GHRSST-XVII ESI breakout Report

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Shipborne SST radiometer SSTskin Network

- Agencies with (or planning) radiometers: RSMAS, NOCS, RAL, CSIRO/ABoM, OUC, SANSA
- Various 2016/2017 planned cruises with SSTskin radiometers installed
  - Southern Ocean: SA Agulus II, RV Investigator, James Clark Ross, Italian Antarctic Resupply vessel
  - Arctic: Denmark - Greenland
  - Mid-latitudes: Cape Town to Gough Is/Marian Island, Celebrity Equinox (Med), Andromeda Leader (Japan - U.S.), Off West Africa, QM II (Southampton – New York), China Seas, Qingdao – Indian Ocean
  - Tropics: Allure of the Seas (Caribbean), Investigator (EAC/GBR), NW Africa, others?
- Data Dissemination: RAL data portal for now (GTS not suitable) : http://isrn.rl.ac.uk/home.shtml
  - netCDF "L2r" format including uncertainties, quality level

Sensor Specific Error Statistics

- **Primary "value added" of L2P**
- **How do we make them?**
- **How do we validate them?**
- **Are they useful?**

How to validation uncertainty?
Gary Corlett (Uni Leicester)

CCI Example using drifters

- Verification shows us whether CCI uncertainty model is correct

- ESA SST_CCI analysis SST0.2m vs drifters compared really well with OSTIA uncertainties

- CCI uncertainty validation works for 90-95% of the time

- Jon Mittaz: In CCI we add in correlated error components calculated from NWP+RTM

Uncertainties Discussion

- Peter Cornillon: We need to reflect the effect of the atmosphere on SST. Small-scale SST gradients and atmospheric variations
  - Sensitivity?
  - Correlated error?
- Chris Griffin: Briefly explained his new "Harmonised Quality" variable, combining supplied SSES and QL to form new "q_s" quality variable allowing blending of different data sets

Methods for SSES Production

- Some SSES methods documented in G-XV ST-VAL breakout report

- Some Quality Level methods documented in G-XVI ST-VAL breakout report

- Is convergence necessary/desirable/possible?

- Inconsistency in L2P products re effect of applying sses_bias

- Following G-XVI H Beggs emailed recommendation to IR L2P producers. JAXA, ABoM and ACSPO agreed to add comments to file headers defining what sses_bias and quality_flags mean

  - ACSPO has decided for new versions of ASCPO products to define IR SST as "subskin" rather than "skin"

  - N.B. "subskin" is not SST_{20cm}

Revised SSES Definition

Single Sensor Error Statistics (SSES) are based on understanding errors associated with a specific satellite instrument and errors associated with the geophysical retrieval of SST for each individual satellite scene. The simplest L2P SST uncertainty estimation is based on matching satellite SST with in situ observations co-located in space and time. The provider should specify what space and time thresholds are used. A large match-up database of data is required for each satellite instrument which is then periodically analyzed to derive a mean bias and standard deviation for each satellite system.

SSES Common Principles

https://www.ghrsst.org/ghrsst/tags-and-wgs/stval-wg/sses-common-principles/

- Compliant with QA4EO. Derivation of quality indicator (i.e.SSES) to be traceable, i.e. documented and available. But… need common reference. includes QC of reference data
- SSES are to provide users with a common uncertainty estimate in comparison to the agreed reference source
- SSTs should be the best estimate prior to SSES production. Responsibility of the SST producer
- SSES are for users NOT for producers
- At present the reference is drifting buoys. By convention (only really global source)
- Content: A bias (not a correction term) and a standard deviation reflecting the local accuracy (at pixel) of the SST estimate. Application of SSES is consistent with the product definition (skin; sub-skin)
- Hierarchical SSES references can be used. Global stats to DRIFTING BUOYS, regional stats using other reference sources such as radiometers, the GTMBA (Tropical moored buoys) or L4 analyses
- Use of common match-up thresholds for SSES: Centre pixel clear; +/- 2 hrs (ideally 30 mins) for all sensors.
- Continuous fields preferred, i.e. no discontinuities between Quality Levels although discontinuities may be inevitable
- SSES must be free from diurnal variability and ideally estimated from night time match-ups
- A common skin to sub-skin adjustment of 0.17 K should be used

Use of SSES in L4

Do they help (how do we know if they help)?

- NAVO ocean model currently assumes errors are uncorrelated but it would be useful to have information about correlation of errors

- CCI has project to model clear-sky atm. error correlation

- RTG (using 2DVAR): sses_bias correction essential

- From G16 IC-TAG discussions: (1) proposal (J.R.-J.) to experiment with L4 analyses done for oversimplified SSES assignments (constant for each data type; it also could be informative to misspecify them dramatically --AK); but overall the effects of SSES on L4 are subtle, it will be hard to see them in experiments that are close to realistic operational analyses. (2) possible motivational proposal (Alexey): for L4 data sets do pairwise analyses of comparing $\langle(T1-T2)^2\rangle$ with $\langle E1^2+E2^2\rangle$ systematically (if the former is larger than latter, then L4 error estimates must be wrong; summarize such results and trace L4 error estimate problems to the input data, L2P SSES being major suspects

Effect of diurnal adjust. on bias correction
Andy Harris (Uni Maryland)

- If you generate an SSES bias term then are you folding in the diurnal warming in the correction?
- If you want to adjust SSTskin to a foundation SST then you need to know how sensitive is the SST algorithm to DW
- Daytime SST retrieval may not see full scope of DW, especially in tropics
  - Need pixel-based estimates of algorithm sensitivity
- People who will use the sses_bias need to know whether or not it is correcting for all or part of the diurnal warming

- **Inter-sessional workshop on SSES/L4 experiments with <u>appropriate preplanning & coordination</u>**

How to deal with small-scale features in L4 analyses?

Mike Chin (JPL)

- Measure of comparison
  - Average difference of grid values (traditional, e.g. MDB stats)
  - Direct comparison of feature geometry (e.g. front locations/shape)
- Extension of past IC-TAG activities
  - Higher resolution GMPE? ("GMPE2"?)
  - Higher resolution model-simulated SST?
  - Extend the public version of experiments in Reynolds et al. 2013

Other business

- Need to revisit construction of L3C (multiple swaths) - the GDS2.0 specifies that you should only take the highest quality SST value to go into an L3C grid cell