AIRS – MODIS TEB Global Comparisons

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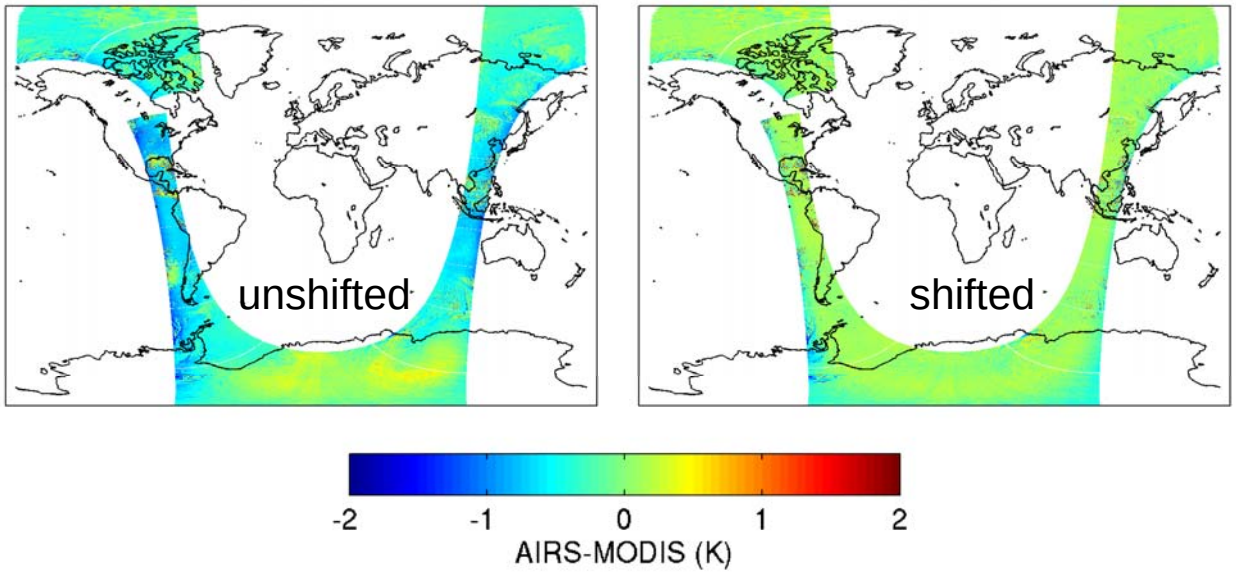
MODIS Calibration Mtg

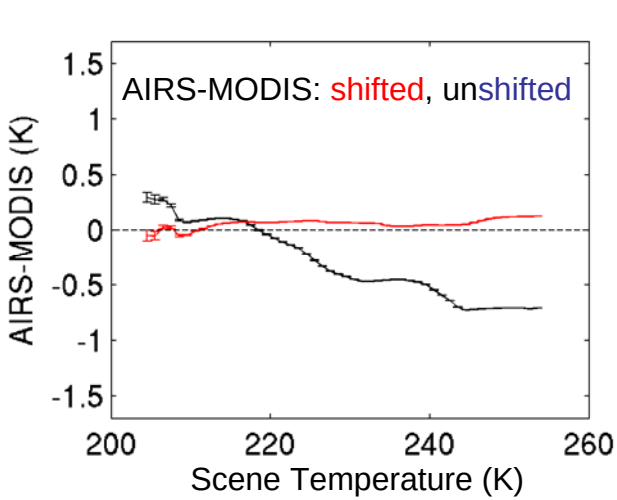
Brief History

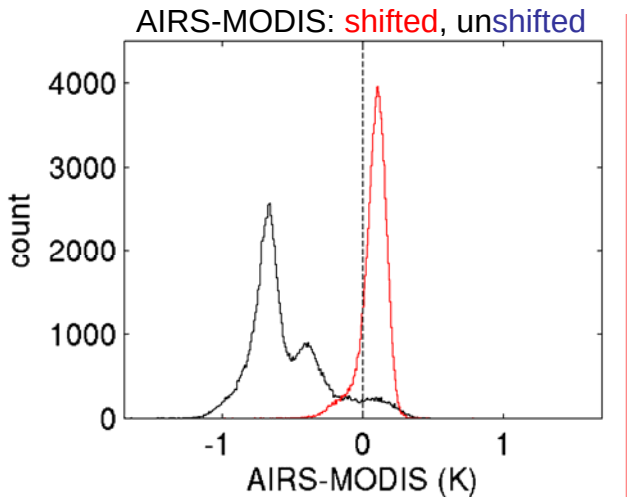
Using two global days of AIRS-MODIS comparisons, Tobin et al (2006) found that AIRS-MODIS radiance bias could be largely removed by shifting MODIS RSR to shorter wavelengths.

Band 35 (13.9 μm) brightness temperature differences for one orbit on 6 Sept 2002

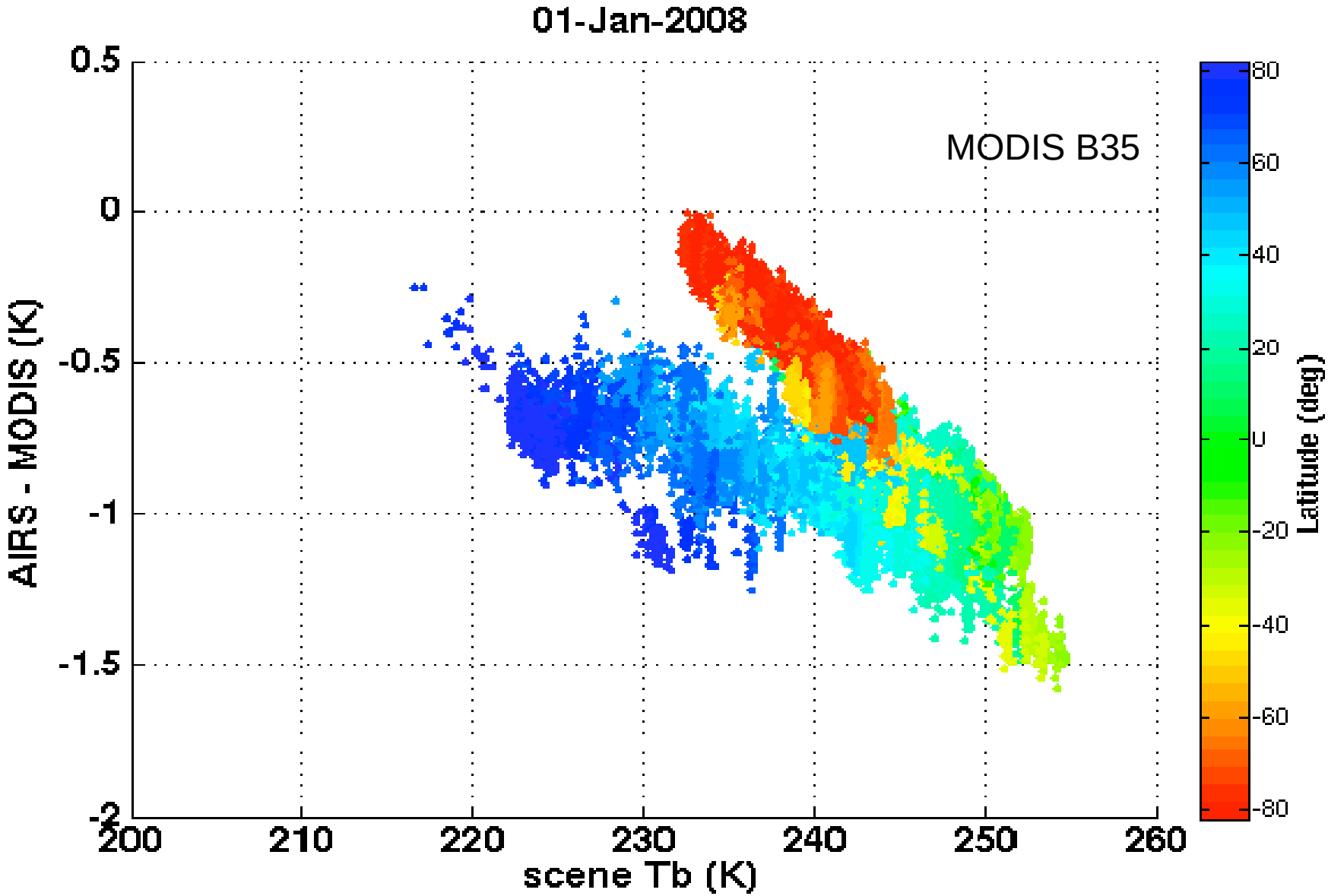


MODIS SRF (black) and MODIS SRF shifted by +0.8 cm^{-1} (red)





Recently, Wisconsin began processing global AIRS-MODIS comparisons for the entire Aqua mission.



The following 24 slides show the AIRS-MODIS B35 calibrated temperature differences for one day of each month from Jan 2006 through Dec 2007.

Note the repeating pattern through the annual cycle.

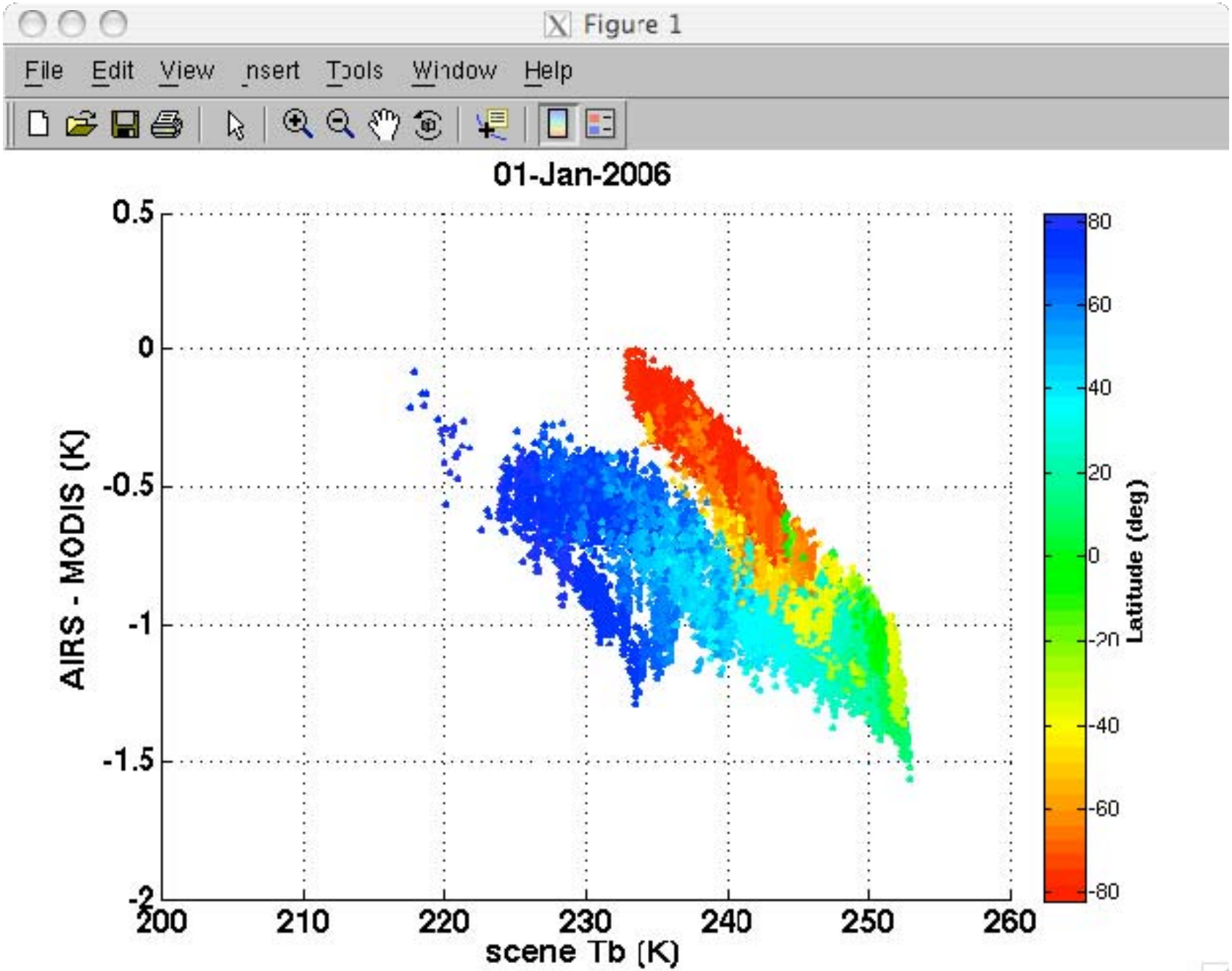


Figure 1
File Edit View Insert Tools Window Help
01-Jan-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

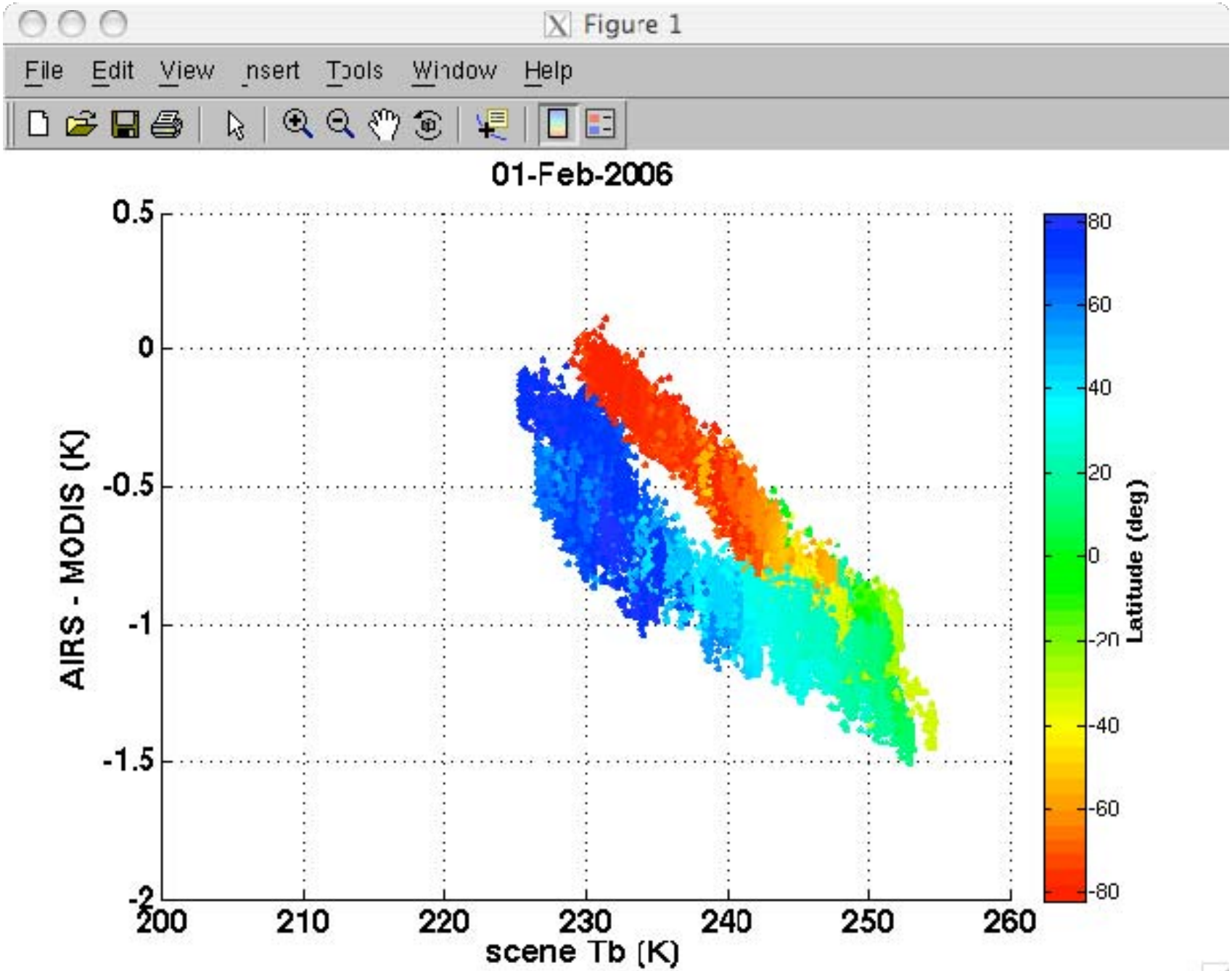


Figure 1
File Edit View Insert Tools Window Help
01-Feb-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

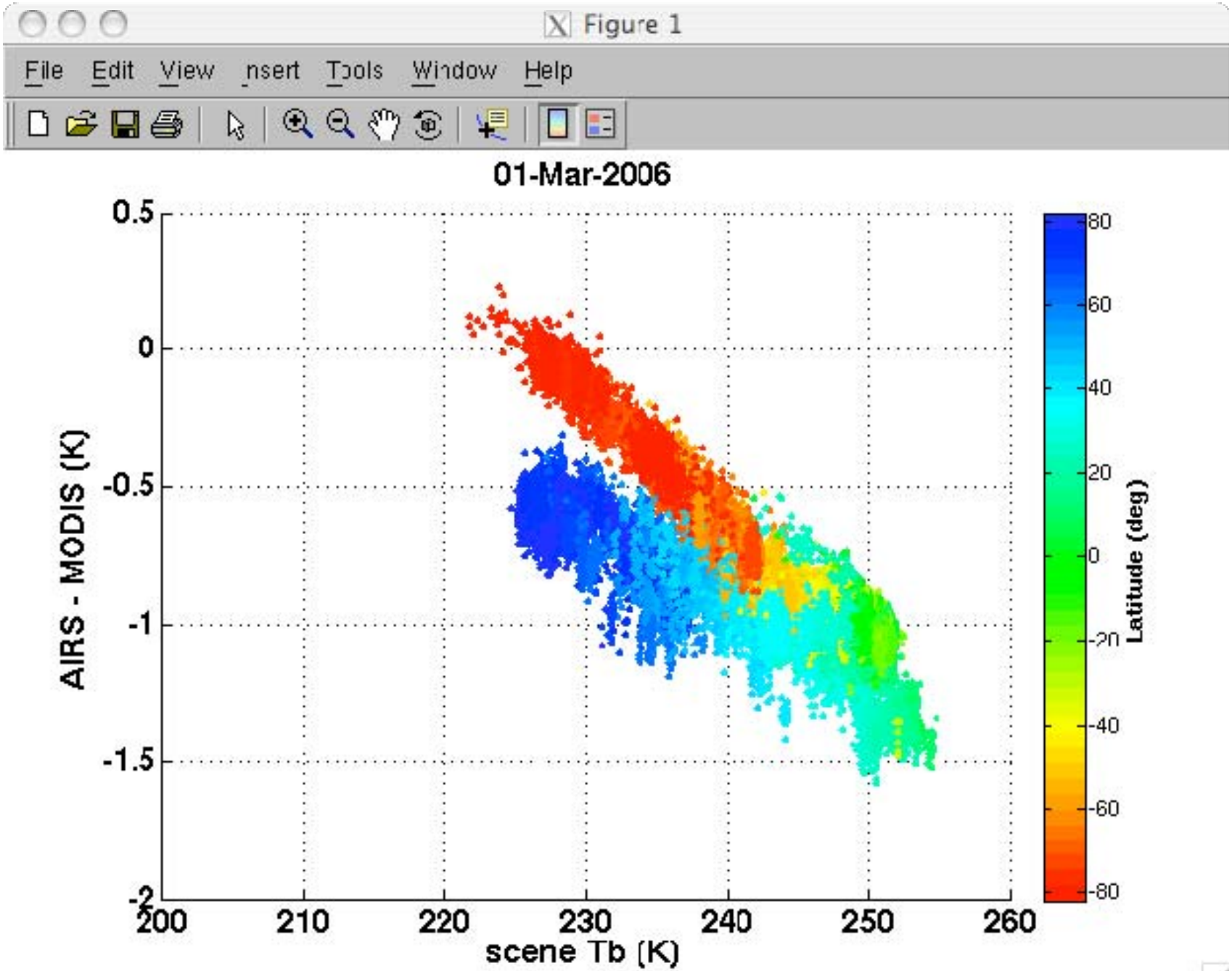


Figure 1
File Edit View Insert Tools Window Help
01-Mar-2006
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
40
20
0
-20
-40
-60
-80

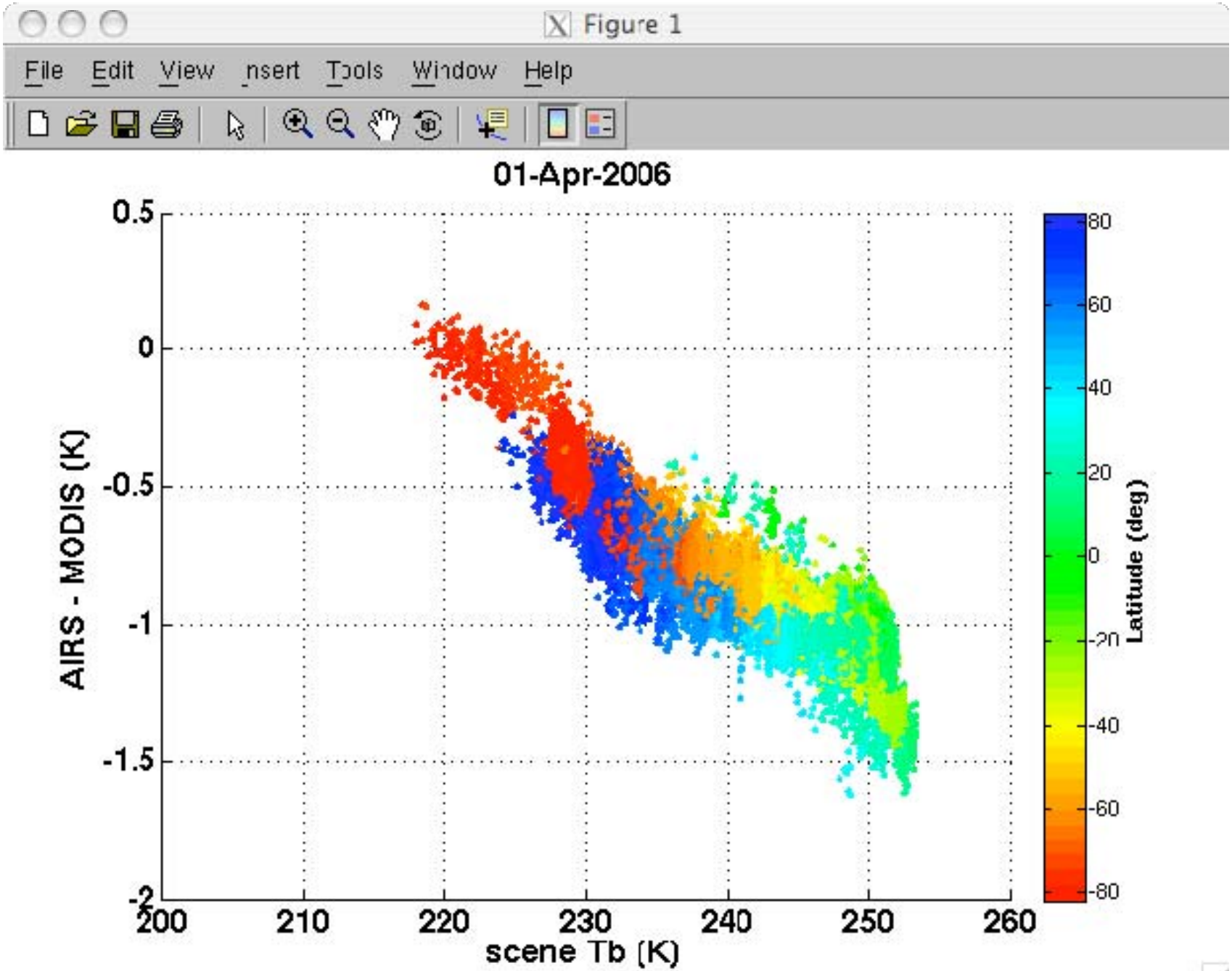


Figure 1
File Edit View Insert Tools Window Help
01-Apr-2006
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
40
20
0
-20
-40
-60
-80

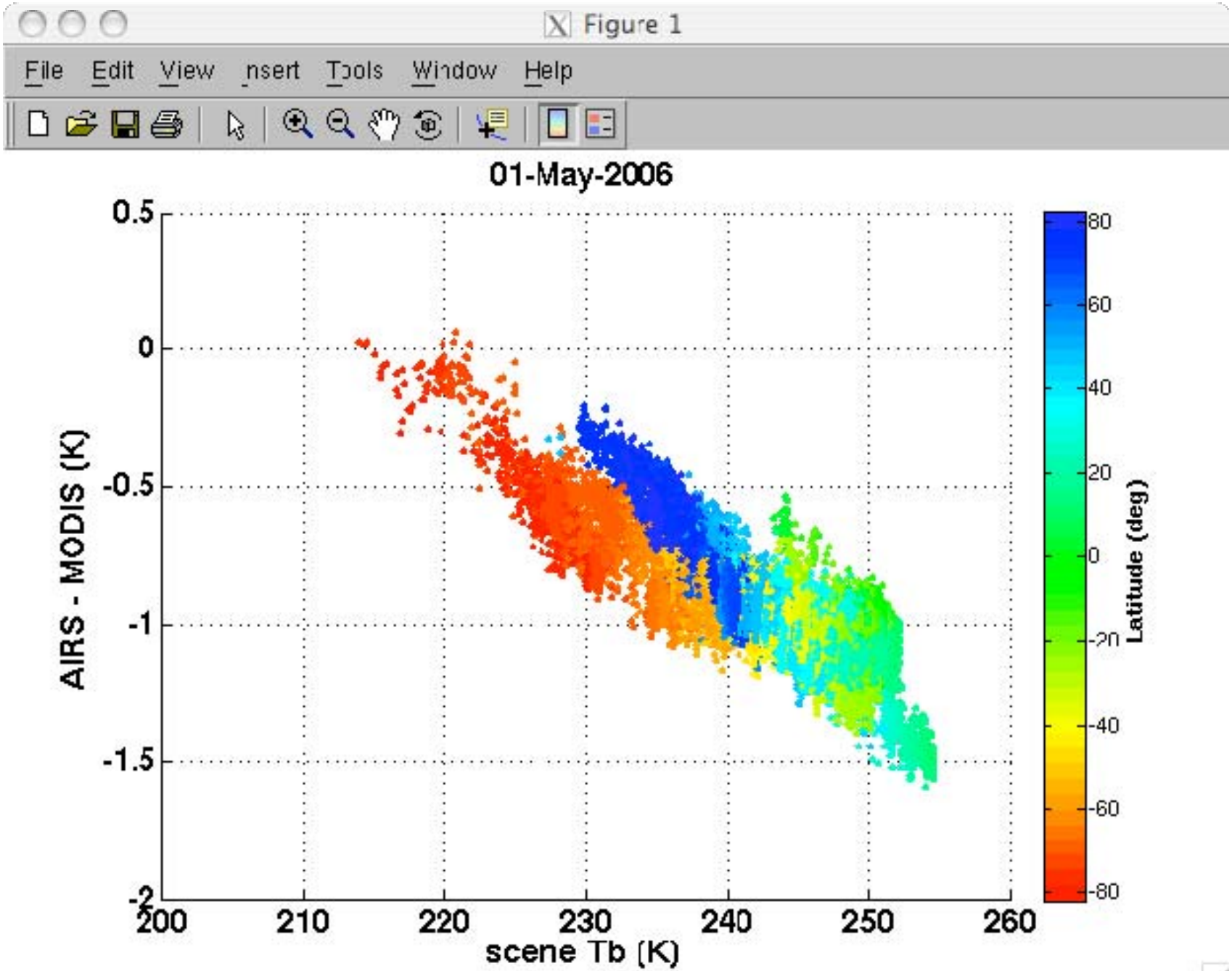


Figure 1
File Edit View Insert Tools Window Help
01-May-2006
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
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0
-20
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-60
-80

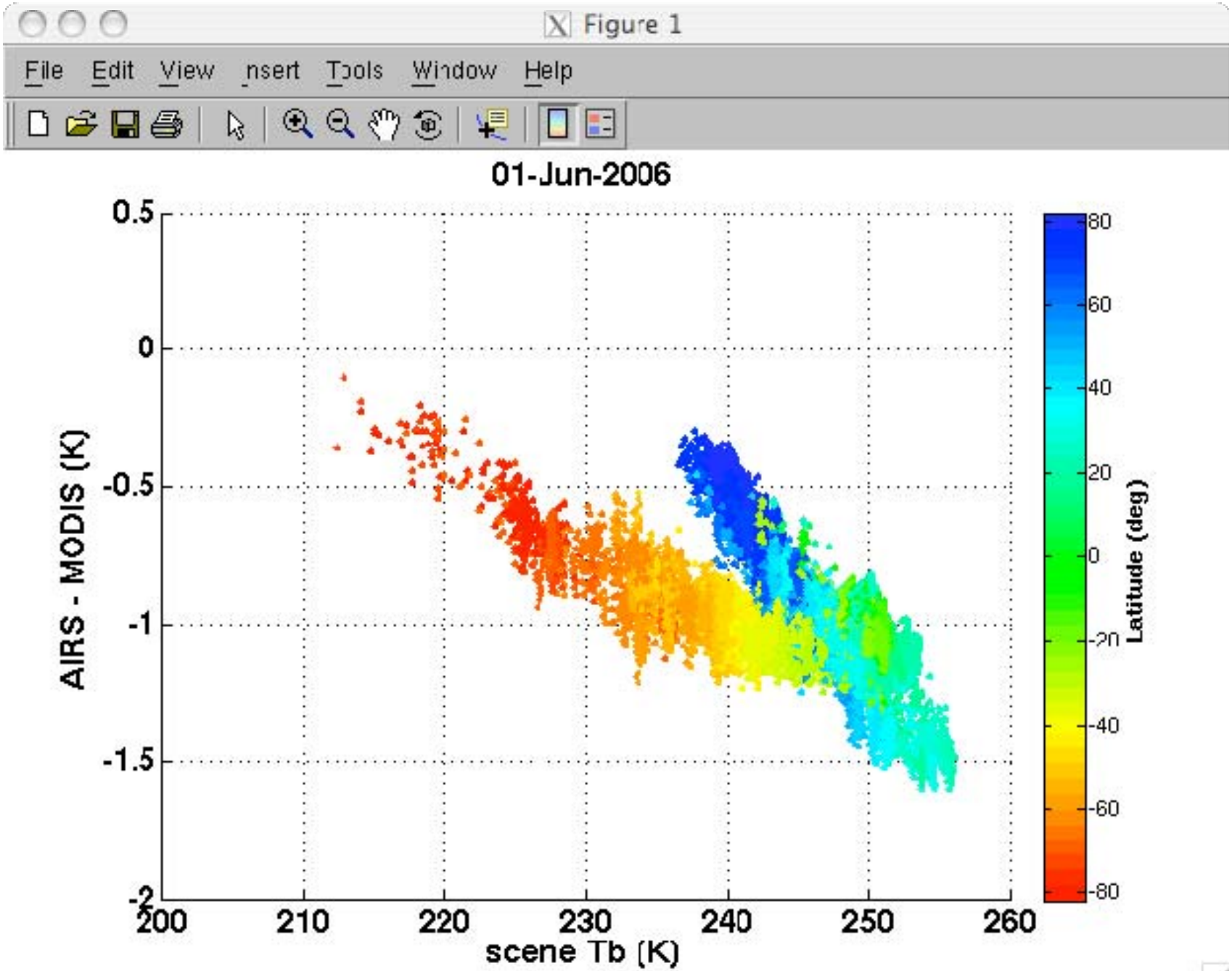
Figure 1
File Edit View Insert Tools Window Help
01-Jun-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

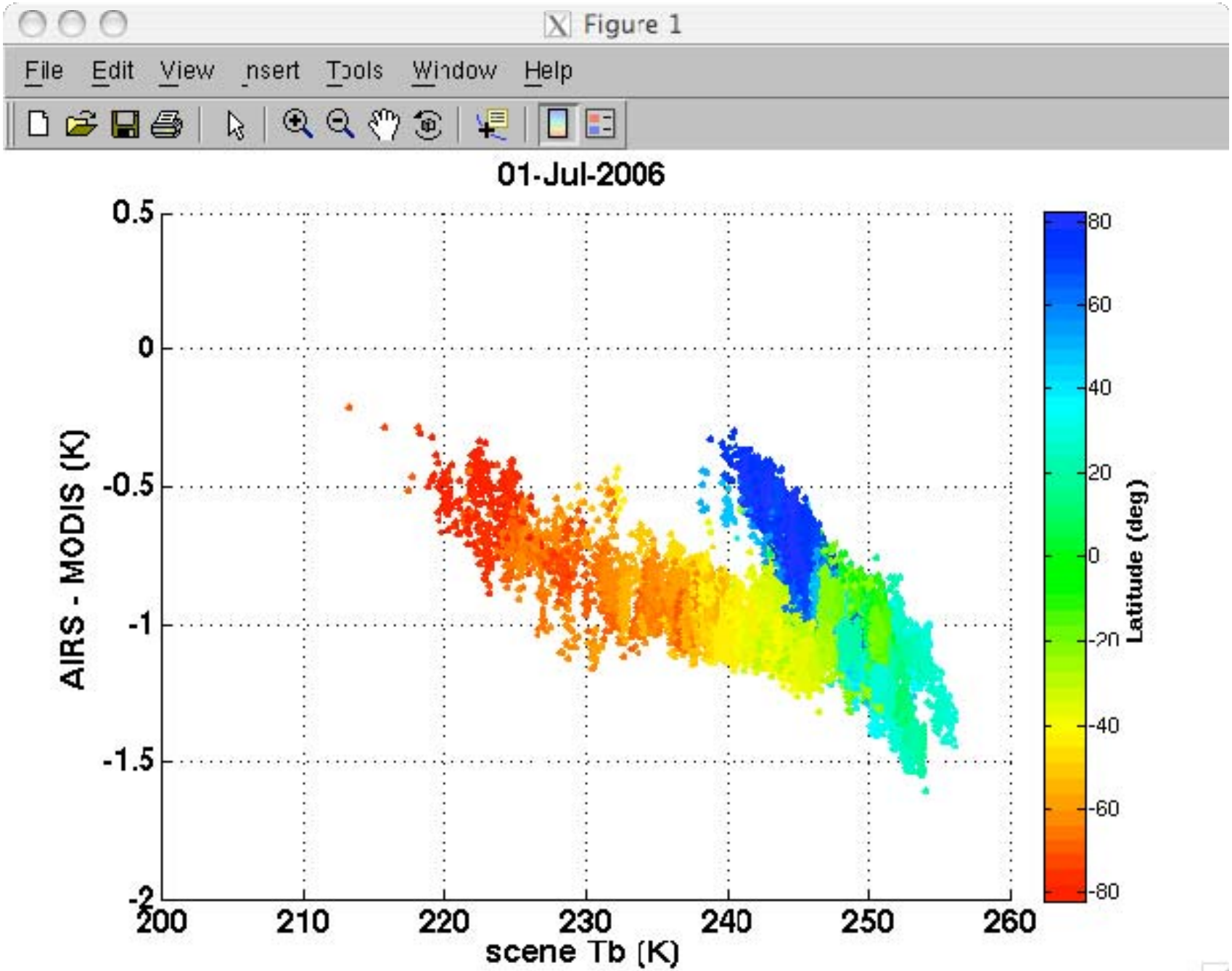
Figure 1
File Edit View Insert Tools Window Help
01-Jul-2006
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
40
20
0
-20
-40
-60
-80

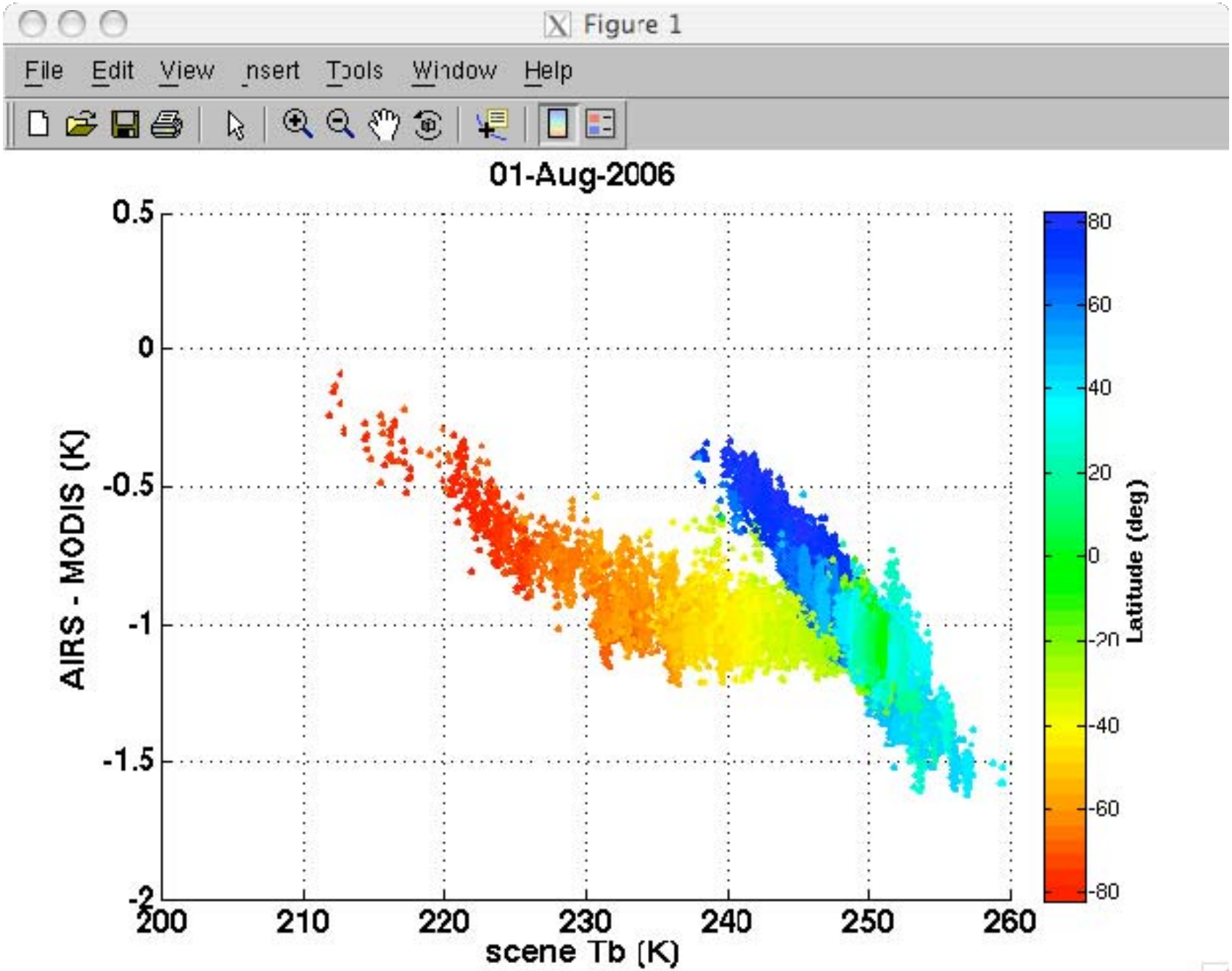
Figure 1
File Edit View Insert Tools Window Help
01-Aug-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

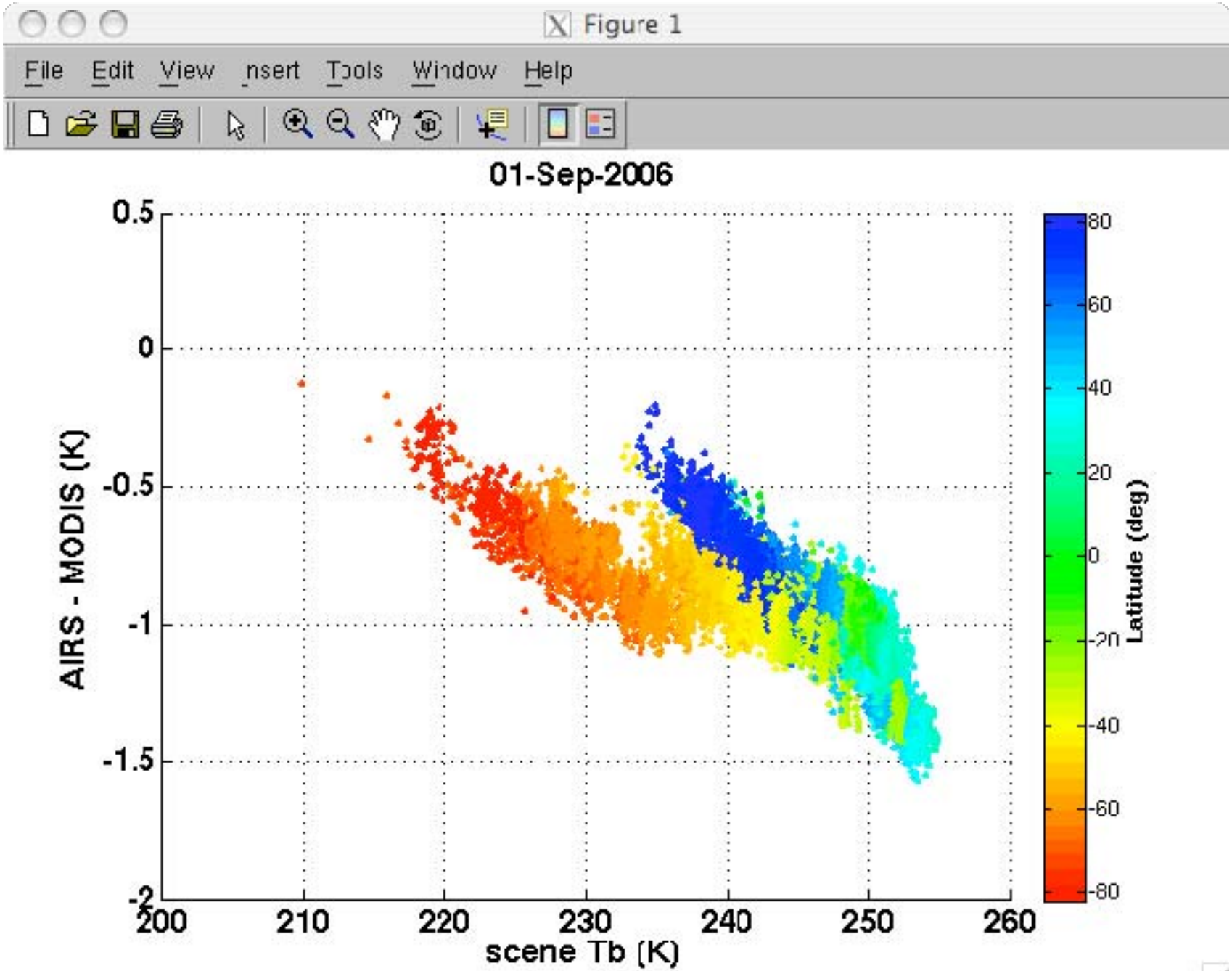
Figure 1
File Edit View Insert Tools Window Help
01-Sep-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

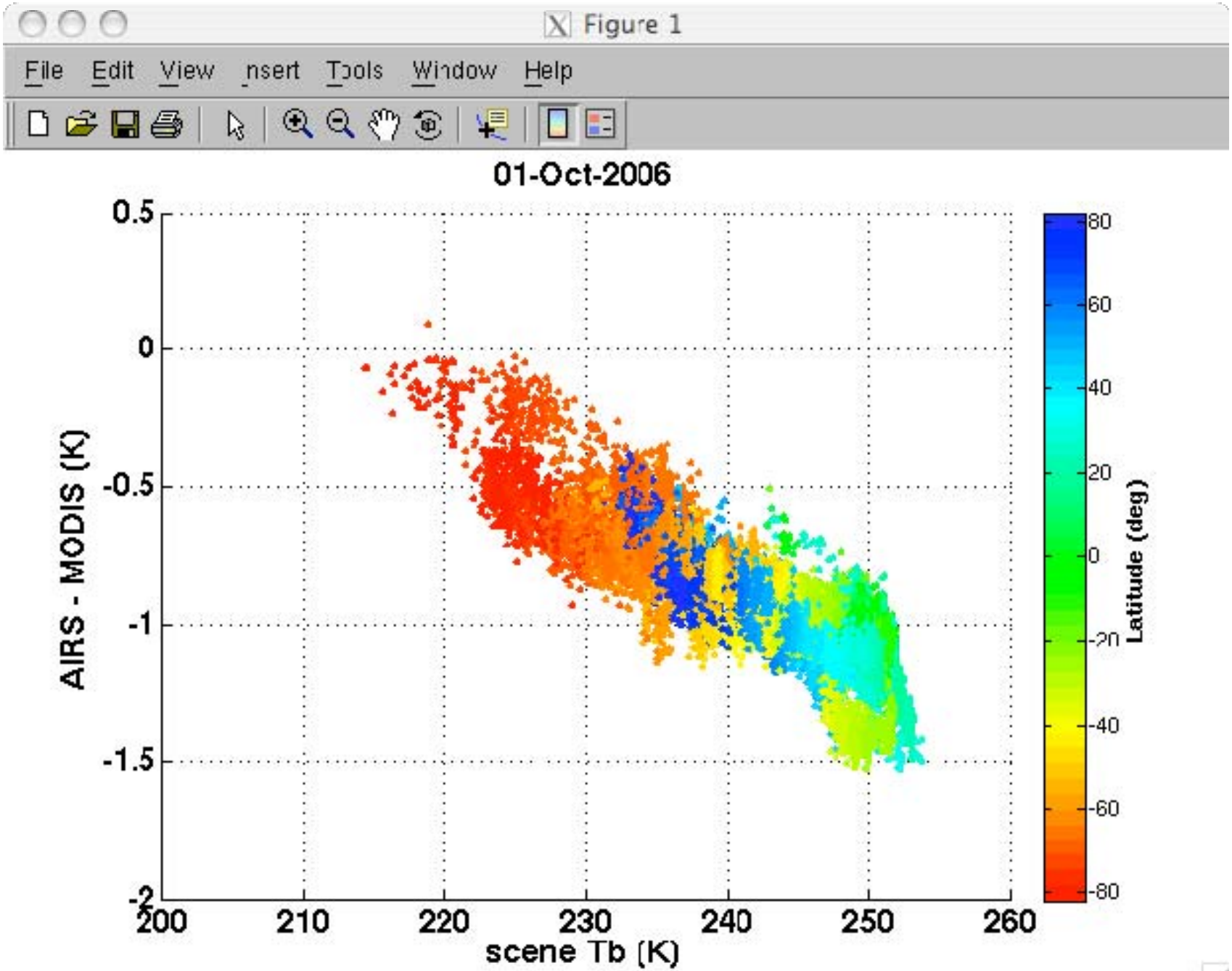
Figure 1
File Edit View Insert Tools Window Help
01-Oct-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

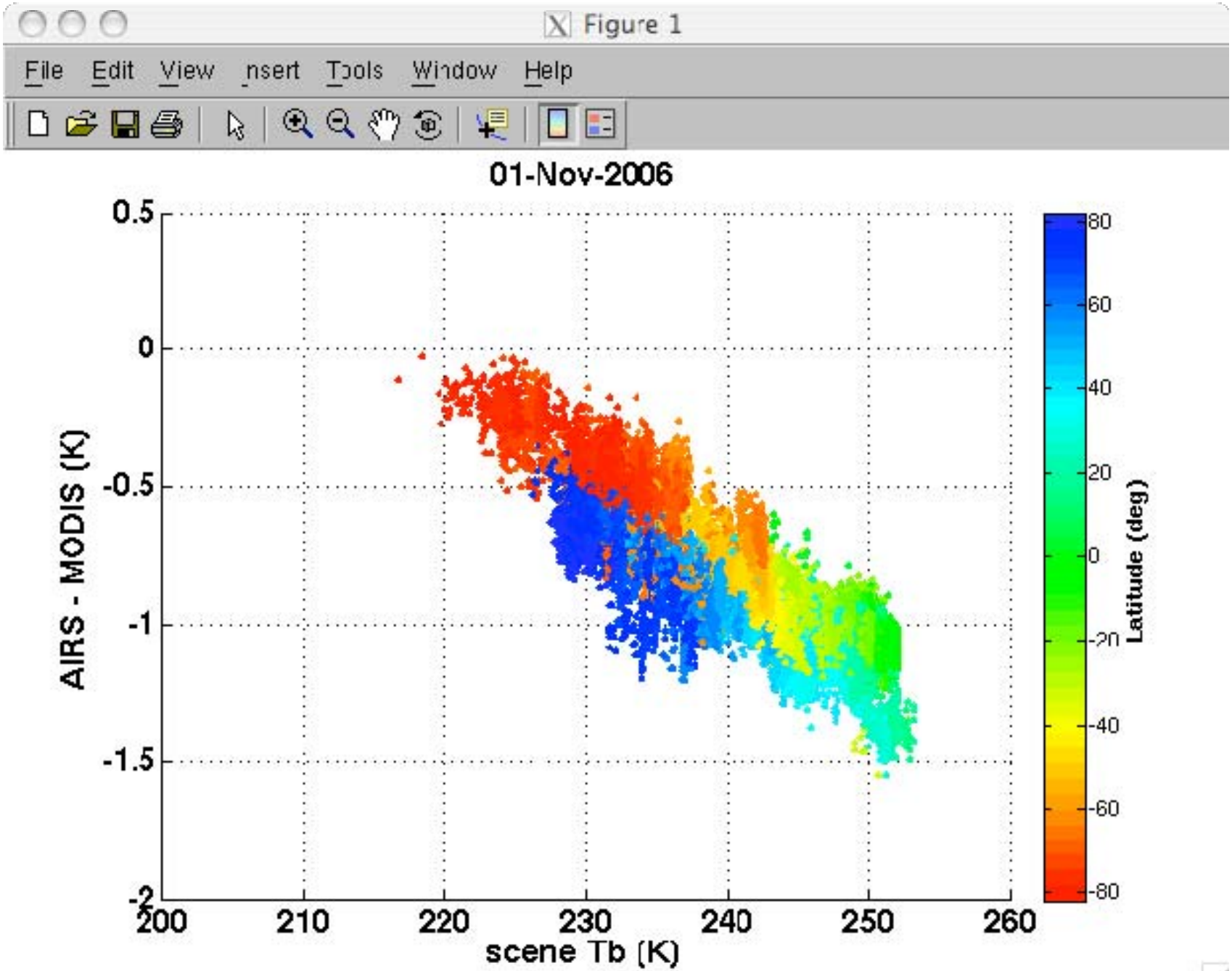
Figure 1
File Edit View Insert Tools Window Help
01-Nov-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
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0
-20
-40
-60
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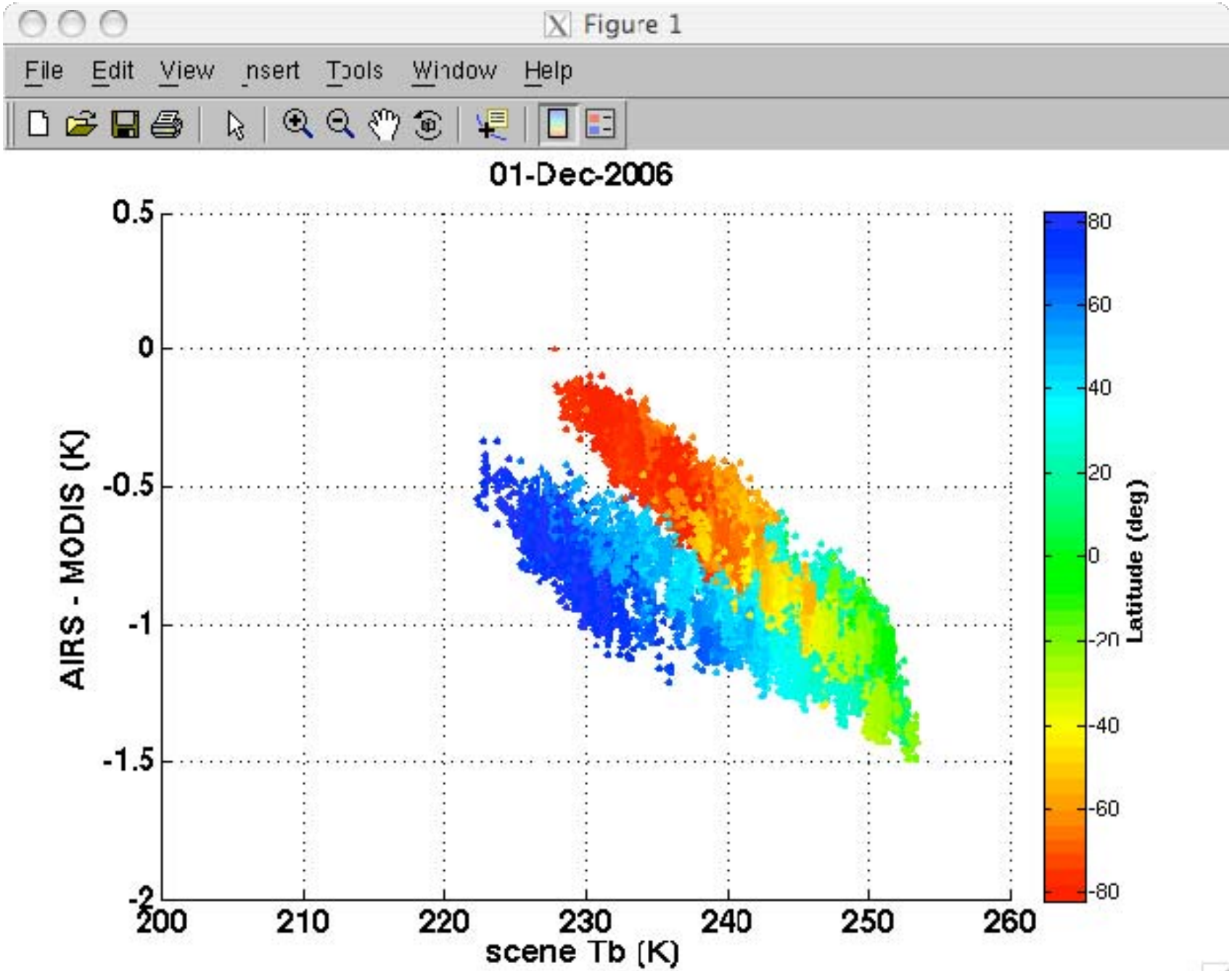
Figure 1
File Edit View Insert Tools Window Help
01-Dec-2006
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
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240
250
260
scene Tb (K)
Latitude (deg)
80
60
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-20
-40
-60
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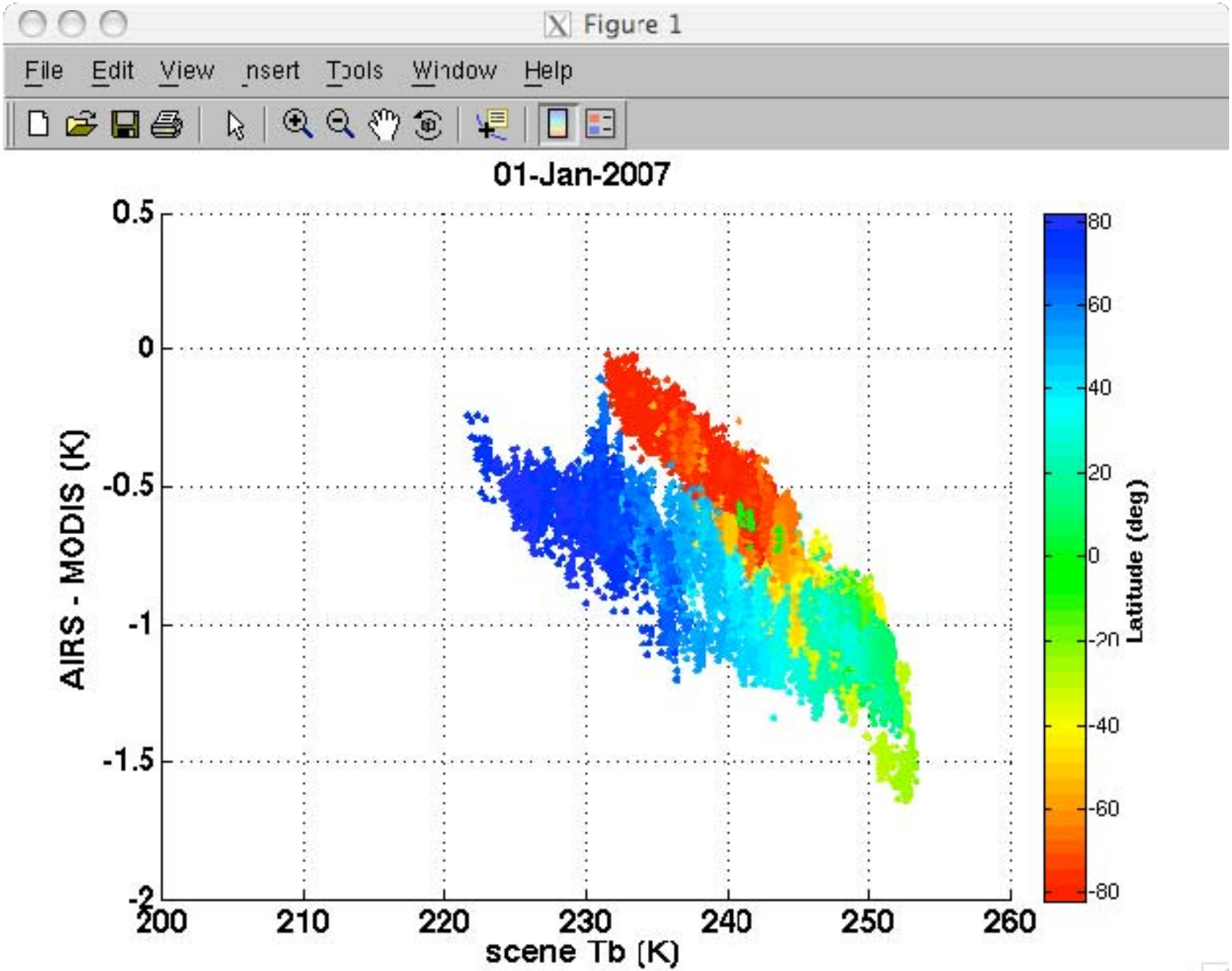
Figure 1
File Edit View Insert Tools Window Help
01-Jan-2007
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
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240
250
260
scene Tb (K)
Latitude (deg)
80
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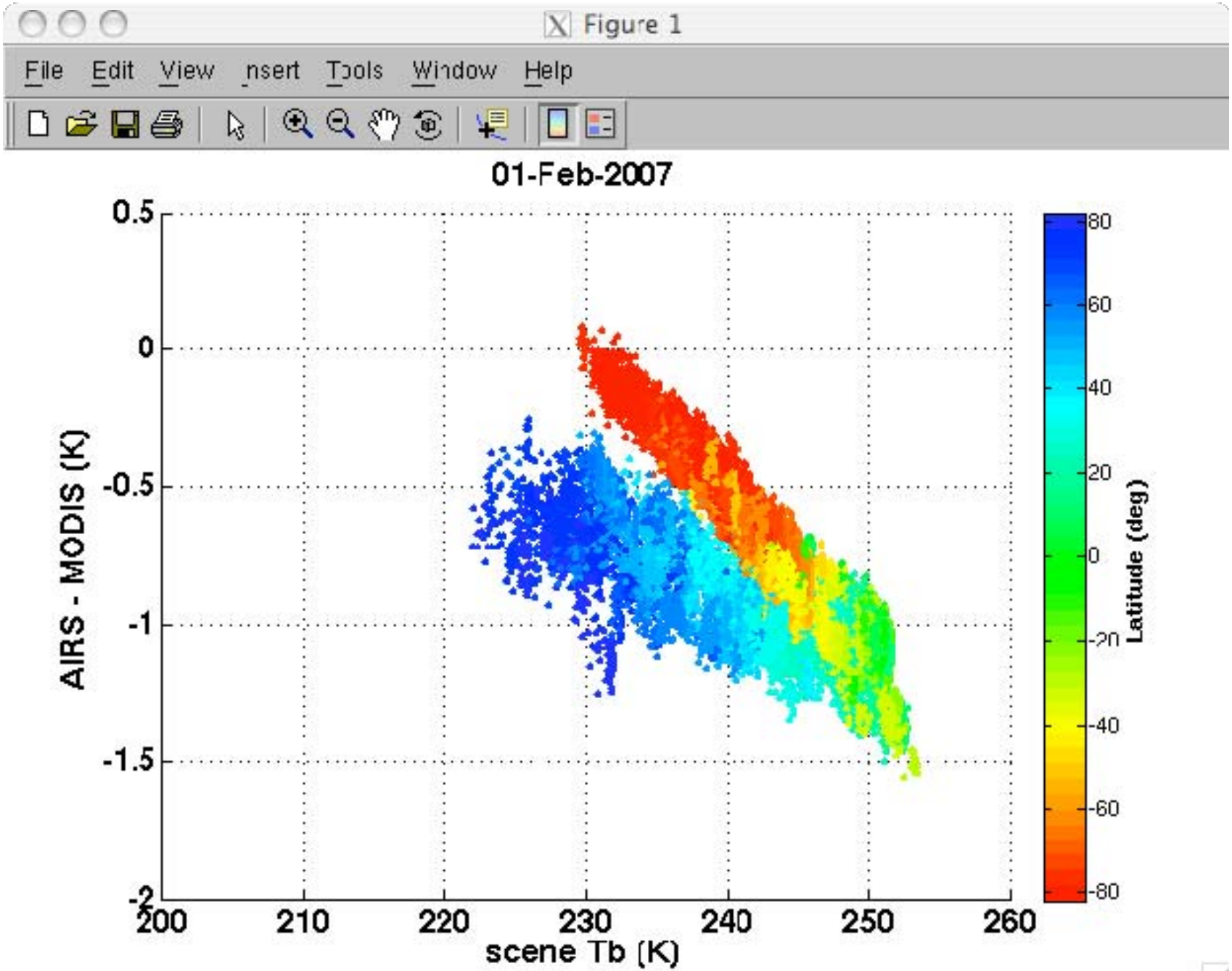
Figure 1
File Edit View Insert Tools Window Help
01-Feb-2007
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
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-0.5
-1
-1.5
-2
200
210
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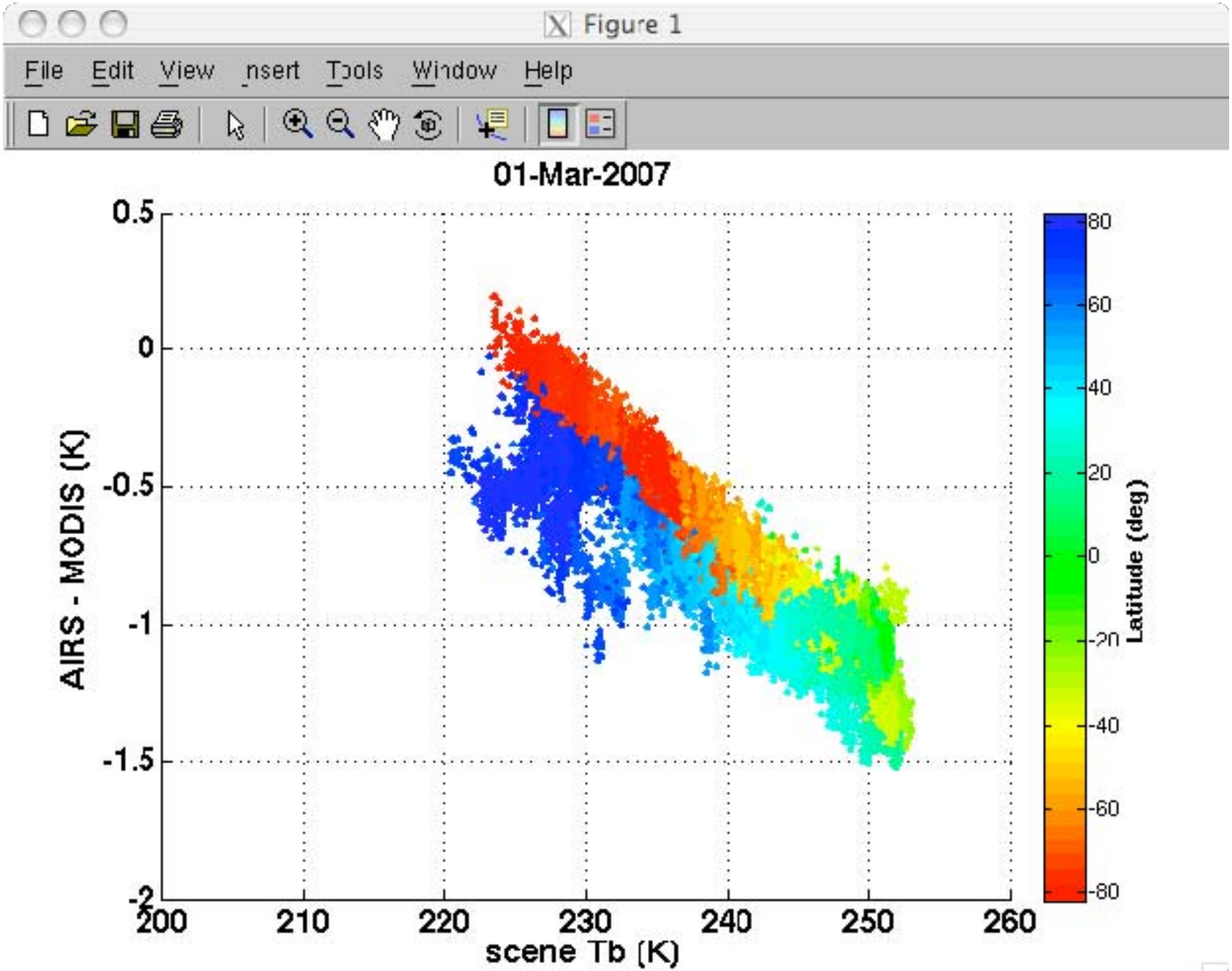
Figure 1
File Edit View Insert Tools Window Help
01-Mar-2007
AIRS - MODIS (K)
0.5
0
-0.5
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-1.5
-2
200
210
220
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240
250
260
scene Tb (K)
Latitude (deg)
80
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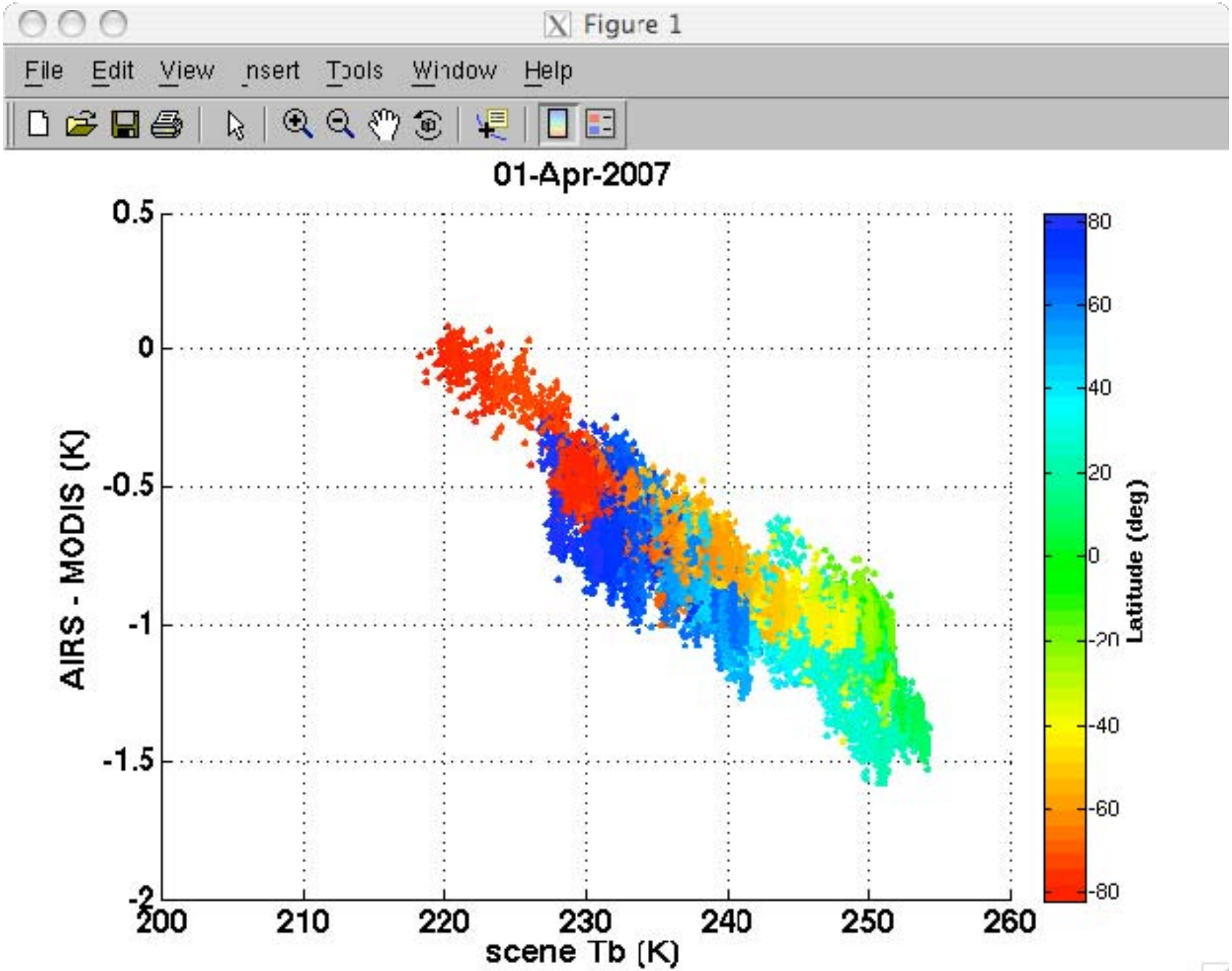
Figure 1
File Edit View Insert Tools Window Help
01-Apr-2007
AIRS - MODIS (K)
0.5
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200
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scene Tb (K)
Latitude (deg)
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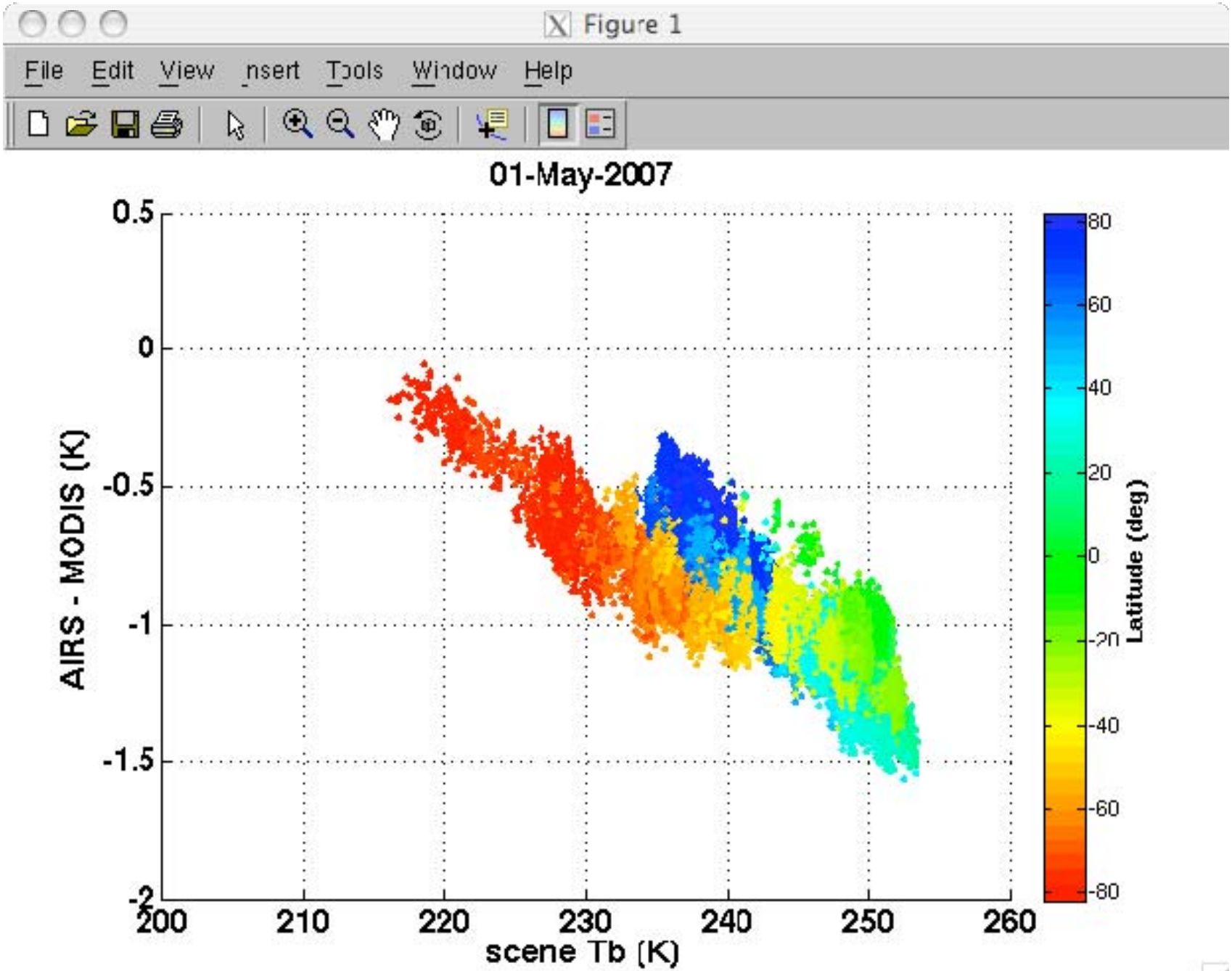
Figure 1
File Edit View Insert Tools Window Help
01-May-2007
AIRS - MODIS (K)
0.5
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200
210
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scene Tb (K)
Latitude (deg)
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-60
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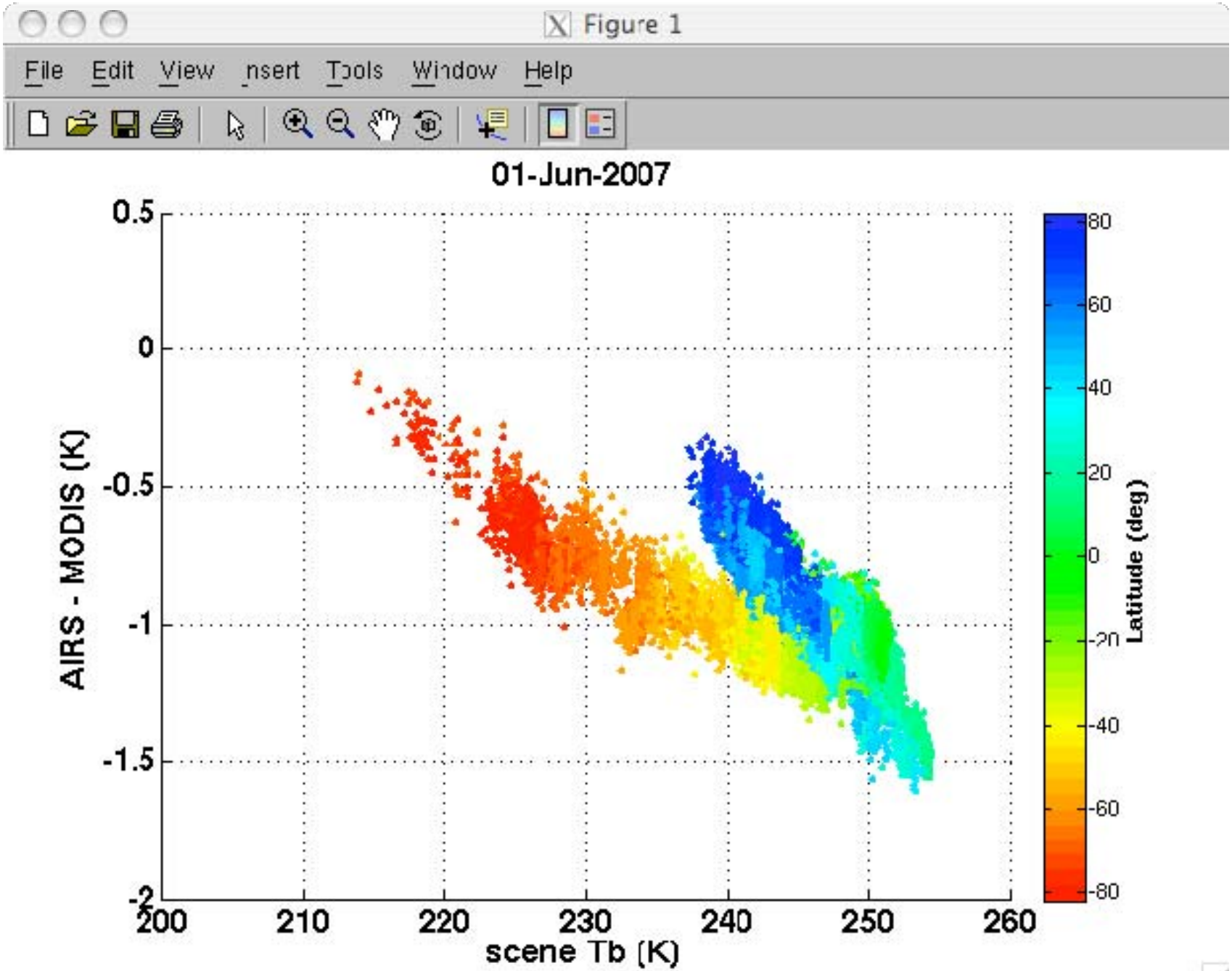
Figure 1
File Edit View Insert Tools Window Help
01-Jun-2007
AIRS - MODIS (K)
0.5
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200
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scene Tb (K)
Latitude (deg)
80
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-60
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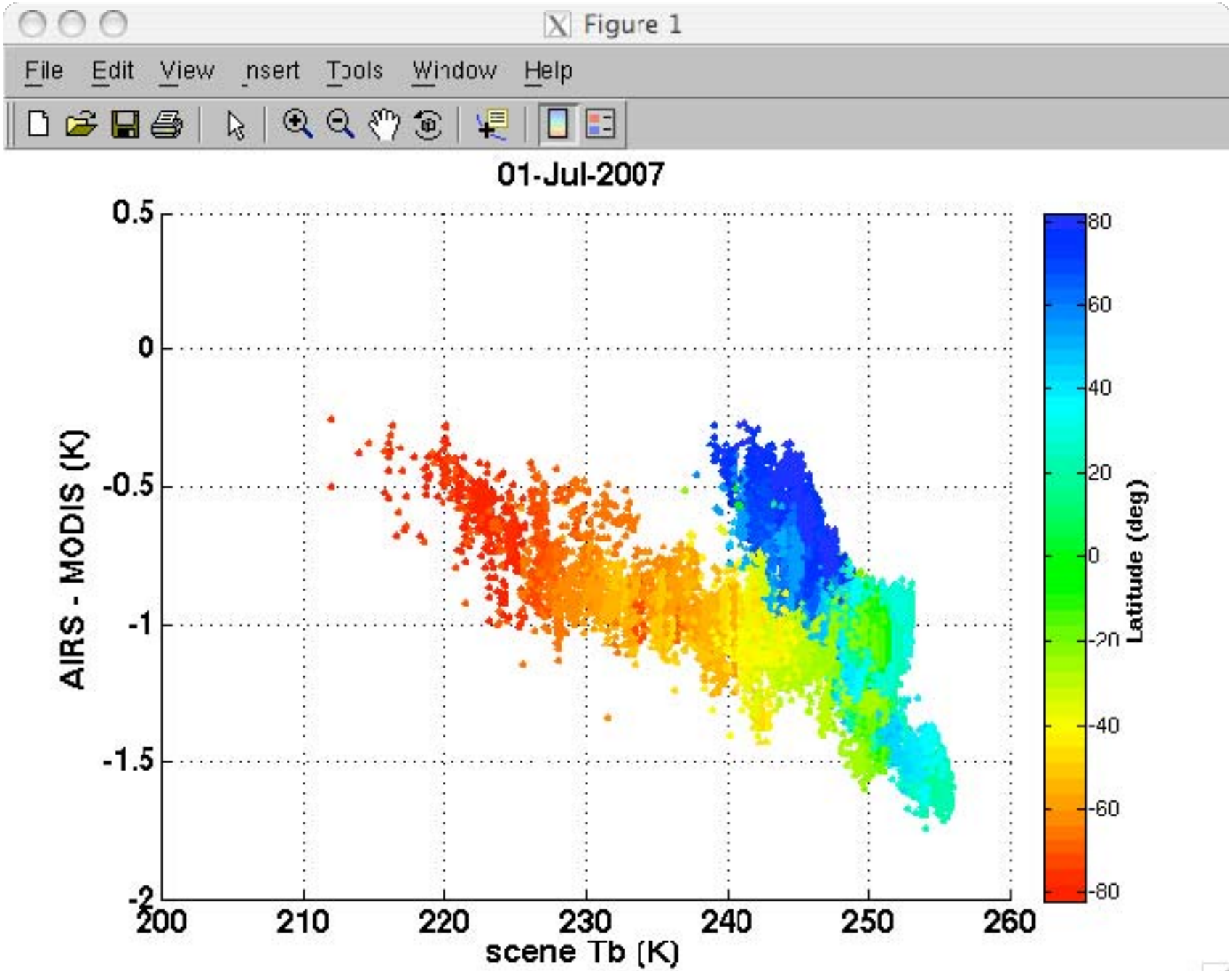
Figure 1
File Edit View Insert Tools Window Help
01-Jul-2007
AIRS - MODIS (K)
0.5
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-0.5
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200
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scene Tb (K)
Latitude (deg)
80
60
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-80

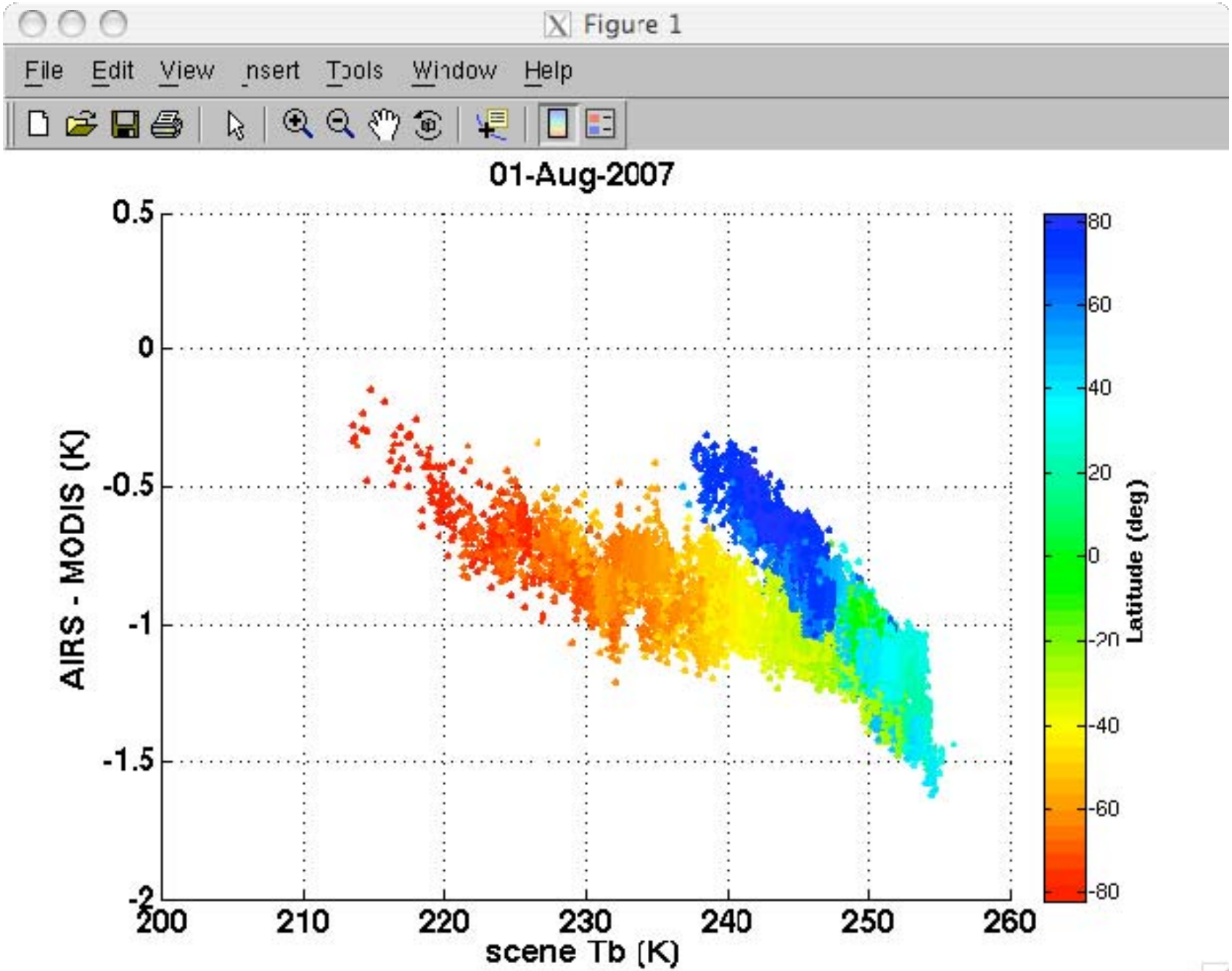
Figure 1
File Edit View Insert Tools Window Help
01-Aug-2007
AIRS - MODIS (K)
0.5
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-0.5
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-2
200
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scene Tb (K)
Latitude (deg)
80
60
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-80

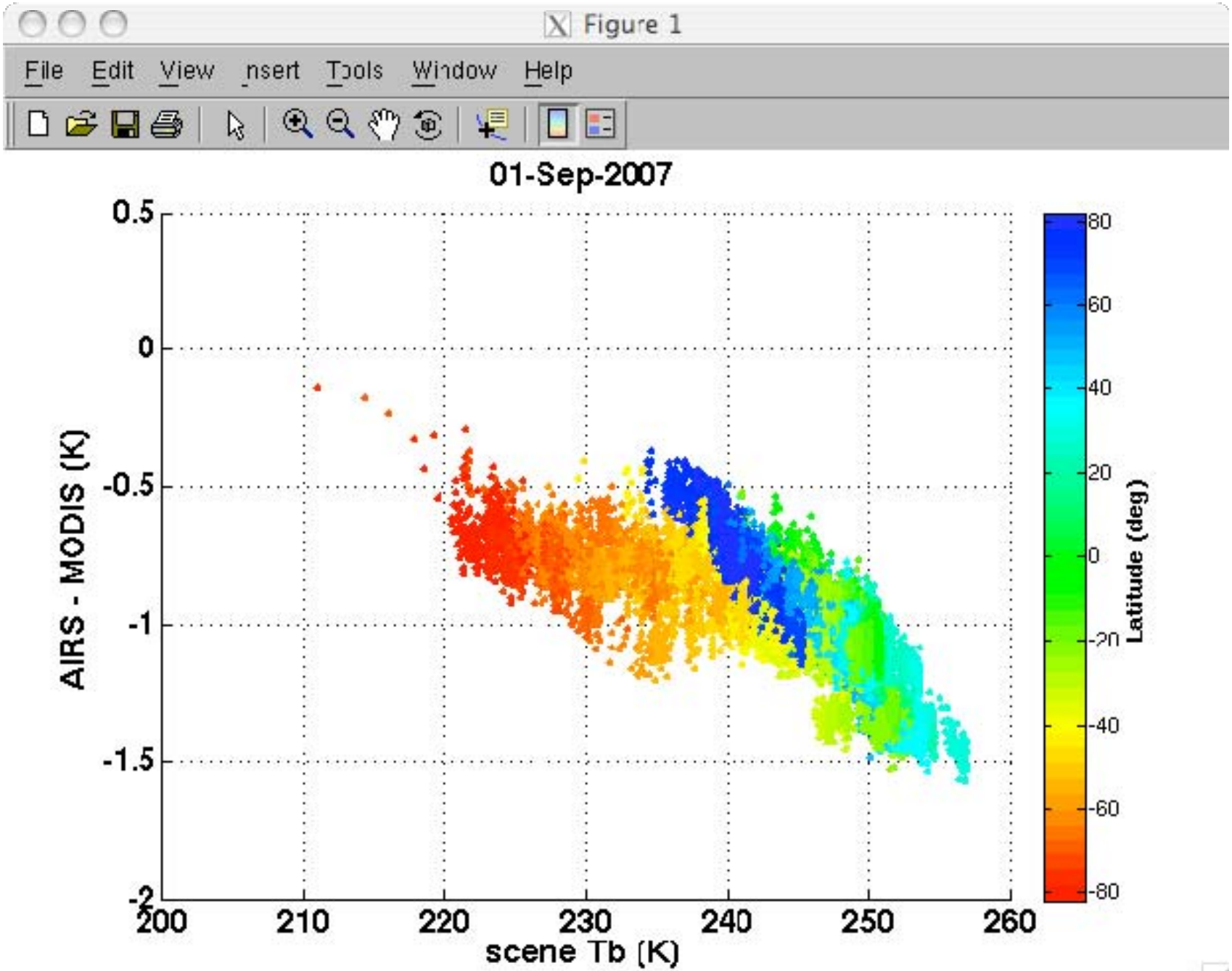


Figure 1
File Edit View Insert Tools Window Help
01-Sep-2007
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

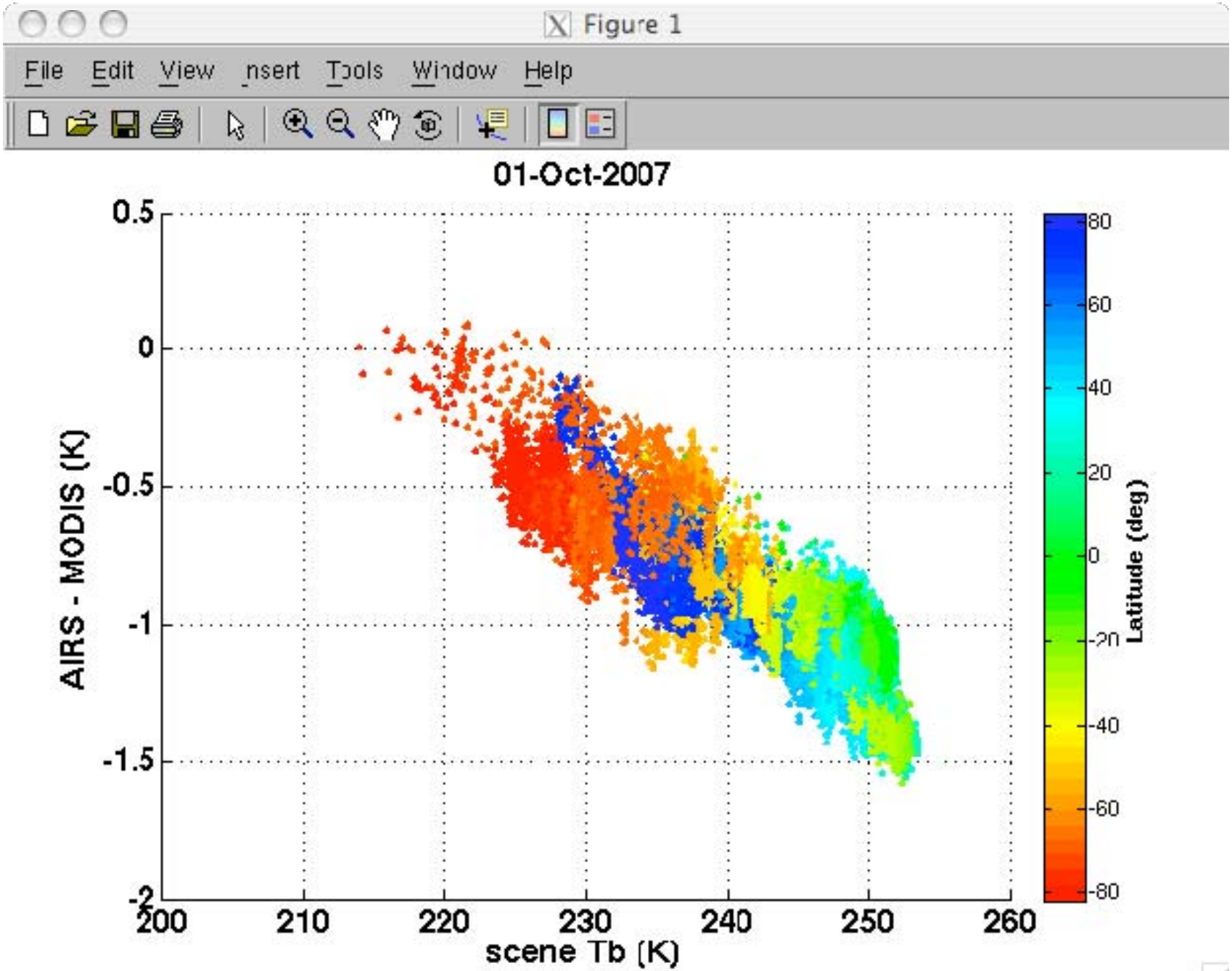


Figure 1
File Edit View Insert Tools Window Help
01-Oct-2007
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
40
20
0
-20
-40
-60
-80

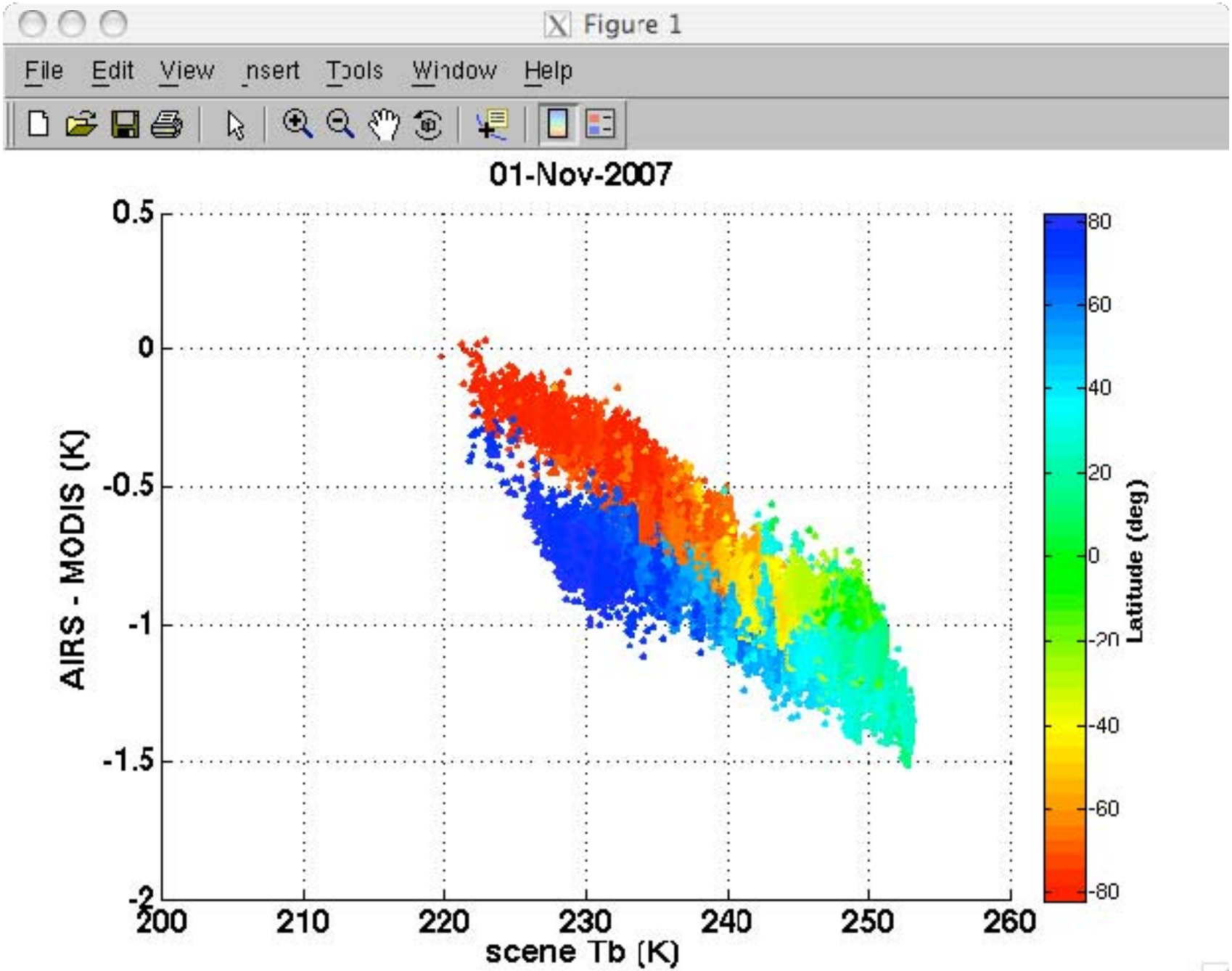


Figure 1
File Edit View Insert Tools Window Help
01-Nov-2007
AIRS - MODIS (K)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
scene Tb (K)
Latitude (deg)
80
60
40
20
0
-20
-40
-60
-80

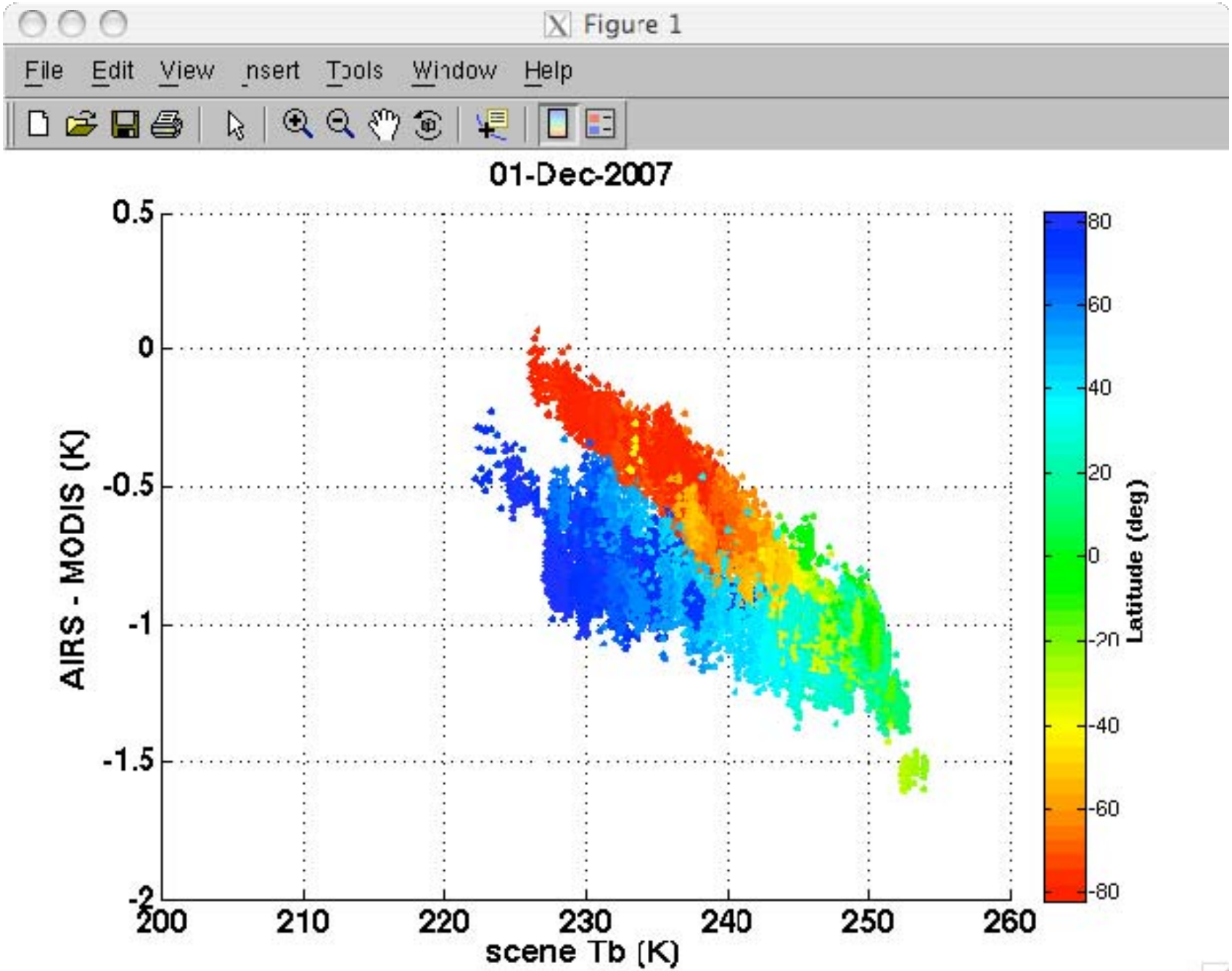
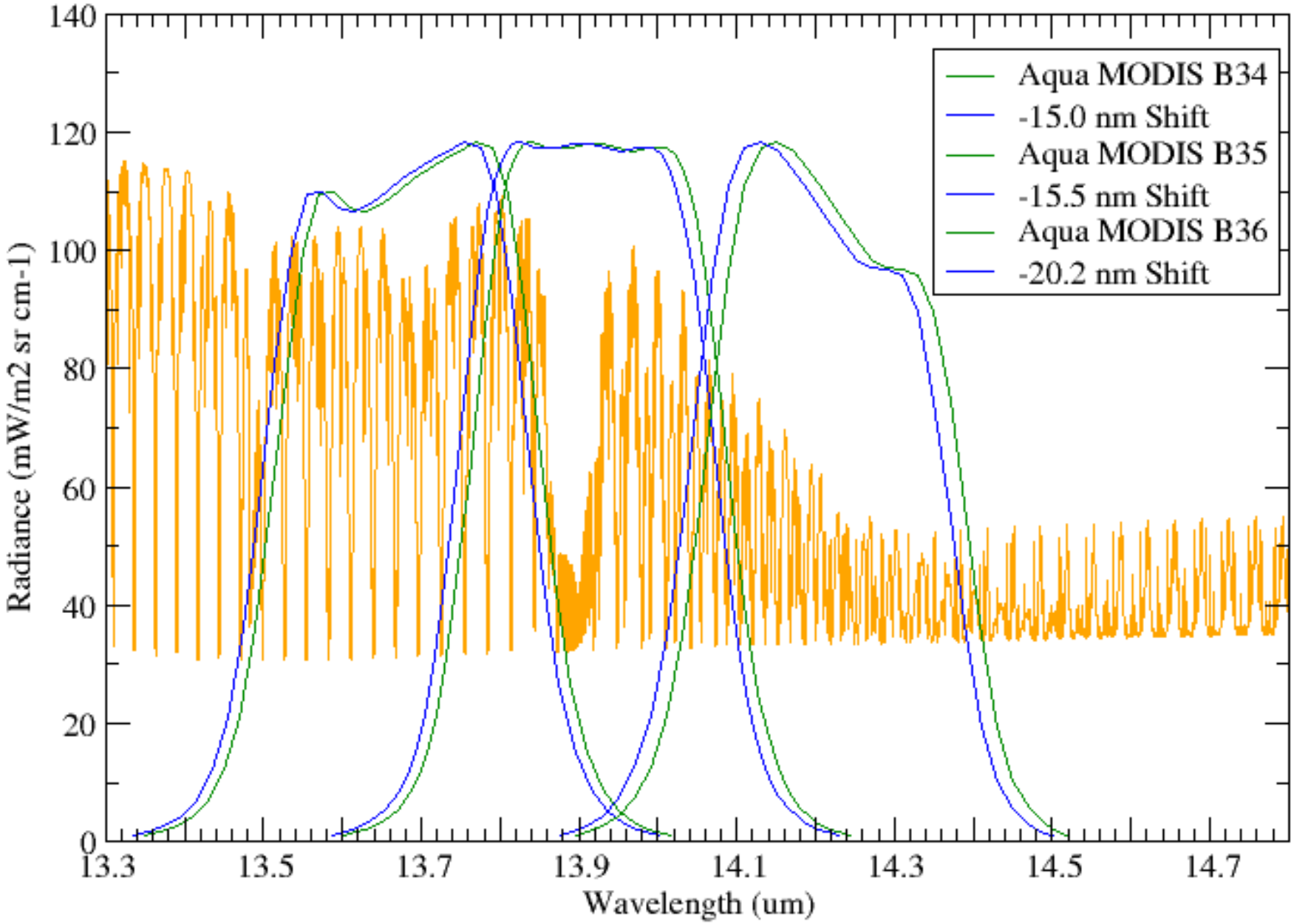


Figure 1
File Edit View Insert Tools Window Help
01-Dec-2007
AIRS - MODIS (K)
scene Tb (K)
Latitude (deg)
0.5
0
-0.5
-1
-1.5
-2
200
210
220
230
240
250
260
80
60
40
20
0
-20
-40
-60
-80

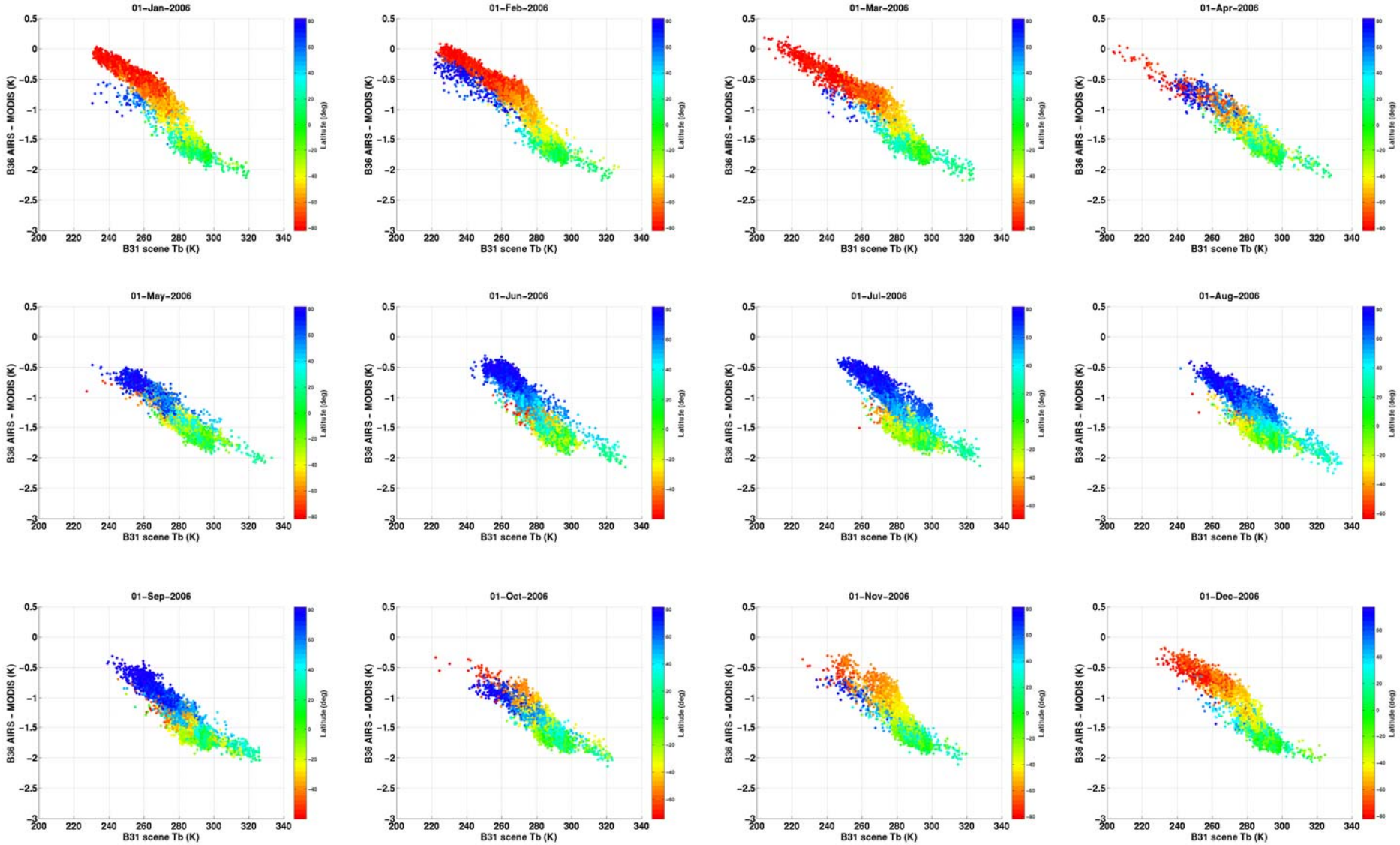
What Are Some Influences That Could Cause This Behavior?

- MODIS spectral characterization error
  - Atmospheric profile variation by season would cause latitudinal dependence of bias
  - Tobin analysis has demonstrated viability
  - Physical mechanism still undetermined
- MODIS out-of-band filter leaks
  - Atmospheric profile variation influence
  - No useful OOB prelaunch data for these bands
- MODIS optical or electronic crosstalk
  - Terra had 11um Xtalk, but was fixed for Aqua

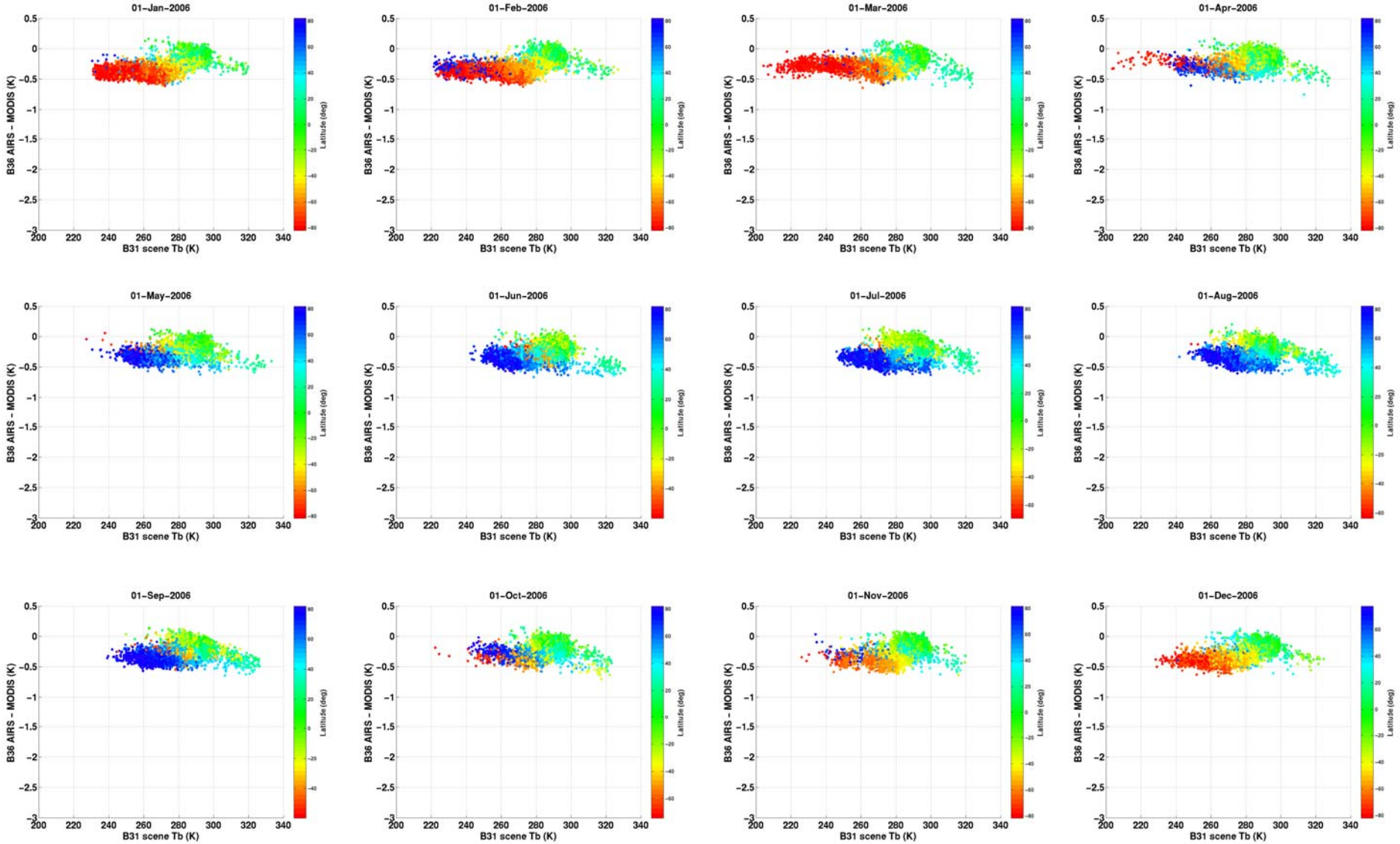
Aqua MODIS RSR over model spectrum



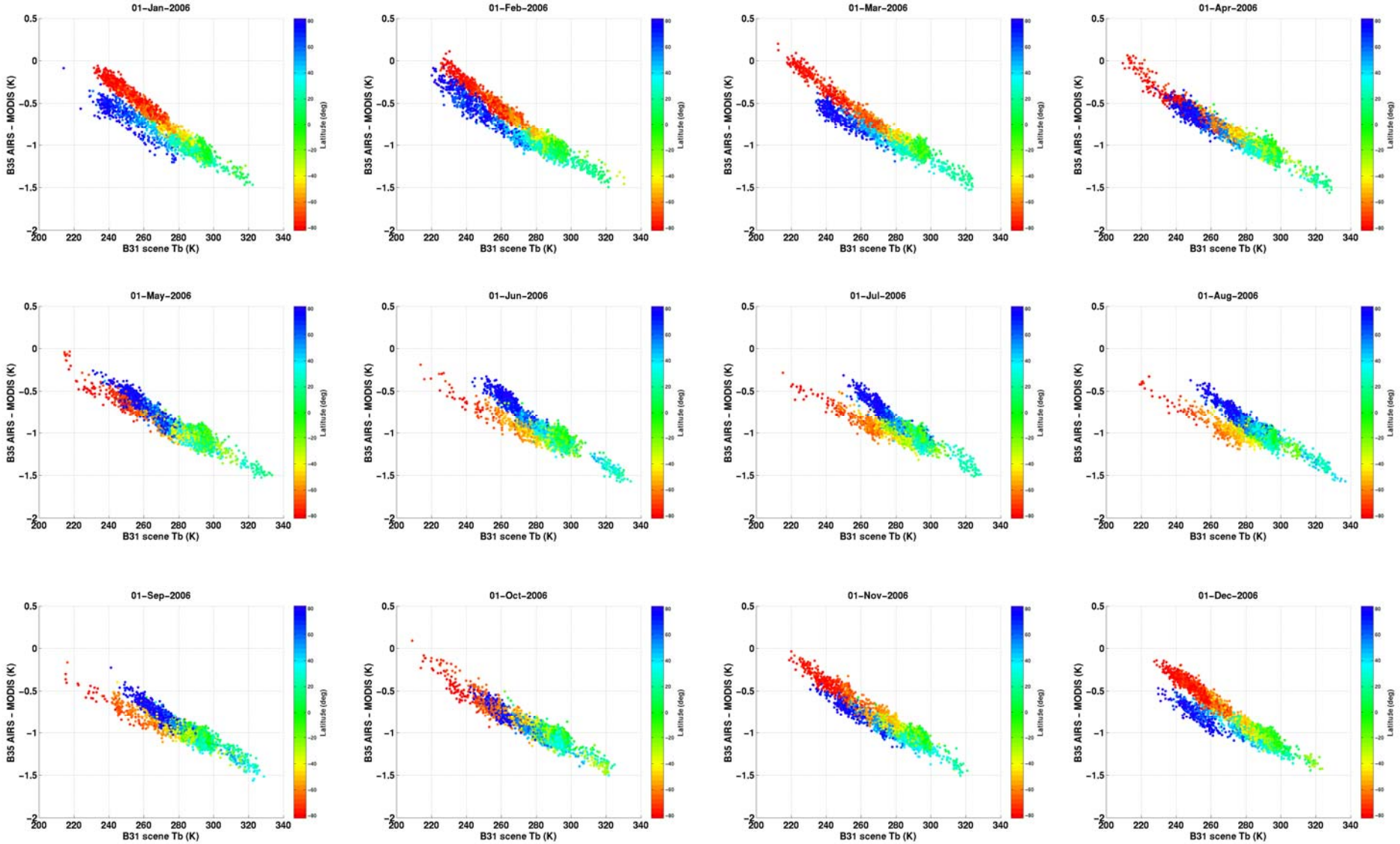
AIRS minus MODIS, Band 36 vs B31 Scene Temp



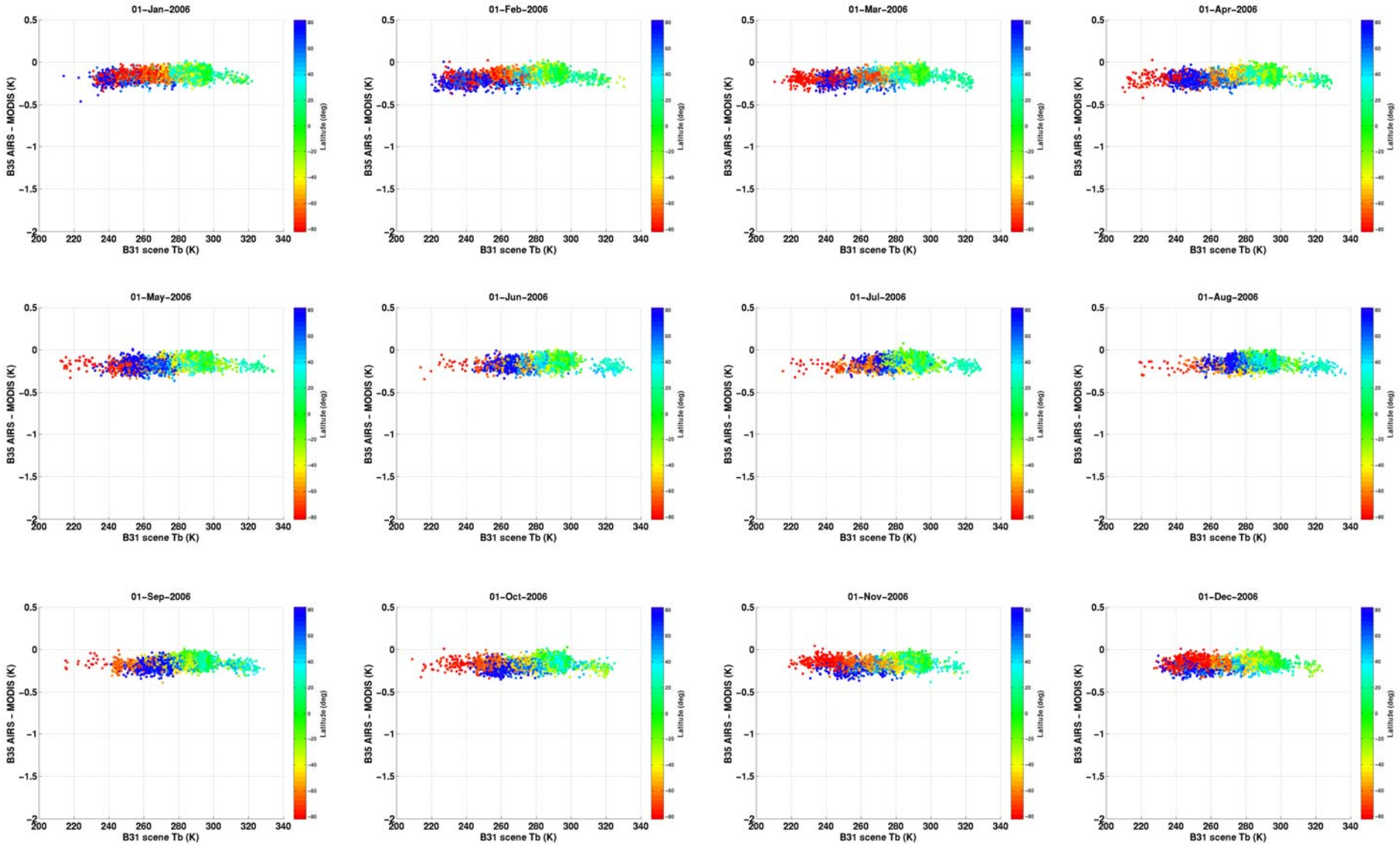
AIRS minus MODIS, Band 36 vs B31, with 1.0 cm^{-1} SRF shift



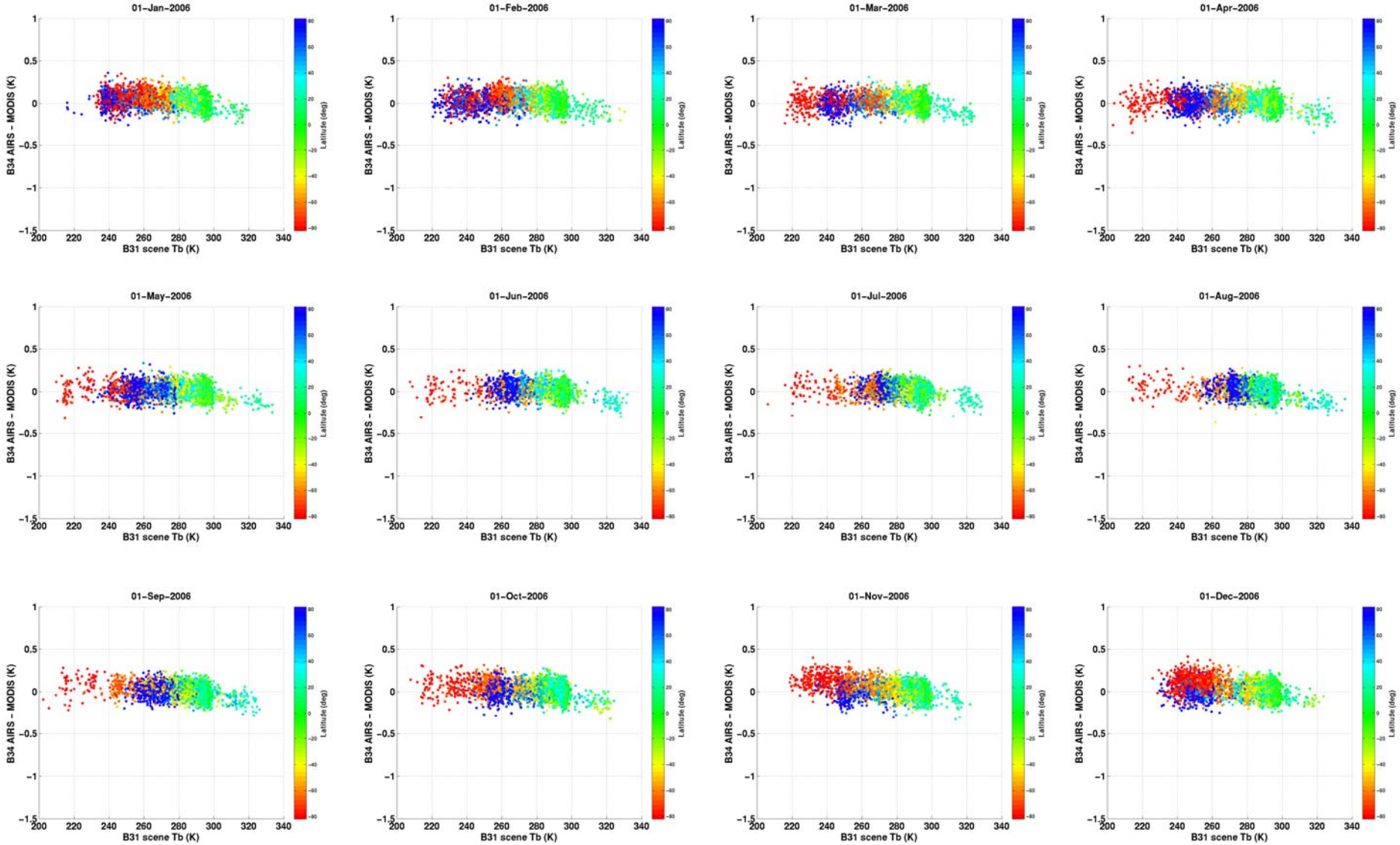
AIRS minus MODIS, Band 35 vs B31 Scene Temp



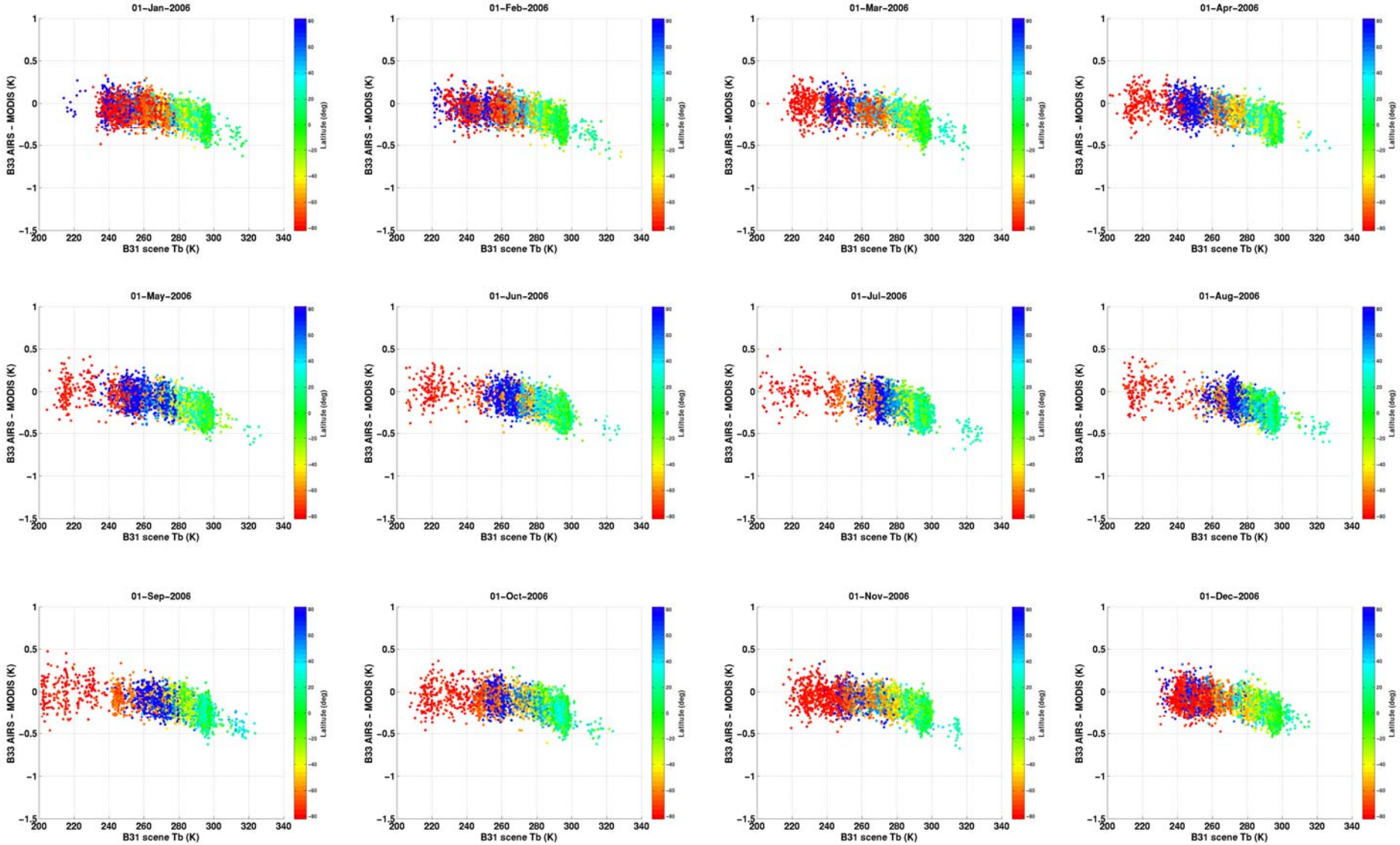
AIRS minus MODIS, Band 35, with 0.8 cm^{-1} SRF shift



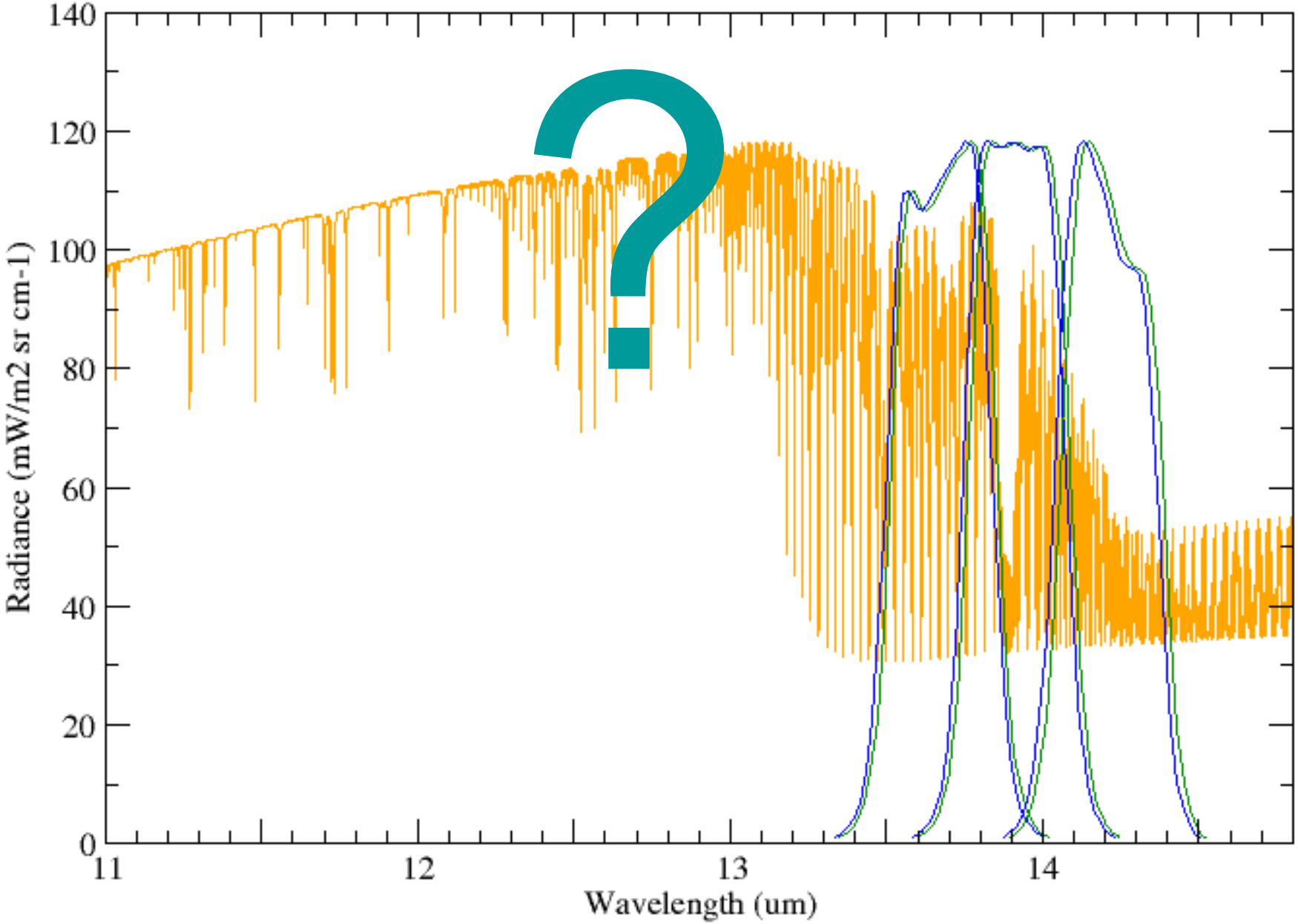
AIRS minus MODIS, Band 34 vs B31 Scene Temp

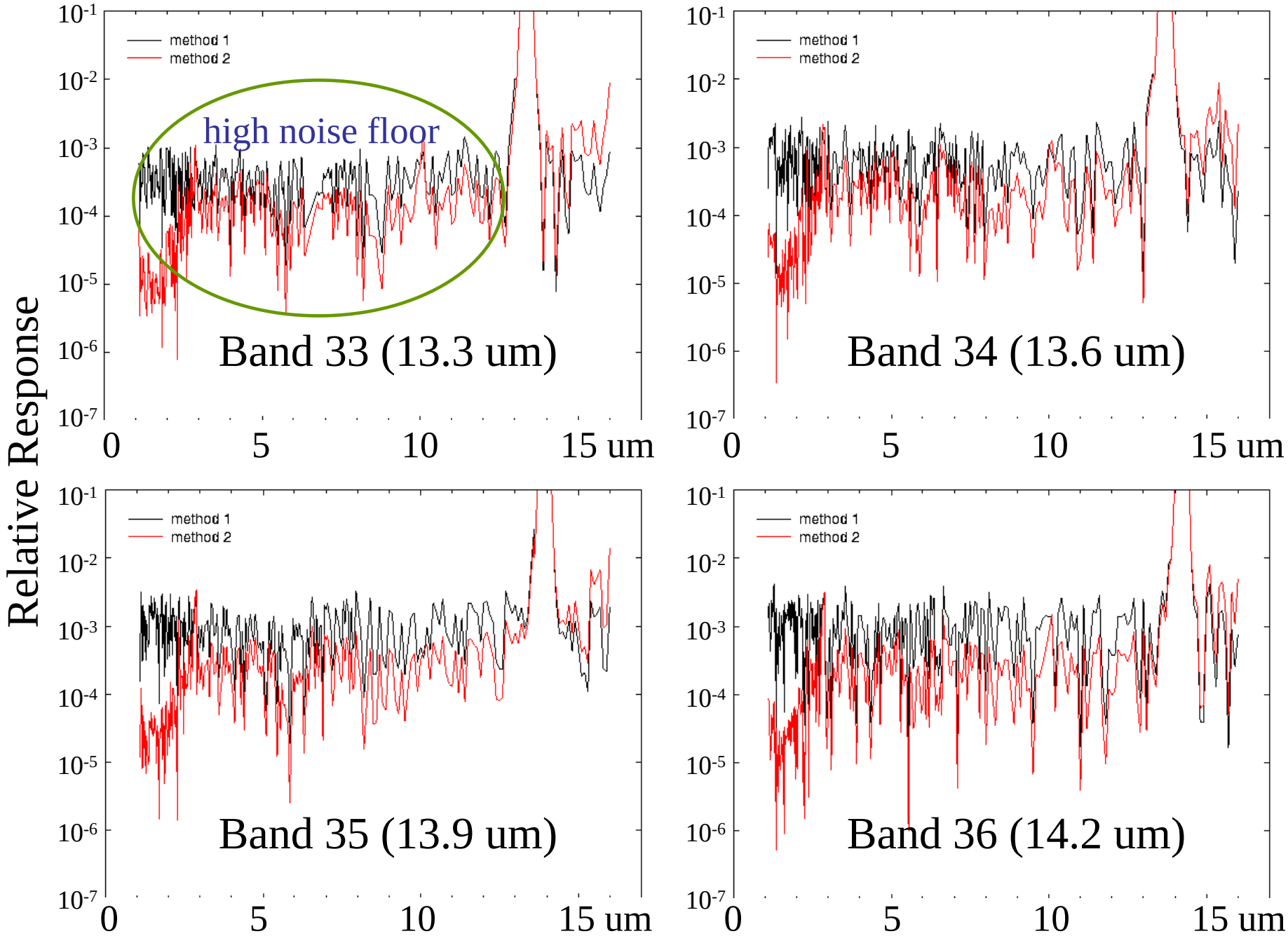


AIRS minus MODIS, Band 33 vs B31 Scene Temp



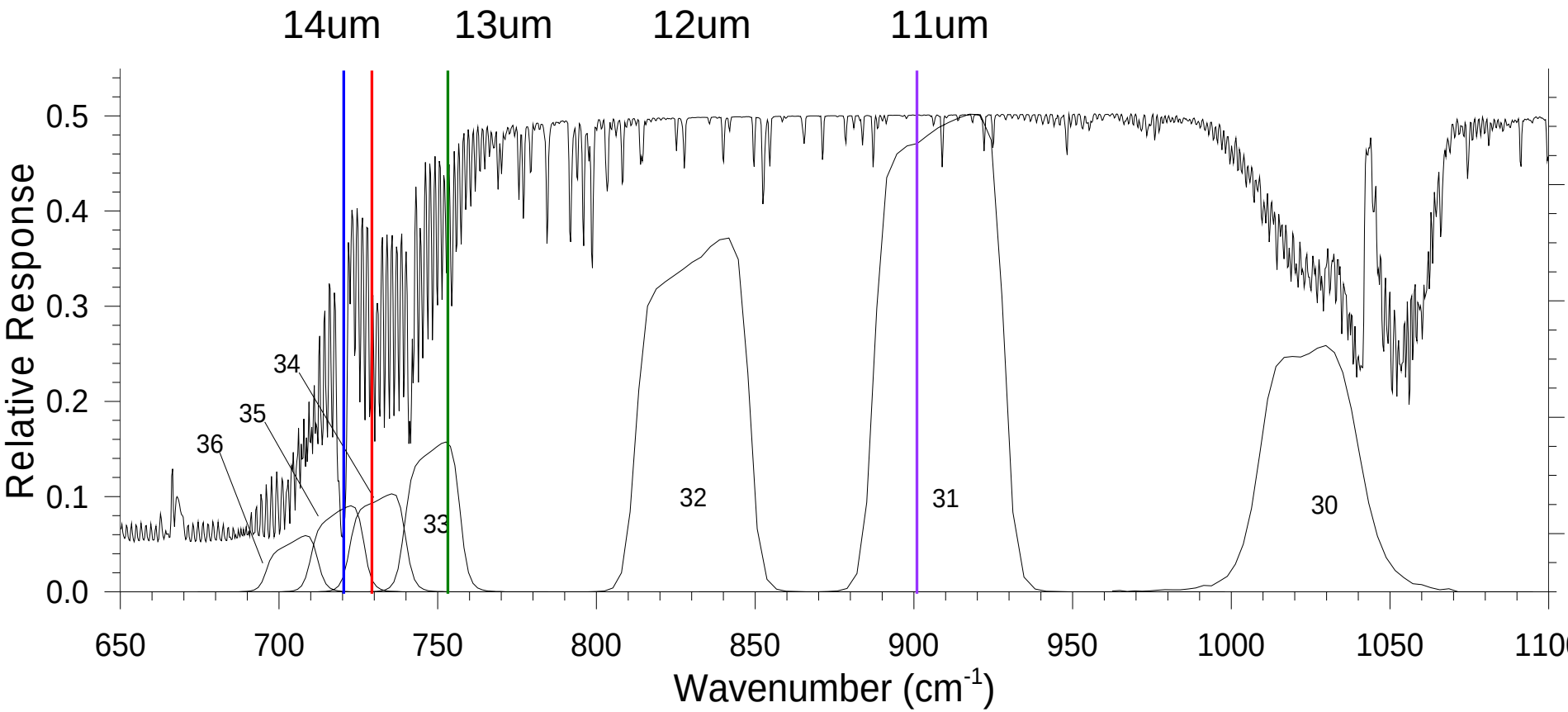
What about OOB filter leaks in B33-36?

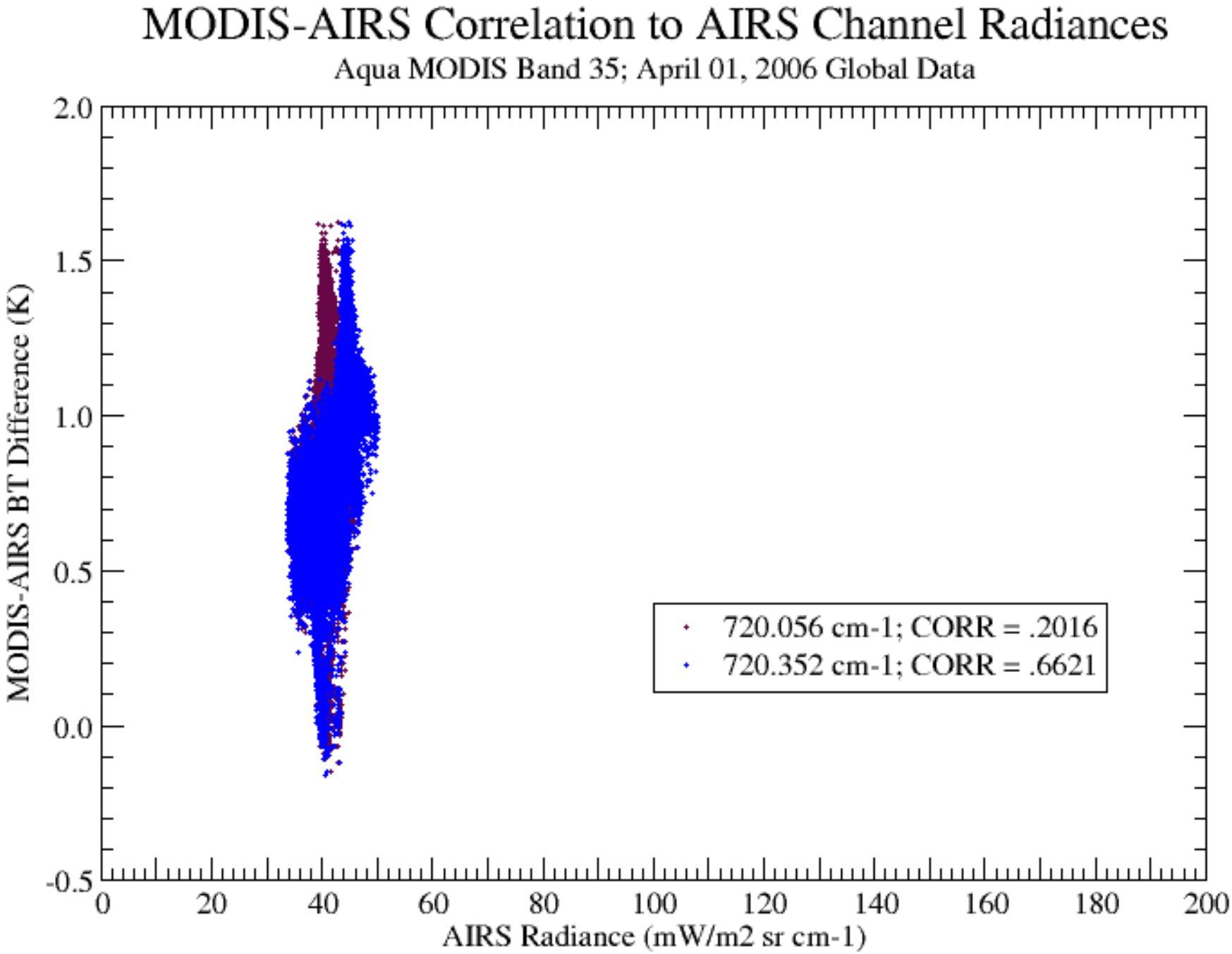


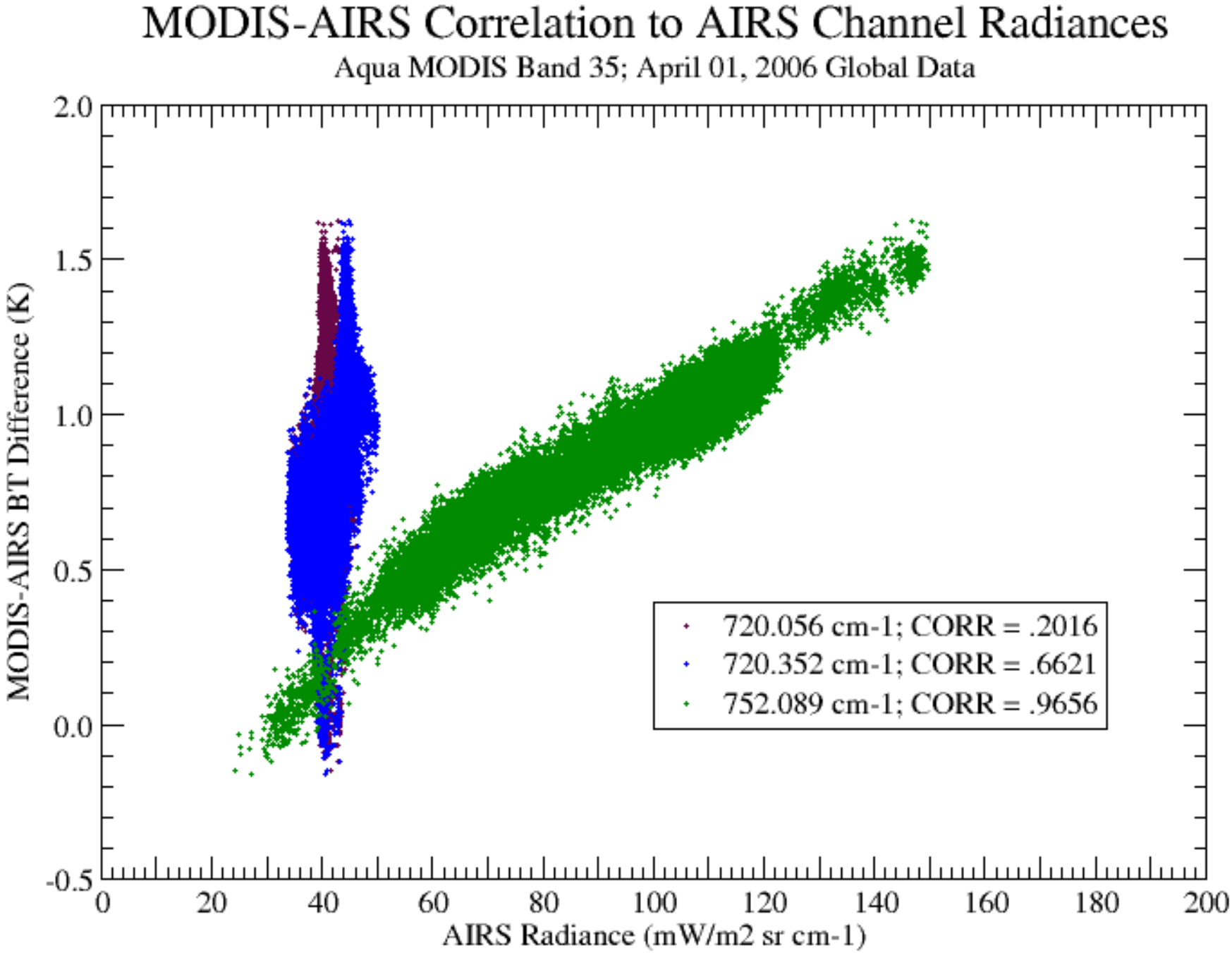

Relative Response
method 1
method 2
high noise floor
Band 33 (13.3 um)
Band 34 (13.6 um)
Band 35 (13.9 um)
Band 36 (14.2 um)
10-1
10-2
10-3
10-4
10-5
10-6
10-7
0
5
10
15 um

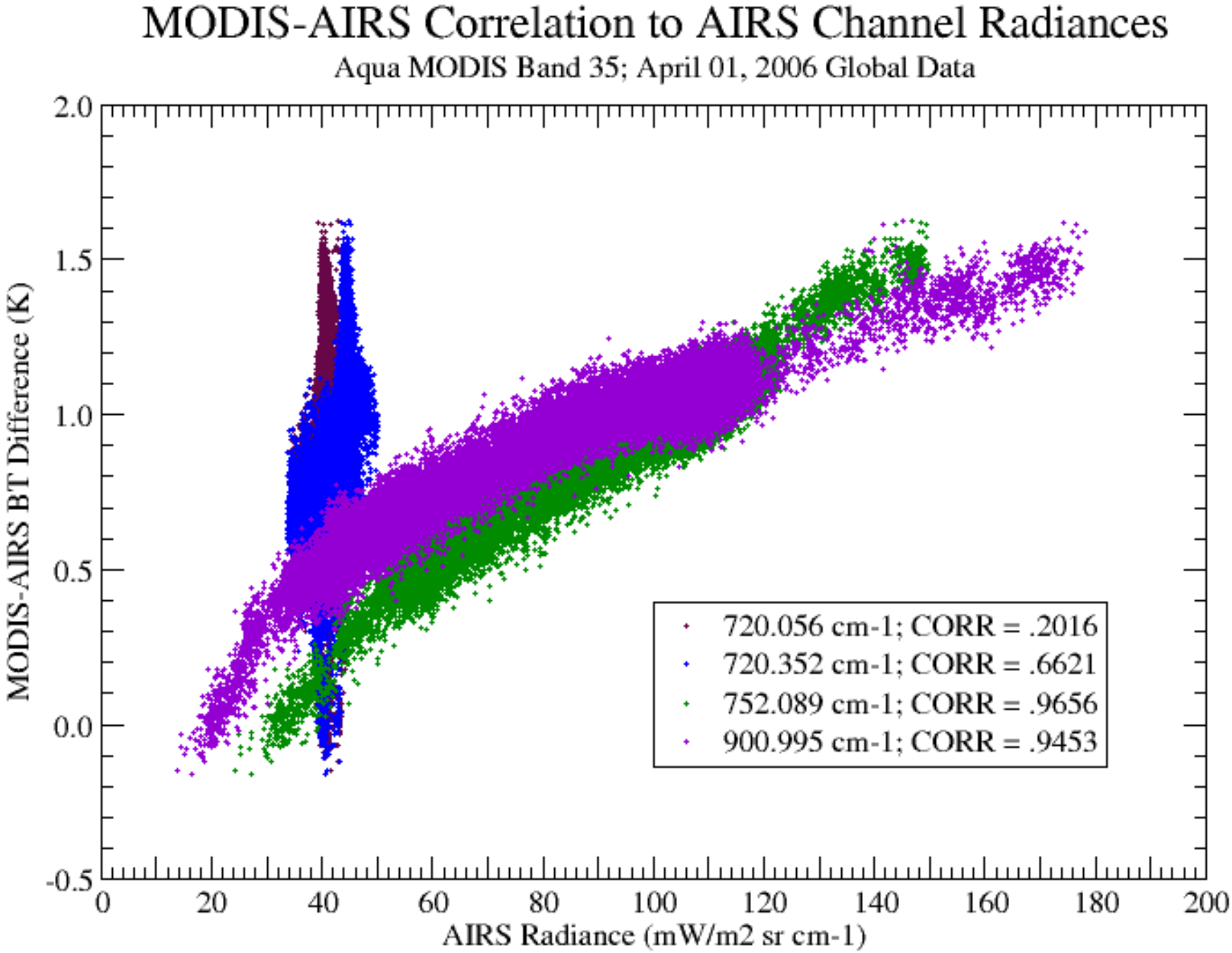
Wisconsin has begun an investigation into possibility of OOB leaks in B33-36

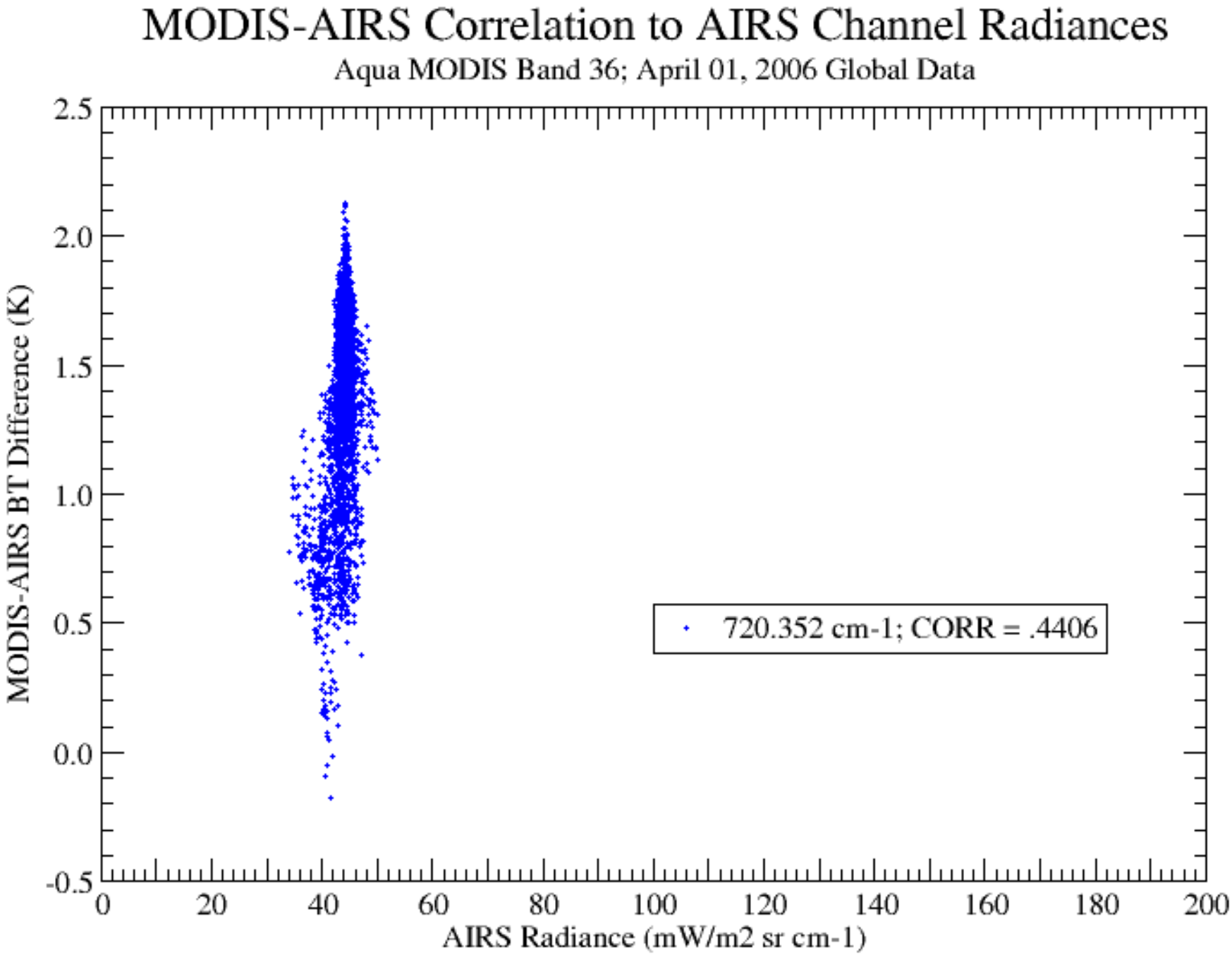
- Correlate individual AIRS spectral channels to MODIS-AIRS differences
- Global data set for one day
- Review linear correlations as first look into possible OOB spectral regions that might contaminate MODIS observations
- Suggestive only, not conclusive
- Preliminary

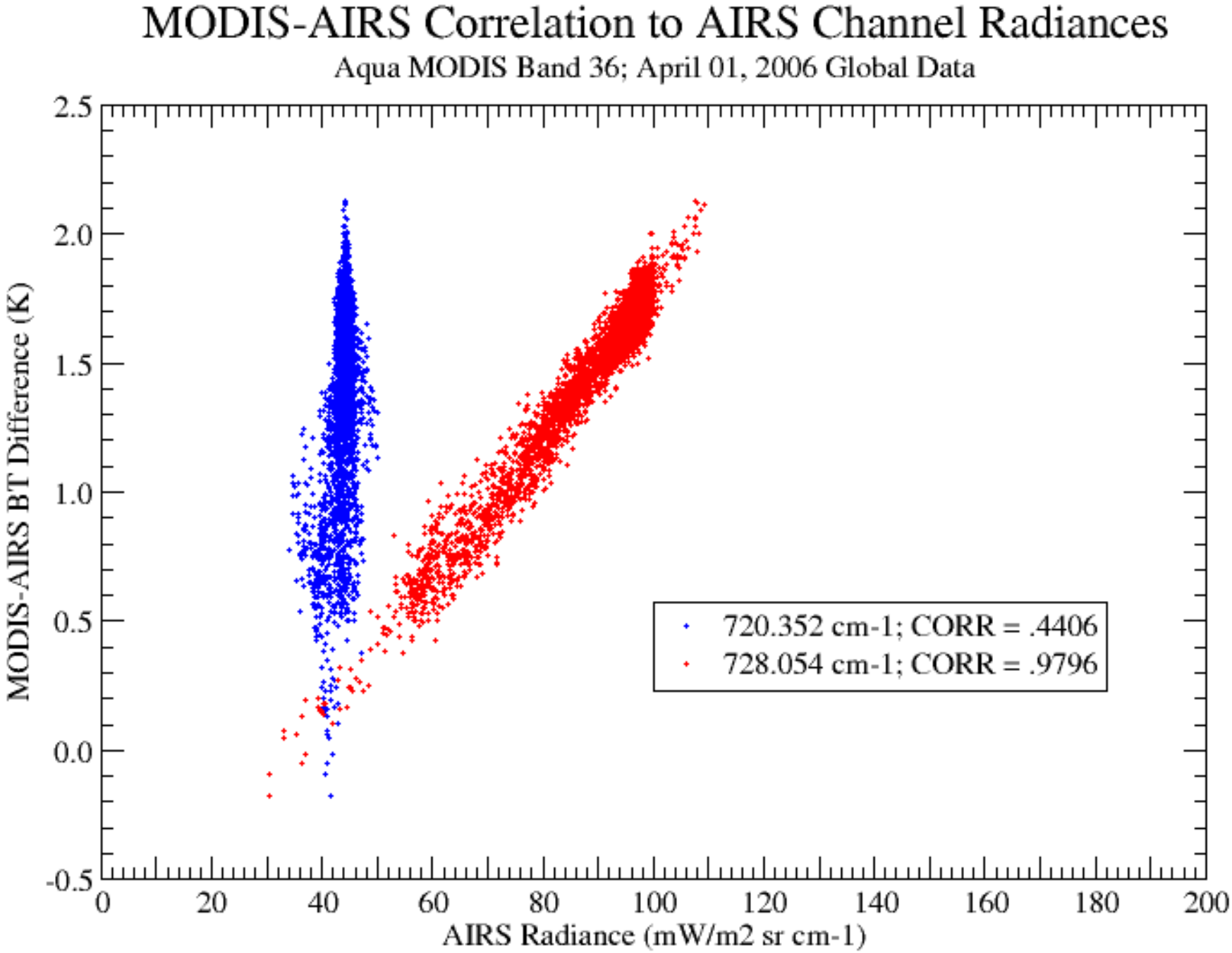

14um
13um
12um
11um
Relative Response
0.0
0.1
0.2
0.3
0.4
0.5
650
700
750
800
850
900
950
1000
1050
1100
Wavenumber (cm-1)
34
35
36
33
32
31
30

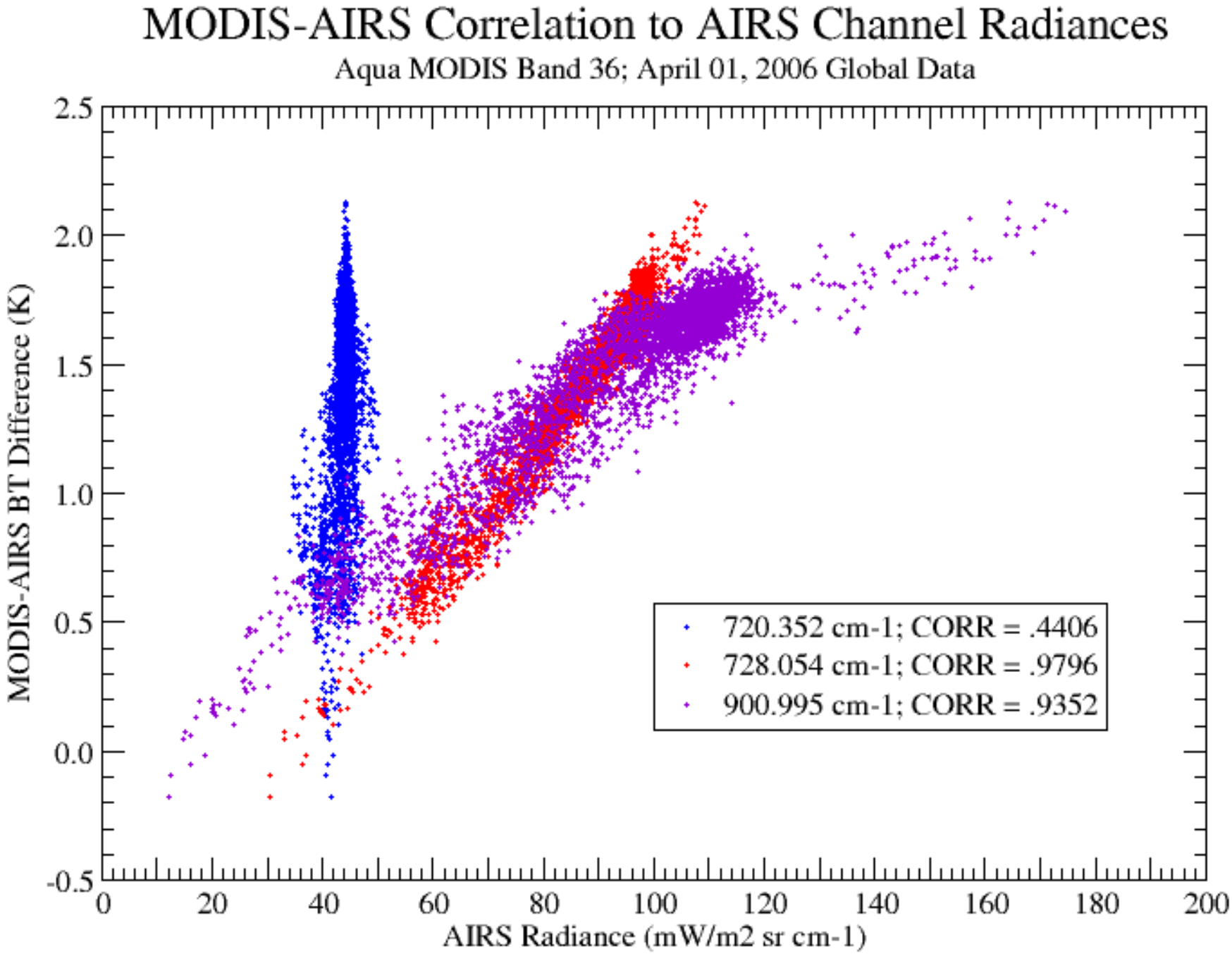

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 35; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
AIRS Radiance (mW/m2 sr cm-1)
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200
720.056 cm-1; CORR = .2016
720.352 cm-1; CORR = .6621

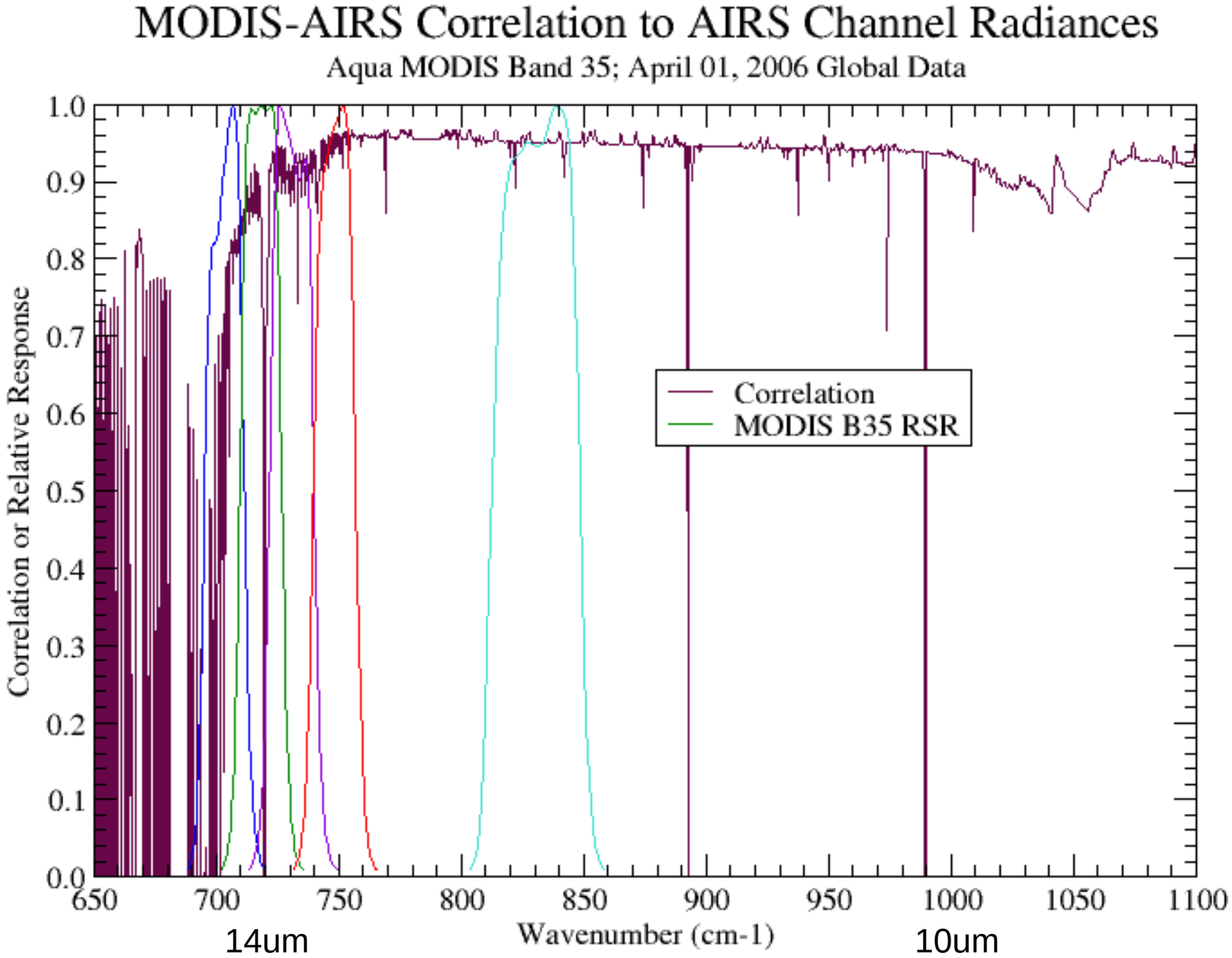

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 35; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
AIRS Radiance (mW/m2 sr cm-1)
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200
720.056 cm-1; CORR = .2016
720.352 cm-1; CORR = .6621
752.089 cm-1; CORR = .9656

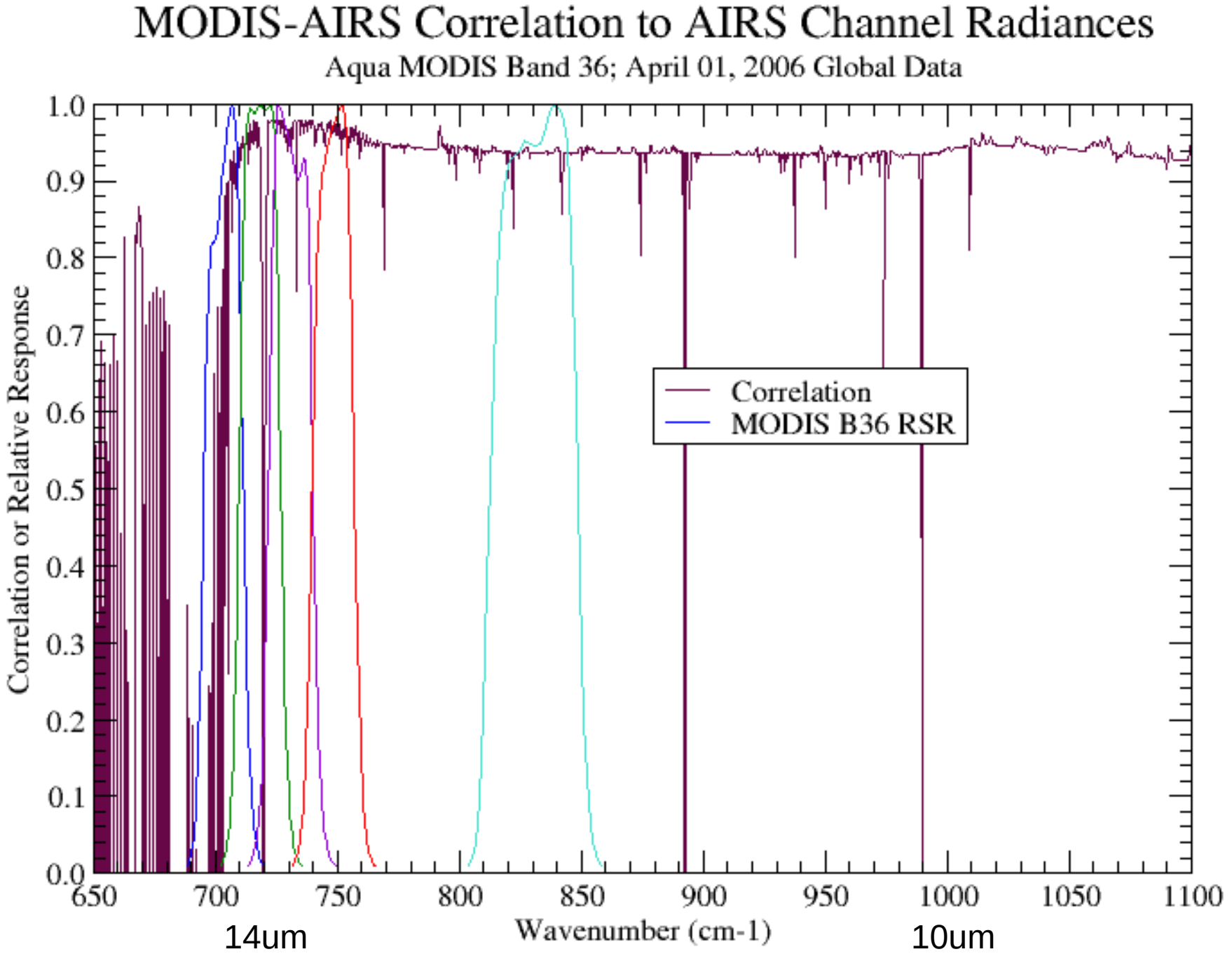

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 35; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
AIRS Radiance (mW/m2 sr cm-1)
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200
720.056 cm-1; CORR = .2016
720.352 cm-1; CORR = .6621
752.089 cm-1; CORR = .9656
900.995 cm-1; CORR = .9453

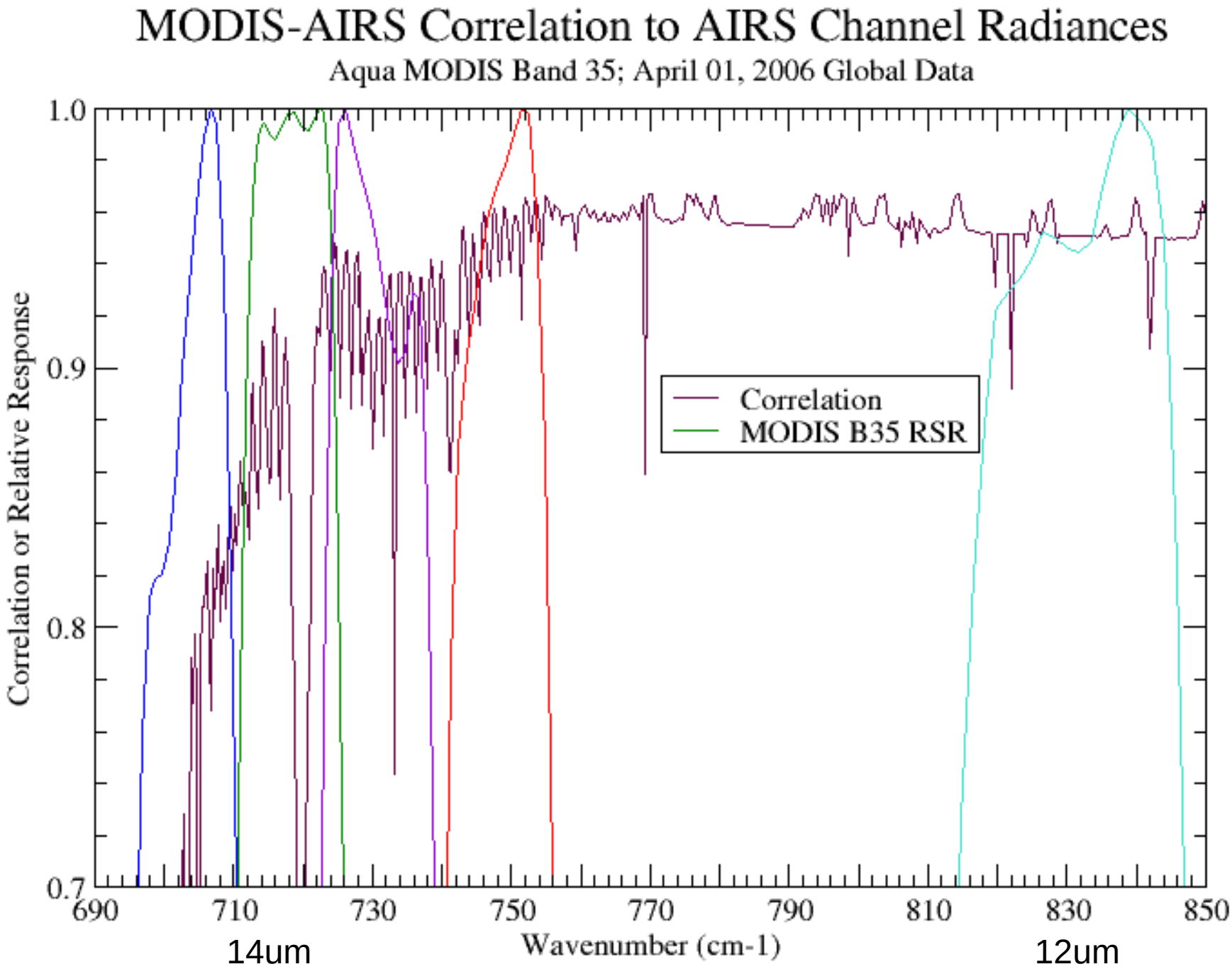

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 36; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200
AIRS Radiance (mW/m2 sr cm-1)
720.352 cm-1; CORR = .4406

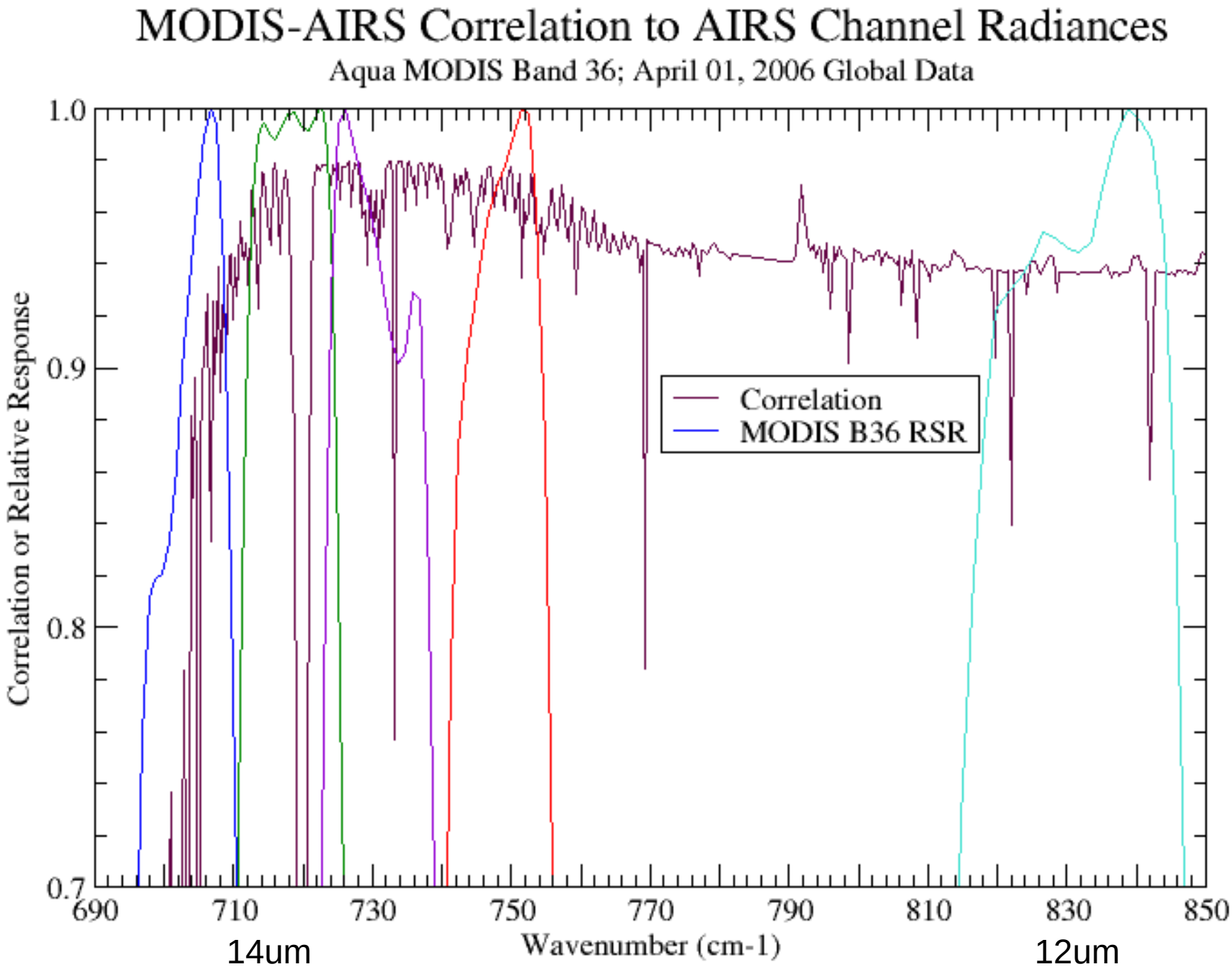

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 36; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
AIRS Radiance (mW/m2 sr cm-1)
720.352 cm-1; CORR = .4406
728.054 cm-1; CORR = .9796
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200


MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 36; April 01, 2006 Global Data
MODIS-AIRS BT Difference (K)
AIRS Radiance (mW/m2 sr cm-1)
720.352 cm-1; CORR = .4406
728.054 cm-1; CORR = .9796
900.995 cm-1; CORR = .9352
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
0
20
40
60
80
100
120
140
160
180
200


MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 35; April 01, 2006 Global Data
Correlation or Relative Response
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
650
700
750
800
850
900
950
1000
1050
1100
Wavenumber (cm-1)
Correlation
MODIS B35 RSR
14um
10um

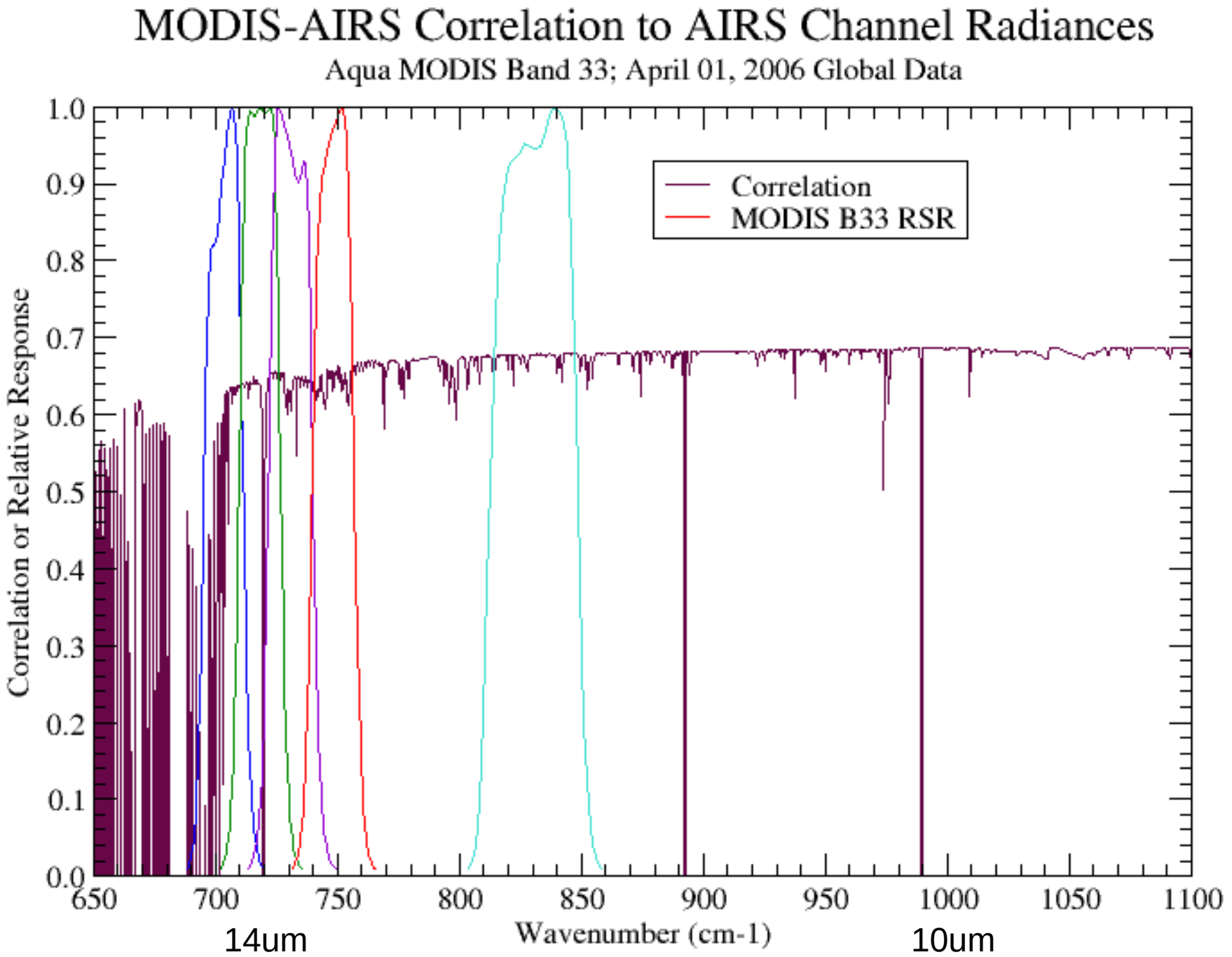

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 36; April 01, 2006 Global Data
Correlation or Relative Response
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
650
700
750
800
850
900
950
1000
1050
1100
Wavenumber (cm-1)
Correlation
MODIS B36 RSR
14um
10um

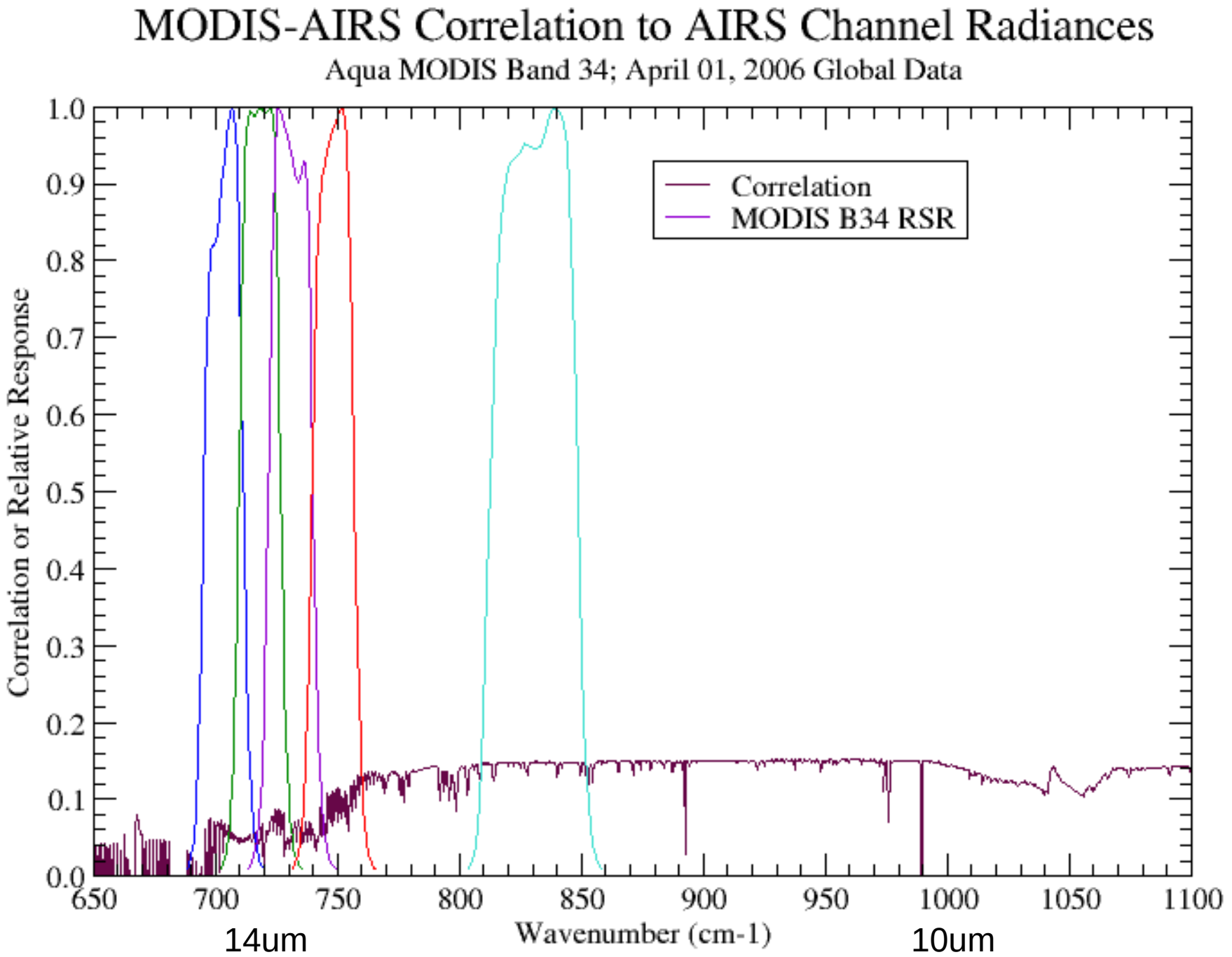

MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 35; April 01, 2006 Global Data
Correlation or Relative Response
1.0
0.9
0.8
0.7
690
710
730
750
770
790
810
830
850
Wavenumber (cm-1)
Correlation
MODIS B35 RSR
14um
12um


MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 36; April 01, 2006 Global Data
Correlation or Relative Response
1.0
0.9
0.8
0.7
690
710
730
750
770
790
810
830
850
Wavenumber (cm-1)
Correlation
MODIS B36 RSR
14um
12um

Summary Remarks

- Spectral shift hypothesis continues under investigation at Wisconsin. New models being generated to investigate spectral shift fidelity with MOD06 results.
- Linear correlation is elevated in CO2 band region, possibly indicating broad OOB influence in B36, less obvious in B35. Further testing will be useful.
- AIRS data set is a resource for investigating MODIS (and AIRS) performance; however, little can be concluded without physical basis for performance anomlies. Mostly suggestive.


MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 33; April 01, 2006 Global Data
Correlation
MODIS B33 RSR
Correlation or Relative Response
Wavenumber (cm-1)
14um
10um


MODIS-AIRS Correlation to AIRS Channel Radiances
Aqua MODIS Band 34; April 01, 2006 Global Data
Correlation
MODIS B34 RSR
Correlation or Relative Response
Wavenumber (cm-1)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
650
700
750
800
850
900
950
1000
1050
1100
14um
10um