Review of IR Intercalibration Algorithm and Recent Visible Calibration Activities

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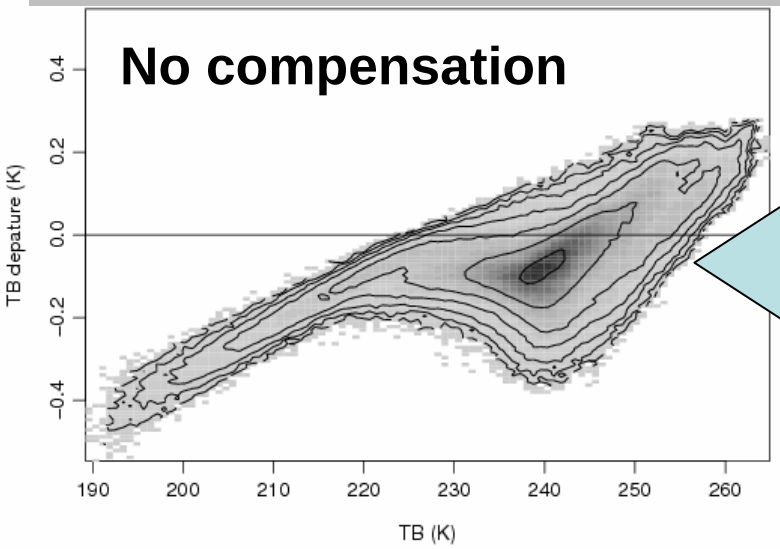
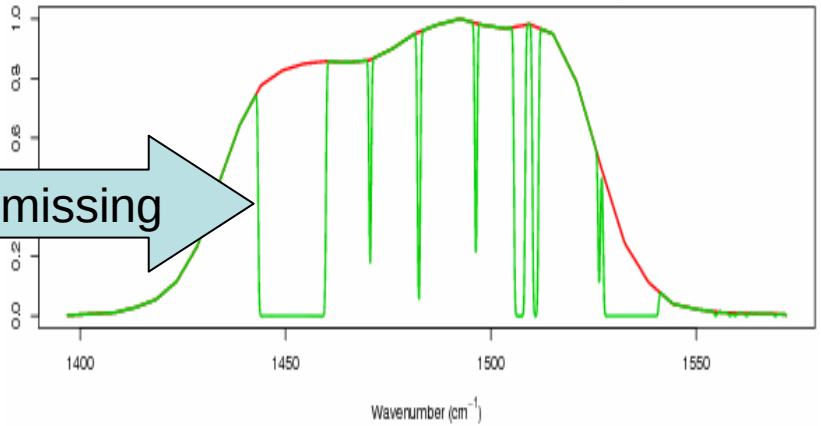
Validation of the “Constraint” Spectral Compensation Method

Validation of Spectral Compensation Tech. Simulating AIRS super channel by IASI

BT Residuals

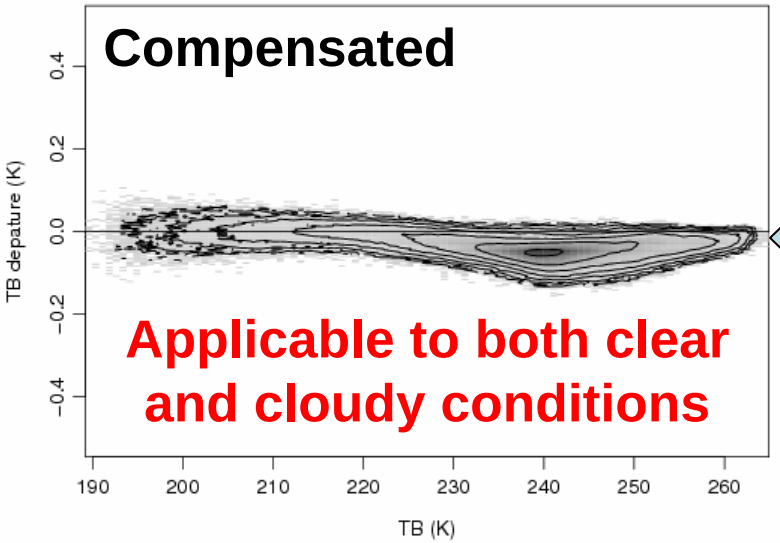


AIRS super channel for MTSAT-1R
WV (6.8 um) simulated by IASI

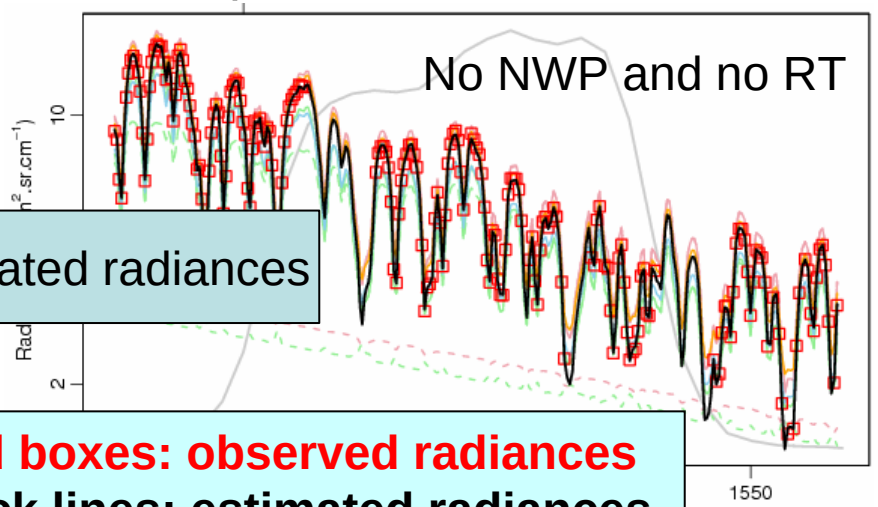


spectral missing

Example of estimated radiances



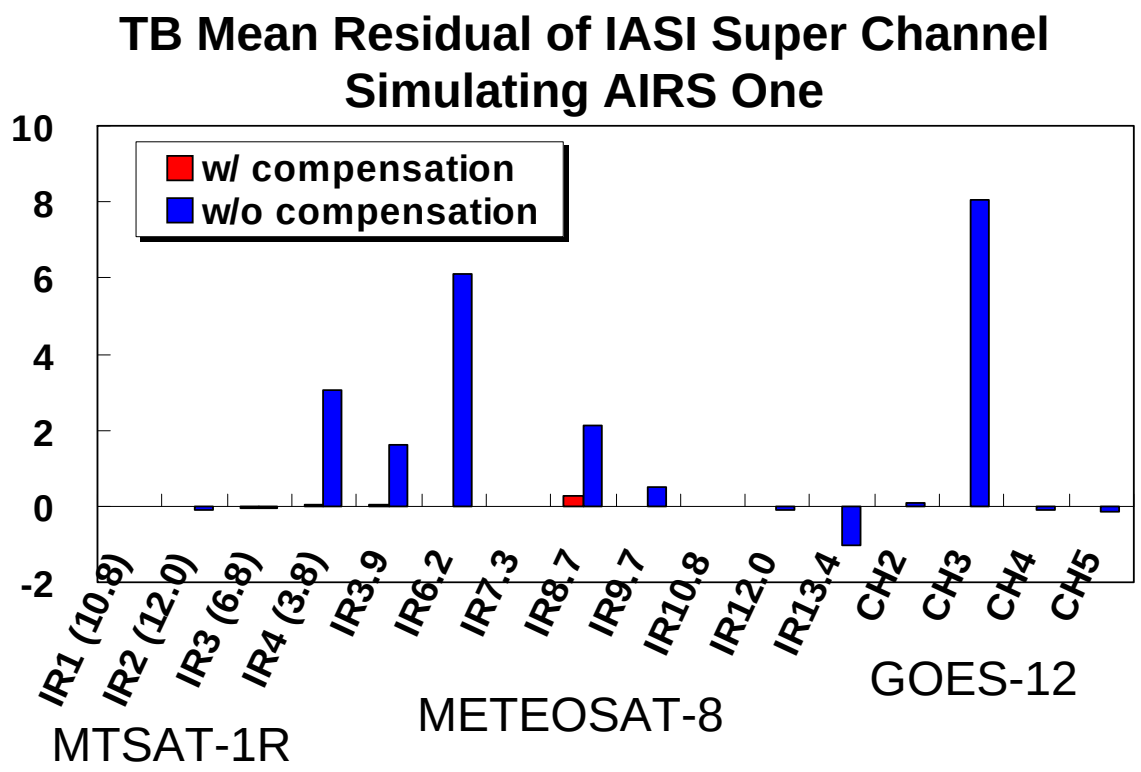
estimated radiances



red boxes: observed radiances
black lines: estimated radiances

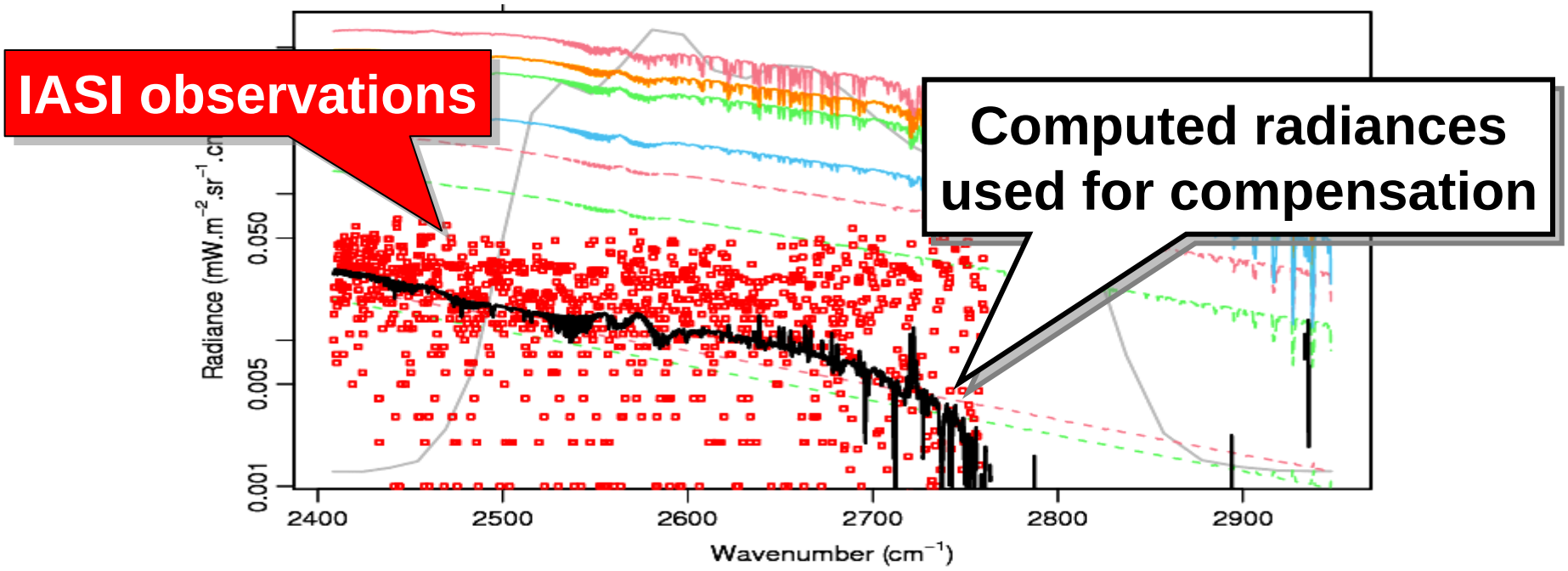
Validation (cont.)

- "Constraint" spectral compensation method is effective for all GEO channels



Compensation		Yes	No
MTSAT-1R	IR1 (10.8)	0.01	-0.02
	IR2 (12.0)	0.01	-0.10
	IR3 (6.8)	-0.04	-0.05
	IR4 (3.8)	0.02	3.03
METEOSAT-8	IR3.9	0.02	1.61
	IR6.2	0.00	6.12
	IR7.3	0.00	-0.02
	IR8.7	0.29	2.13
	IR9.7	0.00	0.49
	IR10.8	0.00	0.02
	IR12.0	0.01	-0.12
	IR13.4	-0.01	-1.04
GOES-12	CH2	0.00	0.09
	CH3	-0.02	8.07
	CH4	0.00	-0.09
	CH5	0.00	-0.13

Difficulty in Extrapolation



- IASI observations are noisy over shorter wavelen.
  - QC is crucial for the spectral compensation
- Currently, reject super channel radiance if

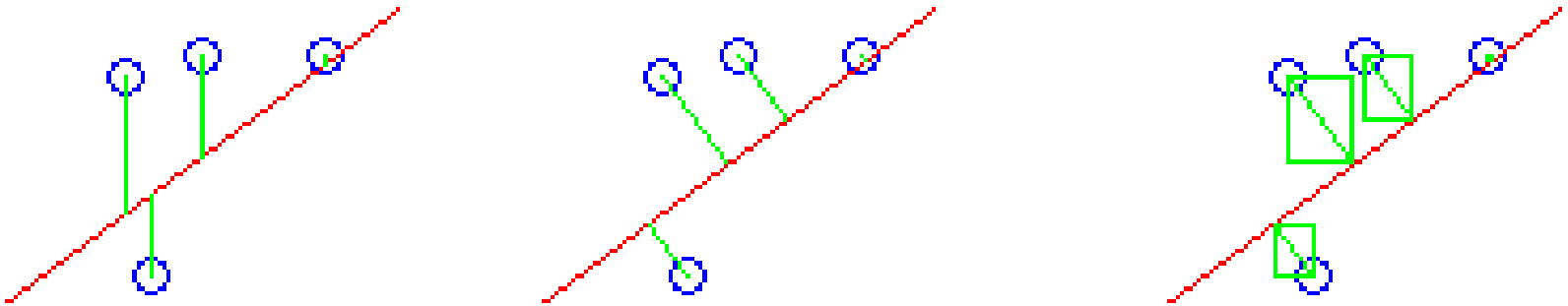
$$| I_{\text{compensated}} - I_{\text{not compensated}} | > 3 \text{ x } I_{\text{not compensated}}$$

Least Square Regression
vs.
Reduced Major Axis Regression

http://bill.srnr.arizona.edu/classes/182/Giraffe/Regression.htm

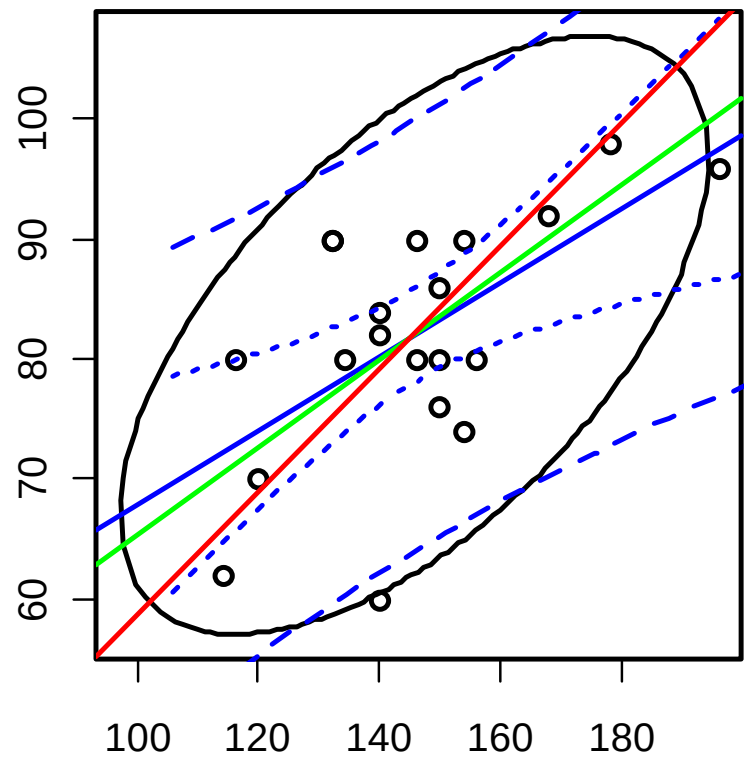
Three Regression Methods

Least Square **Major Axis** **Reduced Major Axis**



Least squares regression is appropriate when there is uncertainty only regarding the y-variable. If both variables are subject to sampling and measurement error, major axis or reduced major axis regression is recommended. In the first two cases, the sum of the squared distances indicated by the green lines is minimized. In the final case, it is the areas of the triangles bounded by the horizontal and vertical green lines that are summed and minimized.

Which Regression?



from http://aoki2.si.gunma-u.ac.jp/R/
(written in only Japanese)

Least squares (LS)

- No error in X is assumed
- $Y = aX + b$ is not equivalent to $X = a'Y + b'$

Major Axis regression (MA)

- Unit of X and Y should be the same
- $Y = aX + b$ is equivalent to $X = a'Y + b'$

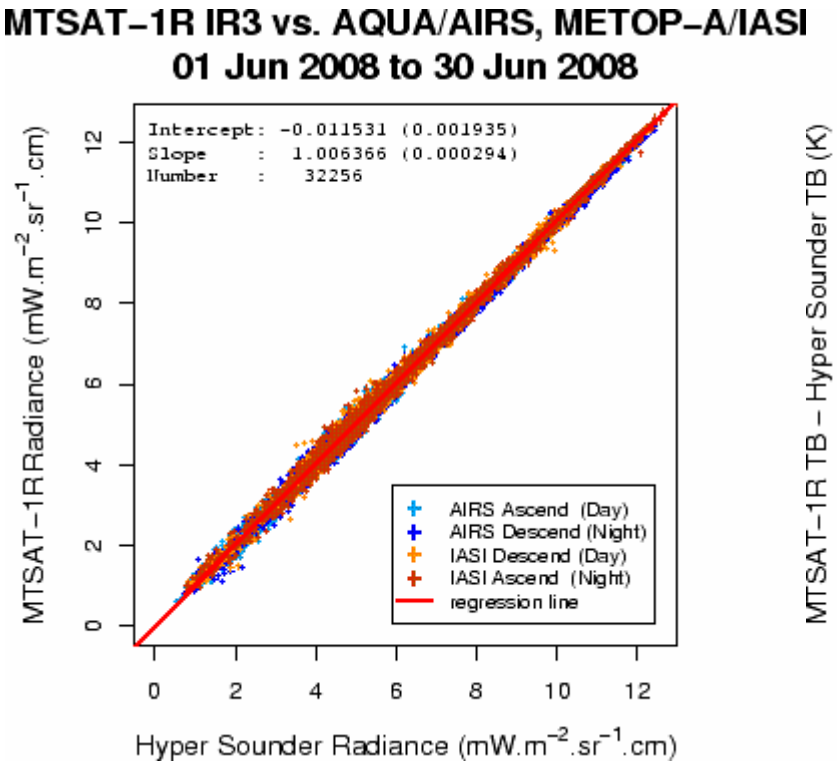
Reduced Major Axis reg. (RMA)

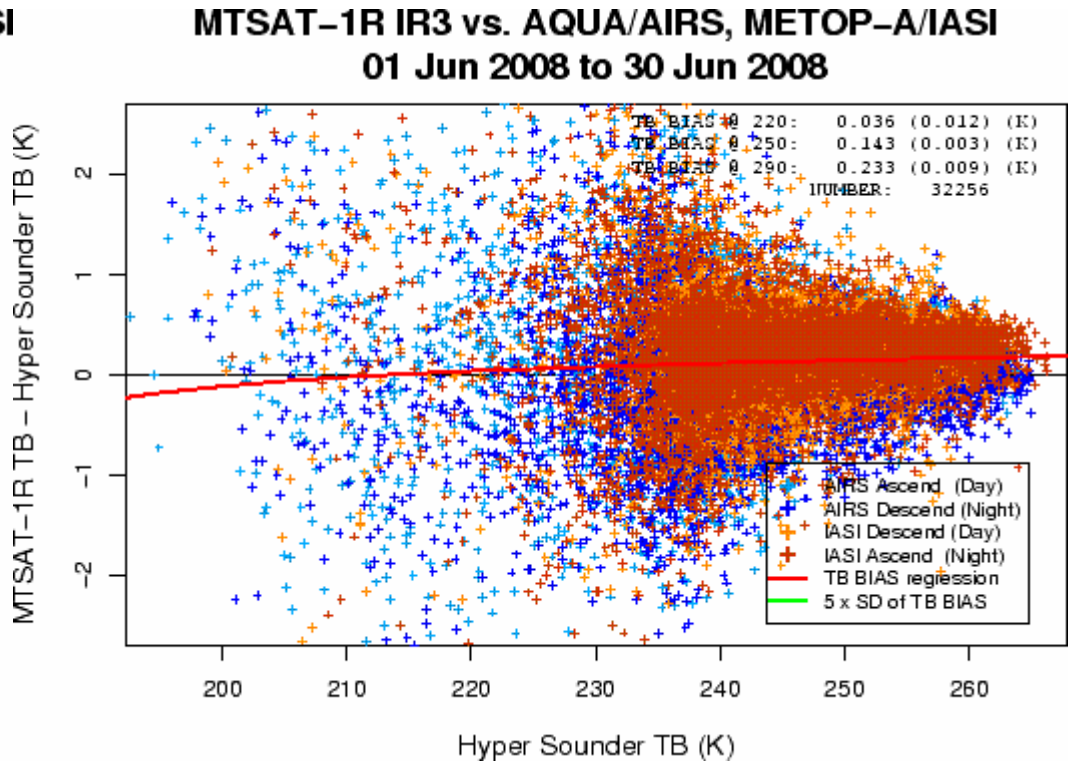
- X and Y are correlated
- $Y = aX + b$ is equivalent to $X = a'Y + b'$
- Easy to calculate

$$a = \pm\sigma_{XY}\sigma_Y/\sigma_X$$

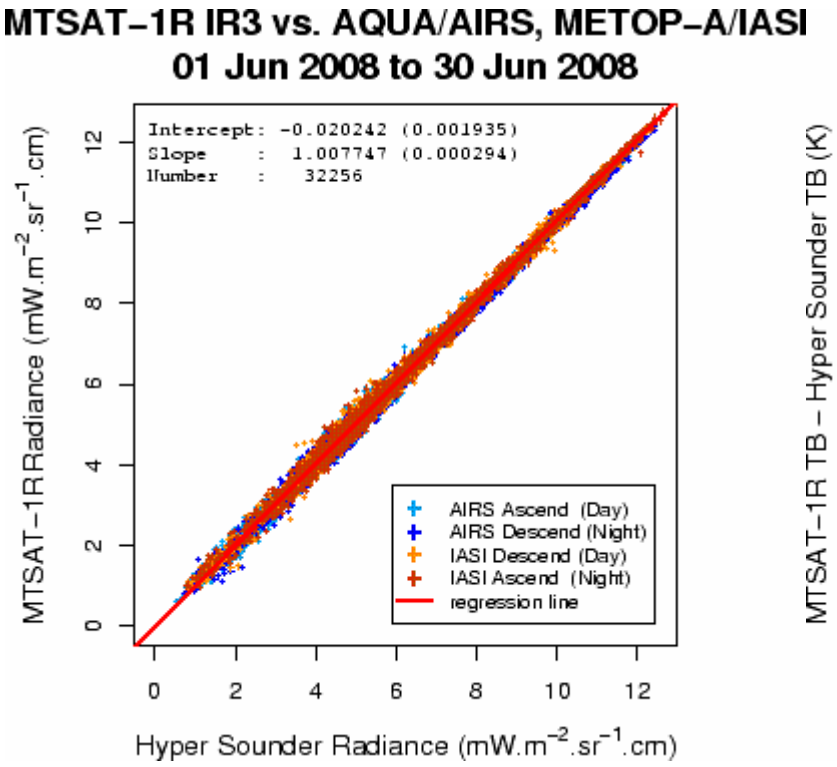
$$b = \overline{Y} - a\overline{X}$$

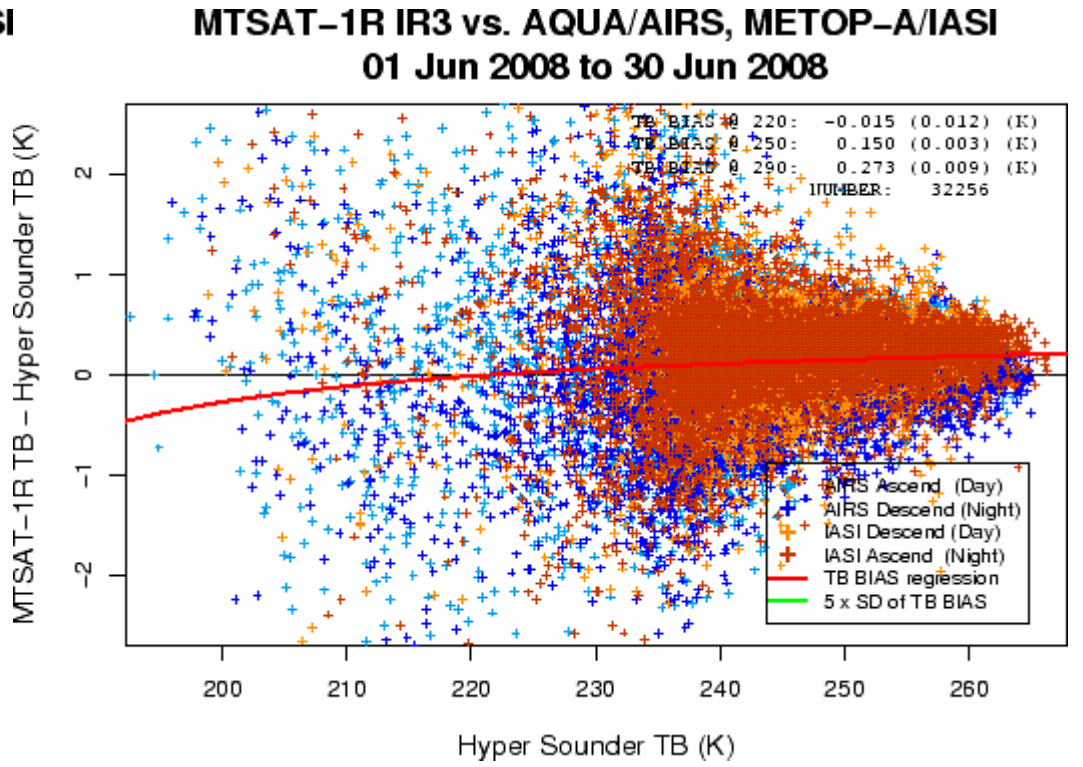
Least Square



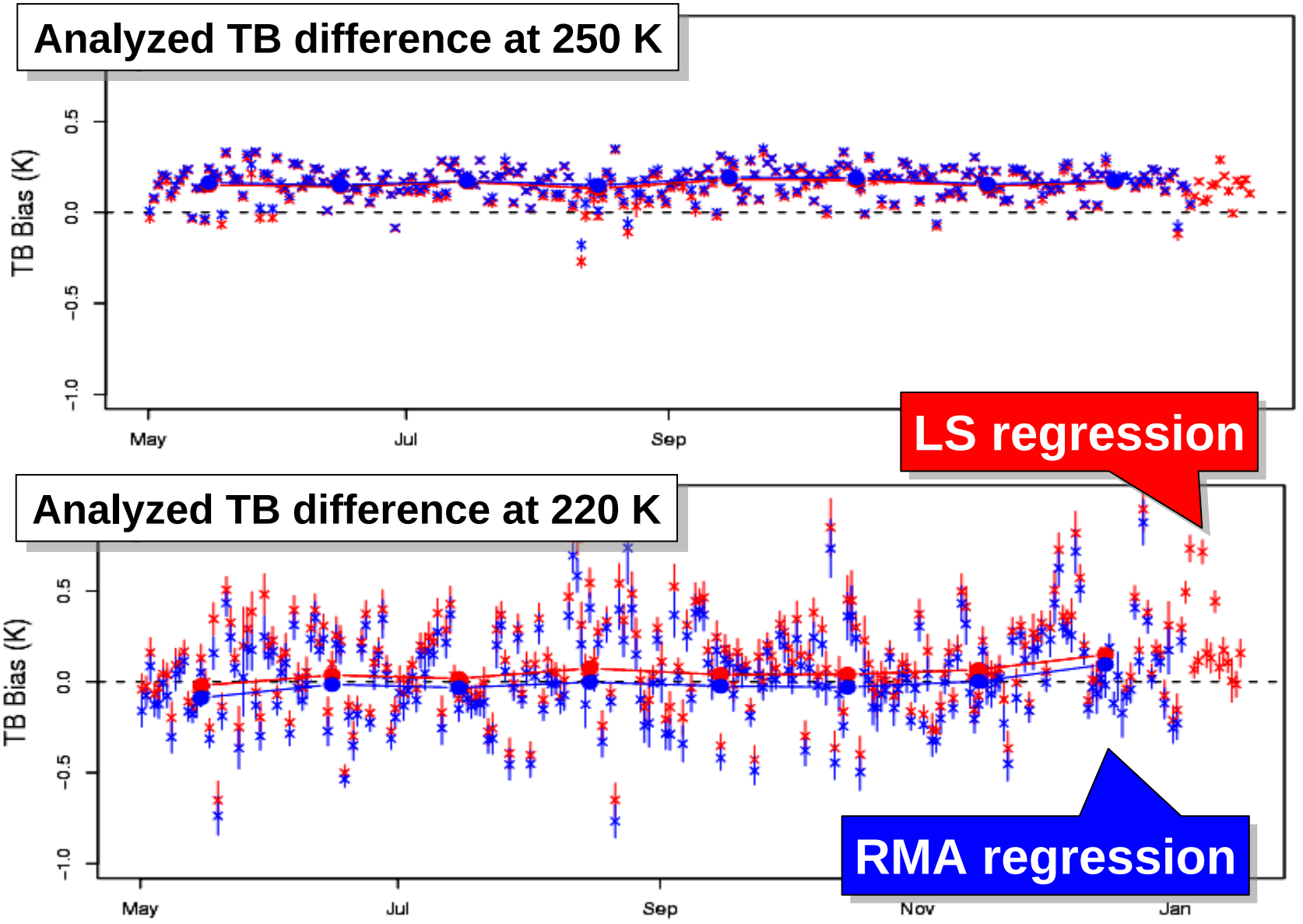


Reduced Major Axis





MTSAT-1R 6.8 um vs. AIRS/IASI



Summary

- RMA (or MA) regression is suitable since both GEO and LEO data contain error
  - RMA slope is always higher than LS one, that causes analysis bias consistently
- However, LS regression is acceptable if the error of GEO/LEO data is small and they are well correlated
  - Difference between LS and RMA is very small in monthly statistics between MTSAT-1R and AIRS/IASI
- RMA (or MA) should be used in case of limited number of data compared
  - Daily statistics
  - Comparison against each LEO orbit