COMPARISON OF VERSION 4.9 RETRIEVAL AND CLEAR COLUMN RADIANCE ACCURACY WITH VERSION 4.0

or

WHAT HAVE WE ACCOMPLISHED OVER THE LAST YEAR?

Joel Susskind, Fricky Keita, Lena Iredell, and John Blaisdell

NASA GSFC Sounder Research Team

AIRS Team Meeting

March 9, 2006

DIFFERENCES OF VERSION 4.9 FROM VERSION 4.0

Fewer steps in processing system

IR RTA

IR & MW Tuning

Time dependent CO_2 mixing ratio

Physics error estimate parameterization (now more theoretical)

Surface emissivity regression

Updates to microwave product algorithm

Channels, functions, damping parameters

Error estimates

Quality control methodology

PRODUCTS TO BE COMPARED

SST, T(p), q(p), $\hat{R}_i$, total O_3, cloud parameters

All comparisons but total O_3 use ECMWF "truth"

All comparisons use quality control of appropriate systems

Results shown

SST: Day, night

T(p): Day, night/ land, ocean, poleward of 50°N,S

q(p): Global, ocean

Clear column brightness temperatures: Global

Cloud parameters: realism of results

LEVEL 2 QUALITY CONTROL USED

SST

Version 4.0 Standard SST test (flag=1) and Tight SST test (flag=0)

Version 4.9 $\delta SST' < 1.25$ (flag=1) and $\delta SST < 1.0$ (flag=0)

T(p)

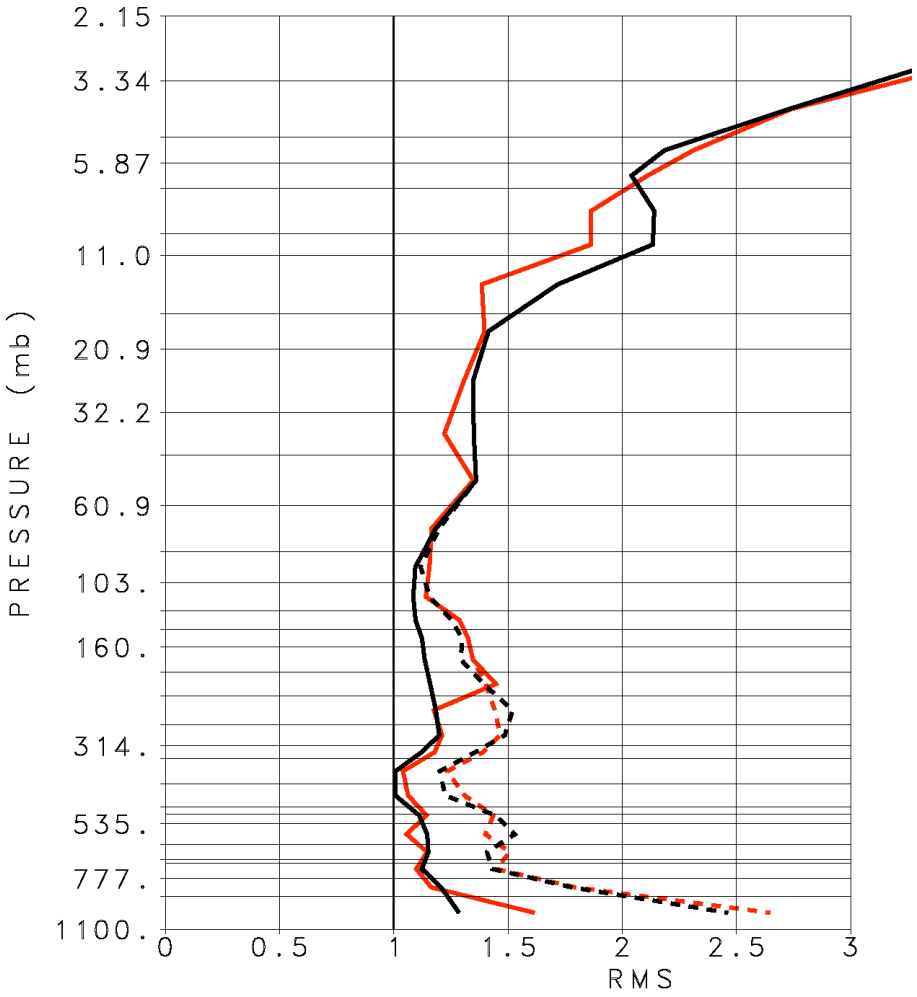
Version 4.0 T(p) flag=0 if $p \leq 200$ mb and stratospheric temperature test is passed
$z \geq 3$ km above surface and mid-tropospheric test is passed
lower tropospheric test is passed

Version 4.9 T(p) flag=0 if $p \leq p_{good}$

q(p)

Version 4.0/4.9 flag=0 if T(p) flag is zero

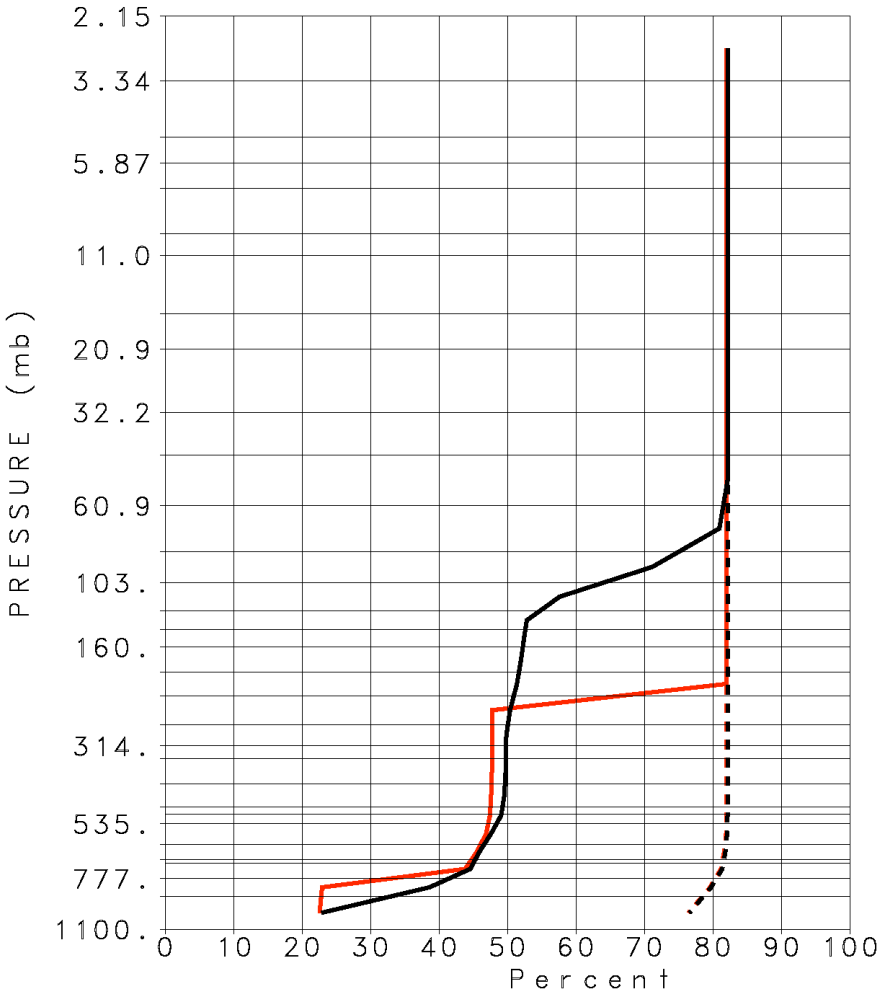
LAYER MEAN RMS TEMPERATURE (°C)
GLOBAL DIFFERENCES FROM "TRUTH"
January 25, 2003 Nighttime Only
Global



V4.0
V4.0 Stratosphere Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Strat Good Cases

Percent of IR/MW Cases Included

January 25, 2003 Nighttime Only
Global



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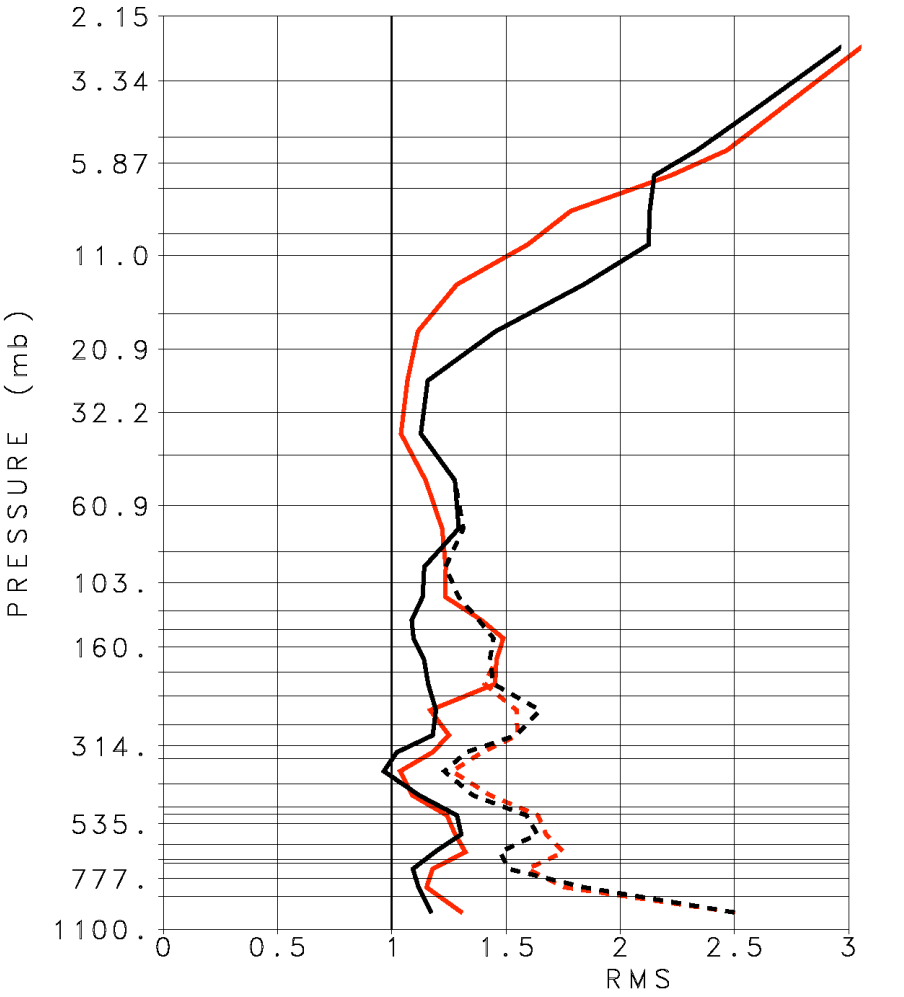

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Percent of IR/MW Cases Included

January 25, 2003 Daytime Only
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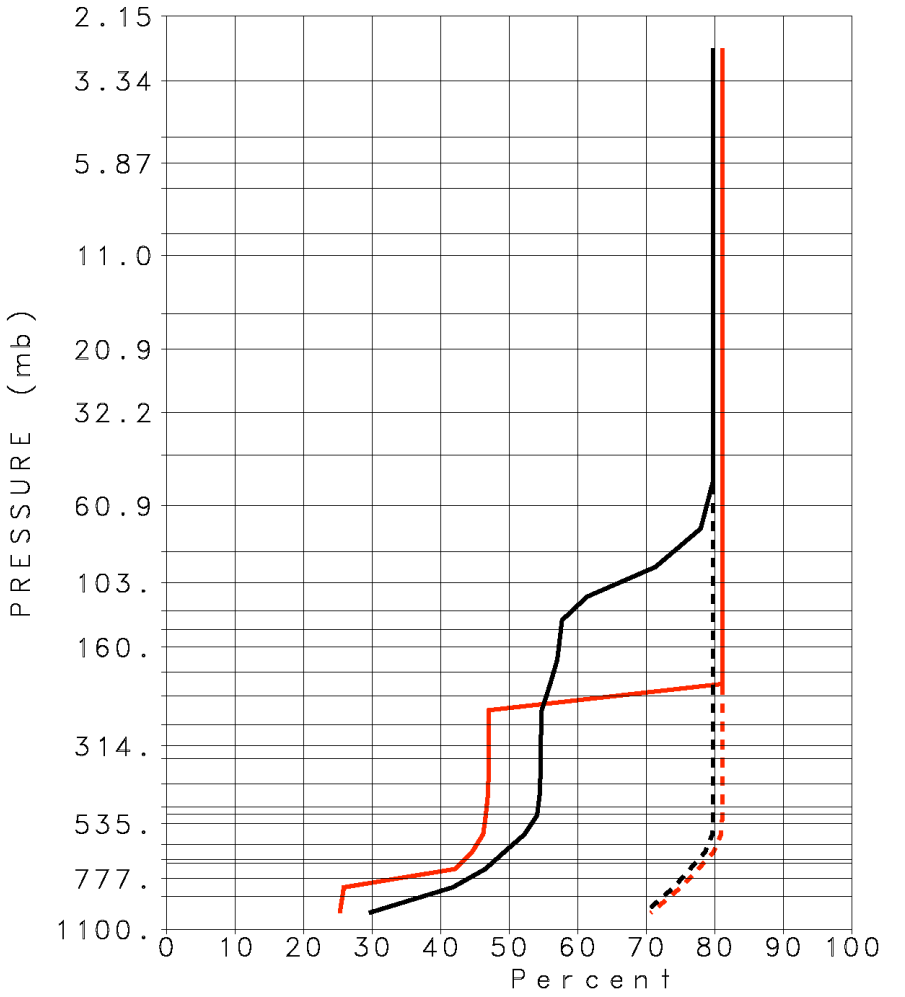

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V4.0 Stratosphere Good Cases
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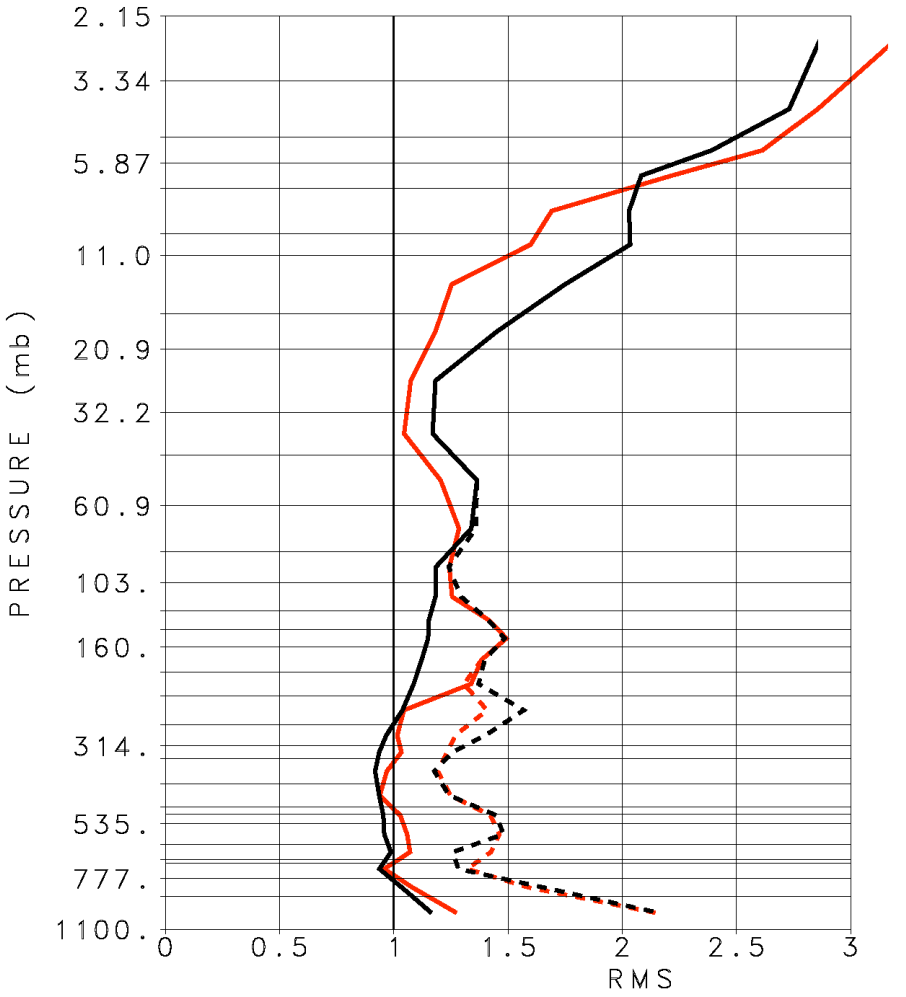
LAYER MEAN RMS TEMPERATURE (°C)
GLOBAL DIFFERENCES FROM "TRUTH"
January 25, 2003
50N to 50S Ocean



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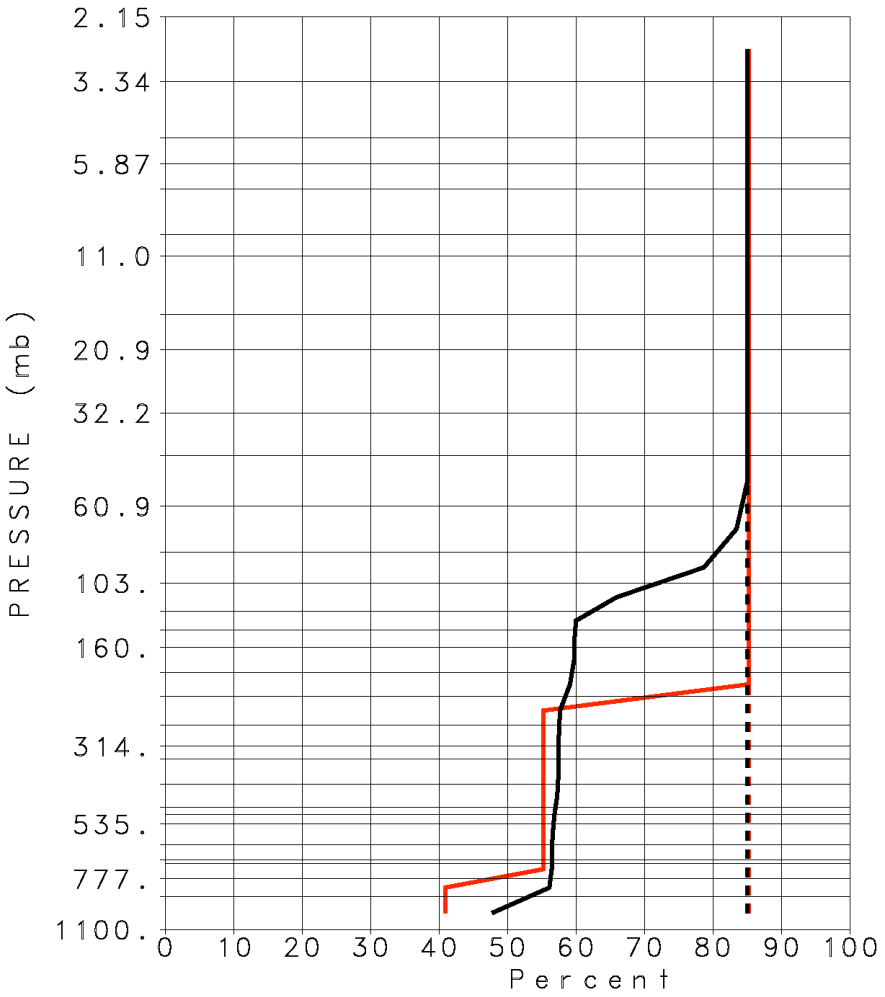
Percent of IR/MW Cases Included

January 25, 2003
50N to 50S Ocean



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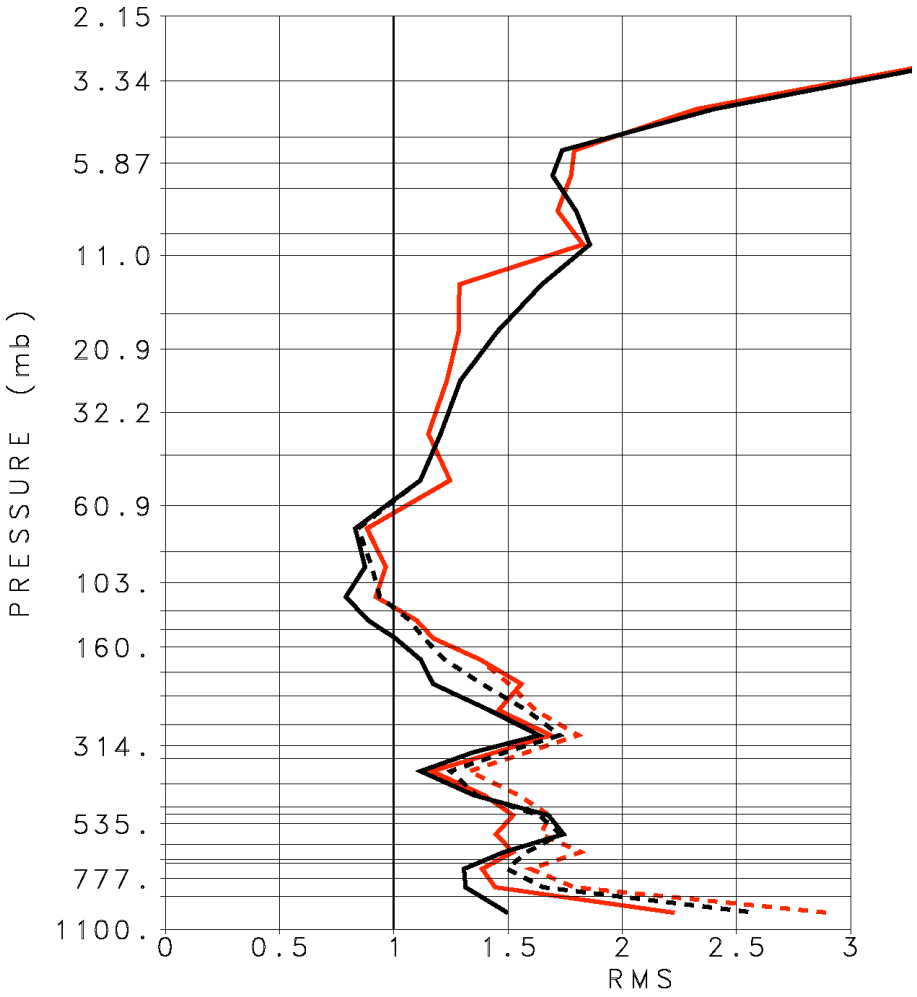
LAYER MEAN RMS TEMPERATURE (°C)
GLOBAL DIFFERENCES FROM "TRUTH"
January 25, 2003
Poleward of 50



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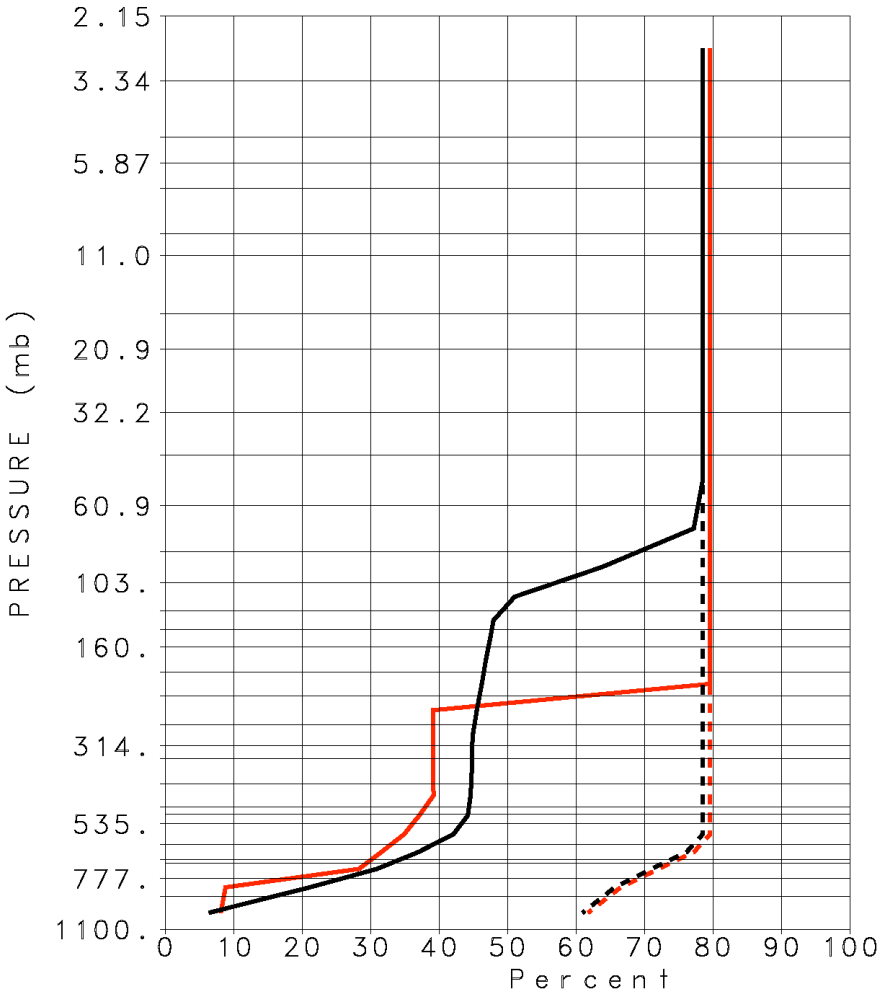
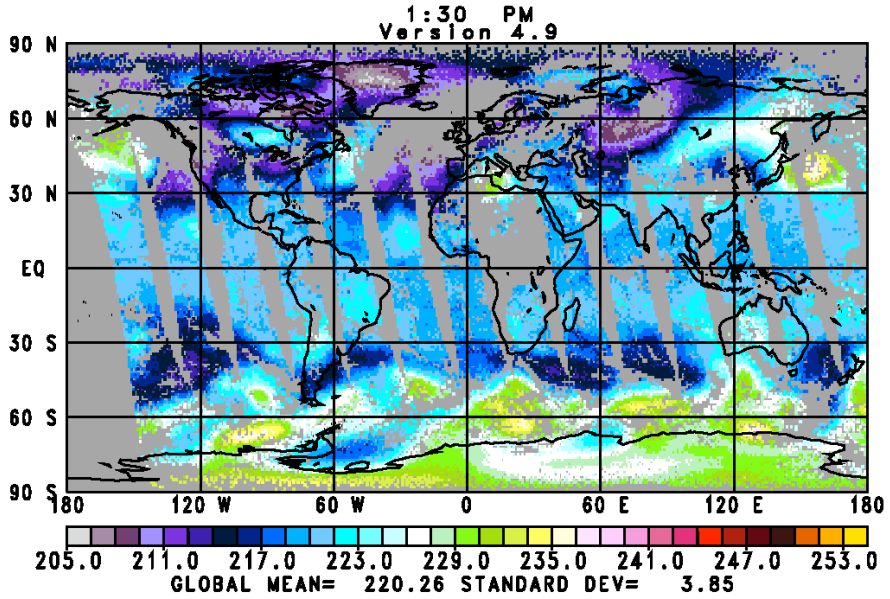
Percent of IR/MW Cases Included

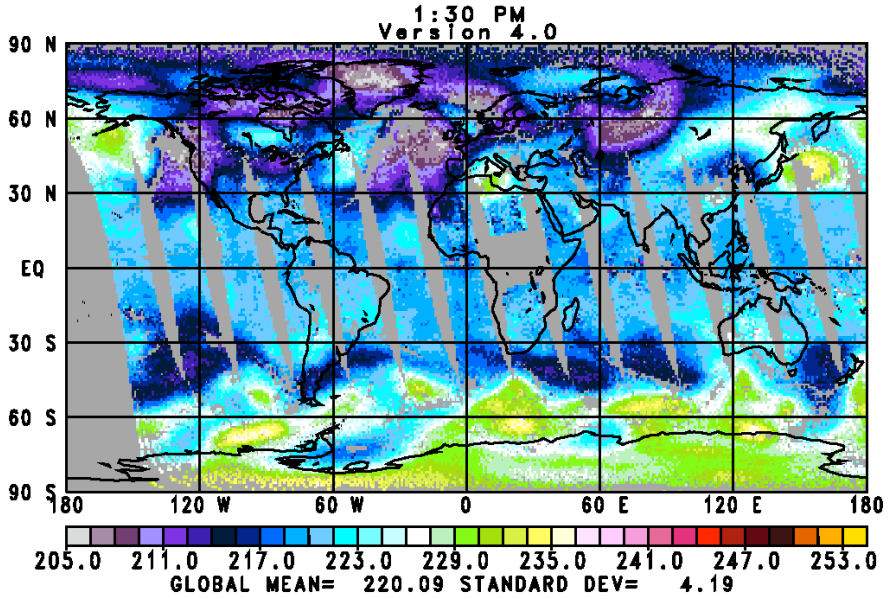
January 25, 2003
Poleward of 50

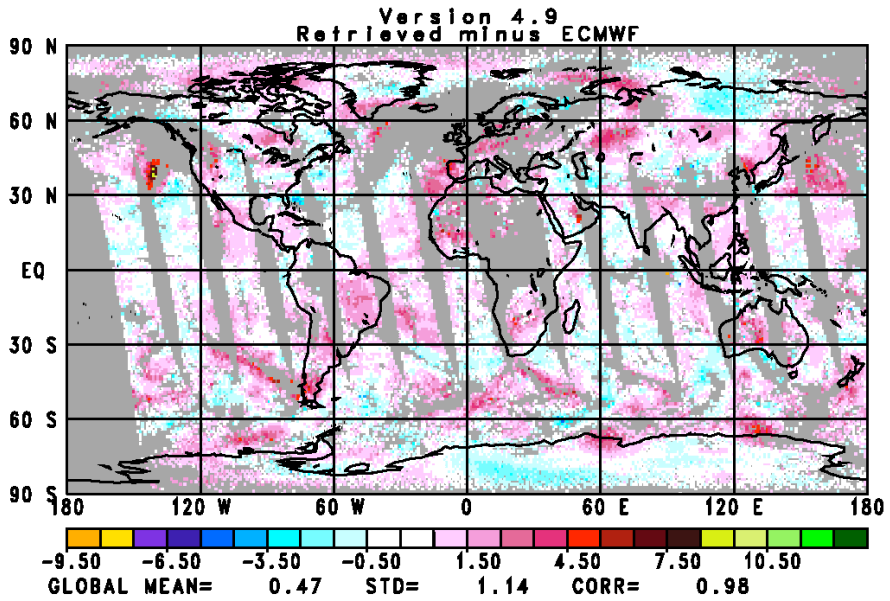


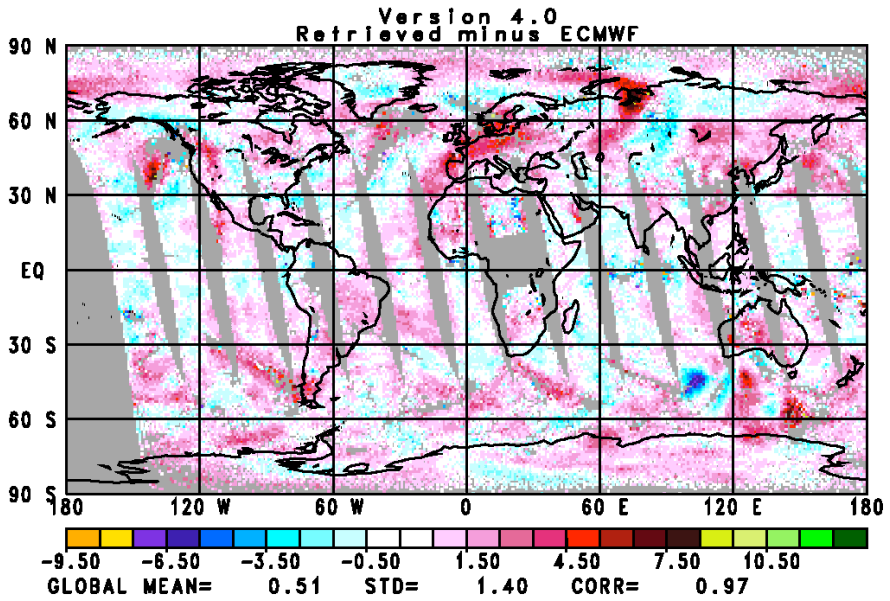
V4.0
V4.0 Stratosphere Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Strat Good Cases

200 mb TEMPERATURE (K)
January 25, 2003

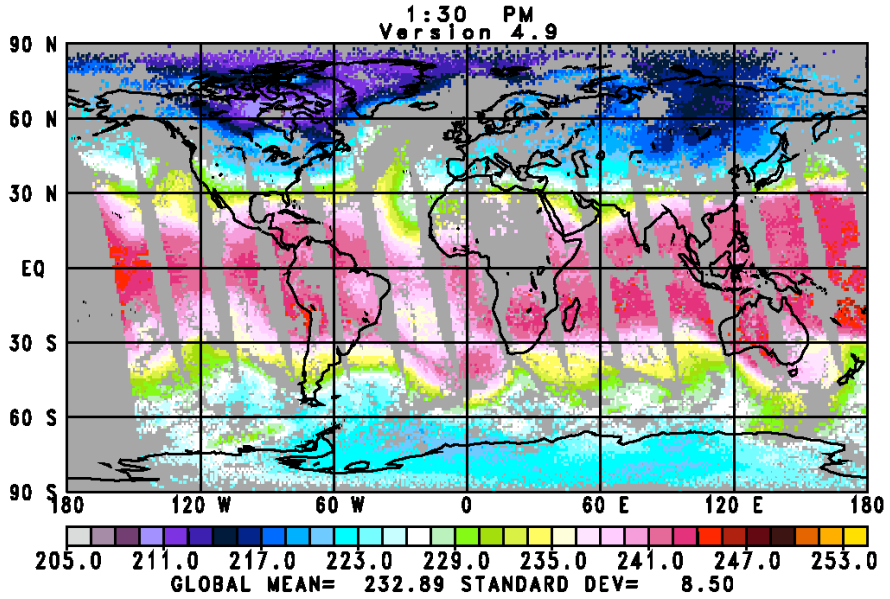


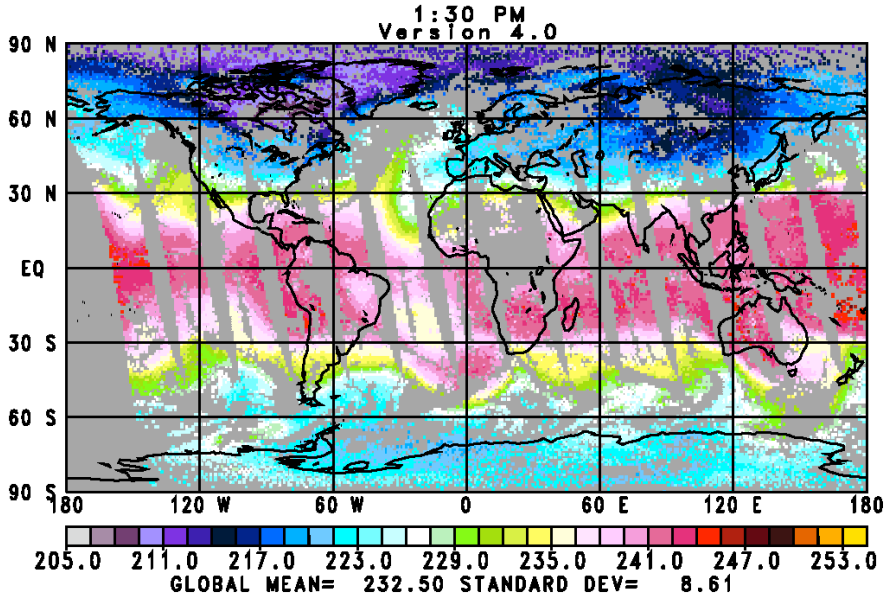


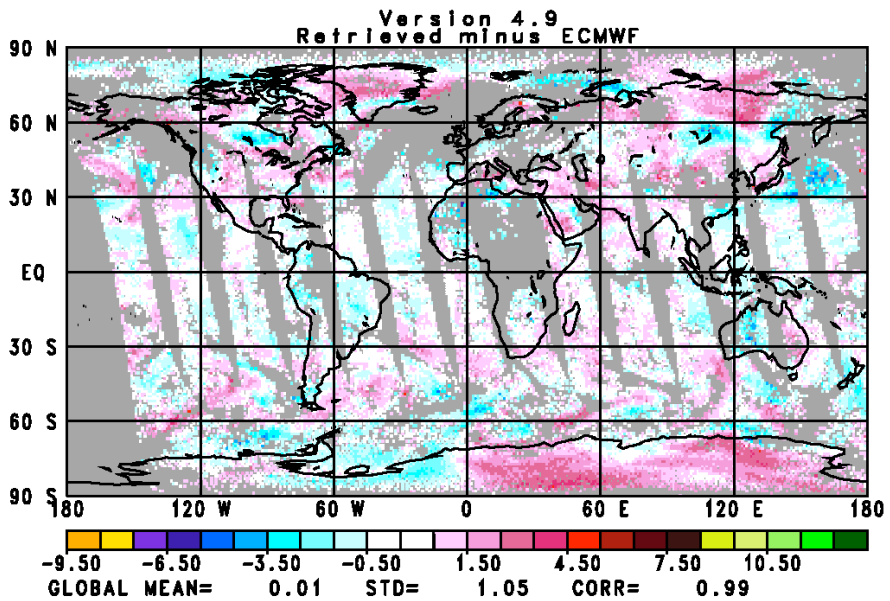


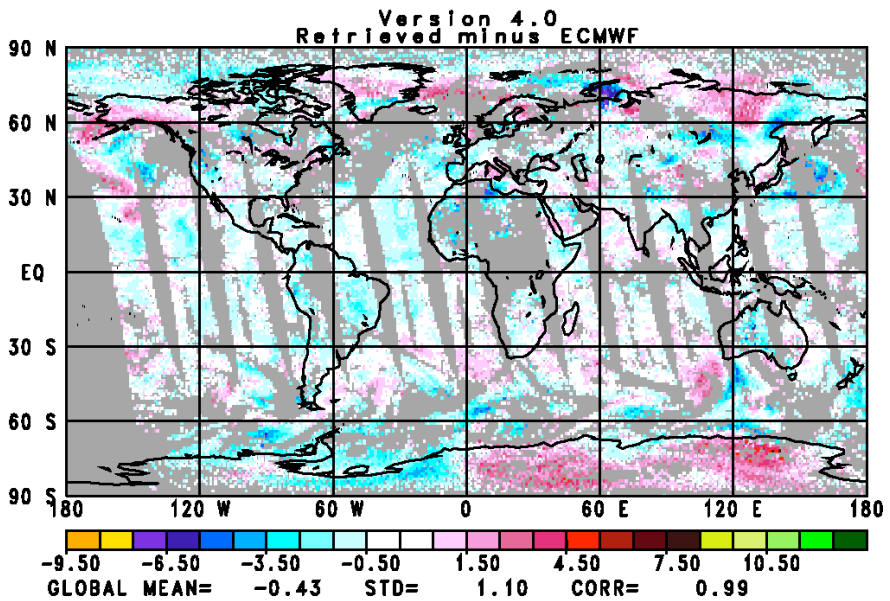


300 mb TEMPERATURE (K)
January 25, 2003

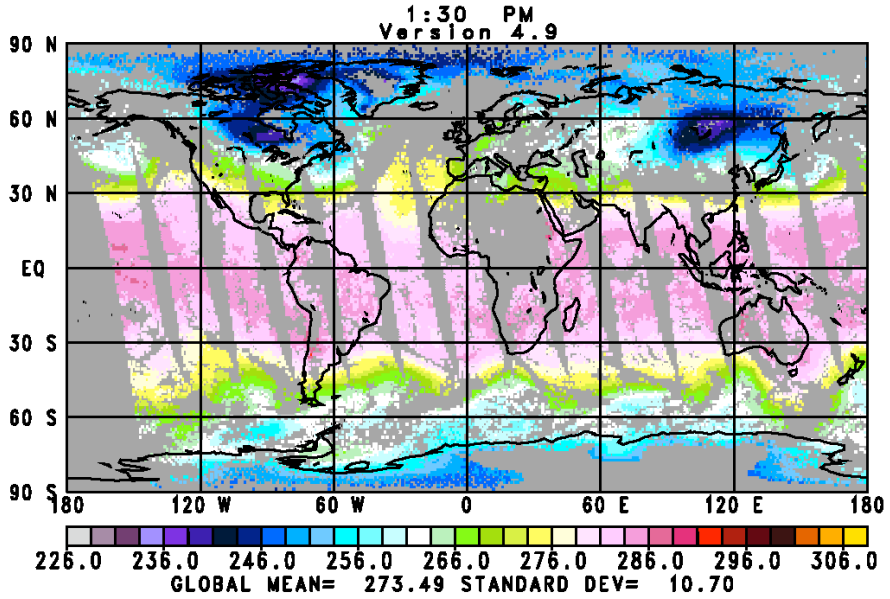


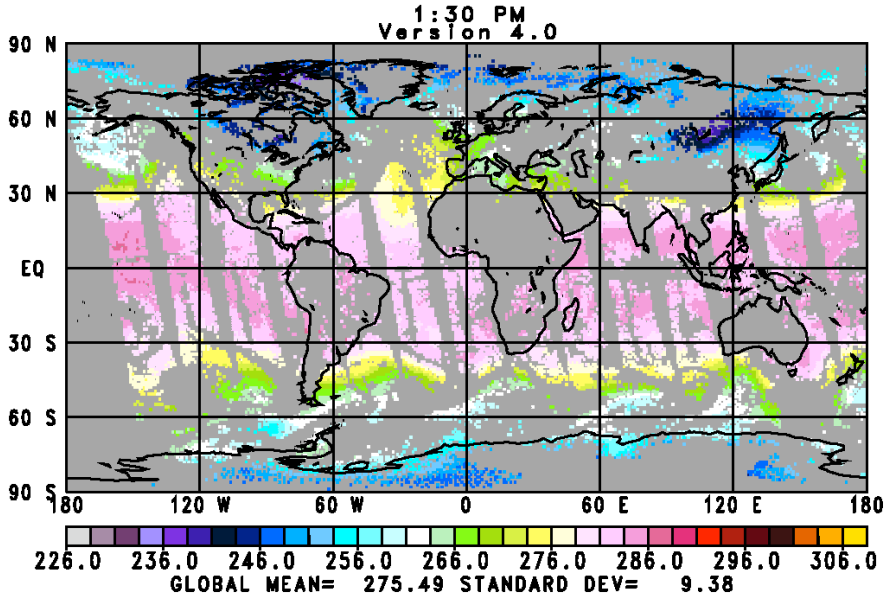


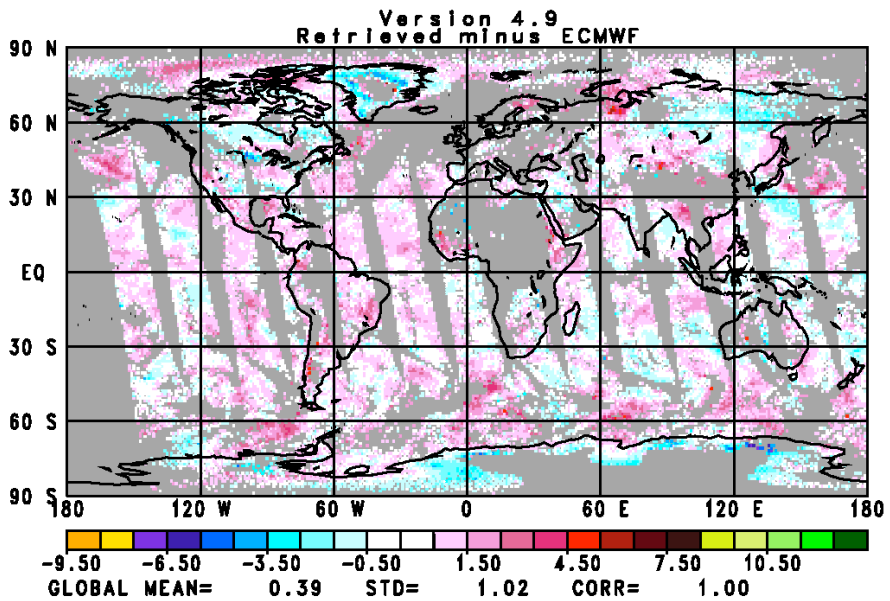


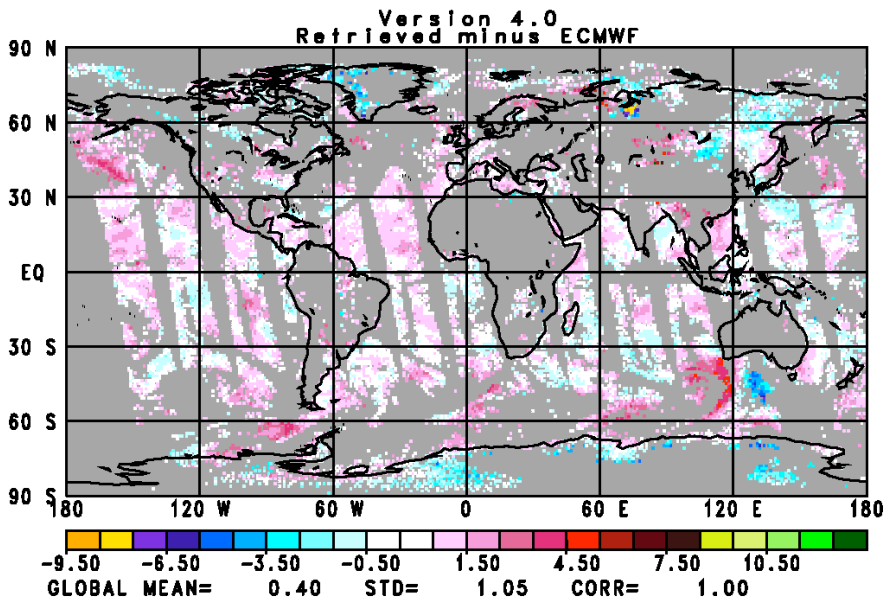


700 mb TEMPERATURE (K)
January 25, 2003

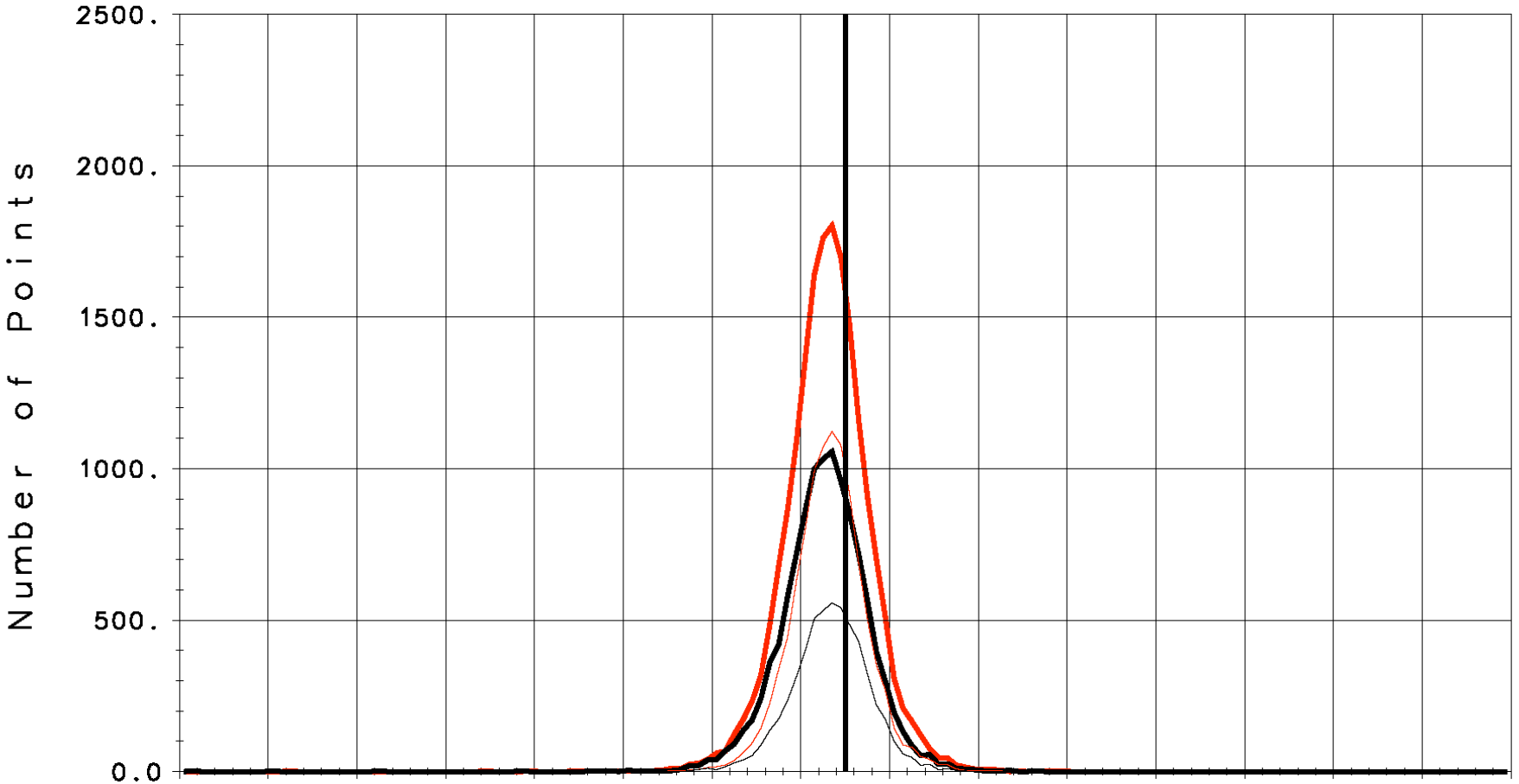




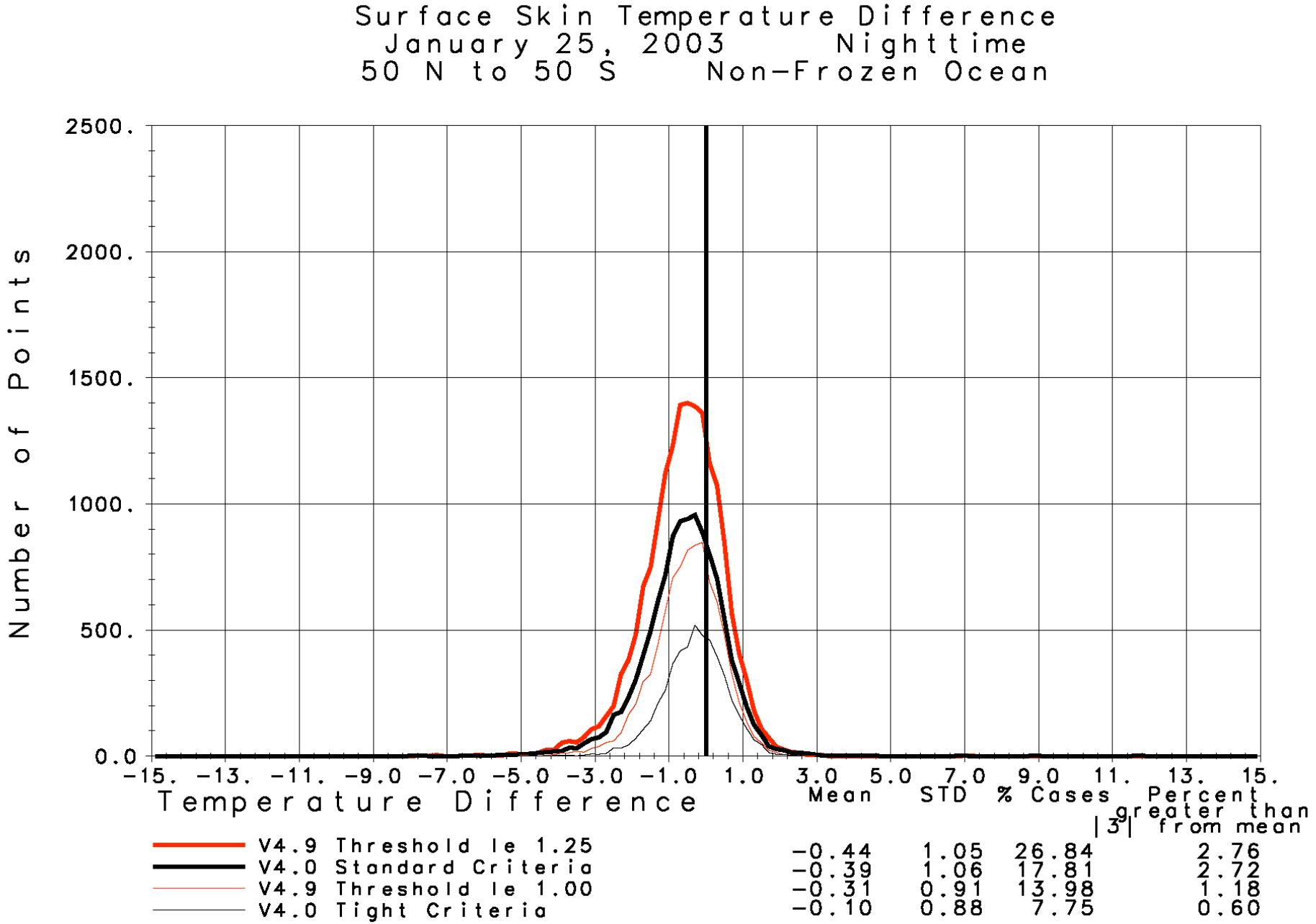




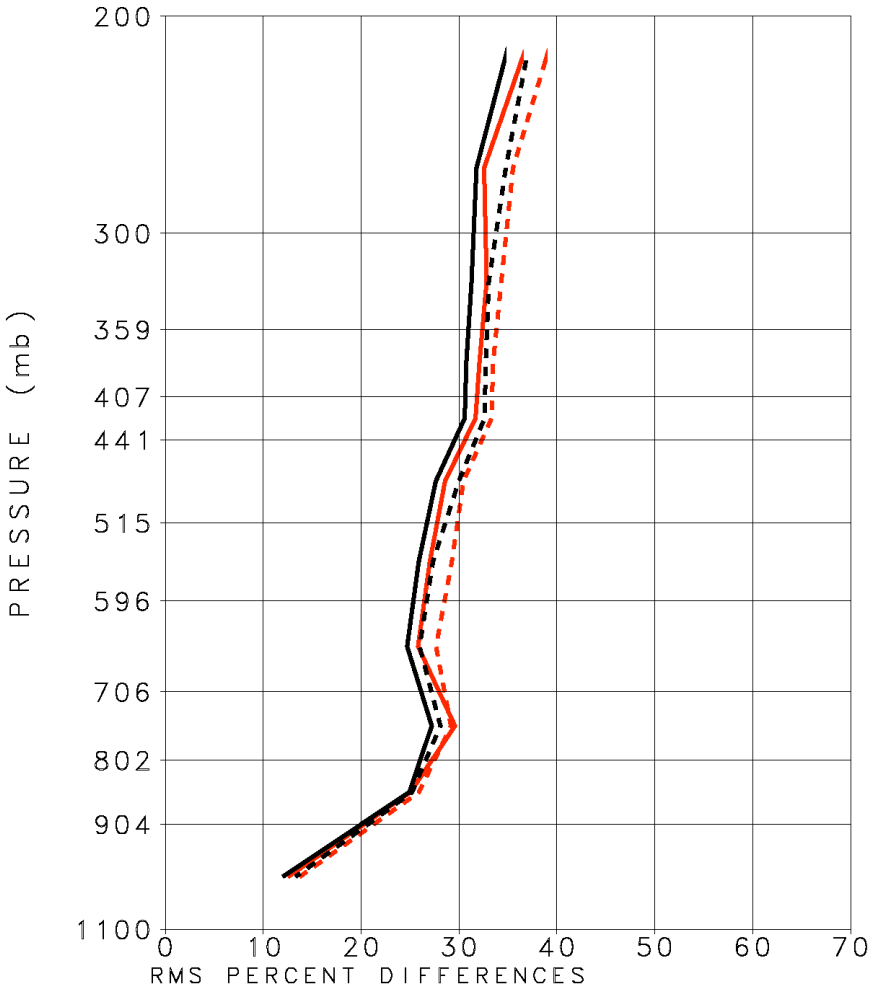
Surface Skin Temperature Difference
January 25, 2003 Daytime
50 N to 50 S Non-Frozen Ocean



	Mean	STD	% Cases |3|	Percent greater than from mean
V4.9 Threshold le 1.25	-0.21	0.93	30.60	0.89
V4.0 Standard Criteria	-0.26	0.97	18.87	1.06
V4.9 Threshold le 1.00	-0.17	0.83	17.25	0.43
V4.0 Tight Criteria	-0.14	0.86	9.28	0.47

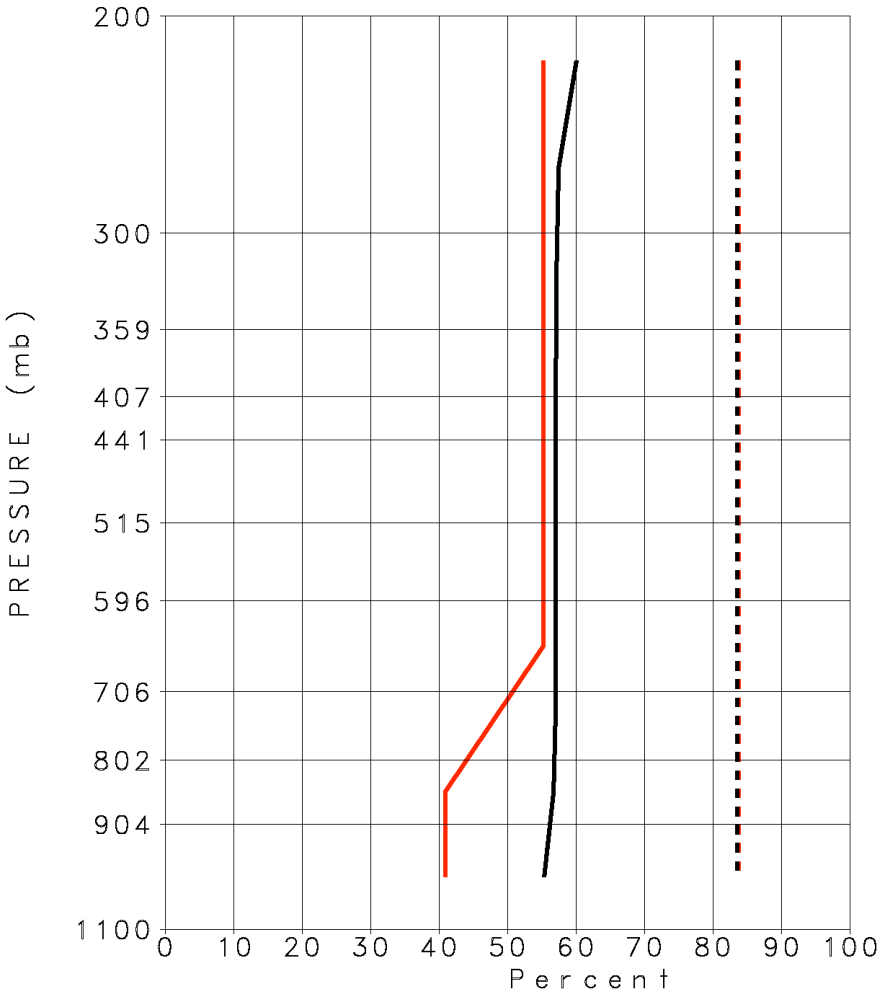

Surface Skin Temperature Difference
January 25, 2003 Nighttime
50 N to 50 S Non-Frozen Ocean
Number of Points
2500.
2000.
1500.
1000.
500.
0.0
-15. -13. -11. -9.0 -7.0 -5.0 -3.0 -1.0 1.0 3.0 5.0 7.0 9.0 11. 13. 15.
Temperature Difference
Mean STD % Cases Percent
|3| greater than from mean
V4.9 Threshold le 1.25 -0.44 1.05 26.84 2.76
V4.0 Standard Criteria -0.39 1.06 17.81 2.72
V4.9 Threshold le 1.00 -0.31 0.91 13.98 1.18
V4.0 Tight Criteria -0.10 0.88 7.75 0.60

1 Km LAYER PRECIPITABLE WATER
% DIFFERENCES FROM "TRUTH"
January 25, 2003
50N to 50S Ocean



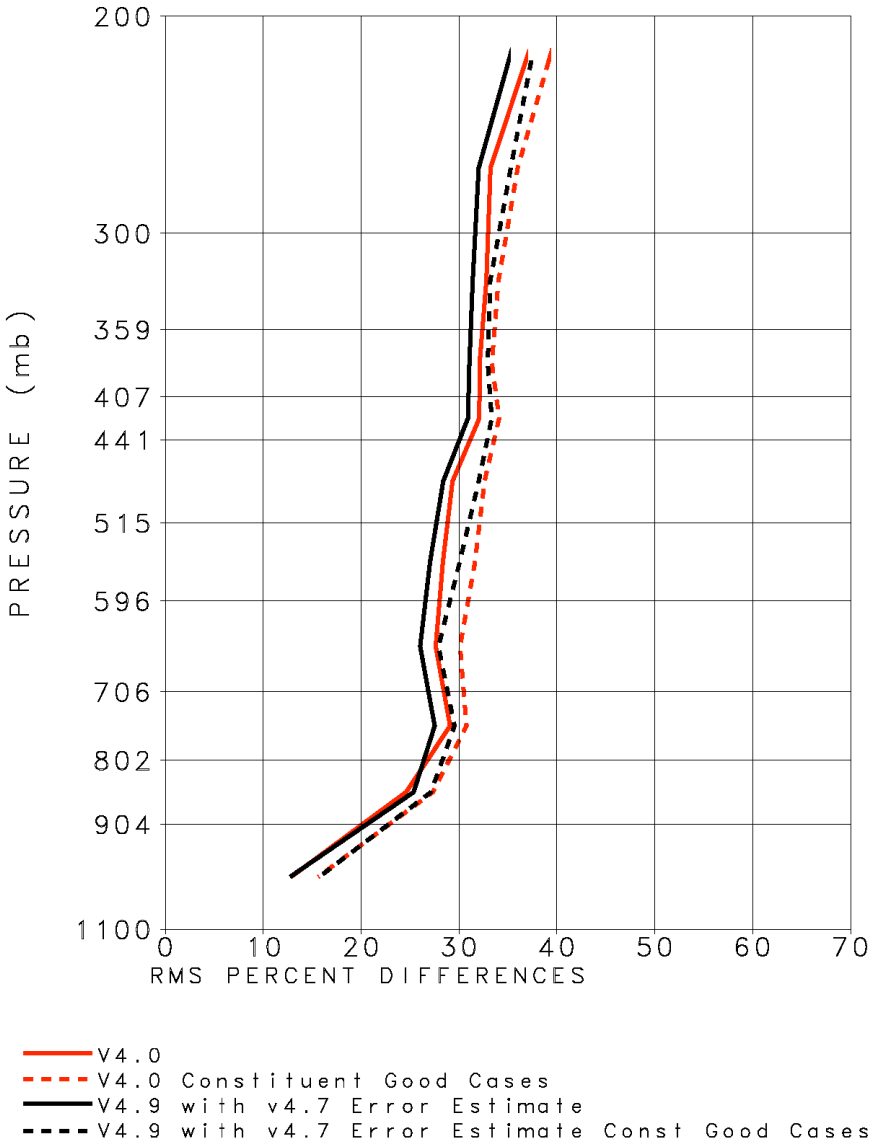
V4.0
V4.0 Constituent Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Const Good Cases

Percent Yield
Water
January 25, 2003
50N to 50S Ocean



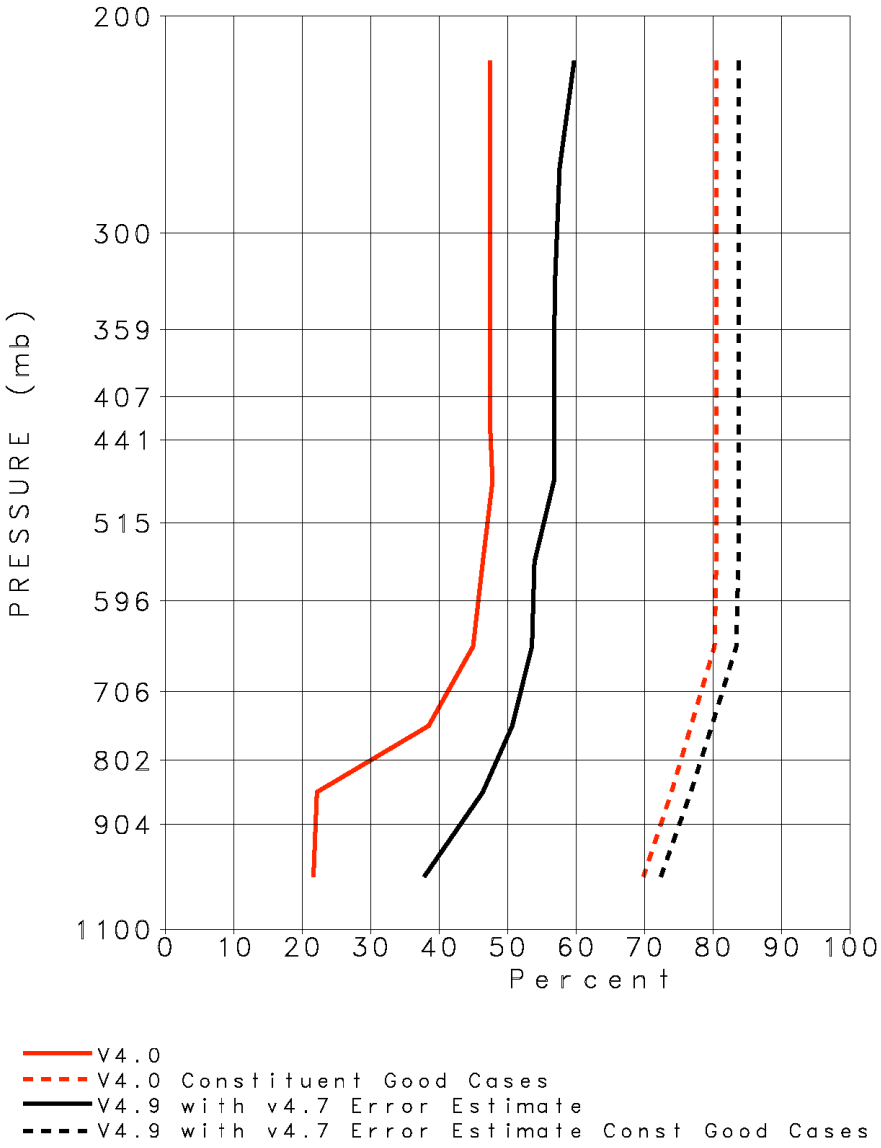
V4.0
V4.0 Constituent Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Const Good Cases

1 Km LAYER PRECIPITABLE WATER
% DIFFERENCES FROM "TRUTH"
January 25, 2003
Global



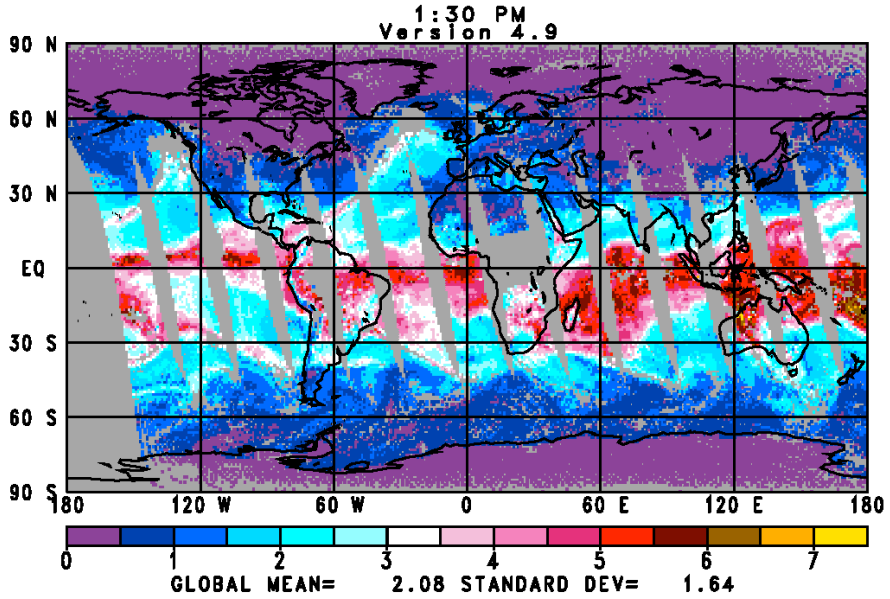
V4.0
V4.0 Constituent Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Const Good Cases

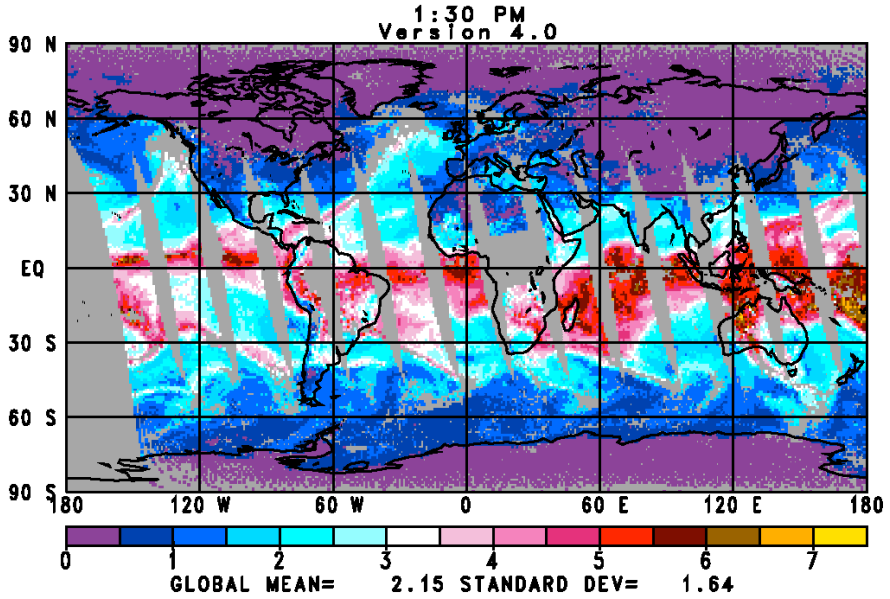
Percent Yield
Water
January 25, 2003
Global

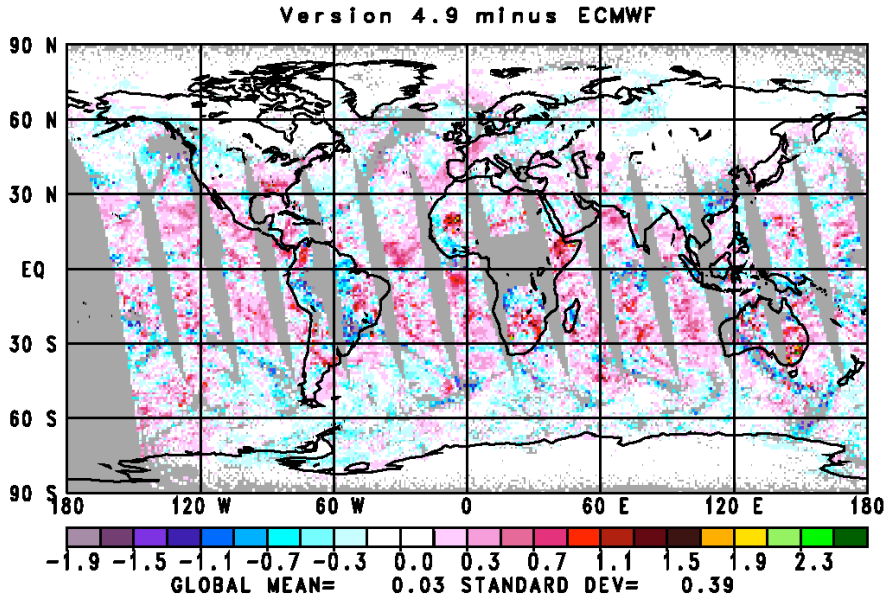


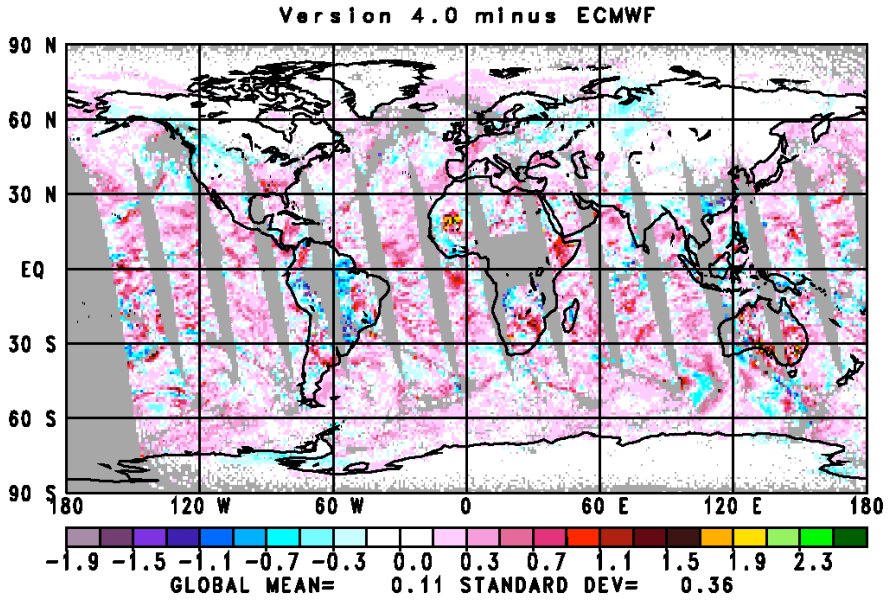
V4.0
V4.0 Constituent Good Cases
V4.9 with v4.7 Error Estimate
V4.9 with v4.7 Error Estimate Const Good Cases

Total Precipitable Water Above the Surface(cm)
January 25, 2003 Constituent Good

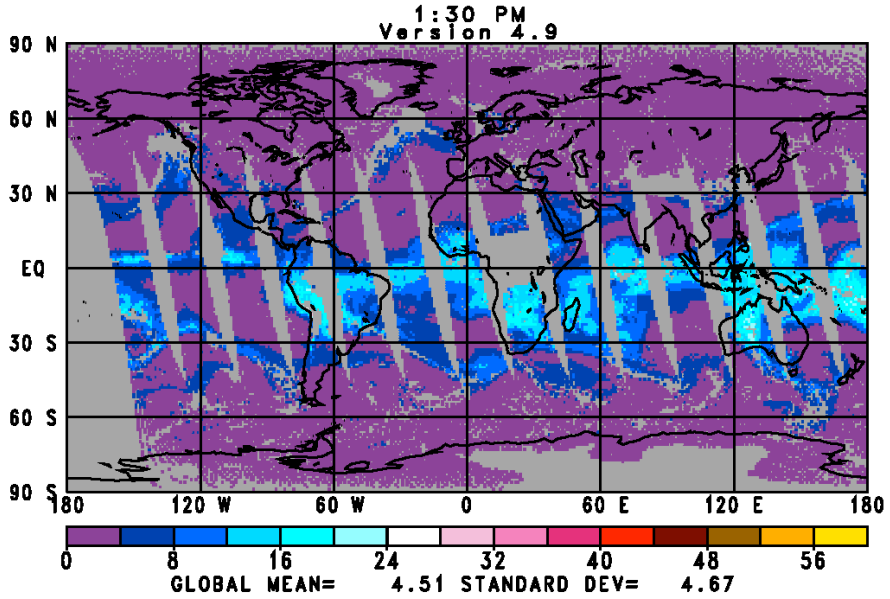


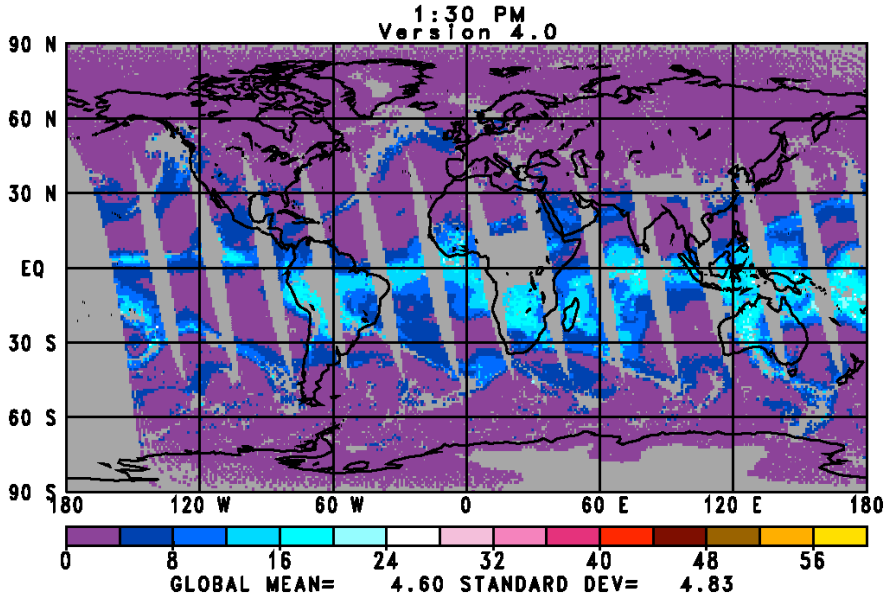


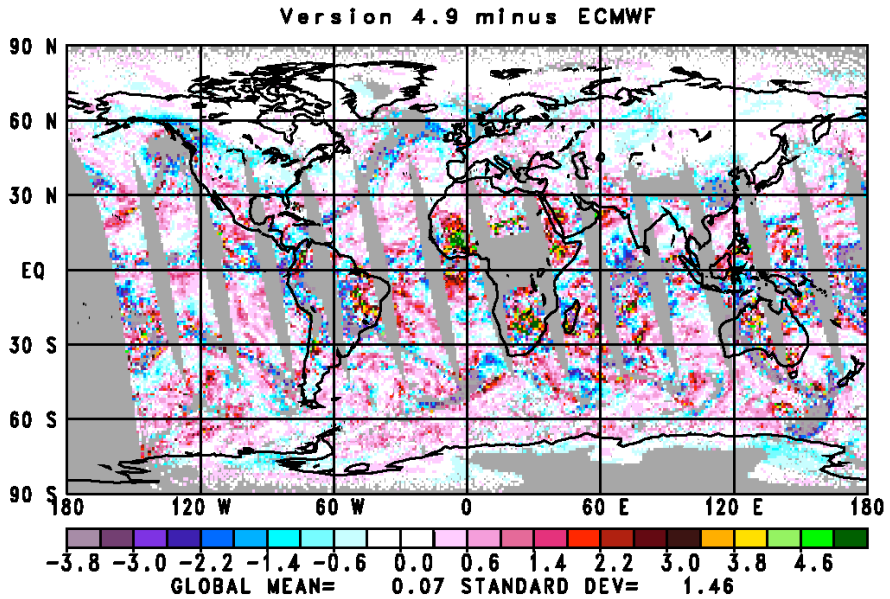


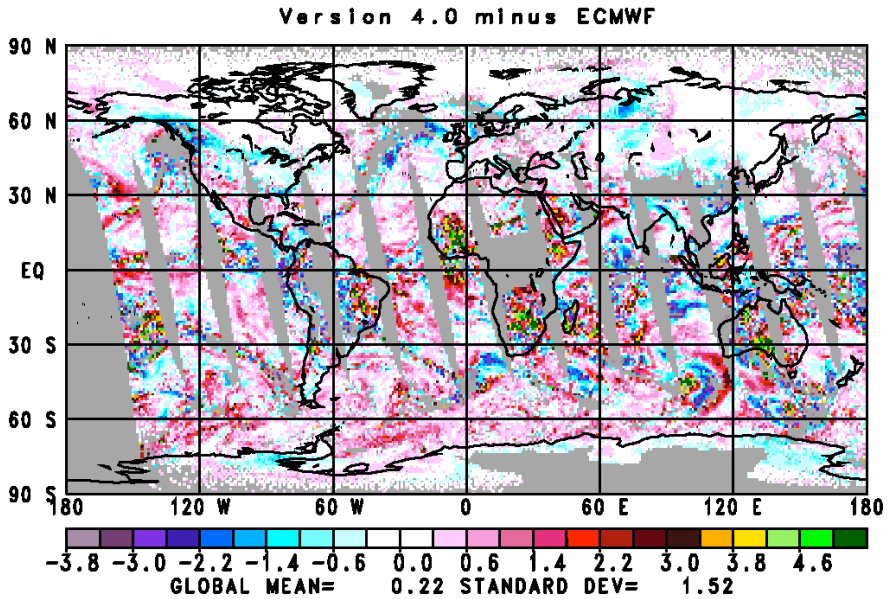


Total Precipitable Water 700 mb to top (mm)
January 25, 2003 Constituent Good

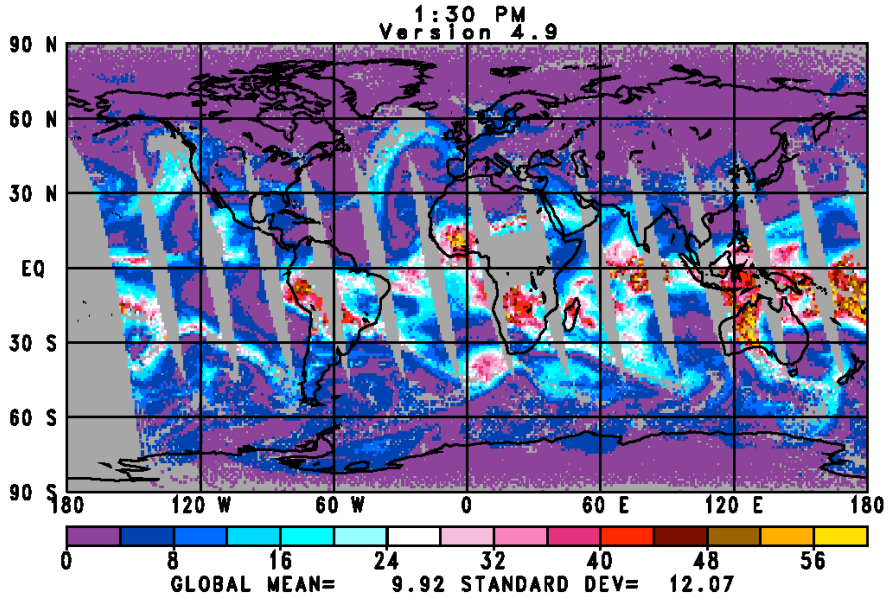


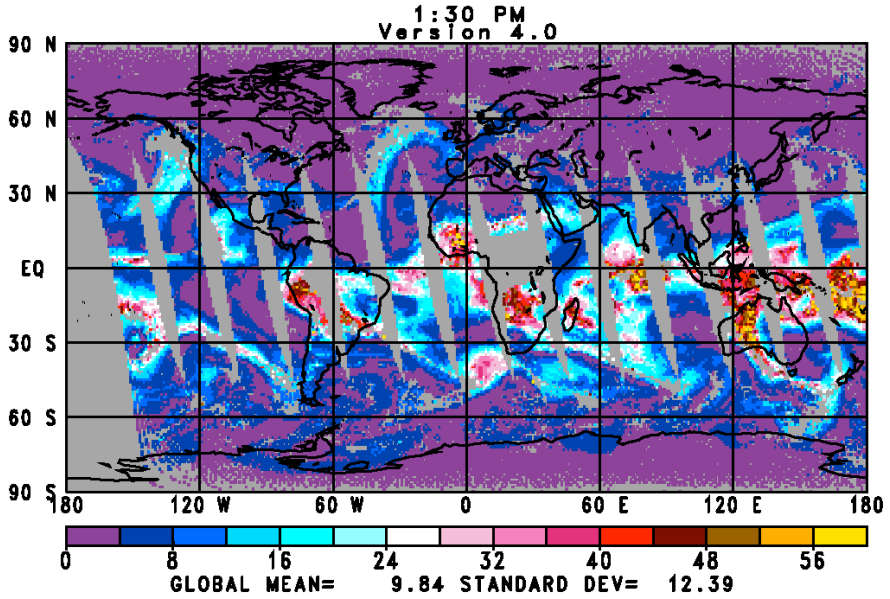


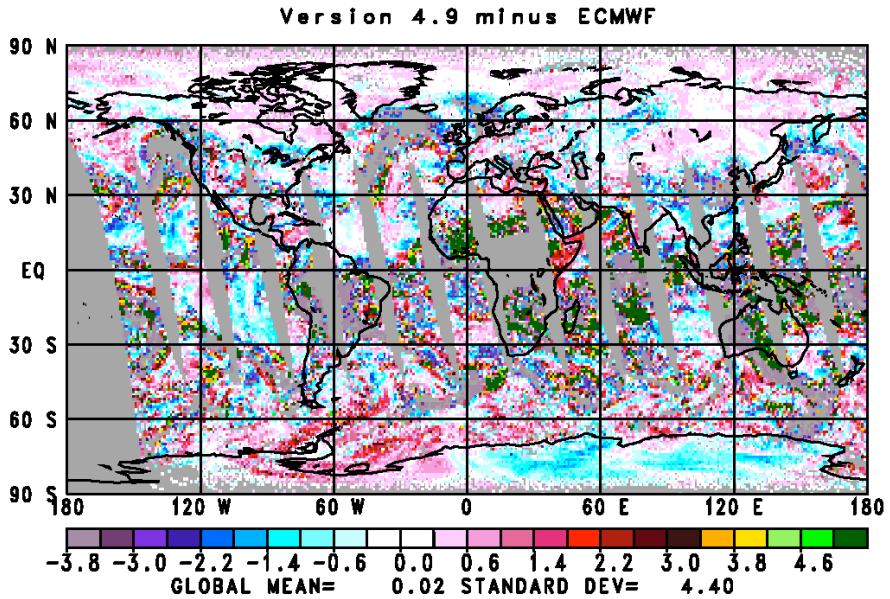


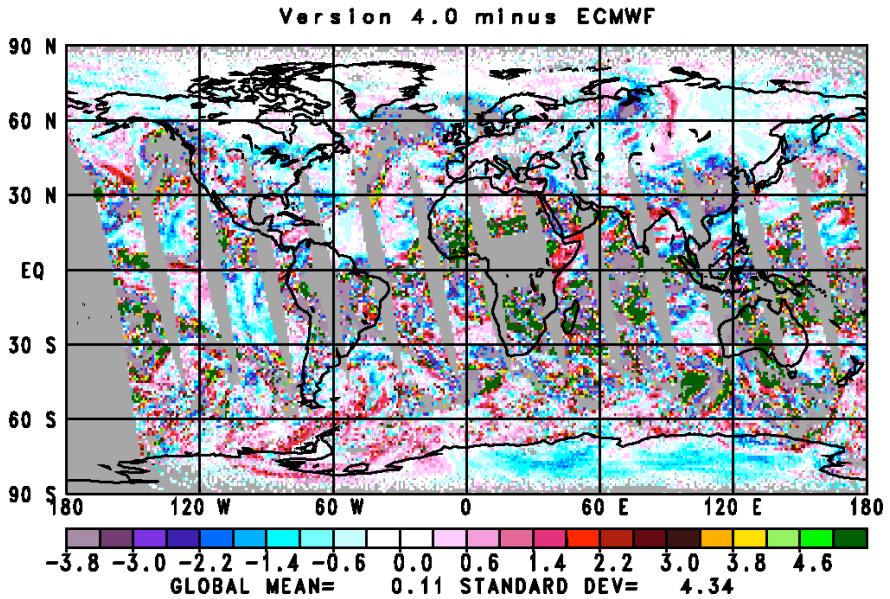


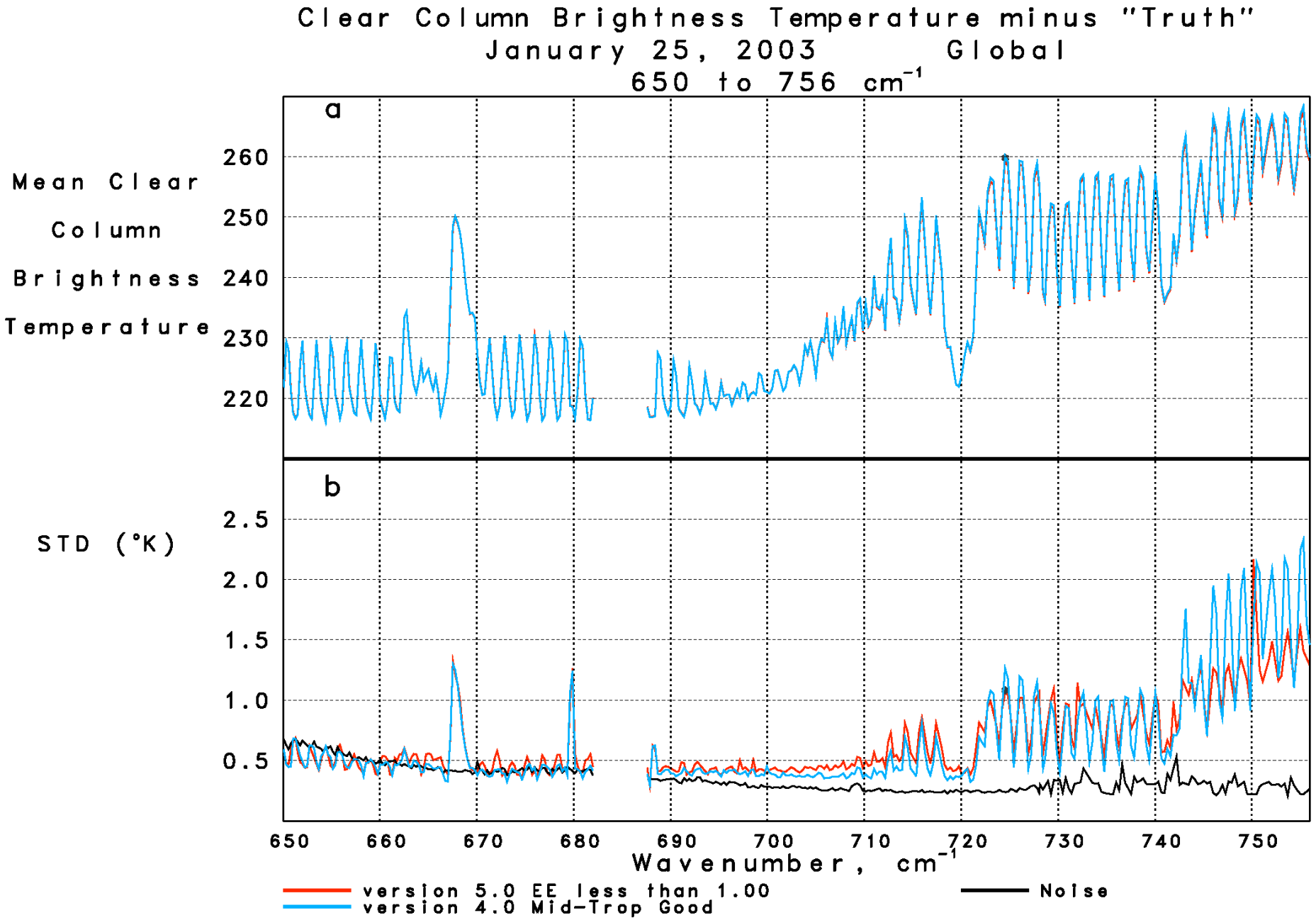
Total Precipitable Water 500 mb to top ($mm*10^{-1}$)
January 25, 2003 Constituent Good





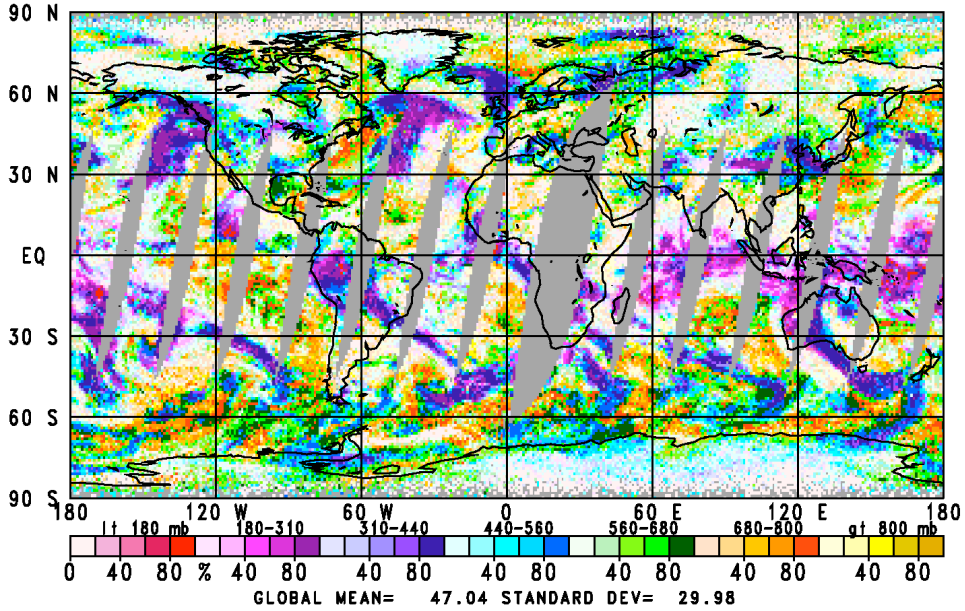





Clear Column Brightness Temperature minus "Truth"
January 25, 2003 Global
650 to 756 cm-1
a
b
Mean Clear Column Brightness Temperature
STD (°K)
260
250
240
230
220
2.5
2.0
1.5
1.0
0.5
650
660
670
680
690
700
710
720
730
740
750
Wavenumber, cm-1
version 5.0 EE less than 1.00
version 4.0 Mid-Trop Good
Noise

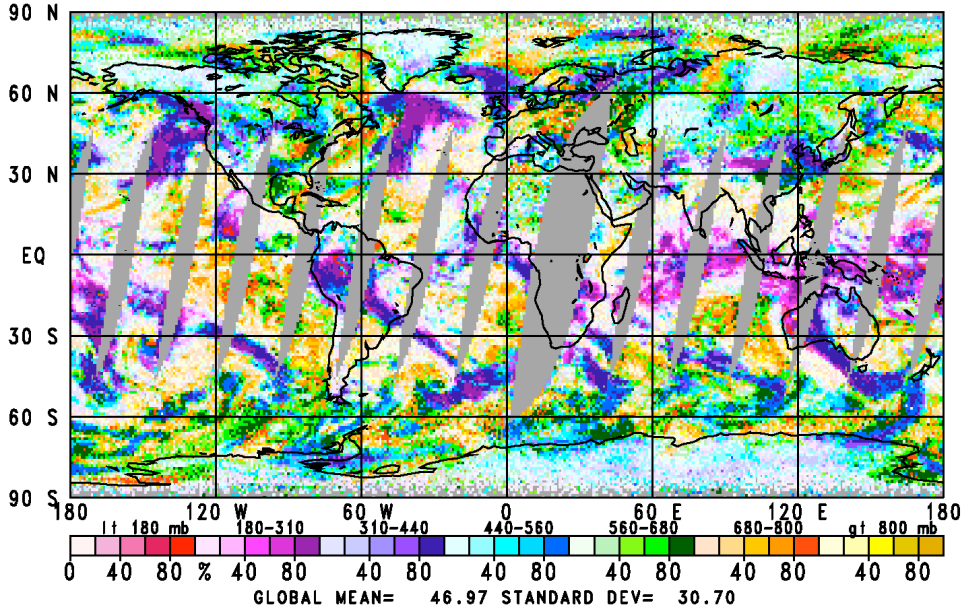
Cloud Parameters January 25, 2003

Candidate Version 5.0
Nighttime



GLOBAL MEAN= 47.04 STANDARD DEV= 29.98

Version 4.0
Nighttime



GLOBAL MEAN= 46.97 STANDARD DEV= 30.70

SUMMARY

Quality controlled Version 4.9 retrievals have significantly better spatial coverage and accuracy than Version 4.0 retrievals over land and ocean

Candidate Version 5 clear column radiance quality control allows for global assimilation of sounding channel radiances sensitive to the surface

Candidate Version 5 nighttime cloud cover over desert appears more realistic than Version 4

Version 5.0 should further improve results, especially over land

There is still room for improvement in Version 6 - especially in

- Water vapor
- O_3
- CO
- CO_2
- Surface emissivity
- .
- .
- .