FY-2C/2D GSICS Status Report from CMA's GPRC

Xiuqing Hu, Peng Zhang, Yong zhang,
Zhiguo Rong, Yuan Li

National Satellite Meteorological Center (NSMC)/CMA

GDWG/GRWG Meeting Jan 28-30, 2009

FY-2C/2D Experimental Operation using GSICS GEO-LEO Baseline Algorithm in CMA

- Applicability modification for FY-2C/2D Based on GSICS Geoleov2 source codes
- Modified the GEO access module for FY-2C/2D L1B format and Read the Normal Disk image geolocation data of these two satellites
- Modified the SRF files into FY-2C/2D
- Debug , compile and Link at eclipse intel Fortran environment on the platform Ubantu Linux system
- Download AIRS data of FY-2C/2D near Nadir from Nov., 2007 to Nov., 2008
- FY-2C/2D IR1, IR2,IR3(WV) bands Experimental running and output collocation results regression and comparison analysis for one year
- FY-2C/2D IR bands' calibration coefficient drift trend and mechanism analysis during one year

Modules

New satellite implemented by replacing either GEO module “access_geo” or LEO module “access_leo”

program **geo_leo_intercal_ir**
[variable definition] geo, leo, colloc

call open_geo(geo, GeoFile)
call get_geo_radiance(geo)

call open_leo(leo, LeoFile)
call get_leo_data(leo, rc)

call colloc_geo_leo(geo, leo, colloc)

call get_simgeo_convolution(geo,leo,colloc)
call get_simgeo_constrain(geo,leo,colloc)

call output(geo, leo, colloc)

call close_geo(geo)
call close_leo(leo)

call destroy_geo(geo)
call destroy_leo(leo)
call destroy_colloc(colloc)
call destroy_simgeo_***()

module **common_constants**
- Basic constants defined

module **access_geo**
- Definition of GEO data structure
- Subroutines to open/close GEO, get GEO data, deallocate arrays

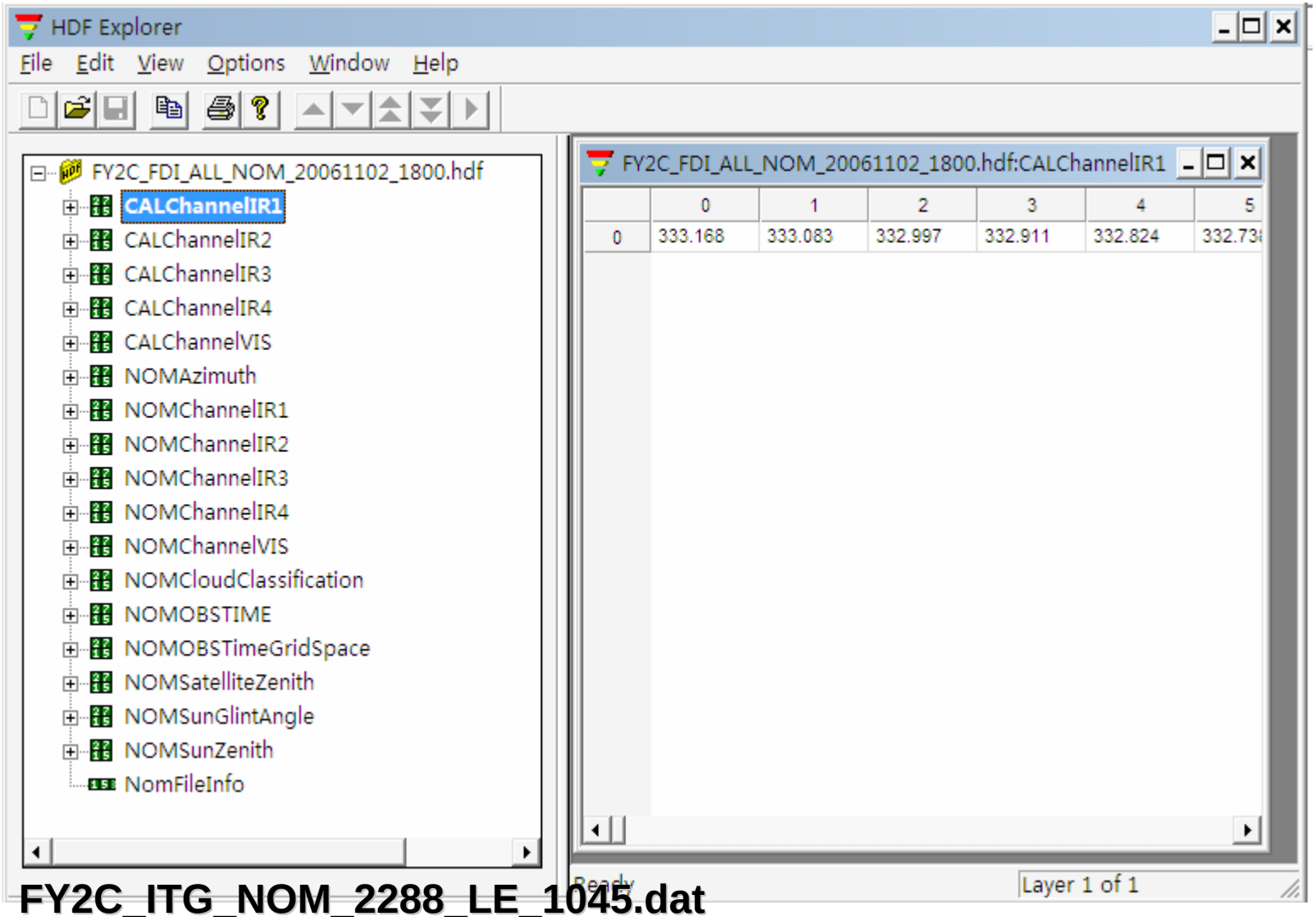
module **access_leo**
- Definition of LEO data structure
- Subroutines to open/close LEO, get LEO data, deallocate arrays

module **collocate_geo_leo**
- Definition of collocation data structure
- Subroutines to collocate GEO-LEO, deallocate arrays

module **simulate_georad_convolution**
module **simulate_georad_constrain**
- Subroutines to estimate GEO radiances from LEO data, deallocate arrays

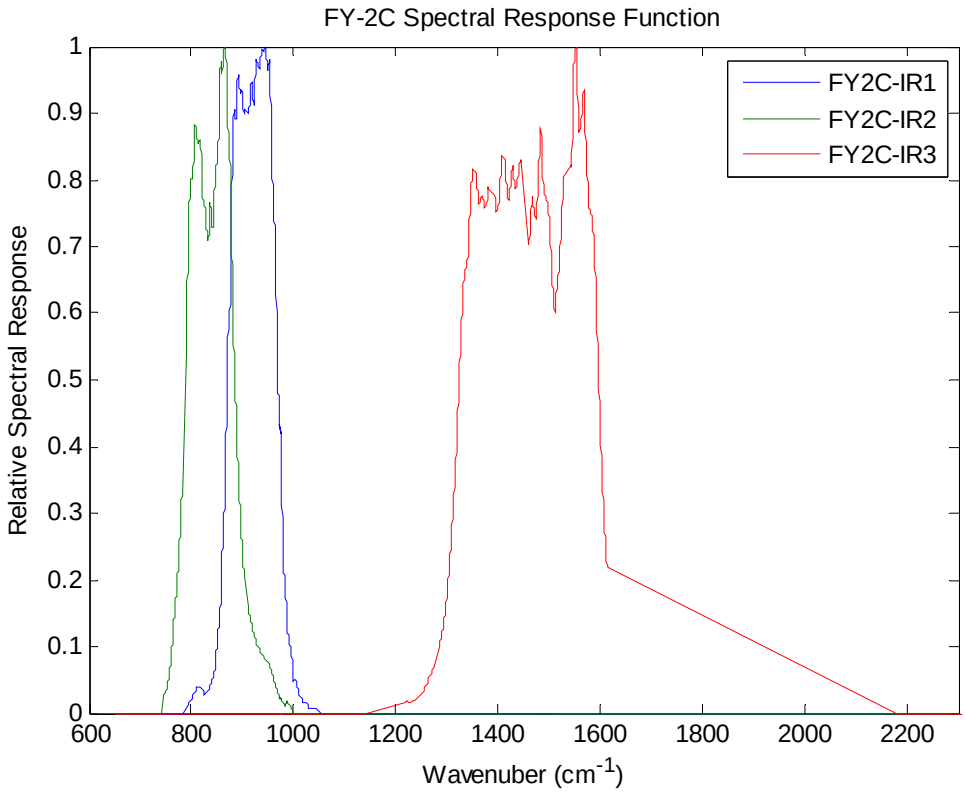
module (**output**)
- Subroutine to write out results

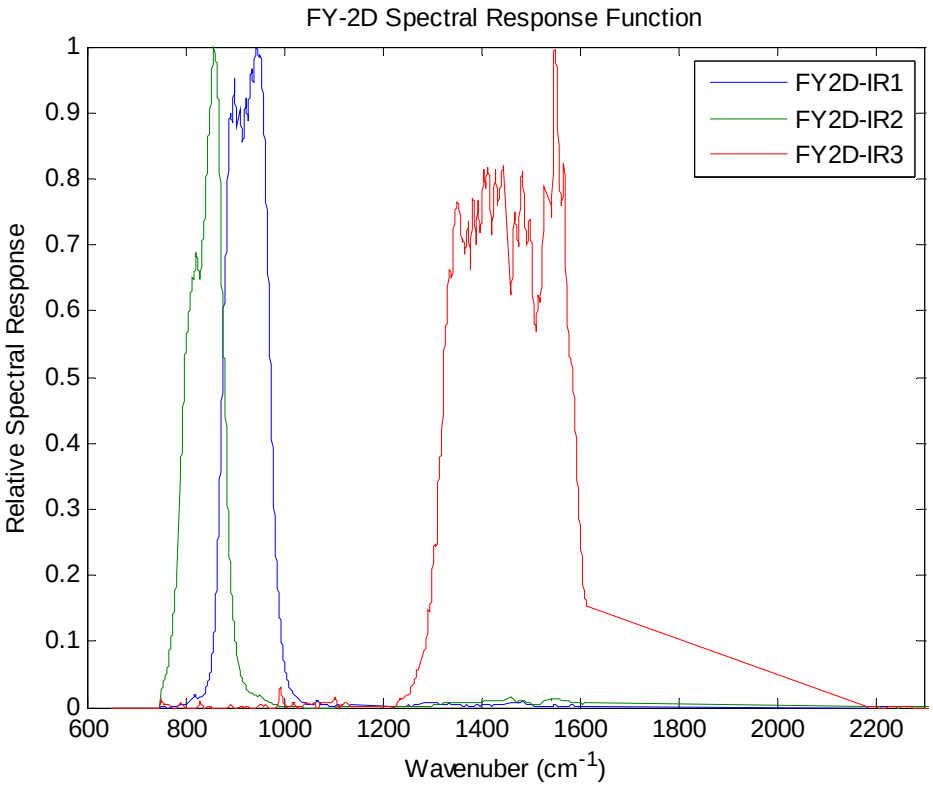
FY-2C/2D L1 HDF



FY2C_ITG_NOM_2288_LE_1045.dat
FY2D_ITG_NOM_2288_LE_0865.dat

FY-2C/2D VISSR SRF





Collocation Method

- **Observation time difference check**

  $| t_{FY2} - t_{sounder} | < dt_{max}$ (<15 mins)

- **Satellite zenith angle difference check**

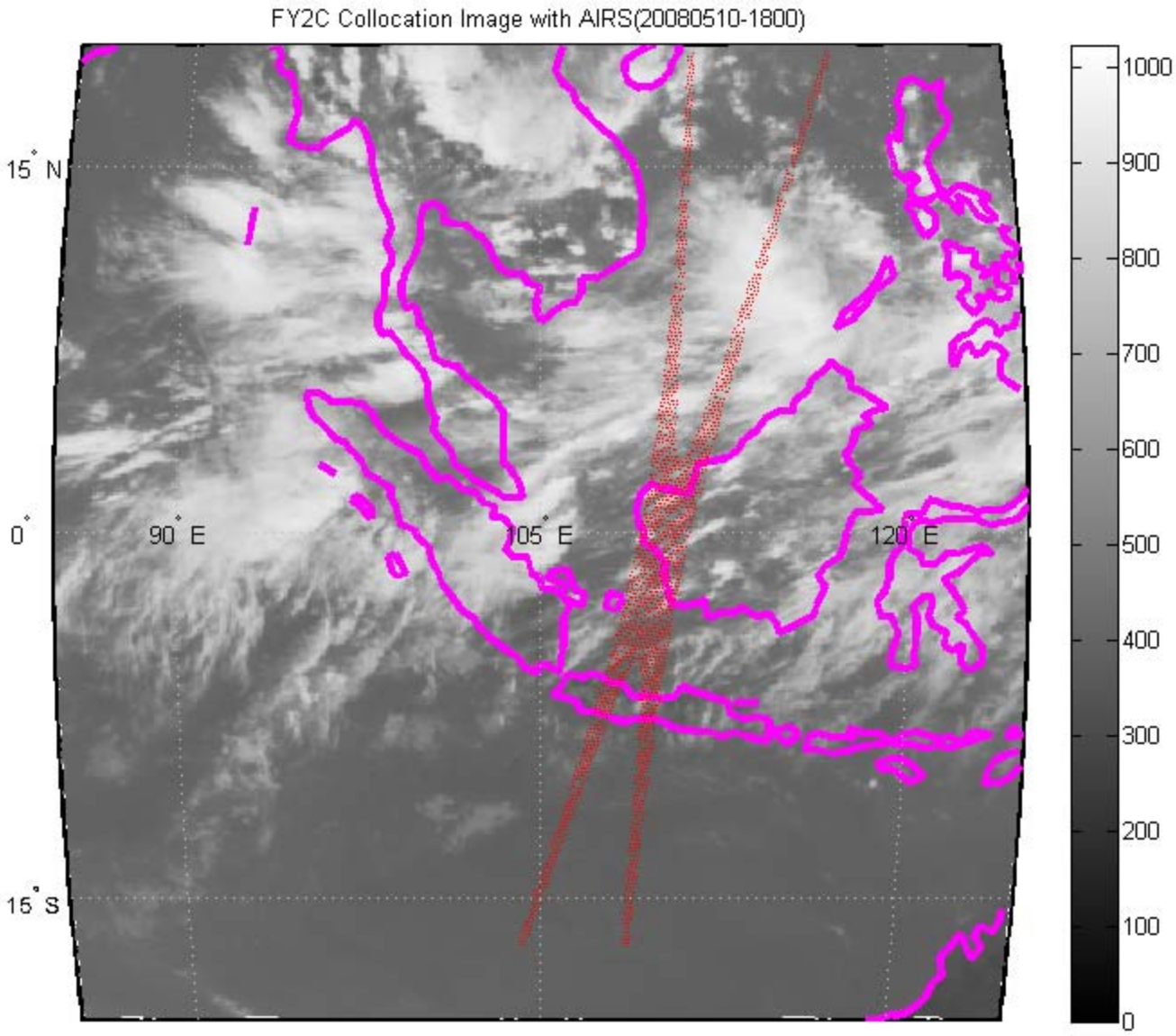
  $| \cos(SZA_{sounder}) / \cos(SZA_{FY2}) - 1 | < MaxRate\_OptPathDiff$

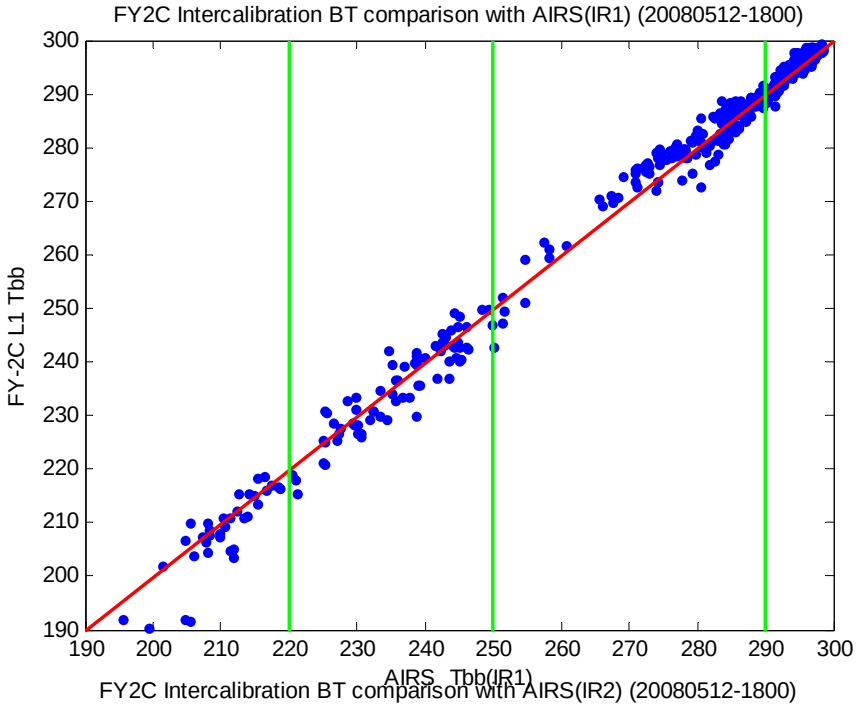
- **Environment uniformity check**

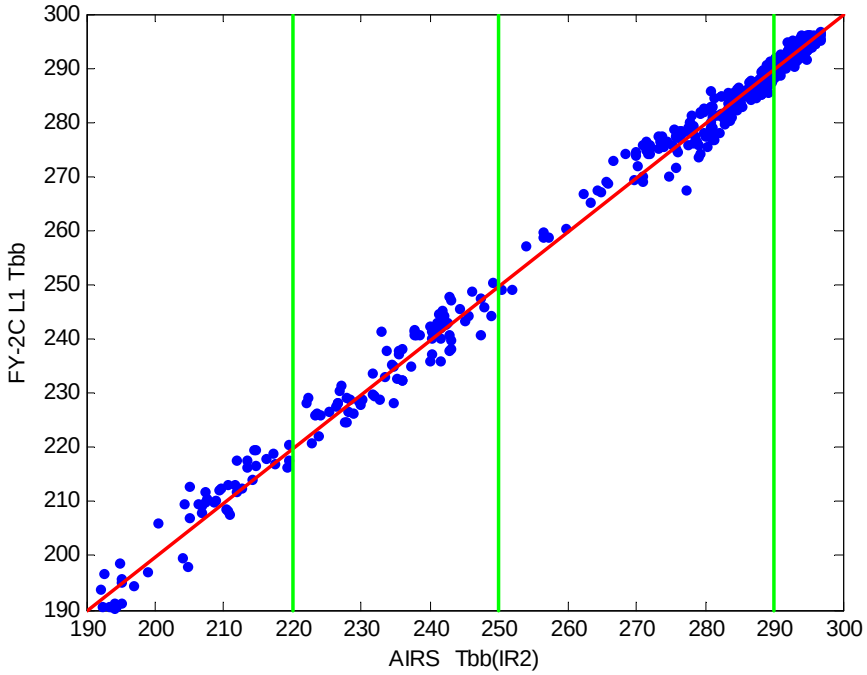
  STDV(FY2 DNs in ENV_BOX) < MaxSTDV ()

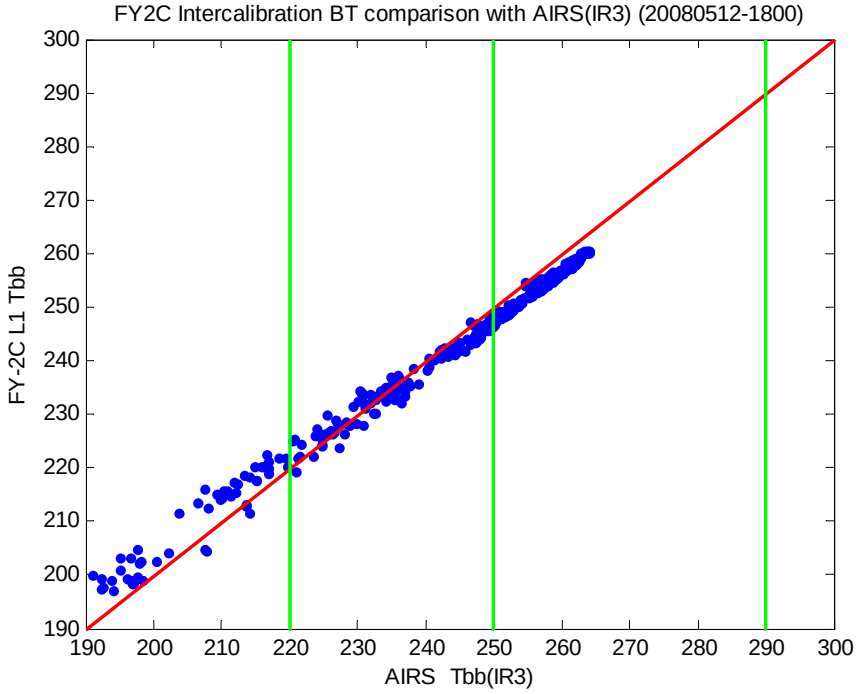
- **Normality check**

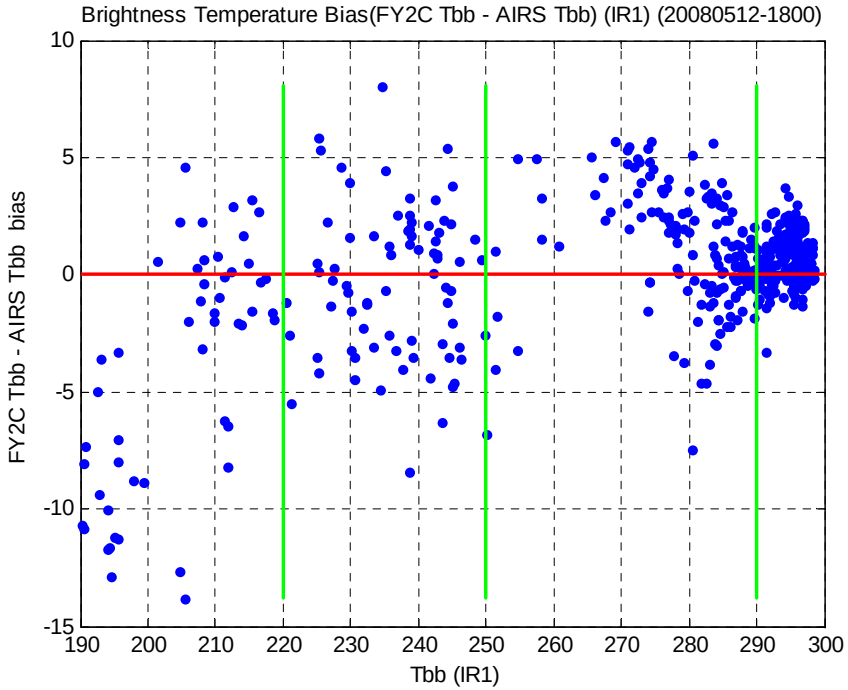
  | MEAN(FOV_BOX) − MEAN(ENV_BOX) | × 9 / STDV(ENV_BOX) < Gaussian

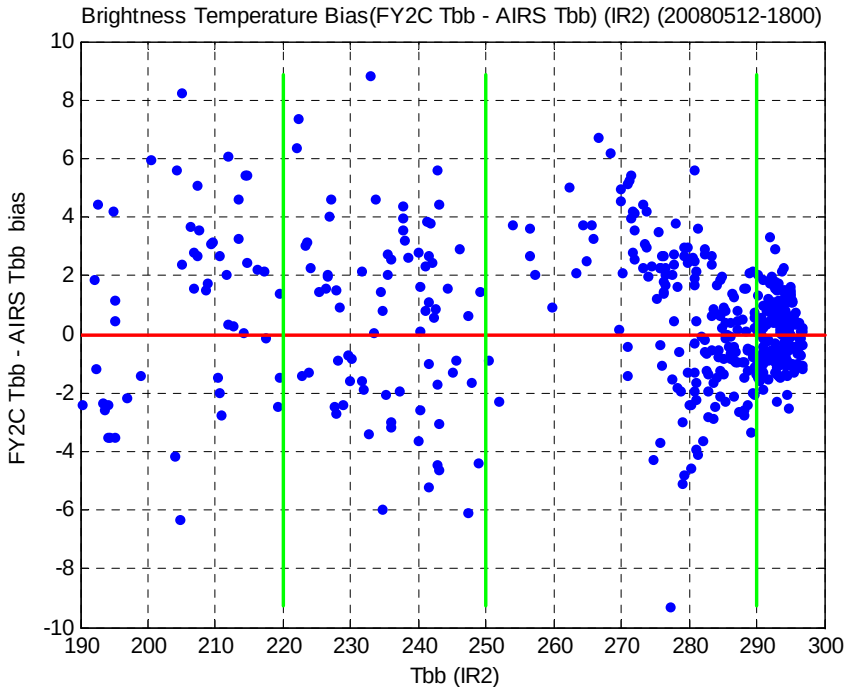

FY2C Collocation Image with AIRS(20080510-1800)
15° N
0°
15° S
90° E
105° E
120° E
1000
900
800
700
600
500
400
300
200
100
0

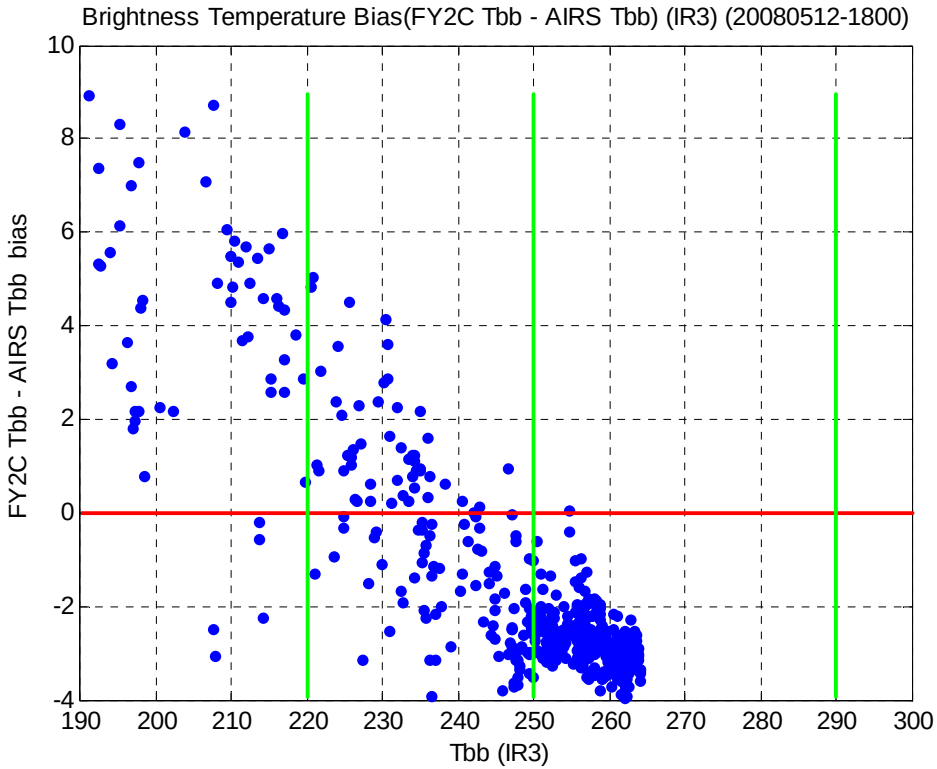

FY2C Intercalibration BT comparison with AIRS(IR1) (20080512-1800)
FY-2C L1 Tbb
AIRS Tbb(IR1)
190
200
210
220
230
240
250
260
270
280
290
300


FY2C Intercalibration BT comparison with AIRS(IR2) (20080512-1800)
FY-2C L1 Tbb
AIRS Tbb(IR2)
190
200
210
220
230
240
250
260
270
280
290
300

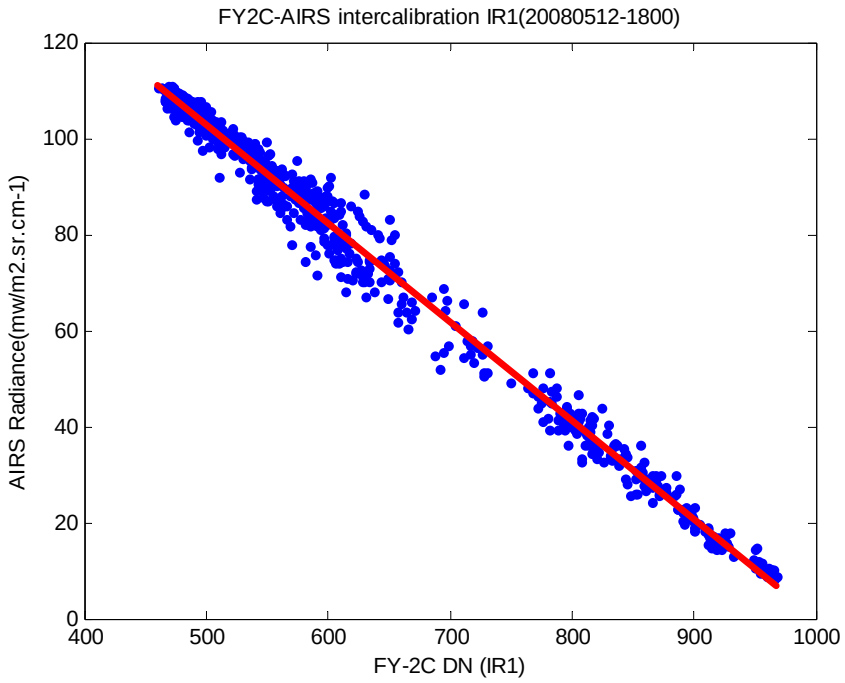

FY2C Intercalibration BT comparison with AIRS(IR3) (20080512-1800)
FY-2C L1 Tbb
AIRS Tbb(IR3)
190
200
210
220
230
240
250
260
270
280
290
300

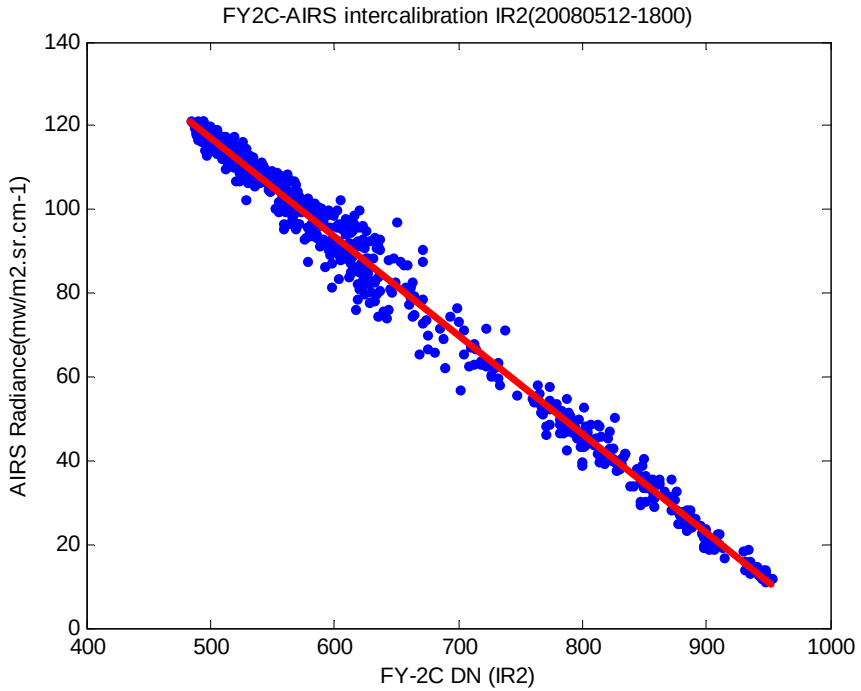

Brightness Temperature Bias(FY2C Tbb - AIRS Tbb) (IR1) (20080512-1800)
FY2C Tbb - AIRS Tbb bias
Tbb (IR1)
10
5
0
-5
-10
-15
190
200
210
220
230
240
250
260
270
280
290
300


Brightness Temperature Bias(FY2C Tbb - AIRS Tbb) (IR2) (20080512-1800)
FY2C Tbb - AIRS Tbb bias
Tbb (IR2)
10
8
6
4
2
0
-2
-4
-6
-8
-10
190
200
210
220
230
240
250
260
270
280
290
300

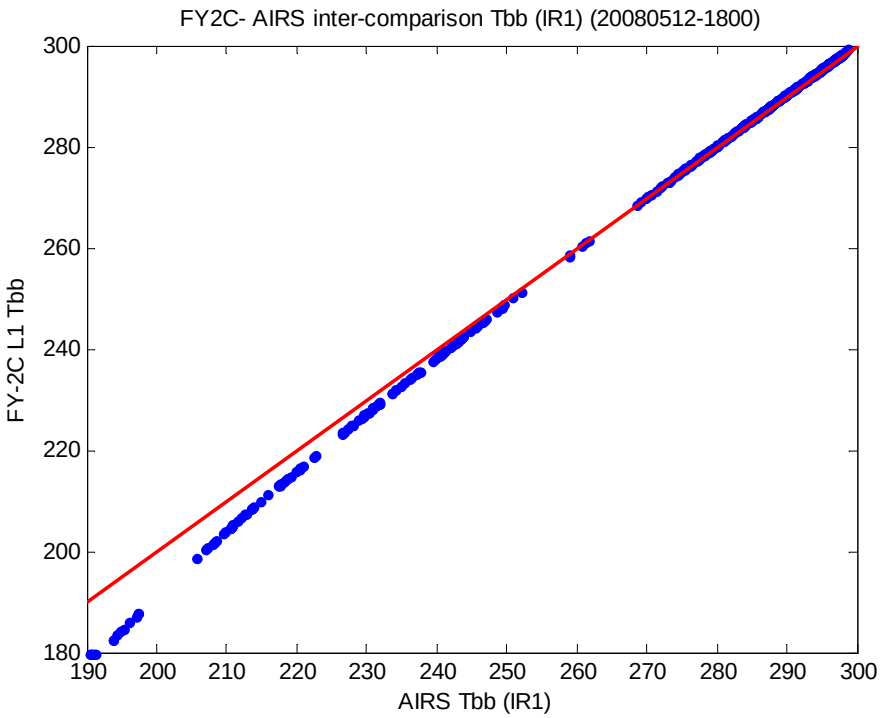

Brightness Temperature Bias(FY2C Tbb - AIRS Tbb) (IR3) (20080512-1800)
FY2C Tbb - AIRS Tbb bias
Tbb (IR3)
10
8
6
4
2
0
-2
-4
190
200
210
220
230
240
250
260
270
280
290
300

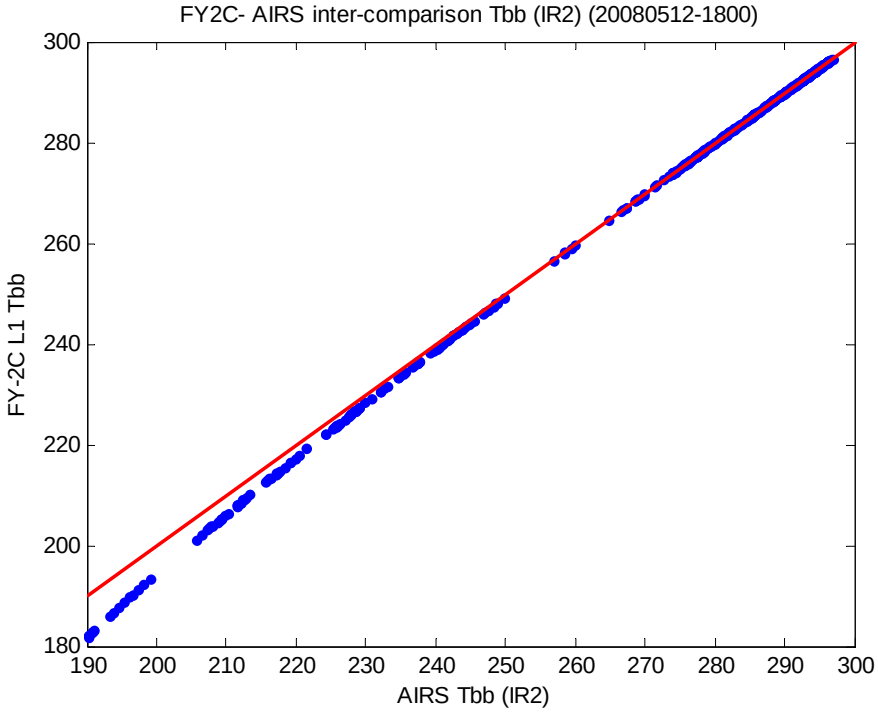
Linear Regression between FY2C DN and AIRS Radiance

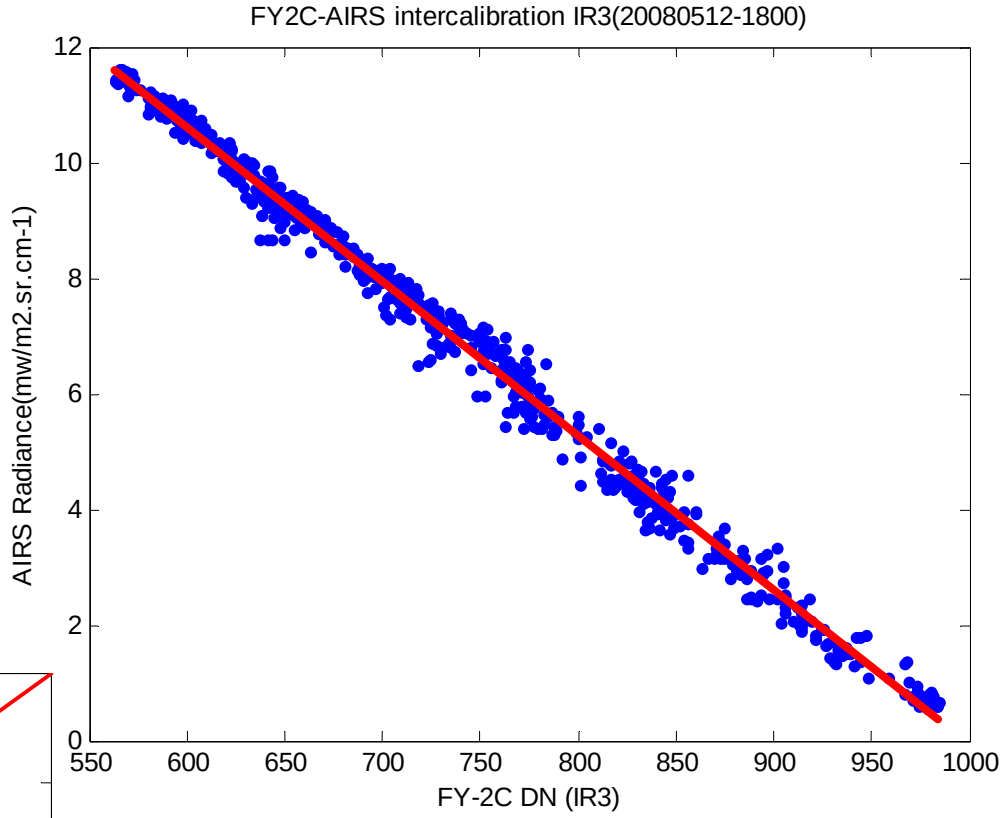


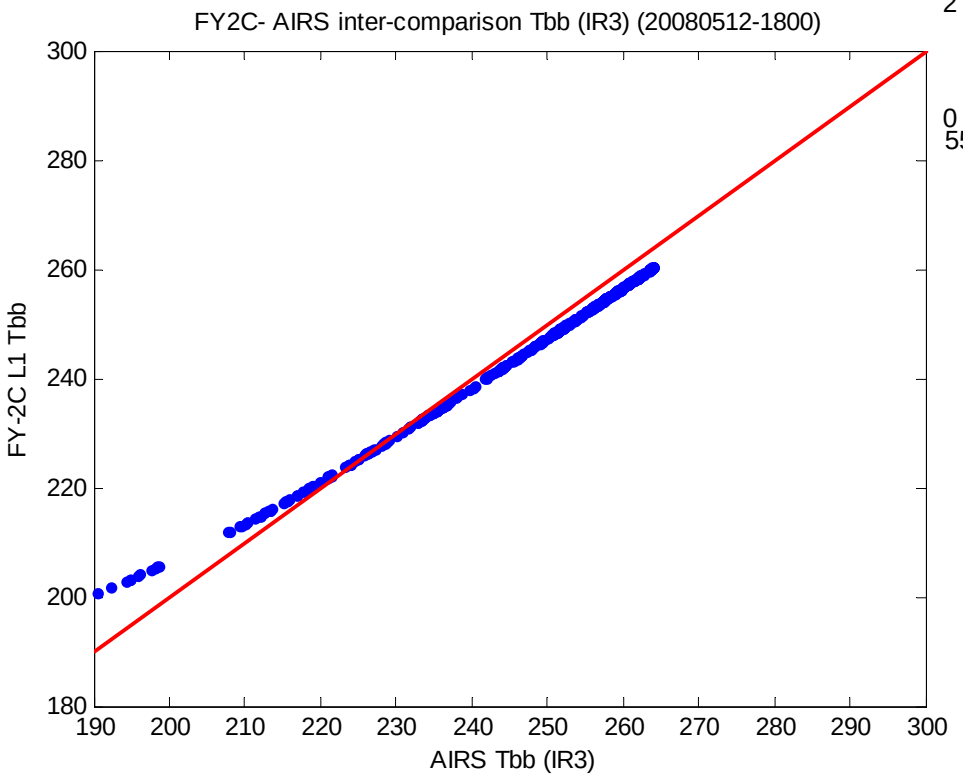


Calibration LUT comparison from FY-2C L1B and AIRS intercal

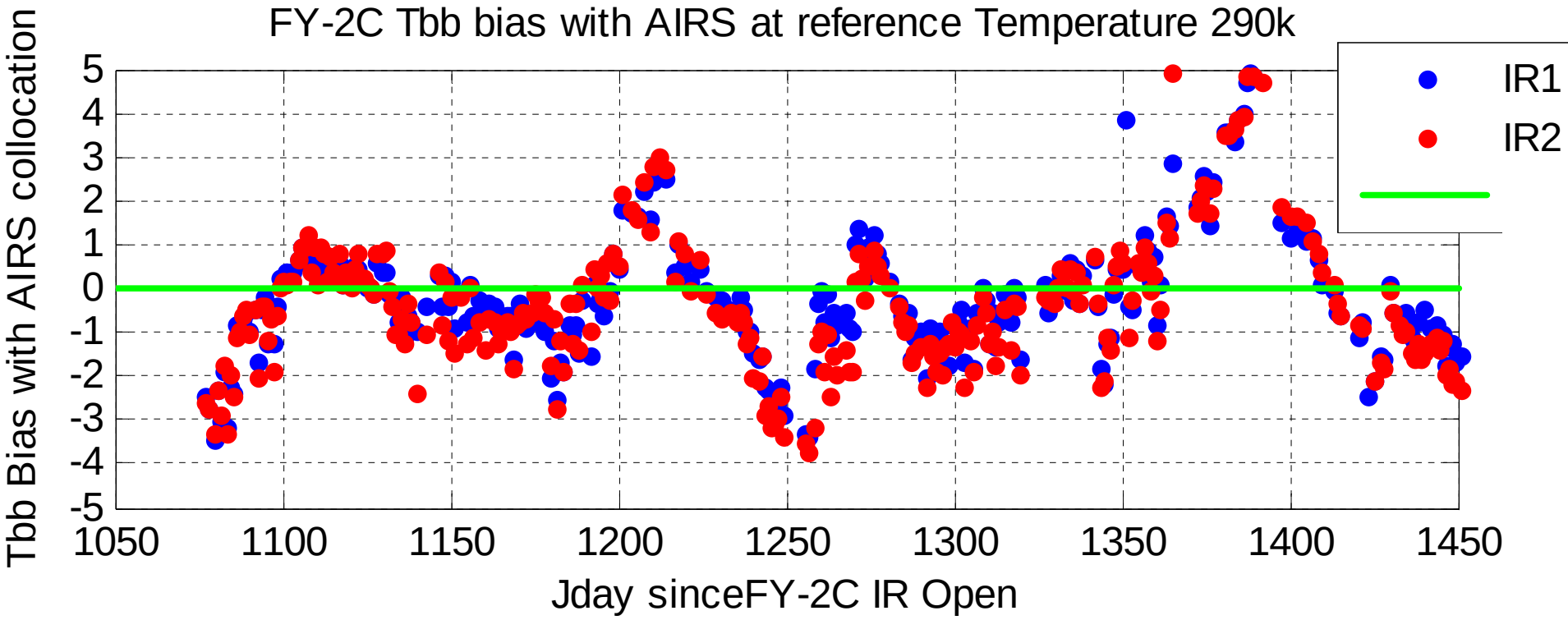




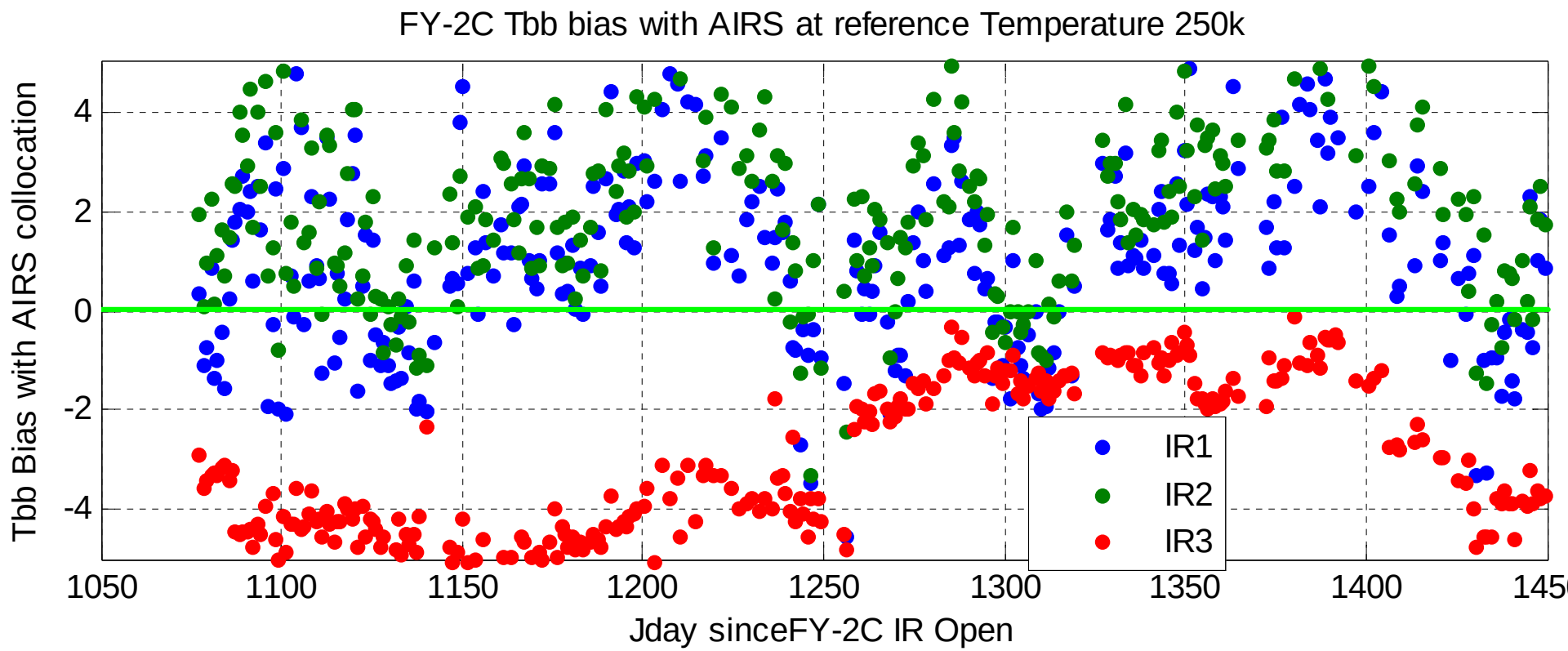

FY2C-AIRS intercalibration IR3(20080512-1800)
AIRS Radiance(mw/m2.sr.cm-1)
FY-2C DN (IR3)
0
2
4
6
8
10
12
550
600
650
700
750
800
850
900
950
1000


FY2C- AIRS inter-comparison Tbb (IR3) (20080512-1800)
FY-2C L1 Tbb
AIRS Tbb (IR3)
180
200
220
240
260
280
300
190
200
210
220
230
240
250
260
270
280
290
300

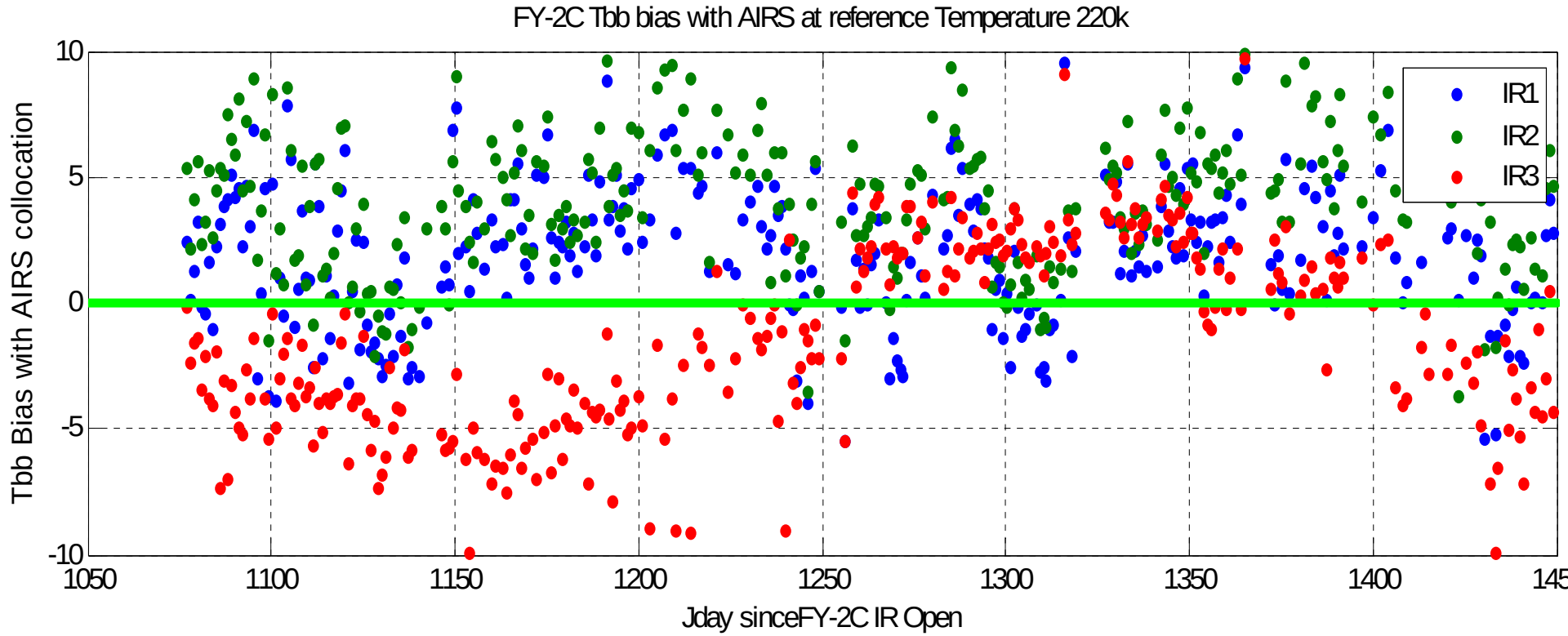
FY-2C Tbb Bias with AIRS for longterm



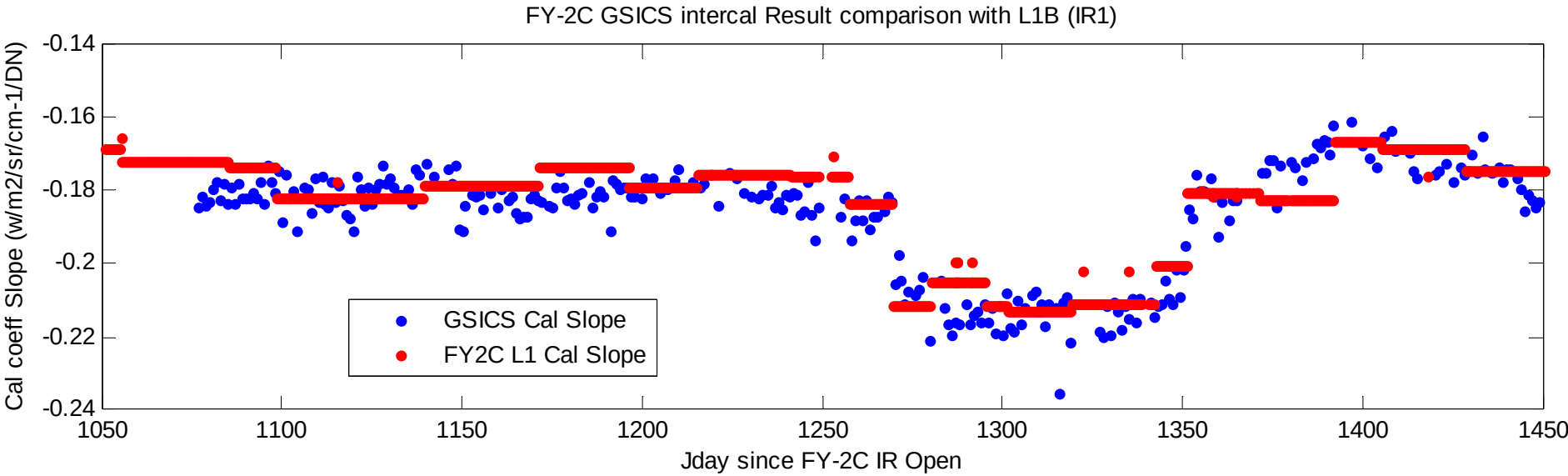
FY-2C Tbb Bias with AIRS for longterm

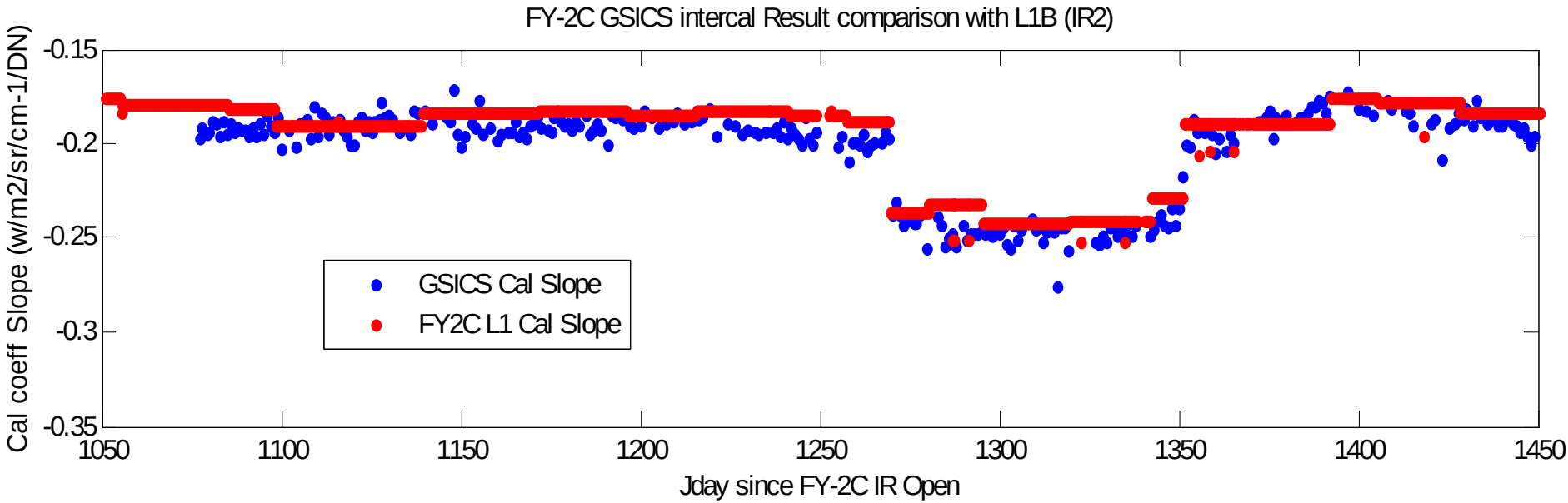


FY-2C Tbb Bias with AIRS for longterm

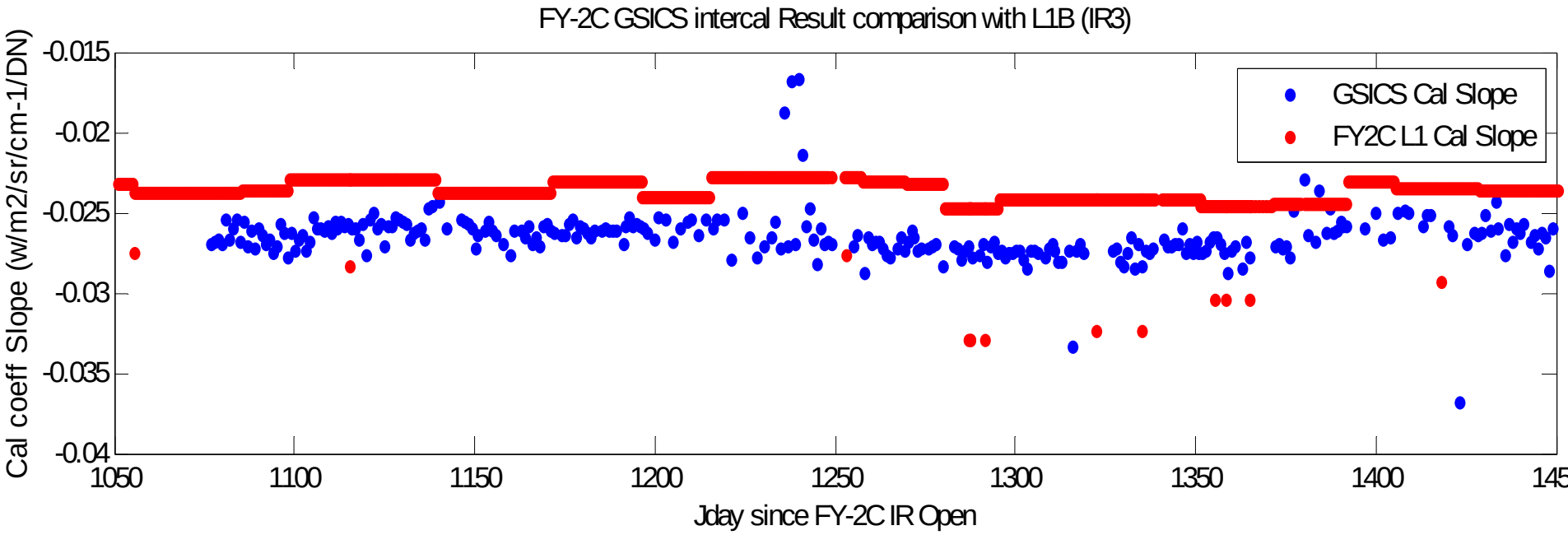


FY-2C GSICS Intercal Slope for long term

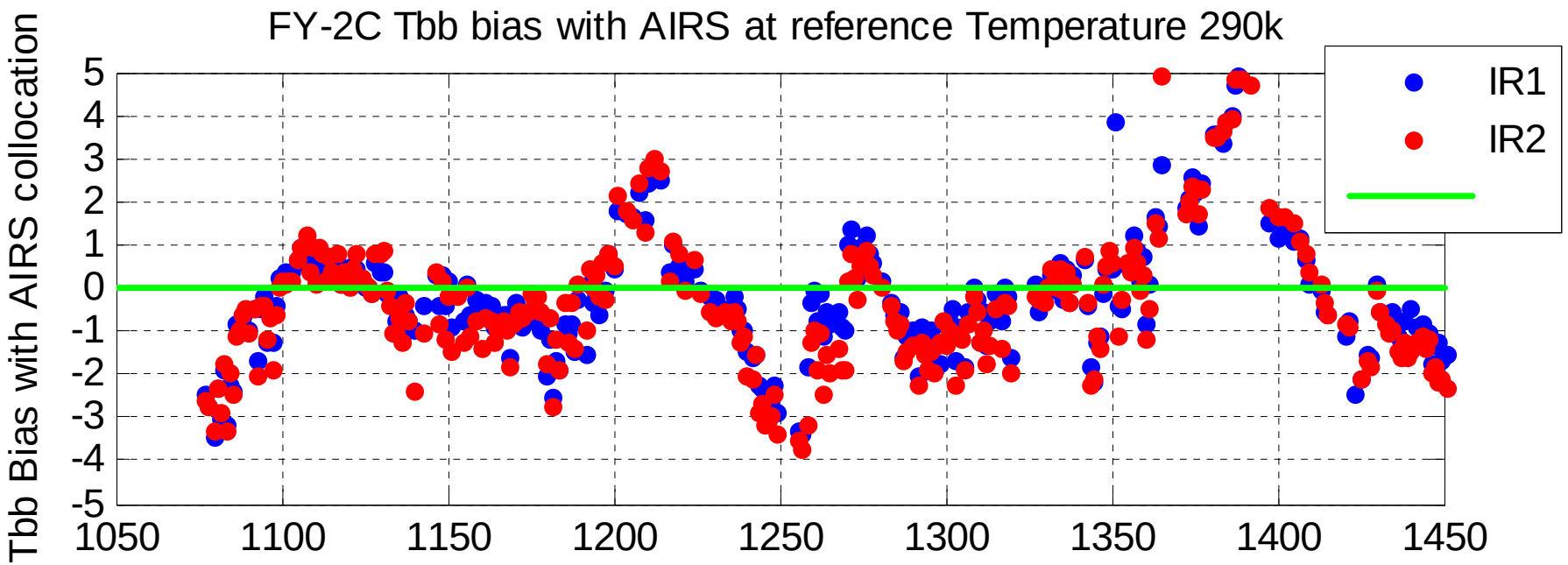


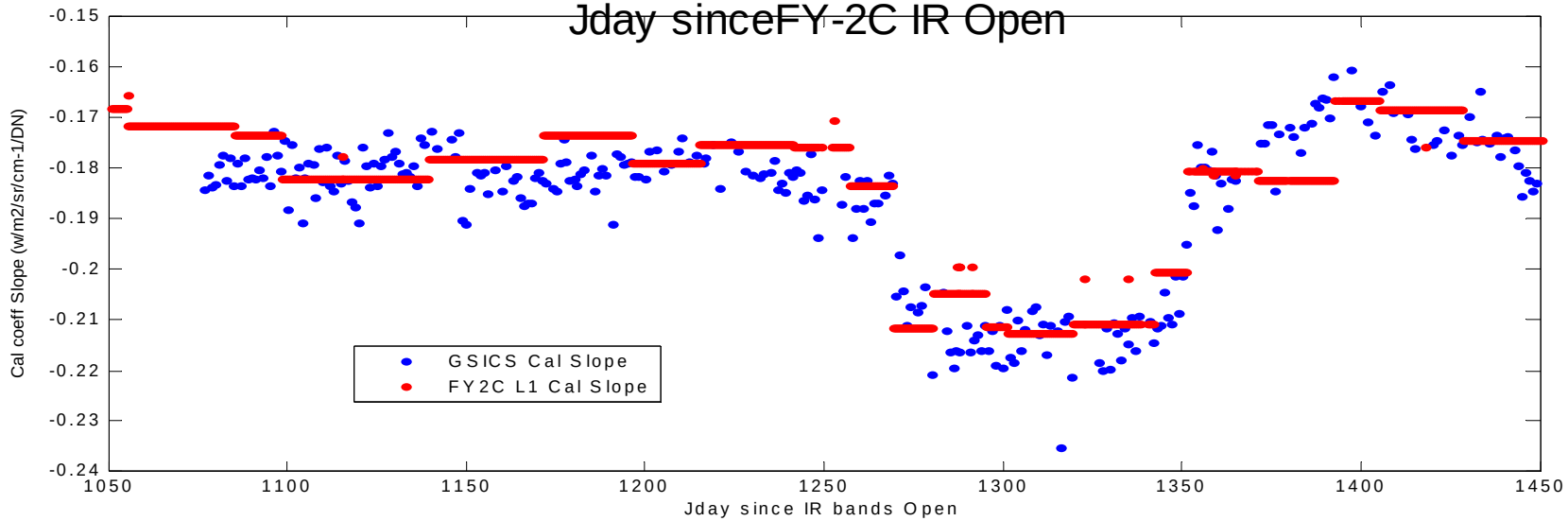


FY-2C GSICS Intercal Slope for long term

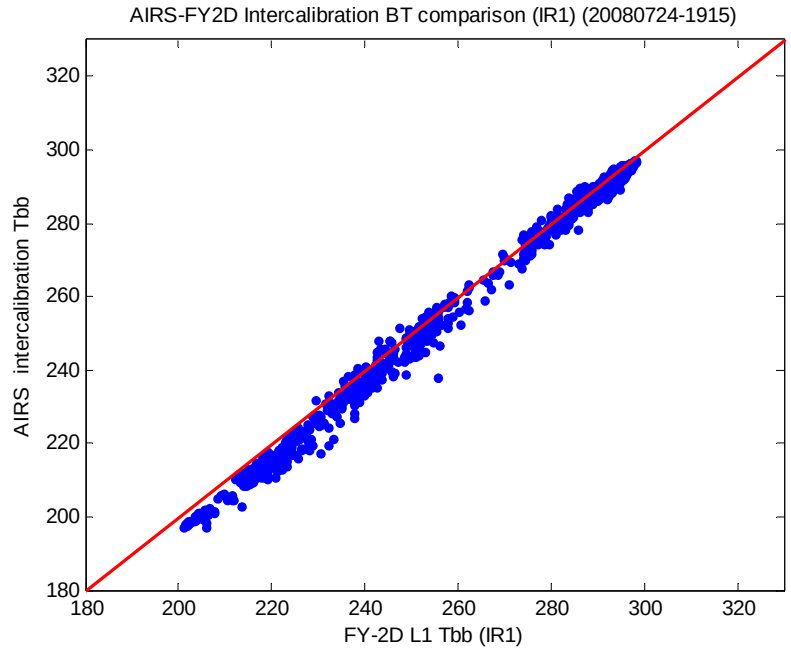


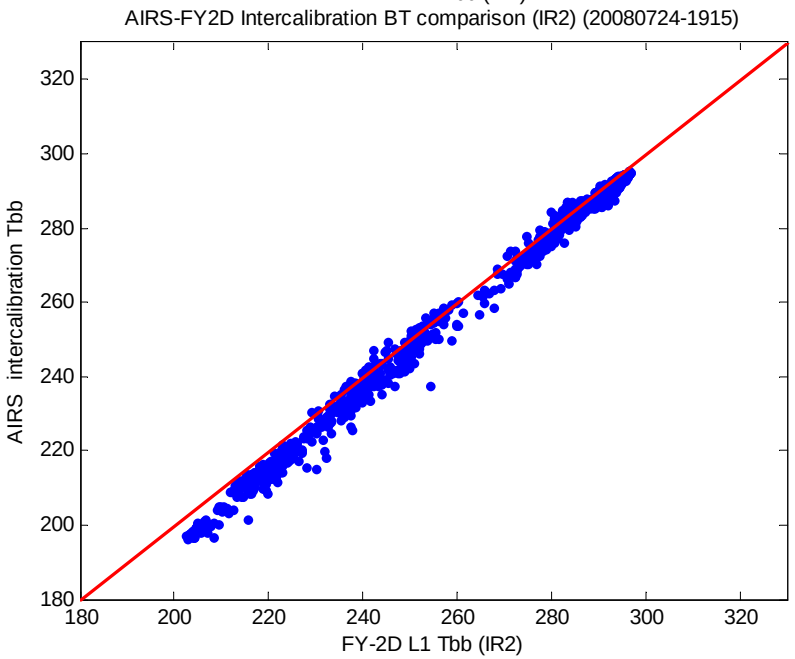
FY-2C Tbb Bias and intercal slope with AIRS for one year

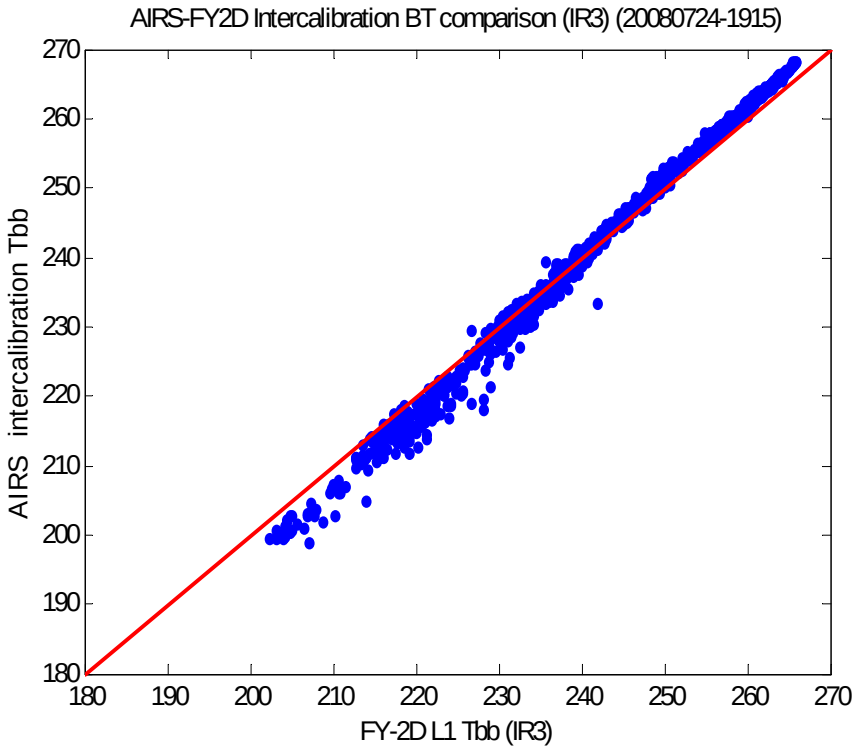




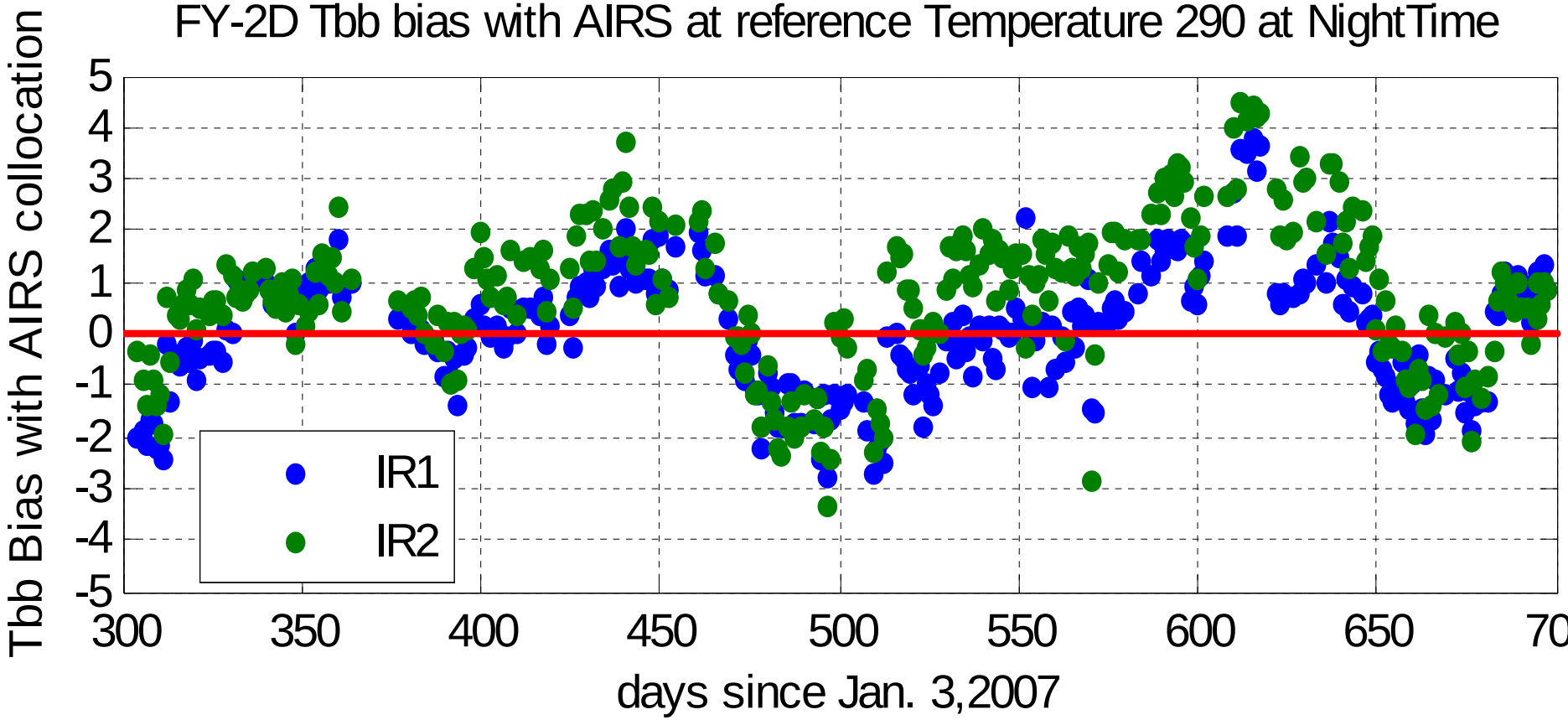
Comparison between FY-2D L1 Cal and AIRS Tbb



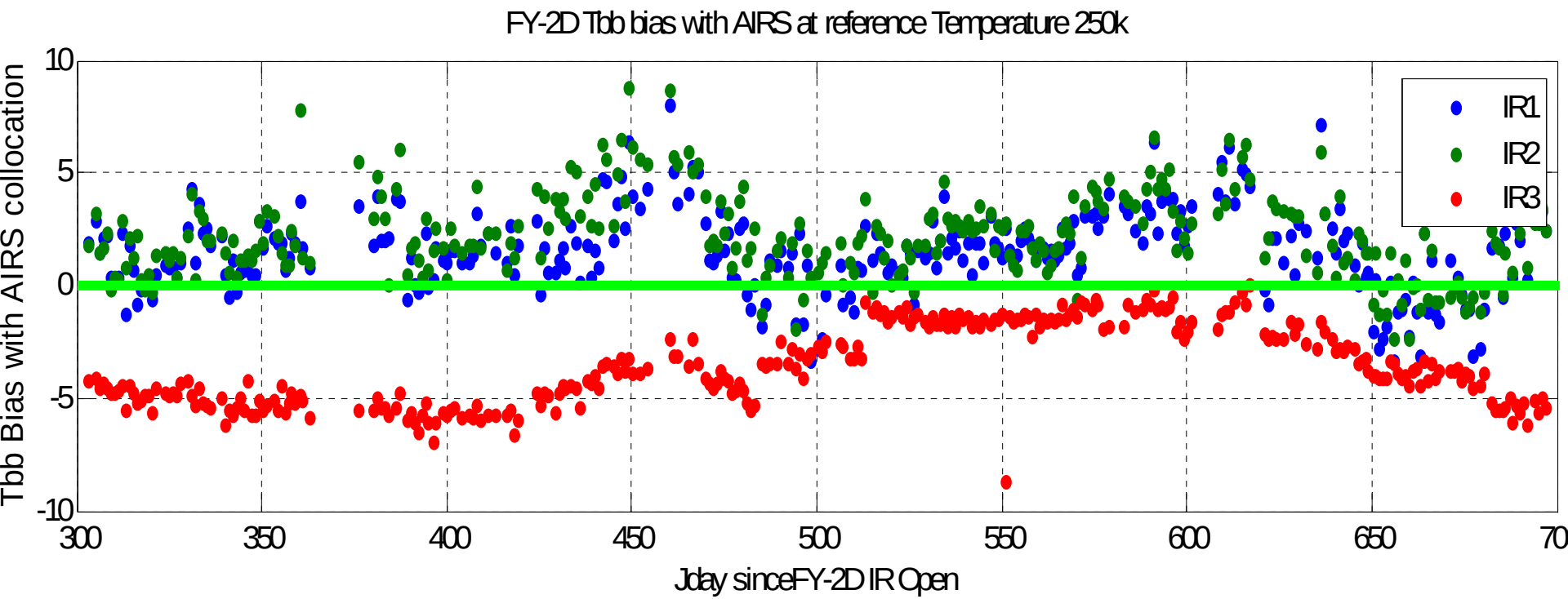




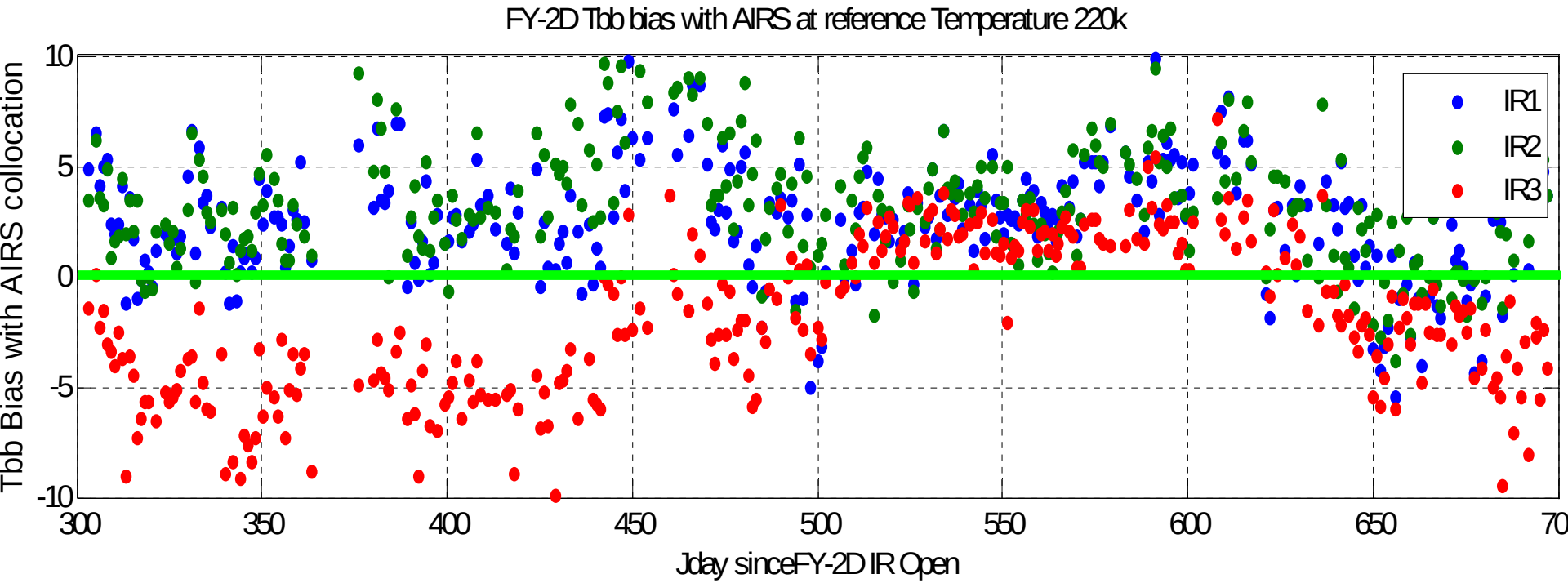
FY-2D Tbb Bias with AIRS for longterm

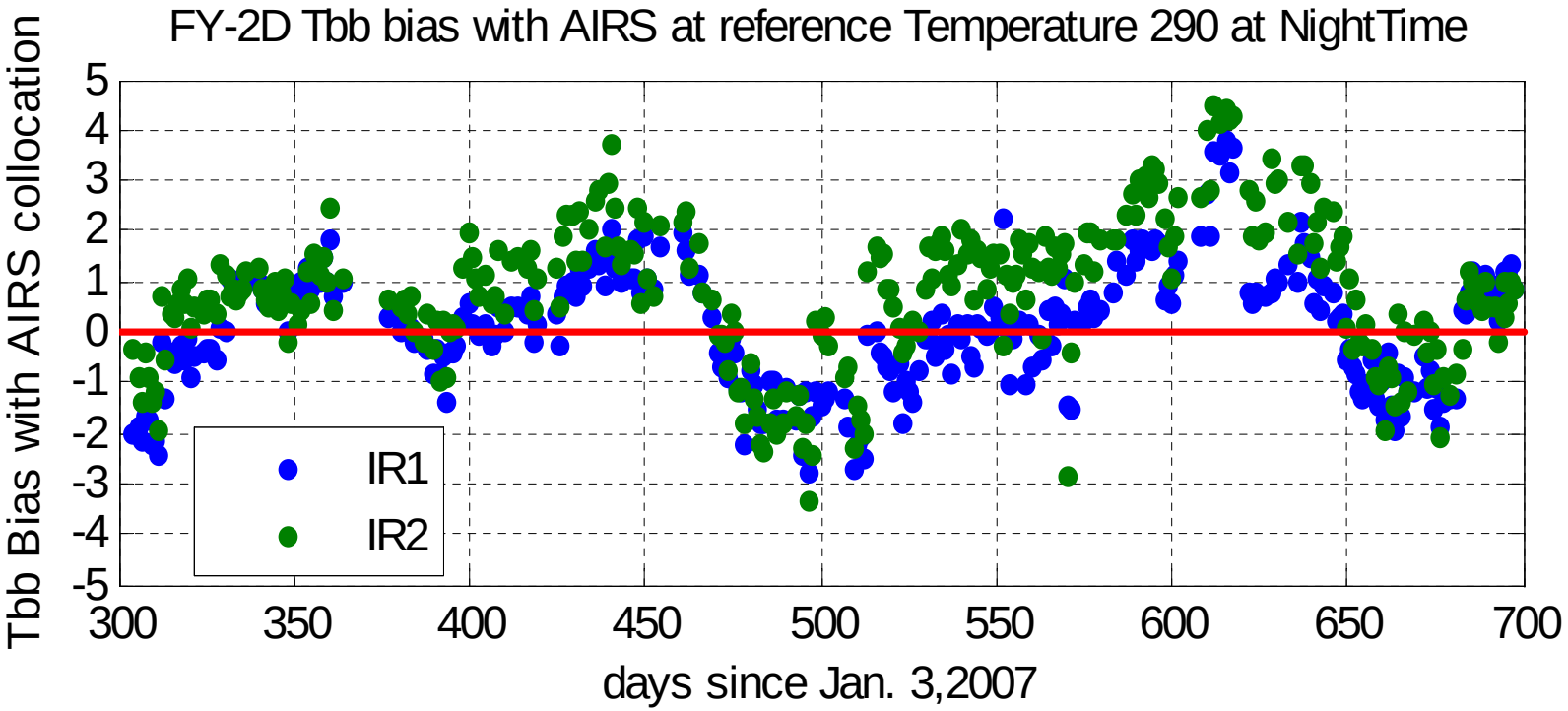


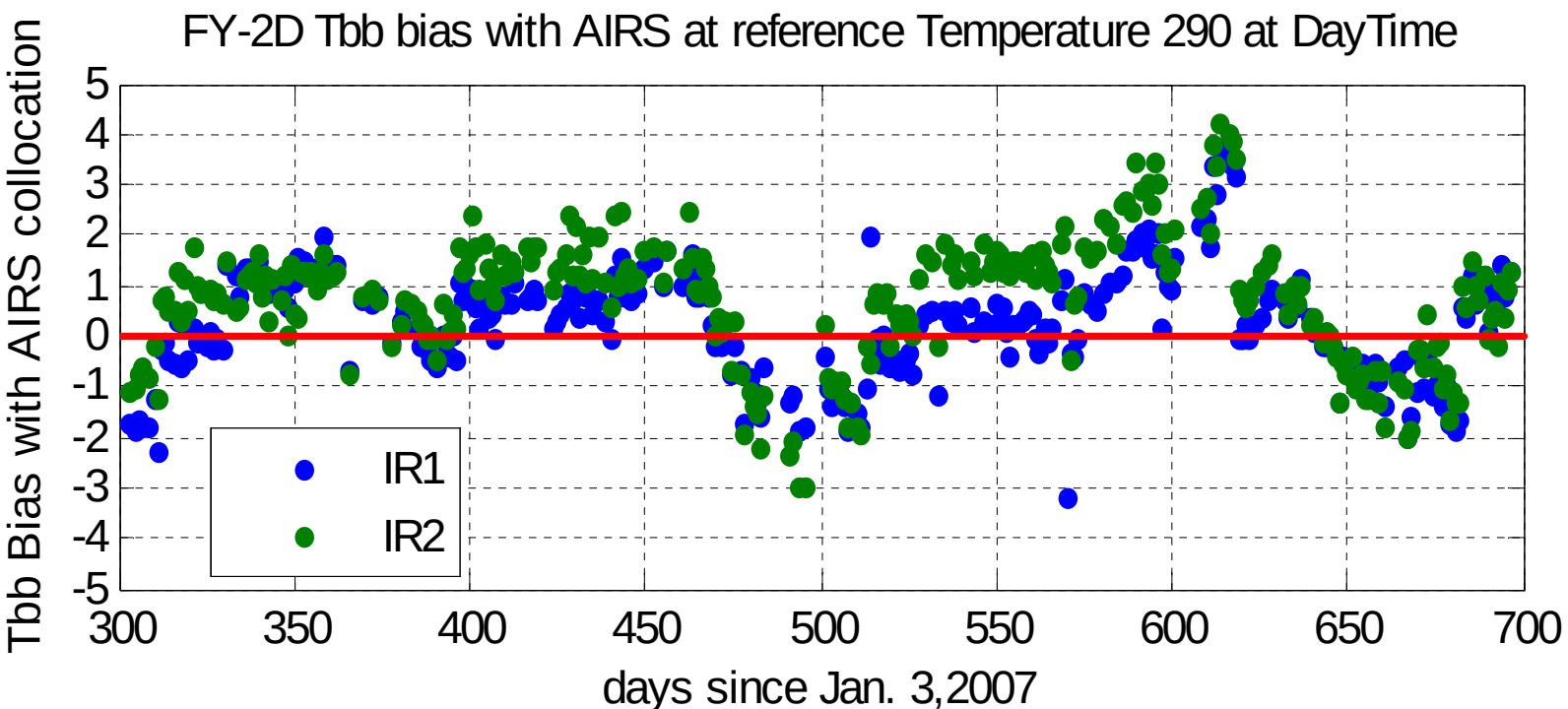
FY-2D Tbb Bias with AIRS for longterm

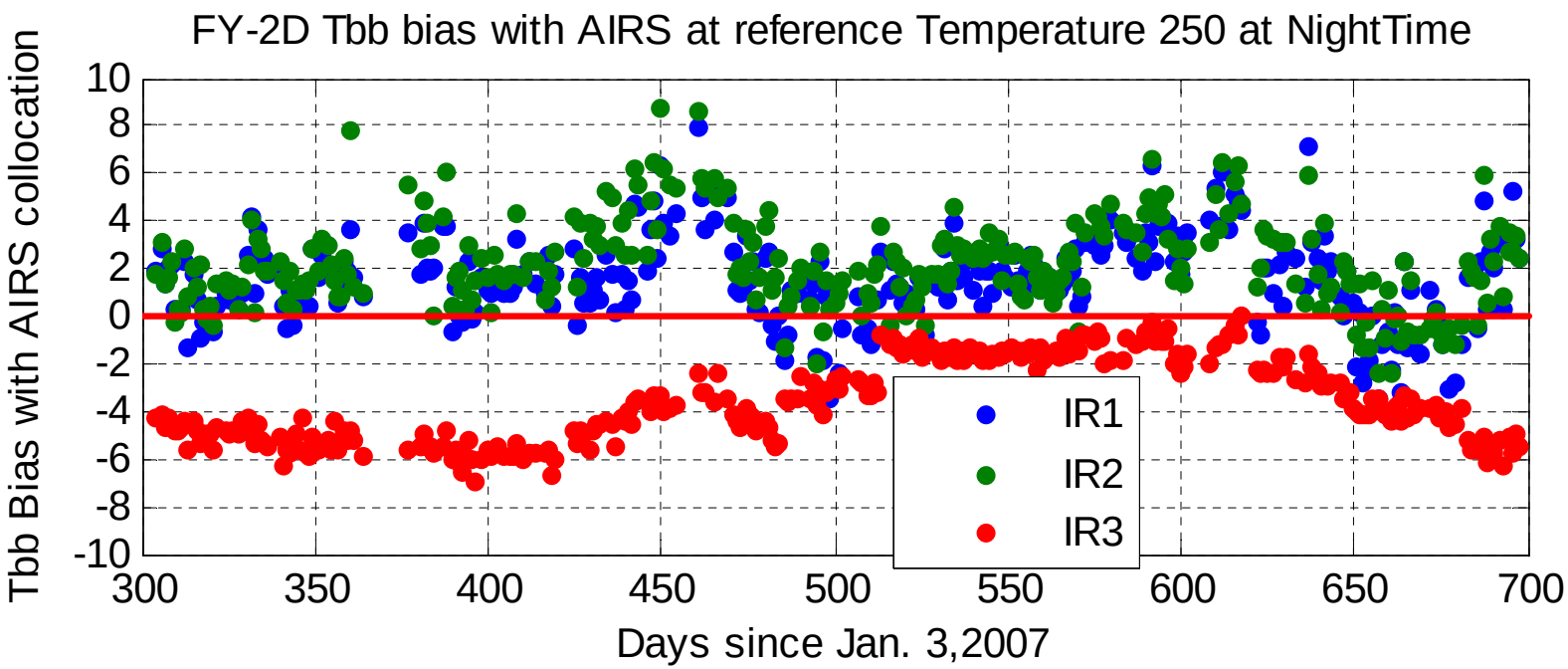


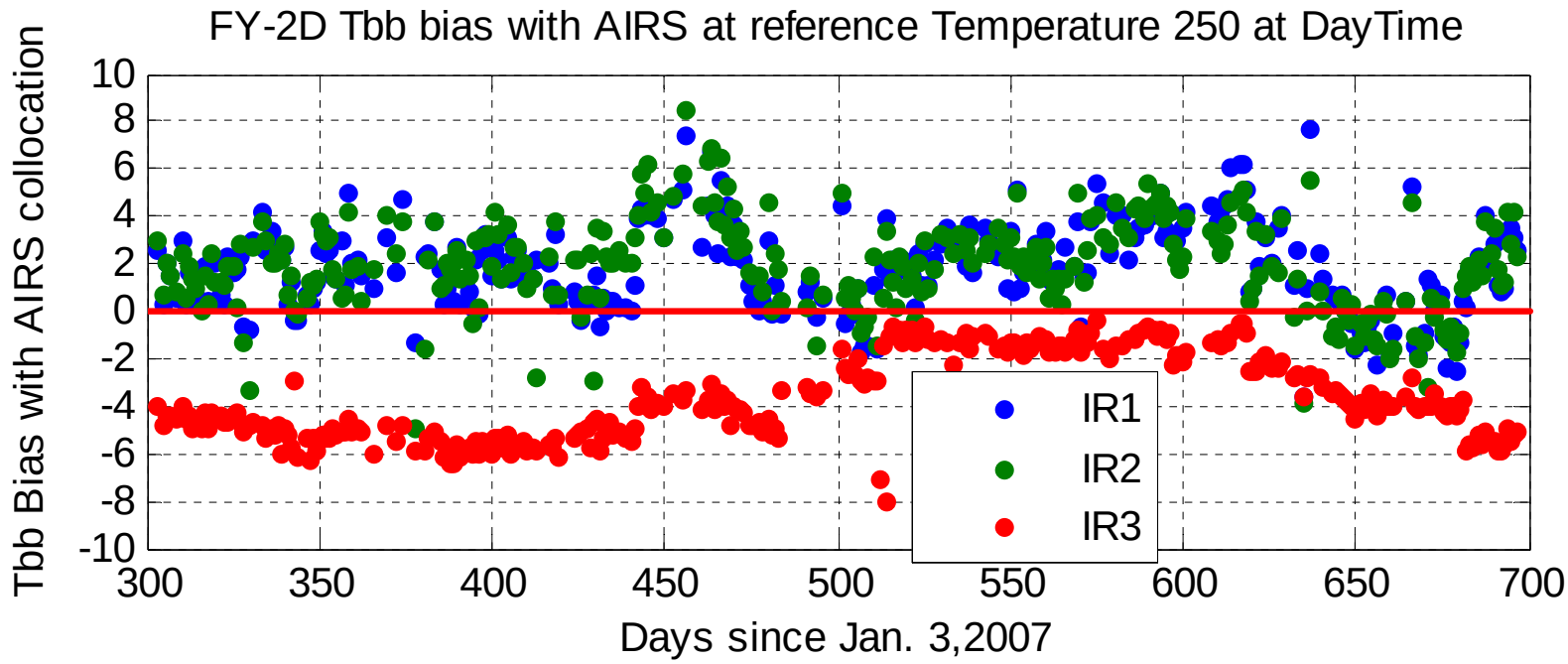
FY-2D Tbb Bias with AIRS for longterm

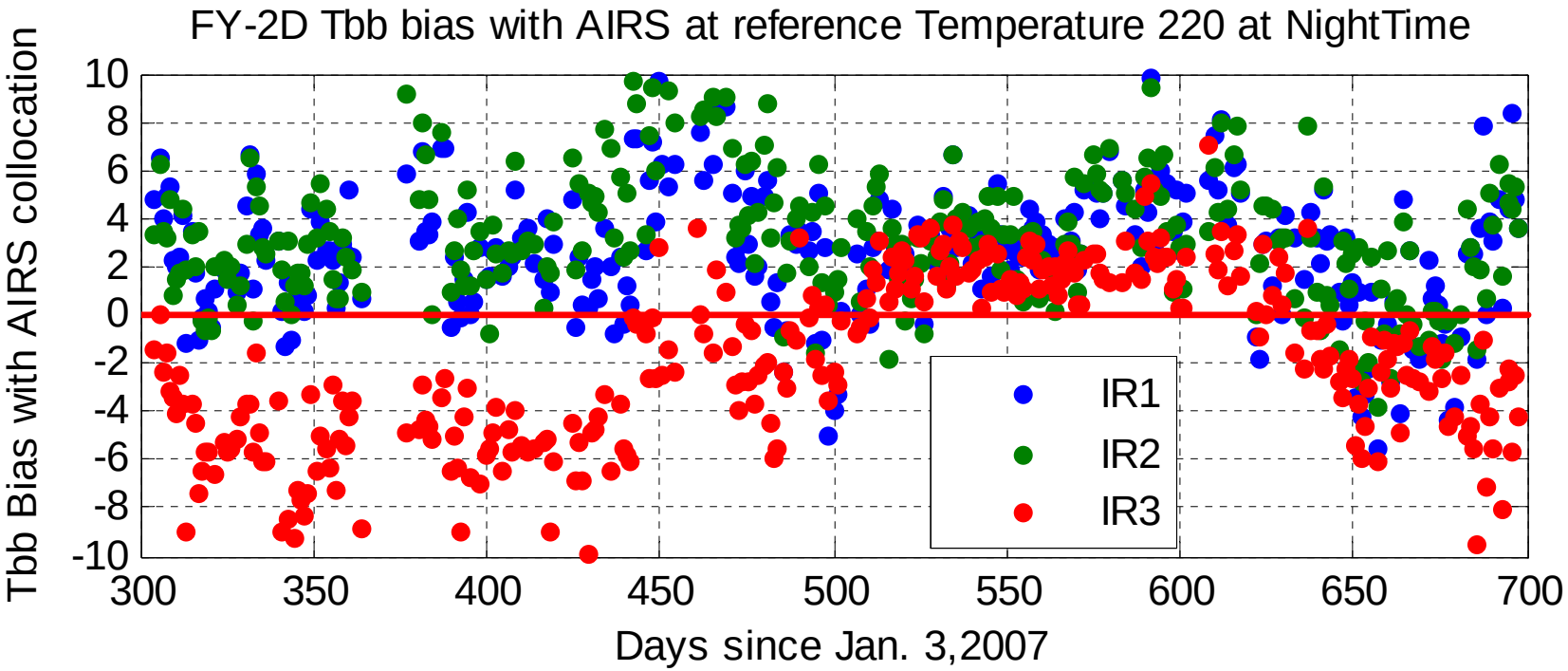


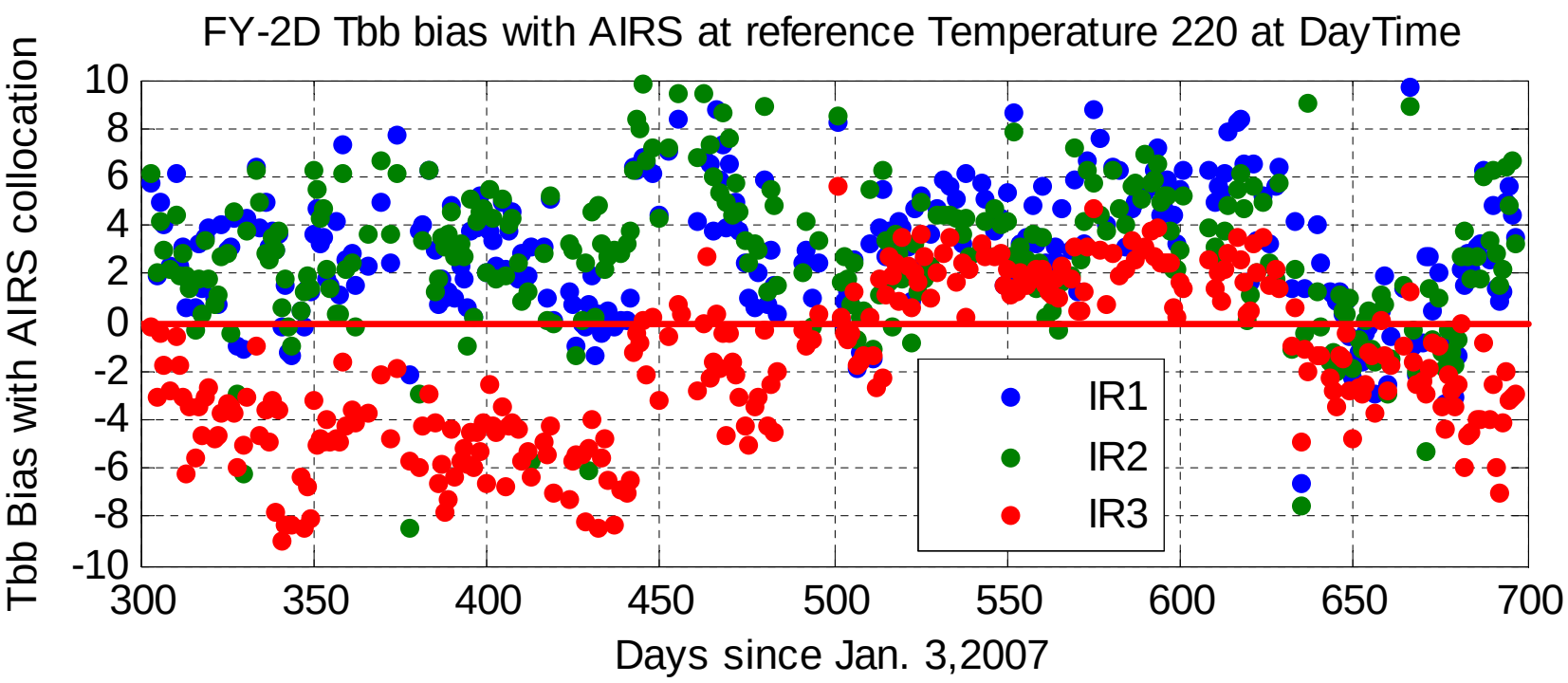

FY-2D Tbb bias with AIRS at reference Temperature 290 at NightTime
Tbb Bias with AIRS collocation
5
4
3
2
1
0
-1
-2
-3
-4
-5
300
350
400
450
500
550
600
650
700
IR1
IR2
days since Jan. 3,2007


FY-2D Tbb bias with AIRS at reference Temperature 290 at DayTime
Tbb Bias with AIRS collocation
5
4
3
2
1
0
-1
-2
-3
-4
-5
300
350
400
450
500
550
600
650
700
IR1
IR2
days since Jan. 3,2007

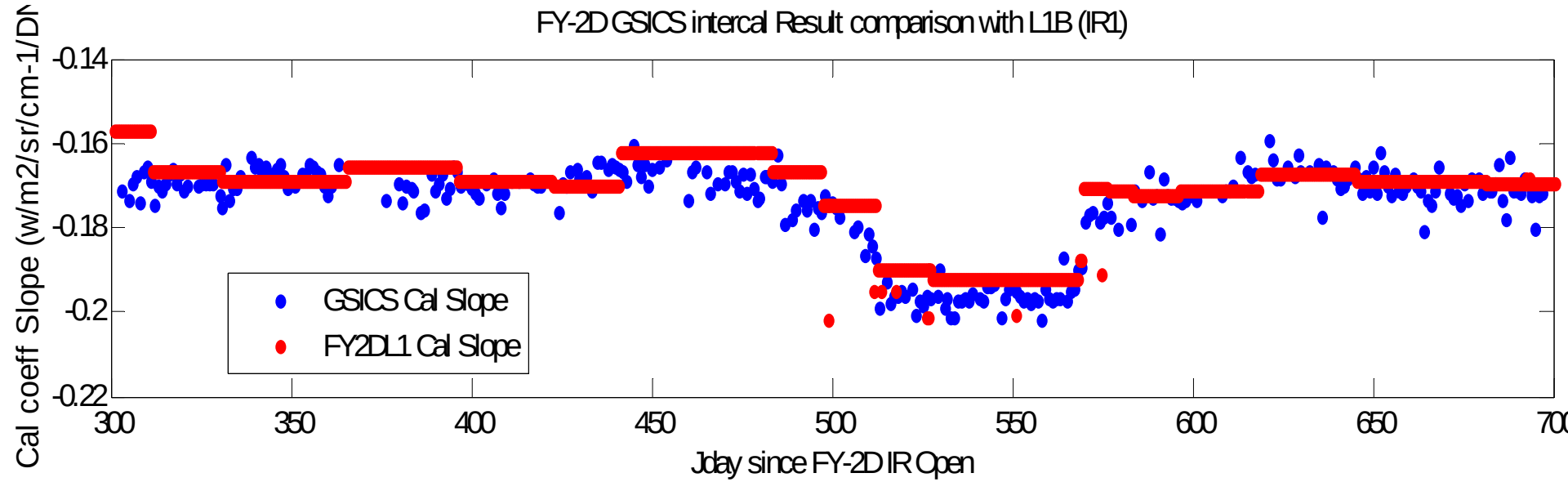

FY-2D Tbb bias with AIRS at reference Temperature 250 at NightTime
Tbb Bias with AIRS collocation
10
8
6
4
2
0
-2
-4
-6
-8
-10
300
350
400
450
500
550
600
650
700
Days since Jan. 3,2007
IR1
IR2
IR3

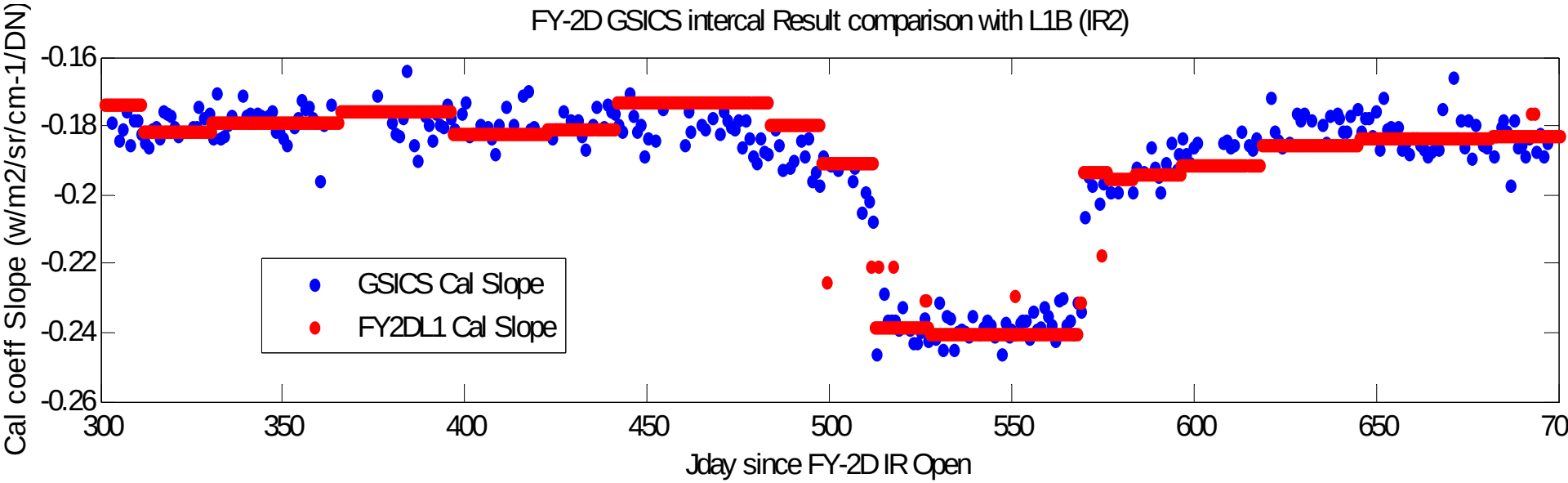

FY-2D Tbb bias with AIRS at reference Temperature 250 at DayTime
Tbb Bias with AIRS collocation
10
8
6
4
2
0
-2
-4
-6
-8
-10
300
350
400
450
500
550
600
650
700
Days since Jan. 3,2007
IR1
IR2
IR3


FY-2D Tbb bias with AIRS at reference Temperature 220 at NightTime
Tbb Bias with AIRS collocation
10
8
6
4
2
0
-2
-4
-6
-8
-10
300
350
400
450
500
550
600
650
700
Days since Jan. 3,2007
IR1
IR2
IR3

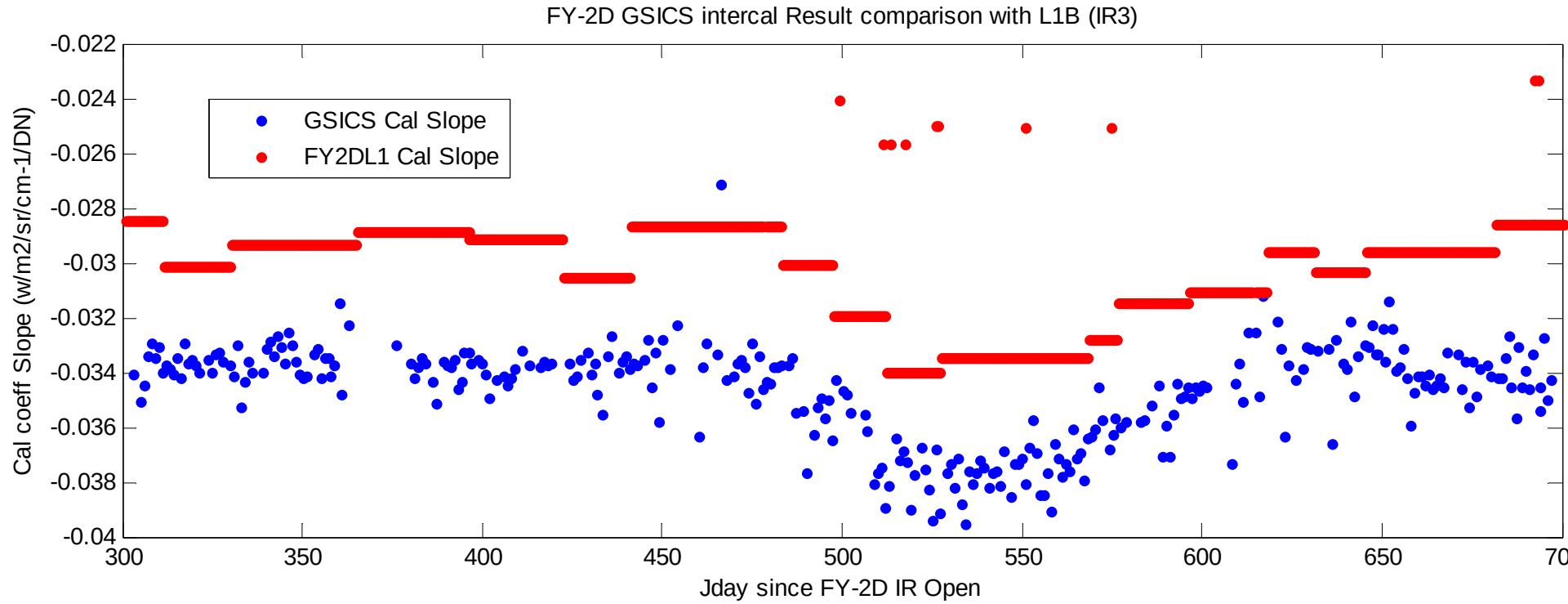

FY-2D Tbb bias with AIRS at reference Temperature 220 at DayTime
Tbb Bias with AIRS collocation
10
8
6
4
2
0
-2
-4
-6
-8
-10
300
350
400
450
500
550
600
650
700
Days since Jan. 3,2007
IR1
IR2
IR3

FY-2D GSICS Intercal Slope for long term

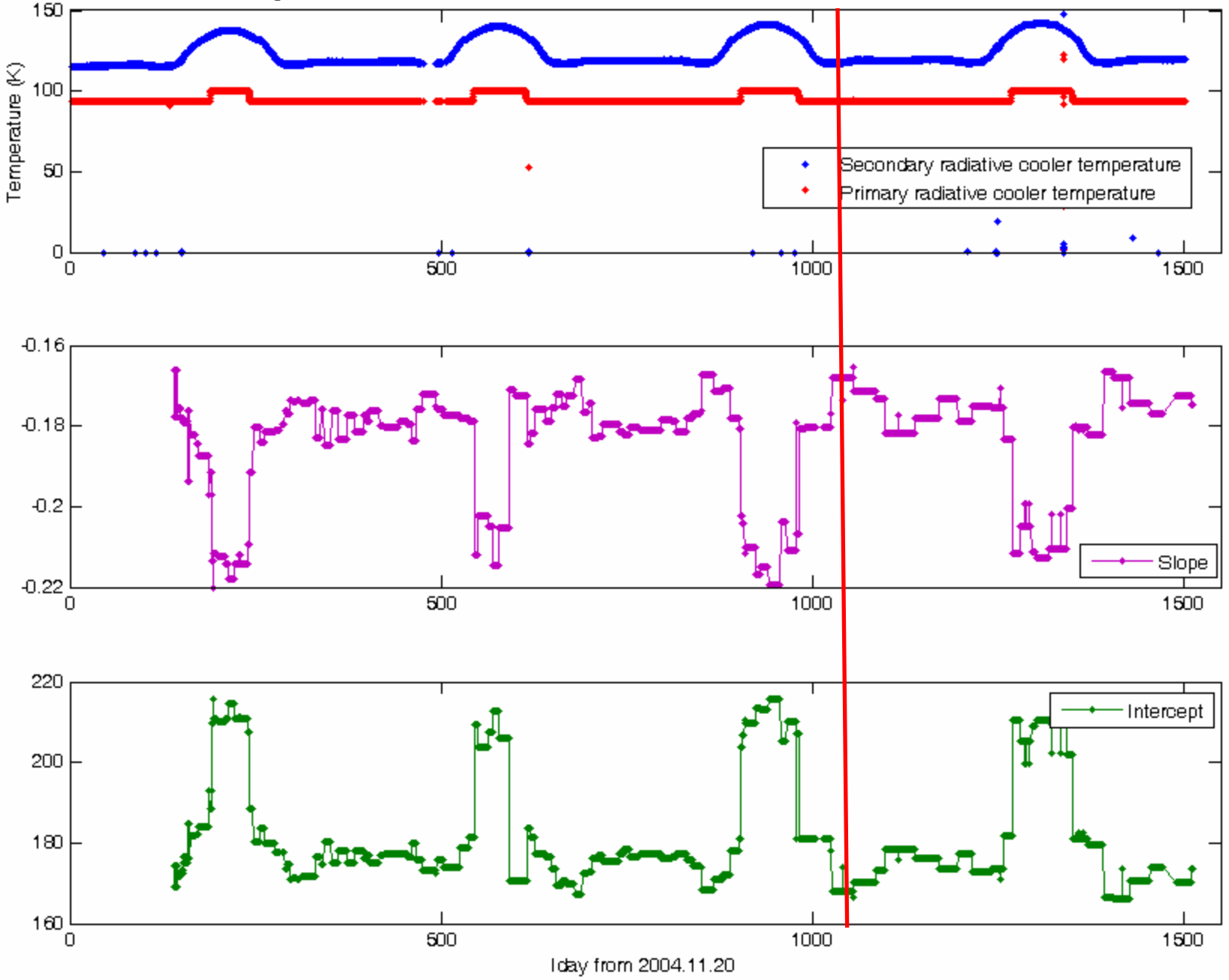




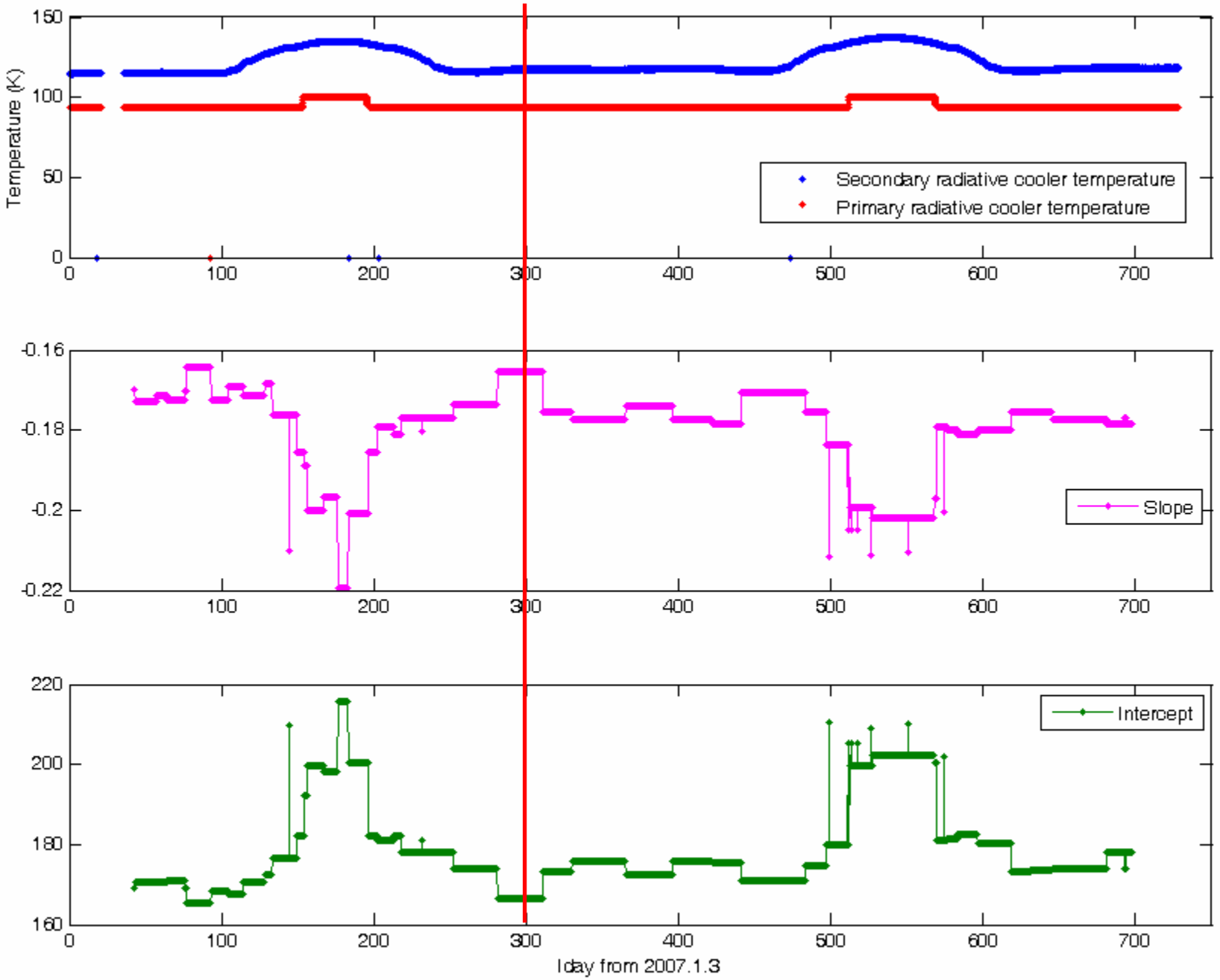
FY-2D GSICS Intercal Slope for long term



Mechanism analysis of FY-2C IR calibration coefficient drift trend



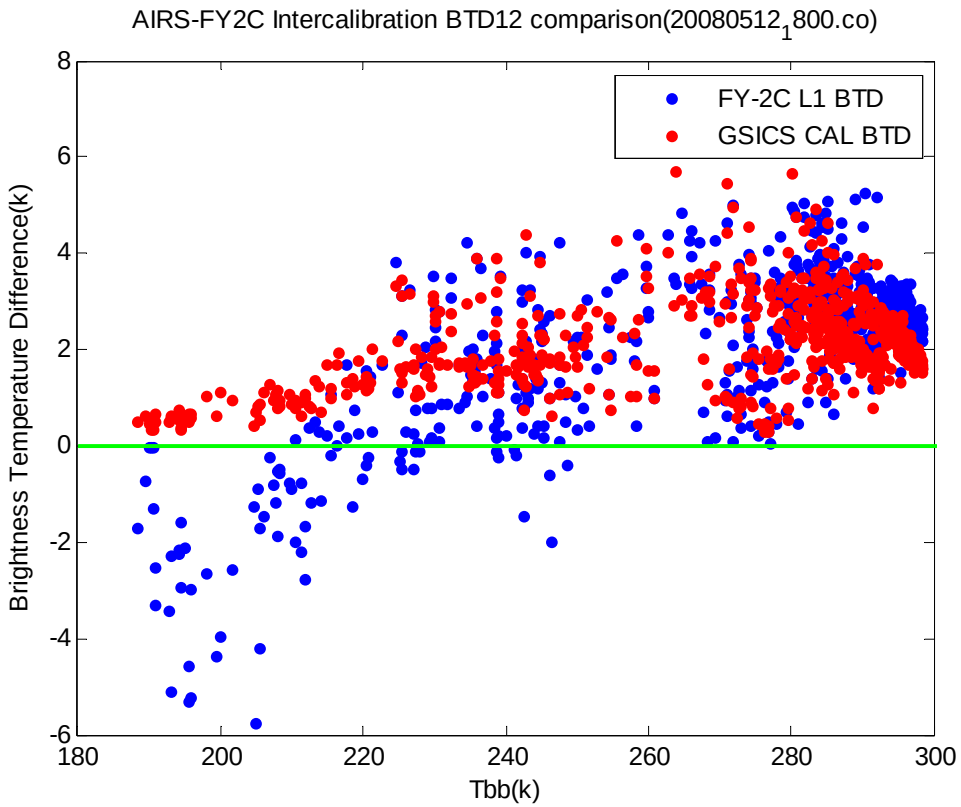
Mechanism analysis of FY-2C IR calibration coefficient drift trend

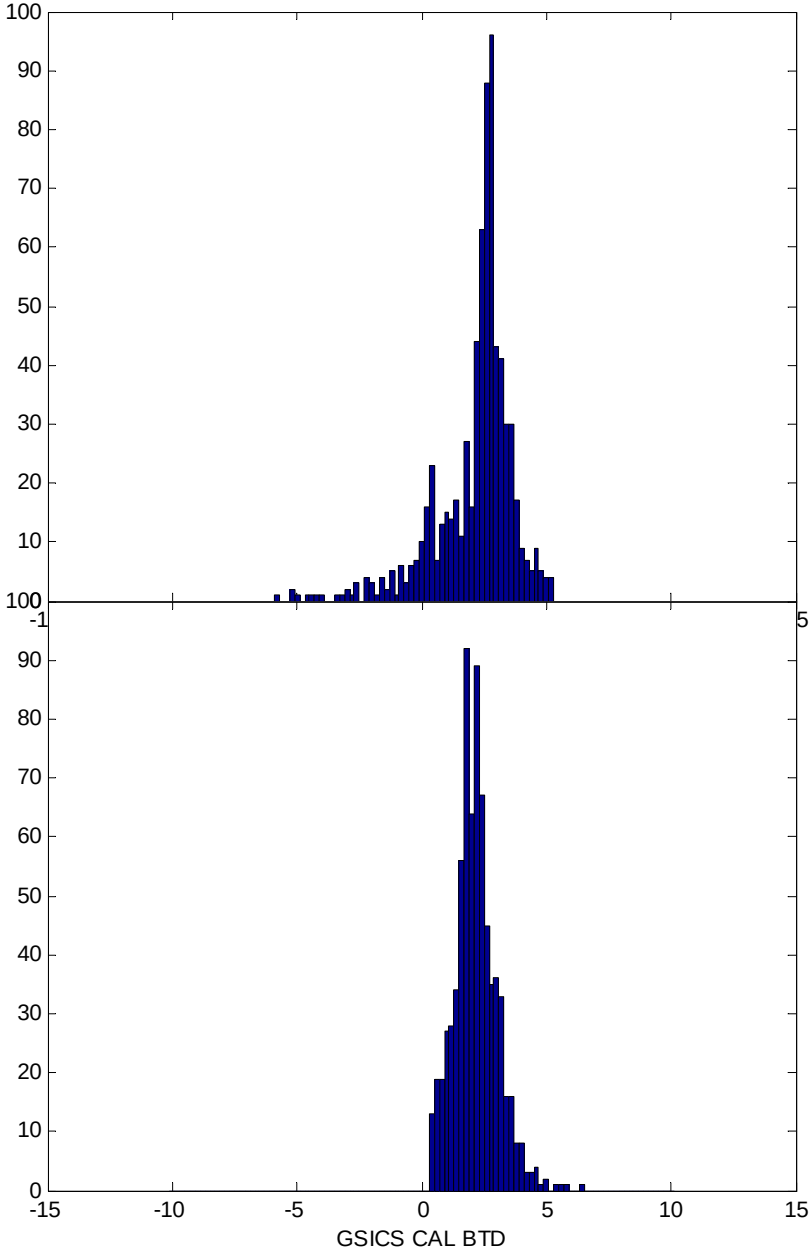


BTD Anomaly on FY-2C/2D

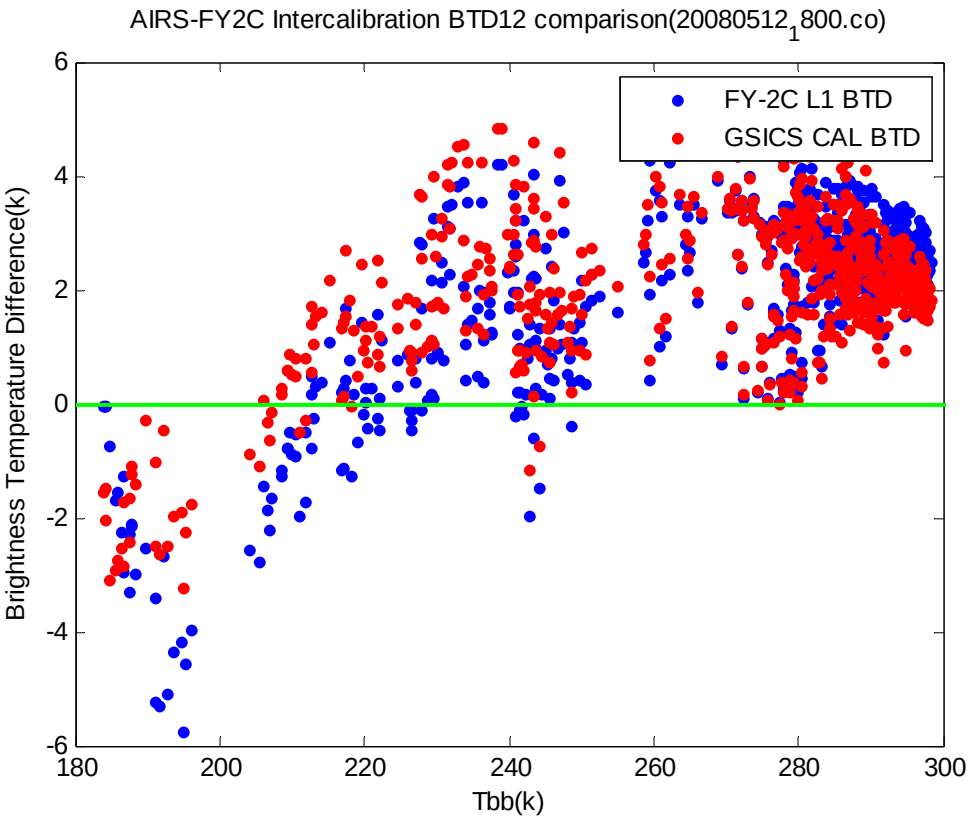
- Anomaly on Split window Brightness Temperature Difference (BTD) of FY-2C/2D L1B was found, especially at cool targets (Deep convective cloud)
- Some reasons from our analysis
  - Straylight contamination
  - MTF difference of these two bands
  - Low sensitivity of sensors at cool targets (<220K)
  - Nonlinear Calibration error
- Expect some BTD improvements for FY-2X calibration from GSICS inter-calibration using AIRS and IASI hyper spectral data.

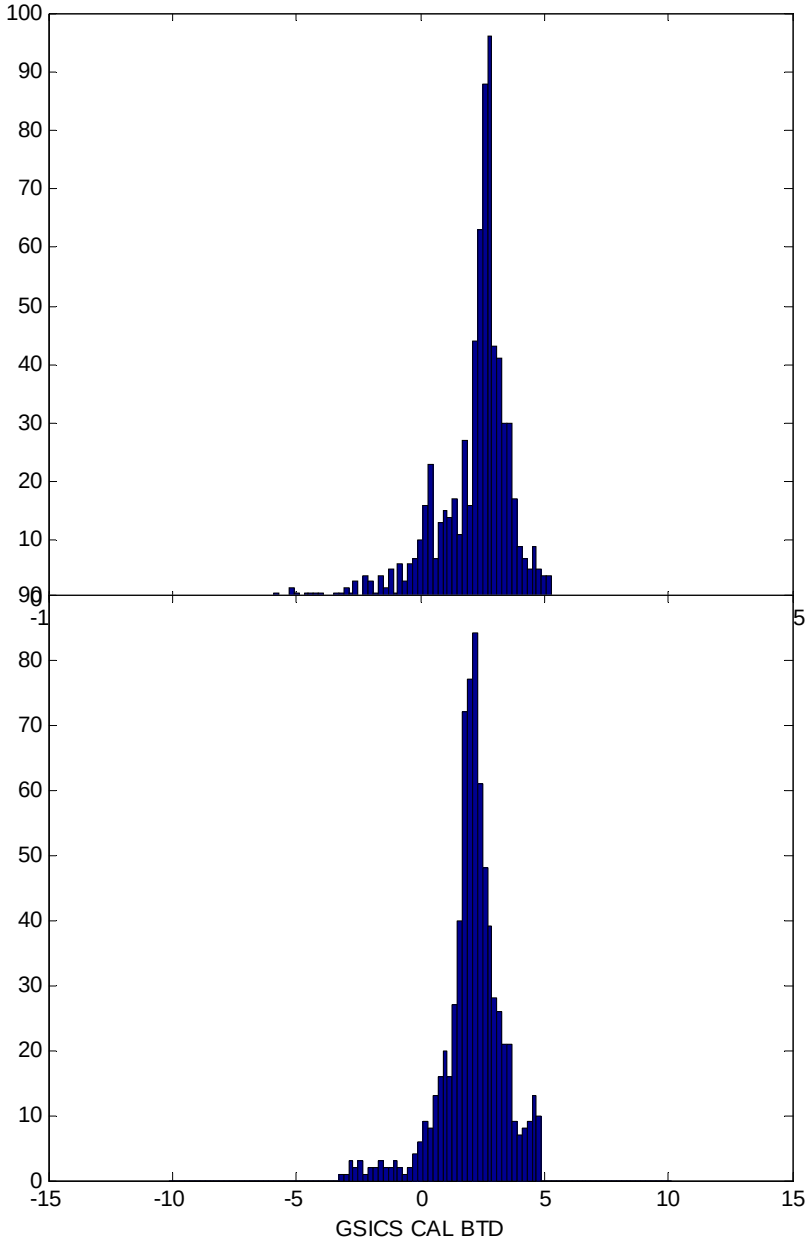
FY-2C BTD comparison with AIRS



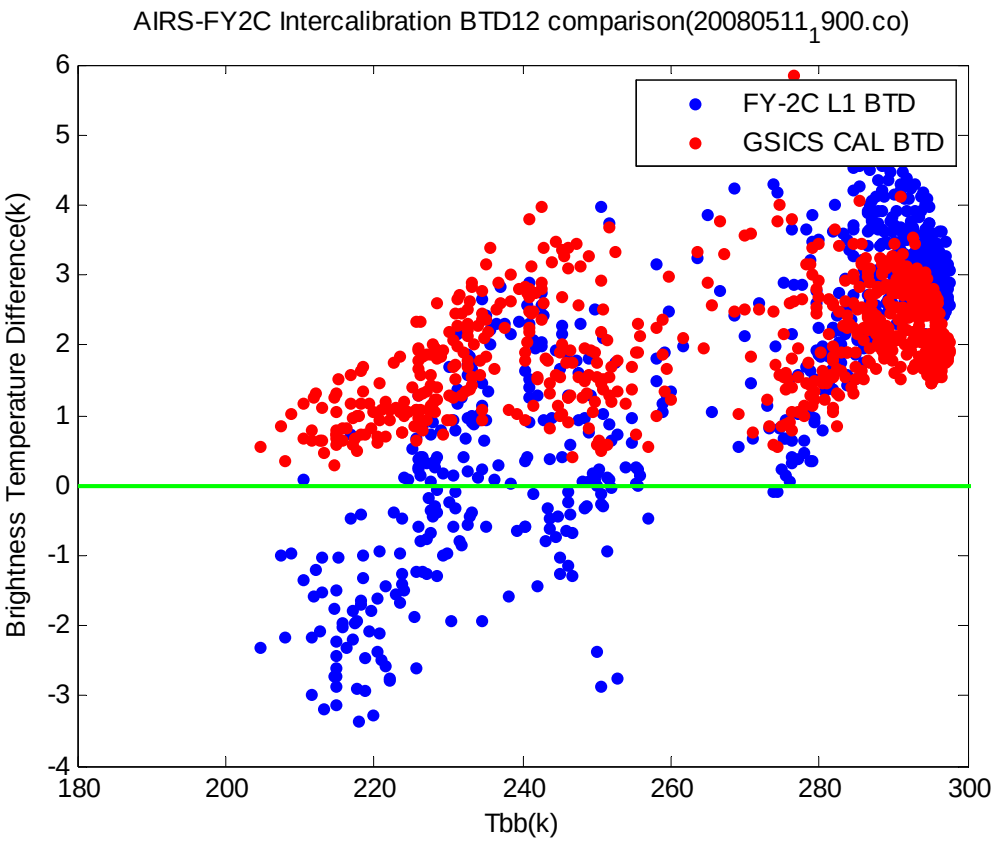


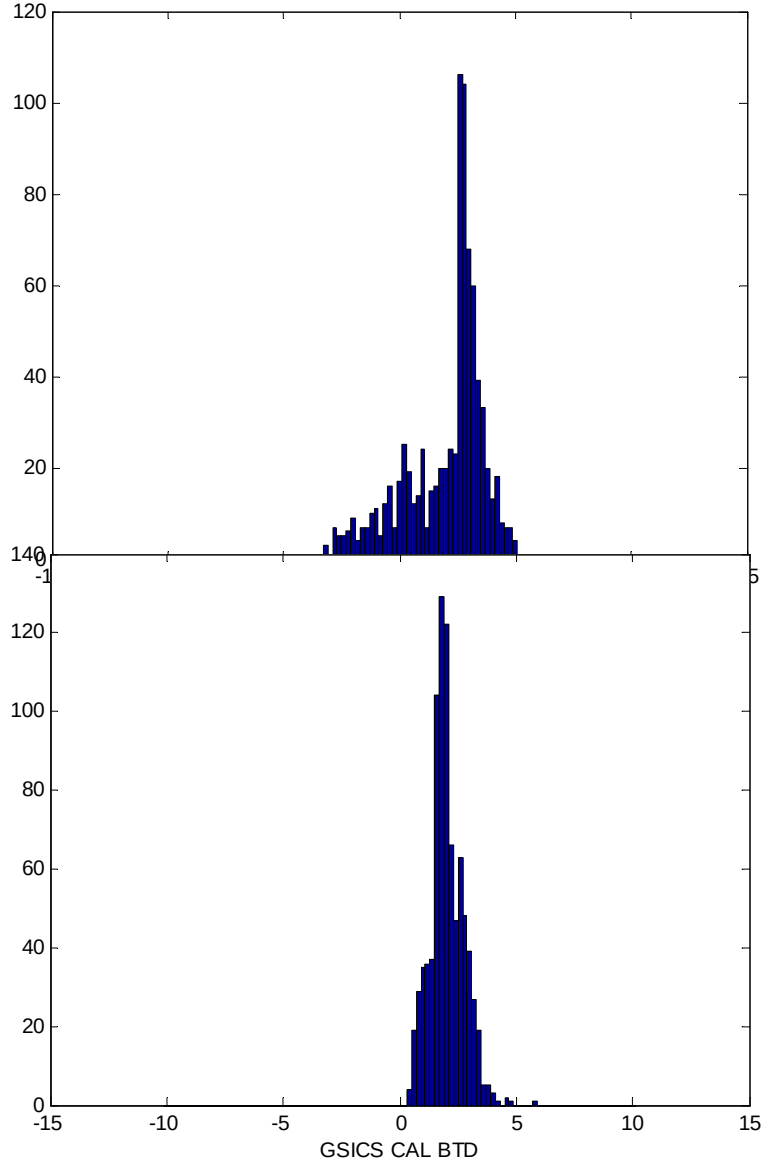
Linear Regression intercalibration BTD Resullt

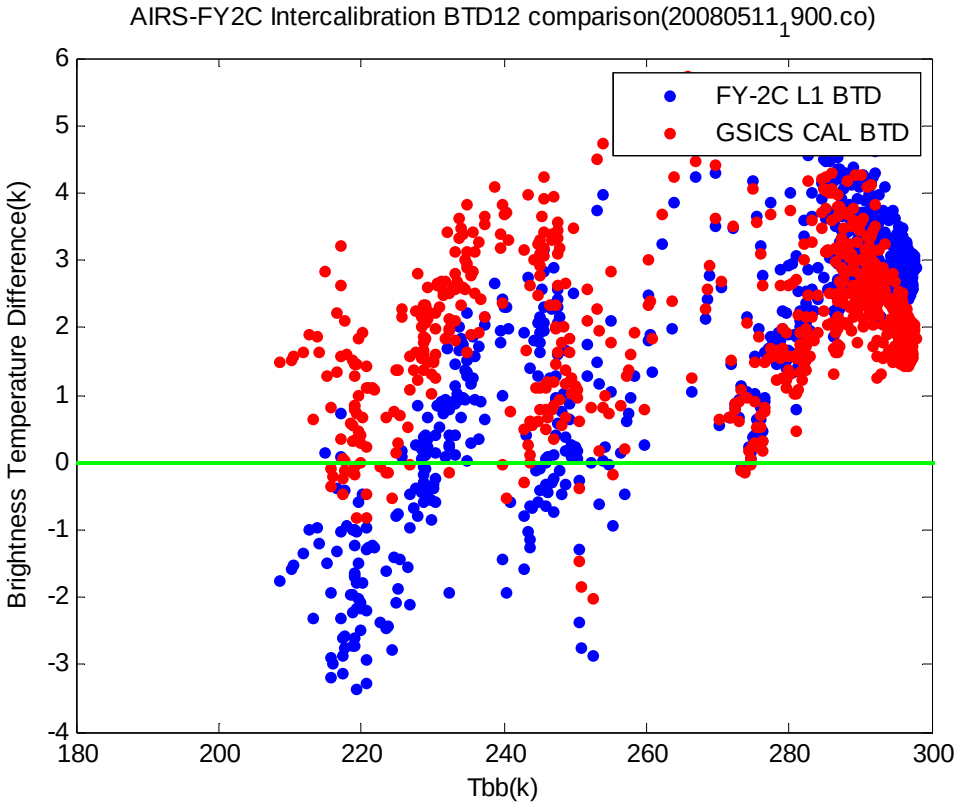


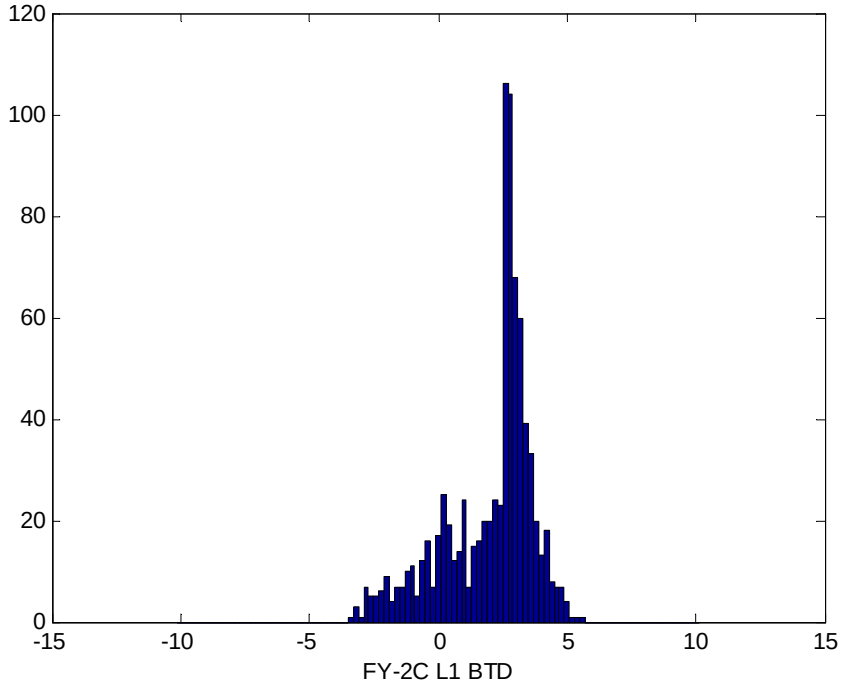


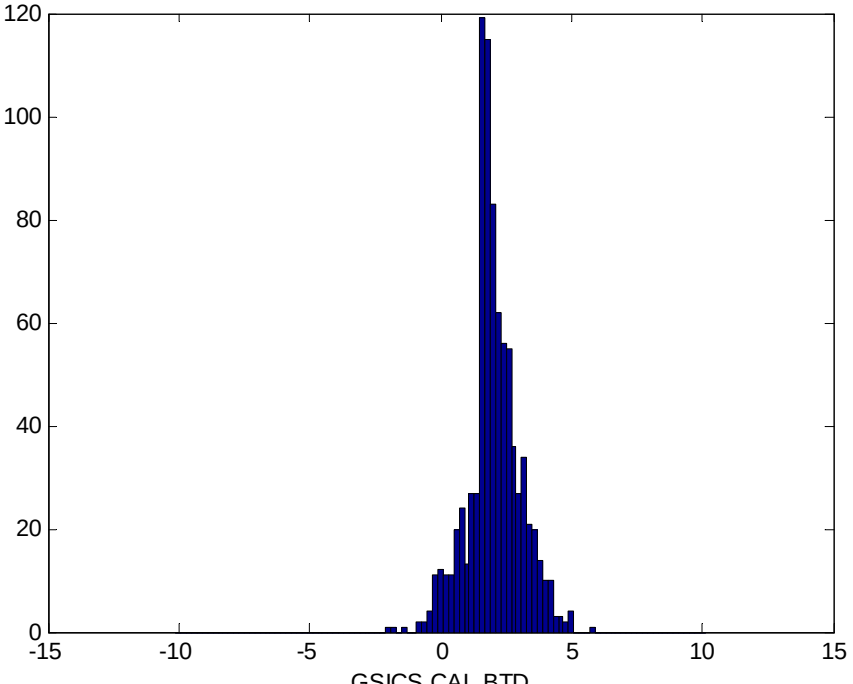
FY-2C BTD comparison with AIRS



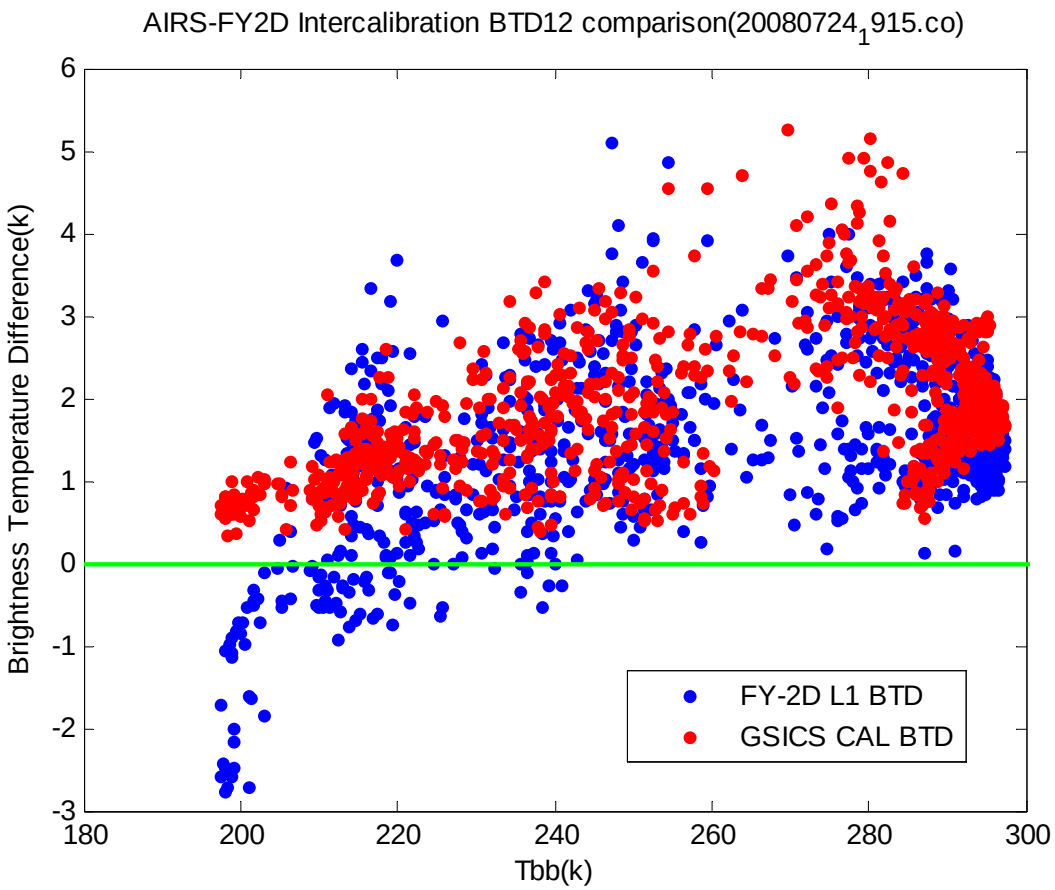


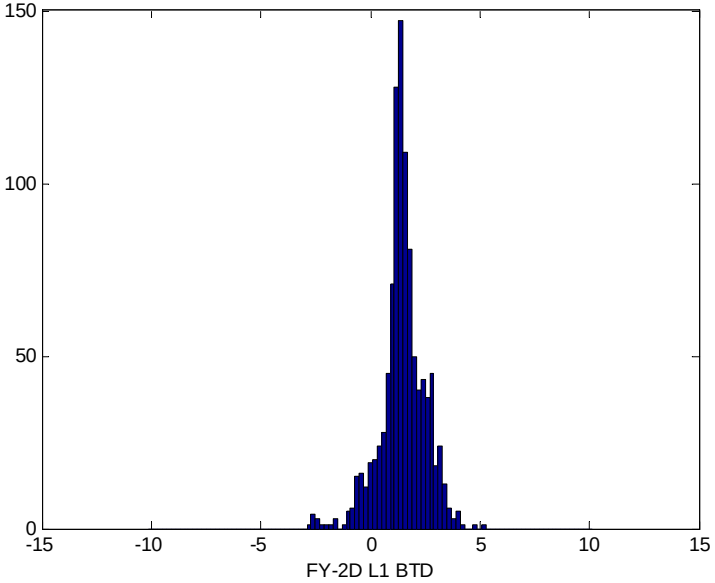

AIRS-FY2C Intercalibration BTD12 comparison(20080511_1900.co)
FY-2C L1 BTD
GSICS CAL BTD
Brightness Temperature Difference(k)
Tbb(k)
6
5
4
3
2
1
0
-1
-2
-3
-4
180
200
220
240
260
280
300

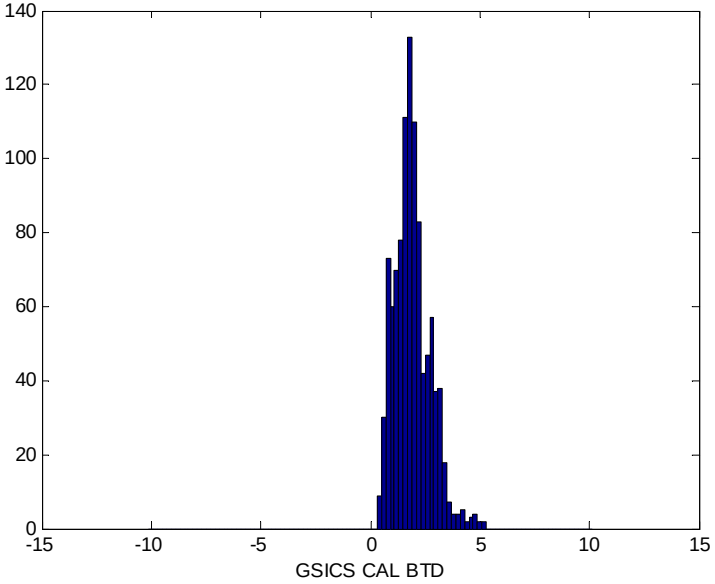

120
100
80
60
40
20
0
-15
-10
-5
0
5
10
15
FY-2C L1 BTD


120
100
80
60
40
20
0
-15
-10
-5
0
5
10
15
GSICS CAL BTD

FY-2D BTD comparison with AIRS



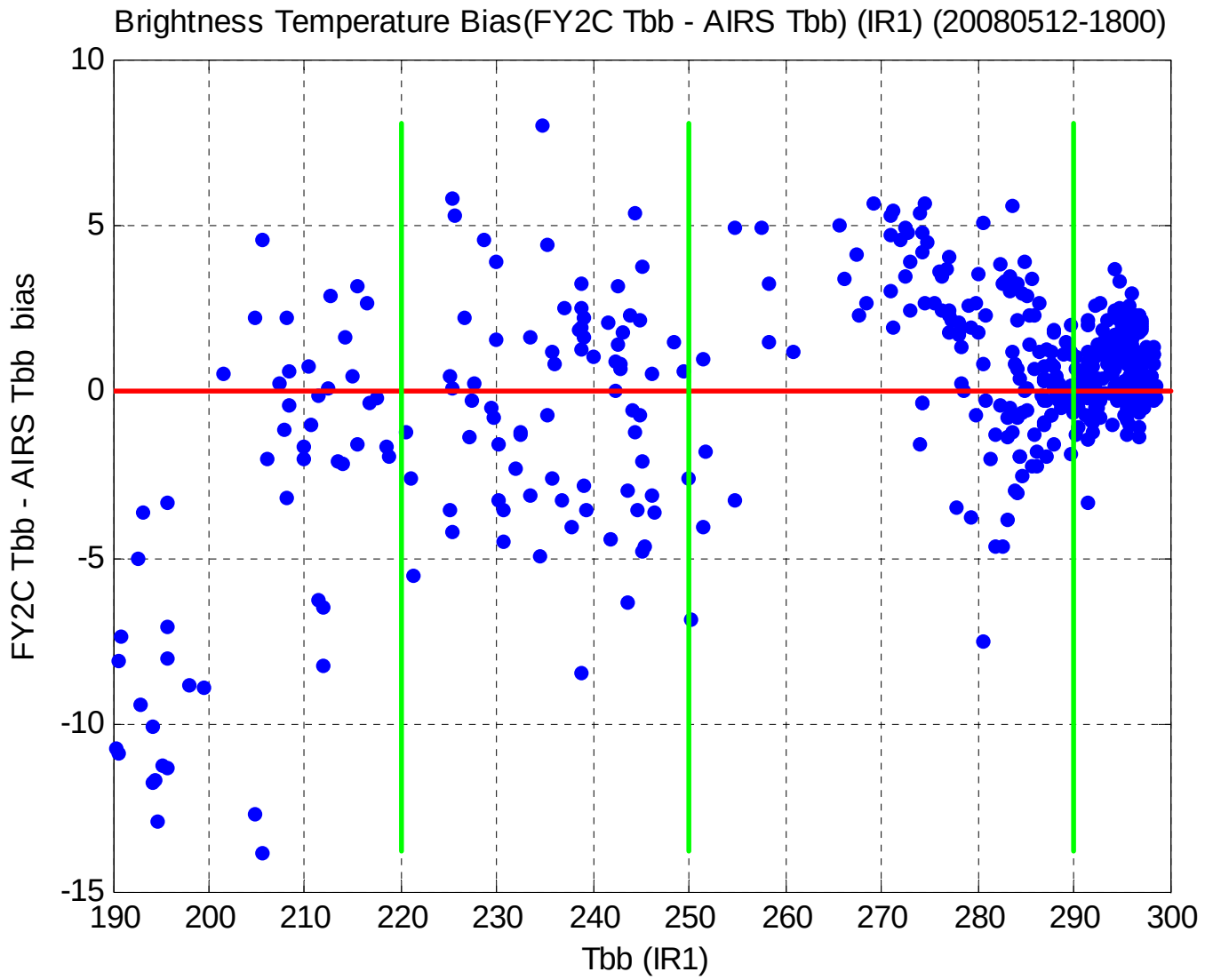




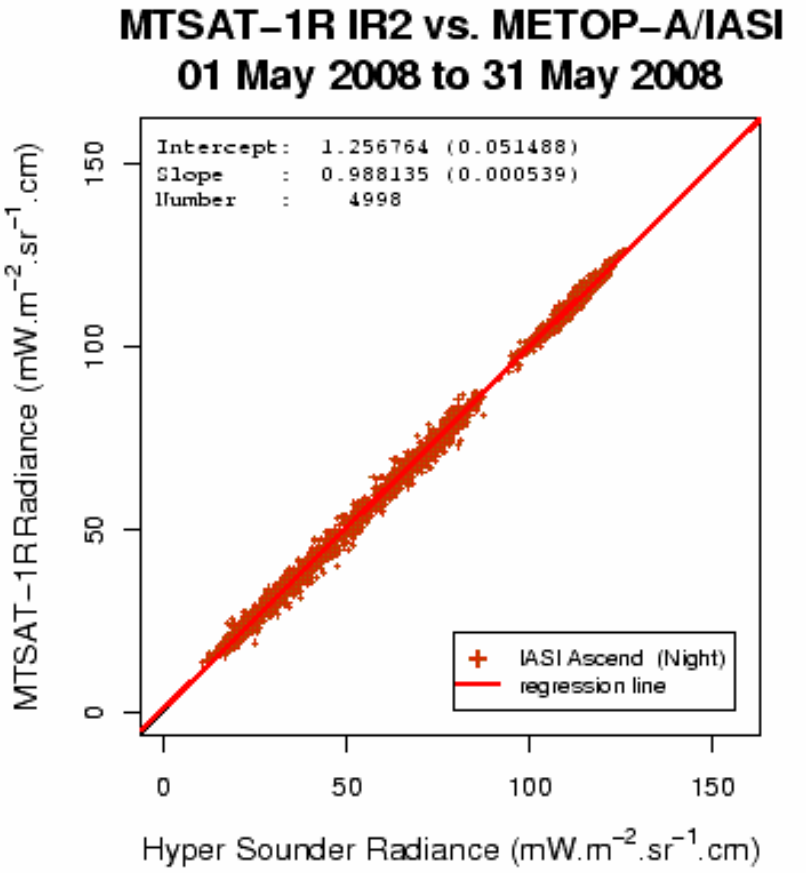
Intensive discussion: GSICS Geo-Leo spatial Collocation for cloud target

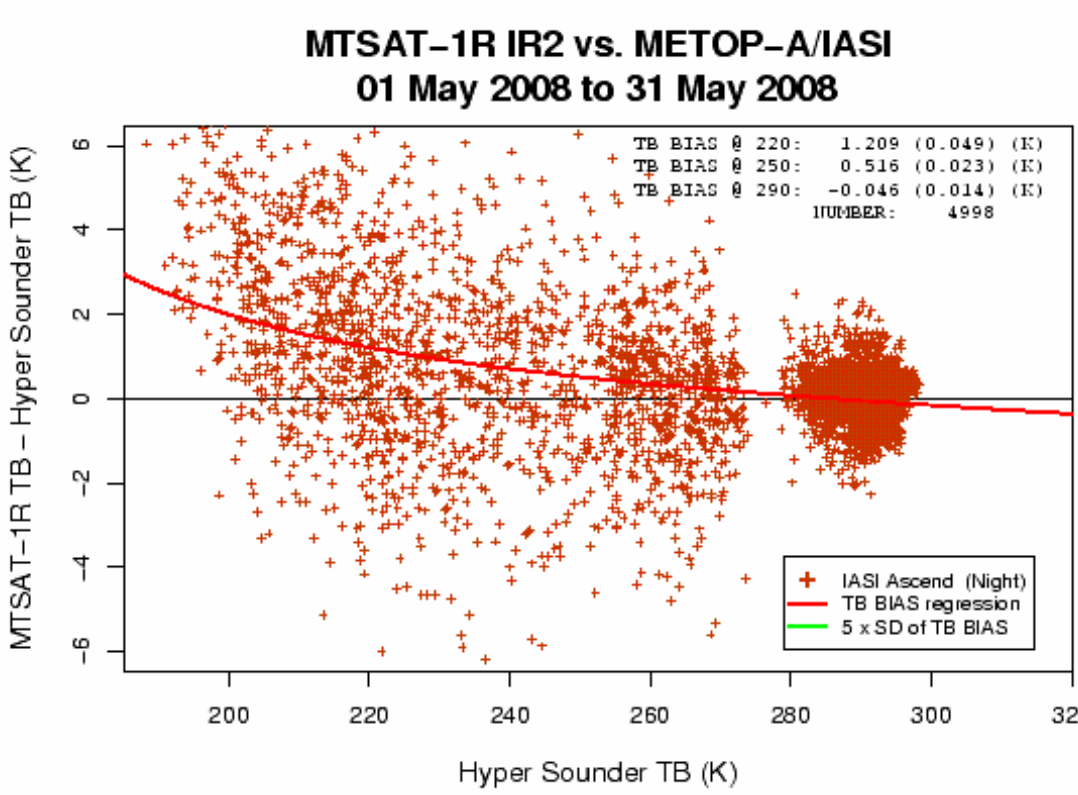
- Higher Tbb bias was found from MTSAT and FY-2C/2D
- High Cloud target maybe affected on the GEO-LEO spatial Collocation
- Should we pay attention to the Height correction of Cool could be considered

Higher Tbb bias was found from FY-2C/2D

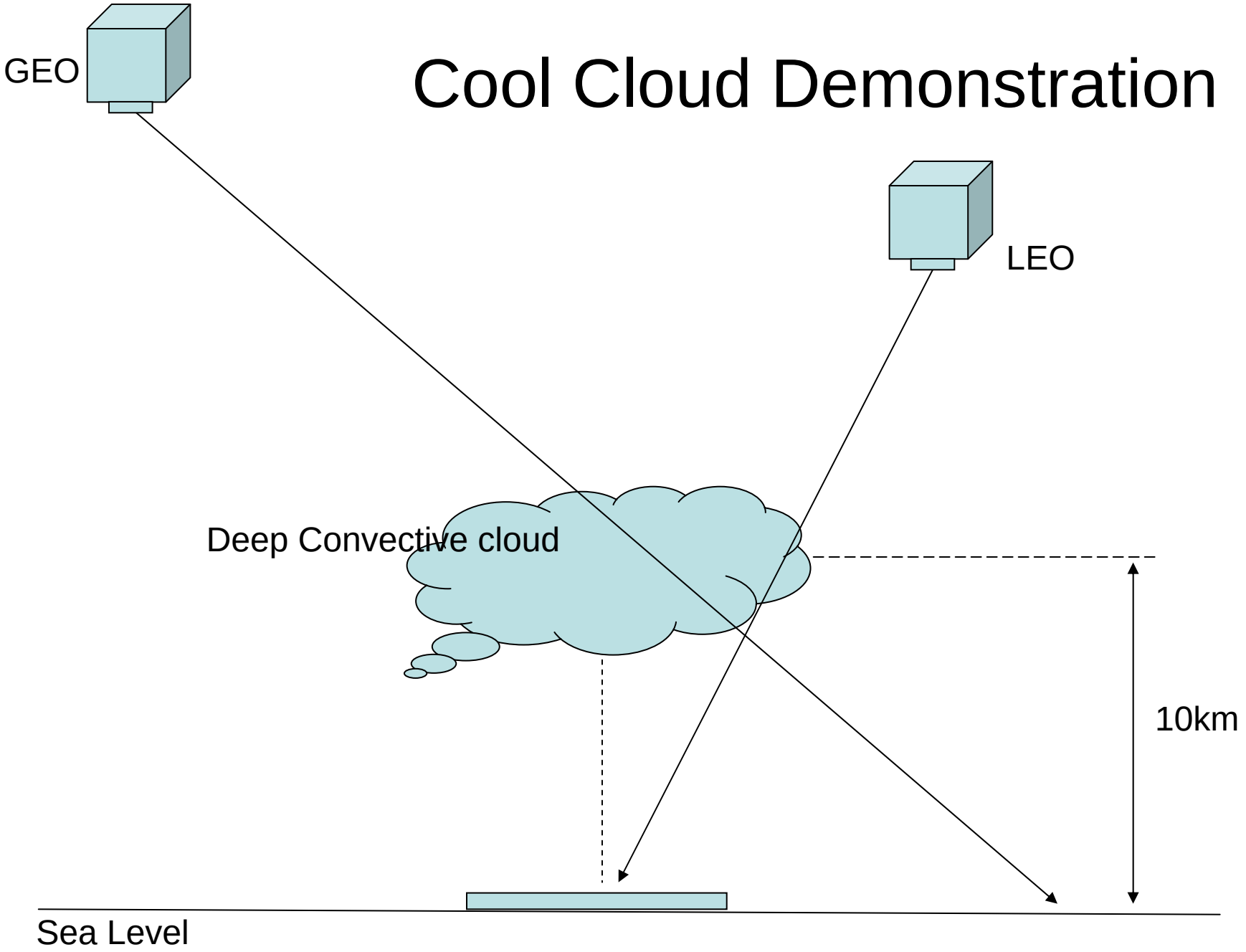


Higher Tbb bias was found from MTSAT





Cool Cloud Demonstration



Near Future Plan

- Operation routinely of GSICS algorithm for FY-2C/2D/2E based on AIRS inter-calibration
- Experimental operation based on IASI and its results will be inter-compared with the results based on AIRS
- Web-based release of FY-2X GSICS results of all lifetime
- Straylight and MTF correction will be conducted deeply
- FY-3A/MERSI/VIRR/IRAS LEO-LEO inter-calibration with MODIS, AIRS and IASI routinely

Timetable of Actions to Implement GSICS Plan in CMA

Action	Responsibility	Target Date
Realize FY-2C/2D GSICS into routinely operation	NSMC	06/31/2009
Create and Open CMA GPRC web site	NSMC	06/31/2009
Establish a near real-time monitoring system of instrument performance of FY serial sensors	NSMC	12/31/2009
Establish calibration data sharing platform for FY serial sensors including SNO data, global reference Sites Images and OBC data	NSMC	12/31/2010
Recalibration for the FY-1C/1D retrospectively	NSMC	06/31/2010