Prime GSICS Corrections, using double-differences of IASI-A and -B against the IR channels of Meteosat/SEVIRI

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Abstract
This paper introduces the basis of the GSICS algorithm to inter-calibrate the infrared channels of geostationary imagers, such as Meteosat/SEVIRI, to be consistent with Metop-A/IASI, and extends it to combine comparisons with other reference instruments. Double-differences of GSICS Corrections derived using the IASIs on Metop-A and -B are used to define a delta correction, which allows comparisons with multiple references to be combined, based on their relative uncertainties, in a way metrologically consistent with the Anchor Reference, to generate what is referred to as Prime GSICS Corrections. These support the creation of Fundamental Climate Data Records, spanning extended periods with multiple reference instruments.

These results show no significant differences between the calibration of the mid- and short-wave bands of IASIS-A and -B were found over SEVIRI’s relatively broad spectral bands. However, there are small (~0.05K), but statistically significant differences in the long-wave band, where IASIS-B is consistently warmer than IASIS-A. These differences are radiance-dependent, but stable over a 3 year period starting in March 2013.

Global Space-based Inter-Calibration System (GSICS)

What is GSICS?
- Initiative of CGMS and WMO
- An effort to produce consistent, well-calibrated data from the international constellation of environmental satellites

What are the strategies of GSICS?
- Best practices and requirements for pre-launch characterisation
- Improve on-orbit calibration by developing an integrated inter-calibration system

This allows us to:
- Better understand current instruments
- Better specify future instruments
- Improve consistency between instruments
- Produce less bias in Level 1 & 2 products
- Retroactively re-calibrate archive data

IASI-A/B Double Difference Analysis
- (MSG)/SEVIRI-Metop-A/IASI) – (MSG)/SEVIRI-MetopB/IASI
- All 5 infrared channels
- GSICS Re-Analysis Corrections over 3 years:
  - No Obvious Trend in Any Channel
  - Small differences in long-wave channels

Results for Mean Double-Difference Analysis:
- No statistically significant trend in any channel
- within standard uncertainty of 10mK/yr
- Consistent results from other Meteosats
- No statistically significant difference in any channel between IASIS-A and -B in Short- and Mid-bands
- Small, but significant difference in long-wave band
- Differences are larger for colder scenes

Results for Radiance-Dependence Analysis:
- IASIS-A/B double difference larger for colder scenes
- Must be careful comparing results from different domains!
- $\Delta T_b$ from polar SN0 vs $\Delta T_b$ from global QSNOs
- Should compare in radiance bins!
- Consistent with Cnes SIC Tool
- Due to non-linearity differences?

Conclusions
- IASIS-A is reference for first operational GSICS product
- Inter-calibration corrections for IR channels of Meteosat/SEVIRI
- Extended concept to merge results from other references
- Correcting all to be consistent with Anchor Reference – IASIS-A
- Based on series of double-differences for SEVIRI
- Analysis of IASIS-B and IASIS-A Double Differences:
  - IASIS-A and IASIS-B calibration stable in all channels over 3 years
  - No significant differences
  - except in long-wave channels (~0.05K for standard scene Tbs)
  - Difference is radiance-dependent – care when comparing different methods

References