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Assessment of contributions from ACSPO VIIRS retrievals of SST in the new high resolution CMC SST analysis

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Introduction

- CMC runs 3 SST analysis:
 - 0.2° with AVHRR
 - 0.2° with AVHRR, ACSPO VIIRS and RSS AMSR2
 - 0.1° with AVHRR, ACSPO VIIRS and RSS AMSR2
- All analyses assimilate in situ observations (ships, drifting buoys and moored buoys) and ice data
- SST analysis refers to a depth temperature (foundation SST) without diurnal variability
- First analysis is running in operations, the last two only in experimental mode



VIIRS SST Product

- VIIRS data is produced by NOAA using Advanced Clear-Sky Processor for Oceans - ACSPO (Petrenko et al. 2014)
- ACSPO VIIRS retrievals publicly available since May 2014, include quality flags and surface wind speeds
- CMC started using VIIRS retrievals and AMSR2 retrievals at the end of May 2014
- Some improvements in CMC SST 0.1° :
 - Improved spatial resolution (from 0.2° to 0.1°)
 - Background error correlations length scale reduced for high latitudes
 - Observations spacing reduced compared to 0.2° SST analysis (33 km compared to 44 km for infrared data at high latitudes)
 - Increased resolution of proxy data from CMC 3DVar ice analysis

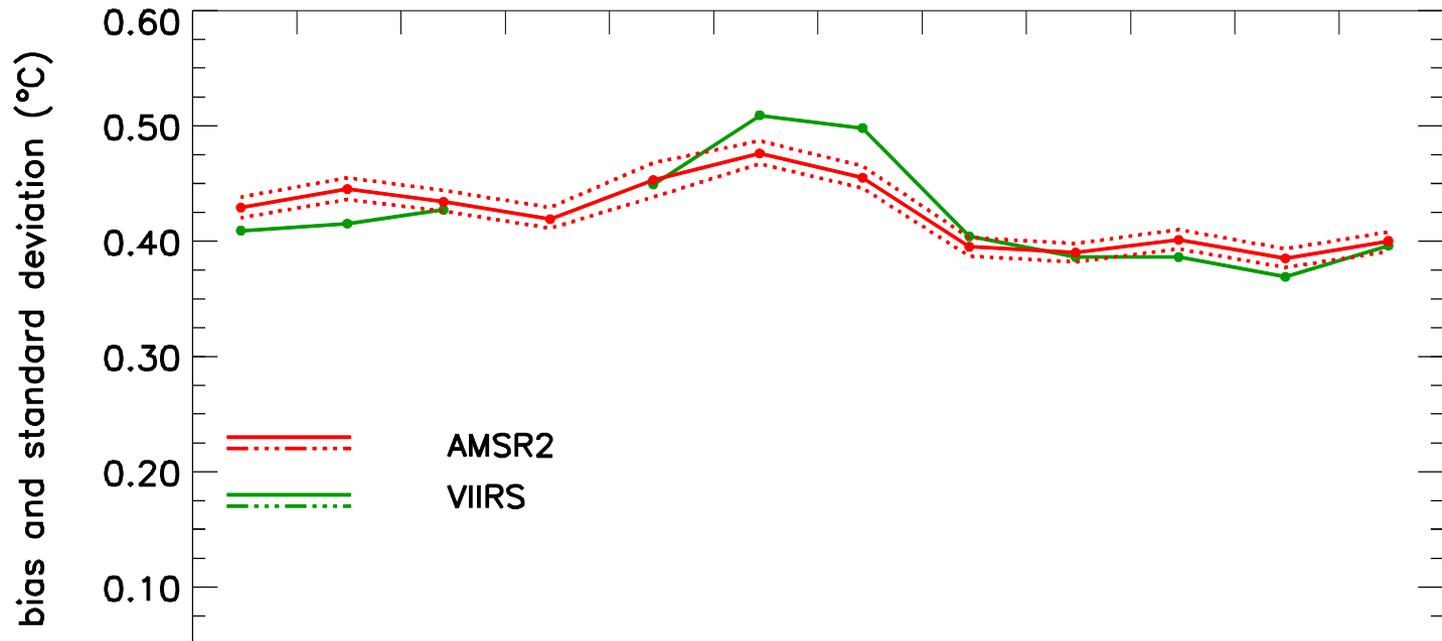


Evaluation of VIIRS in CMC SST

- Because AMSR2 and VIIRS retrievals have been used in the same time, two analysis were produced with the same methodology on a grid with 0.2° resolution assimilating only AMSR2 retrievals or only VIIRS retrievals
- All verifications are done against independent measurements from Argo floats
- Observations are used only if they are between 3 m and 5 m and within four standard deviations of the climatology

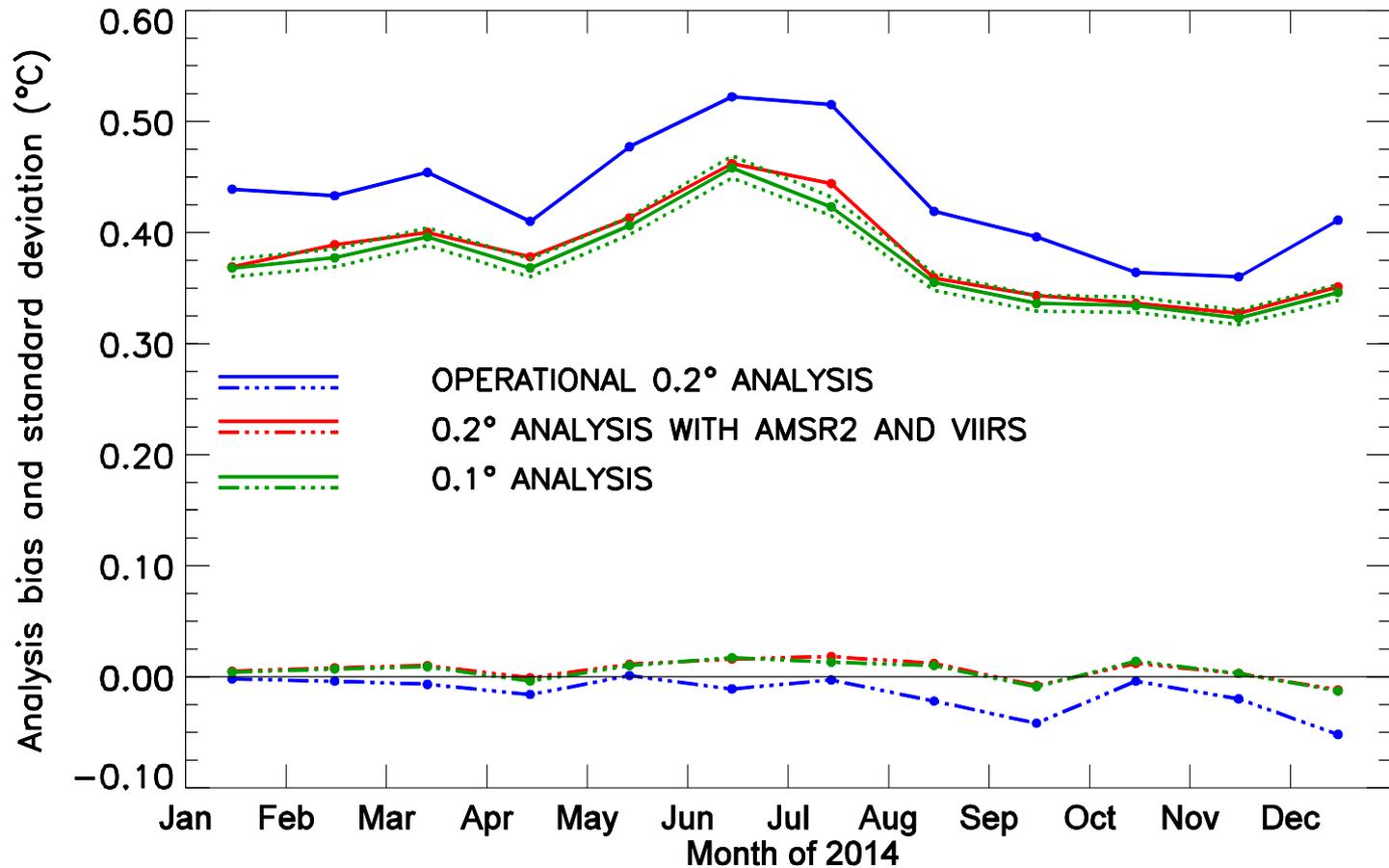


AMSR2 vs VIIRS



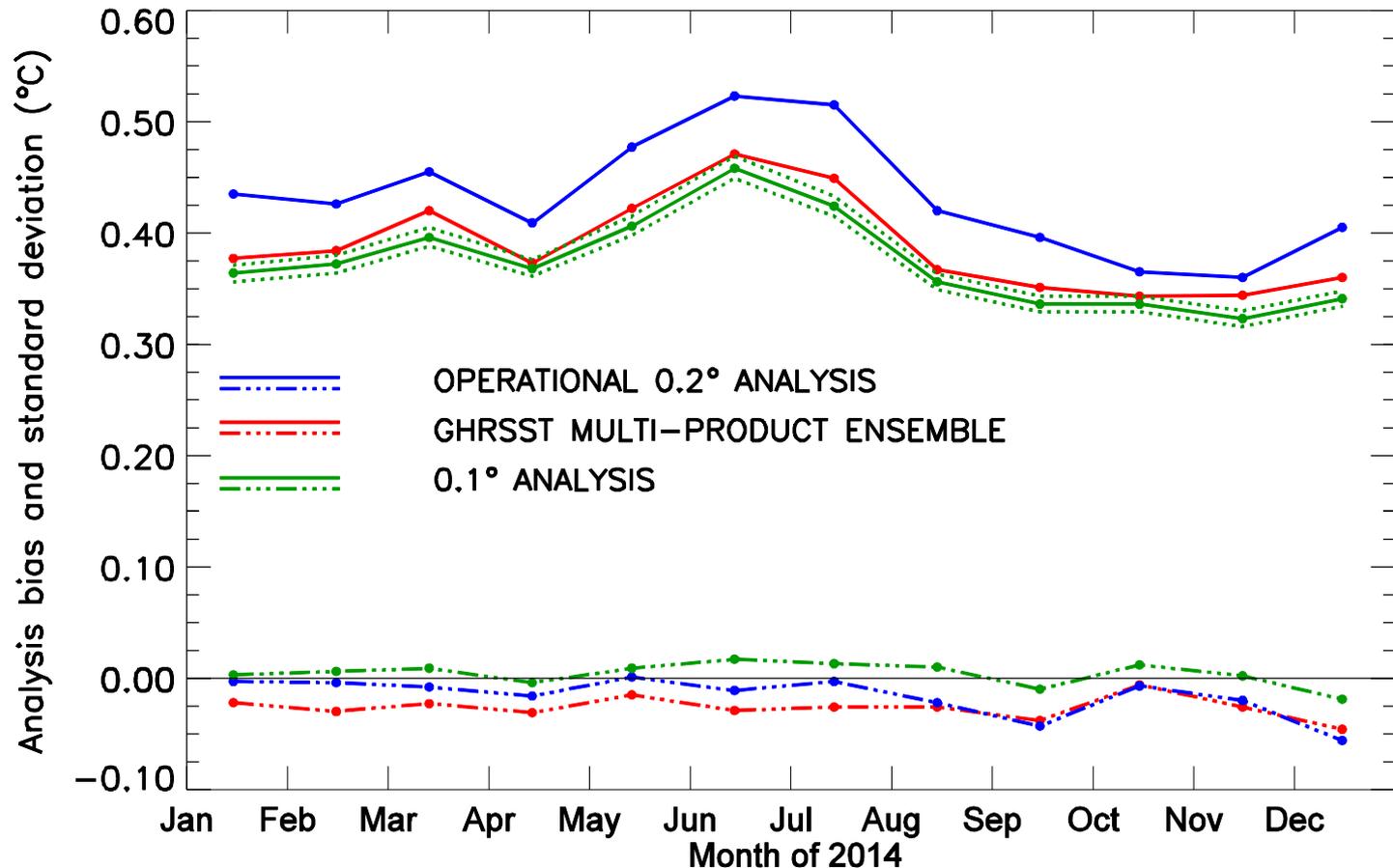
- *VIIRS experiment significantly better than the AMSR2 experiment during January, February, October and November*
- *AMSR2 experiment significantly better than VIIRS during June, July and August (months when data was available 60% of the time compared to 30% of the time for VIIRS over some regions of the globe)*
- *No data were available for VIIRS from April 1st to May 19th 2014*

0.1° vs 0.2°



Most of the reduction in analysis standard deviation results from the addition of AMSR2 and VIIRS data

CMC SST vs GMPE



The 0.1° analysis outperforms (1) the operational 0.2° analysis and (2) the GMPE product even in April (when no VIIRS data were available)

VIIRS 2.30 vs VIIRS 2.40

- NOAA provided VIIRS 2.40 for January to March 2015 in L2P and L3U format
- Improvements in VIIRS 2.40
 - improved cloud screening
 - redesigned SSES
 - destriping

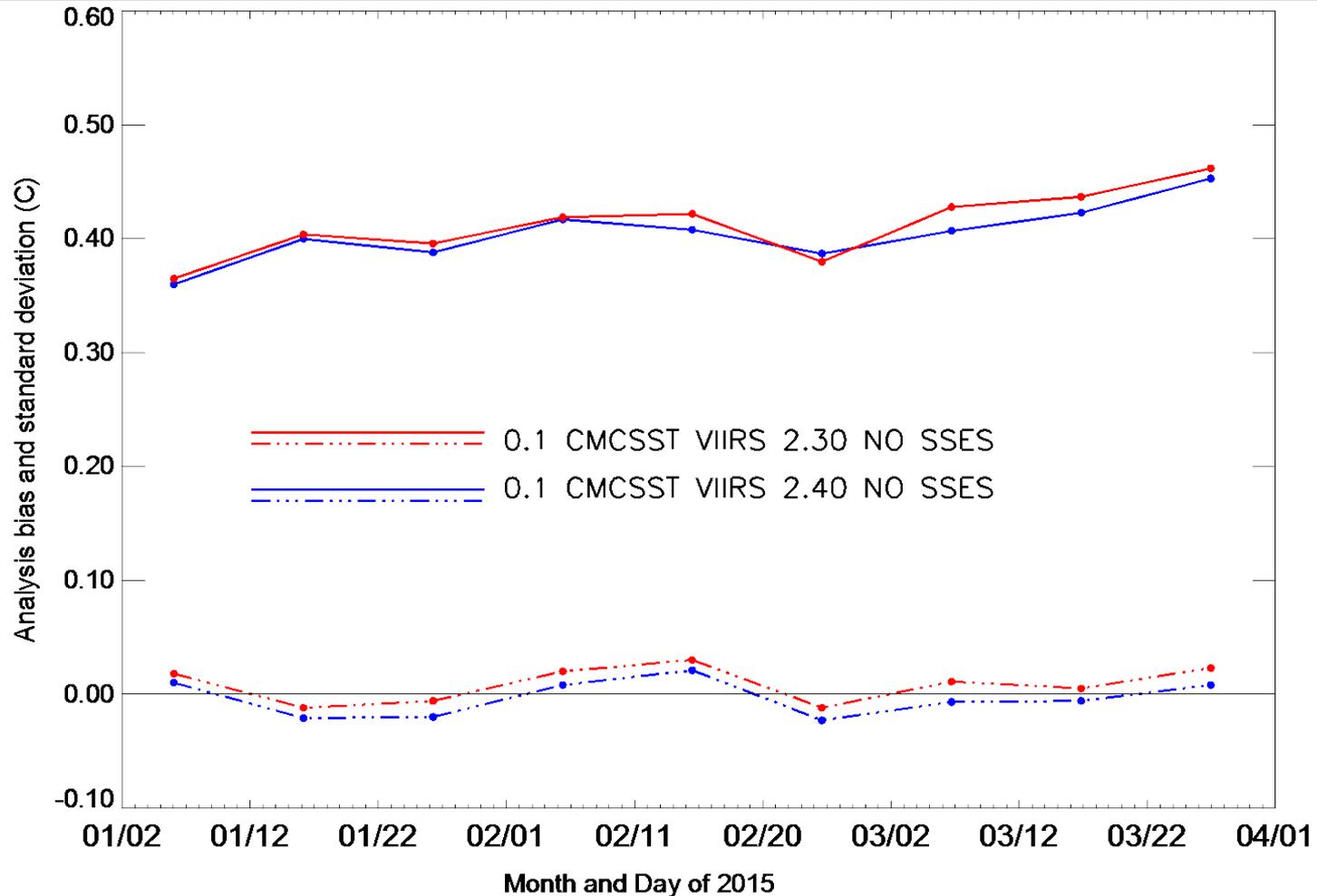
NOTE:

- CMC SST applies its own internal bias correction (BC) to satellite retrievals before they are assimilated in analysis (Brasnett, 2008)
- In 2014 the use of SSES biases in ACSPO VIIRS v2.30 was inconclusive. No SSES biases are used in operational analysis
- 0.2° CMC SST is used as reference for ACSPO VIIRS retrievals

What is the influence of new VIIRS SSES biases in CMC SST analysis?

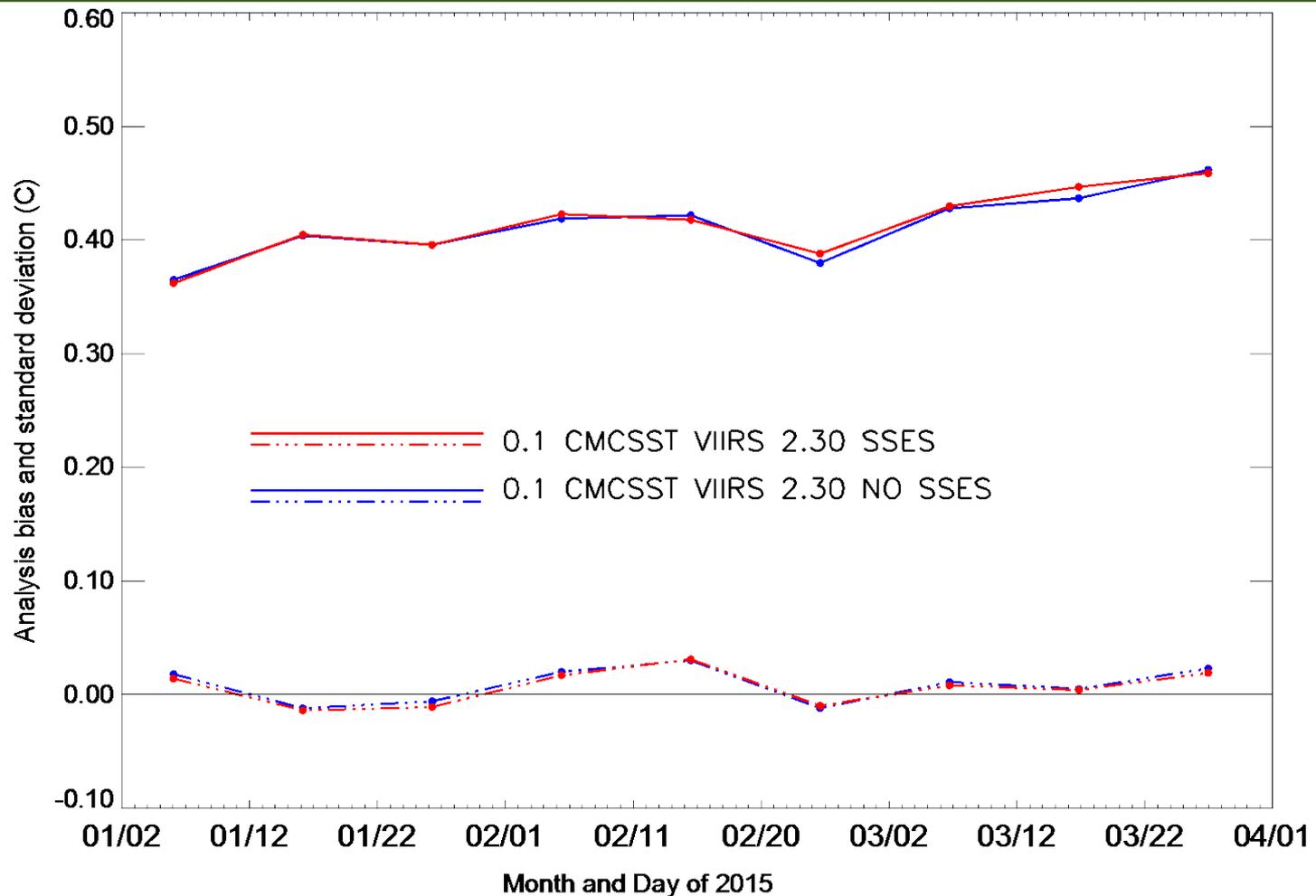


VIIRS 2.30 vs VIIRS 2.40 (no SSES)



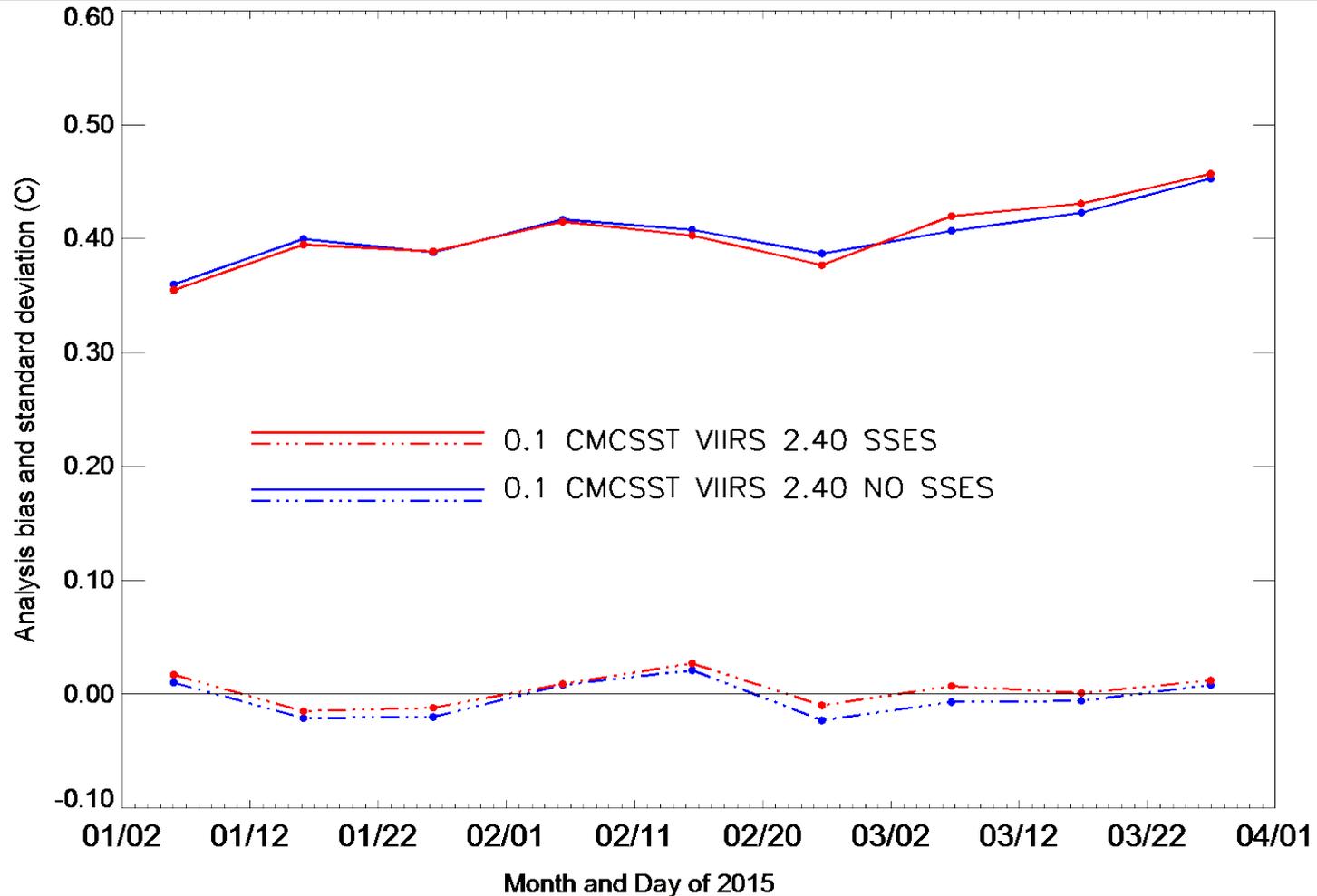
VIIRS 2.40 performs generally better than VIIRS 2.30

VIIRS 2.30 SSES vs VIIRS 2.30 no SSES



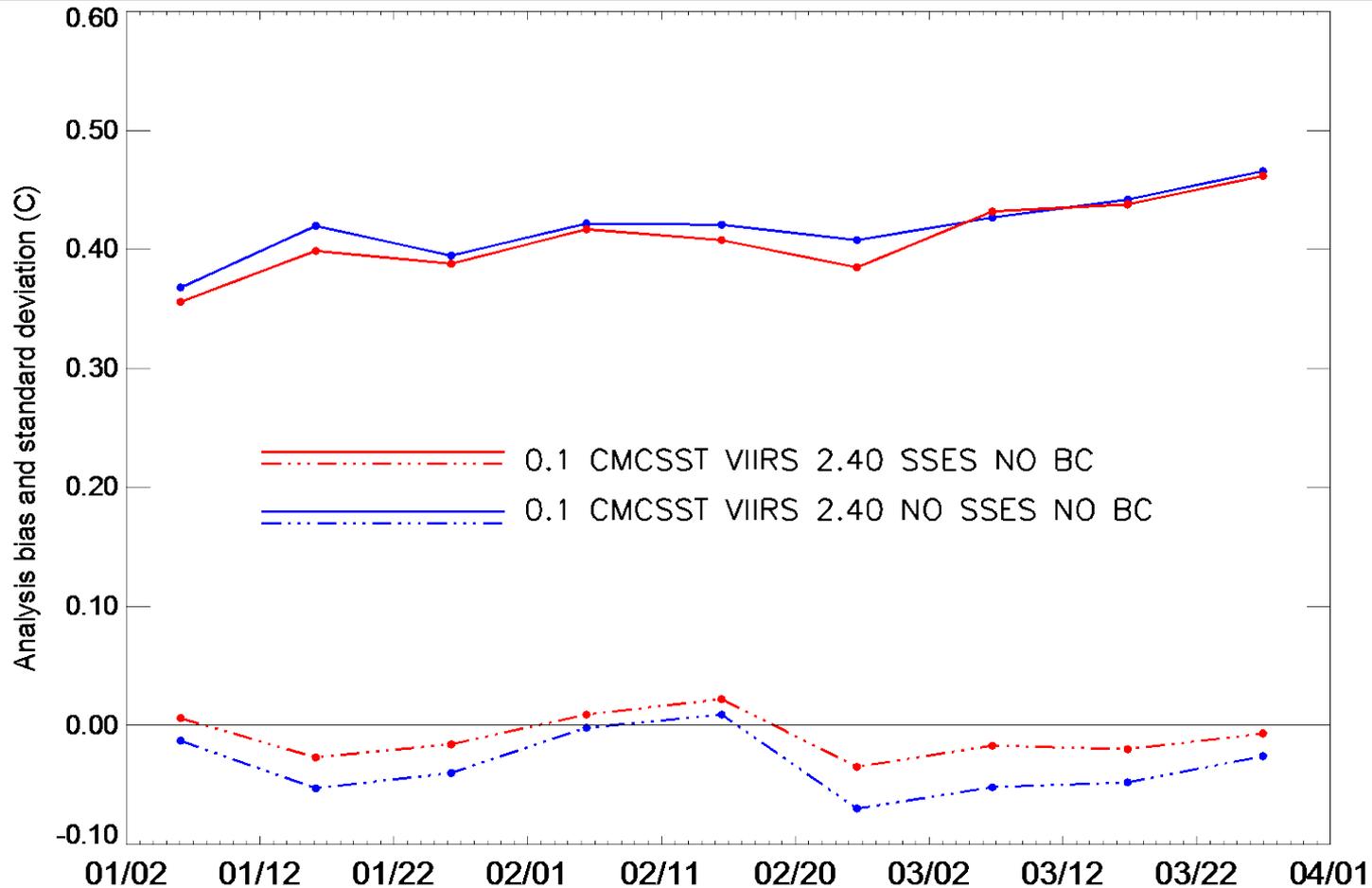
January to March 2015 – use of VIIRS 2.30 SSES inconclusive

VIIRS 2.40 SSES vs VIIRS 2.40 no SSES



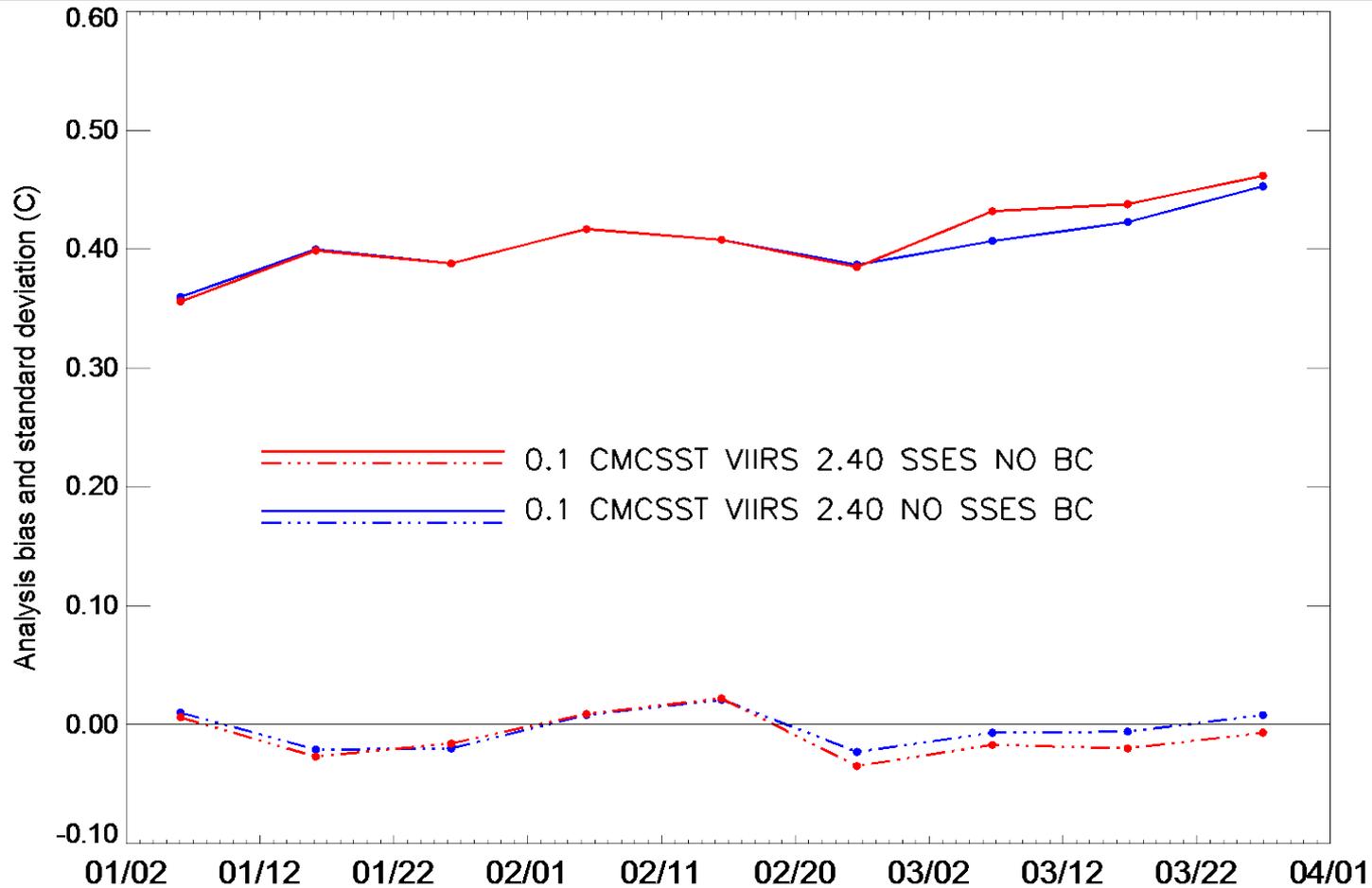
When SSES biases are used: Slight improvement in January and February, some degradation in March

VIIRS 2.40 SSES (no bias correction)



Using SSES biases reduces the standard deviation in the absence of CMC internal bias correction procedure

Bias correction or SSES biases?



In January and February: SSES biases produce similar results to CMC internal BC. In March: the CMC BC does better

Conclusions

- The reduction of “CMC minus ARGO floats” standard deviation by $0.05 - 0.08^{\circ}$ C is obtained by adding two new satellite datasets – AMSR2 and VIIRS. VIIRS contributes more in some months, and AMSR2 in some others
- Use of SSES biases and/or CMC BC method produces smaller reductions in SST standard deviation, due to the methodology used to produce the analysis
- In the next weeks CMC will test VIIRS 2.40 in L3U format
- Tests will continue for the SSES bias; if the improvements will be consistent and/or the use of SSES standard deviation could improve the analysis then we plan to add these in CMC SST 0.1°

