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WP4 – FCDRs

FIDUCEO Team

FIDUCEO RV3
Reading, 12-13 Sep 2018

Content

- MVIRI VIS (EUM + RayF + FOpt)
- Microwave Humidity Sounder (UoH)
- HIRS (UoR + EUM)
- AVHRR (UoR)

Delivery Status

DATASET	PLANNED	ACTUAL
AVHRR FCDR	Harmonised infra-red radiances and best available reflectance/ radiances; 1982 - 2016	1988 to 2016; NOAA-11 to MetOp-A
HIRS FCDR	Harmonised infra-red radiances; 1982 - 2016	1985 to 2018; NOAA-09 to MetOp-B
MW Sounder FCDR	Harmonised microwave BTs for AMSU-B and equivalent channels; 1992 – 2016	1994 to 2017 F11 to Metop-B
Meteosat VIS FCDR	Improved visible spectral response functions and radiance; 1982 to 2016	1982 to 2017; Meteosat-2 to Meteosat-7 EASY & FULL

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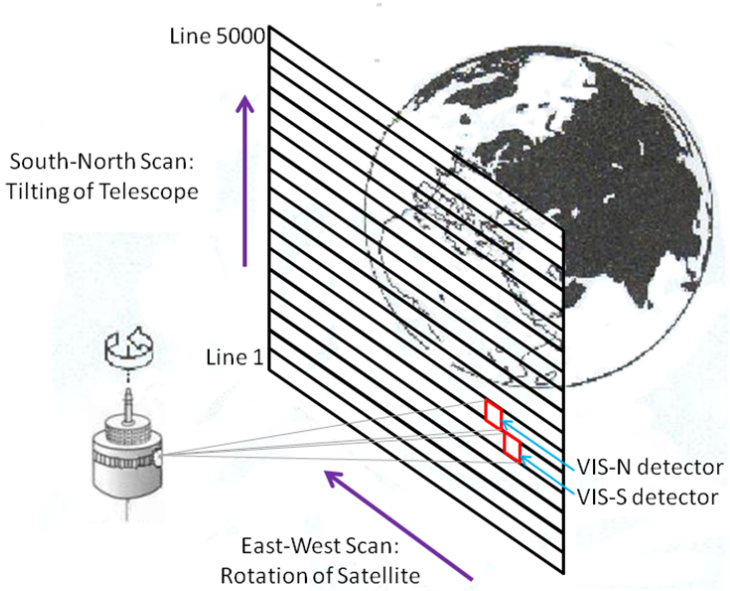
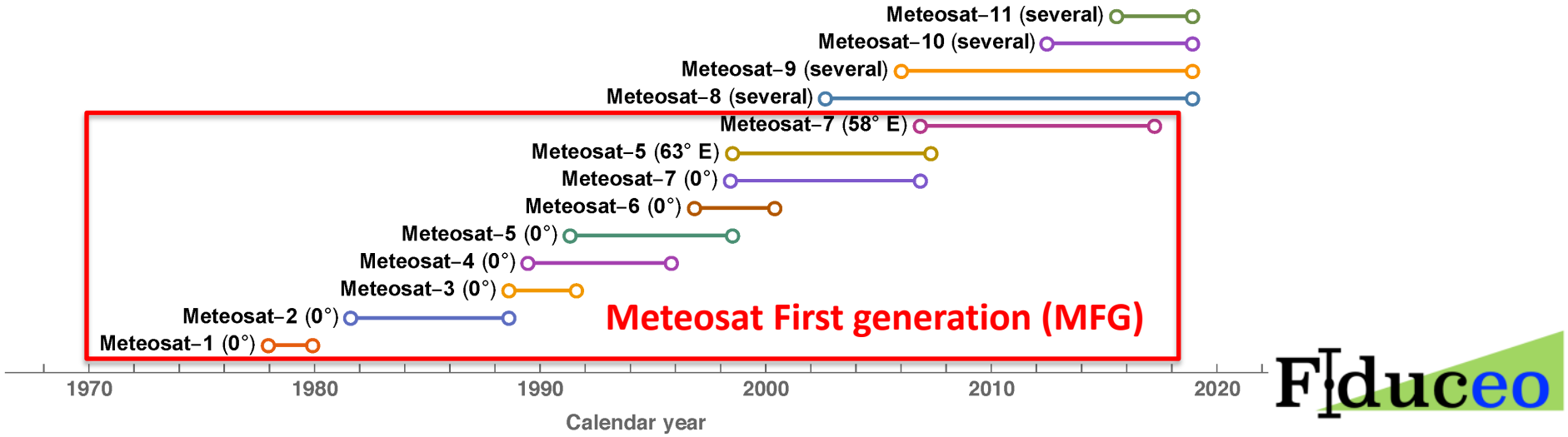
MVIRI VIS Channel



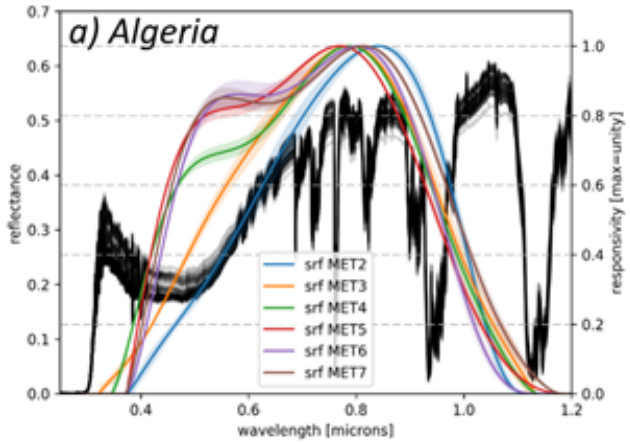
Many things have changed during the MFG era

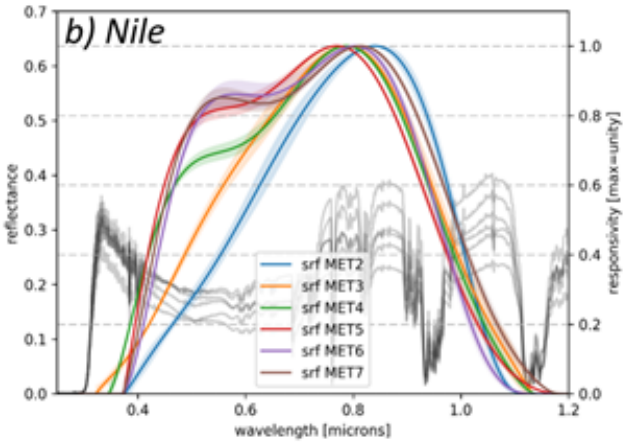
- Pre-launch characterisation;
- Requirements;
- Data Format;
- Digitisation Level;
- Calibration.

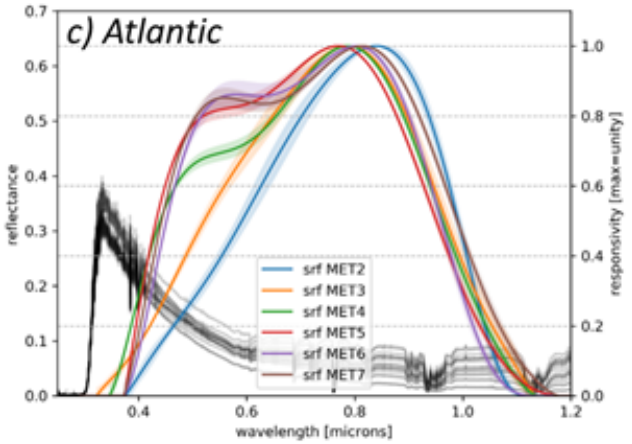


MVIRI VIS Channel

- VIS channel is very broad;
- SRFs not accurately known;







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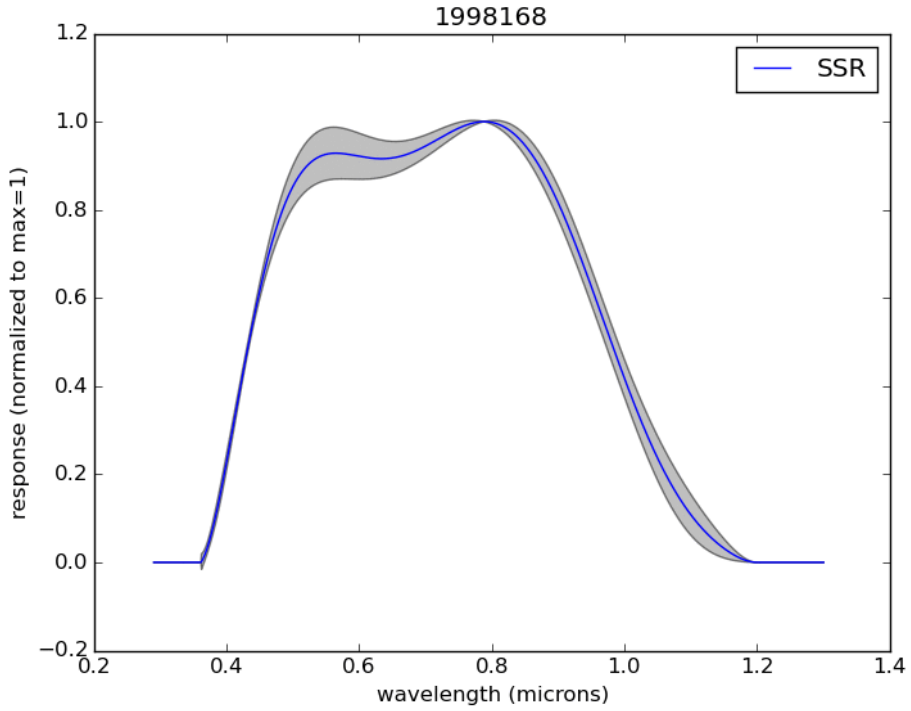
MVIRI VIS Channel

- VIS channel is very broad;
- SRFs not accurately known;
- Spectral degradation;



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Objectives/Achievements

- Develop an empirical and/or physically-based model of the Meteosat VIS band spectral response + Develop a reverse engineering method to reconstruct the VIS band spectral response (including uncertainties) and its spectral ageing:

  1. Govaerts, Y. M., F. Ruethrich, V. O. John, Ralf Quast (2018) Climate Data Records from Meteosat First Generation: Simulation of Accurate Top-Of-Atmosphere Spectral Radiance over Pseudo-Invariant Calibration Sites for the Retrieval of the In-Flight MVIRI Visible Spectral Response, Remote Sens., 10(12), 1959.

  2. Quast, R., R. Giering, Y. Govaerts, F. Rüthrich, R. Roebeling (2019) Climate Data Records from Meteosat First Generation Part II: Retrieval of the In-Flight Visible Spectral Response, Remote Sens., 11, 480.

  ❖ **The retrieved spectral response functions have been published on the FIDUCEO GitHub repository under CC-BY license and also archived at EUMETSAT.**

- Thorough tracing of uncertainties from several effects + Consolidated recalibration across all satellites (Met2 – Met7) + Reprocessing into a common easy-to-use format:

  3. Rüthrich, F., V. O. John, R. A. Roebeling, R. Quast, Y. Govaerts, E. Wooliams, and J. Schulz (2019) Climate Data Records from Meteosat First Generation Part III: Recalibration and Uncertainty Tracing of the Visible channel on METEOSAT 2-7 using Reconstructed, Spectrally Changing Response Functions, Remote Sens., 11, 1165.

  ❖ **FCDRs in EASY and FULL formats are available for all satellites (1982 - 2017) from EUMETSAT.**

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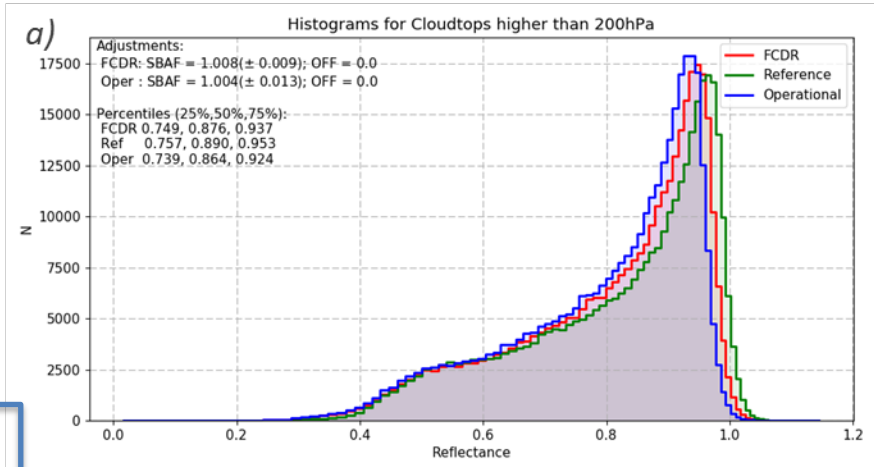
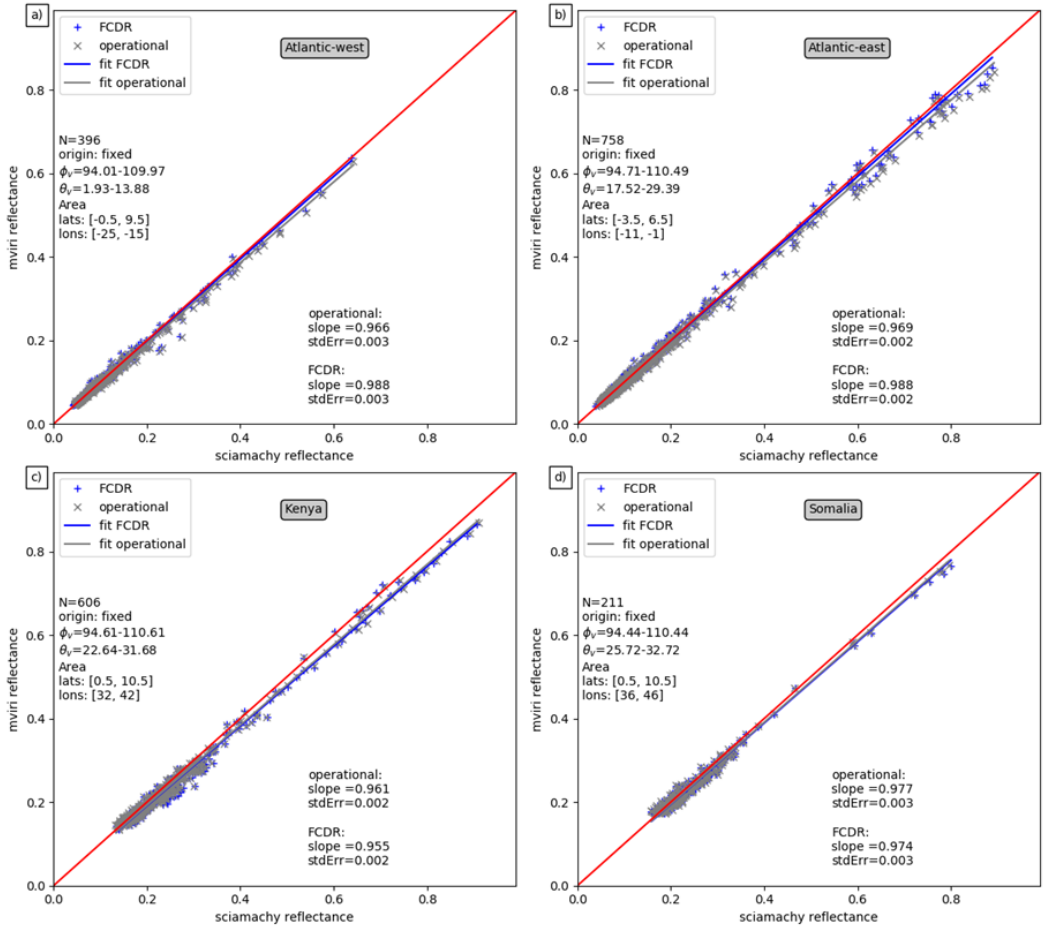
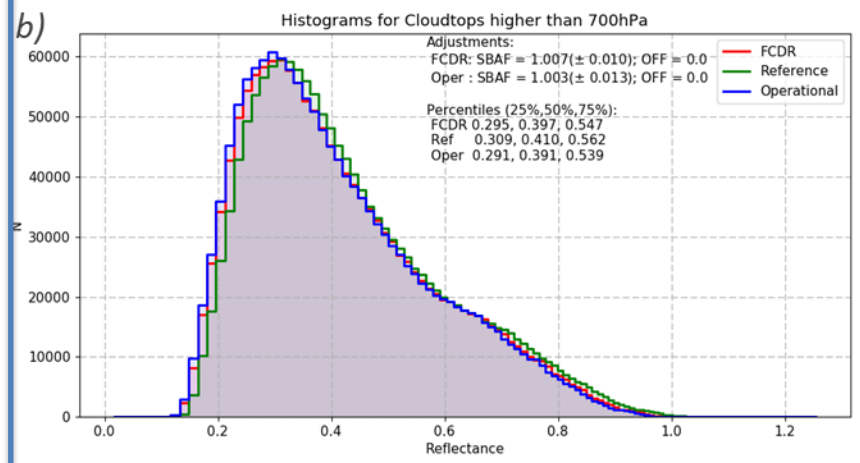
Validation

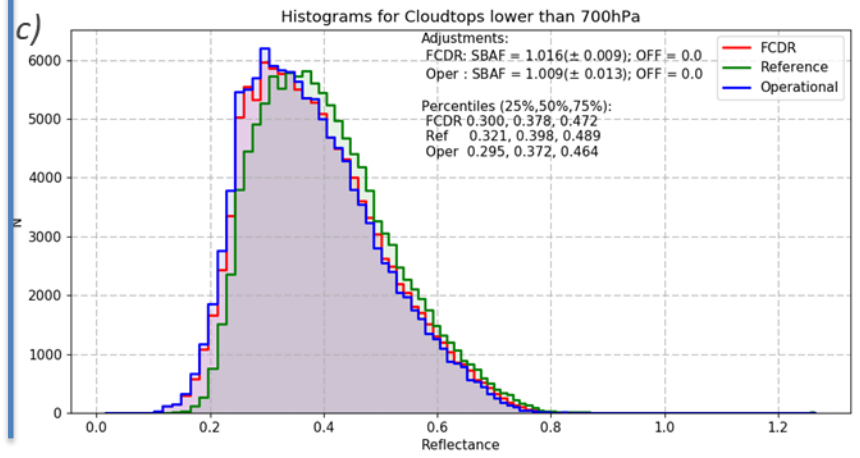
Against SEVIRI:



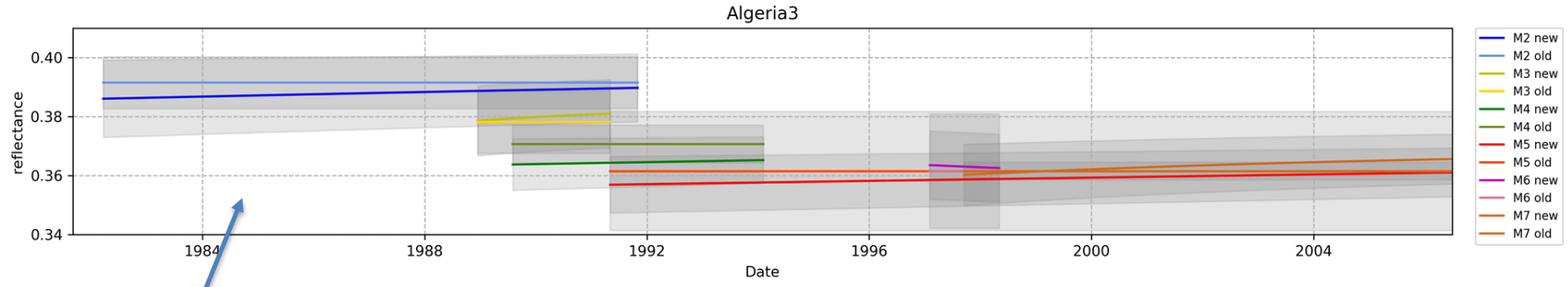
Against SCIAMACHY:

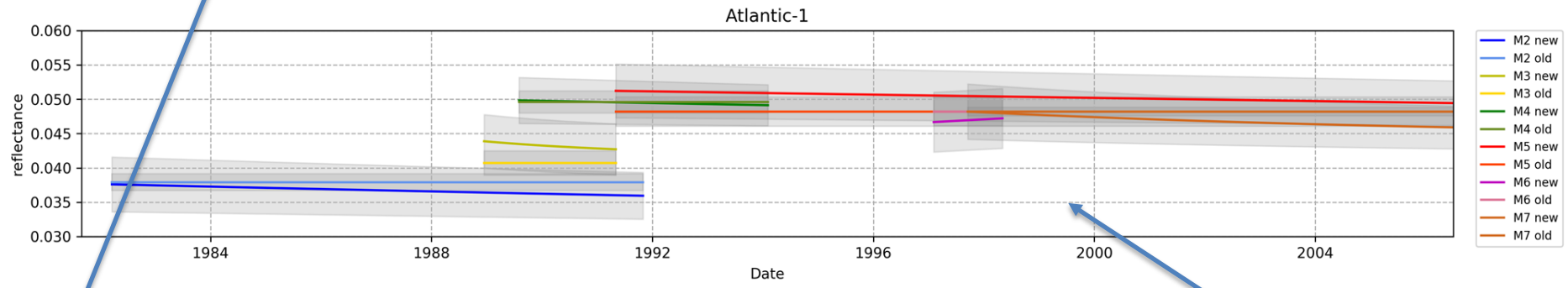


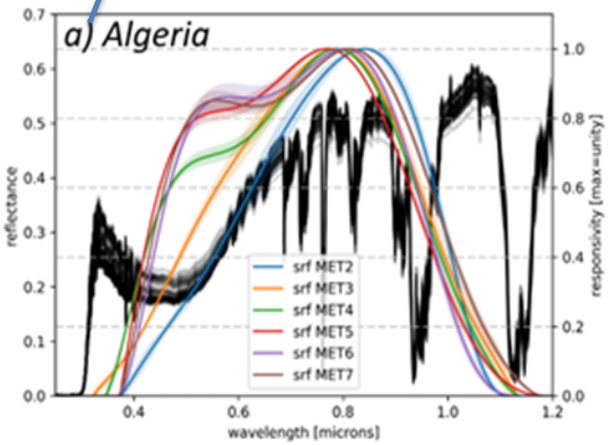


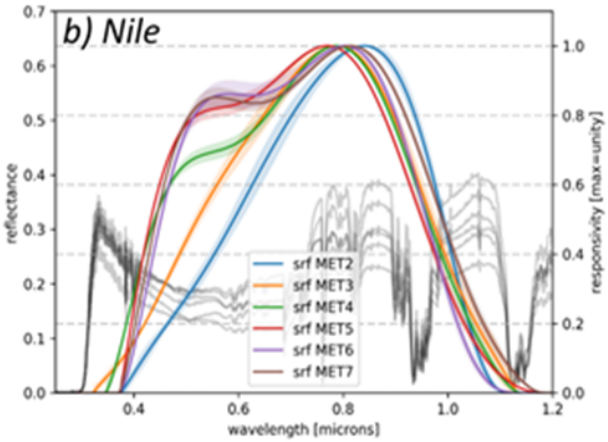


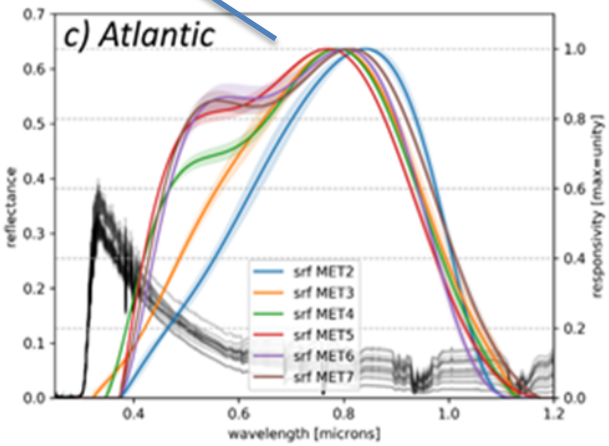
Expected timeseries











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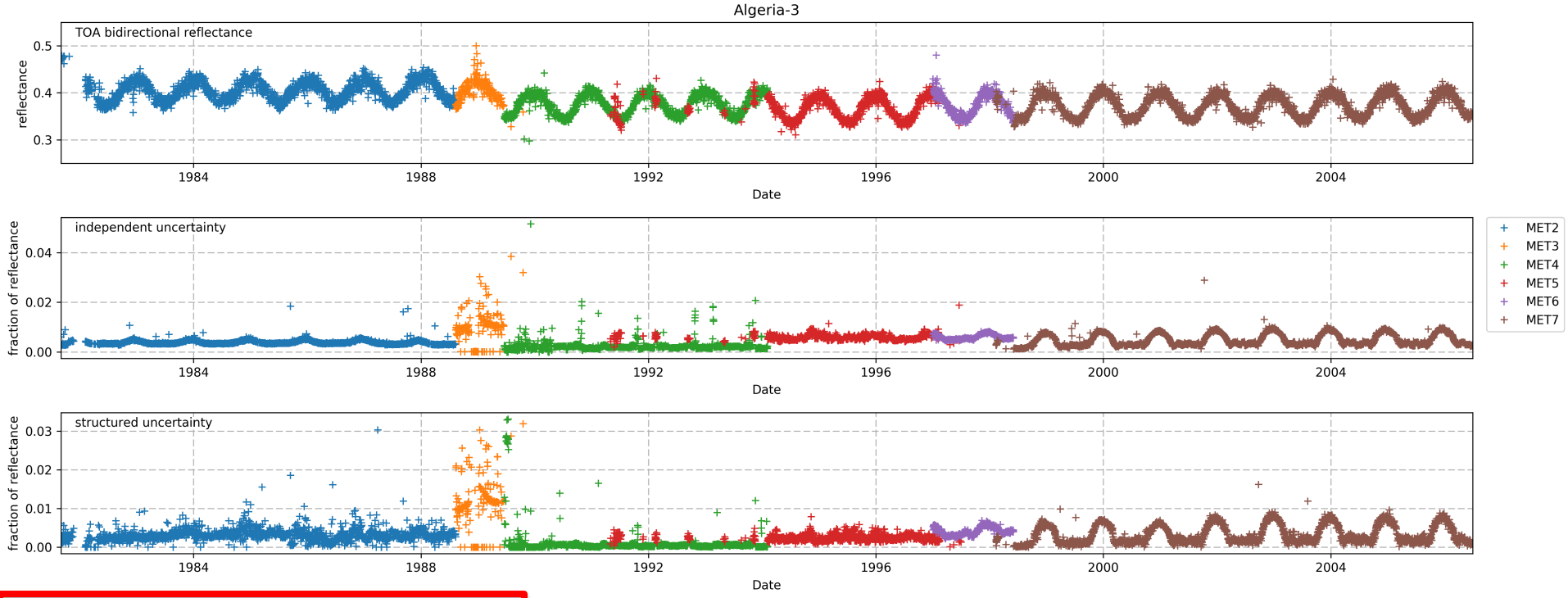
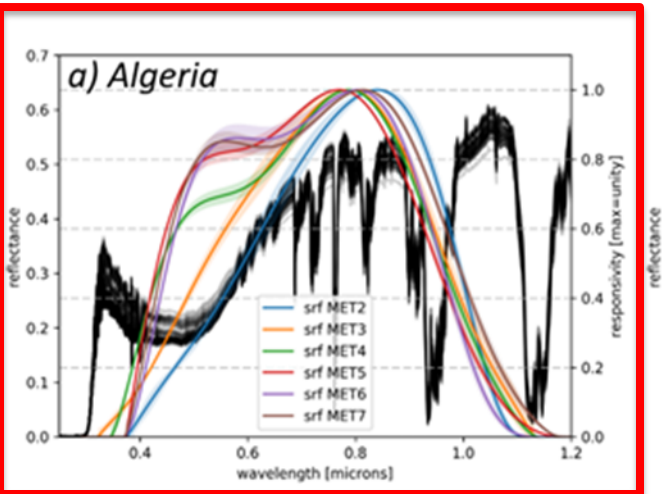
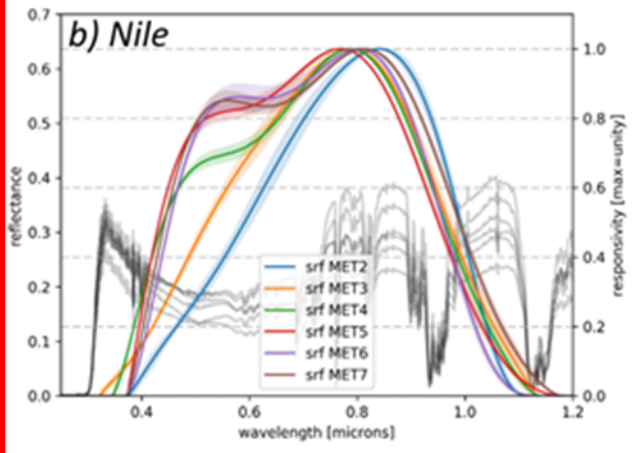
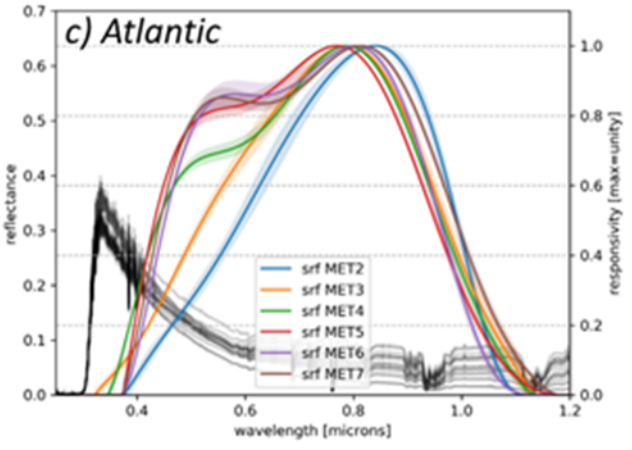
Harmonised time series









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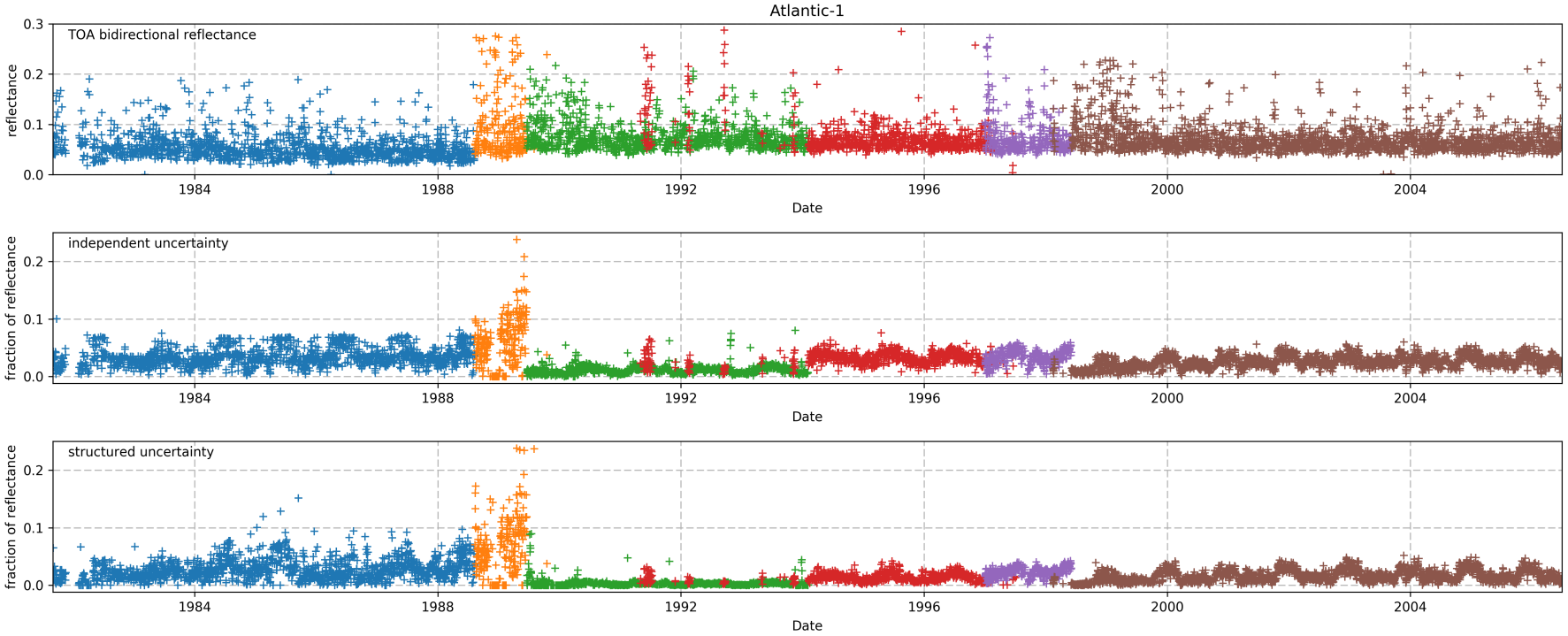
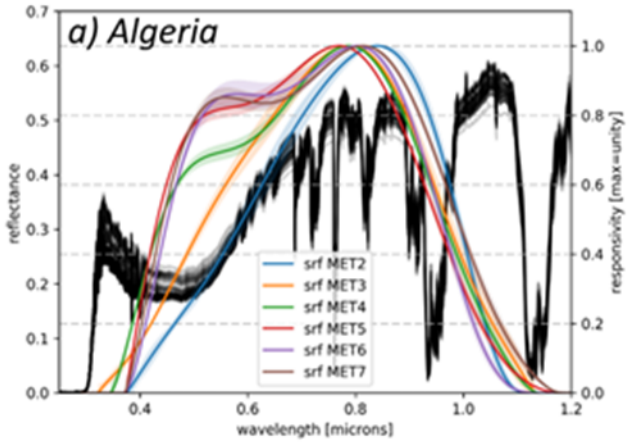
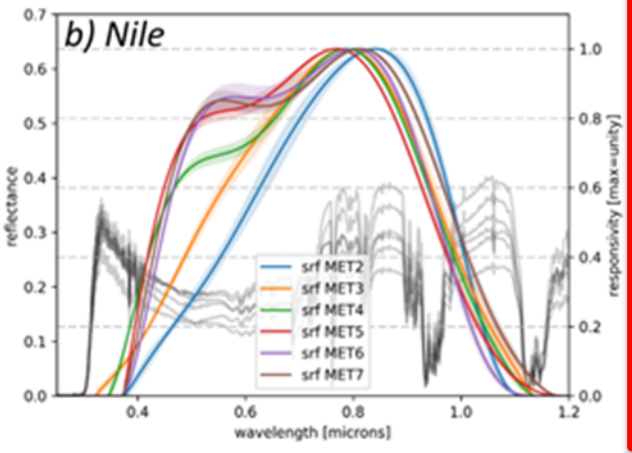
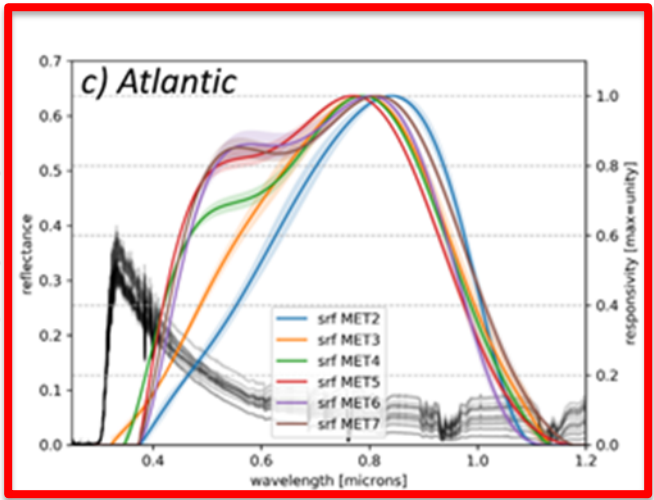
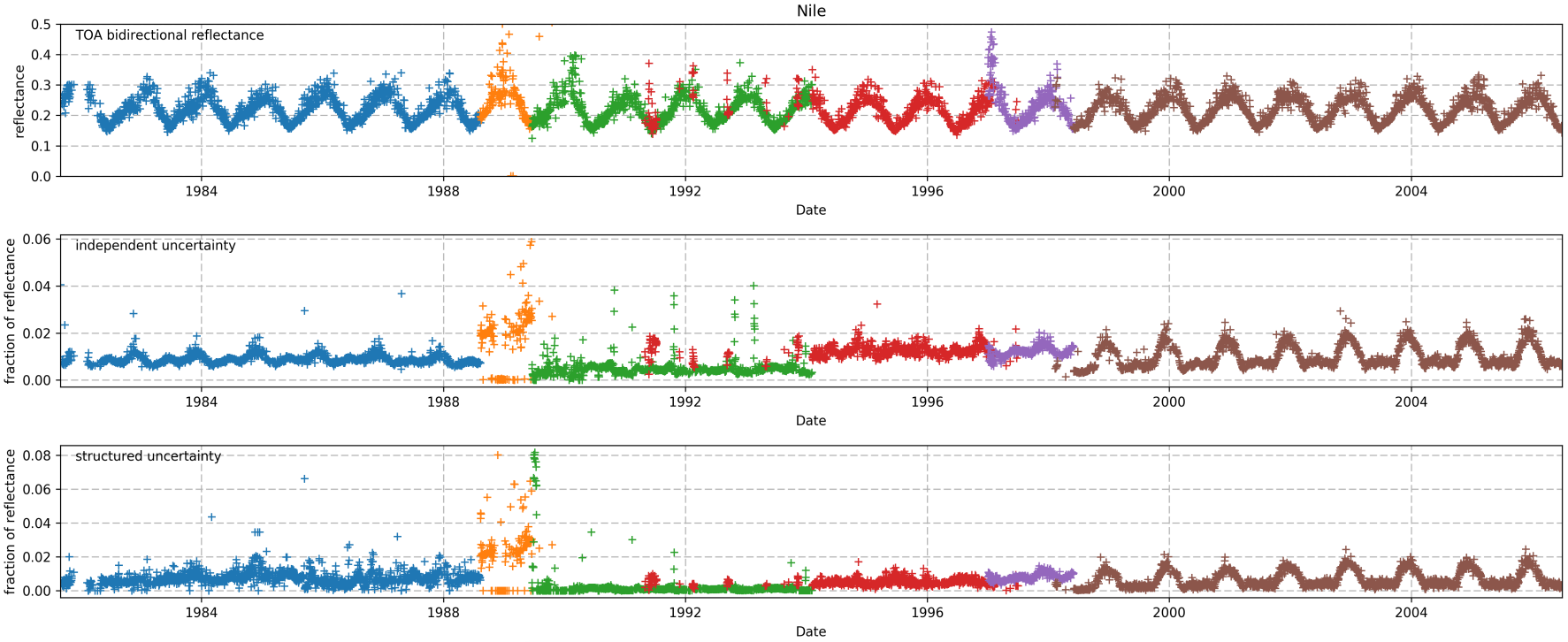


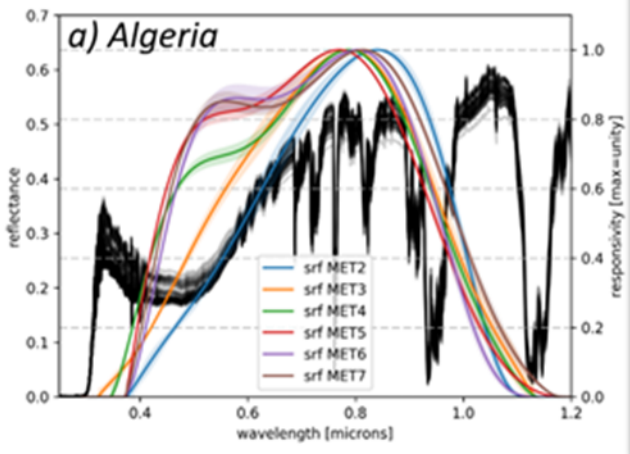


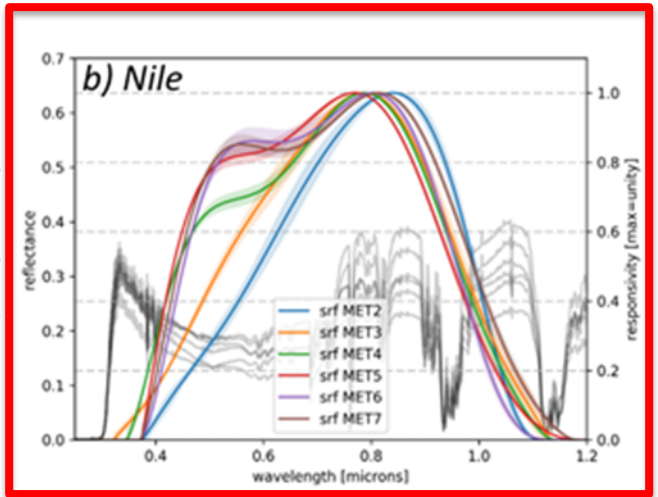


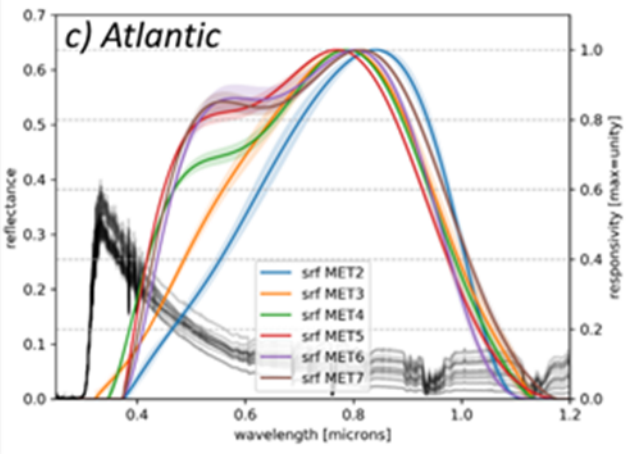


Harmonised time series

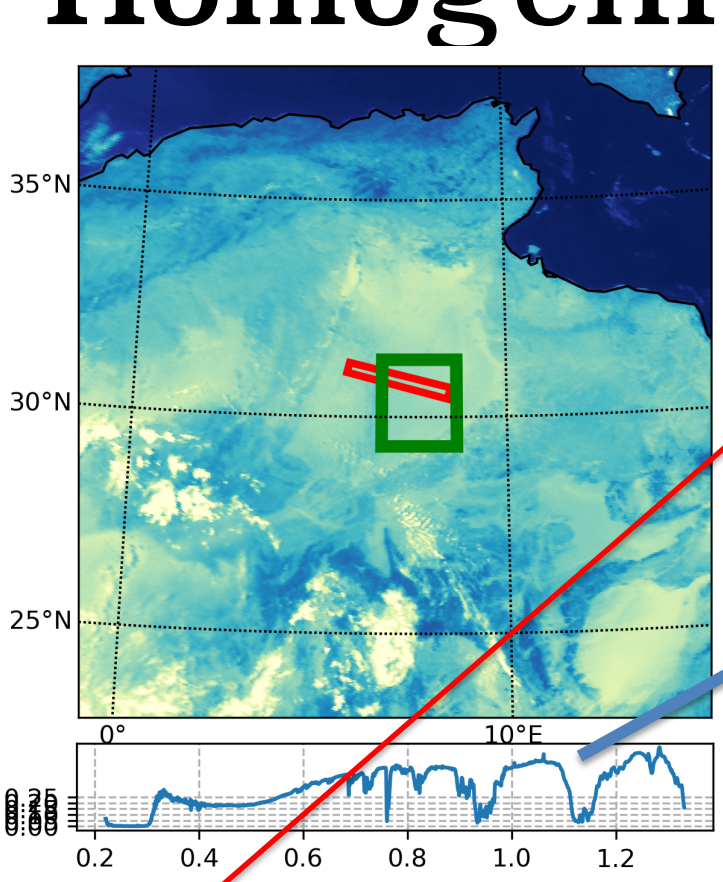


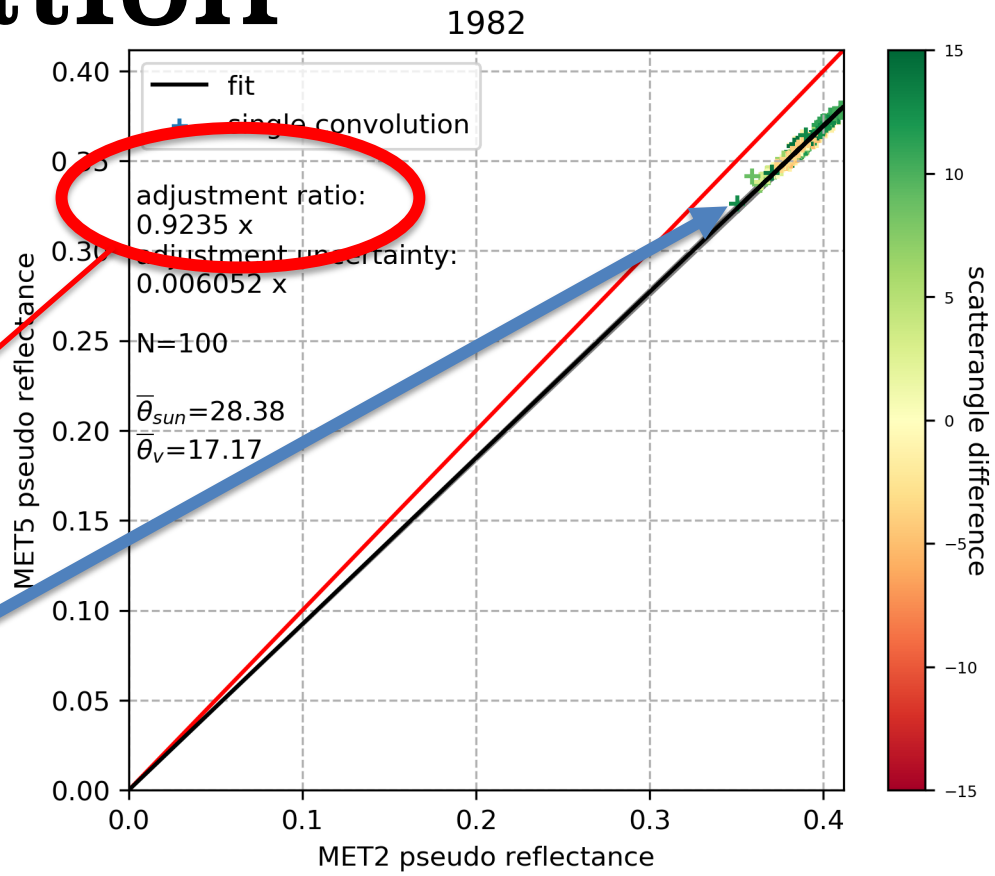


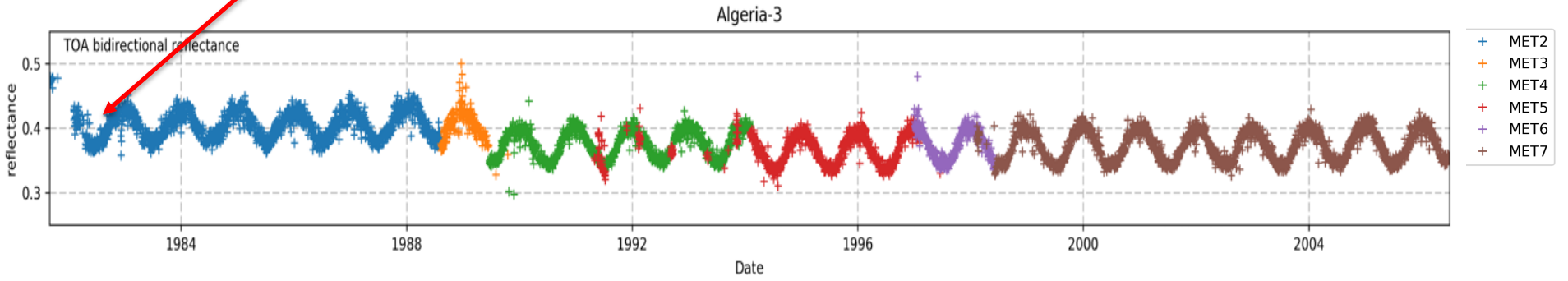




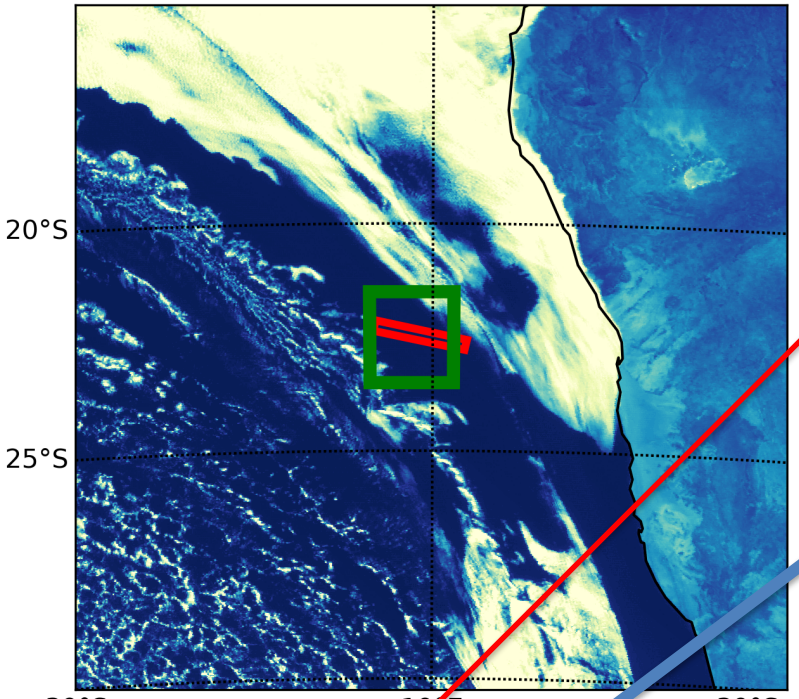
Homogenisation

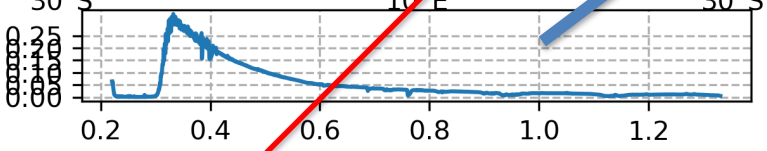


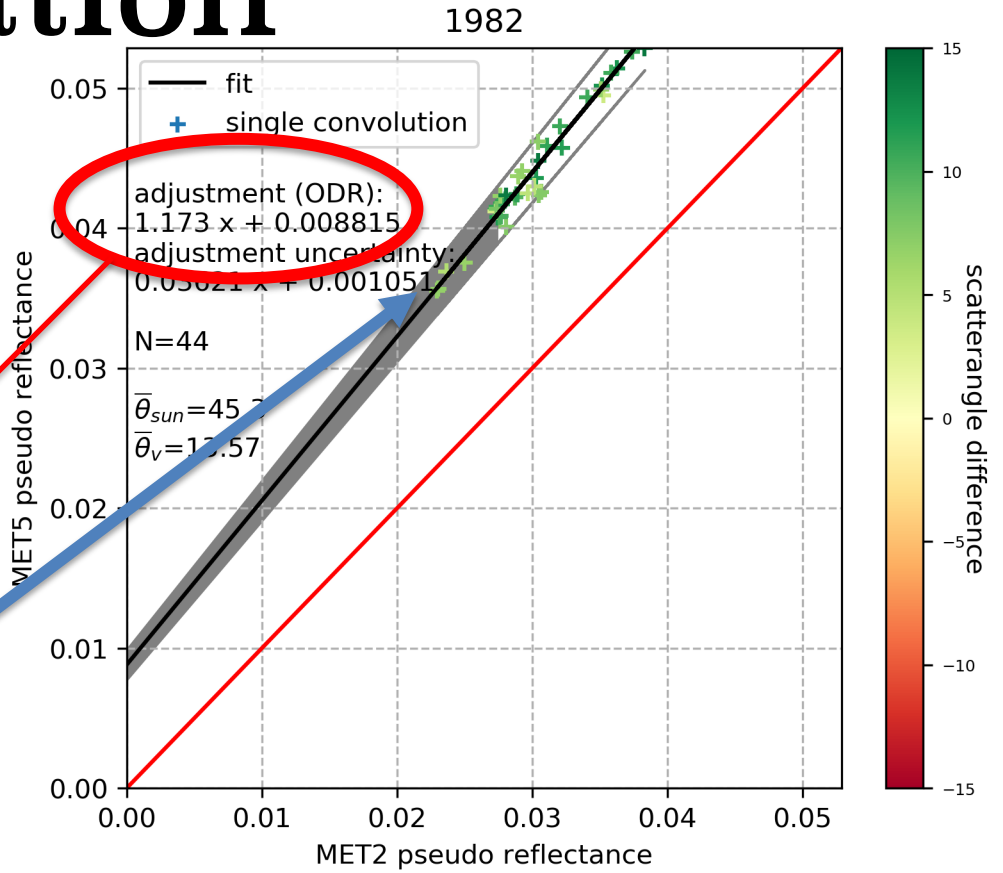


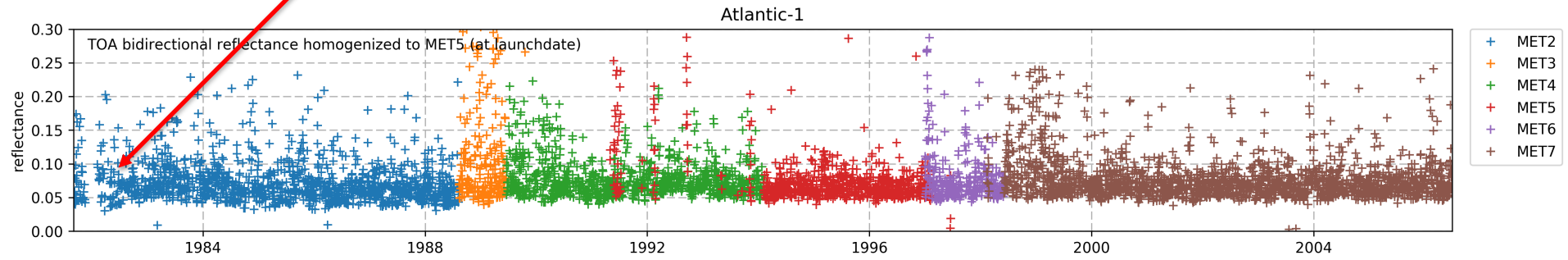


Homogenisation







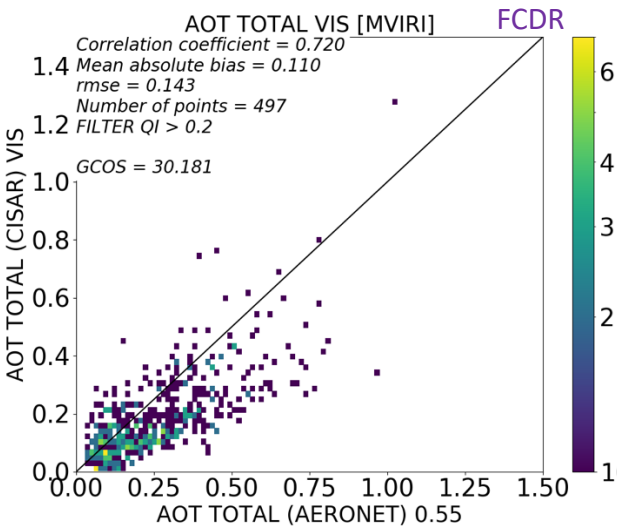


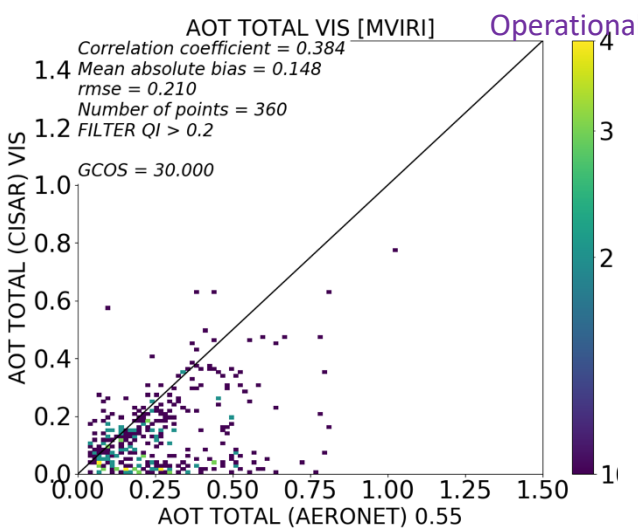
User Challenges

- MVIRI Instruments are different;
- MVIRI instruments measure temporally varying spectral information;

  →Needs consideration in retrieval/study design
- Effective utilisation of the characterised uncertainties.

❖ WP5.1 has demonstrated all these challenges can be successfully addressed.





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Conclusions

For the MVIRI VIS data (Meteosat 2 – Meteosat-7):

- Reconstructed time varying SRFs to account for the spectral degradation;
- Characterised uncertainties at pixel level;
- Recalibrated all measurements consistently – inherently harmonised;
- Created the FCDRs in EASY and FULL formats;
- Validated the FCDRs against superior measurements;
- Analysed the time series to verify the stability;
- Wrote three papers: Govearts et al., 2018; Quast et al., 2019, and Ruethrich et al., 2019 ☺

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