GHRSST-XVI, ESA/ESTEC, The Netherlands

Inter-comparison Technical Advisory Group (IC-TAG)

Breakout session

Alexey Kaplan (Chair), Mike Chin (Vice-Chair)

Thursday 23 July 2015
16:30-18:30

GHRSST-XVI, ESA/ESTEC, The Netherlands
Inter-comparison Technical Advisory Group (IC-TAG) Breakout session
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Thursday 23 July 2015: *16:30-18:30*

Extract

16:50-17:40: **Impact of SSES on L4 SST Products**

Brief res. contrib.: ***Nick Rayner,***
Emma Fiedler,
Mike Chin,
Boris Petrenko

Nick Rayner, *Met Office Hadley Centre, U.K.*

(following 3 slides)

Communicating uncertainty to users

- SST CCI User Workshop on Uncertainties (http://www.esa-sst-cci.org/PUG/workshop.htm) discussed with users how to communicate SST uncertainty and the correlation structure of its components
- Two methods were recommended by the users:
  - Provision of an ensemble **and**
  - Provision of information on uncertainty distribution/parameterised covariance function
- They also recommended documenting the full uncertainty budget

SST User Workshop: provision of ensembles

- Ensemble size 10-1000
  - A single central member, preferred by the data producer
  - A randomly-ordered set of ensemble members so that users can pick at random
- Start ensemble generation from Level 1 (radiances) in order to include the structural uncertainties
- Clearly stated underlying assumptions
- Ensemble produced on 0.05 degrees and coarser
- An operationally available ensemble **or**
- An operationally available best estimate with the ensemble later
- Updates forwards in time must truly belong to the same ensemble member
- Clear, non-confusing terminology e.g. are members “equally likely”?

SST User Workshop: provision of covariance information

- Ensembles not always the best way to present uncertainty information
- Explicitly forming covariance matrix can be prohibitive
- Parameterize covariance instead
- Provide guidance and clear examples
- What shape are the error distributions?
  - “are they close enough to Gaussian?”
  - “is the distribution symmetric?”
  - For analysing extremes, the shape of the tails can be important.
- Parameterize the distribution shapes too
- Provide examples of the shapes of the distributions

Emma Fiedler, *Met Office, U.K.*

(mostly introduction)

Mike Chin, *NASA/JPL/CalTech, U.S.*

(summary of plenary presentation on how SSES is used in MUR, attached as separate document)

Boris Petrenko, *NOAA / GST Inc., U.S.*

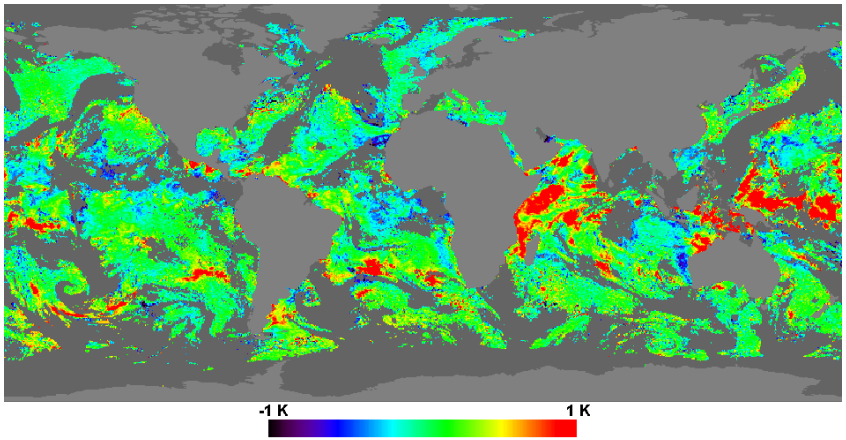
(following 3 slides)

Redesigned SSES in ACSPO v2.40

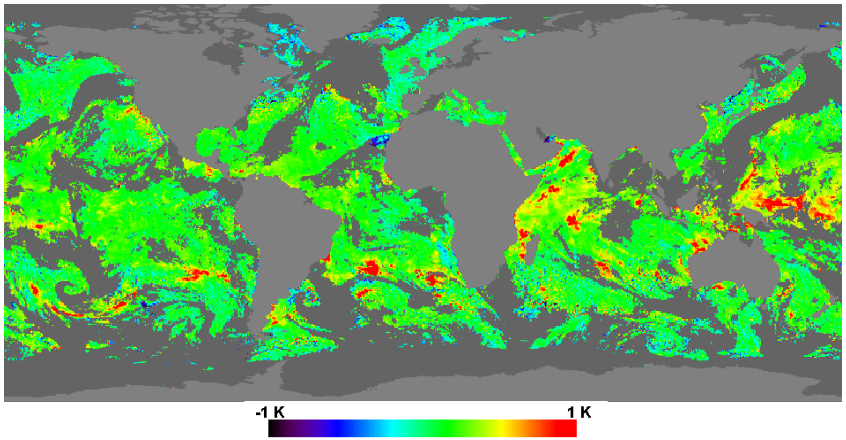
- Most tested at this time is SSES bias (although SD is also available)
- SSES bias-corrected SST compares much better with *in situ* SSTs
- Effects of under-screened clouds and angular biases are significantly reduced by SSES bias correction – *see examples in slide 2*
- During the daytime, bias correction additionally reduces the effects of diurnal warming – *see examples in slide 2*
- Effectively, the ACSPO 2.40 provides the users with two SST products: (a) the baseline "skin", and (b) de-biased "bulk" SST
- Improved comparisons with bulk in situ SST suggests that the de-biased "bulk" SST should be a better input into "foundation" L4 analyses – *see slide 3*
- Daytime ACSPO "bulk" SST can be used in assimilation, on a more equal footing with the nighttime retrievals (currently, daytime SSTs with high winds are assimilated)
- Alternatively, daytime retrievals may be used to create a separate "daytime" L4 SST product
- Processing multi-months data from multiple polar sensors (and recently Himawari geo) show consistent improvement
- Feedback from the L4 producers is required to further optimize the current SSES formulation

Example of SSES bias correction (JPSS VIIRS, 4 Nov 2014)

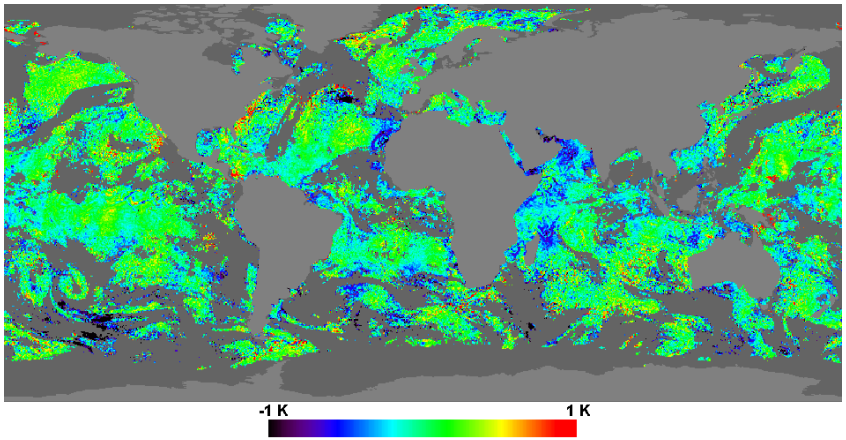
ACSPO BSST – CMC, Day
Bias=0.25 K, SD=0.53 K



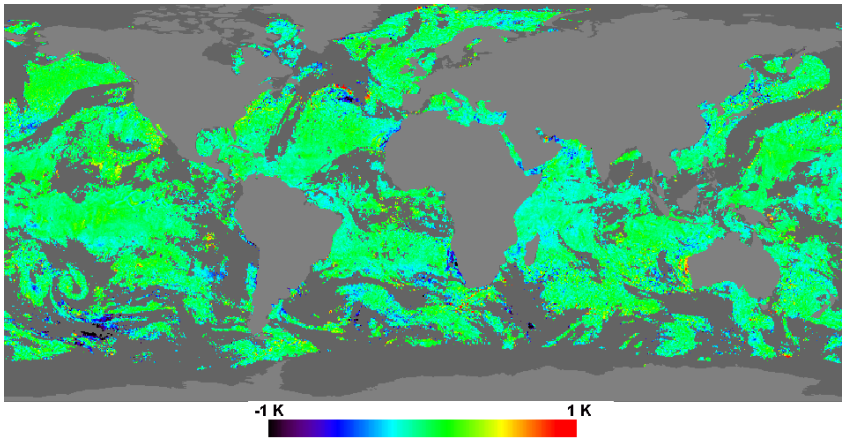
ACSPO de-biased SST – CMC, Day
Bias=0.24 K, SD=0.36 K



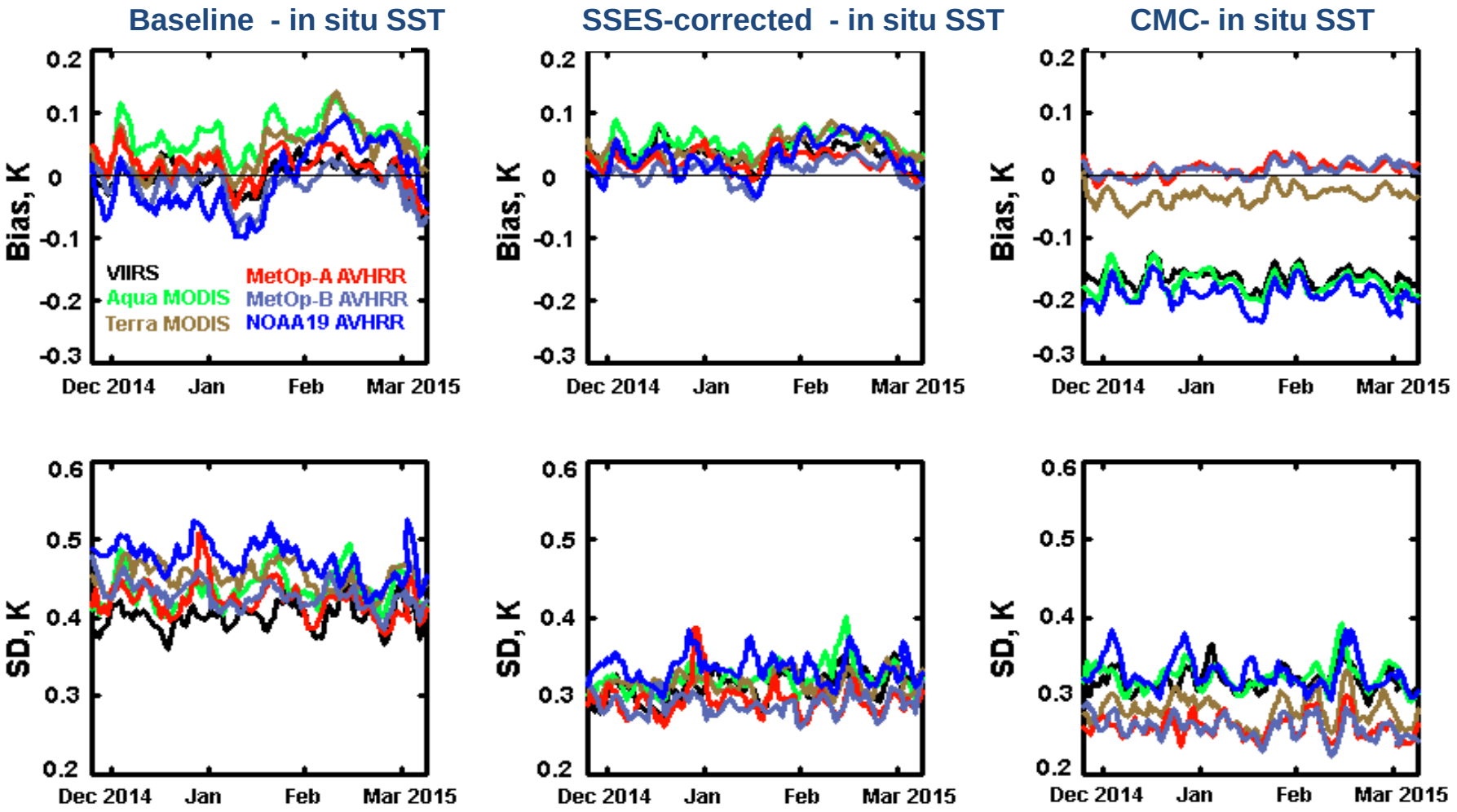
ACSPO BSST – CMC, Night
Bias=0.00 K, SD=0.32 K



ACSPO de-biased SST – CMC, Night
Bias=0.01 K, SD=0.25 K



Example - Time series of daytime global Bias and SD of: Baseline SST, SSES-corrected SST and CMC SST wrt *in situ* SST



- SSES-correction improves cross-platform consistency of global SST biases and reduces global SDs
- The biases in SSES-corrected ACSPO SST are less affected by diurnal warming cycle (cf. biases in CMC)
- SDs of the "SSES-corrected minus *in situ* SST" are comparable with SDs of "CMC – *in situ* SST".
- This suggests the benefit of using the SSES-corrected ACSPO SST as improved input into "foundation" L4 analyses (or, the possibility of creating a daytime L4 SST product)

Jonah Roberts-Jones, *Met Office, U.K.,* e-mail suggestions, 4 March 2015

. . . We rely massively on the SSES's (although it appears they are currently sub-optimal) provided by the L2/L3 data producers. . . .

In terms of defining an experiment I think the difficulty on impact studies concerning the SSES is that assimilating a data type with a better defined SSES will have very little impact on the overall L4 analysis accuracy. This is due to all the other data types an L4 assimilates swamping the analysis, the only scenario I envisage this not occurring would be in improvements in the reference sensors SSES bias. Also in our system (and probably others) the background error dominate the observation errors.

Instead I'd propose **an experiment where instead of using SSES as observation errors you use a single value obs error value (say ~0.4K for IR, ~0.6K for MW) across all the data types assimilated, by comparing the accuracy of this run to standard OSTIA we'd see how much impact the current SSES have on L4.**

Results of the Breakout Discussion on Impact of SSES on L4 SST Products

Brief res. contrib.: ***Nick Rayner, Emma Fiedler, Mike Chin, Boris Petrenko***

Turned out to be a subtle and difficult question to study (J.Roberts-Jones and J.Cummings talk brought this topic to our attention on the last 2 G meetings). Requires time-consuming experiments and significant effort from L4 data producers, with the outcome probably going mostly to the benefit of L2-producers. There was a surprising lack of will to pursue these topics now.

Alternative proposal: Impact of SSES on L4 SST Products

A post-session thought: perhaps first we should make a case for the necessity of SSES and L4 consistency study by making it painfully obvious how inconsistent SST values and their uncertainty estimates across products at present. E.g., for two L4 data sets, consisting of temperature and error estimates (*T* and *E*, respectively), i.e., *D1=[T1 E1] and D2 =[T2 E2]* we often can see see that

$$\langle (T1-T2)^2 \rangle > \langle (E1)^2 \rangle + \langle (E2)^2 \rangle$$

which would mean that both L4 producers can be right…

Ditto with L2 products.

Perhaps we should step back and first do such pairwise analyses systematically, summarize them, and then discuss our uncertainty estimation procedures and how they should be changed?