Comparison of two methods DINEOF and CMEMS operational method at Meteo France on calculation of SEVIRI biases(METOP reference) over one year in operational context on European seas

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graal

OUTLINE

- Introduction
- Overview of the two methods
- Comparison of the two methods versus buoys
- Comparison of the two methods versus reference correcteur
- Conclusion

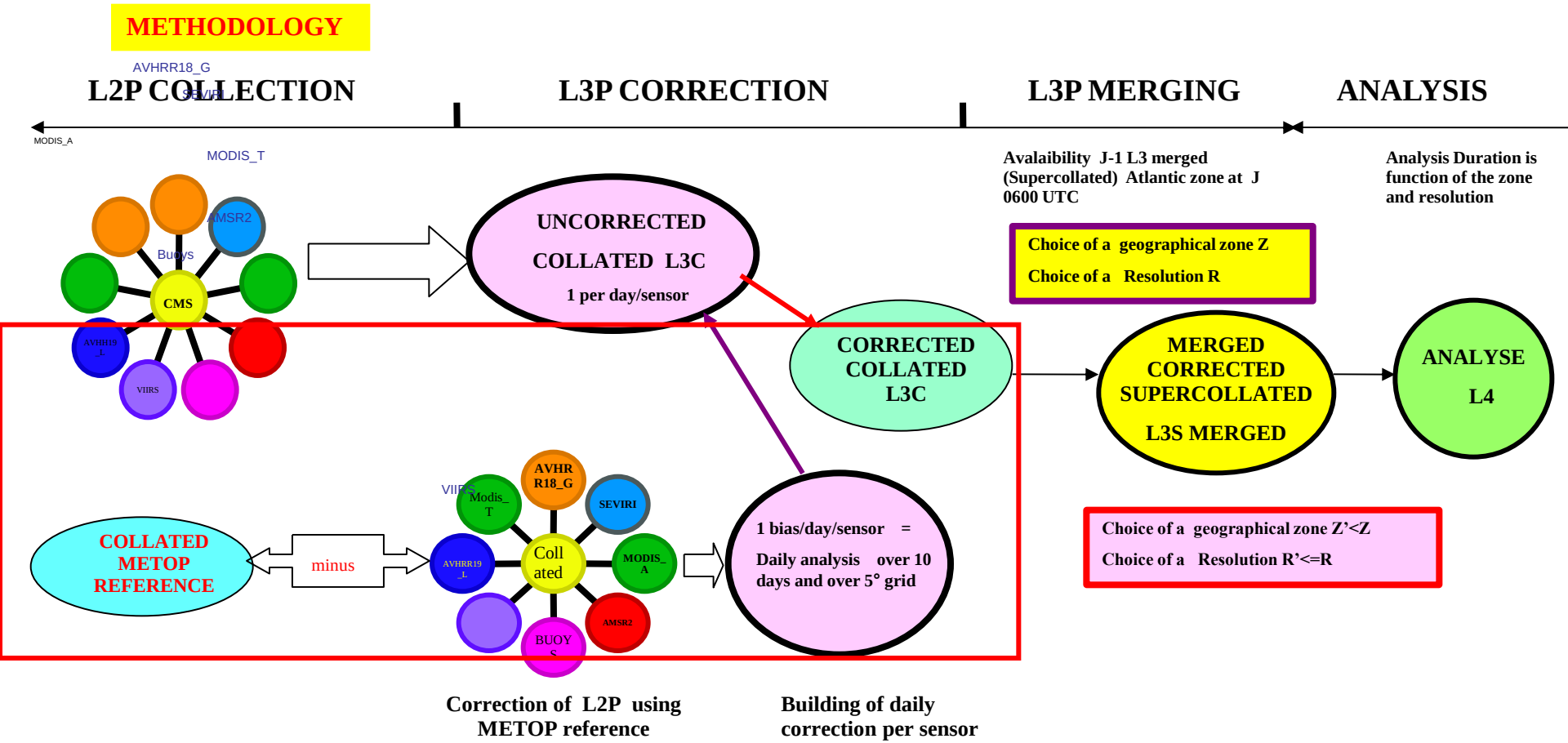
Introduction

Problematic :

correction of SST data of different sensors to merge them . All the methods are based on using one reference.

- Now days method is based on Optimal Interpolation in Copernicus context at Meteo France over European seas .This method needs improvements .
- BESST Project (GHER(Belgium)& Meteo France CMS R&D) in 2013 showed in a study with AATSR as reference corrector and SEVIRI sensor to be corrected, that the correction is better with Dineof method than with usual method .
- The question is : is it true, in an operational Near Real Time context and with METOP_A corrector ?
- To test :evaluation with comparison to buoy in NRT and to Metop_A which is the reference, to test the robustness of the methods in a quite operational context

Present method in CMEMS Copernicus project at CMS Météo France production (2 km resolution)



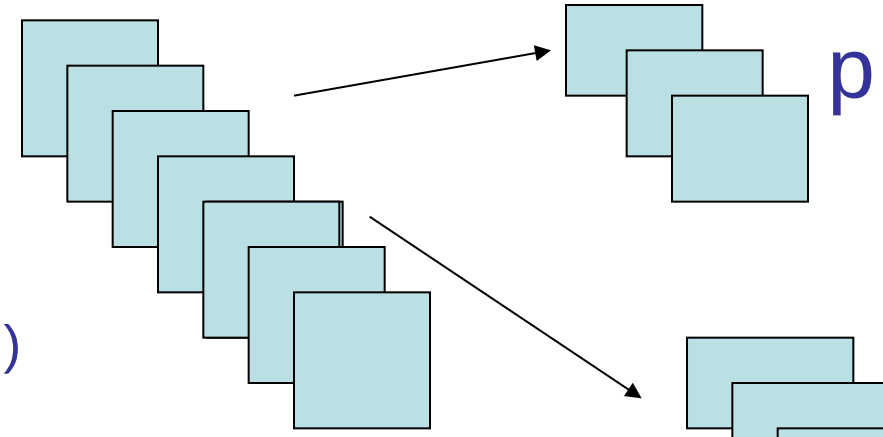
Fill gaps with Optimal Interpolation 5° resolution

Explanation very simplified of the Dineof method

Fill gaps with method based on EOF, singular values, cross validation

Parameters to adjust in experiments : convergence ,nb iterations_max,….

Cross_validation on p values used to calculate optimal nb of EOF



p

N data

with gap (clouds etc)

X itérations EOF until Convergence

N-p

Missing_data calculated :$X_{m,n}=U_{m,l}\sum V^{T}_{n,l}$ for the most dominant EOF reinjected and reitération until convergence

M spatial size

N temporal size

EOF=Empirical Orthogonal Fonction

Calculation of singular values

Reconstruction fill gaps of N data

- Two methods are based on calculating nighttime daily difference of SST between the sensor and the corrector-reference .

- For both methods the results are better to first produce differences and then fill the gap

Experiments in test NRT chain Copernicus with 2 sensors :
METOP_A (corrector), SEVIRI + Buoys. +statistiques.

- Data= SEVIRI to correct every day– 0.05 deg; nightime daily.

Methods :

- Operational Optimal Interpolation, resolution 5° NADA(Fortran, C) performance 50s,10 days needing.

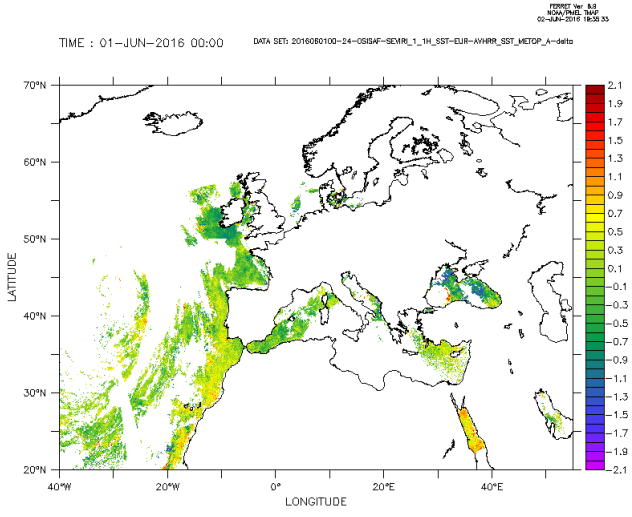
- DINEOF based on Fortran, Octave+ shell and python,number of EOF needed max 5, 20 days needing(more have been tested), 1° resolution

Most of days only 1 EOF needed to converge Calculation duration ~1.07second

- Most of days more than 70 % of missing values clouds or bad quality only 4 and 5 .

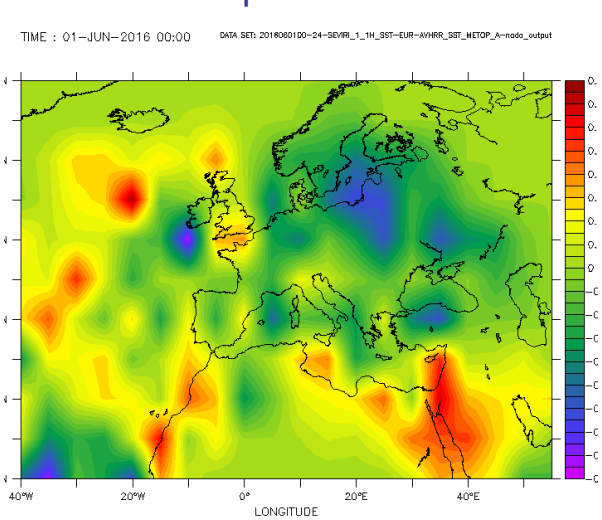
1st june 2016

difference Seviri minus Metop



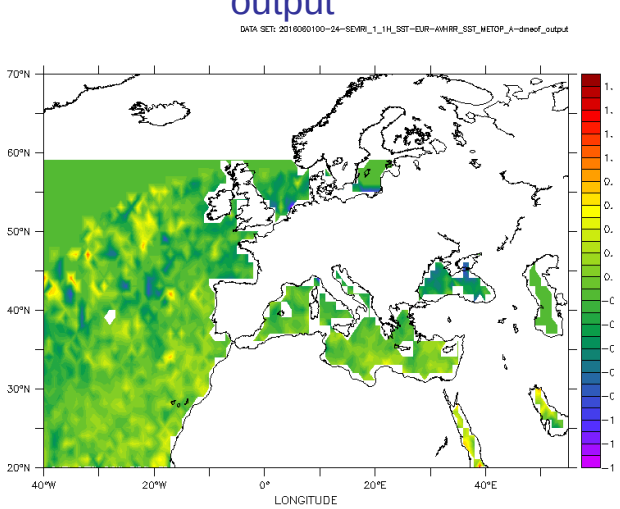
bias error derived from reference (kelvin)

OPERATIONAL BIAS output



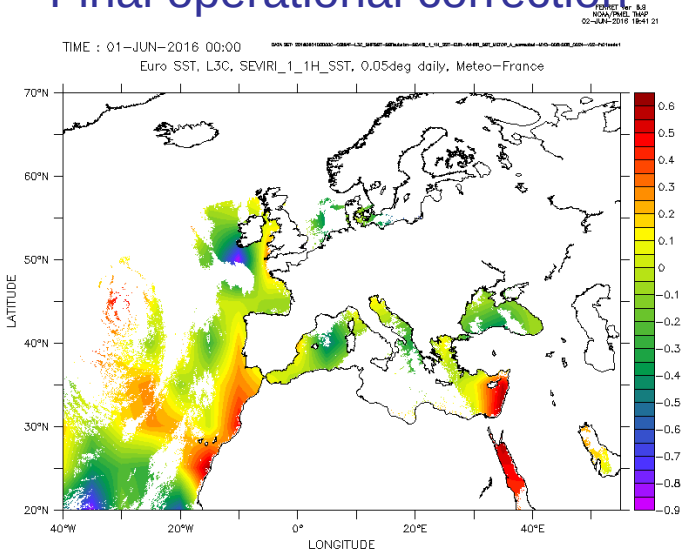
bias error derived from reference (kelvin)

DINEOF BIAS output



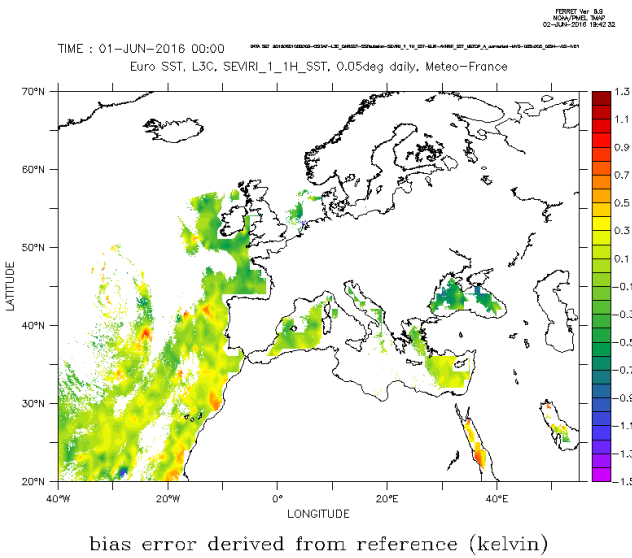
bias error derived from reference (kelvin)

Final operational correction



bias error derived from reference (kelvin)

Final dineof correction

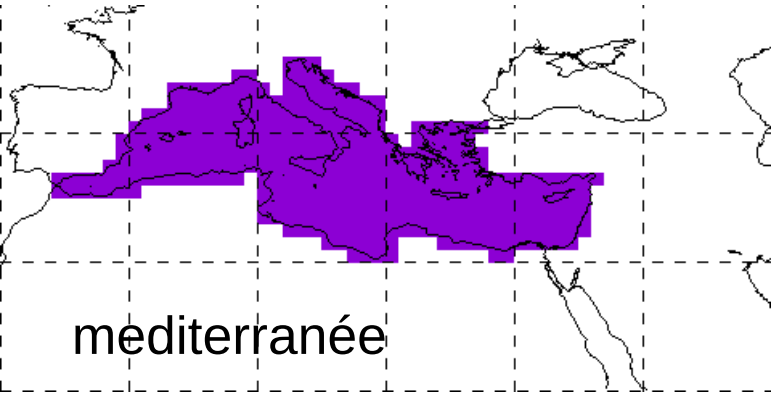


bias error derived from reference (kelvin)

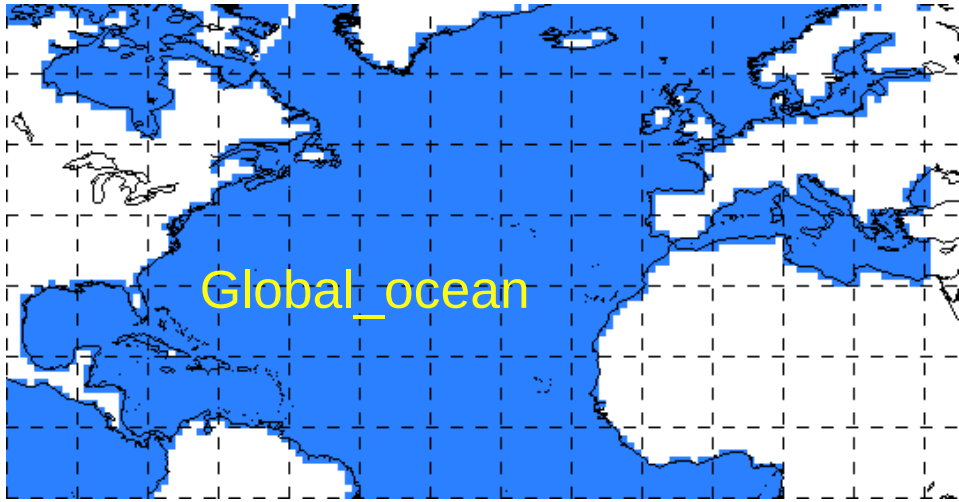
GHRSST XVII
Washington
6-10 june 2016

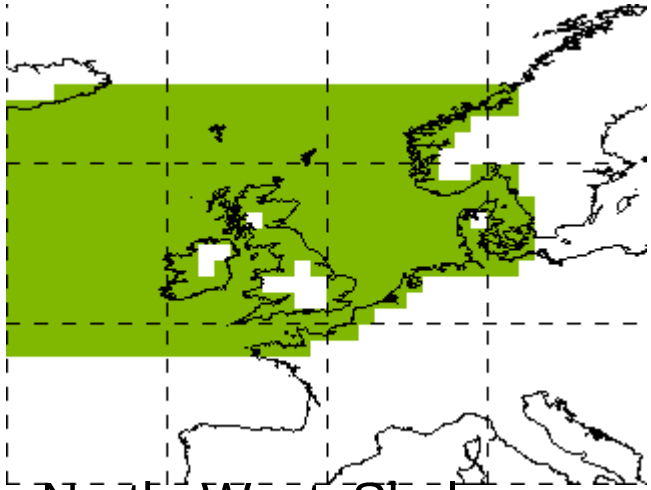
RESULTS

Régions COPERNICUS used in production CMEMS at CMS MF european seas

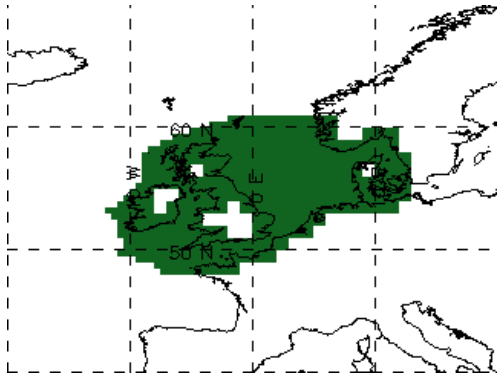


mediterranée

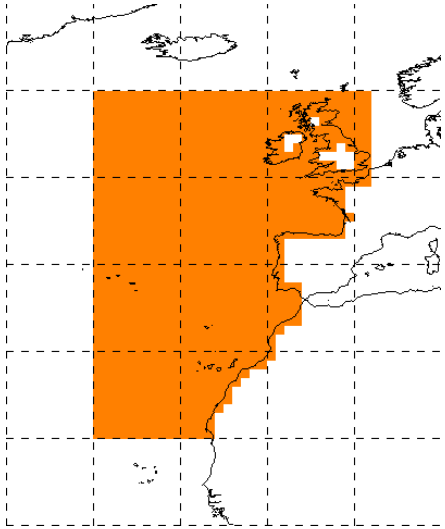




North_West_Shelves

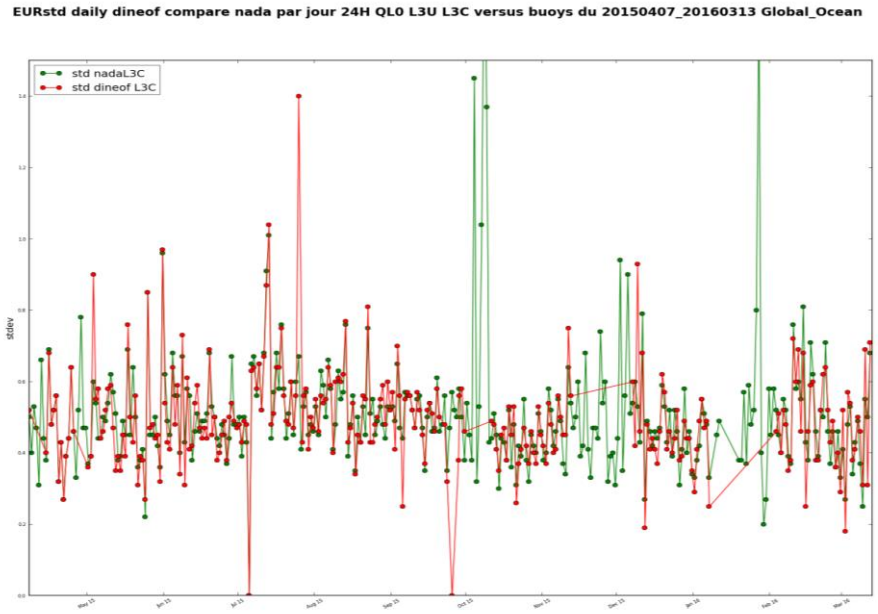


Actual NW shelves



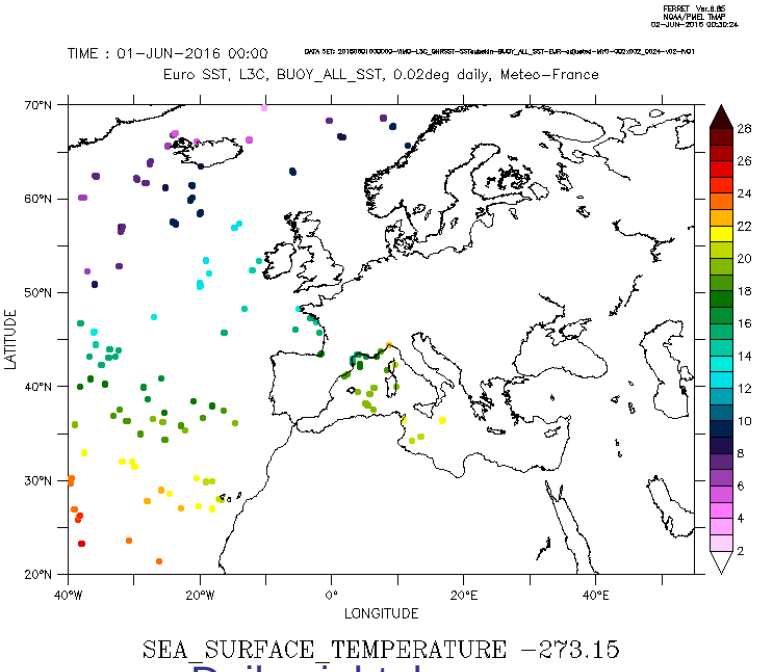
IBI_ROOS

Comparison with the two methods, of L3C SEVIRI versus BUOYS during one year on different regions (global region means over European seas)

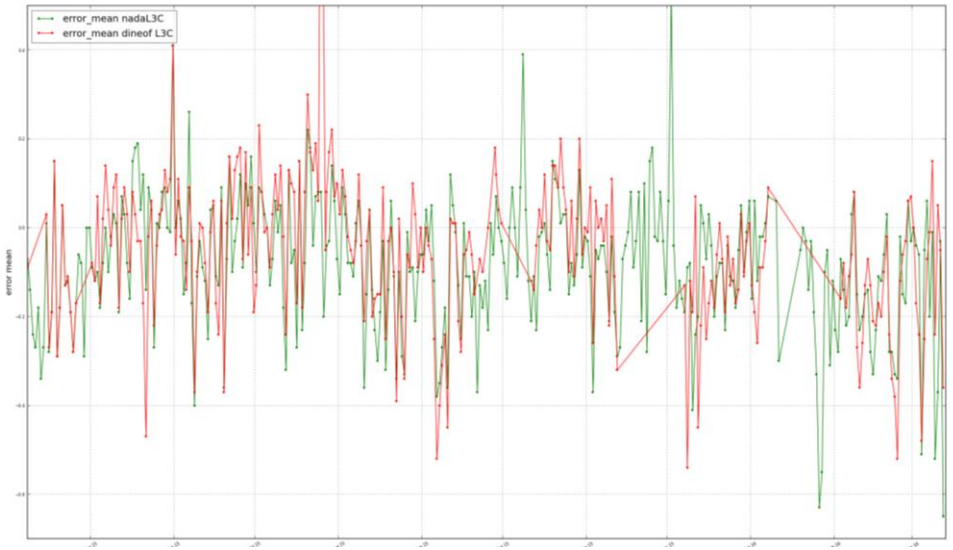


Mean error between buoys and Seviri corrected by METOP_A from 7 april 2015 to 13 March 2016

Filter order 2



Daily night buoys



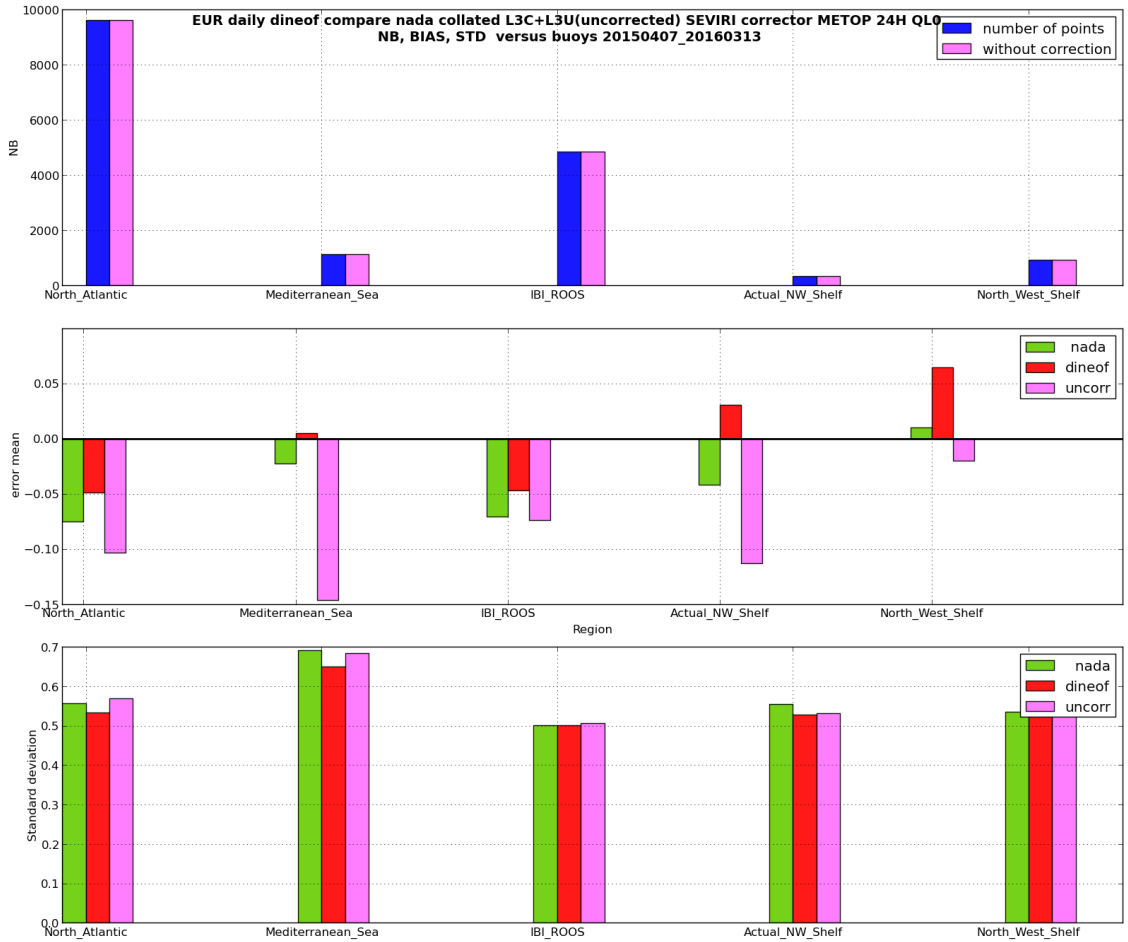
EURerror mean daily dineof compare nada par jour 24H QL0 L3U L3C versus buoys du 20150407_20150630 Global_Ocean

Filter order 2

Standard deviation

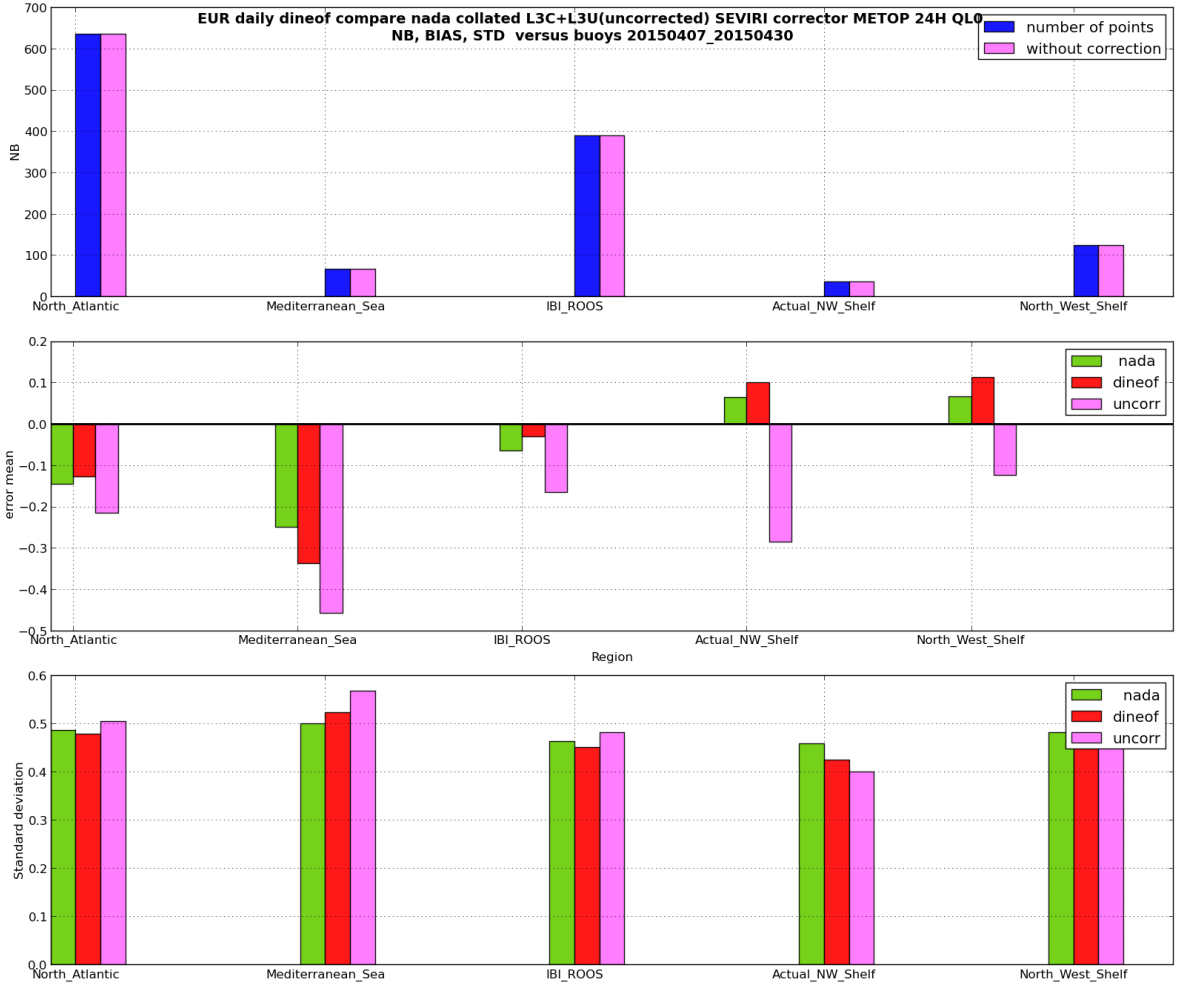
Versus buoys

Easier to conclude



DINEOF better in most of regions

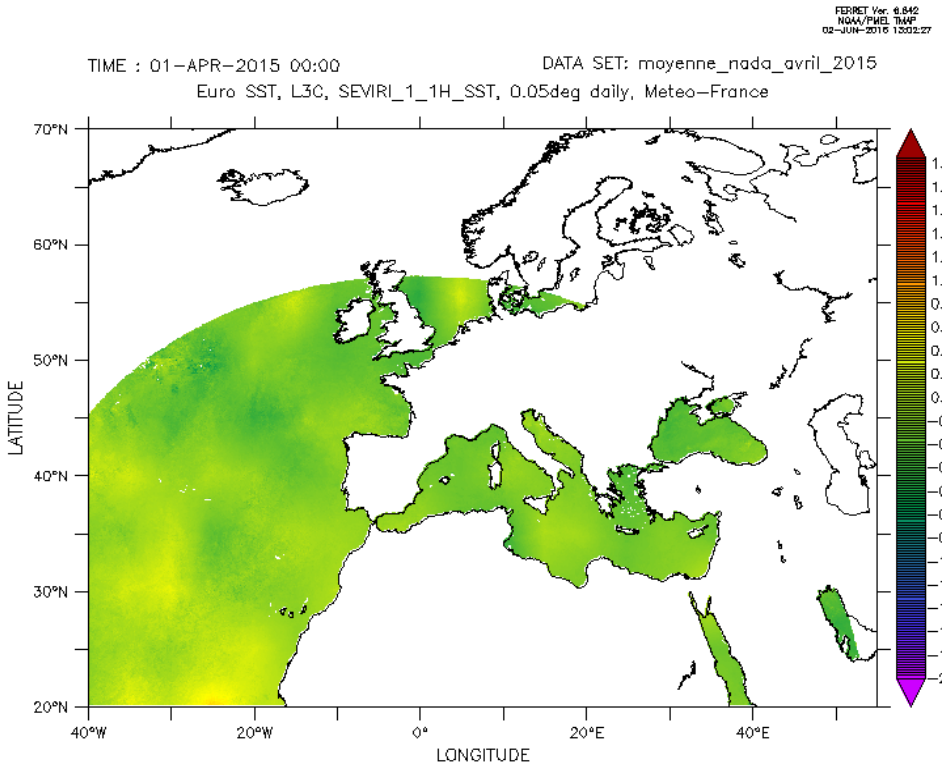
Monthly animation



Monthly mean error and standard deviation by region

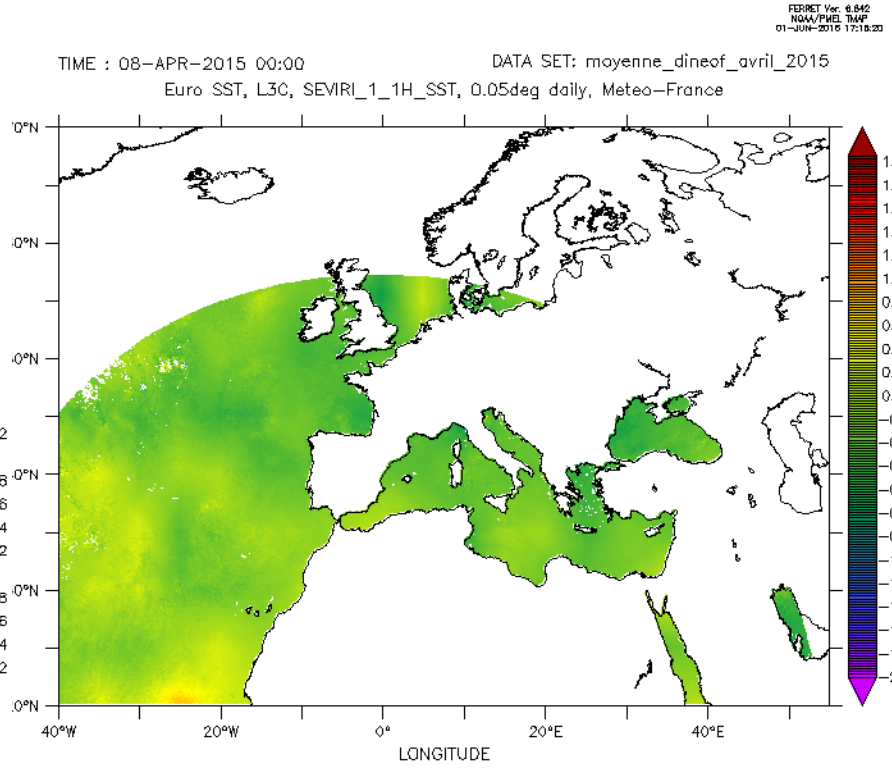
Mean error better most of time with DINEOF but some months (march,october) present method is better standard deviations are closed.

OPERATIONAL



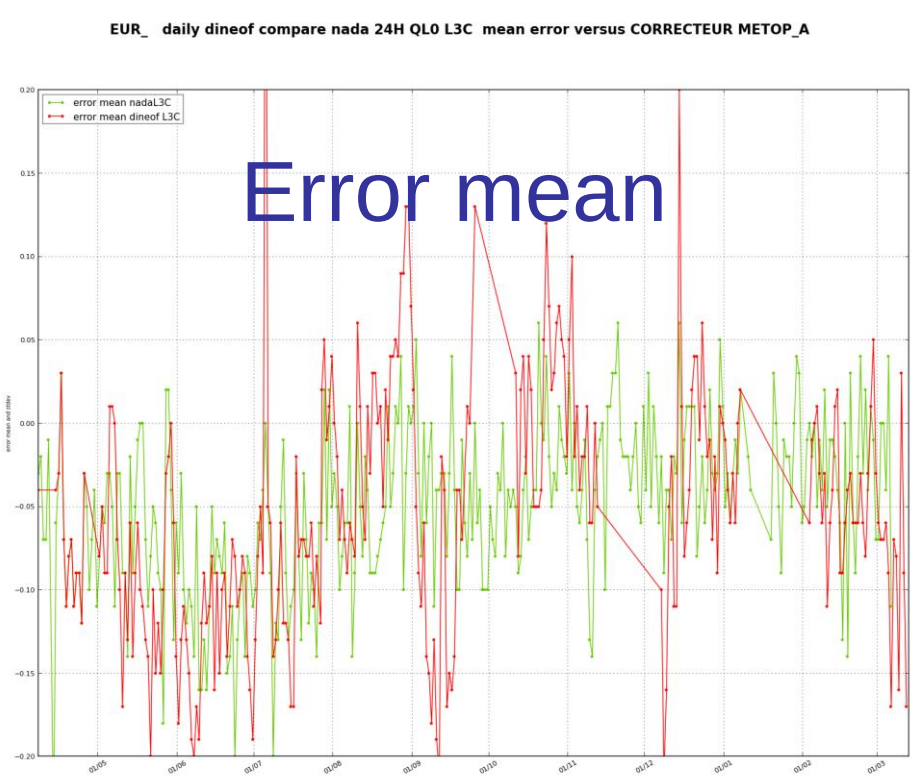
bias error derived from reference (kelvin)

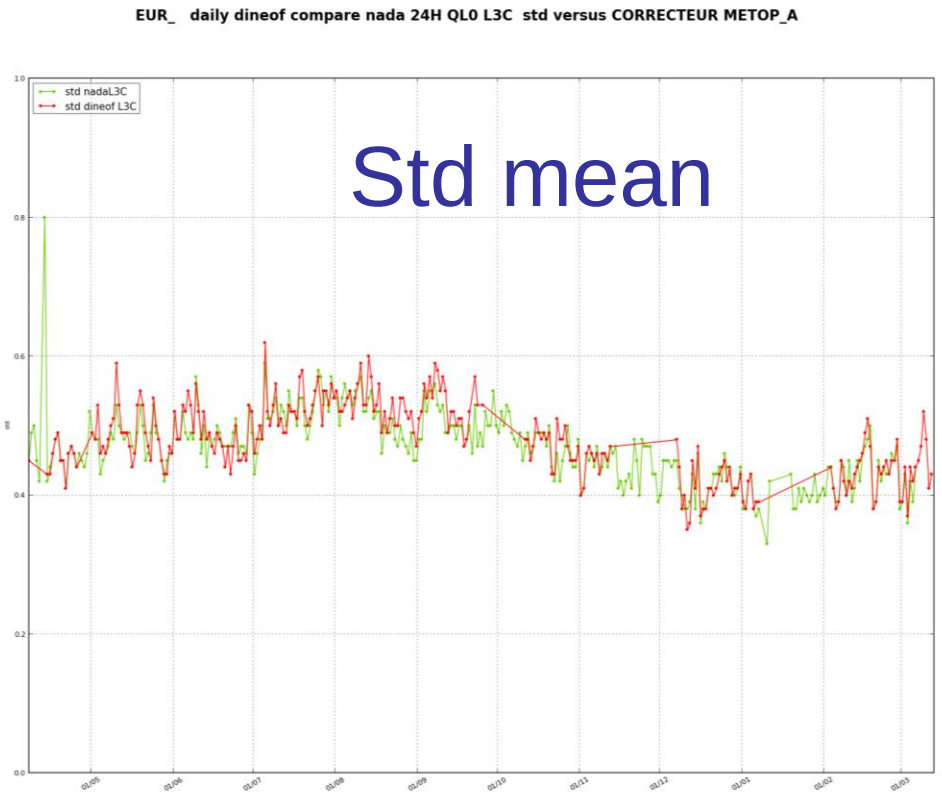
DINEOF



bias error derived from reference (kelvin)

Comparison of Statistic of the 2 methods SEVIRI L3C versus corrector METOP





EURerror mean daily dineof compare nada par jour 24H QL0 L3U L3C versus corrector METOP 20150407_20160313 North_Atlantic

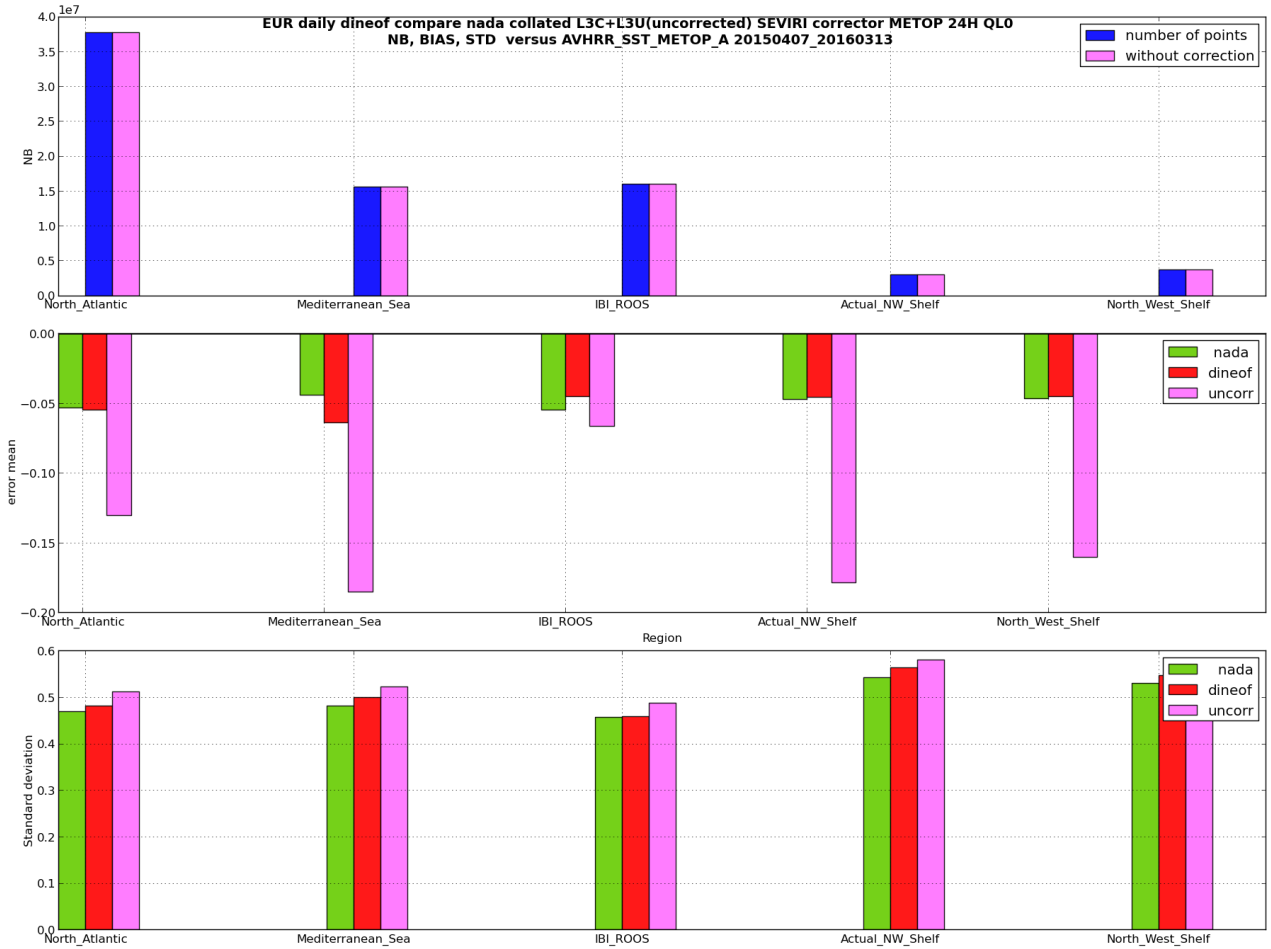
Order 2

EURstd mean daily dineof compared to nada par jour 24H QL0 L3U L3C versus corrector METOP 20150407_20160313 North_Atlantic

Order 2

ANNUAL STATISTIC versus correcteur

which ought to be perfect



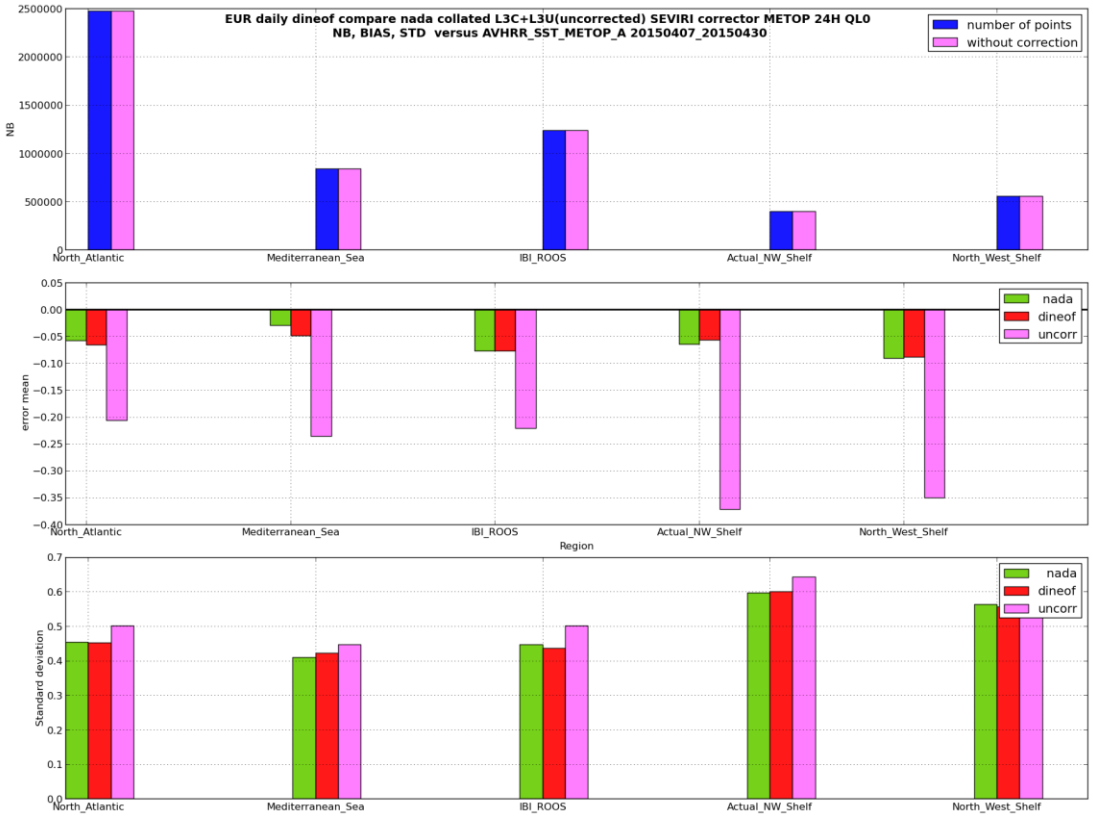
Two methods are similar for quite all the regions

Error mean near -0.05

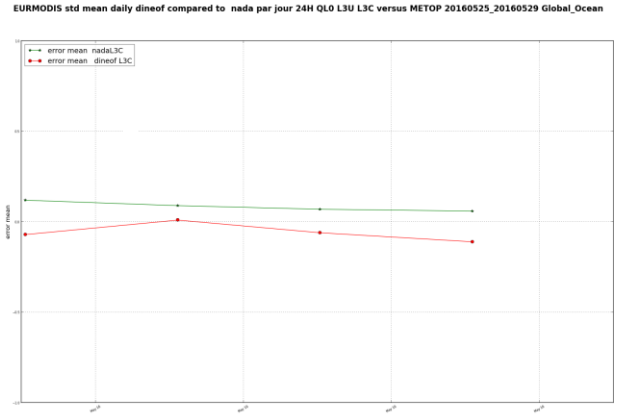
L3C SEVIRI corrected very similar to METOP

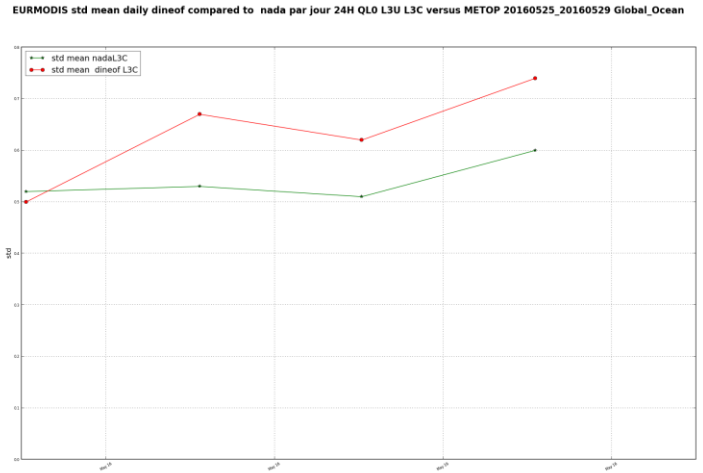
Good correction

Monthly animation



- MODIS_A has been tested to but adjust parameters was more difficult .
- We need to resample difference MODIS-METOP on 4° resolution instead of 2° initially, probably octave limits in function Delaunay needs more memory or compilation option has to be modified..
- 4 EOF needed before convergence





Conclusion

New method DINEOF can be used in operational context with better performance than present method for SEVIRI . Performance of Dineof are better in time, memory, CPU.

Some adjustments seem still to be brought even on SEVIRI to get smoother results, tuning parameters to get less noise, size of learning samples, number of EOF to need etc to be more robust to NRT operational chain (lack of data ,..)

A daily chain test with an adjustment specific for each sensor (SEVIRI,VIIRS, AMSR2,MODIS_A, MODIS_T, AVHRR18_G, AVHRR19_L) is going to be implemented at CMS.

Evaluation of improvement on L3S (supercollated) and L4 products on European seas has to be done .