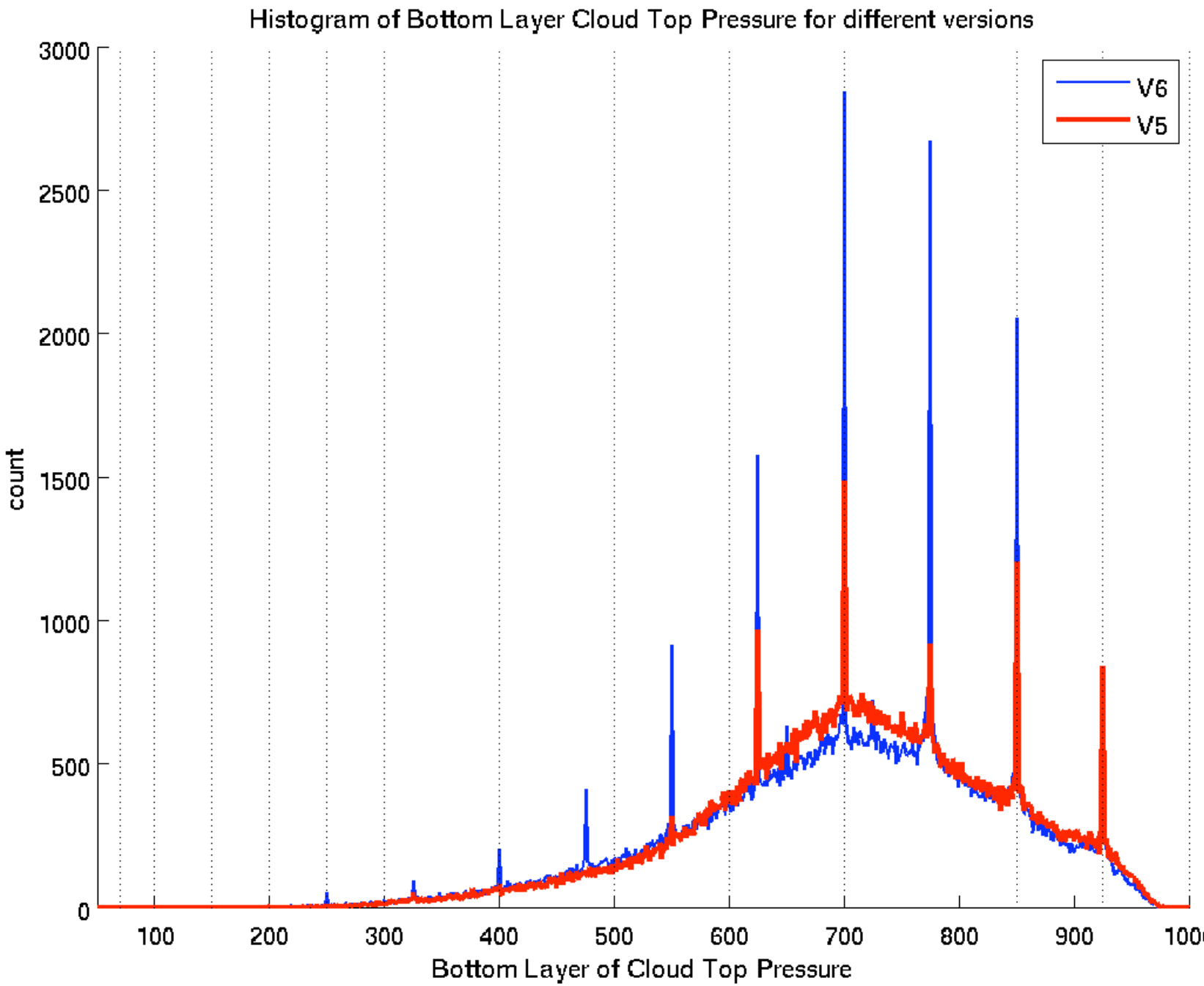
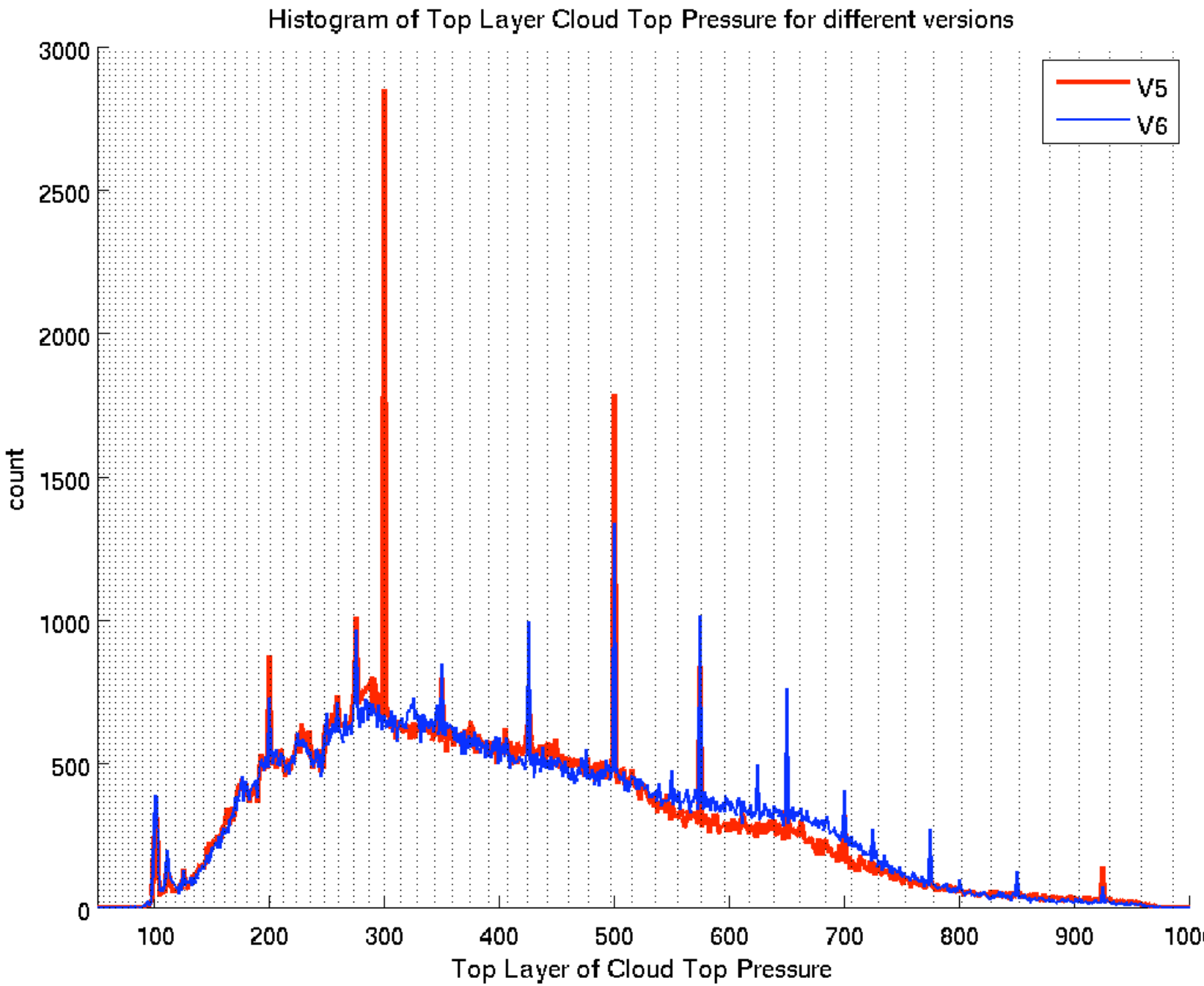
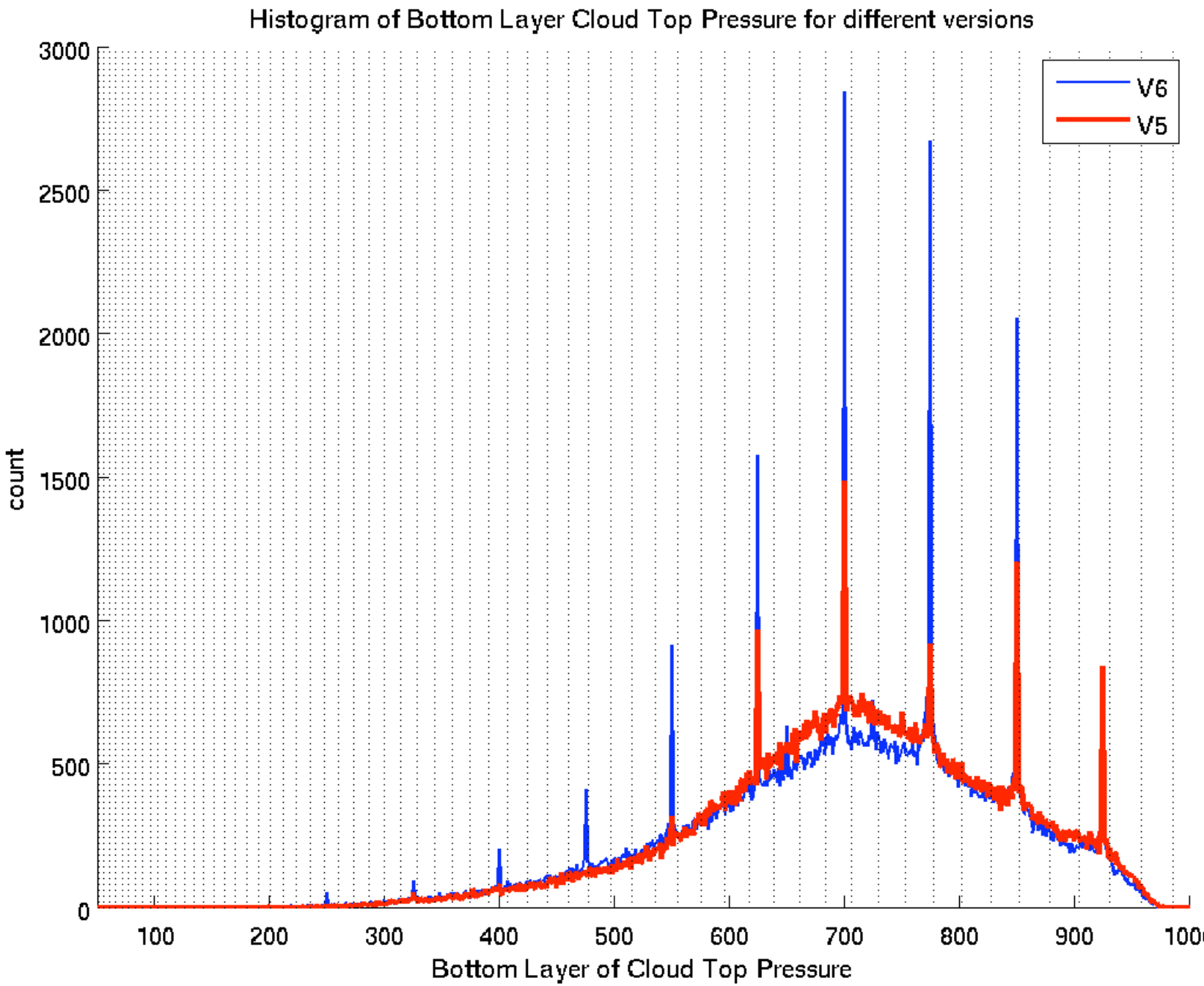
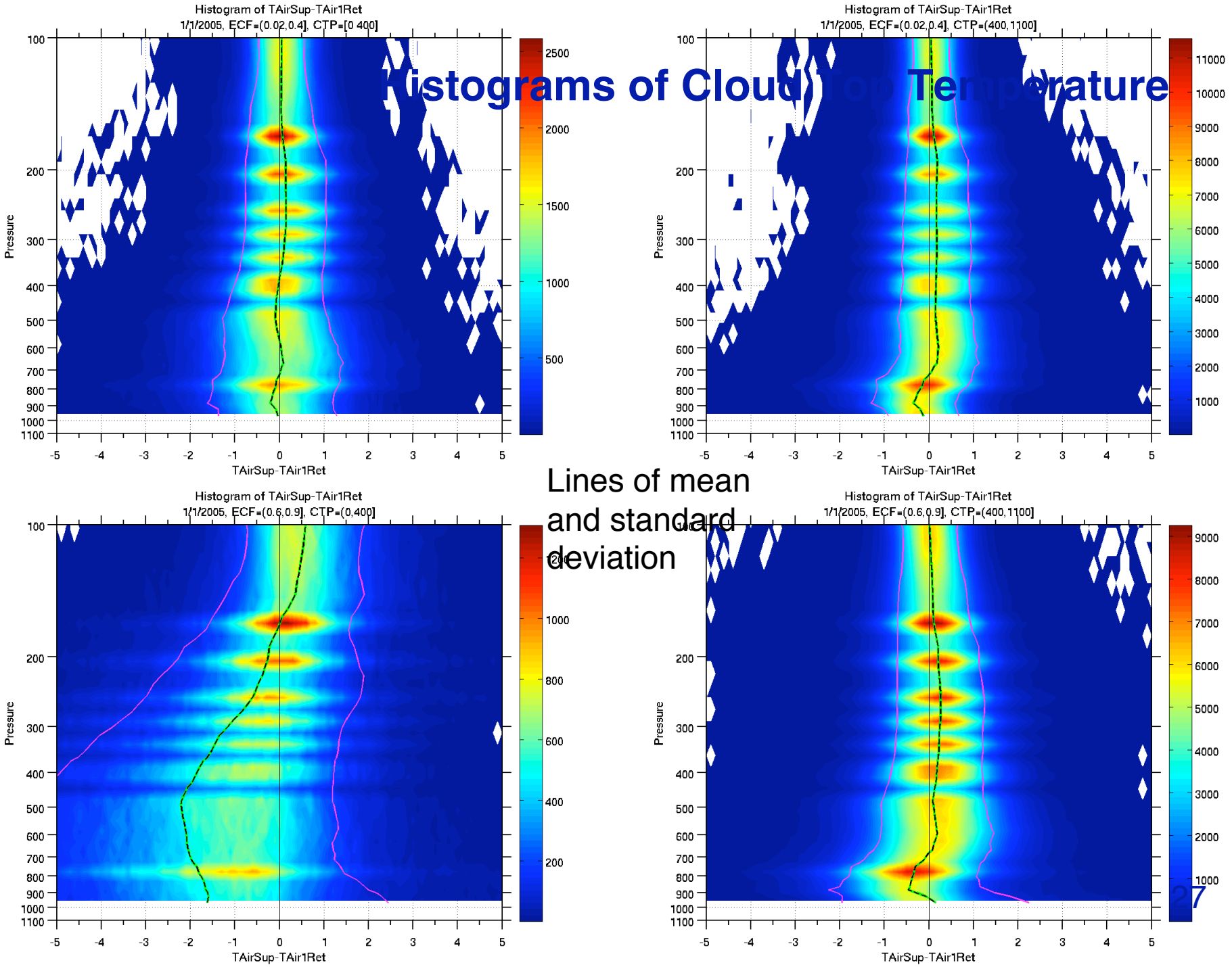

Histogram of Top Layer Cloud Top Pressure for different versions
V5
V6
count
3000
2500
2000
1500
1000
500
0
100
200
300
400
500
600
700
800
900
1000
Top Layer of Cloud Top Pressure


Histogram of Bottom Layer Cloud Top Pressure for different versions
V6
V5
count
3000
2500
2000
1500
1000
500
0
100
200
300
400
500
600
700
800
900
1000
Bottom Layer of Cloud Top Pressure


Histogram of Top Layer Cloud Top Pressure for different versions
V5
V6
count
3000
2500
2000
1500
1000
500
0
100
200
300
400
500
600
700
800
900
1000
Top Layer of Cloud Top Pressure

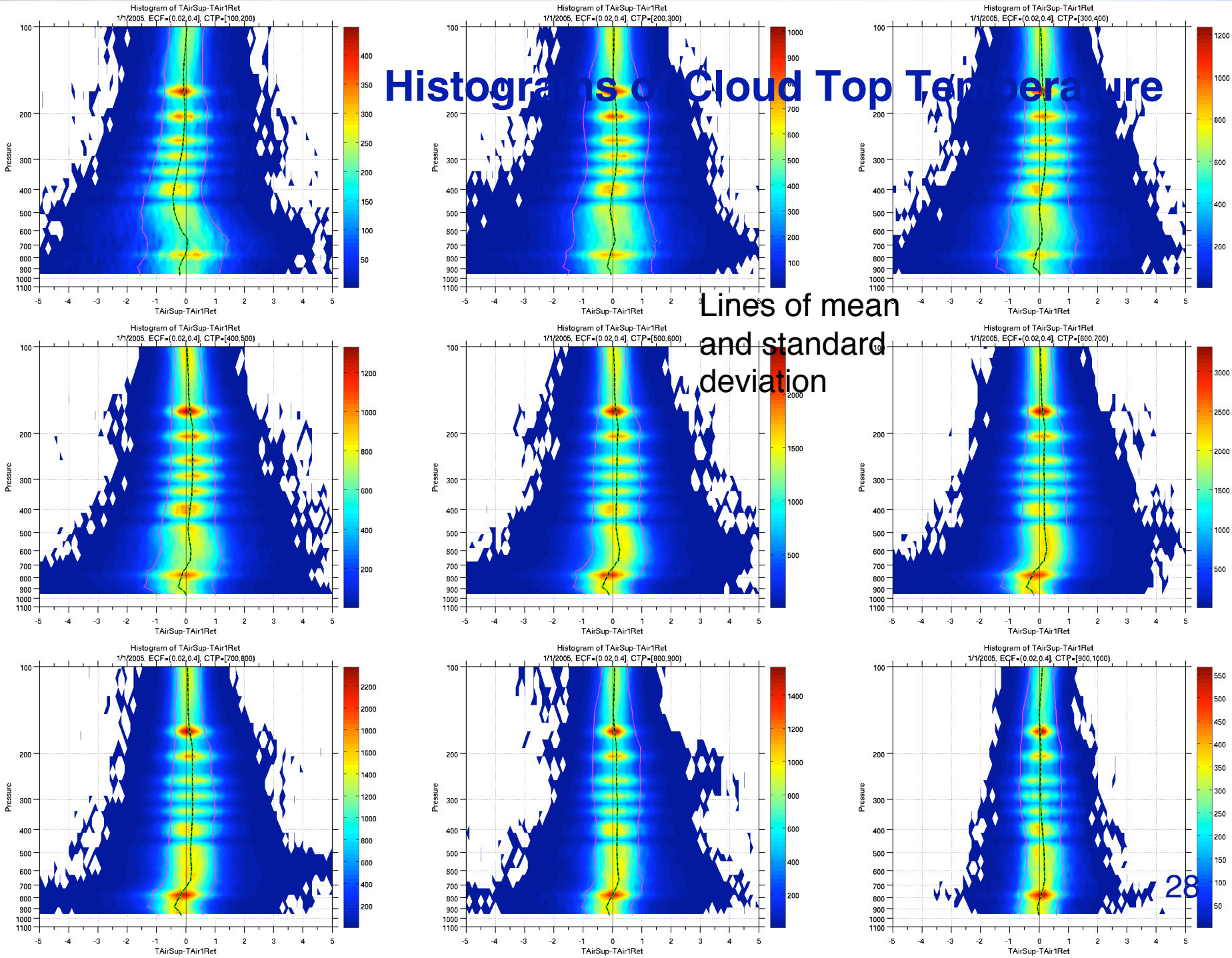

Histogram of Bottom Layer Cloud Top Pressure for different versions
count
3000
2500
2000
1500
1000
500
0
100
200
300
400
500
600
700
800
900
1000
Bottom Layer of Cloud Top Pressure
V6
V5

Histograms of Cloud Top Temperature



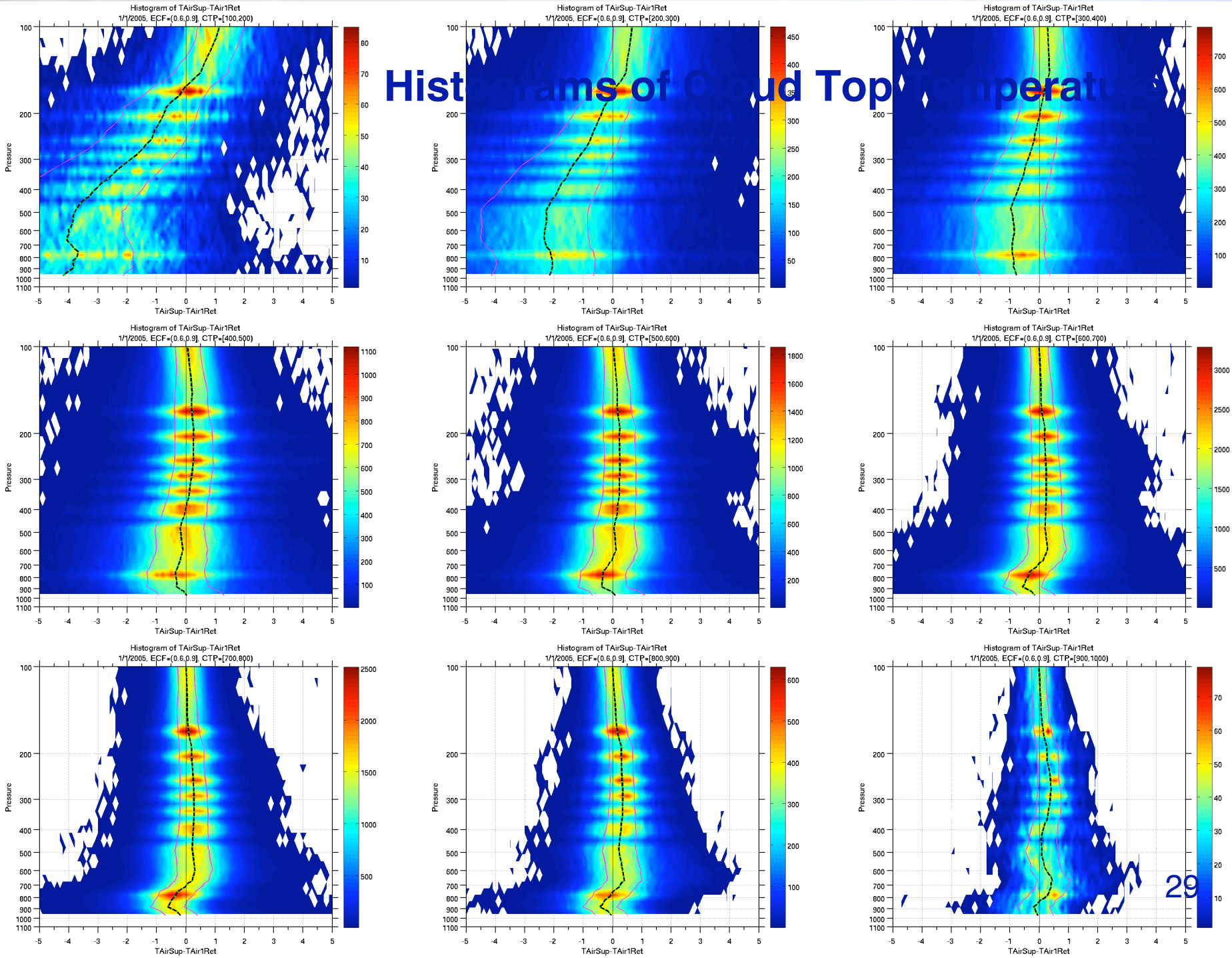
Lines of mean and standard deviation

Histograms of Cloud Top Temperature

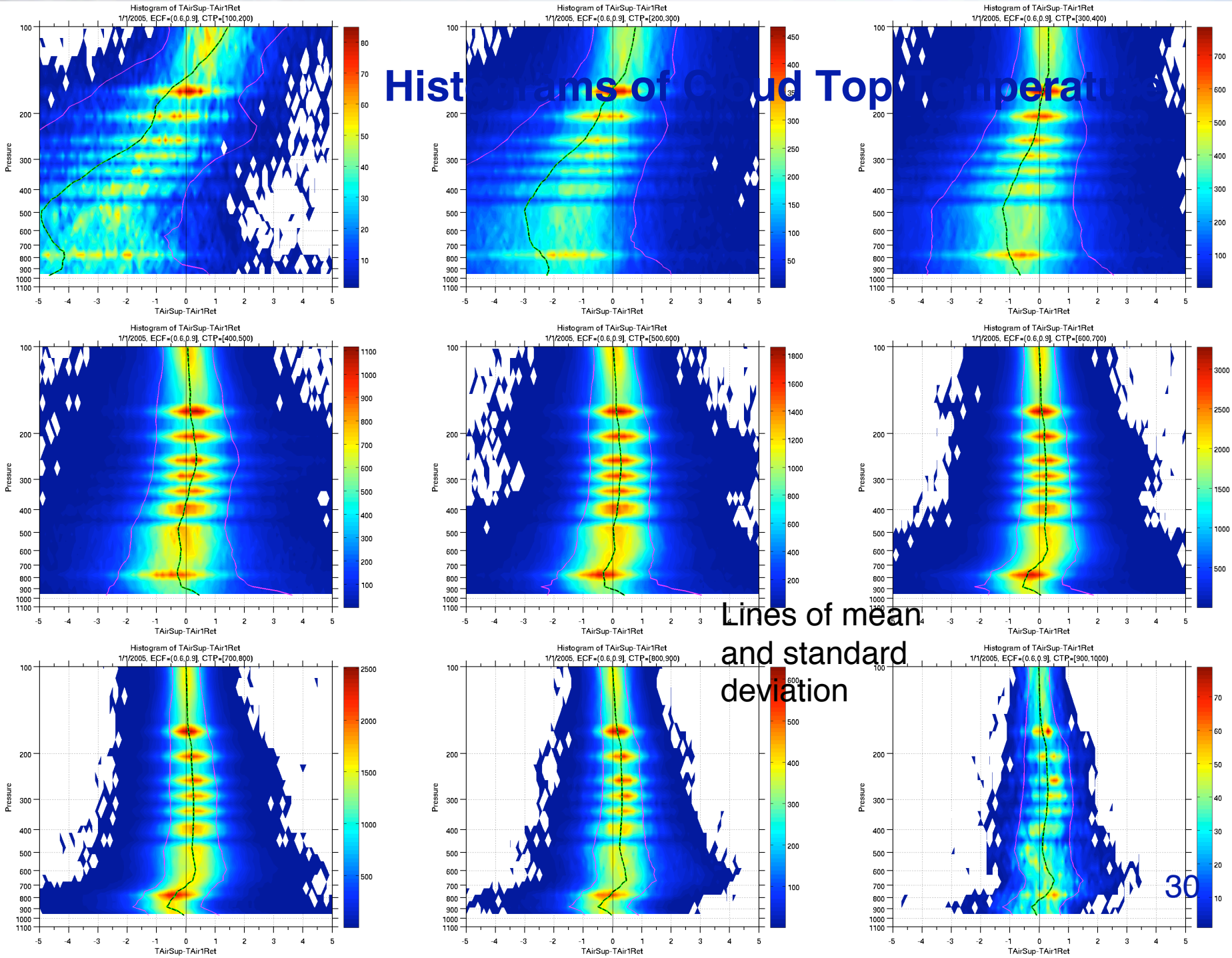


Lines of mean and standard deviation

Histograms of Cloud Top Temperature



Histograms of Cloud Top Temperature



Lines of mean and standard deviation