Implementing Inter-calibration of Meteosat with IASI

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IASI and/or AIRS as a reference?

EUMETSAT: Meteosat-IASI
NOAA: AIRS-IASI

IASI has no spectral gaps
IASI + HIRS/4 on same platform

A lot of work for us to complete the triangle: Meteosat-AIRS (Integrity check)
Collocation Criteria

Meteosat First Generation

\( \Delta \text{Lat} < 30^\circ, \Delta \text{Lon} < 30^\circ \) of SSP

\( \Delta t < 30 \text{ mins} \) (=scan period)

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

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

3x3 MFG pixels / IASI iFoV

Filtering:

No filtering \( \sim 400 \) pts

\( \sigma T_b(MFG) < 0.5K \) \( \sim 50 \) pts

\( \sigma L(MFG) < 5\% L_{REF} \) \( \sim 200 \) pts
Marianne told us all about the new radiance definition
ECP833 also includes changes to non-linearity corrections

As a temporary work around for 2007 data, needed to ensure consistent definition of radiance:
– Read in old IMPF-defined radiances
– Convert to brightness temperatures
– Convert back to effective radiances
Estimate uncertainty due to spatial variability as Standard Deviation of Meteosat pixels within collocated IASI iFoVs.

Use as error bars in weighted regression.
Weighted Regression of Meteosat v IASI

Offset ≠ 0    Slope ≠ 1 => Difference is scene-dependent

Wy-1: \( a = 0.125 \pm 0.017 \)    \( b = 1.0703 \pm 0.0033 \)

Reference Scene, \( L_{REF} \)

Outliers = Clouds?

Ir-2: \( a = 7.682 \pm 0.584 \)    \( b = 0.9108 \pm 0.0052 \)

Weighted Regression
Error bars = Variance
Non-linearity

Compare linear regression with quadratic fit:

V. little difference at ref. scenes <0.05K

Difference increases for low $T_b$
As expected for non-linear errors
Only significant for MSG 7.3µm channel and still <1K at $T_b=220K$

But differences are v. variable
Error bars currently underestimated
Large biases!
Constant with time,
But dependent on $T_b$

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).
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).

Small biases: \( \mu < 1K \)

Constant: \( \sigma \approx 0.10K \)
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).
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
- Compare with NWP bias monitoring statistics
- Assess collocation requirements – WV, window, O₃ channels

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

Set-up GSICS Data and Products server