METOP-A MHS and SAPHIR comparisons

Vivienne Payne, Ming Luo (JPL/Caltech)
Jean-Luc Moncet, Pan Liang (AER)

XCAL meeting, Fort Collins, August 2013

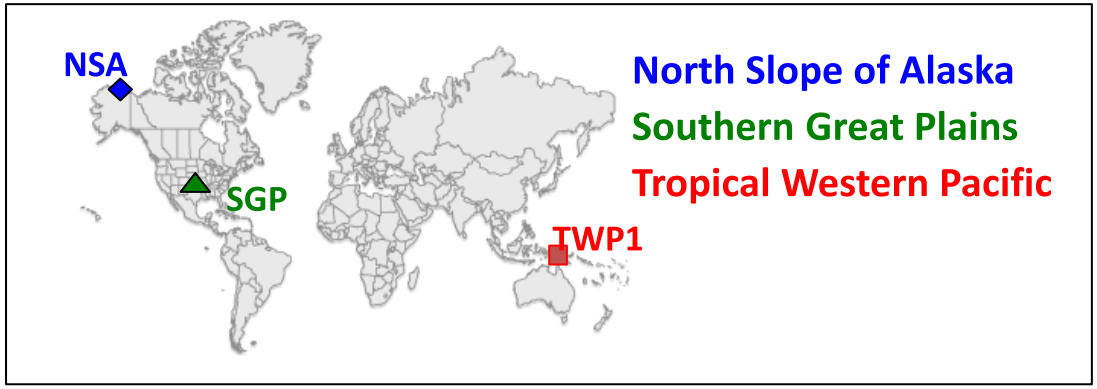
Copyright 2013. All rights reserved.

Measurements

- **July to December 2012**
  - **Mergesonde available for TWP1**
- Satellite instruments:
  - **MetOp-A MHS**
  - **Megha-Tropiques SAPHIR**
- Satellite Tb data:
  - **From Base files**
- Footprint center within 8 km of a DoE ARM site
- **"Clear-sky"** measurements
  - determined using approach of Buehler et al. (2007)
  - Additional convection check
- **Avoid surface influence** using channel-dependent total precipitable water vapor thresholds

Inputs to RTM: Atmospheric state

- **Temperature, H_2O profiles**
- **Merged Sounding** product (MS)
  - From Department of Energy (DoE) Atmospheric Radiation Measurement (**ARM**) sites
    - NSA, SGP, TWP1
  - Sophisticated interpolation of radiosonde profiles
    - 1 minute temporal resolution
  - Attempts to correct for **known radiosonde biases**
  - Assume MS are our **best estimate of "truth"**



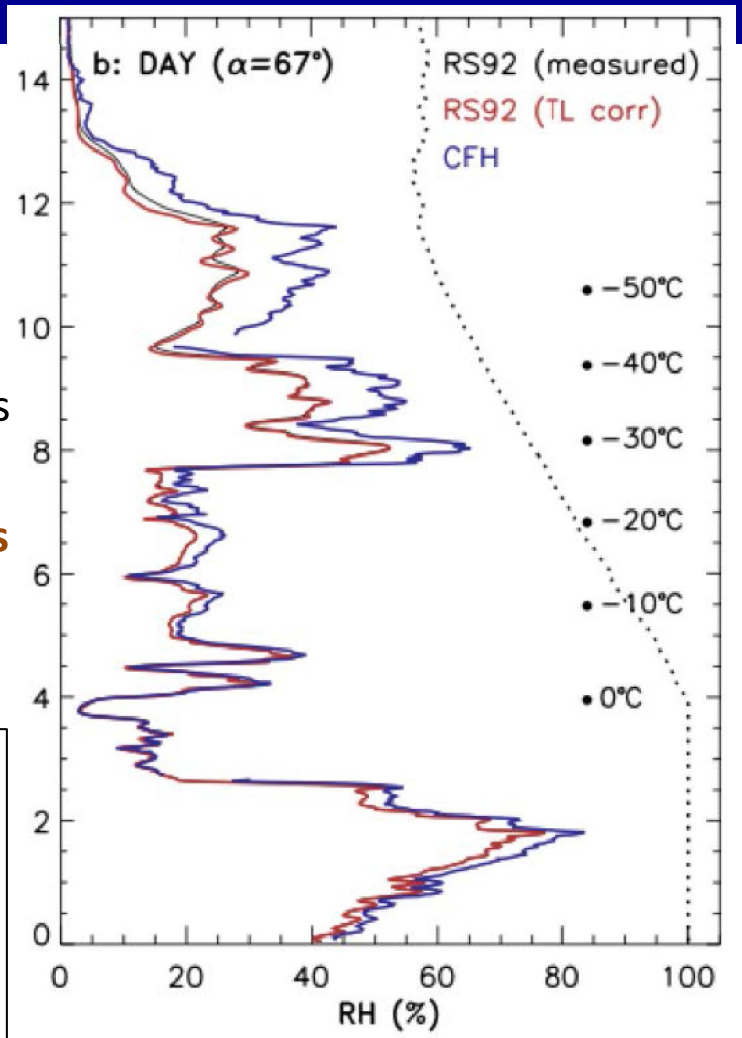


Figure from Miloshevich et al. (2009)

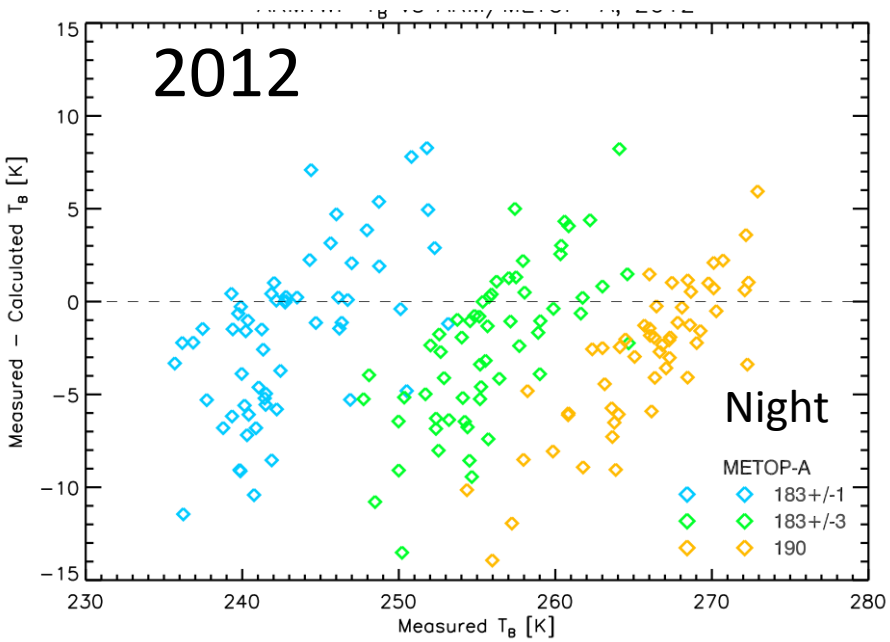
Modeling Tbs

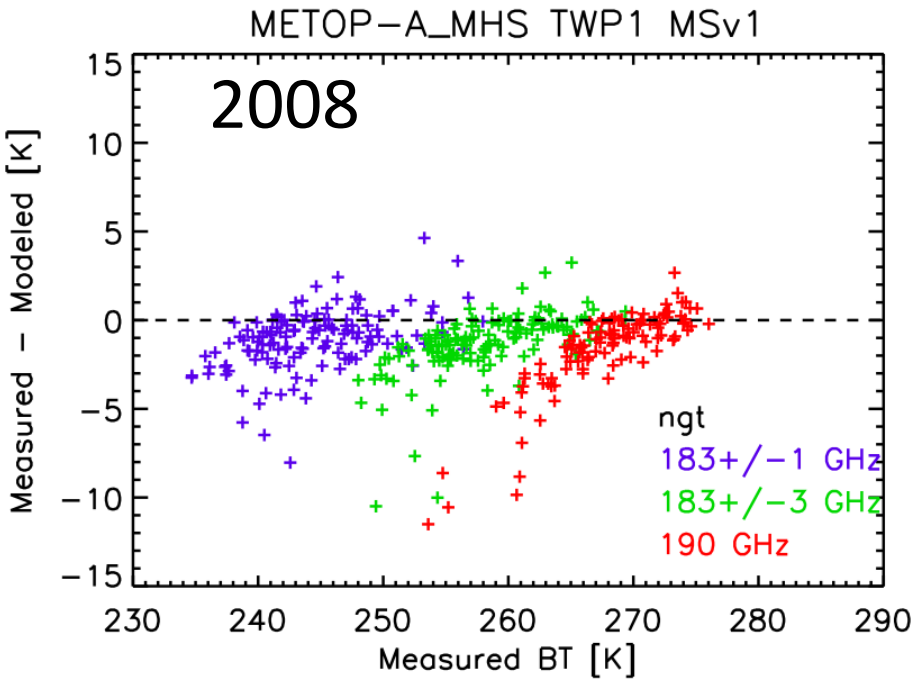
- MonoRTM (http://rtweb.aer.com)
- Assume “top hat” instrument functions
- 200 points per channel

- SAPHIR instrument function info from
  - http://mirs.nesdis.noaa.gov/saphir.php

MetOpA MHS: 2012 vs 2008

Example filename: 1Base.METOPA.MHS.TB2013.20120731-S210151-E224312.030007.V00A.HDF5
MetOp-A MHS files downloaded July 10th.

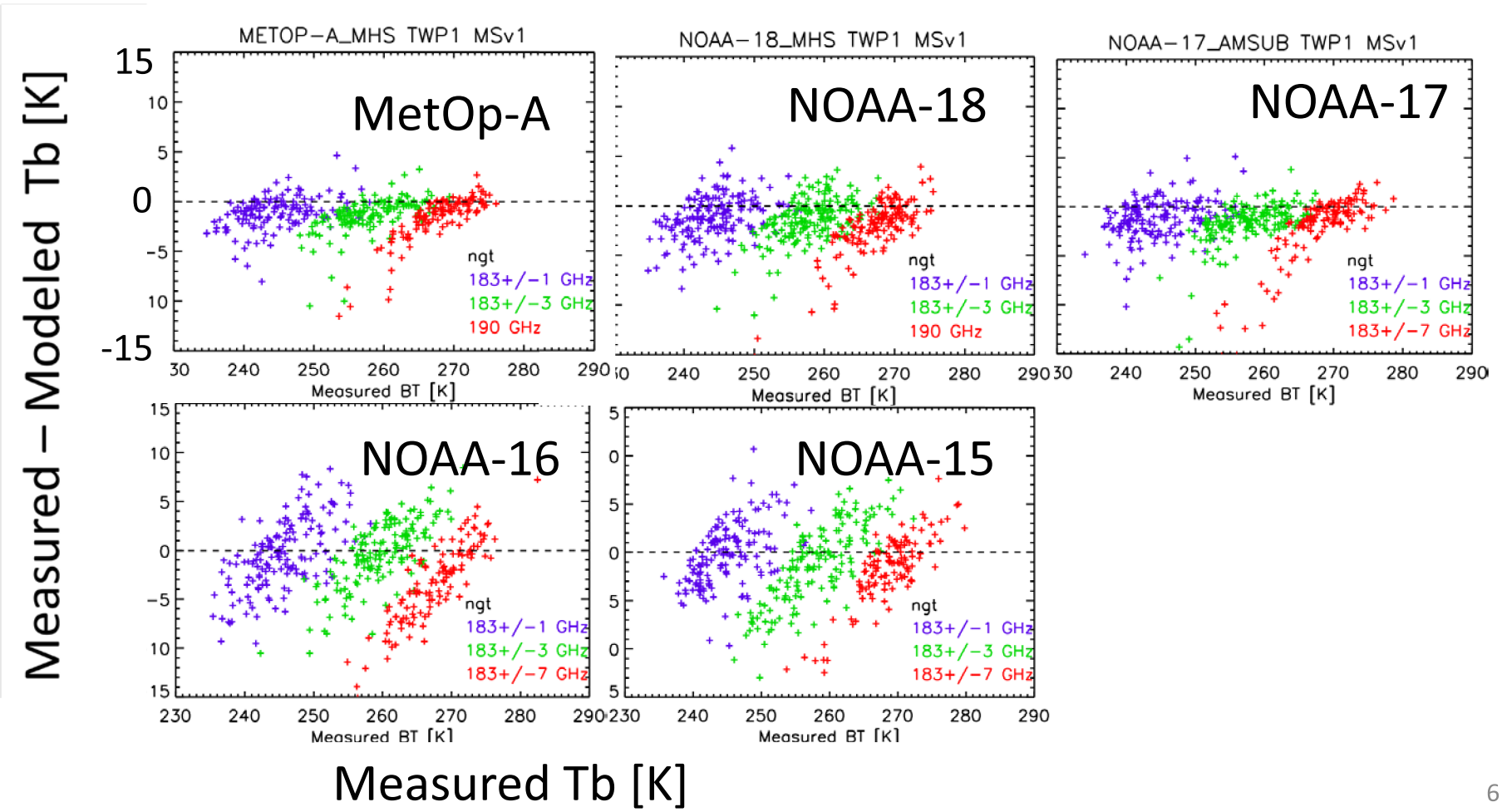




2012 comparisons don't look as good as 2008 did. **Why?**

2008 comparisons

Night-time comparisons at the TWP1 site. All scan angles included.



Scan angle dependence: MetOp-A MHS

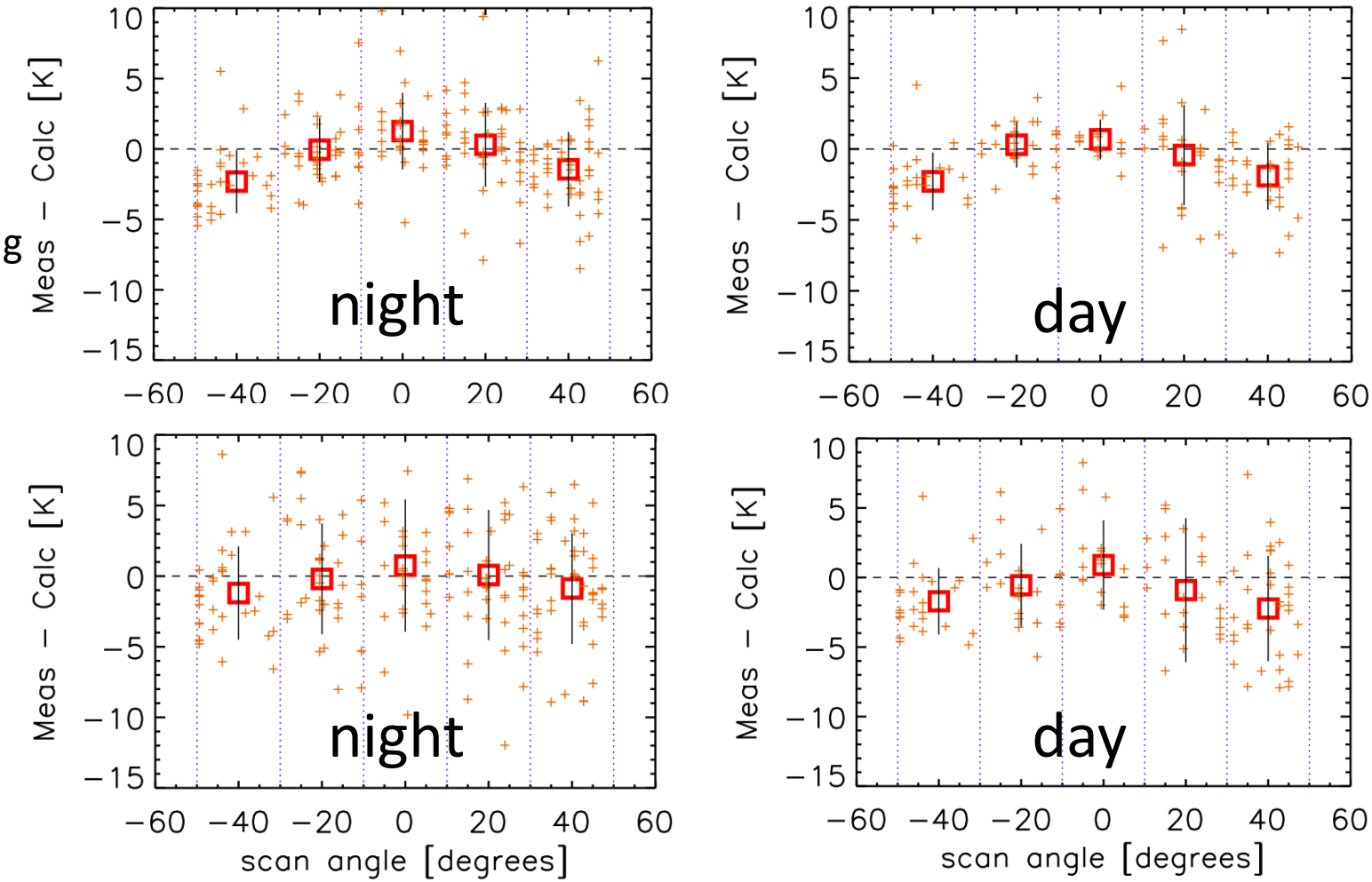
2-3 K variation in model/meas differences between nadir and outer angles

183 +/-1 GHz, SZA > 90, SGP

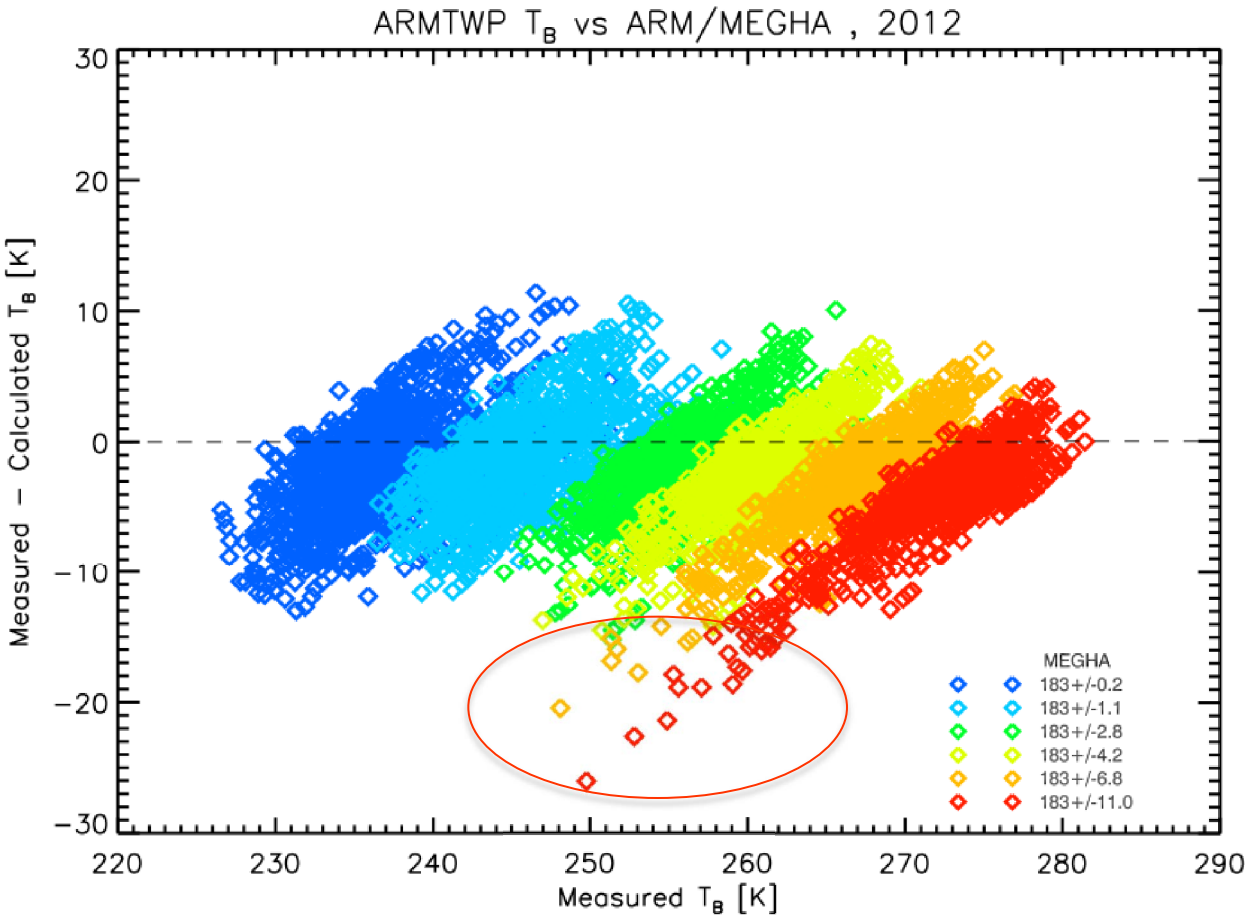
183 +/-3 GHz, SZA > 90, SGP

Merged Sounding

GFS



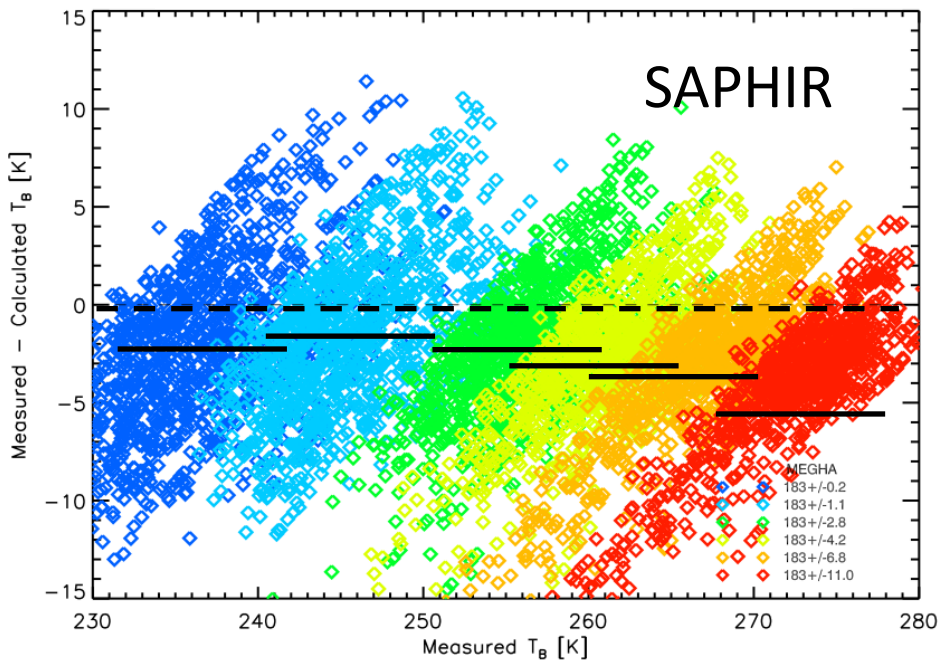
SAPHIR single differences

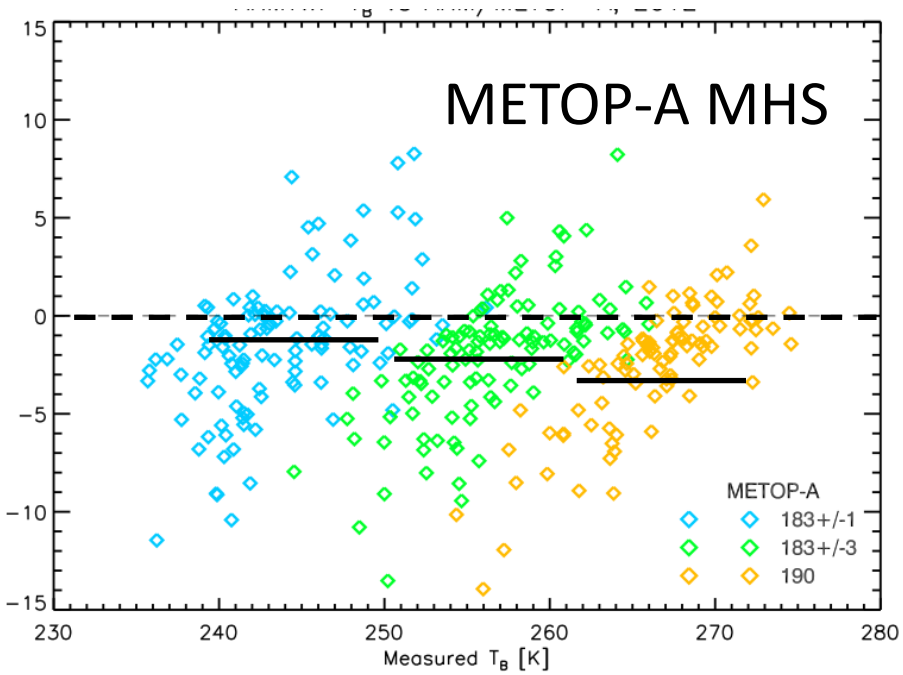


Cloudy points are sneaking through filtering

Single differences

Observed – calculated (all angles)





Example filename: 1Base.MT1.SAPHIR.TB2012.20120731-S205456-E223650.004150.V00B.HDF5
SAPHIR files downloaded August 1st

Solid horizontal lines show mean difference for each channel

Summary of single differences

Day and night data included in these averages
Tables show mean differences (std dev in brackets)
Both METOP-A MHS and MEGHA-SAPHIR show scan angle dependence in the single diffs

Channel	183+/-1 (m3)	183+/-3 (m4)	190 (m5)
Obs-Calc (all angles)	-1.5 (3.5)	-2.1 (3.3)	-3.1 (4.6)
Obs-Calc (<10° off-nadir)	-0.7 (2.9)	-1.7 (3.3)	-2.7 (5.6)

Channel	183+/-0.2 (s1)	183+/-1.1 (s2)	183+/-2.8 (s3)	183+/-4.2 (s4)	183+/-6.8 (s5)	183+/-11 (s6)
Obs-Calc (all angles)	-2.1 (4.2)	-1.6 (3.9)	-2.2 (3.8)	-2.9 (3.9)	-3.5 (4.8)	-5.5 (6.1)
Obs-Calc (<10° off-nadir)	-1.0 (4.5)	-0.9 (4.2)	-1.7 (4.3)	-2.6 (4.6)	-3.5 (5.9)	-5.7 (7.8)

Summary of double differences

$$DD = (obs_{SAPHIR} - calc_{saphir}) - (obs_{MHS} - calc_{MHS})$$

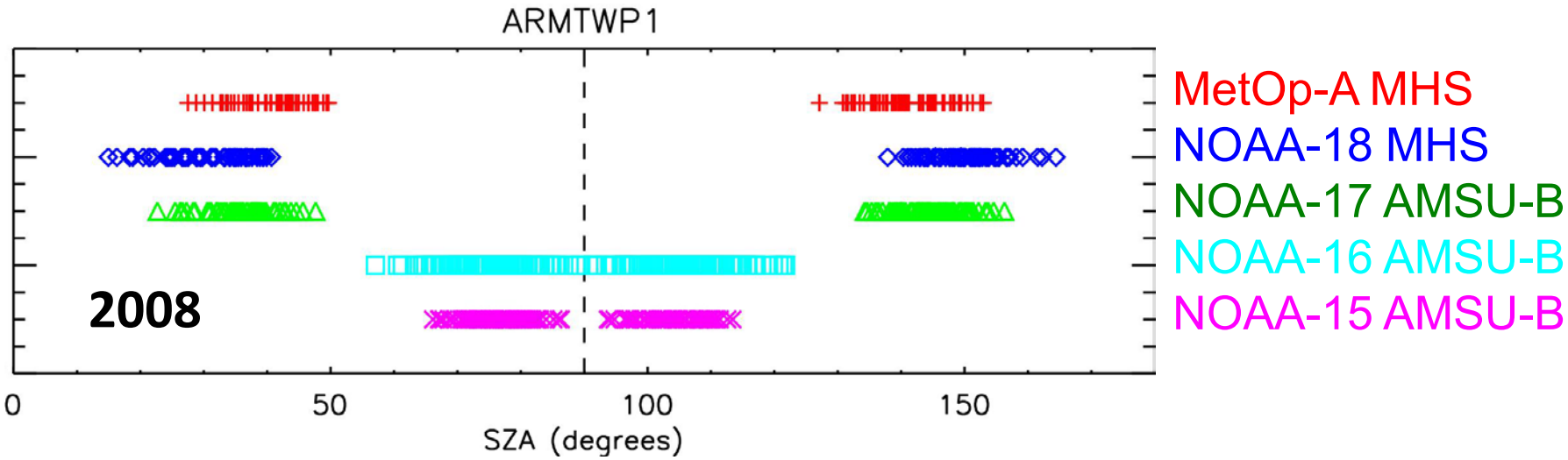
Difference	S1-m3	S2-m3	S3-m4	S4-m4	S5-m5	S6-m5
All angles	-0.6	-0.1	-0.1	-0.8	-0.4	-2.4
<10° off-nadir	-0.3	-0.9	0.0	-0.9	-0.8	-3.0

Channel pairs with similar frequencies

Backup

Overpasses of ARM TWP site

METOP-A MHS SZAs for TWP overpasses



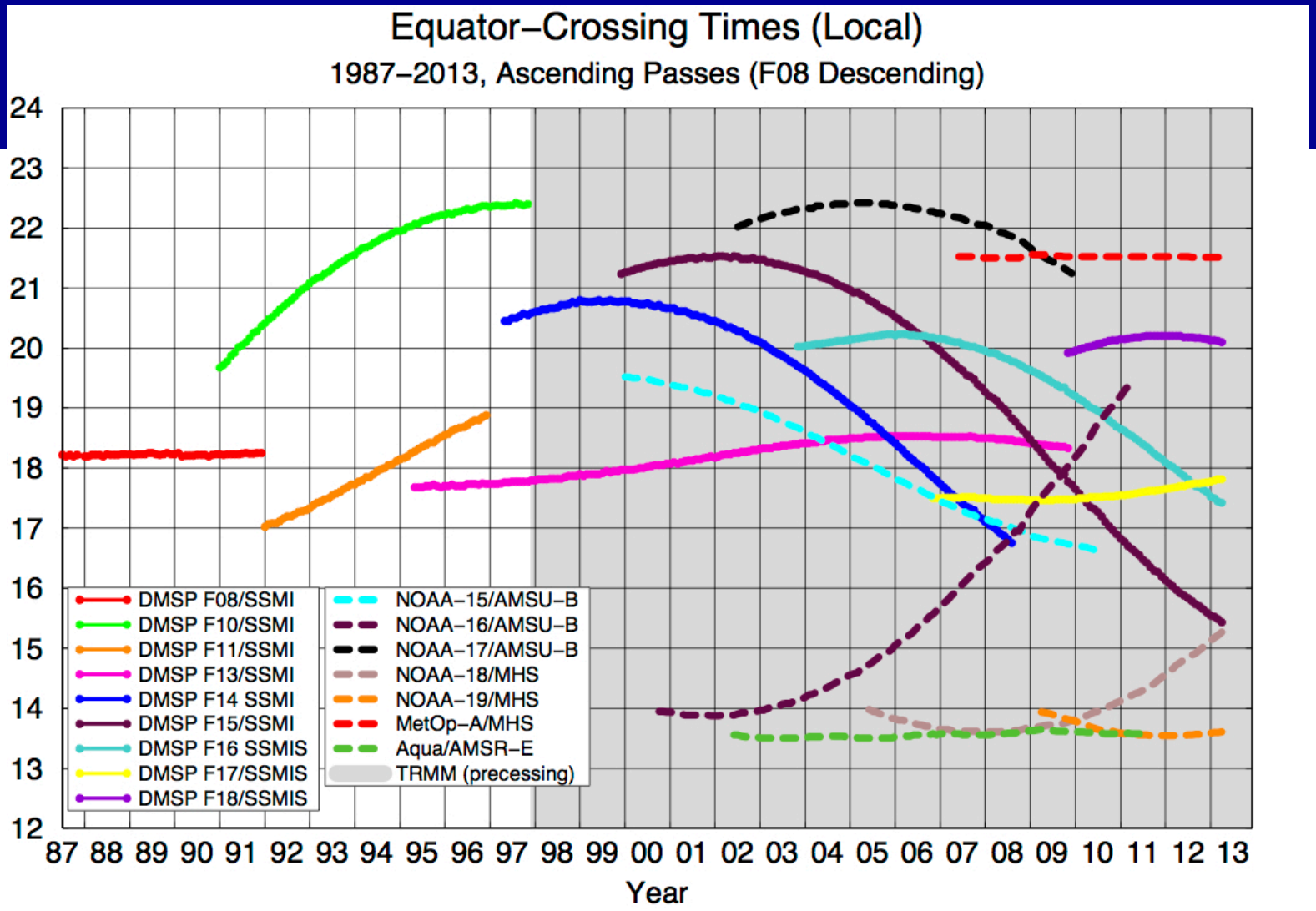


Image by Eric Nelkin (SSAI), 17 April 2013, NASA/Goddard Space Flight Center, Greenbelt, MD.