Routine analyses of Sentinel-3A SLSTR Sea Surface Temperature (SST) employing Monitoring & Evaluation of Thematic Information from Space (METIS)

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Interactive Presentations I – Products, Systems and Services

1. Introduction

- There are three main scientific challenges associated with SST retrieval from calibrated L1B data: [**a**] inverse algorithm, [**b**] identification and removal of cloudy pixels, and [**c**] ***an objective evaluation and validation***. These challenges are listed sequentially, however, their roles are interwoven.
- Inspired by the benefits of NOAA SST Quality Monitor (**SQUAM**) (Dash *et al.*, 2010), a similar system is set-up for an objective evaluation and validation of EUMETSAT SST products, which is an independent but mutually complementary monitor called as the **Monitoring & Evaluation of Thematic Information from Space (METIS)**.
- The intention and plan to set-up such a customized system was presented at the 2016 GHRSST Science Team meeting, which has now been realised, with a password-restricted web-interface: ***http://metis.eumetsat.int***
- METIS is **Scalable** and **Flexible** for testing of third party data streams and **other Thematic Information**, *e.g.*, Ocean Colour and Ice Surface Temperature (IST). The SST component of METIS is called **METIS-SST**.
- METIS performs both **Global** & **Regional** analyses. The choice of regions is flexible, but based on the OSI SAF classification, **15** regions of interest (**ROI**) are pre-selected.
- EUMETSAT SST products currently included in METIS-SST are from: **Sentinel-3A SLSTR**, **Metop-B AVHRR** and **IASI** SST.

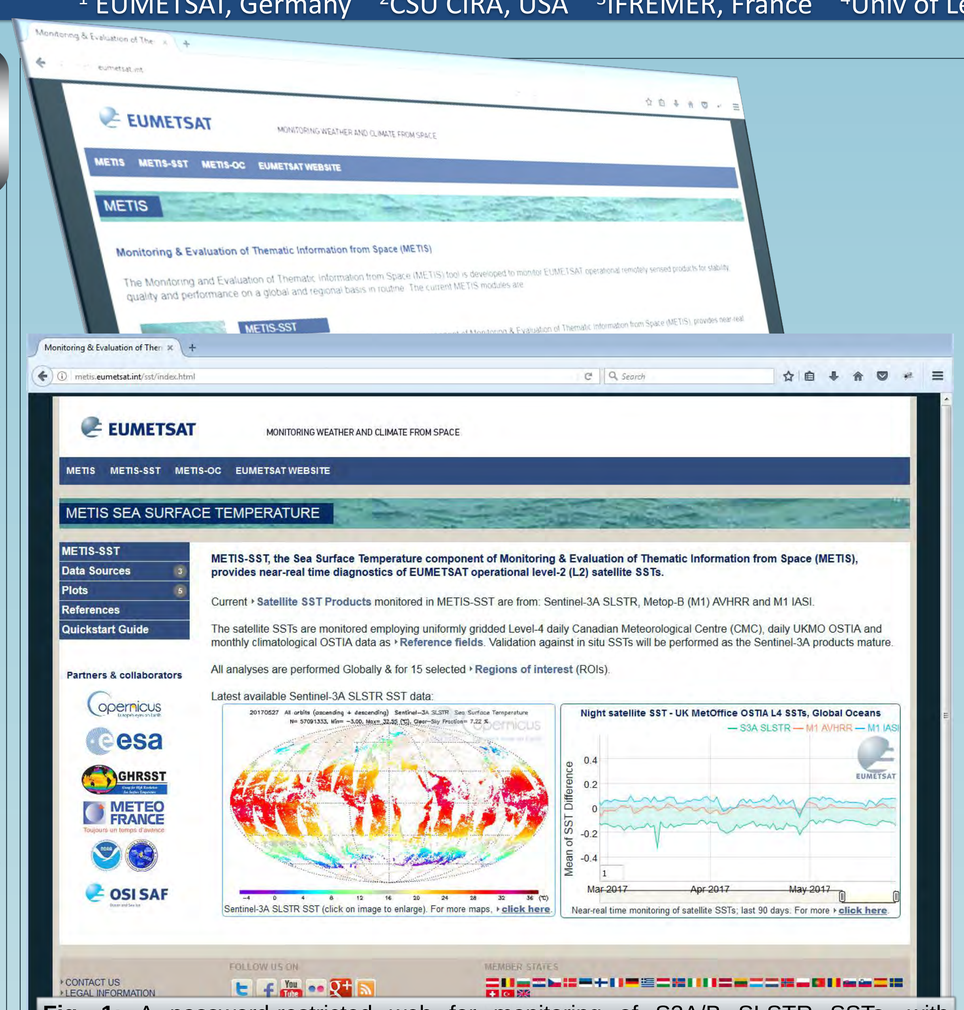


Fig. 1: A password-restricted web for monitoring of S3A/B SLSTR SSTs, with organisational level domain name: http://metis.eumetsat.int. For the purposes of benchmarking, operational Metop-B AVHRR and IASI SSTs are also included. Monitoring is performed for Global & 15 Regional areas. Besides SST, the monitor is scalable for other products, *e.g.*, Ocean Colour, IST **(ask us for a demo).**

2. Purpose

- Evaluate performances of SST products for:
  SST algorithm, Retrieval domain, Cloud-detection - Operational issues - Inter-comparison with other SSTs – Assess improvement with ver. updates
- Evaluate science quality once products are stable
- Observe extreme events; IST & polar studies (long run)

3. Approach

- Basic analyses (visual inspection) in the product space (T_S) and in-depth analyses (visual & statistical) in the difference space: $\Delta T_S = T_S - T_{REF}$, by evaluating for Normality $X \sim N(\mu,\sigma)$. The choice of T_{REF} (*in situ* and Level-4 fields):
  -Val (*in situ*): matches generated by Felyx; consider *iQuam*
  -Monitoring &cross-consistency (*vs.* L4s: CMC 0.1°, OSTIA 0.05°, climate)
- SST (product) maps are useful to check for coverage and large image quality issues
- Difference *wrt.* Ref: relative product performances, cloud leakage, anomalous issues, scene or long-term stability

4. S3A SLSTR SST (& related presentations)

- S3A SLSTR SST in GDSr5 L2P format are available for S3VT. See ***Poster*** by O'Carroll *et al*. (this meeting) entitled "Operations of Sentinel-3A SLSTR SST …" for further details.

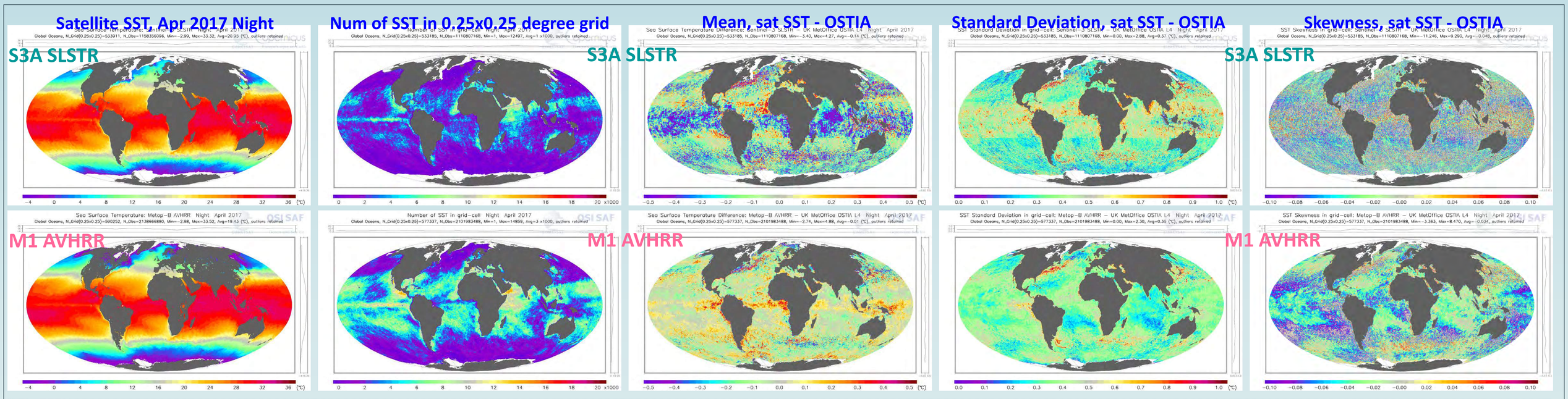
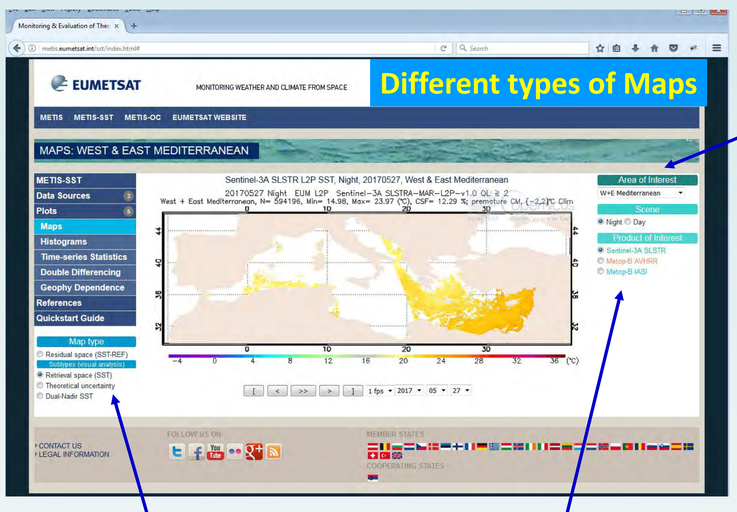


Fig. 2: April 2017 average nighttime satellite SST, its comparison with OSTIA L4 analysis fields and associated parameters. Top-panel: **S3A SLSTR**, Bottom-panel: **M1 AVHRR**. These images are non-routine in METIS and are generated beyond METIS, offline, for a gross comparison. Note that S3A SLSTR SST is being improved and possible cold biases (top-row, middle column) and striping artifacts (top-row, second column) are noticed in these monthly aggregated maps.

5. METIS-SST diagnostics and functionalities

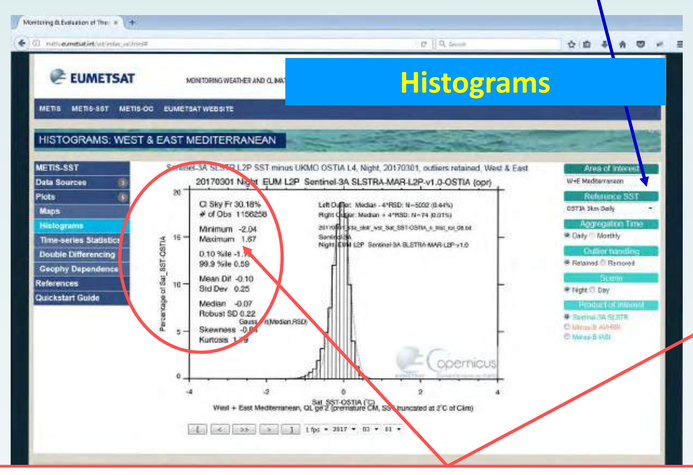


Maps are generated for both SST and SST differences

Separated by Day and Night, outlier conditions and satellites

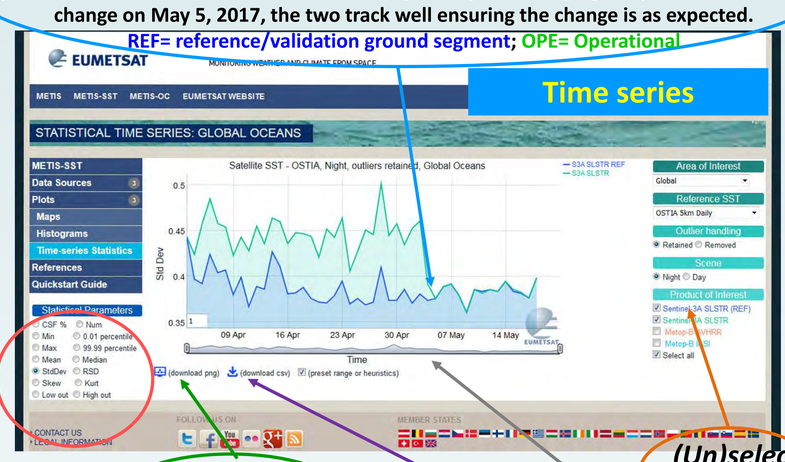
Region of Interest (ROI). A choice of 16 ROIs

Reference SSTs (CMC, OSTIA, Climate, In situ)



A range of statistical parameters for monitoring stability of SST and product inter-comparison; also assess the performance of cloud-mask algorithm and data coverage, e.g., clear-sky fraction percentage (CSF).

Interactive time-series plots
This example is from INTERNAL METIS page for evaluating version update.
(notice two radio buttons for S3A SLSTR: REF (in blue) and OPE (in green). After the version change on May 5, 2017, the two track well ensuring the change is as expected.
REF= reference/validation ground segment; OPE= Operational

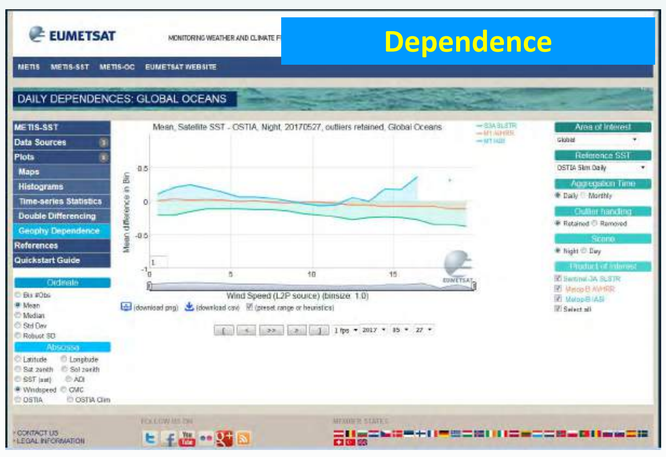


Exportable to PNG images

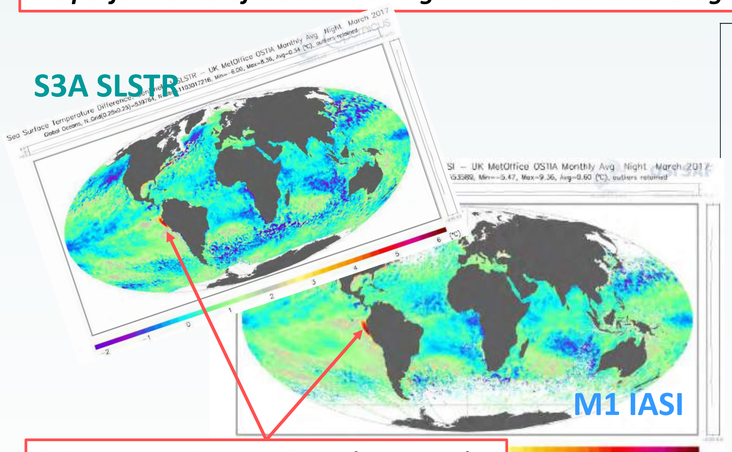
Download as CSV

(Un)select products

Range slider



Dependence plots: currently, ~9,600 plots per day/night, outlier with and without, 3 references, 10 x-axis parameters, 5 statistical parameters, 16 ROI



Extreme events, e.g., Peruvian warming
(example spin-off potential of METIS-SST)

For more monitoring activities and examples of extreme events, see our interactive presentation.

6. Summary and outlook

- Password restriction will be removed once S3A SST data are publicly released.
- Newer diagnostics, *e. g.*, persistent cloud detection and internal error determination by employing triple-collocation method are being explored.
- Preparing for the launch of Sentinel-3B in 2018.

References

- Dash, Ignatov, Kihai, Sapper (2010), The SST Quality Monitor (SQUAM) , J. of Atm. & Oceanic Tech, 27(11), 1899-1917.
- Dash, O'Carroll, *et al*., Sentinel-3 SLSTR monitoring at EUMETSAT – The Plan, The 17th GHRSST Science Team Meeting, 6-10 June, 2016, Washington DC.
- Dash, O'Carroll, Corlett, Ignatov, TROPMET 2016 - National Symp. on Trop. Meteorology: Climate Change & Coastal Vulnerability 18 - 21 Dec, 2016, Bhubaneswar, Odisha, India.

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