

Estimating Inter-Sensor Sea Surface Temperature Biases using DINEOF analysis

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ABSTRACT

The error correction for each SST sensor can be calculated as a difference between SST data derived from referent sensor (e.g. ENVISAT/AATSR) and from the other sensors (SEVIRI, AVHRR, MODIS) (Le Borgne et al., 2011). However, these empirical difference (bias) fields show gaps due to the satellite characteristics (e.g. narrow swath in case of AATSR) and to the presence of clouds or other atmospheric contaminations. We are using methodology based on DINEOF (Data INterpolation Empirical Orthogonal Functions) technique (Alvera et al., 2008; Beckers and Rixien, 2003) to reconstruct and analyse SST biases with the aim to study temporal and spatial variability of the SST bias fields. The results are based on DINEOF reconstruction of differences (RECDIFF) by correcting SEVIRI SST data using AATSR and Metop-A/AVHRR SST data. Corrected SST fields were validated against independent in situ buoy SST data and with ENVISAT/AATSR SST data. Results show that we obtained overall near-zero bias without the change in standard deviation parameters.

OBJECTIVE: analyse spatial and temporal variability of inter-sensor SST bias fields

DATA

- Domain: European Sea
- Time range: 2010/10-2012/03
- Nighttime data only
- format: L3C
- source: MyOcean

SST:

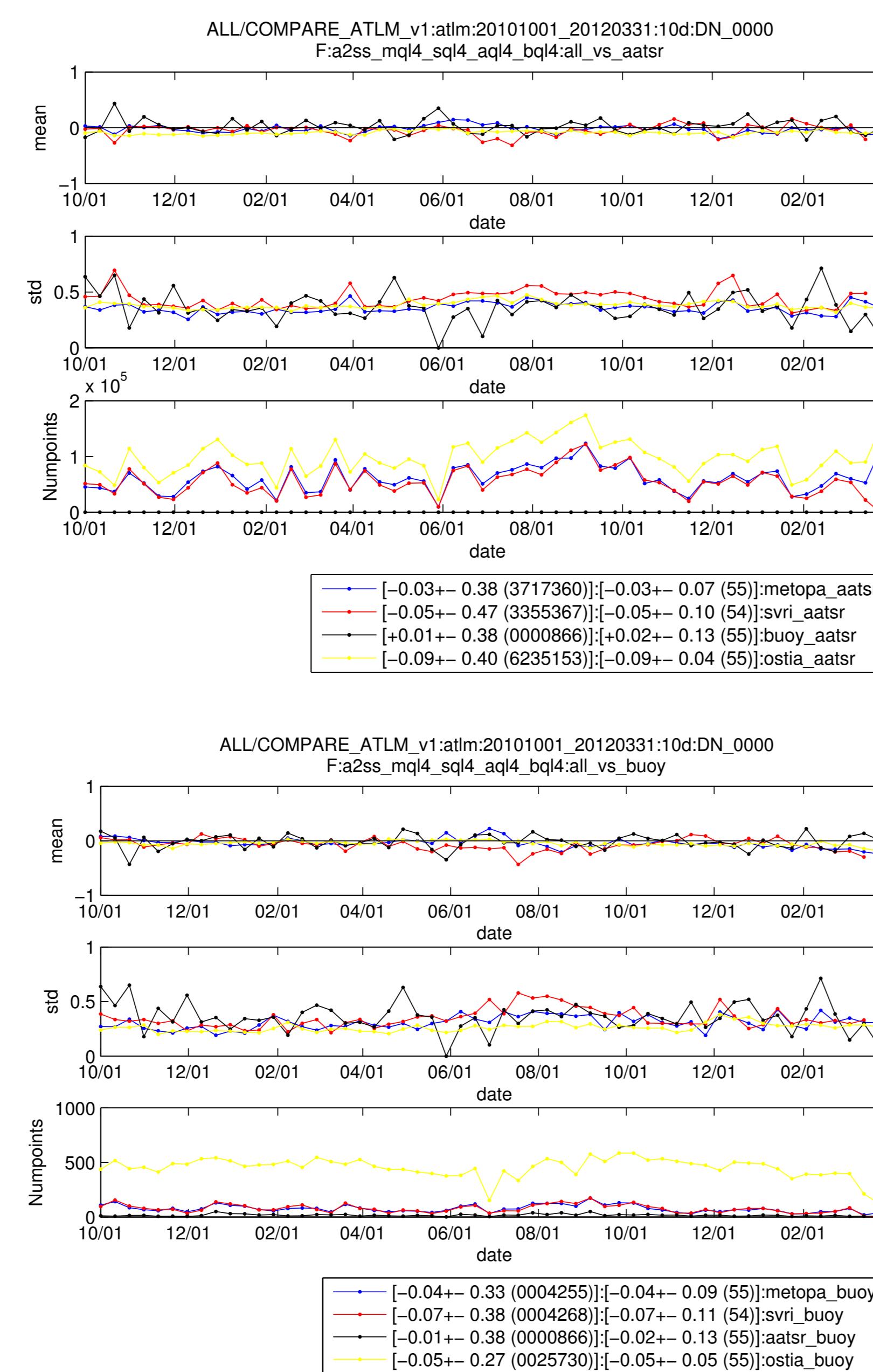
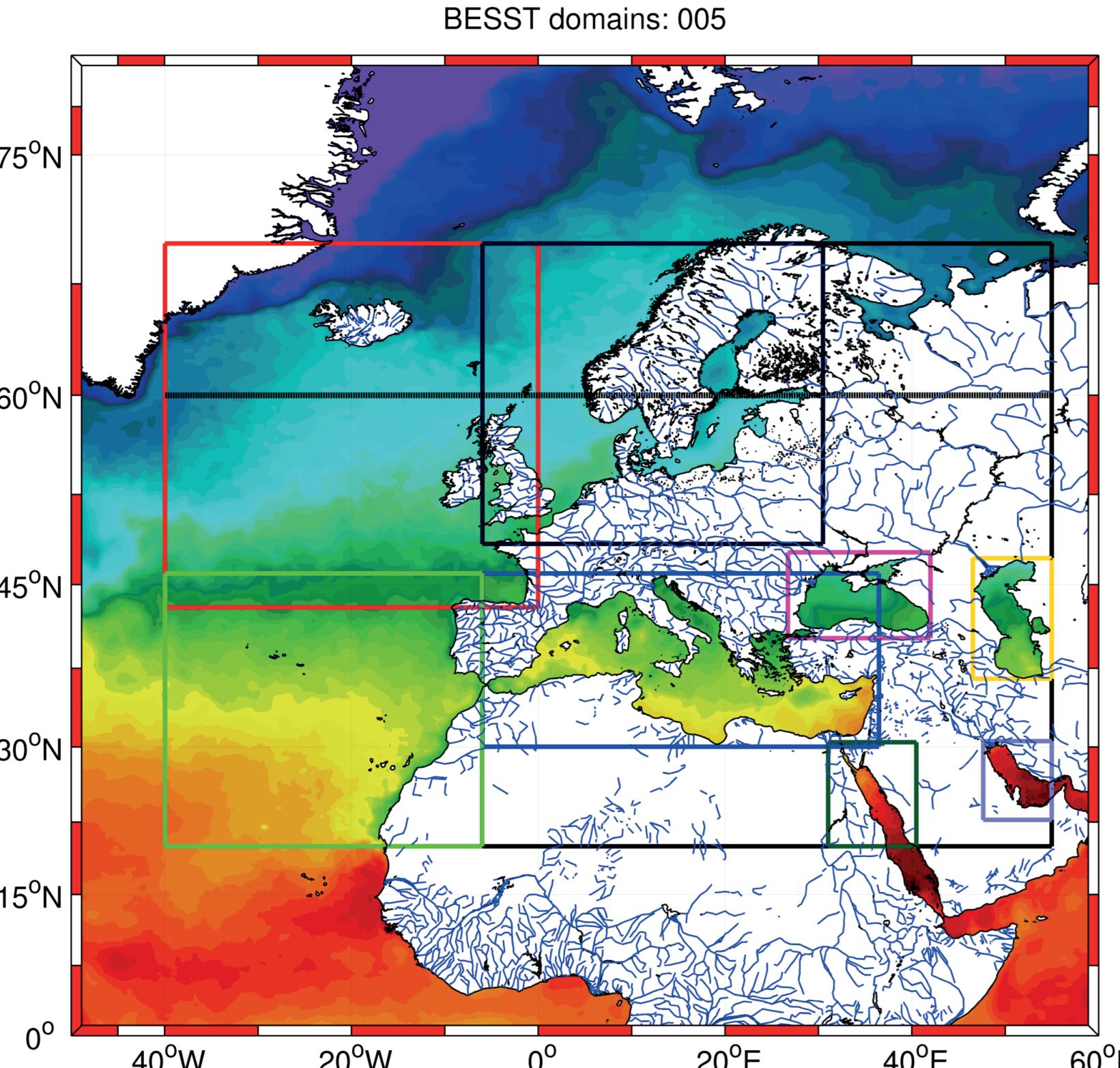
- Meteosat/SEVIRI: 0.05 deg

Referent SST:

- Metop-A/AVHRR: 0.02 deg
- ENVISAT/AATSR: 0.02 deg

Validation SST:

- In situ buoy: 0.02 deg
- ENVISAT/AATSR: 0.02 deg



METHODOLOGY

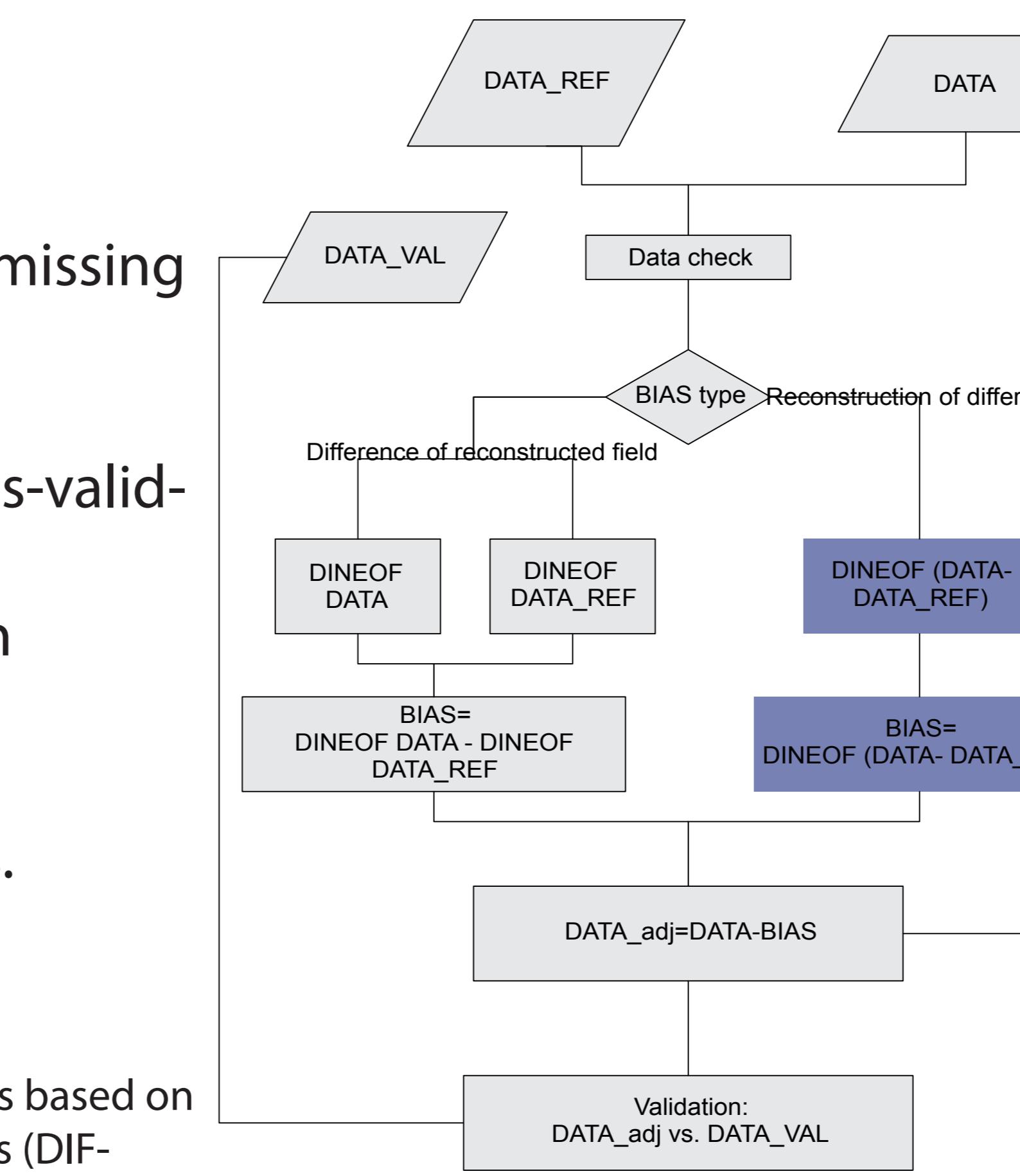
DINEOF

- EOF based technique to fill in missing data
- iterative method
- optimal number of EOFs by cross-validation
- non-parametric, noise reduction

BIAS

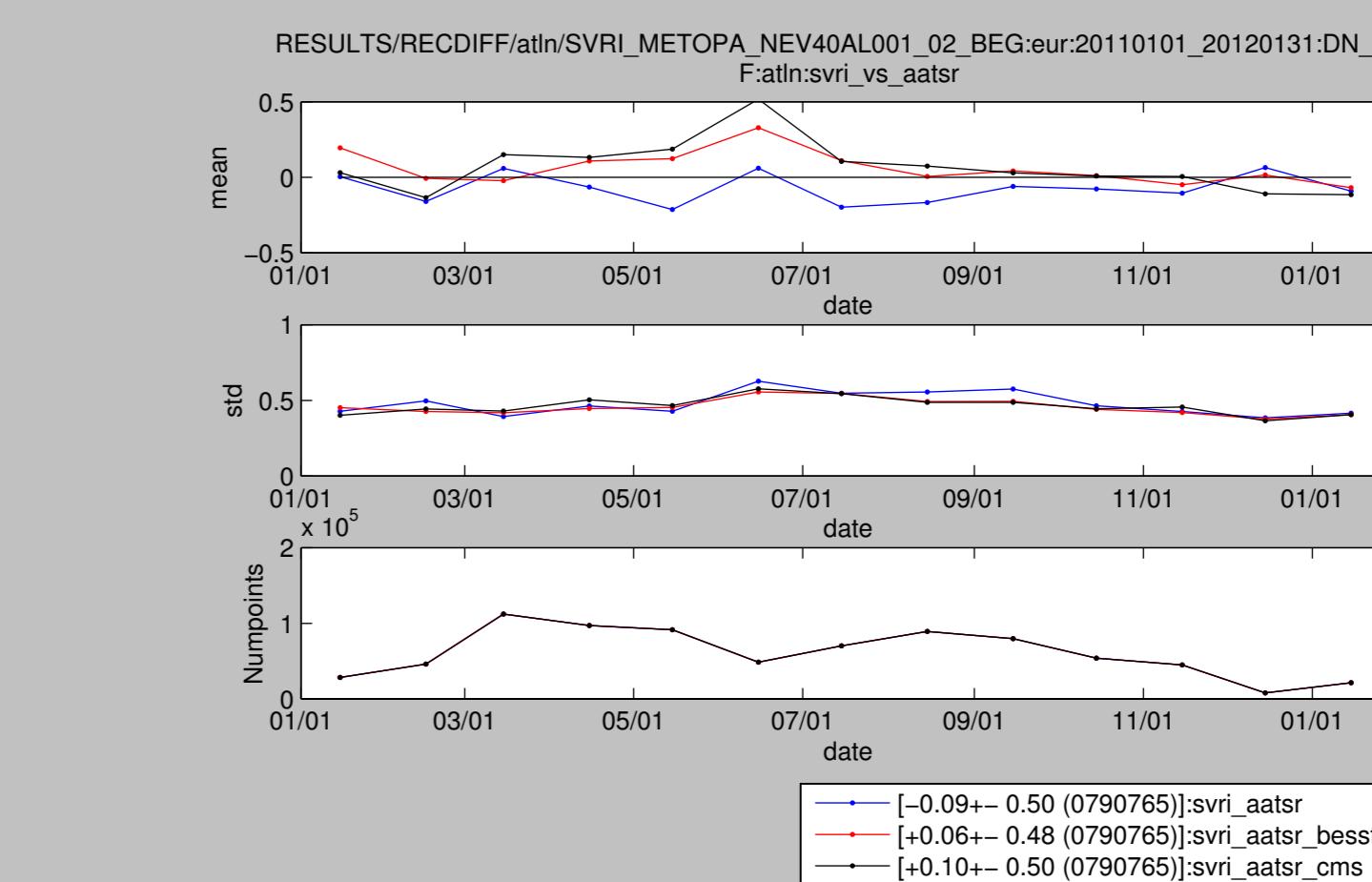
- DIFFREC : reconstruction of diffs.
- Grid size: 0.2 deg
- SEVIRI vs. Metop-A and AATSR

Fig 3. Diagram for deriving corrected SST fields based on two methods: a) differences of reconstructions (DIFFREC) and b) reconstruction of differences (RECDIFF).

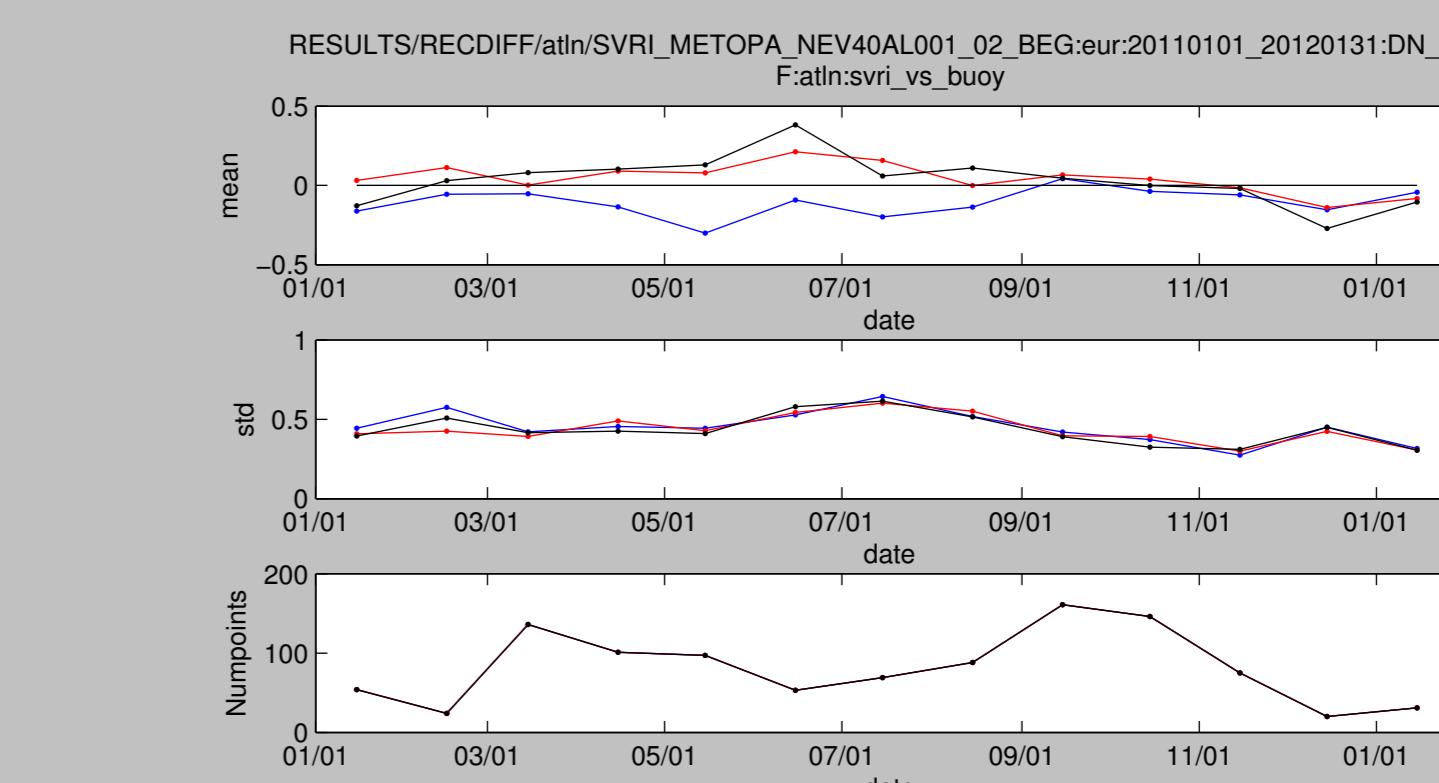


RESULTS

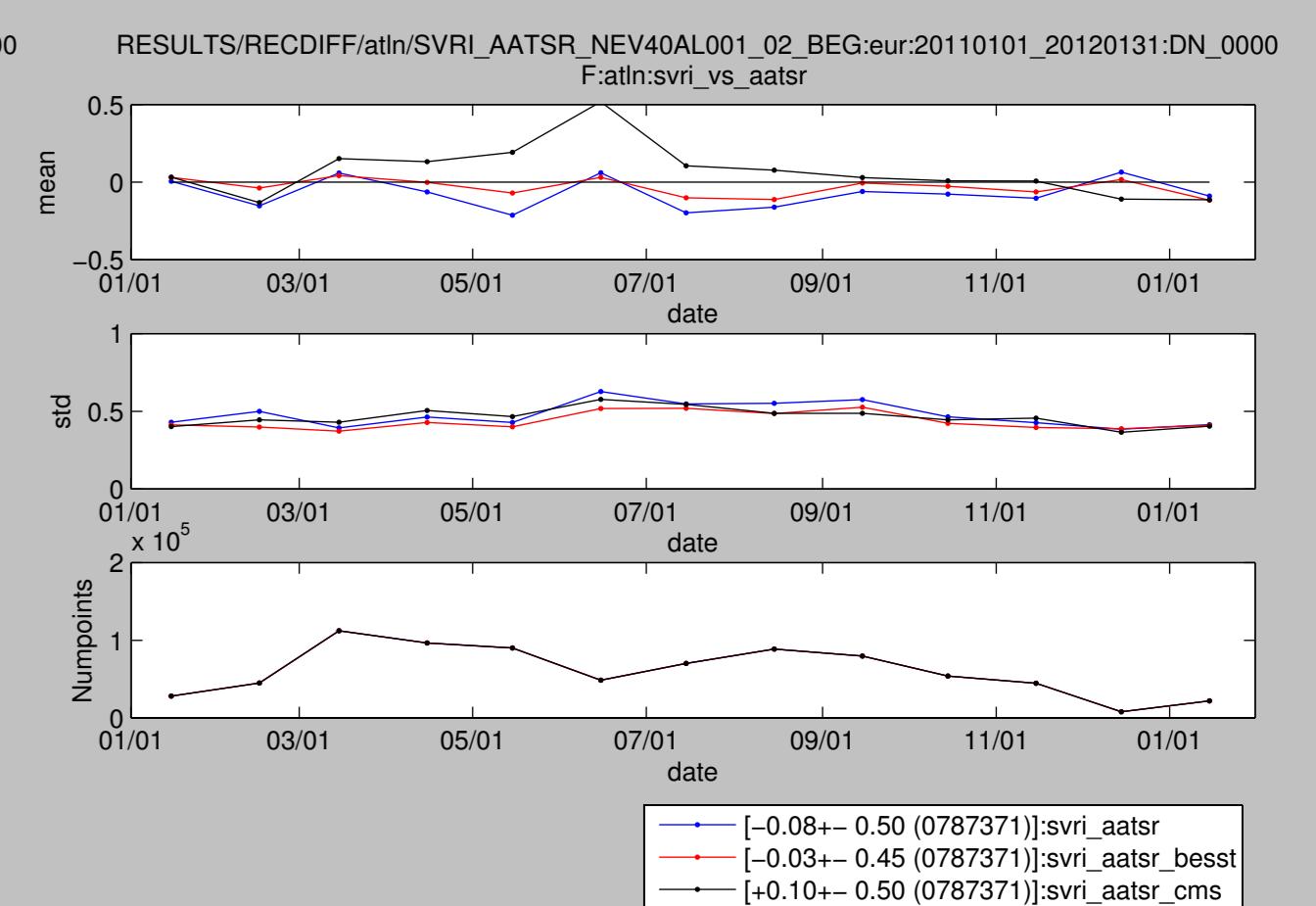
SEVIRI (Metop-A) vs. AATSR



vs. in situ



SEVIRI (AATSR) vs. AATSR



vs. in situ

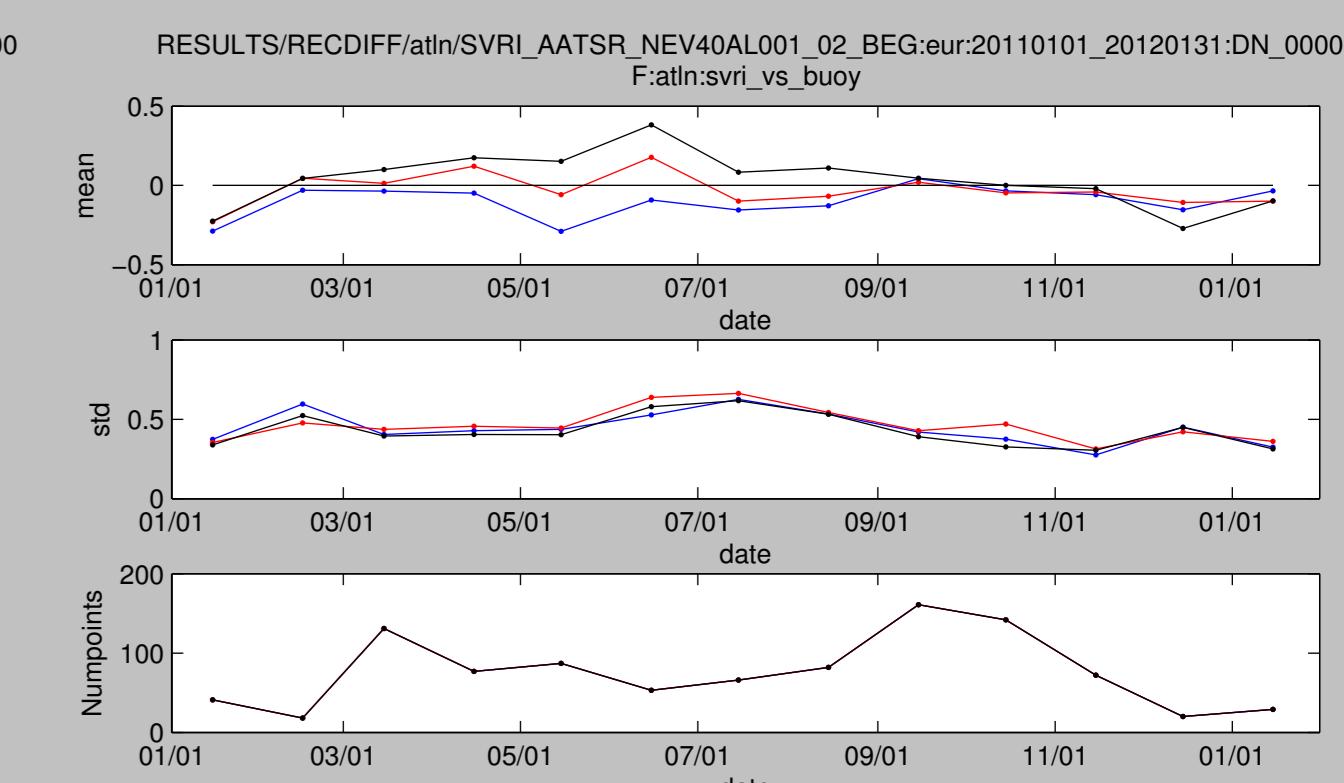


Fig 4. Time series (red lines) of monthly averaged biases and standard deviation over North Atlantic - north region for SEVIRI corrected with Metop-A (left) or AATSR (right) and validated against AATSR (upper) or in situ (lower). Red lines show results using DINEOF based correction, black lines show results using operational CMS correction (OI) and blue lines are without correction.

CONCLUSION

- DINEOF based reconstruction of differences reduces SEVIRI biases corrected with Metop-A/AVHRR or AATSR when compared to AATSR and in situ data
- AATSR improves correction
- total biases across different regions close to zero (< 0.1 K)
- standard deviations similar to the operational results
- referent sensor:
 - AATSR: only 1 EOF mode (not optimal)
 - Metop-A: 2-3 EOF modes (optimal but AVHRR not true ref. sensor)
- improvement compared to OI (operational @CMS)

<http://www.gher.ulg.ac.be/BESST>

Future work:

- physical interpretation of SST bias fields
- error analysis
- implementation in Meteo-France/CMS operational chain

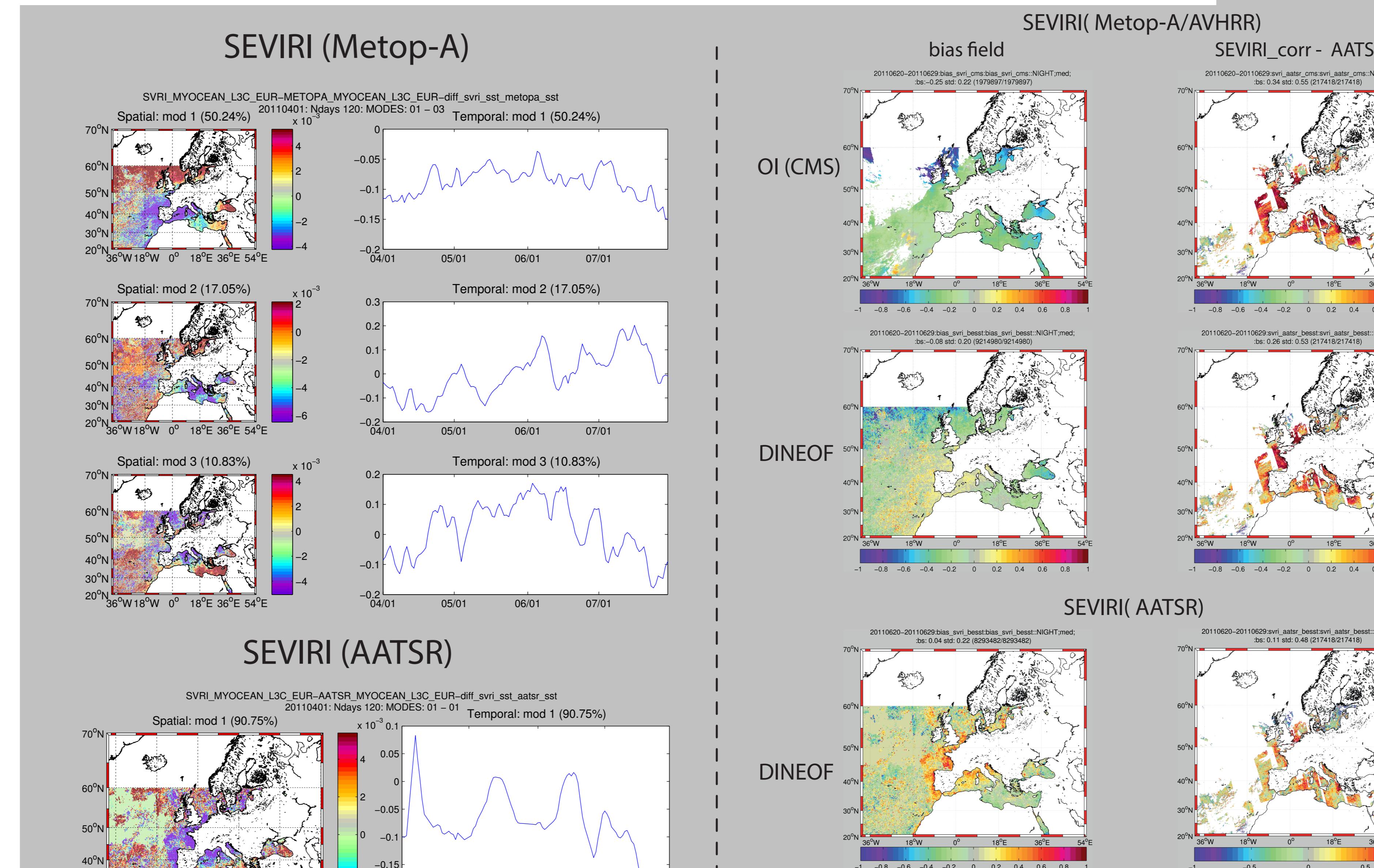
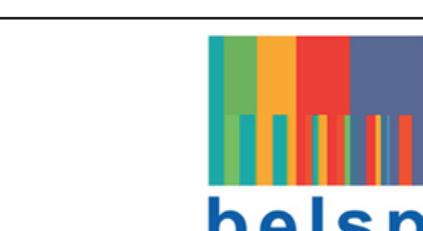


Fig 6. 10 days averaged bias (SEVIRI - SST_REF) correction field (left column) and differences between SEVIRI corrected and AATSR (right column) when using Metop-A/AVHRR as corrector (1st and 2nd row) and improved results when using AATSR as a corrector (3rd panel). Results using OI (operational) based correction are shown in 1st row while result using DINEOF based corrections are shown in the 2nd and 3rd row.

References:

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