



# Meteosat-IASI Inter-calibration

**Tim Hewison**

**Marianne König**

# Global Space-based Inter-Calibration System (GSICS)

- **What is GSICS?**
  - **Global Space-based Inter-Calibration System**
  - **An effort to produce consistent, well-calibrated data from the international constellation of operational satellites**
- **What are the basic strategies of GSICS?**
  - **Make pre-launch instrument tests traceable to SI standards**
  - **Improve on-orbit calibration by integrated cal/val system**
  - **Initially by LEO-GEO Inter-satellite/inter-sensor calibration**
  - **Retrospectively re-calibrate archive data using this**



# Inter-calibration Strategy

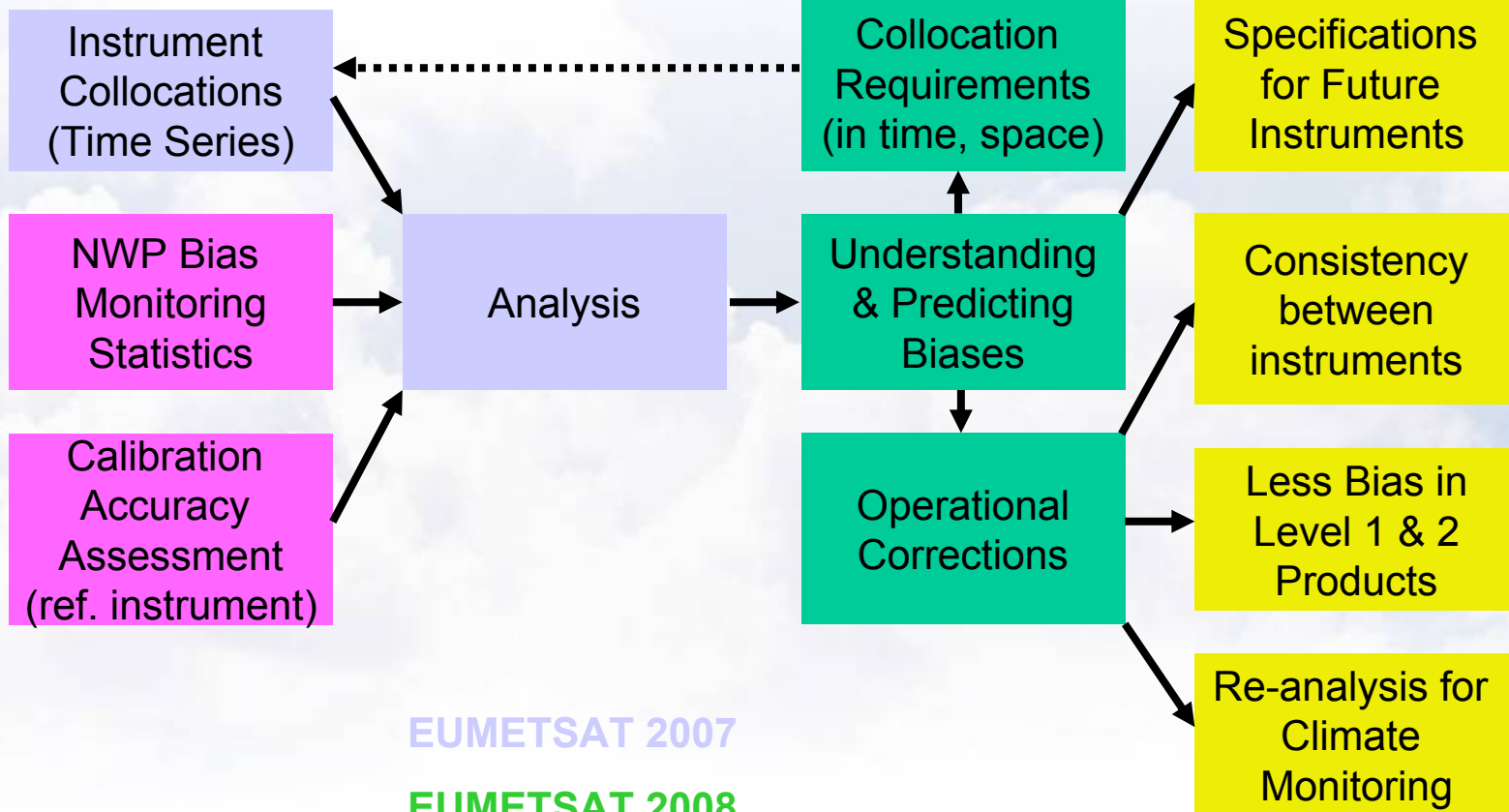
Principles

Methodology

Results

Benefits

Consistency  
Traceability



EUMETSAT 2007

EUMETSAT 2008

Liaisons 2008

# Use of IASI as a reference

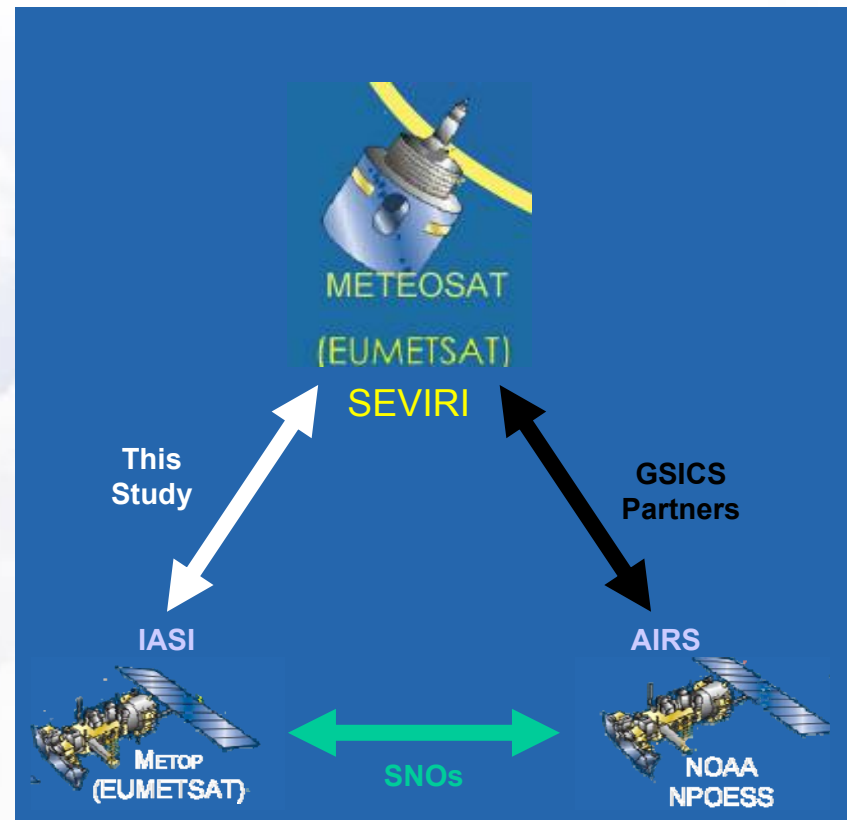
Meteosat Geostationary Imager  
+  
Infrared Atmospheric Sounding  
Interferometer, IASI,  
on Metop polar-orbiting satellite

Benefits of IASI as reference:

- Well-characterised
- Carefully controlled calibration
- Built-in linearity controls
- No spectral gaps
- On same platform as HIRS/4

Can cross-check with AIRS:

- **Simultaneous Nadir Overpasses: SNOs**
- **Inter-calibrating Meteosat-AIRS**



# Collocation Criteria

## Simultaneous Nadir Overpasses

### Of Meteosat and Metop

Only night-time data

$\Delta Lat < 30^\circ$ ,  $\Delta Lon < 30^\circ$  of SSP

$\Delta t < 15$  mins (=scan period)

$|\theta| < 15^\circ$  (Incidence angle)

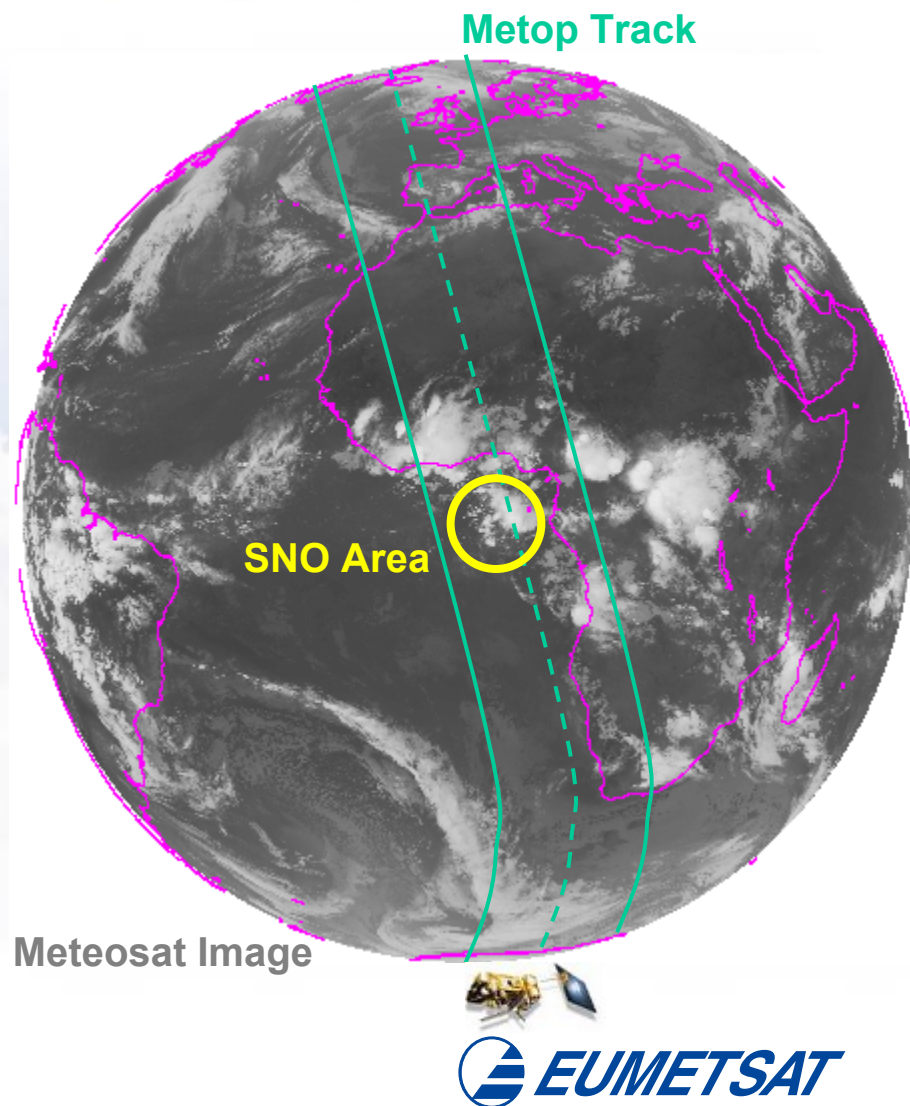
$\Delta \theta < 2^\circ$  (Incidence angle diff.)

5x5 MSG pixels / IASI iFoV

Restricts collocations to Tropics

~1 orbit/day

~200 good collocations





# Spectral Convolution

$\mu\text{m}$

13.4

12.0

10.8

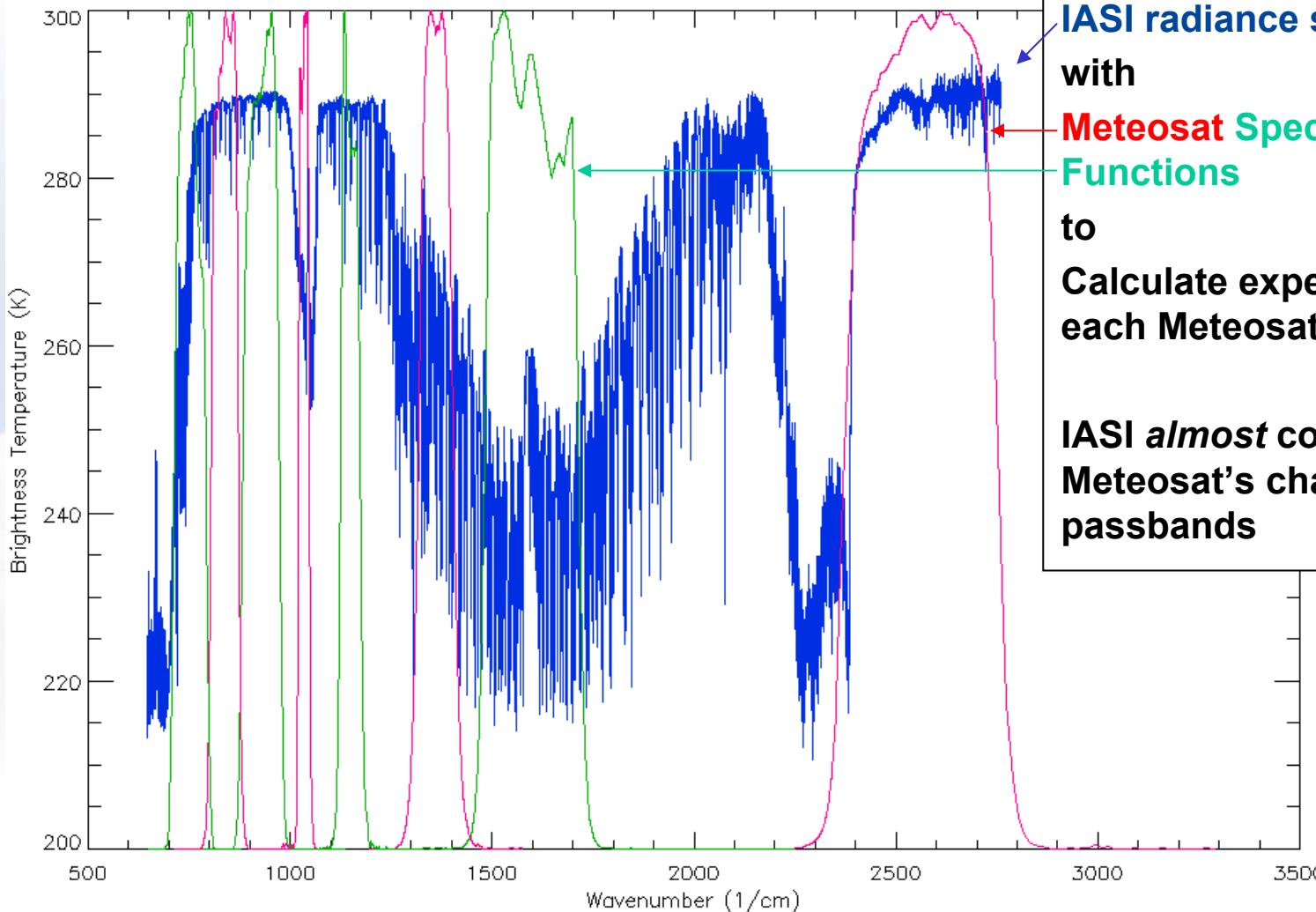
9.7

8.7

7.3

6.2

3.9



Convolve  
IASI radiance spectra  
with  
Meteosat Spectral Response  
Functions  
to  
Calculate expected radiance in  
each Meteosat channel

IASI *almost* completely covers  
Meteosat's channels'  
passbands



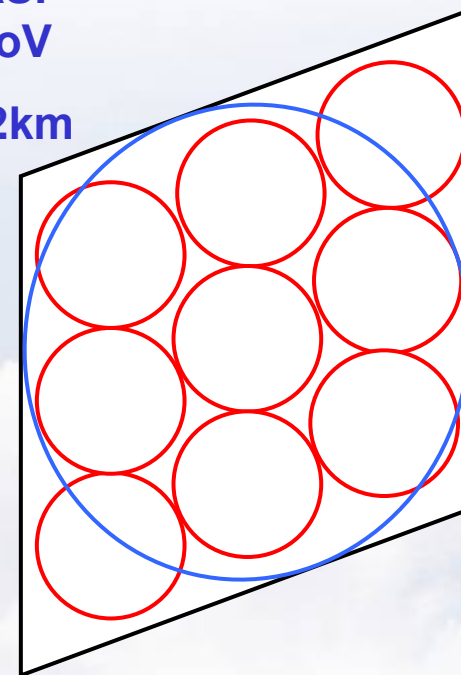
# Spatial Averaging

**Average Meteosat pixels  
within each IASI iFoV**

**Estimate uncertainty  
due to spatial variability  
as Standard Deviation of  
Meteosat pixels**

**Use in weighted regression**

**IASI  
iFoV  
~12km**



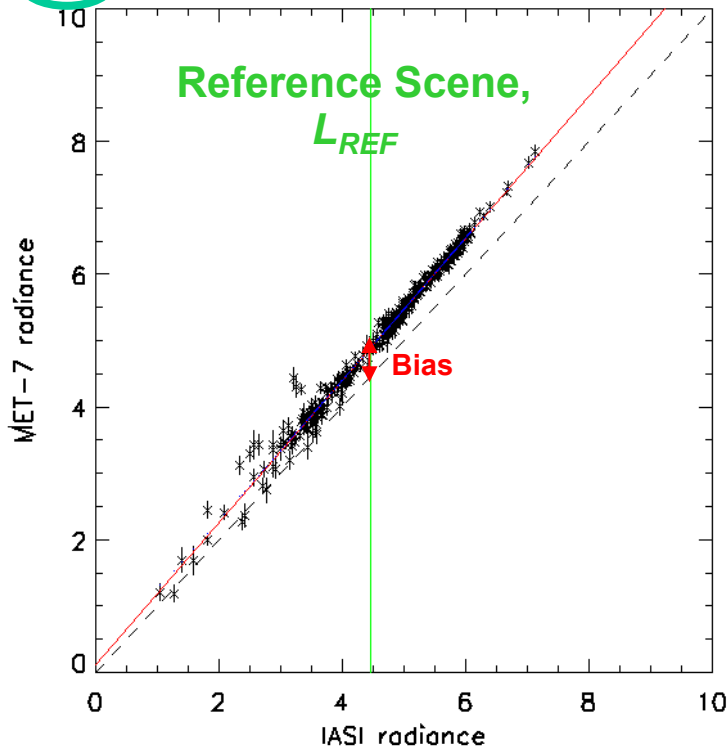
**Meteosat  
pixels**



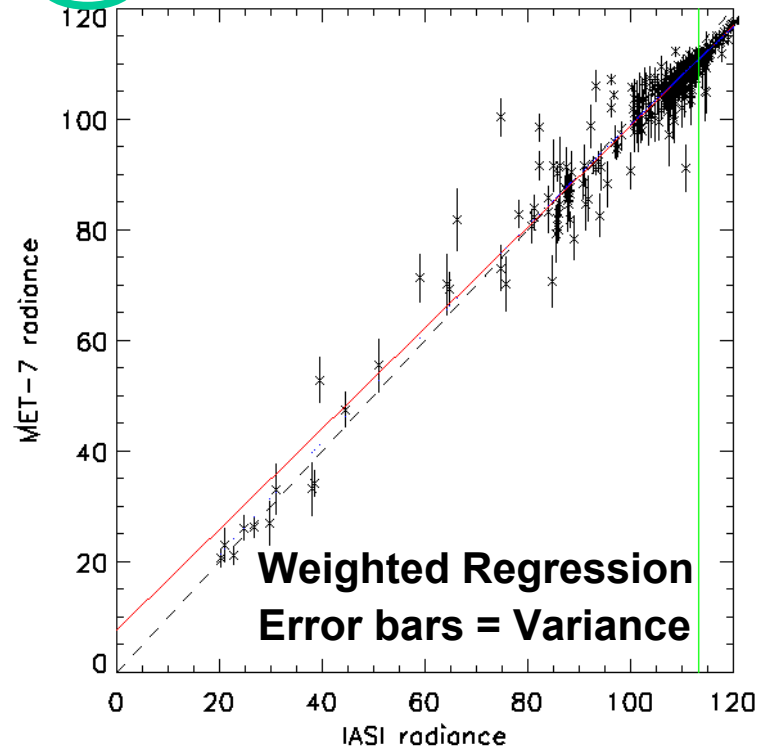
# Regression

Offset  $\neq 0$  Slope  $\neq 1$   $\Rightarrow$  Difference is scene-dependent

$wv-1$ :  $a = 0.125 \pm 0.017$   $b = 1.0703 \pm 0.0033$

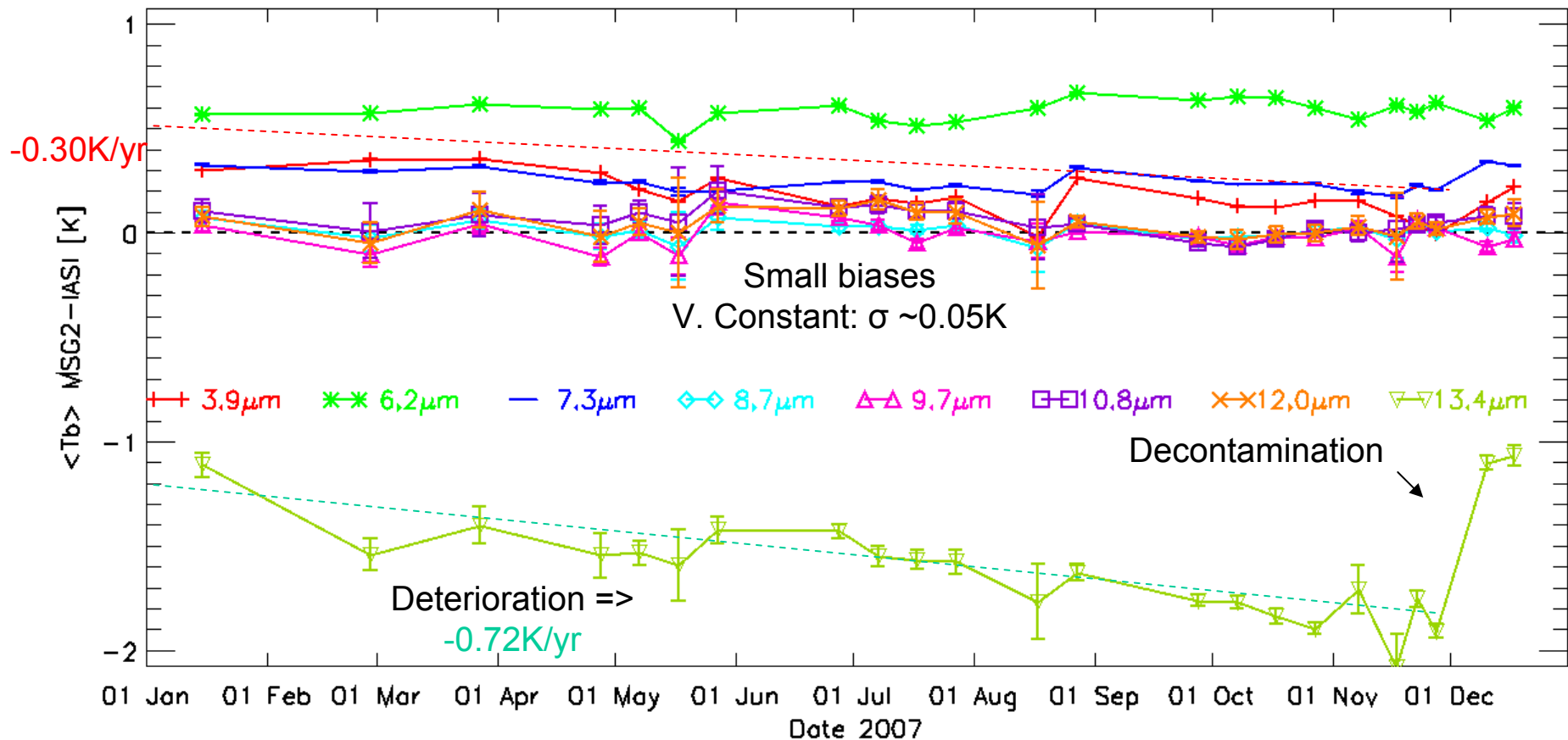


$\bar{r}-2$ :  $a = 7.682 \pm 0.584$   $b = 0.9108 \pm 0.0052$



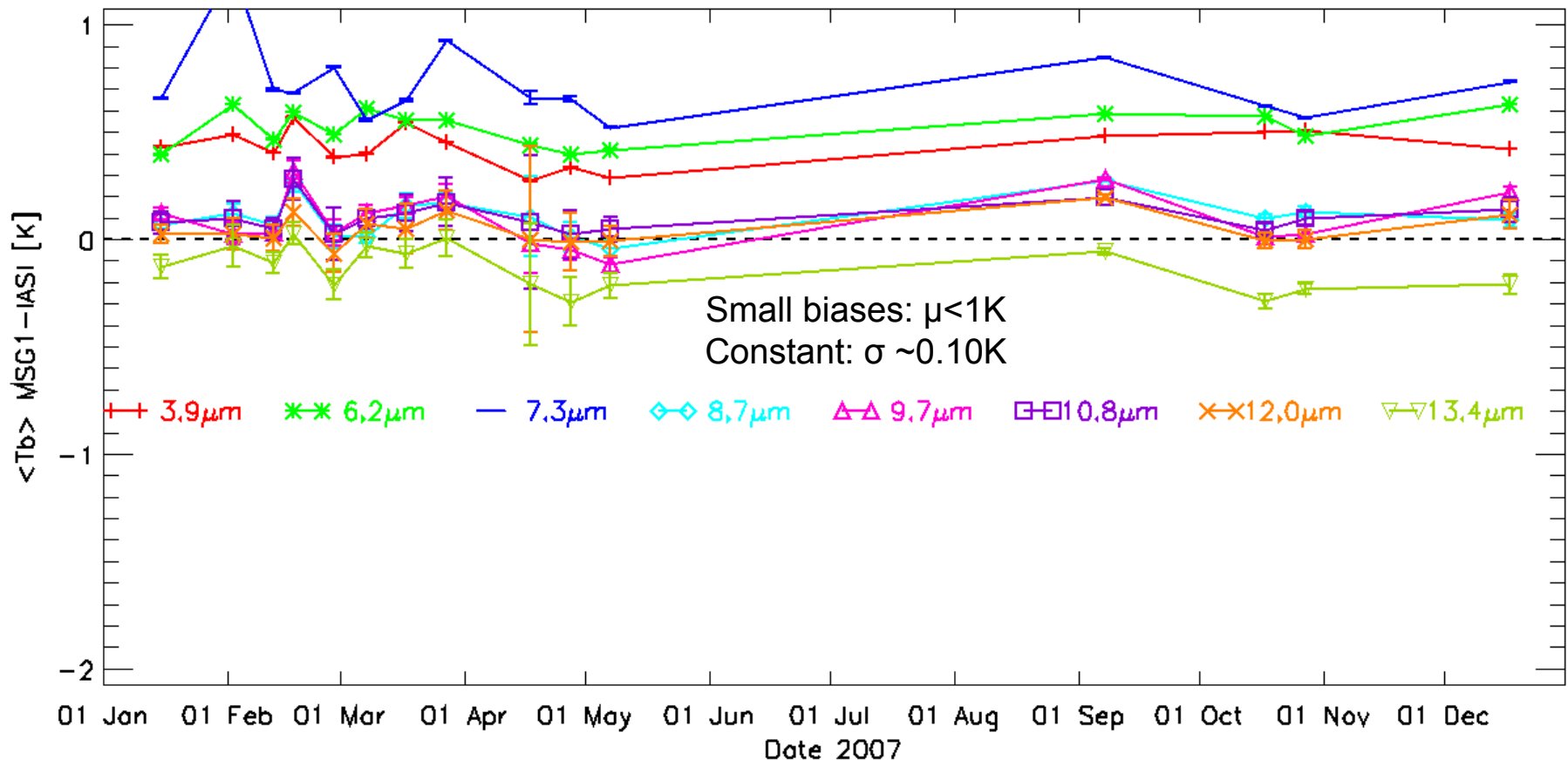
Reference Scene  
defined as modal value  
(typical clear sky radiance)

# SEVIRI on Meteosat-9 – IASI on Metop



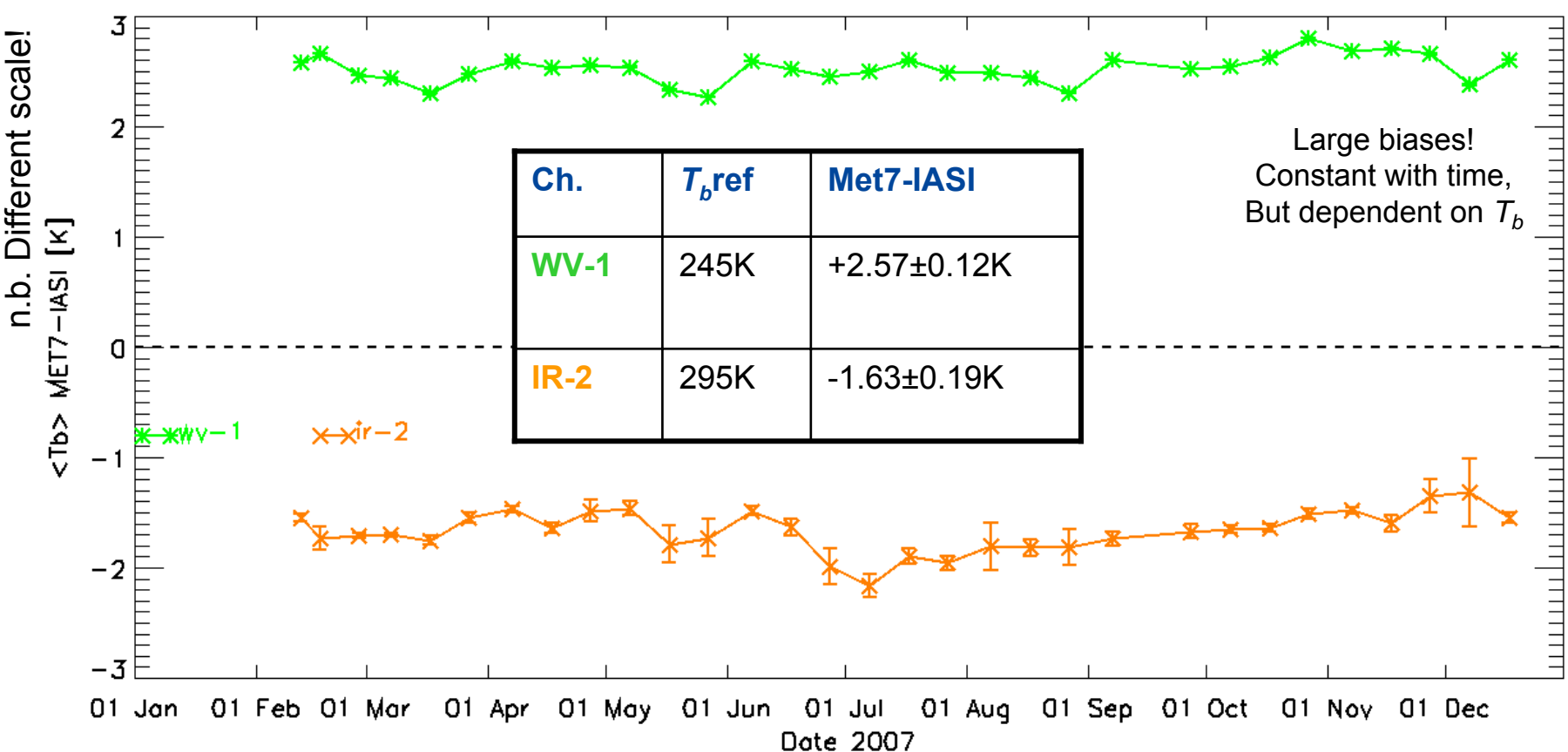
Time series of brightness temperature differences between MSG2-IASI for typical clear-sky radiances. Each MSG infrared channel is shown in a different color, with different symbols, following the legend. Error bars represent statistical uncertainty on each mean bias (may be very small).

# SEVIRI on Meteosat-8 – IASI on Metop



Time series of brightness temperature differences between MSG1-IASI for typical clear-sky radiances. Each MSG infrared channel is shown in a different color, with different symbols, following the legend. Error bars represent statistical uncertainty on each mean bias (may be very small).

# MVIRI on Meteosat-7 – IASI on Metop



Time series of **brightness temperature differences** between Met7-IASI for typical clear-sky radiances: Each Met7 infrared channel is shown in a different color, with different symbols, following the legend. Error bars represent statistical uncertainty on each mean bias (may be very small).



# EUMETSAT Inter-calibration Plans: 2008

## **IASI – Meteosat intercalibration:**

**Investigate impact of MSG radiance definition**

**Include temporal variability in error propagation**

**Investigate angular dependence using Rapid Scan at ~40°N**

**Assess collocation requirements – WV, window, O<sub>3</sub> channels**

**Compare with NWP bias monitoring statistics**

**Check calibration of visible channels by Deep Convective Cloud**

## **Extend inter-calibration to HIRS:**

**Compare HIRS/4-IASI on Metop-A**

**Compare HIRS-Meteosat-8 and -9**

**Build-up time series with older HIRS and MVIRI**

**Thank you**



**Questions and Answers**