



# **JPSS SST 2018 UPDATE**

**NOAA STAR**

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**STAR, OSPO, GST, CICS-CREST, CSU-CIRA**

- Cal/Val Team
- Sensor/Algorithm Overview
- SNPP/N20 Products Performance
- Major Risks/Issues and Mitigation
- Milestones and Deliverables
- Future Plans/Improvements
- Summary: Users, FY18 Accomplishments, FY19 Work

# Cal/Val Team Members

Name	Organization	Tasks
<b>Ignatov, Sasha</b>	STAR	JPSS Algorithm & Cal/Val Lead
<b>DiGiacomo, Paul</b>	STAR	JPSS Ocean Lead/CoastWatch
Lance, Veronica	STAR – GST	Coast Watch / JPSS Ocean Coordinator
Sapper, John	OSPO	NDE/OSPO Operations, Data distribution & Archival
Kihai, Yury	STAR – GST	ACSPO SW/HW; Preprocessor; L2P Code; In situ match-ups ACSPO Regional Monitor for SST (ARMS) – back end; L3U product
Pennybacker, Matthew	STAR – GST	L3U/C/S Code/Algorithms (U=Uncollated; C=Collated; S=Super-Collated); Resampling; Pattern Recognition; Ocean Fronts; ARMS
Jonasson, Olafur	STAR – GST	VIIRS SST Reanalysis (RAN); RDR-to-SDR; SST Quality Monitor (SQUAM); Monitoring IR Clear-sky Radiances for SST (MICROS)
Petrenko, Boris	STAR – GST	ACSPO Algorithms: Clear-Sky Mask/SST/Error Characterization
Zhou, Xinjia	STAR – CIRA	SST Quality Monitor (SQUAM); Monitoring IR Clear-sky Radiances Oceans for SST (MICROS); In Situ Quality Monitor ( <i>iQuam</i> )
<b>Gladkova, Irina</b>	STAR–CCNY CREST/GST	L3U/C/S Code/Algorithms (U=Uncollated; C=Collated; S=Super-Collated); Resampling; Pattern Recognition; Ocean Fronts; ARMS

# SST Algorithm

- NOAA enterprise Advanced Clear-Sky Processor for Ocean (ACSPO) system
- ACSPO is a stand-alone system (does not the Enterprise Cloud Mask, etc)

## Night M12/14/15/16 (3.7/8.6/10.8/12 μm)

$$T_S = a_0 + a_1 T_{11} + a_2 (T_{11} - T_{3.7}) + a_3 (T_{11} - T_{8.6}) + a_4 (T_{11} - T_{12}) +$$

$$+ [a_5 + a_6 T_{11} + a_7 (T_{11} - T_{3.7}) + a_8 (T_{11} - T_{8.6}) + a_9 (T_{11} - T_{12})] S_\theta +$$

$$+ [a_{10} (T_{11} - T_{3.7}) + a_{11} (T_{11} - T_{8.6}) + a_{12} (T_{11} - T_{12})] T_S^0$$

## Day M14/15/16 (8.6/10.8/12 μm) + M5/7 (0.68/0.86 μm)

$$T_S = a_0 + a_1 T_{11} + a_3 (T_{11} - T_{8.6}) + a_4 (T_{11} - T_{12}) +$$

$$+ [a_5 + a_6 T_{11} + a_8 (T_{11} - T_{8.6}) + a_9 (T_{11} - T_{12})] S_\theta +$$

$$+ [a_{11} (T_{11} - T_{8.6}) + a_{12} (T_{11} - T_{12})] T_S^0$$

$T_{3.7}, T_{8.6}, T_{11}, T_{12}$

$S_\theta = 1/\cos(\theta) - 1$

$T_S^0$

$a$ 's

BTs at 3.7, 8.6, 11 and 12 μm

$\theta$  is VZA

L4 SST in °C (currently by Canadian Meteorological Center – CMC)

regression coefficients, trained against drifters and mooring buoys

- Regression coefficients are trained against *in situ* SST & stabilized by taking special steps to keep only significant eigenvectors/values of the covariance matrix
- Error characterization (Single Scanner Error Statistics, SSES) significantly reduces errors in retrieved SSTs (due to aerosols, residual cloud, etc) & improves consistency with *in situ*

- Regression SST

Product	L1RDS APU Thresholds	SNPP Performance	N20 Performance
L2P/L3U (Night)	Accuracy: $\pm 0.20$ K Precision: 0.6 K	Accuracy: $\pm 0.15$ K Precision: 0.35 K	Accuracy: $\pm 0.15$ K Precision: 0.35 K
L2P/L3U (Day)	Accuracy: $\pm 0.20$ K Precision: 0.60 K	Accuracy: $\pm 0.20$ K Precision: 0.45 K	Accuracy: $\pm 0.20$ K Precision: 0.45 K

- SSES Bias Corrected SST

Product	L1RDS APU Thresholds	SNPP Performance	N20 Performance
L2P/L3U (Night)	Accuracy: $\pm 0.20$ K Precision: 0.6 K	Accuracy: $\pm 0.10$ K Precision: 0.30 K	Accuracy: $\pm 0.10$ K Precision: 0.30 K
L2P/L3U (Day)	Accuracy: $\pm 0.20$ K Precision: 0.60 K	Accuracy: $\pm 0.15$ K Precision: 0.35 K	Accuracy: $\pm 0.15$ K Precision: 0.35 K

- Performance is expected to improve in the reprocessed (RAN) products

# Major Risks/Issues and Mitigation

Risk/Issue	Description	Impact	Action/Mitigation
<b>1 – WUCD anomalies remain unresolved</b>	<b>Quarterly/Annual WUCDs exercises</b>	<b>VIIRS SST off specs for 2-3 days per quarter/year</b>	<b>Quarterly reduced to annual. SDR plans to correct</b>
<b>2 – ACSPO Updates in NDE</b>	<b>NDE implementation takes a little too long</b>	<b>Negative impact on users, producers, archive</b>	<b>Working with PO to address</b>
<b>3 – Parallel Testing</b>	<b>Need both data streams for at least two weeks</b>	<b>Negative impact on users, producers, archive</b>	<b>Working with PO to address</b>
<b>4 – OSPO/NDE Integration</b>	<b>OSPO has no access to NDE to help with builds</b>	<b>Negatively affects implementation time</b>	<b>Working with PO to address</b>

# FY19 Milestones & Deliverables

Task Category	Task/Description	Start	Finish	Deliverable
Development (D)	ACSPO 2.61 (update N20, GFS 0.50/0.25; optimize); 2.70 (improve clear-mask/SST in support of data fusion)	Jun'18	Aug'19	V2.61: deliver in Dec 2018 V2.70: deliver in Aug 2019 (Versions may be combined)
Integration & Testing (I)	Continue testing/Improving N20 SST. Improve SST/clear mask/ocean fronts. Iterate based on users' feedback.	Jun'18	Jun'19	N20 SST archived PO.DAAC & evaluated by users. Improved ACSPO algorithms integrated
Calibration & Validation (C)	Support N20 and SNPP Cal/Val & fixes. Work on N20 RAN1 & SNPP RAN2. Archive N20 w/PO.DAAC.	Jun'18	May'19	JPSS SST meets specs/users' needs. N20 RAN1 complete. SNPP RAN2 advanced.
Maintenance	Maintain ACSPO, SQUAM, <i>iQuam</i> , ARMS, match-up codes, RAN infrastructure. Improve & optimize	Ongoing	Ongoing	ACSPO, SQUAM, <i>iQuam</i> , ARMS, match-up, RAN codes functional, stable & optimal
LTM & Anomaly Resolution (L)	Work w/VIIRS SDR Team to fix WUCD anomalies. Sustain SQUAM, <i>iQuam</i> , and ARMS monitoring & optimize	Ongoing	Ongoing	Real-Time/RAN performance stats available online in SQUAM, <i>iQuam</i> , ARMS

- **Algorithm Improvements**
  - Improved SST, Clear-Sky Mask/QC, and Error Characterization Algorithms in support of users and data fusion
  - Pattern Recognition and Front Detection Algorithms
- **J2 and Beyond**
  - Support J2/N21 Algorithm Updates and Cal/Val
  - Support J3/4 Algorithm Updates and Cal/Val
- **Reprocessing Plans/Status**
  - SNPP RAN2 underway. Expected completion: Dec 2019
  - N20 RAN1 underway. Expected completion: Dec 2018
- **Long Term Monitoring/Website links**
  - SQUAM (satellite monitor) [www.star.nesdis.noaa.gov/sod/sst/squam/](http://www.star.nesdis.noaa.gov/sod/sst/squam/)
  - iQuam (in situ monitor) [www.star.nesdis.noaa.gov/sod/sst/iquam/](http://www.star.nesdis.noaa.gov/sod/sst/iquam/)
  - ARMS (regional monitor) [www.star.nesdis.noaa.gov/sod/sst/arms/](http://www.star.nesdis.noaa.gov/sod/sst/arms/)



- **Users' Feedback: Generally Positive**
  - NOAA: NESDIS (CW, CRW, GPB), NOS, OAR, NCEP, NMFS
  - Int'l: CMC, EUMETSAT, Met Office, BoM, DMI, JMA, U. Melbourne
  - Academia: OSU, URI, UMD
  - Private Industry: Digital Globe, ESR
- **Summary FY18 Accomplishments**
  - ACSPO: 2 versions released, 2.50 & 2.60
  - N20 SST: Declared provisional (pending implementing ACSPO 2.60 in NDE)
  - SNPP RAN2: Infrastructure set up in STAR, underway with 2.60
  - Validation systems: SQUAM, *i*Quam, ARMS all upgraded to v2.0/2.1
  - PGRR SST fusion project: Will aggregate individual L3Us into L3C/S
- **Major Focus in FY19**
  - Development: ACSPO v2.61 (GFS/improved N20) & 2.70 (Improved SST/Mask)
  - Integration: Archive N20 w/PO.DAAC. Evaluate 2.61/2.70 improvements w/Users
  - Cal/Val: Support N20 & SNPP Cal/Val. Perform N20 RAN1. Advance SNPP RAN2
  - Maintenance: Sustain ACSPO, SQUAM/*i*Quam/ARMS, match-up codes, RAN's
  - LTM/Anomaly: Sustain SQUAM/*i*Quam/ARMS. Resolve anomalies (WUCD)