"TRENDS" OF FOUR YEARS OF MONTHLY MEAN VERSION 4.0 AIRS PRODUCTS

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***UMBC**

AIRS Science Team Meeting

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OBJECTIVES

Assess reasonableness and compatibility of DAAC AIRS Version 4 Level 3 products

They are available to the general scientific community

Compare interannual variability with other satellite products

Assess eventual utility for climate research

Requires compatibility with variability of other long term data sets

Findings for 4 year period September 2002 - August 2006 are not significant to draw climate inferences

PRODUCTS TO BE EVALUATED

Temperature Profile

Comparison of AIRS final product with AIRS microwave product

Clear Sky OLR

Comparison with CERES

AIRS OLR had a bug in DAAC Version 4 processing

To assess potential utility for longer term studies, overlap comparison with TOVS data products (1979- 2004) are shown

METHODOLOGY

All DAAC monthly mean fields have been spatially interpolated to include missing data grid points

- Elevated terrain excluded at appropriate pressure levels

AIRS 4 year 1° x 1° monthly mean "climatologies" are generated

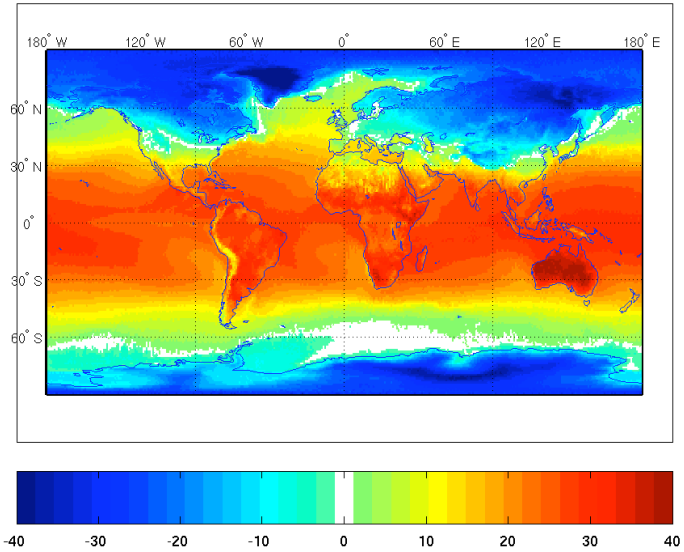
Monthly mean anomalies are area weighted differences from monthly climatologies

Area weighted "trends" are defined as slope of linear fit through anomaly time series

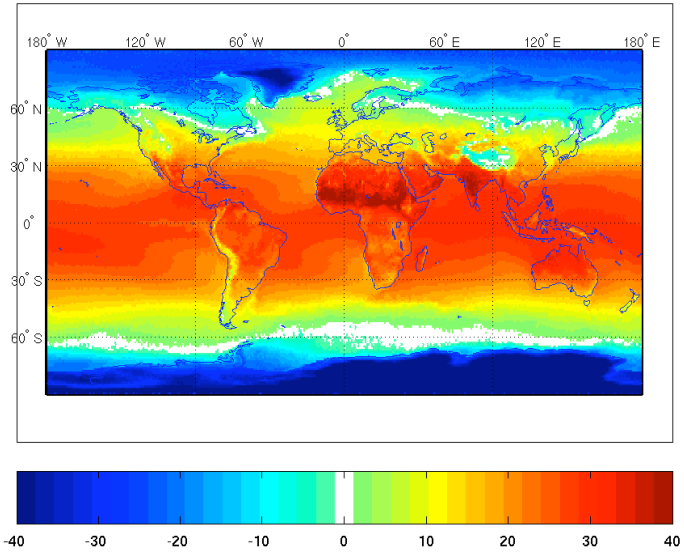
- Use for consistency assessment purposes
- Regional "trends" are larger than global "trends"
- Relative regional trends are useful for climate process studies
  - Less (un?) affected by instrument drift

09/02-08/06 Climatological AIRS Surface Skin Temperature Means

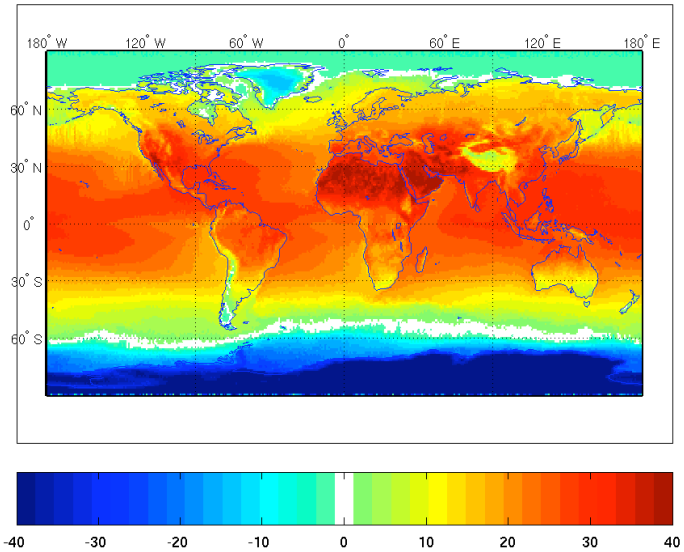
09/02-08/06 January AIRS Mean Skin Temperature [^{o}C]



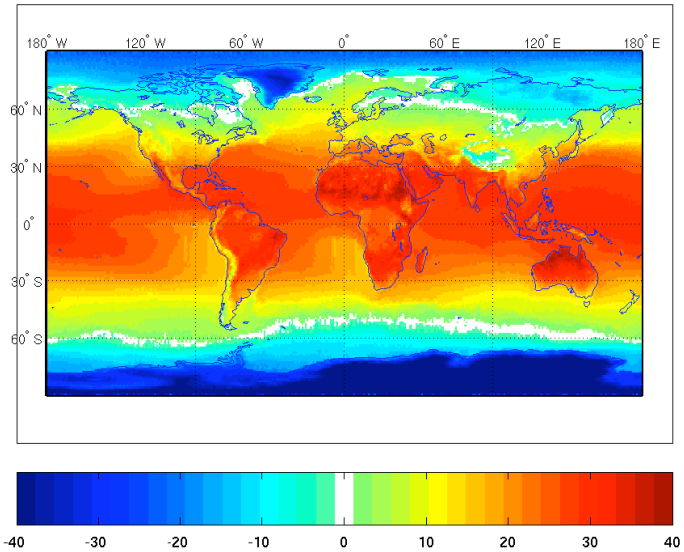
09/02-08/06 April AIRS Mean Skin Temperature [^{o}C]



09/02-08/06 July AIRS Mean Skin Temperature [^{o}C]



09/02-08/06 October AIRS Mean Skin Temperature [^{o}C]



TEMPERATURE PROFILE TRENDS

"Trends" are compared in space and height

Final product (T^F) and microwave product (T^M) compared with themselves and each other

Microwave product T(p) trends should be unaffected by CO_2 changes

Therefore - $T^M(p)$ trends are not spurious results of CO_2 trends

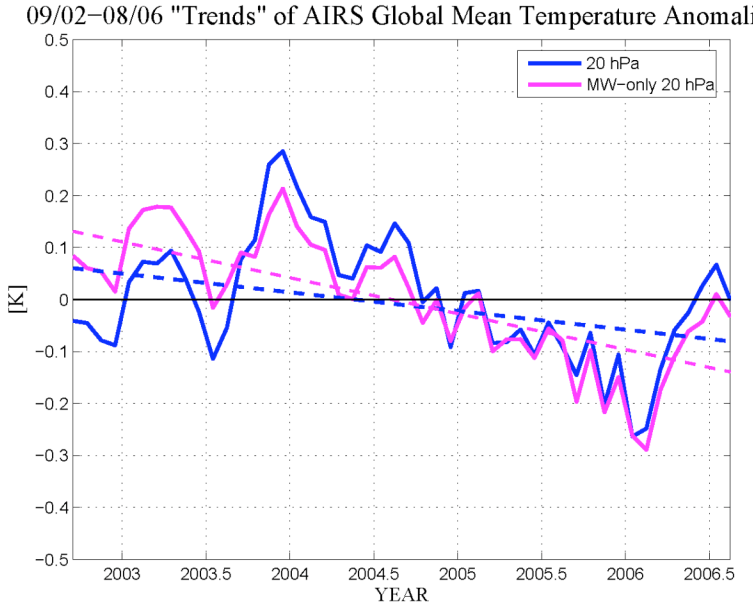
Agreement of T^F with T^M does not mean $T^F(p)$ trends are not spurious

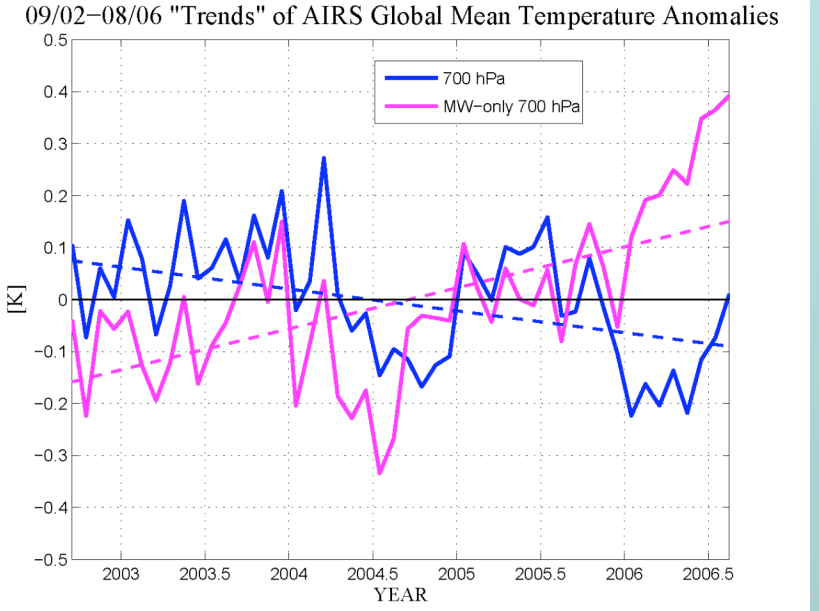
All AMSU channels are used in Version 4 and $T^F(p)$ retrieval

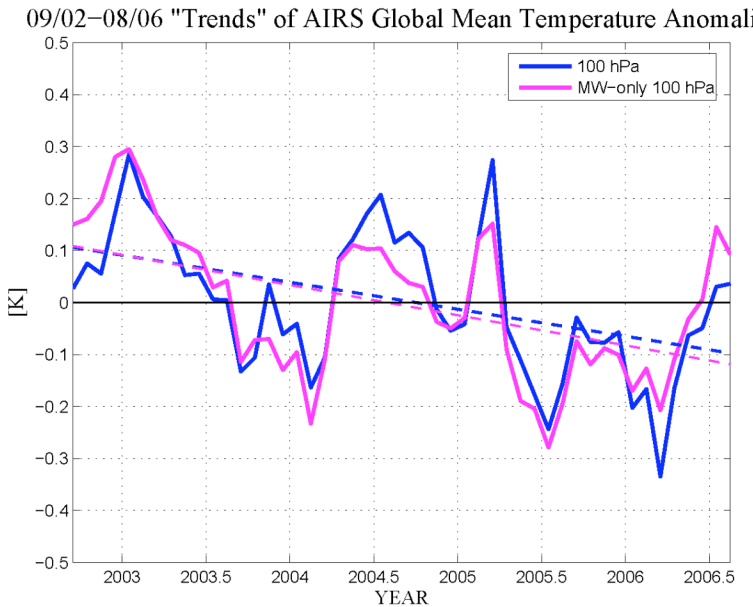
Global T^F "trends" could be influenced by "spurious" AMSU radiance trends

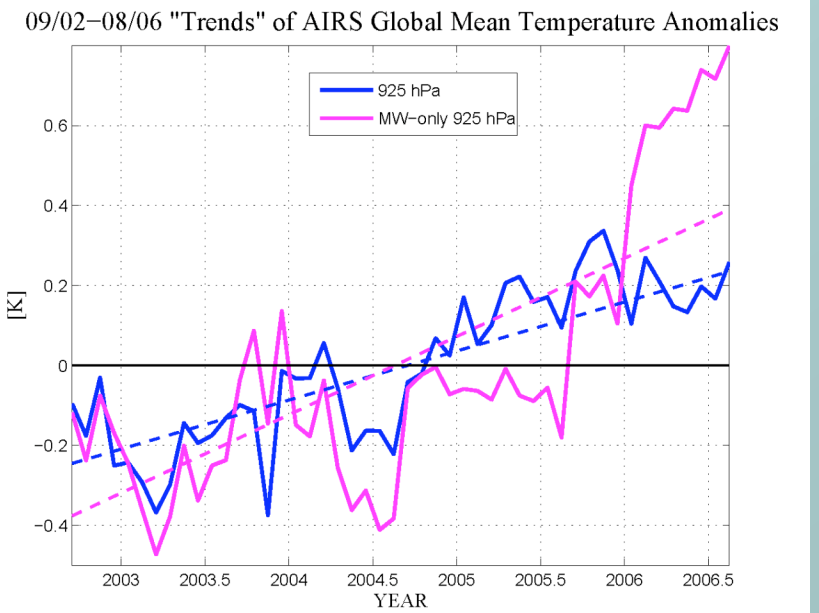
Spatial distribution of "trends" should not be affected

09/02-08/06 Global Mean Temperature Anomaly "Trends"

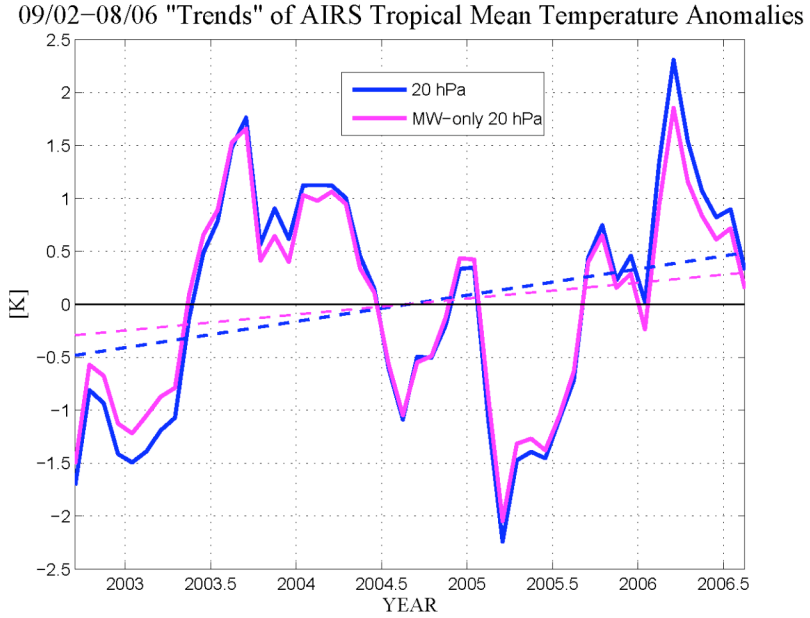


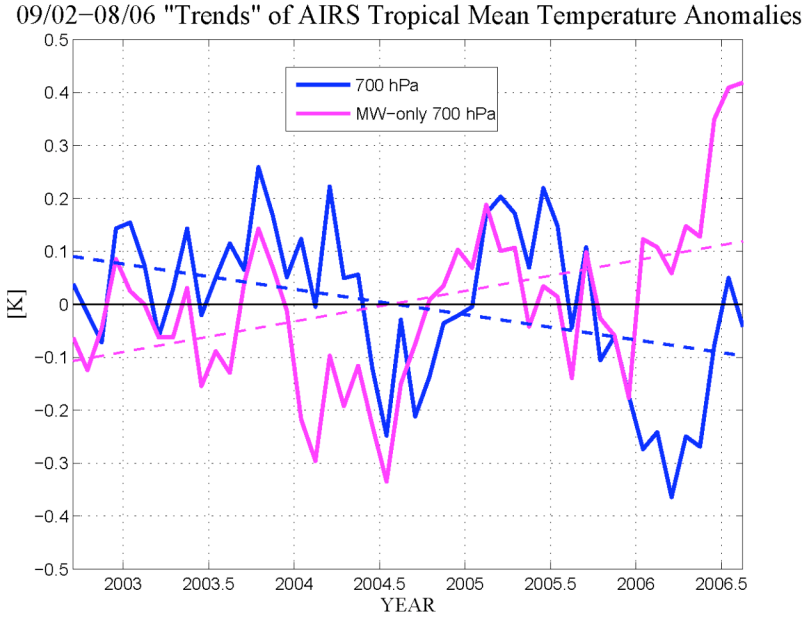


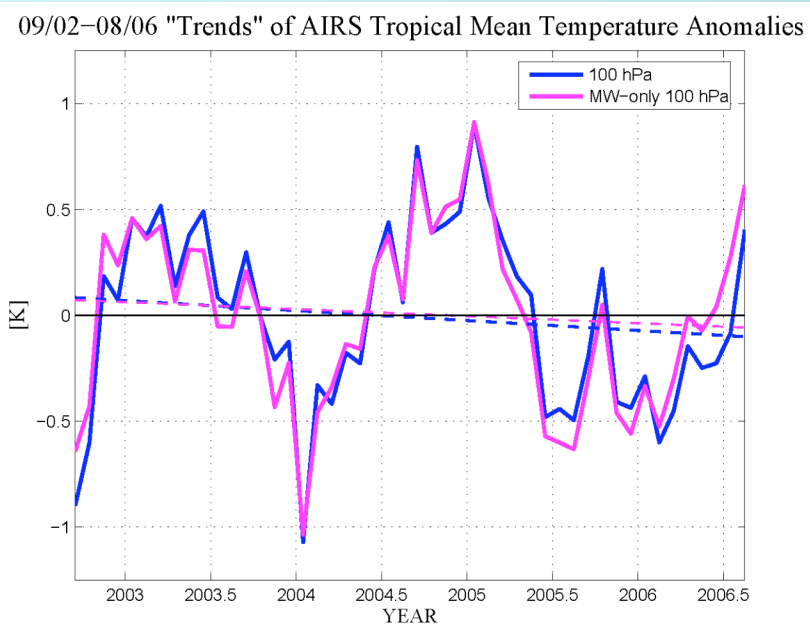


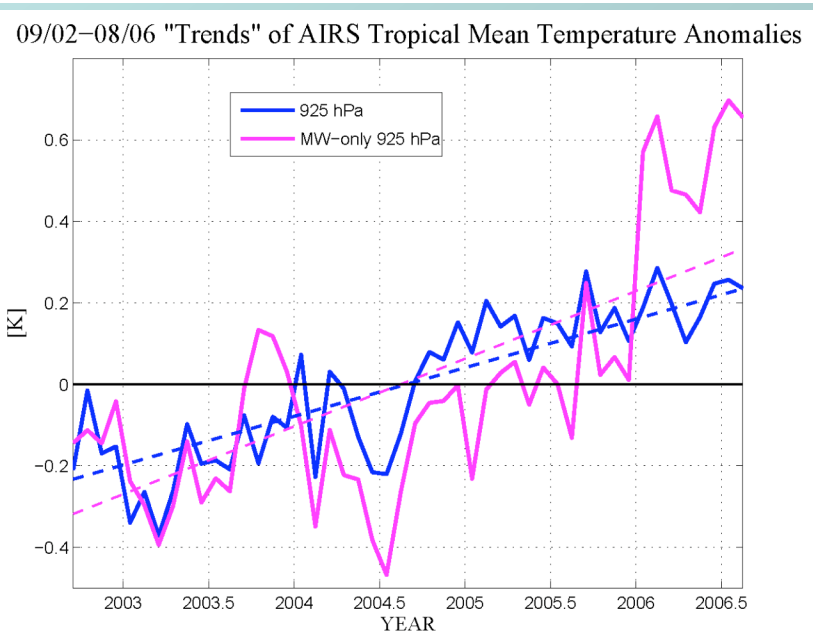


09/02-08/06 Tropical Mean Temperature Anomaly "Trends"

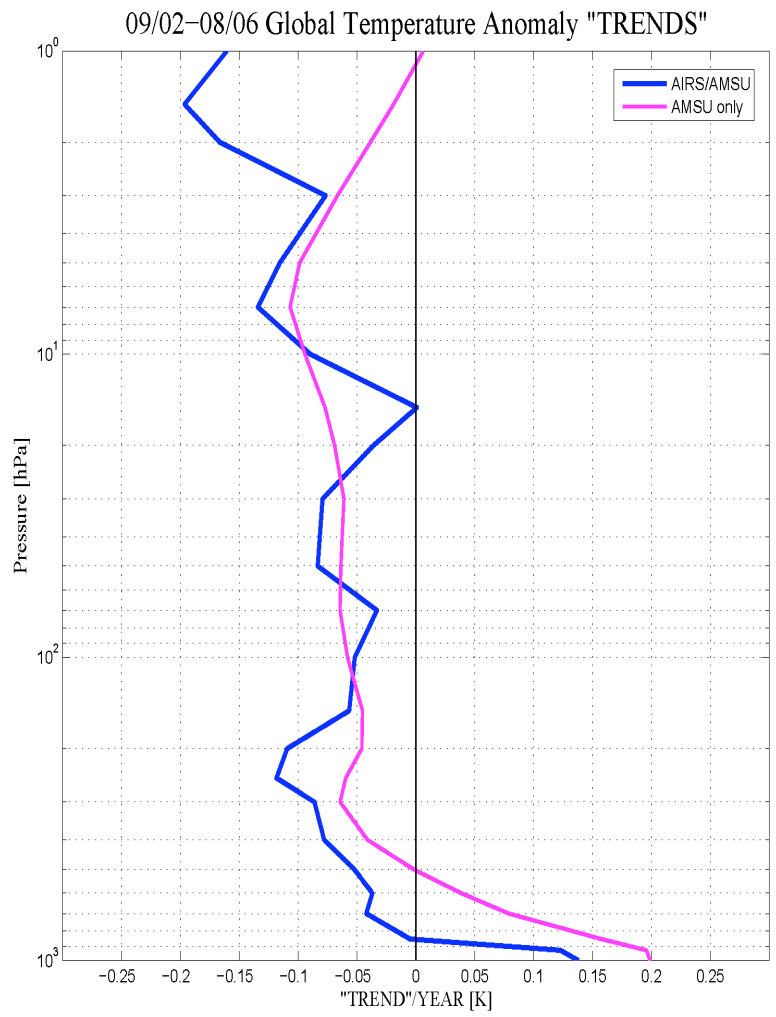


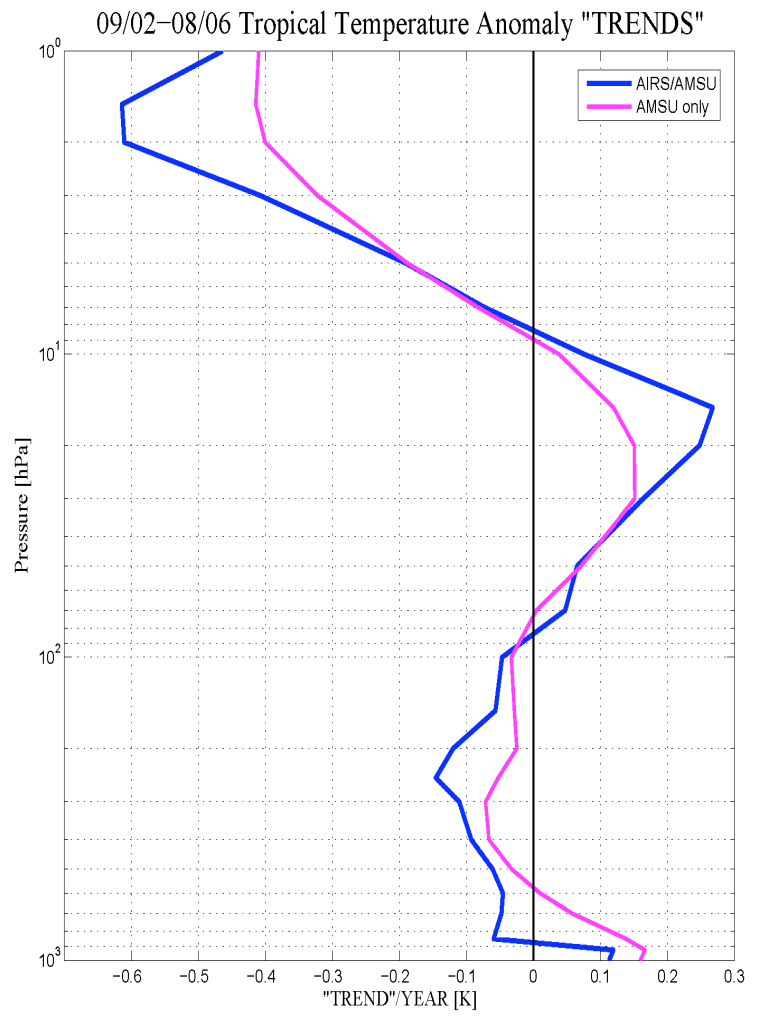






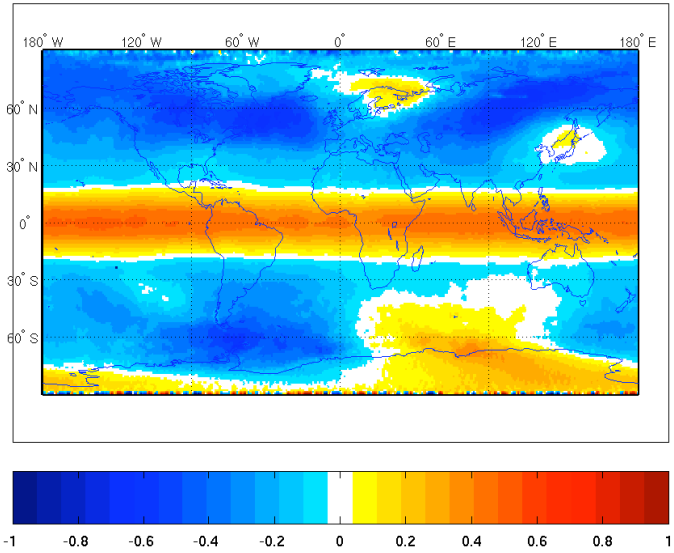
Vertical temperature Profile “Trends”



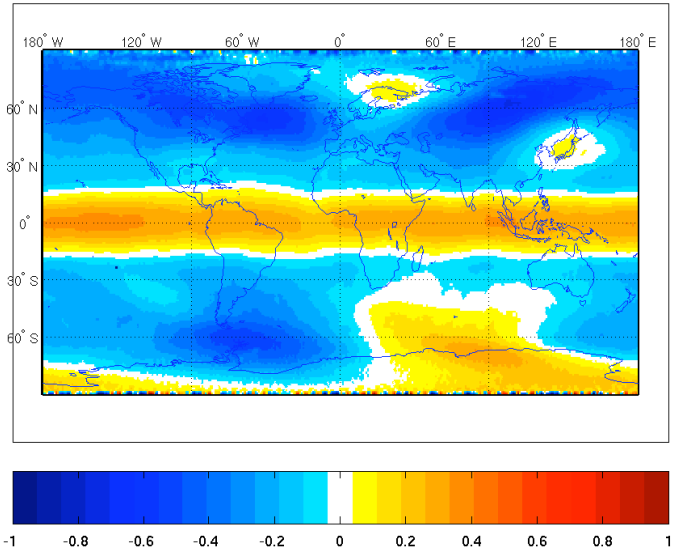


09/02-08/06 Stratospheric Spatial Temperature “Trends”

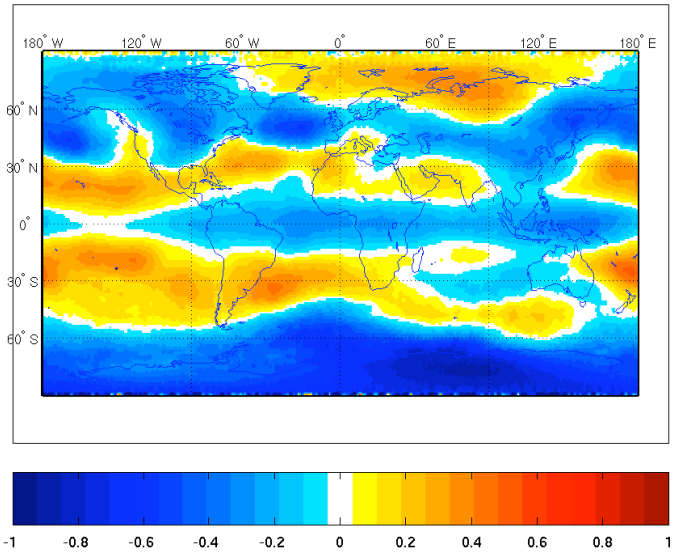
09/02-08/06 AIRS/AMSU 20 hPa Temperature Anomaly "Trend" [°C]/yr]



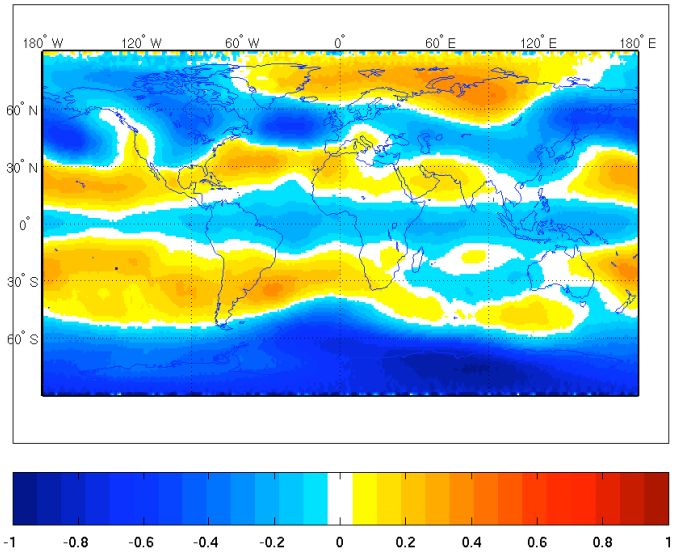
09/02-08/06 AMSU-only 20 hPa Temperature Anomaly "Trend" [°C]/yr]



09/02-08/06 AIRS/AMSU 100 hPa Temperature Anomaly "Trend" [°C]/yr]

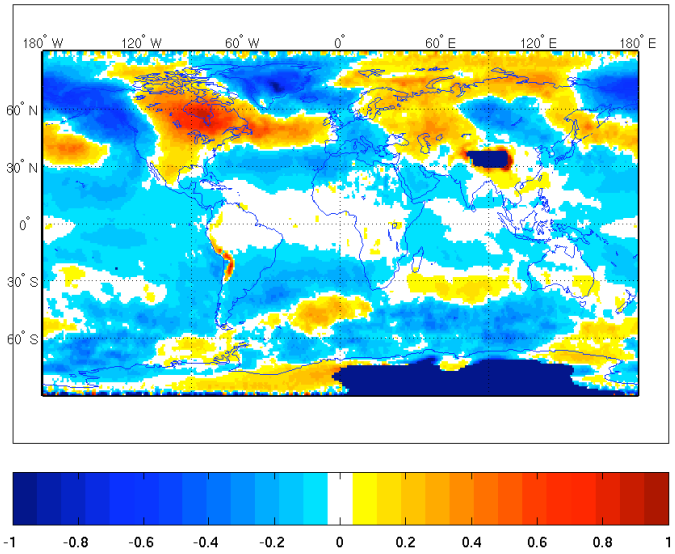


09/02-08/06 AMSU-only 100 hPa Temperature Anomaly "Trend" [°C]/yr]

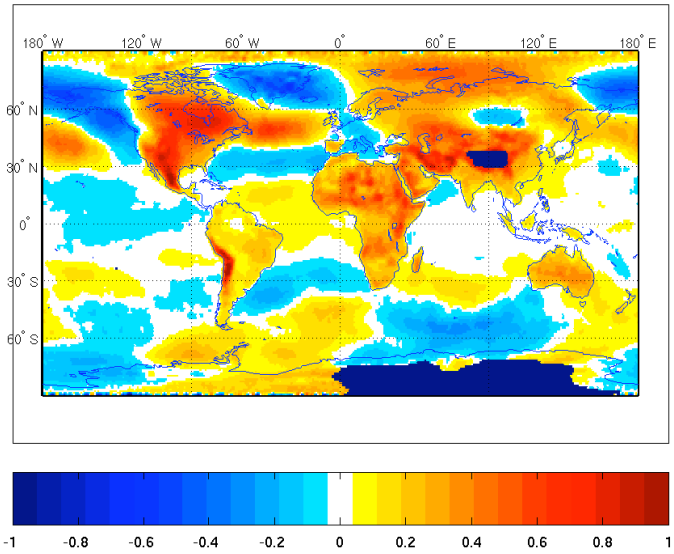


09/02-08/06 Tropospheric Spatial Temperature “Trends”

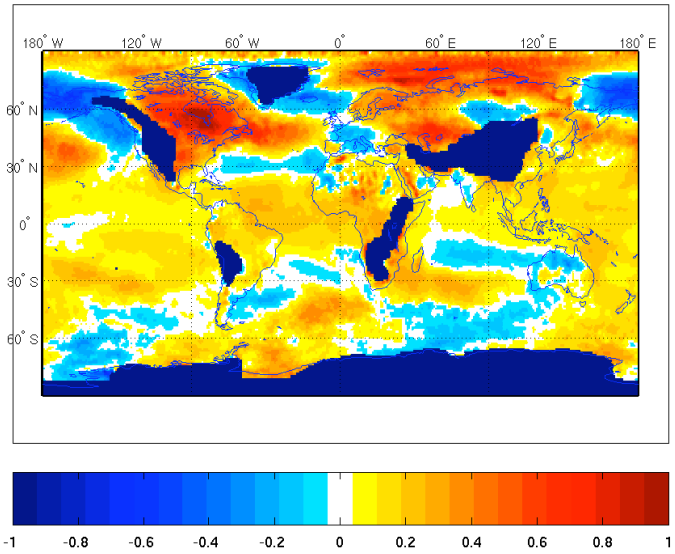
09/02-08/06 AIRS/AMSU 700 hPa Temperature Anomaly "Trend" [°C]/yr]



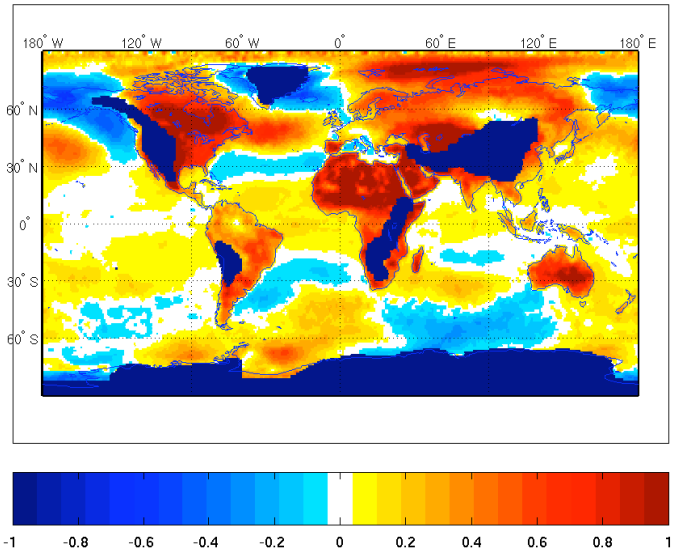
09/02-08/06 AMSU-only 700 hPa Temperature Anomaly "Trend" [°C]/yr]



09/02-08/06 AIRS/AMSU 925 hPa Temperature Anomaly "Trend" [°C]/yr]

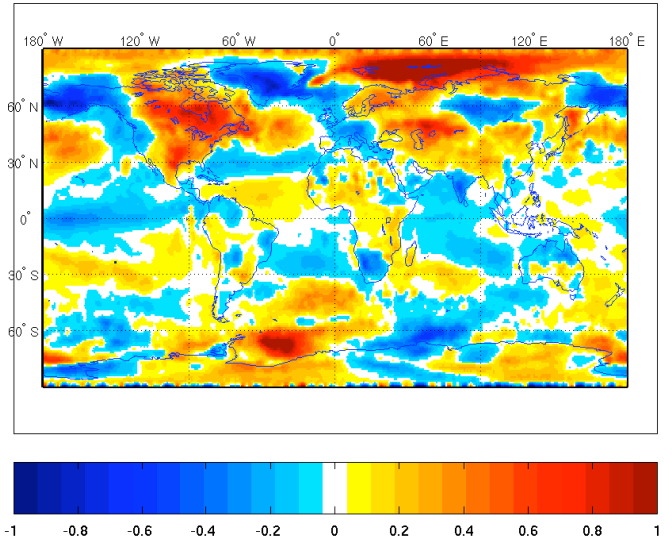


09/02-08/06 AMSU-only 925 hPa Temperature Anomaly "Trend" [°C]/yr]

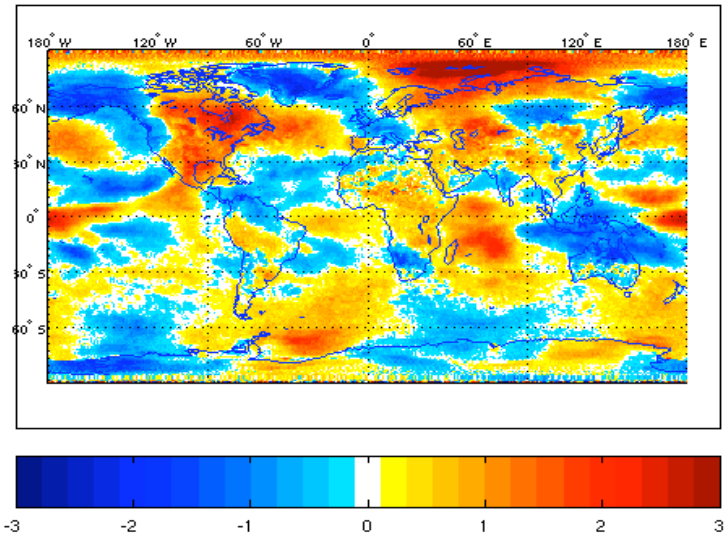


09/02-08/06 Spatial "Trends"

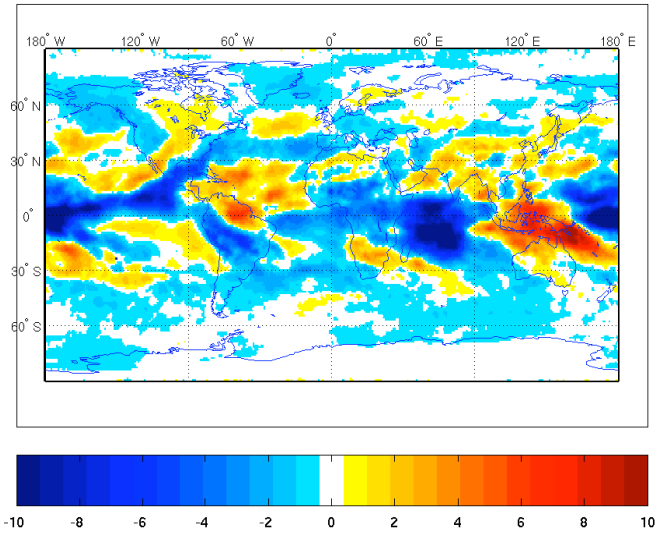
09/02-08/06 AIRS Skin Temperature Anomaly "Trend" [^{o}C]/yr]



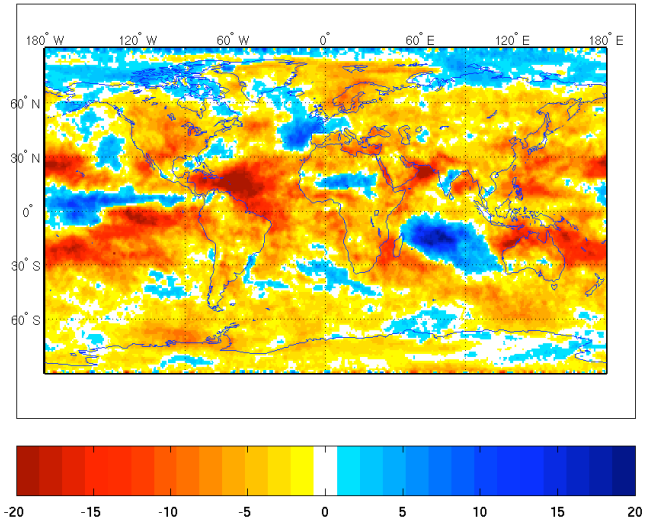
09/02-05/06 AIRS Clear-Sky OLR Anomaly Trend [W/m^2]/yr



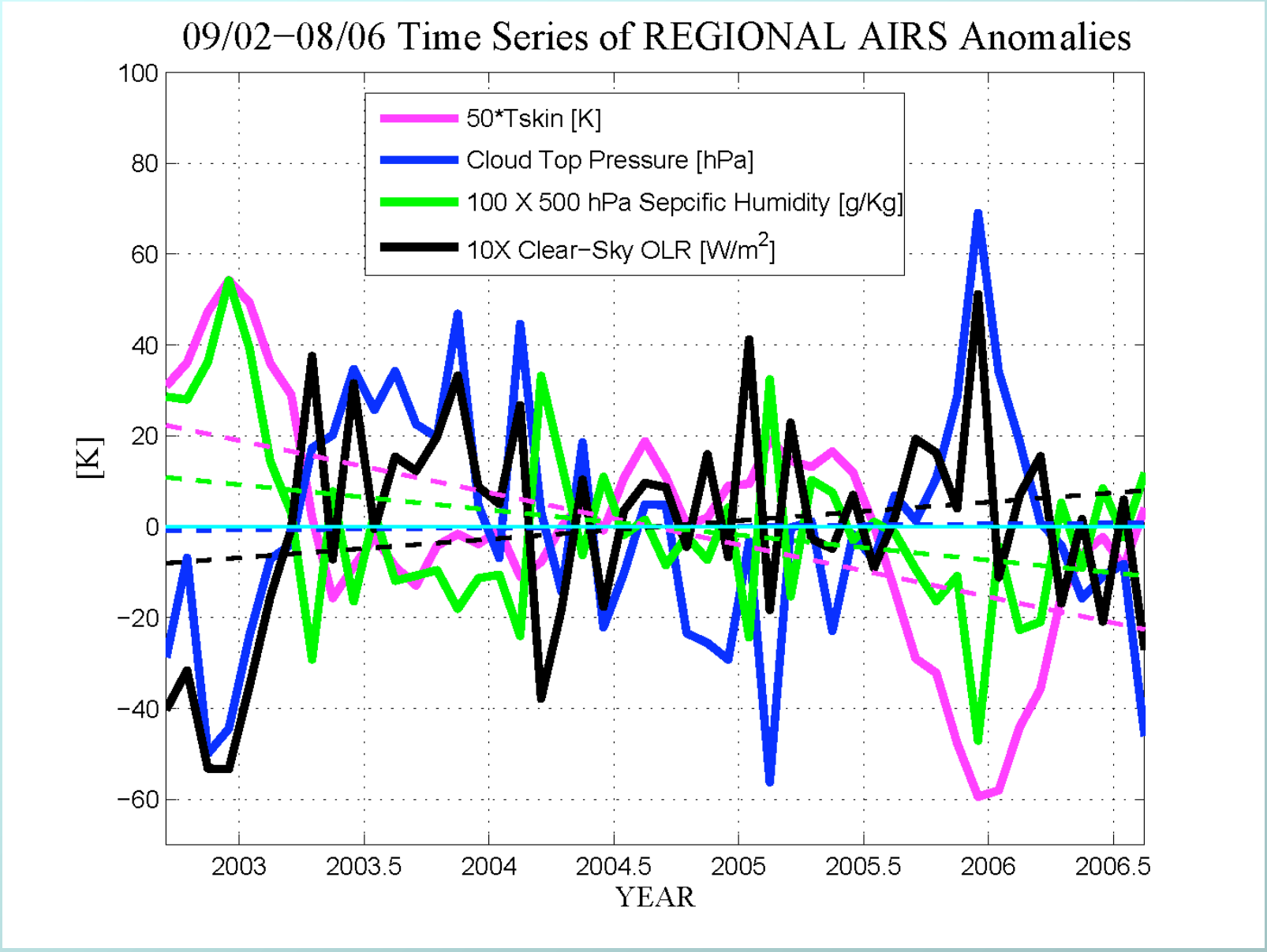
09/02-08/06 AIRS 100 x 500 hPa Specific Humidity Anomaly Trend [g/Kg/yr

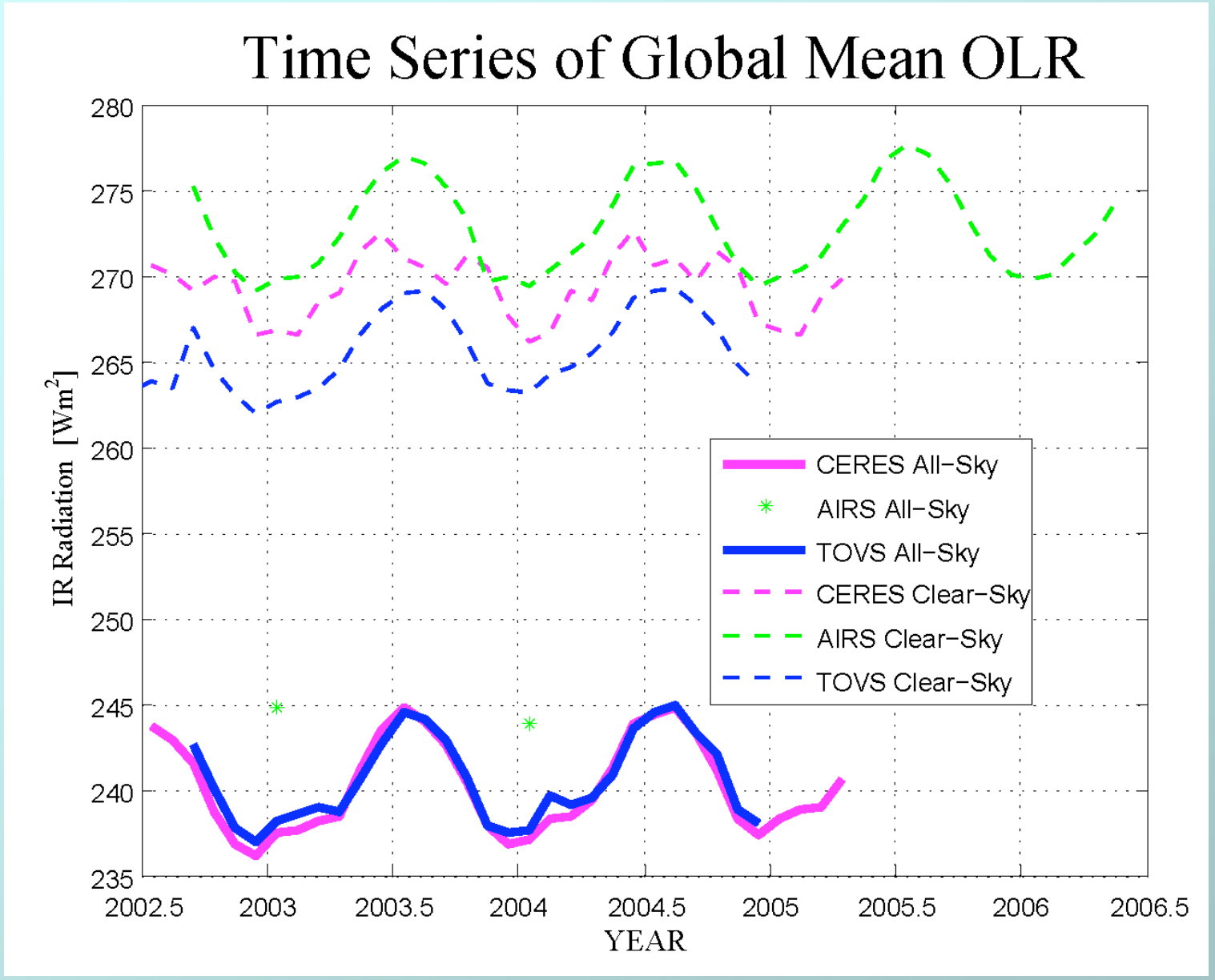


09/02-08/06 AIRS Cloud Top Pressure Anomaly Trend [hPa/yr]

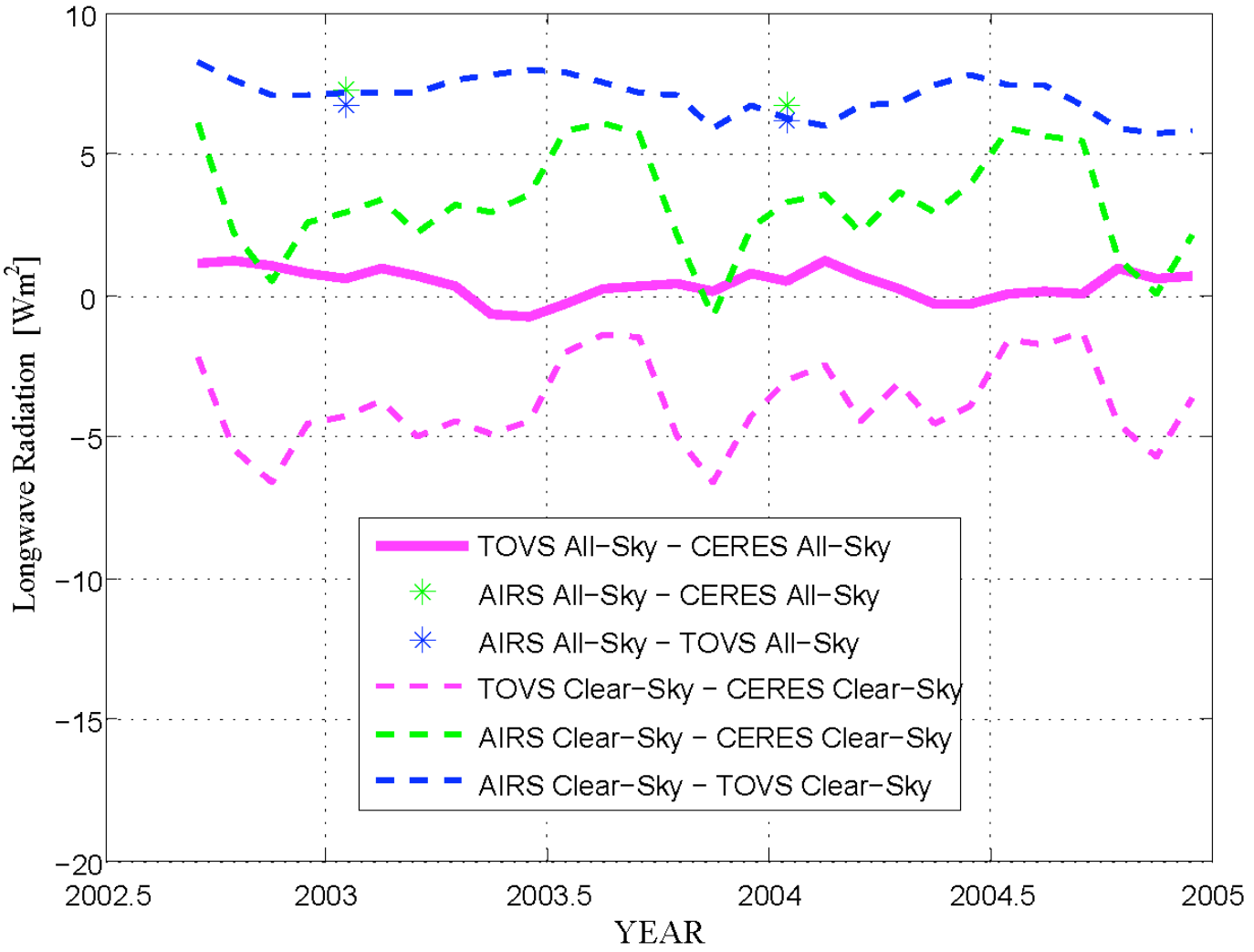


AIRS Anomalies over the +/- 5 Deg. – 120-180 Deg. W REGION

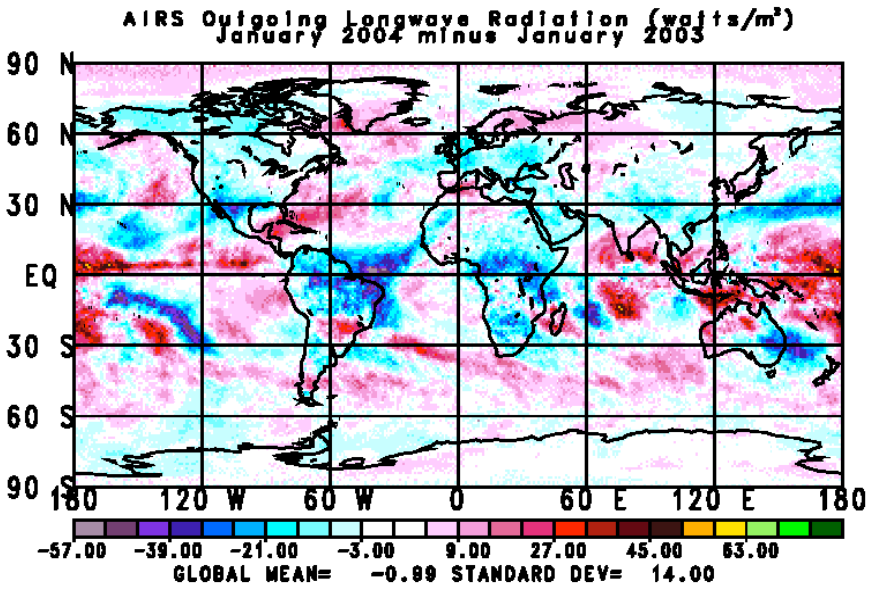


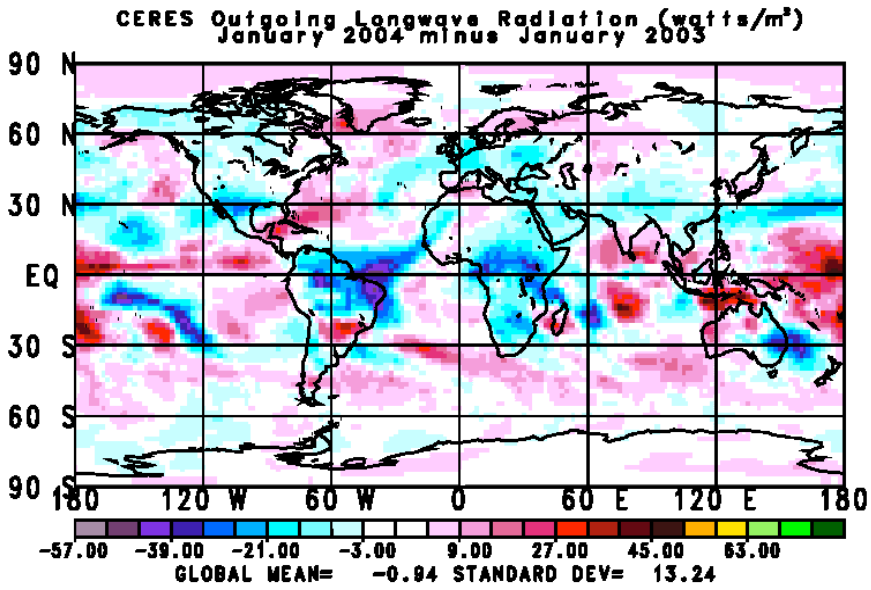

Time Series of Global Mean OLR
IR Radiation [Wm^2]
YEAR
280
275
270
265
260
255
250
245
240
235
2002.5
2003
2003.5
2004
2004.5
2005
2005.5
2006
2006.5
CERES All-Sky
AIRS All-Sky
TOVS All-Sky
CERES Clear-Sky
AIRS Clear-Sky
TOVS Clear-Sky

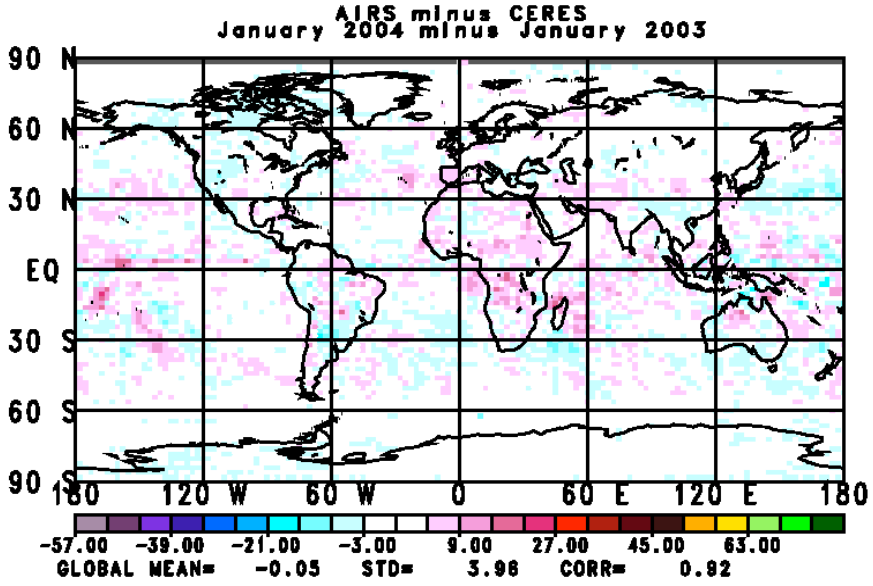
Time Series of Global Mean OLR Differences



Outgoing Longwave Radiation (watts/m²)

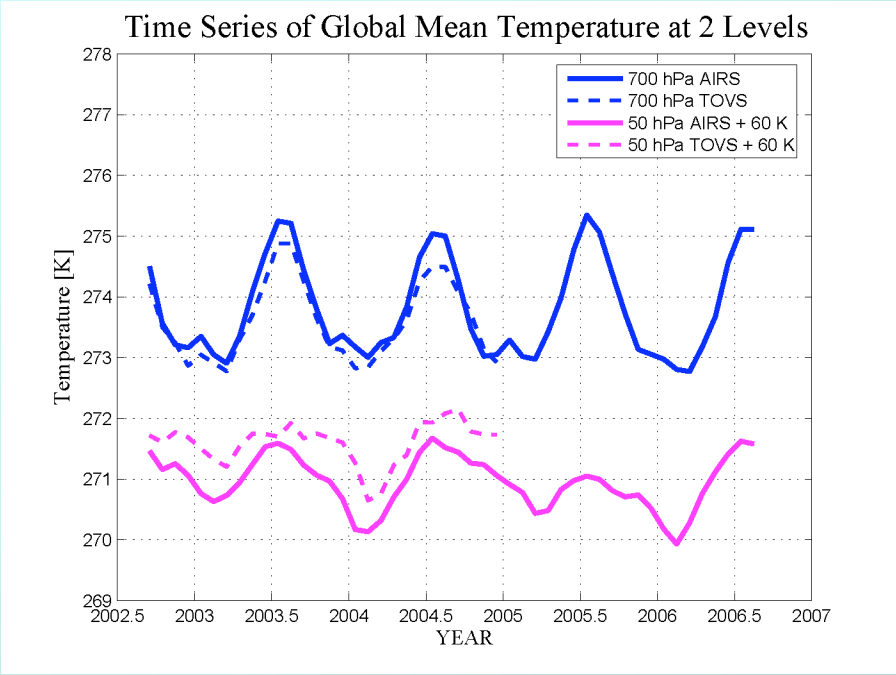


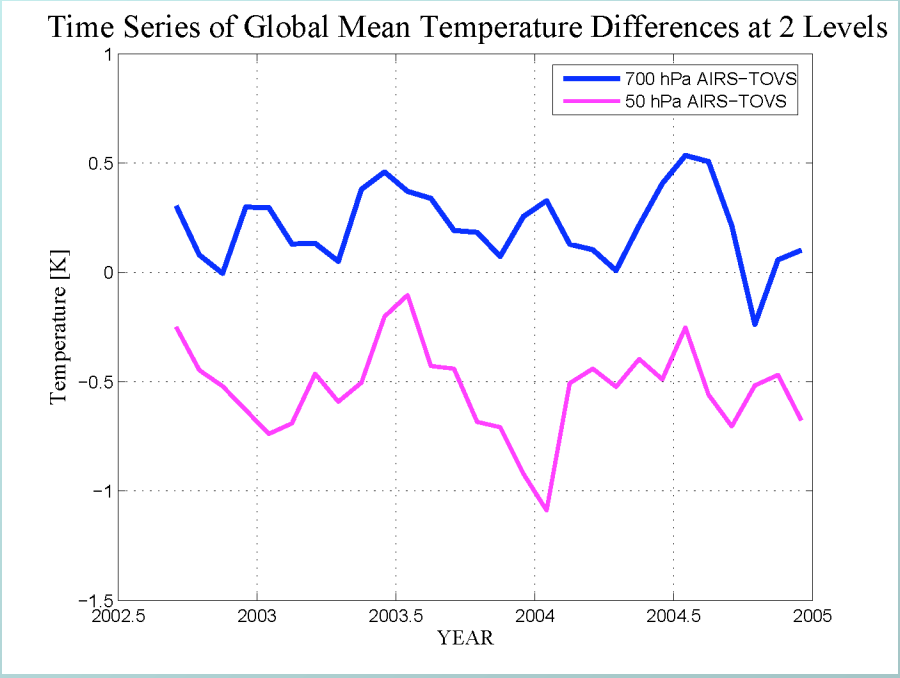




Jan./2004-Jan./2003 CERES-AIRS Interannual OLR Variability

AIRS-TOVS Temperature Time Series





SUMMARY

AIRS Version 4.0 monthly mean product "trends" show reasonable consistency with each other and other satellite products

- Vertical distribution of T(p)
- Spatial distribution of different products

Version 5.0 (and future Version 6.0) will be even better for climate purposes

- Spatial coverage of Version 5.0 level 2 products is better
- $T^F(p)$ will be independent of $T^M(p)$
- Will have OLR product and Coarse Climate Indicators
- Will cover 5 (and at least 6) years - Version 7.0?

We have a proposal to analyze AIRS Level 3 product time series and merge with TOVS products to study 1979 - 2008^+ anomalies and trends