The Monitoring and Evaluation of Thematic Information from Space (METIS) framework for validation of EUMETSAT SST products

http://metis.eumetsat.int

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NOAA STAR SST team for SQUAM
Scientific challenges:
(once L1B data are available)

The roles are interwoven; however, beneficial to have an objective Eval/Val system where results are shareable

Therefore, METIS was set-up - partly motivated by the success and benefits of the NOAA SQUAM system
https://www.star.nesdis.noaa.gov/sod/sst/squam/

Dash, Ignatov, Kihai, Sapper, 2010. JTECH. The SST Quality Monitor
1. Concept with example case studies

2. METIS
   1. Online interface and various modules
   2. Some more case studies
   3. Spin-offs, extreme events
   4. Potential further diagnostic
Concept case: Himawari-08 BT anomaly

State (product) space

Regression SST, Himawari-8 AHI (ACSPO), v2.41b02, 201506301630
Clear: 24.68%

Skin SST, Himawari-8 AHI (JAXA), v1.0-v02.0-fv01.0, 201506301630
Clear: 14.78%

SST (product) maps:
- Useful to check for coverage and large image quality issues
- Not necessarily good for product(s) evaluation/comparison

Himawari 8 (NOAA ACSPO), Cl. sky covg = 24.7%
(ACSPO CM, Petrenko et al., JTech, 2010)

Himawari 8 (JAXA), Cl. sky covg = 14.8%
(Bayesian CM, Kurihara et al., GRL, 2016)

Adapted from: Dash, Ignatov, Kihai; 19-Nov-2015; Presentation at EUMETSAT HQ
http://www.eumetsat.int/website/home/VisitingScientists/SciencePresentations/DAT_2908128.html

Satellite validation international workshop; amt4sentinelfrm Workshop, 20-21 June, 2017, Jurys Inn, Plymouth, UK
Same Scene/Sensor/Reference
Different SST Processors

Deviation from Ref:
- Relative product performance?
- Cloud leakages?
- Data anomalies/issues?
- SST stable in space? Time?

Approach:
- Distribution Normal $X \sim N(\mu, \sigma)$?
- Compare/trend moments of $N$
Concept case: Sentinel-3A SLSTR SST coefficient update

S3A SLSTR WST Product during development phase;  http://metis.eumetsat.int/sst/index.html

6 Satellite validation international workshop; amt4sentinelfrm Workshop, 20-21 June, 2017, Jurys Inn, Plymouth, UK
Concept case: impact on SST of WuCd event for NPP VIIRS

Adapted from: Dash, Vazquez, Corlett; Identifying Gaps in GHRSST services to the users and their applications; July-2015; Presentation at GHRSST Science Team Meeting, The Netherlands
The Problem Statement

Scientific challenges: (once L1B data are available)

- Inverse algorithm
- Cloud detection
- Evaluation
- Validation

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Monitoring & Evaluation of Thematic Information from Space (METIS)

The Monitoring and Evaluation of Thematic Information from Space (METIS) tool is developed to monitor EUMETSAT operational remotely sensed products for stability, quality and performance on a global and regional basis in routine. The current METIS modules are:

METIS-SST

METIS-SST, the Sea Surface Temperature component of Monitoring & Evaluation of Thematic Information from Space (METIS), provides near-real time diagnostics of EUMETSAT operational level-2 (L2) satellite SSTs.

Current Satellite SST Products monitored in METIS-SST are from: Sentinel-3A SLSTR, Metop-B (M1) AVHRR and M1 IASI.

METIS-OC

METIS-OC, the OC component of Monitoring & Evaluation of Thematic Information from Space (METIS), provides near-real time diagnostics of EUMETSAT operational level-2 and level-3 satellite Ocean Colour products.

Current Satellite OC Products monitored in METIS-OC are from: Sentinel-3A OLCI, Aqua (AQ) MODIS, OrbView-2 SeaWifs, Envisat MERIS and Suomi-NPP VIIRS.

Daily maps, histograms, time-series, geophysical dependence, Global and 15 regional analyses in routine work underway (9 RoI) … Contact: Ewa.Kwiatkowska, Malcolm.Taberner @eumetsat.int
METIS-SST: Global + 15 Regional ROIs
online interface and various modules: [http://metis.eumetsat.int/sst/index.html](http://metis.eumetsat.int/sst/index.html)
METIS
revisiting the parameters of a probability density function: the data will tell their story…

20170612 All orbits (ascending + descending) Sentinel-3A SLSTR Sea Surface Temperature
N= 63525062, Min= -2.99, Max= 34.19 (°C), Clear–Sky Fraction= 8.11 %

Latest map
Annotate PDF on it
Explain the importance of parameters
Tell some “failure” stories! and then robust parameters
Some more case studies: **IASI version update & improvements (internal)**

**Operational**

20170122 Night EUMETSAT OSI SAF Metop-B IASI v2.0 Qual 3.5 ESE µ applied

Global Oceans, N=47307, Min=-0.86, Max=31.11 (°C), CST=11.25 %

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**Experimental (internal)**

20170122 Night EUM OSI SAF Metop-B IASI v2.3m Quality Level 2-3

Global Oceans, N=76474, Min=-1.90, Max=36.03 (°C), CST=15.33 %

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**Story: coverage doubled; trade-off with std dev; almost double coverage, 0.1K Std Dev increase**
METIS
Some more case studies: Sentinel-3A WST REF/OPE transition (internal)

Update PB from REF to OPE
Some more case studies: **S3A WST sensitivity to QL/SSES etc (internal)**

- **Sensitivity of performance to QL**
  - do to dt_analysis cut-offs

- **SSES eval**

- **Tracking performance of different versions**
Peruvian coast
Coastal El Nino, Feb-Mar 2017
SST anomaly exceeding 5°C
Caused intense flooding
Work in progress and potential Improvements

- In situ (Felyx) recently added for S3A; extending time-series and for other sensors
- WCT analysis (internal), work in progress
- Triple-collocation (ts, spatial)
- Correlated error analysis
- CM analysis (test case S3)
- Analyses of BT in SST bands
- Geo capability

Thanks