SST Algorithm Noise Sensitivity

1) Define a VIIRS Proxy Data Stream

2) Define the required in situ data

3) Tuning of algorithms and LUTS (Vicarious

4) Ocean Algorithm, stability evaluation and

5) Product validation and product long-term

6) Satellite inter-comparisons, robustness,

Presenter/Affiliation: Dan Baldwin/CCAR

Performers: CCAR Univ. of Colorado

Thrust area: Ocean Algorithm Stability Evaluation

Award date:

Total Man-Months Effort:

FY09	FY10	FY11
2	2	2

SST Algorithm Noise Sensitivity

Project Objectives

Supports: Ocean cal/val plan element 4

Determine sensitivity of SST algorithms to introduced Sensor noise

Major FY09 Challenges/Issues

- Obtain proxy NPP data from MOVICON software
- Define Regions of Interest
- Design cloud clearing procedure

Milestones / Deliverables

		FY 09 1 2 3 4	FY10 1 2 3 4	FY11 1 2 3 4
1.		2		1
2.			1	
3.				1

Major Progress

- Installed GTP client to obtain Proxy MOVICON BTs
- Two 20 degree lat/lon Regions of Interest have been defined: one in North Pacific, one in North Atlantic
- Cloud clearing procedure has been designed

SST Algorithm Noise Sensitivity

Collaboration and Coordination with Inside and Outside Activities

NAVOCEANO: Doug May
Miami: Sue Walsh
NASA: LPEATE-Carol Davidson
NOAA: Alex Ignatov
NPOESS-NOAA: Joe Zajic
IPO: Richard Cember/Vince Chaing

Transition Partners

NAVO – NP3- MSCCT - Doug May

NOAA - Coastwatch - P. Di Gacamo

NGST-Raytheon-IDPS – Gary Grant

Leveraged RDT&E Projects

NASA – MODIS
NOAA-NODC-SST – Ken Casey
NOAA- GOES_R
NOAA-NCDC-Reynolds SST
Gravite

International Partnerships

ESA-Sentinal-GHRSST – Craig Donlon

EUMETSAT-Metop-AVHRR – Peter Schluessel

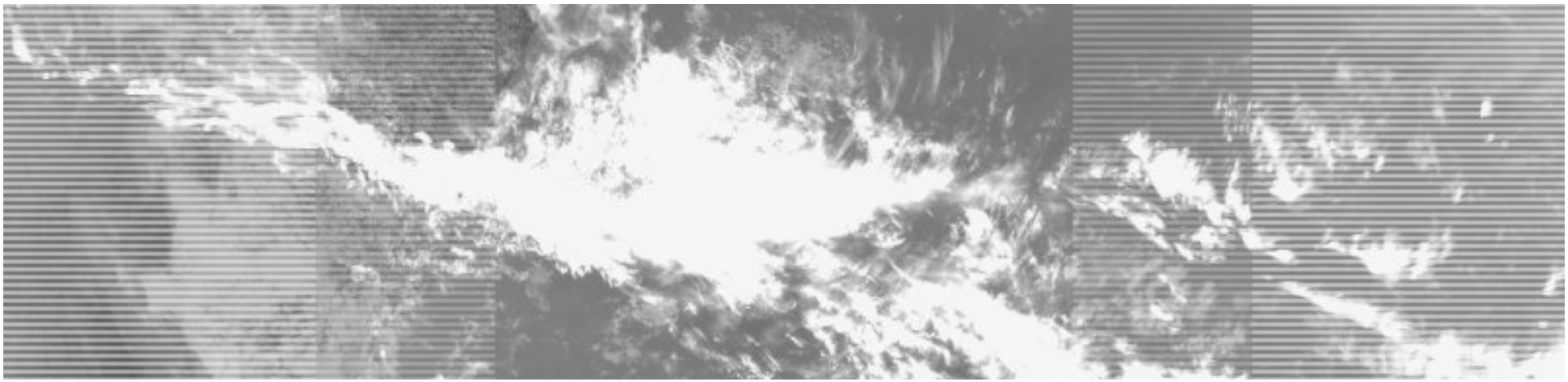
Meteo-France-Severi – Pierre LeBorgne

SST Algorithm Noise Sensitivity

FY 09- MILESTONES **Completed** **In Progress**

- **Set up software for obtaining NPP proxy BTs from MOVICON**
- **Design data processing stream and procedures**
- **Acquire SST algorithms**
- **Define Regions of Interest**

SST Algorithm Noise Sensitivity



- *Milestone 1: Image of M15 channel NPP Proxy Data from GTP/MOVICON*

SST Algorithm Noise Sensitivity

Milestone 2: Data processing stream

For Regions of Interest 1 and 2, for 30 day time period and daytime data

1) Grid proxy BTs and Reflectivities from channels M15,M16 and M05
2) Identify and eliminate land pixels– land mask
3) Identify and eliminate cloudy pixels
    a) Channels M15 and M16 BT thresholds
    b) Channel M05 Reflectivity threshold
    c) 7 day time series BT filter for each pixel for channel M15
4) Add prescribed Gaussian noise to BTs
5) Compute various SSTs
6) Compare

SST Algorithm Noise Sensitivity

Milestone 3: SST algorithms

Navo and Noaa:

Tf(15/16) = .9933M15 + 3.9717(M15-M16) + 1.0243(M15-M16)(sec(0)-1) – 271.2347

NL(15/16) = .9502T15 + .1288Tf(M15-M16) + 1.3501(M15-M32)(sec(0)-1) – 257.5792

(Coefficients are for Navo algorithm and based on non-corrected Modis data)

Miami:

Dt=M16-M15
mu =cos(senz)
Dt < 0.5: sst=a00+a01(M15)+a02(Dt)(Tf)+a03(Dt)(1.0/mu-1.0)
Dt > 0.9: sst=a10+a11(M15)+a12*(Dt)(Tf)+a13(Dt) (1.0/mu-1.0)
0.5<Dt<0.9:
sstlo=a00+a01(M15)+a02(Dt)(Tf)+a03(Dt)(1.0/mu-1.0)
ssthi=a10+a11(M15)+a12*(Dt)(Tf)+a13(Dt) (1.0/mu-1.0)
sst=sstlo + (Dt-0.5))/(0.9-0.5)(ssthi-sstlo)

SST Algorithm Noise Sensitivity

Milestone 3: SST algorithms (continued)

NGST:

$$SST = a_0 + a_1 T15 + a_2 (T15 - T16) RSST + a_3 (T15 - T16)(\sec(z) - 1)$$

a0, a1, a2, a3: Regression coefficients
T_{15}: Brightness temperature at 11 mm (Band M15)
T_{16}: Brightness temperature at 12 mm (Band M16)
RSST: Model sea surface temperature (Reynolds weekly)
z: Sensor zenith angle

This algorithm is stratified by T_{11}-T_{12} with a switch point at 0.8 K. For the range of 0.6 K to 1.0 K results from the two stratifications are linearly interpolated.

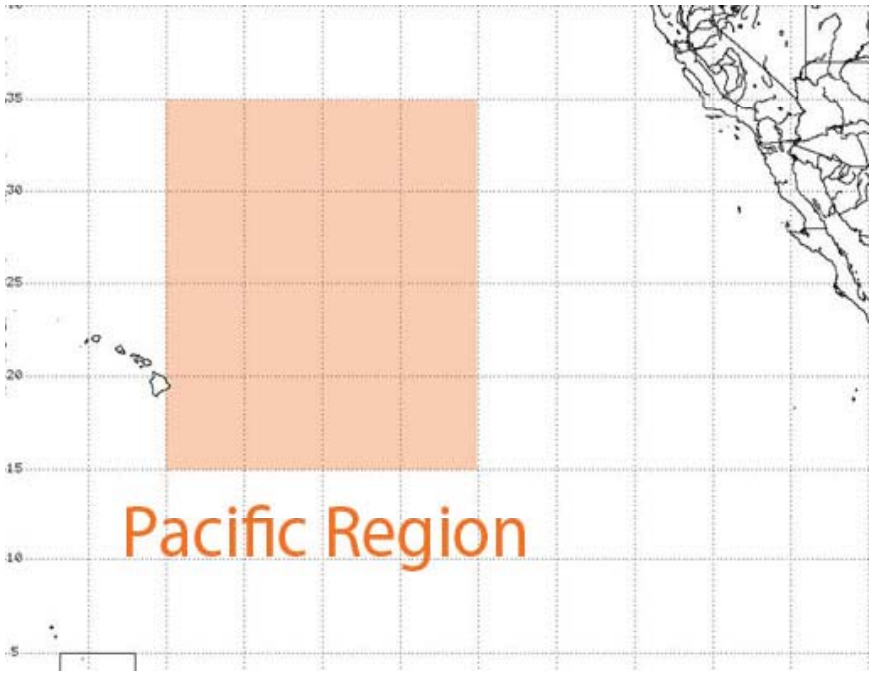
SST Algorithm Noise Sensitivity

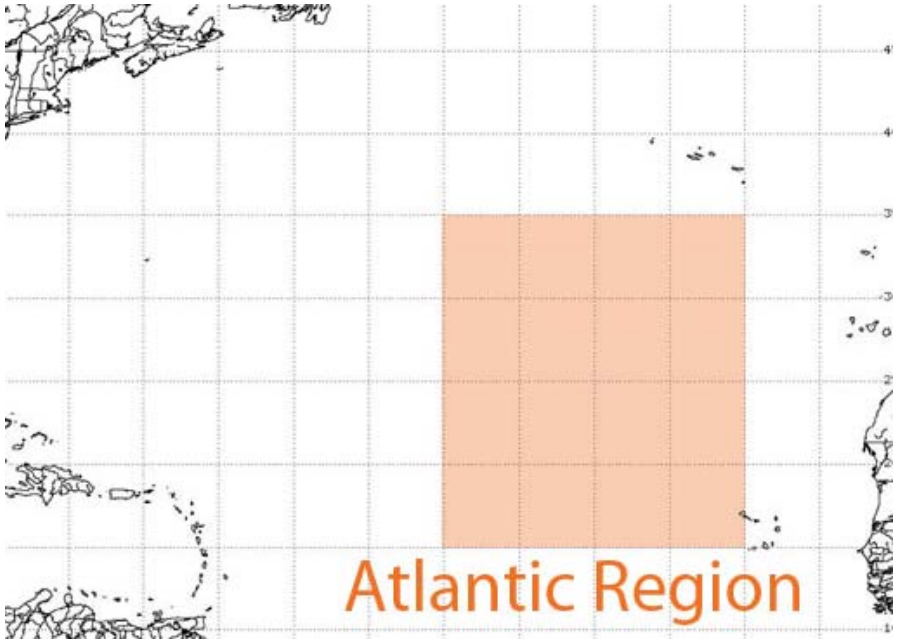
Milestone 4: Regions of interest

Two 20 x 20 degree lat/lon regions:

Northern Pacific : (35N-15N,155W-135W)

Northern Atlantic: (35N-15N,45W-25W)





SST Algorithm Noise Sensitivity

FY 10- MILESTONES

1) Access 30 days data for both regions
2) Grid BTs and Reflectivity and cloud clear
3) Add noise
4) Compute SSTs
5) Compare against NPP specifications
6) Compare against each other

Deliverables

1) Statistics which will describe response of SST algorithms to BT noise
2) Results of comparisons

SST Algorithm Noise Sensitivity

Status and Issues:

- Deliverable: Statistics describing response of SST algorithms to BT noise
  1. Delivered by 10/2010
  2. Development status: 0% (percent complete at time of review)
  3. The GTP proxy data client does not have geographic search capability, but is expected soon. Also, we will need to use MODIS coefficients in the SST algorithms until new proxy coefficients are available.
- Deliverable: Algorithm inter-comparisons of noise sensitivity results
  1. Delivered by 10/2010
  2. 0% complete
  3. No issues

SST Algorithm Noise Sensitivity

Summary : Impact of Deliverables on Program:

Estimate effect of noise on the VIIRS SST EDR's as a function of SST algorithm.

Compare results with NPOESS IORD requirements.

SST Algorithm Noise Sensitivity

Schedule with Major Deliverables

Red background indicates delays and green indicates on or ahead of schedule (as compared to FY09 DD1498)

Title																				
Milestones	FY08				FY09				FY10				FY11				FY12			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Acquire data feed And design process.								C												
Acquire data and compute statistics with MODIS coeffs.										S										
Compute statistics with proxy coeffs														S						

Note: Timeliness of deliverables science and transition (i.e., documents/demo/software, etc). Indicate changes from FY09 1498 by highlighting original planned time in red. You can use this table legend:
S – Start, C – Complete, D – Demo, I-Issues, M - Manual/Documentation, R – Final Report, T- Transition

SST Algorithm Noise Sensitivity

1) Define a VIIRS Proxy Data Stream

2) Define the required in situ data stream for Cal/Val

3) Tuning of algorithms and LUTS (Vicarious calibration and SDR feedback)

4) Ocean Algorithm, stability evaluation and uncertainty

5) Product validation and product long-term stability

6) Satellite inter-comparisons, robustness, seasonal and product stability

Questions ?

SST Algorithm Noise Sensitivity

NPP SST Accuracy Specifications

From Interagency Operational Requirements Document version 2 (IORD-2):

Threshold Bias= 0.2 deg Objective Bias = 0.1 deg

Threshold Uncertainty = 0.5 deg Objective Uncertainty= 0.1 deg

Approach for Adding Noise

Castro, et al 2010 , **Instrument Noise and Spatial Variability Impacts on the Accuracy of Skin and Subsurface Regression-Based Sea Surface Temperature Algorithms (submitted)**