JOINT POLAR SATELLITE SYSTEM PROGRAM

# NEWSLETTER

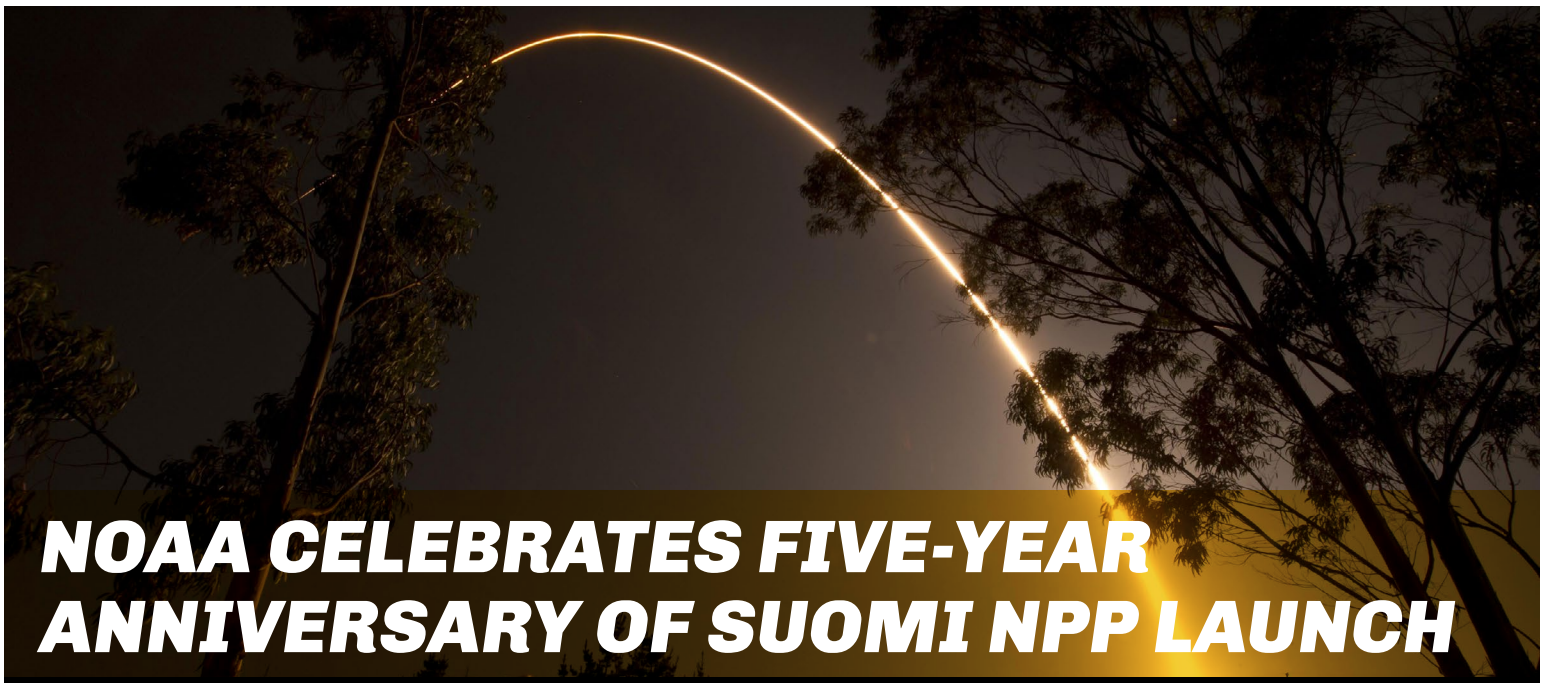
2016 • QUARTER #4

## FROM HARRY

We will look back on 2016 as a pivotal year for JPSS. Suomi NPP passed five years on orbit, continuing to exceed its performance requirements. The program finished the year strongly, solidifying the program life cycle baseline through Polar Follow-On/JPSS-3 and JPSS-4 to 2038. We faced setbacks for the JPSS-1 ATMS and spacecraft, but have taken corrective actions for the issues. We also faced setbacks in Block 2.0 readiness, but as we finish the year, the system is transitioning to final operational readiness validation. Both the satellite and Block 2.0 necessitated moving our JPSS-1 launch date commitment from 2nd Quarter FY2017 to 4th Quarter FY2017. While it is a disappointment to miss our original commitment and there are many challenges ahead, I have confidence we will have an extremely successful JPSS-1 mission.

On a personal note, I joined JPSS in September 2011 and will be moving to serve as Acting Director of the NESDIS Center for Satellite Applications and Research at the beginning of 2017. I thank everyone who has been part of the JPSS team during my time as Director. It has been a real honor and pleasure to be part of such a great team contributing to such a great mission. I look forward to watching JPSS continue to deliver in the future, supporting the ability to predict and monitor severe weather and environmental events to protect lives, property and prosperity, touching nearly everyone, almost everywhere, every day.

To learn more, you can read previous issues of the JPSS Newsletter here.



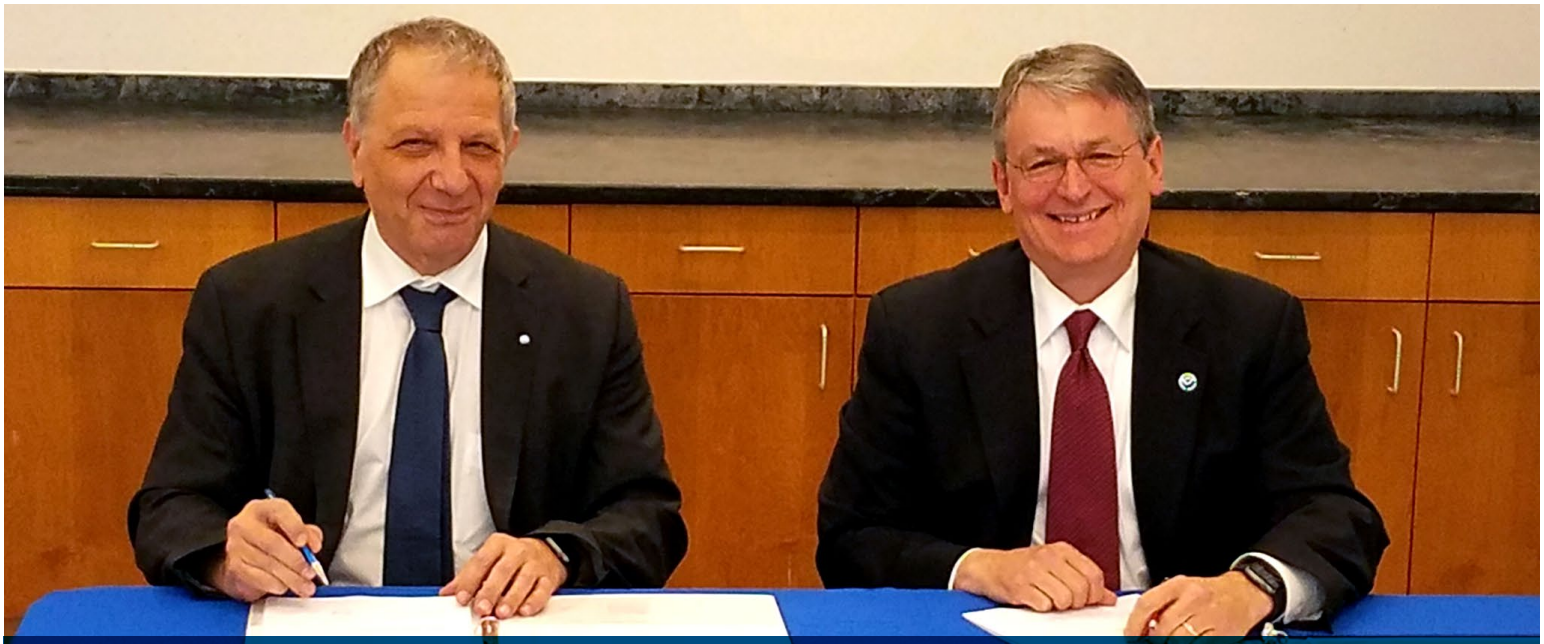
## NOAA CELEBRATES FIVE-YEAR ANNIVERSARY OF SUOMI NPP LAUNCH

▲ Suomi NPP being launched on Oct. 28, 2011.

After five years in space, the NOAA/NASA Suomi National Polar-orbiting Partnership (Suomi NPP) mission continues to contribute significant advances in severe weather prediction and environmental monitoring leading to better forecasts and situational awareness for the nation and users worldwide.

Launched on Oct. 28, 2011, Suomi NPP is a bridge to National Oceanic and Atmospheric Administration's (NOAA's) next generation Joint Polar Satellite System (JPSS) weather satellites. The JPSS-1 satellite is scheduled to launch in 2017 to complement the data from Suomi NPP.

Suomi NPP serves as NOAA's primary polar-orbiting weather satellite. Data from Suomi NPP are critical input to forecasts beyond 48 hours, enabling the increased consistency and accuracy of forecasts three to seven days in advance of a severe weather event for NOAA's National Weather Service (NWS). These data are also provided to other federal, state and local users, the commercial weather sector and international partners. Read more here.



# JPSS AND EUMETSAT: INTERNATIONAL PARTNERS

▲ Marc Cohen and Harry Cikanek signing the JPS PIP.

On December 15, 2016, Harry Cikanek, JPSS Director and Marc Cohen, EUMETSAT Associate Director for LEO Programmes, signed the Joint Polar System (JPS) Program Implementation Plan (PIP). The JPS PIP provides additional details on how the cooperation of the JPS Agreement signed on Dec. 2, 2015, will be implemented.

The JPS Agreement continues the long-standing polar-orbiting cooperation of data sharing between NOAA and EUMETSAT. Under the JPS cooperation, NOAA will make available to EUMETSAT its ground assets at McMurdo, Antarctica. In exchange, EUMETSAT will make available to NOAA its ground assets at Svalbard, Norway. The satellites covered by the cooperation are JPSS-2/3/4 and the EUMETSAT Polar System-Second Generation (EPS-SG).

# GOES-R AND JPSS WORKING TOGETHER

The successful launch of the GOES-R (Geostationary Operational Environmental Satellite R-series), now GOES-16 satellite was a major achievement for NOAA on the path to implementing the nation's next generation of weather satellites. These will include completing and placing the upcoming GOES- S, T and U series satellites in geostationary orbit, as well as launching several polar satellites within JPSS in the next decade. The first satellite in the JPSS system is the existing NOAA/NASA Suomi NPP, soon to be accompanied by JPSS-1, launching in 2017.


Polar and geostationary satellites are important and complementary components for weather forecasting, monitoring environmental conditions and mitigating the risks of severe weather, such as hurricanes, floods, fires and tornadoes. By orbiting above a fixed point on the Earth, GOES satellites provide imagery of the Western Hemisphere with high temporal resolution, producing an image every few minutes. By orbiting from pole to pole 14 times a day, JPSS's satellites provide images of higher spatial resolution covering the entire globe twice daily. Together the sets of data are used to improve forecasting and the accuracy of weather prediction models across the US.

In addition to the high spatial resolution, there are other important benefits of the JPSS mission. While geostationary satellites produce imagery of the Western Hemisphere with high frequency, polar satellites provide timely pictures of Alaska and the Arctic, as their relative coverage of the poles is much larger due to the wide swath crossing the poles every orbit. These images are vital for monitoring river ice, air quality, travel routes, wildfires and navigation in polar regions.

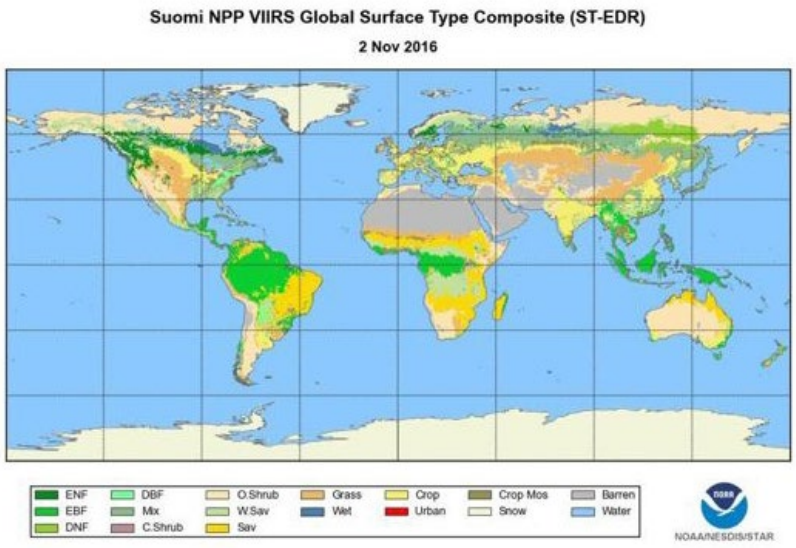
Satellites in the JPSS constellation carry the Visible Infrared Imaging Radiometer Suite (VIIRS), whose unique Day/Night Band can capture the Earth even in the lowest moonlit conditions. This capability has proven useful for many applications including tracking storms at all hours of the day and monitoring ship traffic, a useful tool to address illegal fishing worldwide.

The most important aspect of JPSS data is as input for weather modeling and forecasting. The Advanced Technology Microwave Sounder and the Cross-track Infrared Sounder, two instruments aboard Suomi NPP and upcoming JPSS satellites, provide three dimensional measurements of air temperature and moisture. These data are critical to the accuracy and timeliness of medium-to-long term (3- to 7-day) weather forecasts.

The JPSS constellation provides additional products to those mentioned above including precipitation type and rates, surface and sea surface temperature measurements, vegetation health assessments, ocean color and aerosol tracking from volcanic eruptions.

Together, NOAA's polar and geostationary satellites provide the nation with accurate and up-to-date environmental and weather monitoring.

# ANNUAL UPDATE TO THE GLOBAL SURFACE TYPE

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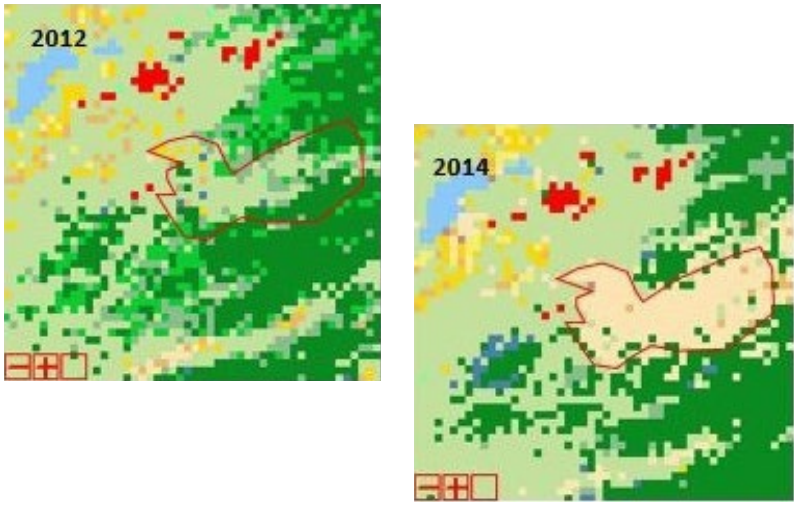



▲ Surface type change caused by Rim fire in 2013 reflected in the two VIIRS Annual Surface Type products.

NOAA's Center for Satellite Applications and Research (STAR) has announced the release of the 2016 update to the Global Surface Type (GST) data, provided by Suomi NPP's VIIRS instrument.

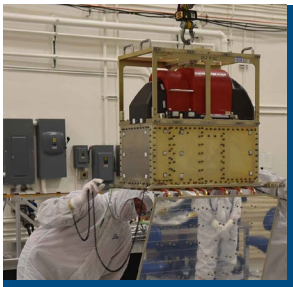
Updated annually, the GST data product provides users with the most recent information of global land surface type, which may change from year to year as a result of significant natural events (e.g., large scale wildfires) or human activities (e.g., deforestation, urbanization, and reforestation). As such, it is a required input for many land surface models, including numerical weather prediction, climate and hydrological forecasts, studies on natural resources and disaster management.

The VIIRS instrument's surface reflectance, brightness temperature and vegetation index data are vital to creating accurate GST products.

Although land surface type changes occur frequently around the world, some of the changes may take place over a multi-year timescale, whereas others may take place in just a few days. While the VIIRS annual global surface type product may not always capture significant, but short-term surface type changes, it does illustrate their consequences through the detection of such landscape features as burn scars or flooded areas.

For example, the more than 250,000-acre Rim Fire of 2013 resulted in large scale surface type changes in the State of California. As denoted by the red polygon in the graphic to the left, the GST products generated with 2012 and 2014 VIIRS data show how the surface type of the affected region has surface type changed from woody savanna to shrubland.

STAR is leading efforts to develop, test, validate, and refine the algorithms used to process data from instruments aboard JPSS satellites. The STAR-JPSS Surface Type team is tasked with generating the Global Surface Type product annually to provide the most recent land surface type information for users.



# TECHNICAL UPDATES

## JPSS-1

Environmental testing identified issues with the Advanced Technology Microwave Sounder (ATMS) and the instrument was returned to the Northrup Grumman Electronic Systems group last summer. Work is underway so that ATMS may be re-integrated with the spacecraft in the second quarter of 2017. Validation requirements for the ground system continue to be addressed as the team works aggressively towards launch readiness.

## BASELINE THROUGH 2038

JPSS has baselined the cost and schedule of the Polar Follow-On portion of the JPSS Program. This means it has identified and committed to the life cycle cost of the program for the JPSS-3 and JPSS-4 satellites and operations of all the JPSS satellites through 2038. This is an important step in ensuring future funding for the program and extending the provision of critical data used for weather forecasting.

## MEET THE TEAM: DR. ERIC STEVENS

*Science Liaison, Geographic Information Network of Alaska (GINA), University of Alaska Fairbanks*

**Q: How and why do you rely on data from JPSS satellites?**

**A:** GINA uses a pair of antennas to receive data from polar orbiting weather satellites as they pass over Alaska. We have been receiving data from the Suomi NPP satellite since late 2011 and GINA is eager to build on this success and receive data from JPSS-1 later this year.

Alaska is a unique place. Uniquely beautiful, uniquely remote, and uniquely challenging for weather forecasters due to the sparseness of weather observations. One of the few advantages Alaska has is more frequent coverage from polar orbiting weather satellites. Due to Alaska's high latitude, and due to the laws of orbital motion that govern the flight paths of weather satellites, Alaska receives more imagery from NOAA's polar satellites than any other part of the United States. Our role at GINA is to partner with the JPSS Program and help the NWS make the most of this advantage by providing meteorologists the highest quality satellite imagery with minimum latency. It's all about getting forecasters the right tools so they can succeed in their mission to protect Alaskans and all Americans.

**Q: How does data from JPSS satellites improve safety and/or protect lives and local economies as it relates to your organization?**

**A:** NWS protects the lives and property of Americans by warning people of approaching weather hazards. To do this, forecasters need to know the location and intensity of storms, the speed at which weather fronts are moving, the orientation of the jet stream and much more. Satellite imagery helps forecasters monitor such weather features in near real time. Nowhere are polar orbiting satellites more important in this role of weather surveillance than in Alaska. Other observing platforms such as the radar network and the weather balloon network are also very helpful but suffer significant gaps in coverage over Alaska. Satellites have the advantage of reporting information from data-sparse areas like the Arctic Ocean and the Bering Sea.

To complete any task, you need the right tools for the job. When the task is protecting the lives and property of Americans by giving the best possible weather warnings, one of the most important tools is NOAA's polar satellite constellation.

# VIIRS DNB FEATURED ON COVER OF BAMS

The old adage goes that lightning never strikes the same place twice, but if you happen to be out at night in the vicinity of Lake Maracaibo, Venezuela you might not press your luck. Lake Maracaibo stands out as one of the most prolific sources of nocturnal lightning activity worldwide (with activity nearly 300 nights per year). The cover image to this month's Bulletin of the American Meteorological Society, featuring an overpass of this lightning hotspot by Suomi NPP and its Day/Night Band low-light visible imaging sensor, captures a single beat of this electrical rhythm. The imagery, collected on Sept. 4, 2015 around 1:50 a.m. local time, reveals a nightscape replete with light emissions from major cities and towns, as well as moonlight reflecting off clouds throughout the region from a last quarter moon rising in the east. Near the center of the scene, a large thunderstorm complex boils over the western shore of Lake Maracaibo (located just south of the city of Maracaibo). The bright segment atop the convection is the telltale sign of a lightning flash, whose bloom of scattered/diffused light at cloud top was captured at just the moment when the Day/Night Band detector stack happened to sweep across the storm top.


Credit: Steve Miller/CIRA

# EVENTS AND CONFERENCES

## AMERICAN GEOPHYSICAL UNION MEETING 2016

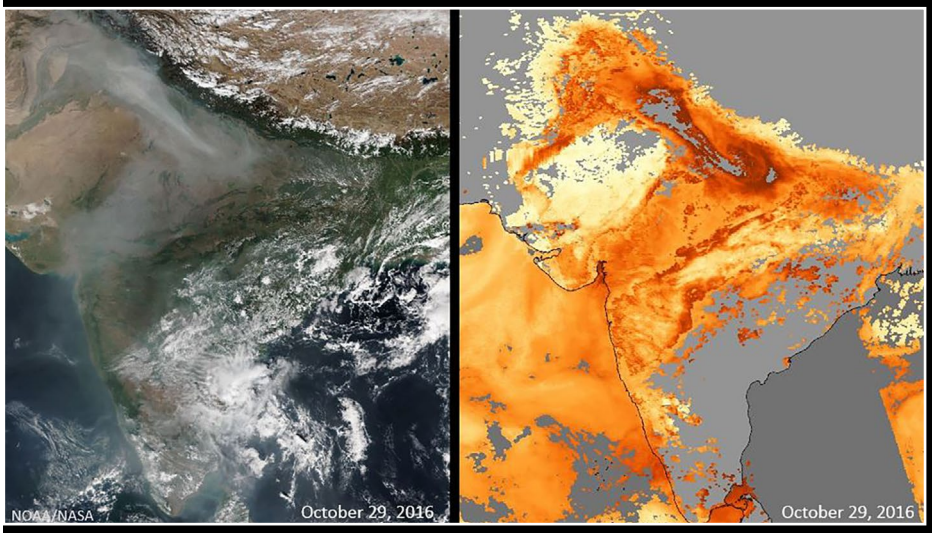
The American Geophysical Union (AGU) 2016 Fall Meeting, the world's largest organization of Earth and space scientists, took place in San Francisco, California with over 25,000 attendees on December 12–16, 2016. Focusing on areas including atmospheric science, ocean science and Earth and space sciences, the AGU Fall Meeting showcased many of the capabilities of the JPSS constellation. Suomi NPP environmental satellite imagery was featured during several presentations and data from the satellite was highlighted on over 40 posters. Presenters featured applications of JPSS from volcanic ash and dust monitoring to snowfall and ozone measurements to vegetation indices to monitoring of storms around the globe.

Steve Miller from the Cooperative Institute for Research in the Atmosphere at Colorado State University, a university partner of JPSS, highlighted the added capabilities of satellite data with the Day/Night Band on Suomi NPP's VIIRS instrument. Safety on land, sea and air is greatly improved with nighttime sensing capabilities, from rescue searches to navigation support. One of Dr. Miller's DNB images was recently used for the cover of the Bulletin of the American Meteorological Society (see article above).


◀ Mitchell Goldberg, Ph.D., JPSS Program Scientist, discusses the societal benefits of polar-orbiting environmental satellites at the NOAA booth at the AGU Fall Meeting.


◀ Steve Miller, Ph.D., Deputy Director of the Cooperative Institute for Research in the Atmosphere at Colorado State University, details the applications of the VIIRS Day/Night Band.

# INTERESTING IMAGES




## ◄ TRUE-COLOR IMAGERY

This true-color image (left) and map of aerosol optical thickness data (right) from the VIIRS instrument aboard Suomi NPP show a large plume of smoke over Northwest India on Oct. 29, 2016.

Although it is not actual photography, true-color imagery is similar to looking at a picture of Earth. To create it, scientists combine data from three of VIIRS's 22 channels—namely those sensitive to green, red, and blue wavelengths of light—along with supplemental data from other channels. True-color imagery can be used in a variety of applications, including differentiating snow/ice from cloud, demarcating the boundaries between warm and cold air masses and, as this image illustrates, distinguishing smoke from cloud cover.

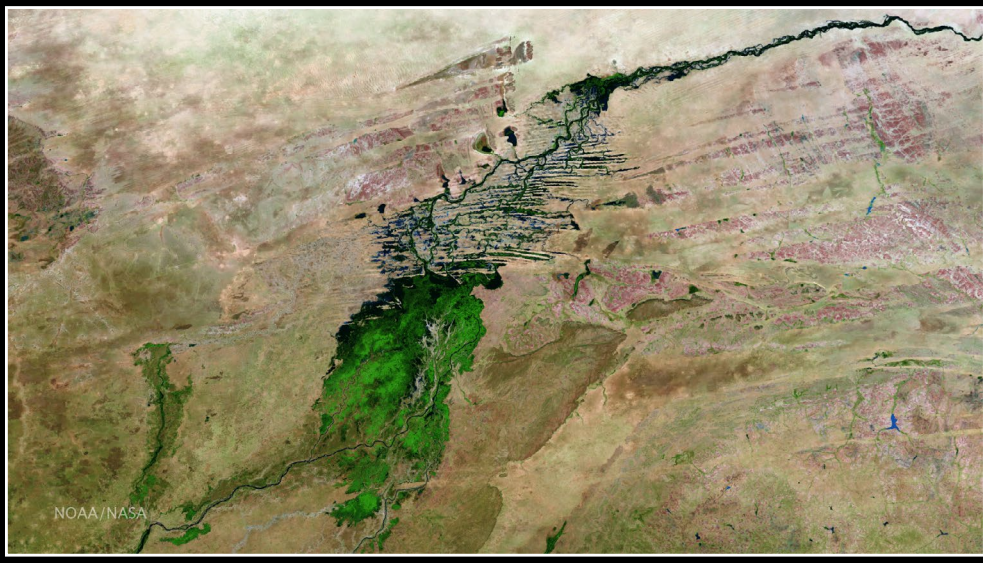
In addition to generating images in true color, VIIRS can also detect areas of the atmosphere in which aerosols (a catch-all term that refers to mixtures of gases and fine particles in the air) are absorbing or scattering sunlight. In this map, the areas of deep orange denote thick aerosol layers and correspond well with the areas covered by smoke in the true-color image. Areas of low aerosol optical thickness are colored light yellow.

Credit: NOAA/NASA

## INNER NIGER DELTA ►

The VIIRS instrument on Suomi NPP also snapped this true-color image of the Inner Niger Delta, a large area of lakes in the semi-arid transition zone known as the Sahel between the Sahara and the Sudanian Savanna, on Dec. 2, 2016.

This inland delta is a complex combination of river channels, lakes, swamps and occasional areas of higher elevation. This wet oasis in the African Sahel provides habitat both for migrating birds and West African manatees. The fertile floodplains also provide much needed resources for the local people, who use the area for fishing, grazing livestock and cultivating rice.




Three of the VIIRS instrument's 22 channels—SVI3, SVI2, SVI1—were combined to create this false color image. This channel combination is useful for determining land surface type along with areas of wildfires and flooding.

Credit: NOAA/NASA


## DID YOU KNOW?

Learn more about JPSS instruments and applications in an informational overview video—you can view and download it here.