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## Introduction

The Joint Polar Satellite System (JPSS) is the National Oceanic and Atmospheric Administration's (NOAA's) next-generation operational Earth observation program. The first JPSS satellite mission, the Suomi National Polar-orbiting Partnership (S-NPP) satellite, was successfully launched in October 2011. It will be followed by two JPSS satellites: JPSS-1, planned for launch in fiscal year (FY) 2017, and JPSS-2 to follow in FY 2022.

Significant progresses have been made by the NOAA JPSS STAR (JSTAR) science teams on JPSS algorithm development and improvements, calibration and validation (Cal/Val), and maintenance of the Sensor Data Record (SDR) and Environment Data Record (EDR) products. As of today, all the S-NPP SDR products and most of the EDR products have reached the validated maturity stage. Currently, JSTAR science teams are working on JPSS-1 algorithm updates and Cal/Val plans to ensure JPSS-1 launch readiness. Based on the lessons learned from S-NPP, with the upgraded NOAA enterprise algorithms and deep-dive validation tools as well as routine validation and monitoring systems, the schedule for the maturity of the JPSS-1 data products is expected to be accelerated. As part of the quality assurance and users engagement, JSTAR also developed a website that provides detail information on the JPSS instruments, science data products and documents, product maturity status, and long term validation and monitoring of SDR/EDR products.

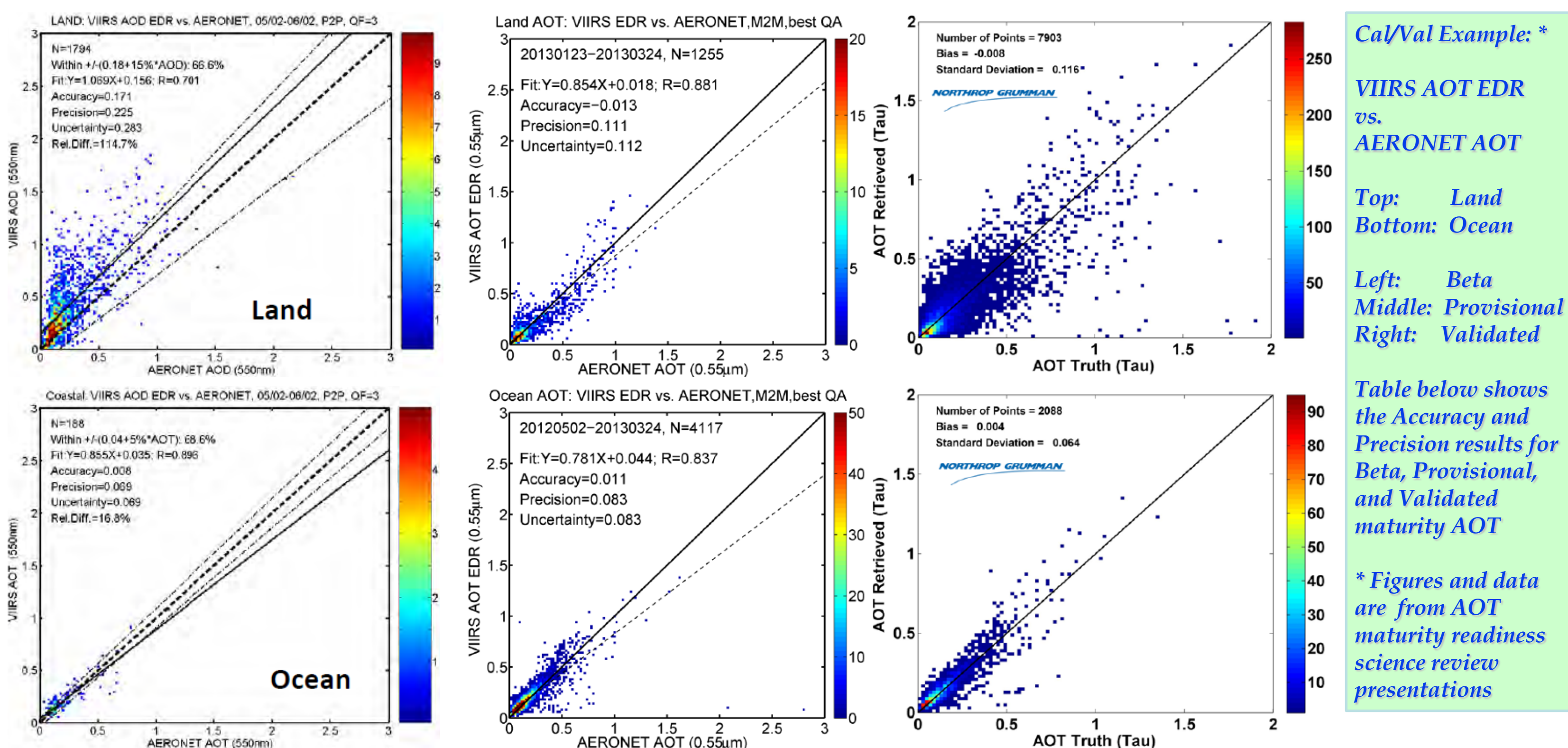
This paper presents an overview of the S-NPP product maturity status, JPSS-1 Cal/Val readiness and timelines. An EDR validation and monitoring system that is currently under development to routinely monitor science product performance will also be discussed. Examples from the S-NPP EDR product suite, the S-NPP validated performance, JPSS-1 planned algorithm improvements and validation will also be walked through in details.

## S-NPP Product Maturity

The product cal/val maturity status is determined by comparing the performance of the algorithm against the requirements as well as the level of validation accomplished (e.g. number and type of data sources, area of earth covered, etc.). Three maturity levels have been defined: Beta, Provisional, and Validated.

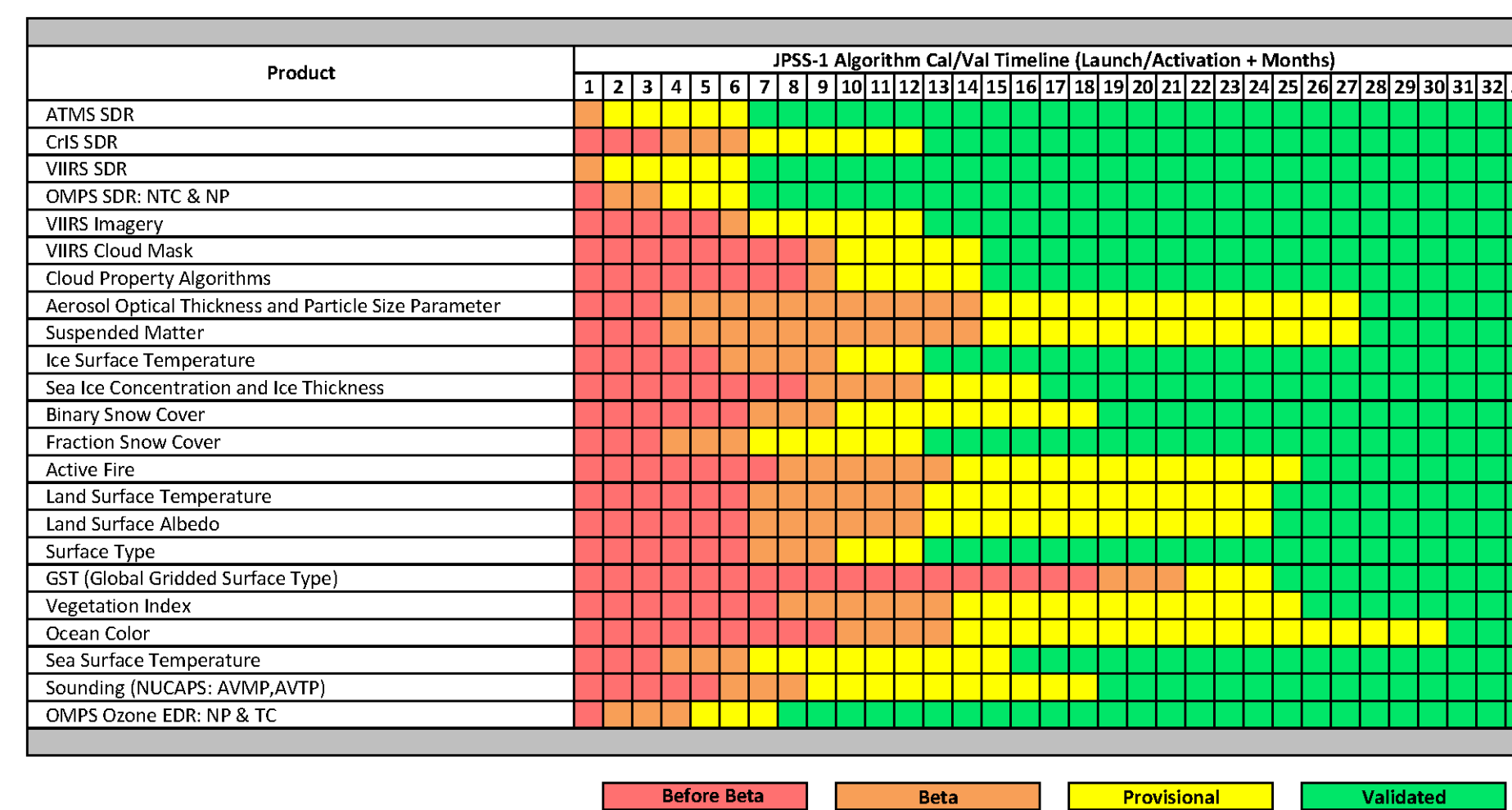
Sensor	Algorithm	Beta	Provisional	Validated
ATMS	SDR	Jan-12	Oct-12	Dec-13
CrIS	CrIS SDR	Apr-12	Oct-12	Dec-13
VIIRS	VIIRS SDR	Apr-12	Oct-12	Dec-13
OMPS	OMPS SDR: NTC & NP	Feb-12	Oct-12	Aug-15
VIIRS	Imagery (Not Near-Constant Contrast)	May-12	Jan-13	Jan-14
VIIRS	NCC Imagery	Oct-12	Aug-13	Jan-14
VIIRS	Cloud Mask	Jun-12	Jan-13	Jan-14
VIIRS	Cloud Property Algorithms*	Jun-13	Jan-14	Sep-14
VIIRS	Aerosol Optical Thickness and Particle Size	Sep-12	Apr-13	Aug-14
VIIRS	Aerosols - Suspended Matter	Jun-13		
VIIRS	Ice Surface Temperature	May-13	Aug-13	Jan-14
VIIRS	Sea Ice Concentration and Ice Thickness	May-13	Nov-13	
VIIRS	Binary Snow Cover	May-13	Nov-13	Jan-14
VIIRS	Fraction Snow Cover	May-13	Nov-13	
VIIRS	Active Fires	Oct-12	Aug-13	Sep-14
VIIRS	Land Surface Temperature	Dec-12	Apr-13	Dec-14
VIIRS	Land Surface Albedo	Jun-13	Apr-14	Dec-14
VIIRS	Surface Type	Feb-13	Jan-14	Dec-14
VIIRS	Land Surface Reflectance	Feb-13	Aug-13	Sep-14
VIIRS	Vegetation Index	Feb-13	Aug-13	Sep-14
VIIRS	Ocean Color	Jan-13	Jan-14	Mar-15
VIIRS	Sea Surface Temperature	Feb-13	Jan-14	Sep-14
CrIS	Soundings	Aug-12	Jan-13	Sep-14
OMPS	Total Column Ozone EDR	Jul-12	Jan-13	Aug-15
OMPS	Nadir Profiler Ozone EDR	Aug-12	Jan-13	Aug-15

**S-NPP Algorithm Maturity Matrix**  
 All the Maturity Review material is available on JSTAR web  
 \* Except Nighttime Cloud Optical Properties, and Cloud Cover Layer



		Beta (# of samples)	Provisional (# of samples)	Validated (# of samples)
Accuracy	Land	0.171 (1794)	-0.013 (1255)	-0.008 (7903)
	Ocean	0.008 (188)	0.011 (4117)	0.004 (2088)
Precision	Land	0.225 (1794)	0.111 (1255)	0.116 (7903)
	Ocean	0.069 (188)	0.083 (4117)	0.064 (2088)

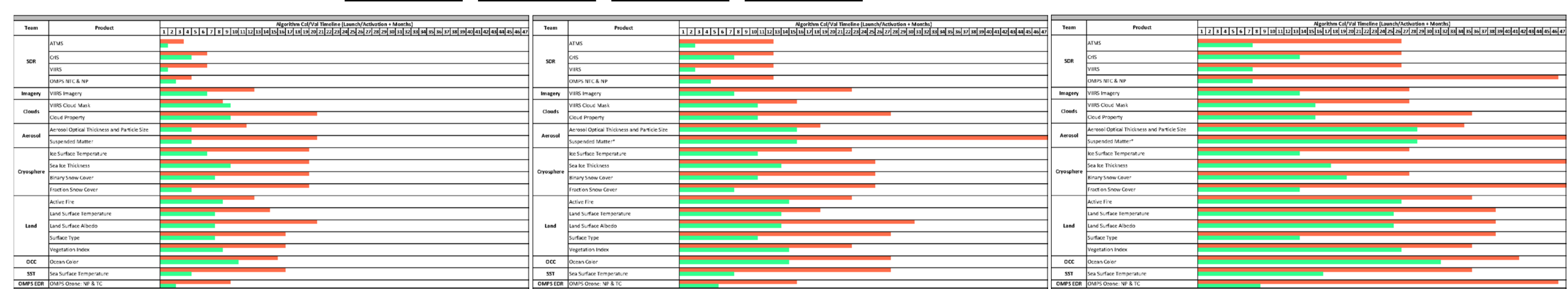
## JPSS-1 Cal/Val Plan



JSTAR science teams delivered draft Cal/Val plans in June 2015. Final Cal/Val plans are expected by December 2015 and will be posted on the JSTAR website.

Left: JPSS-1 Cal/Val maturity timeline, developed based on the draft Cal/Val plans.

Below: Comparison of S-NPP Cal/Val maturity timeline and draft JPSS-1 Cal/Val maturity timeline. Left: Beta; Middle: Provisional; Right: Validated S-NPP; Red; JPSS-1: Green



## Algorithm Refinements for JPSS-1

### Algorithm Refinements to Meet JPSS Level 1 Requirements

CrIS: Process for full spectral resolutions SDR product. *Delivered, will be in operational FY16.*

OMPS: Update SDR code with decompression and aggregator for extend spectral range (Total Column (TC): 300-420µm; Nadir Profiler (NP): 250-310µm) and reduce horizontal cell size (TC: 10km at nadir; NP: 50km at nadir). *Delivered, will be in operational FY16.*

Vegetation Index: Add top-of-canopy normalized difference vegetation index (NDVI). *Delivered, integrated into operational build.*

Active Fires: Add fire radiative power; Add 2D fire mask. *Delivered, will be in operational FY16.*

Ocean Color: Code for coastal and inland water. *Delivered, in operational.*

### Algorithm Refinements Based on Instrument Test Data

VIIRS GEO code change to accommodate JPSS-1 DNB aggregation mode change. *Under testing*

### Sensor Mounting Coefficients Update Based on Pre-Environmental Test Data

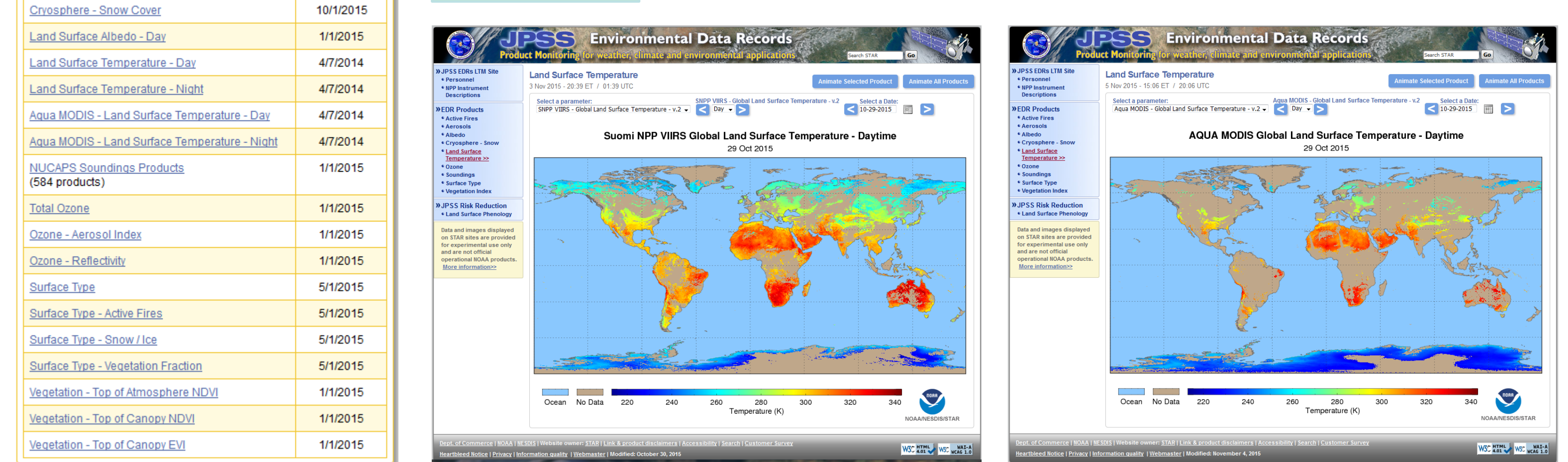
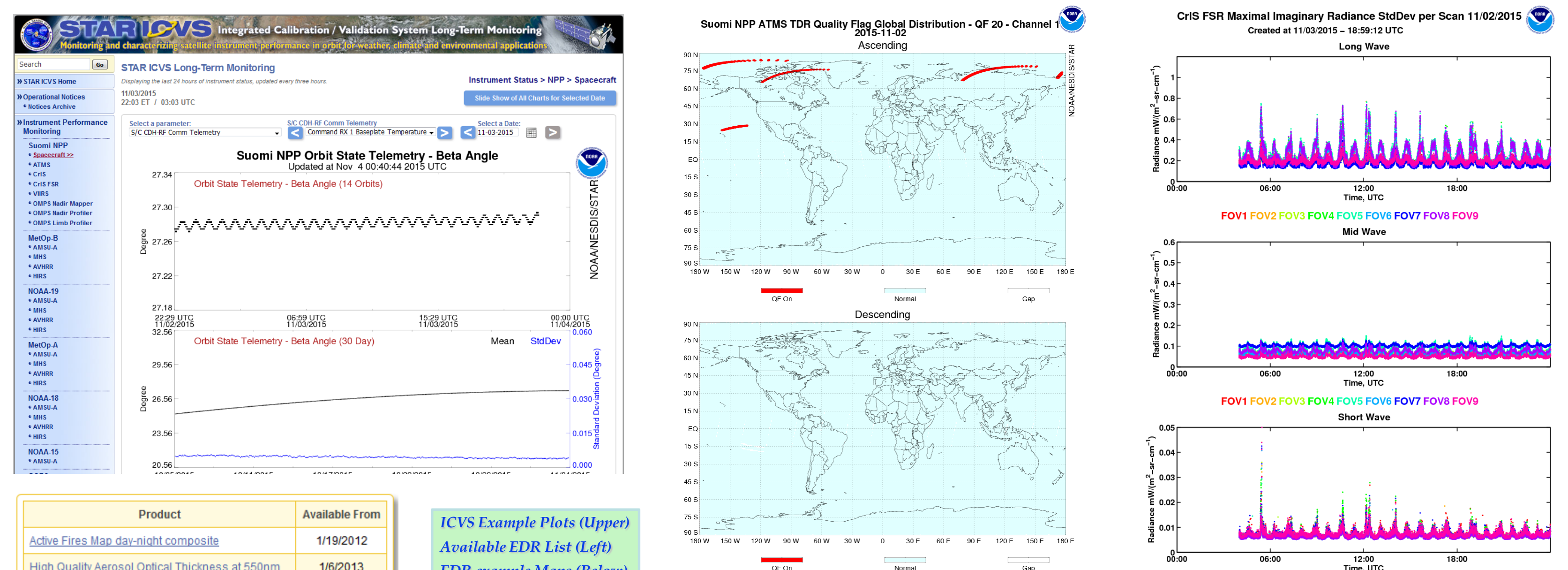
All SDRs. *Scheduled delivery: Mar-2016*

### Enterprise algorithm development: FY16 JSTAR annual meeting objective

## Product Performance Monitoring Systems

Integrated Calibration/Validation System (ICVS) is running near real time on STAR web server to monitor the near real-time S-NPP spacecraft and onboard instruments health status, performance, and SDR product data quality. The system will automatically send warning messages when anomaly is detected.

An ICVS like EDR product performance monitoring system is currently under development. The goal is to develop and integrate science product monitoring and routine validation system which allows operational users and product scientists to monitor the EDR product quality in near real time, routinely, as well as on a long term basis.



Website	POC	URL
STAR JPSS web	Lori Brow, Xingpin Liu, Tom Atkins	<a href="http://www.star.nesdis.noaa.gov/jpss/">http://www.star.nesdis.noaa.gov/jpss/</a>
SDR Monitoring System (ICVS)	Ninghai Sun, Fuzhong Weng, Kenneth Carey	<a href="http://www.star.nesdis.noaa.gov/icvs/index.php">http://www.star.nesdis.noaa.gov/icvs/index.php</a>
EDR Monitoring System	Lori Brow, Xingpin Liu, Tom Atkins	<a href="http://www.star.nesdis.noaa.gov/jpss/EDRs/index.php">http://www.star.nesdis.noaa.gov/jpss/EDRs/index.php</a>
Example deep-dive monitoring: SST	Alex Ignatov	<a href="http://www.star.nesdis.noaa.gov/sod/sst/squam/index.html">http://www.star.nesdis.noaa.gov/sod/sst/squam/index.html</a>
Example deep-dive monitoring: Aerosol	Shobha Kondragunta, Istvan Laszlo	<a href="http://www.star.nesdis.noaa.gov/smed/emb/viirs_aerosol/products_gridded.php">http://www.star.nesdis.noaa.gov/smed/emb/viirs_aerosol/products_gridded.php</a>

## Summary

- All S-NPP SDRs and most of EDRs have reached the Validated Maturity stage
- Schedule for the maturity of the JPSS-1 data products is expected to be accelerated
- Most of algorithm refinements for JPSS-1 are completed, the codes are ready for operational use. EDR teams are working toward enterprise algorithms.
- Product performance monitoring systems allow operational users and scientists to monitor the data product quality