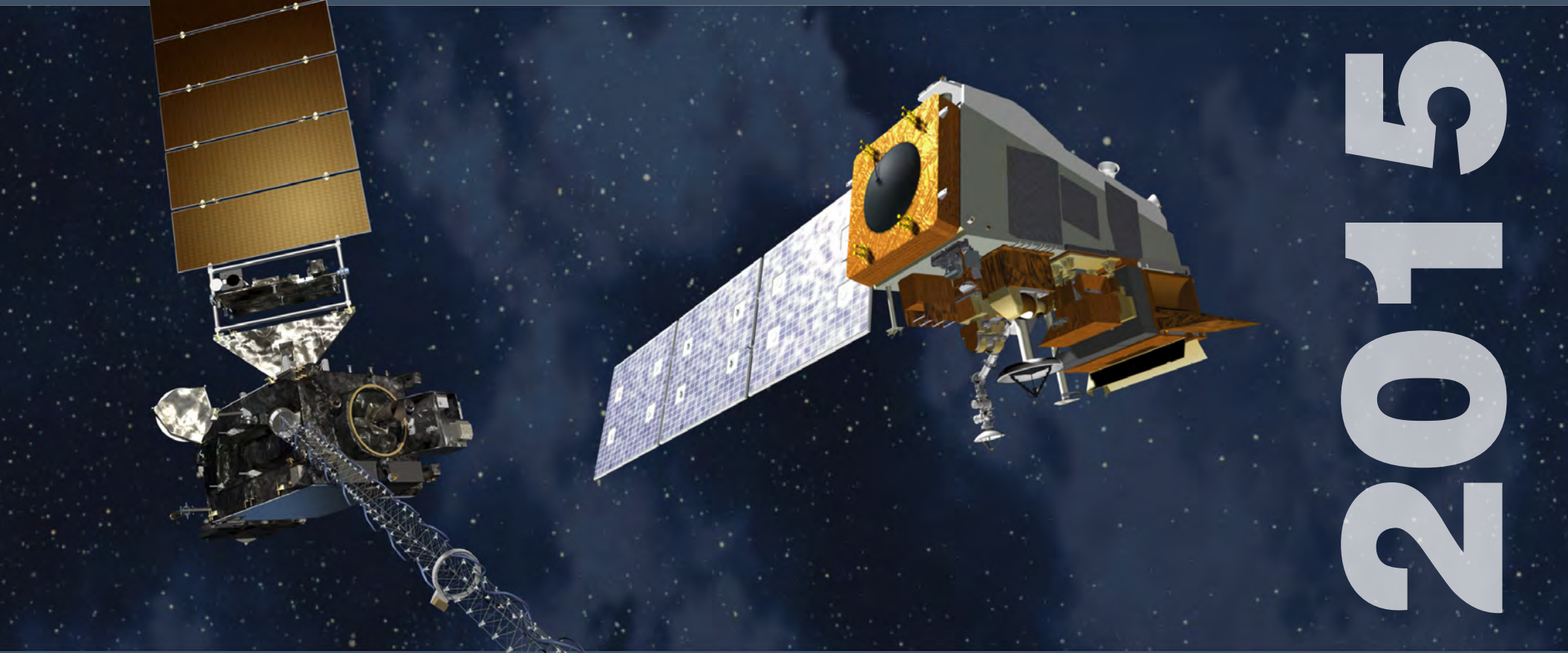


GOES-R

Geostationary Operational Environmental Satellite - R series

JPSS

Joint Polar Satellite System

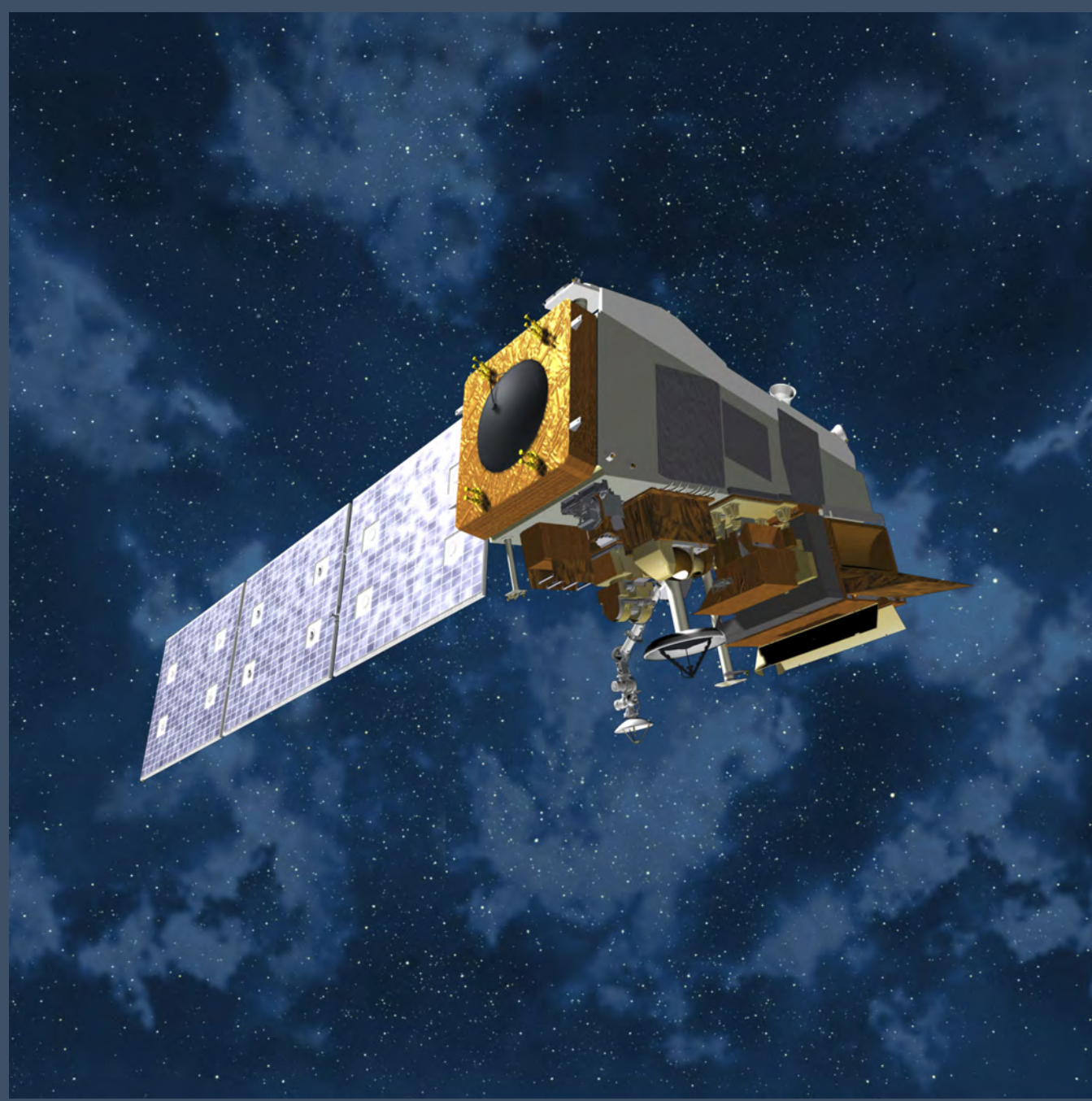
NOAA's Next-Generation Environmental Satellites

www.nasa.gov

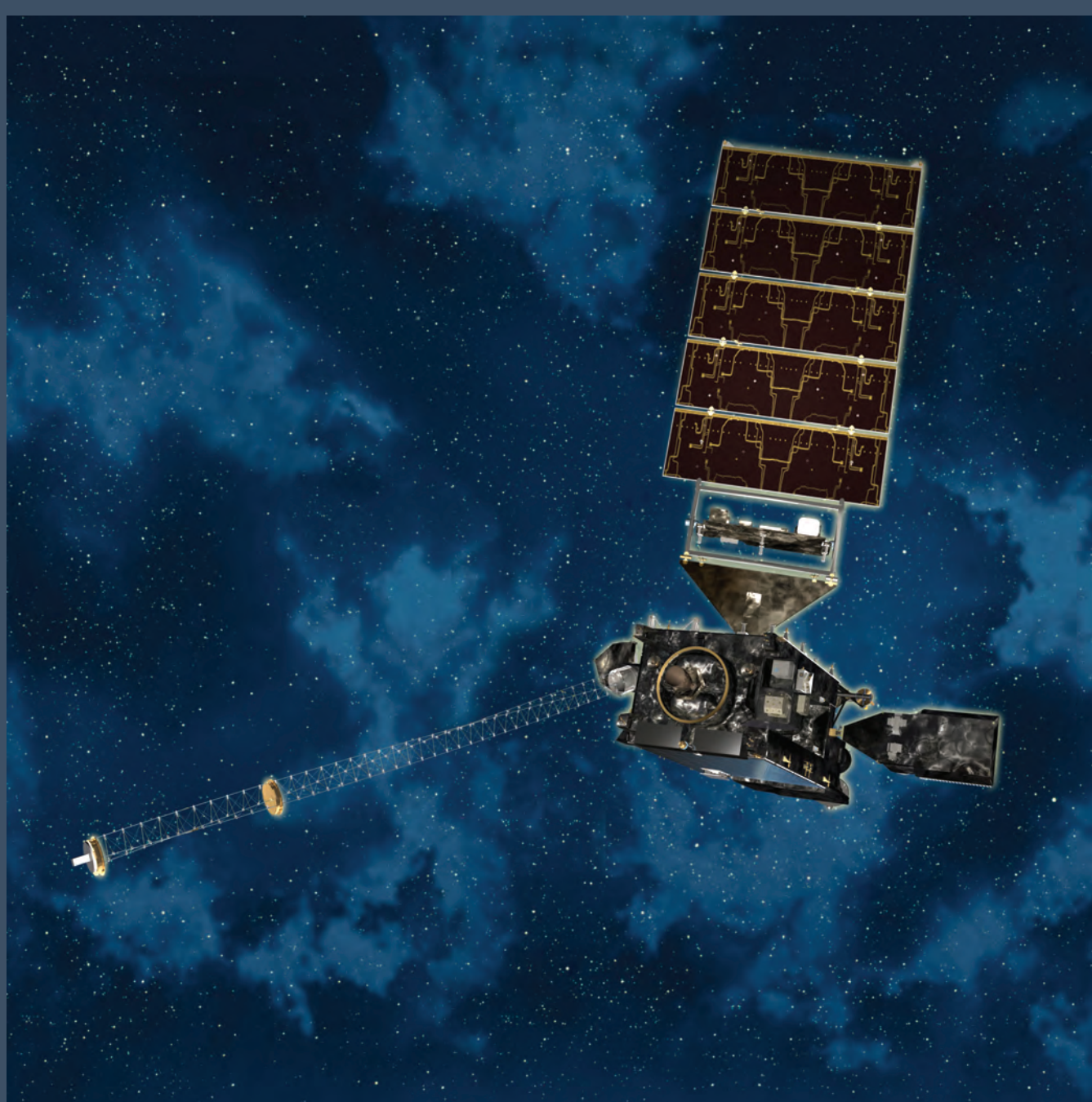
www.noaa.gov

JPSS

The Joint Polar Satellite System (JPSS) is NOAA's next generation of polar-orbiting environmental satellites. The satellite constellation is comprised of the currently flying Suomi NPP satellite, launched in 2011, and the future JPSS-1 and JPSS-2 satellites to be launched in 2017 and 2021, respectively. JPSS satellites simultaneously provide sophisticated meteorological data and observations of atmosphere, ocean and land for short-term, seasonal and long-term monitoring and forecasting. The most important function of JPSS is to increase the timeliness and accuracy of forecasts three to seven days in advance of a severe weather event. NOAA's National Weather Service uses JPSS data as critical input for numerical forecast models, providing the basis for these mid-range forecasts. These forecasts allow for early warnings and enable emergency managers to make timely decisions to protect American lives and property, including ordering effective evacuations.



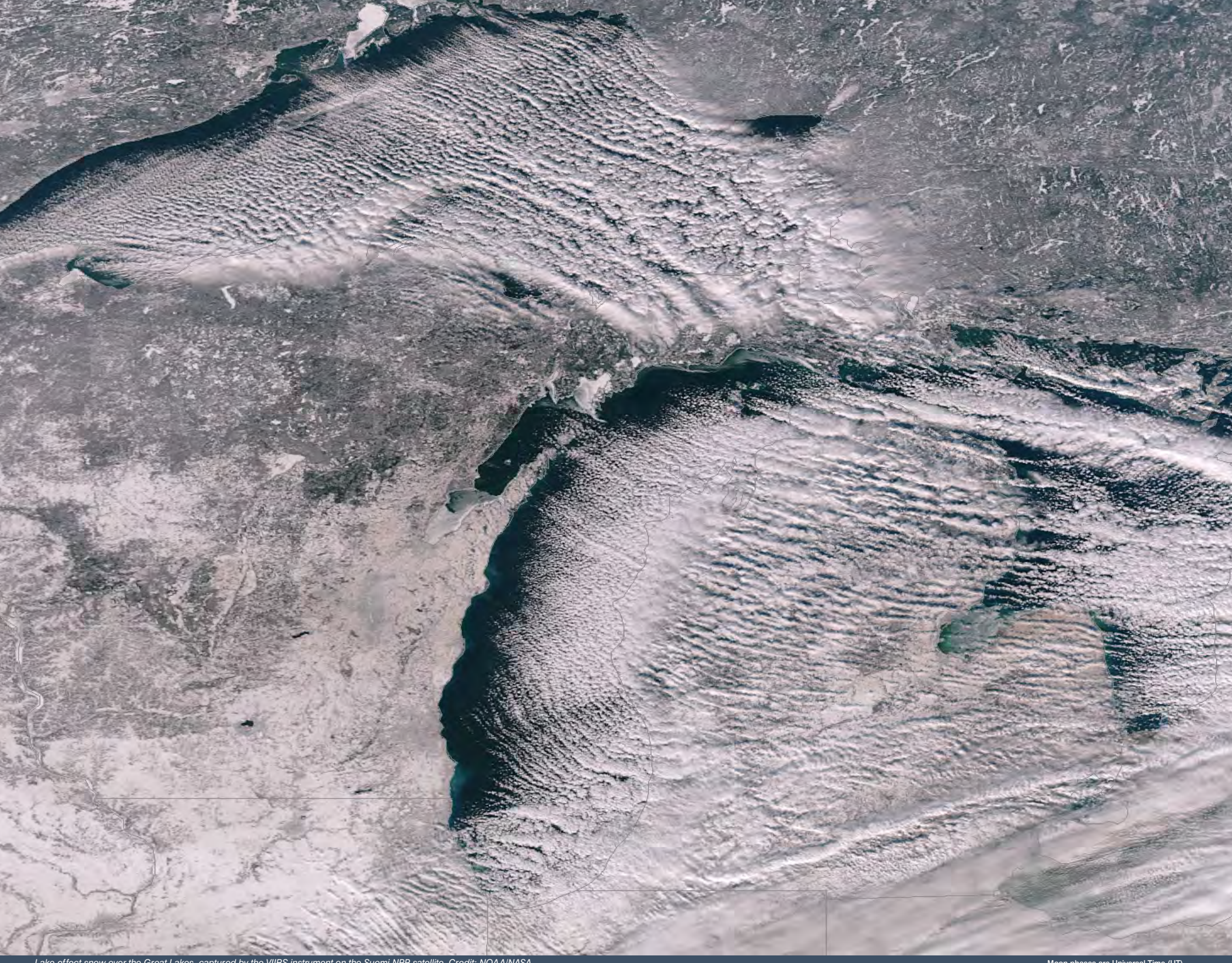
Credit: Ball Aerospace & Technologies Corp.



Credit: Lockheed Martin

GOES-R series

The Geostationary Operational Environmental Satellites – R Series (GOES-R) is the next generation of NOAA geostationary weather satellites. GOES-R will provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere and space weather monitoring to provide critical atmospheric, hydrologic, oceanic, climatic, solar and space data. GOES-R series environmental data products will improve short-term weather forecasts, increase thunderstorm and tornado warning lead time, improve hurricane tracking and intensity forecasts, improve aviation flight route planning, provide data for long-term climate variability studies, and improve solar flare warnings for communications and navigation disruptions. GOES-R will also support maritime forecasts, seasonal predictions, drought outlooks and space weather predictions. The GOES-R series (GOES-R, S, T, and U) will extend the availability of the operational GOES satellite system through 2036. The first satellite in the series is scheduled for launch in March 2016.



Lake-effect snow over the Great Lakes, captured by the VIIRS instrument on the Suomi NPP satellite. Credit: NOAA/NASA

January 2015

Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
DECEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	FEBRUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28			1 New Year's Day	2	3
4 Perihelion	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19 Martin Luther King, Jr., Day observed	20	21	22	23	24
25	26	27	28	29	30	31

Data for a cold winter

JPSS's Advanced Technology Microwave Sounder (ATMS) and Cross-track Infrared Sounder (CrIS) data will enhance National Weather Service models and snow forecasts during severe winter storms. The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument provides imagery that can capture mountain snow events sometimes missed by weather radar.

This image, captured by Suomi NPP's VIIRS instrument on February 10, 2013, shows snow on the ground after a historic New England snowstorm.

Credit: NOAA Visualization Lab

A massive filament of solar material erupts from the sun into space during a coronal mass ejection in August 2012. Credit: NASA/SDO/GSFC

February 2015

Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4	5	6	7
8	9	10	11	12	13	14 Valentine's Day
15	16 Presidents' Day	17	18	19	20	21
22	23	24	25	26 GOES-H launched, 1987	27	28

JANUARY

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

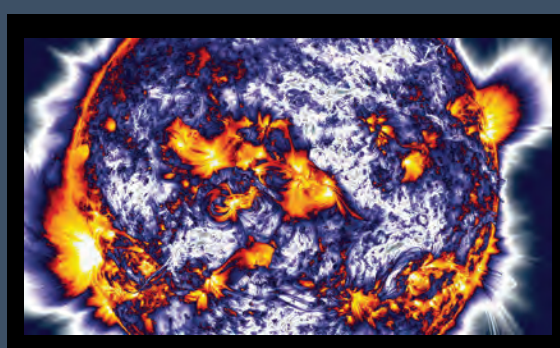
MARCH

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Forecasting space weather

The Solar Ultraviolet Imager (SUVI) on the GOES-R series will observe the sun in the extreme ultraviolet wavelength range. SUVI will monitor active regions of the sun in order to detect solar flares and the warning signs of coronal mass ejections. Depending on the size and trajectory of solar eruptions, the energetic particles reaching Earth's environment in space can disrupt power utilities, communication, and navigation systems, and could harm satellites, the International Space Station, and astronauts. SUVI observations will provide an early warning of such impacts to the Earth environment. SUVI will replace the current GOES Solar X-ray Imager (SXI) instrument and will produce multiband "color" images at the same rate as SXI produces single-band images.

Simulated GOES-R SUVI image from the Solar and Heliophysics Observatory Extreme Ultraviolet Imaging Telescope.



Credit: NASA/Goddard Space Flight Center

The U.S. Coast Guard Cutter Mackinaw escorts the Motor Vessel Paul R. Tregurtha safely through the ice at Port Huron on the U.S./Canada border, Dec. 23, 2010. Photo U.S. Coast Guard.

March 2015

Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1	2	3	4 GOES-P launched, 2010	5	6	7
8 Daylight Saving Time begins	9	10	11	12	13	14
15	16	17	18	19	20 Vernal Equinox	21
22	23	24	25	26	27	28
29	30	31				

FEBRUARY

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

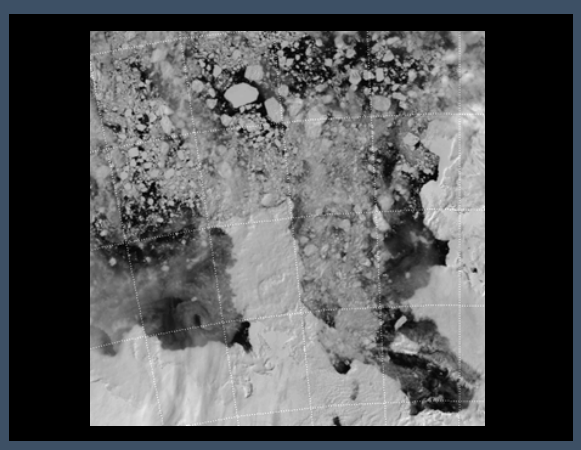
APRIL

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Tracking ice

NOAA's National Weather Service (NWS) in Alaska uses the data from the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument on Suomi NPP to produce graphic analyses of sea surface temperatures, sea ice and five-day sea ice forecasts year round. Correctly determining the location of sea ice to help accurately forecast its movement is vital to rescue of vessels stuck in ice fields, it provides critical input to fishing fleets as they plan their seasonal catches, and is used by forecasters to determine the impact of storm-induced waves on coastal villages.

The ability to track icebergs both day and night is very important and the VIIRS Day/Night Band makes that possible. This image of ice calving in Antarctica was captured by the VIIRS instrument on the NOAA/NASA Suomi NPP satellite on December 26, 2013.



Credit: NOAA/NESDIS

Flooding in lower Park Avenue, Arches National Park, Utah. National Park Service Photo by Neal Herbert

April 2015

Moon phases are Universal Time (UT)

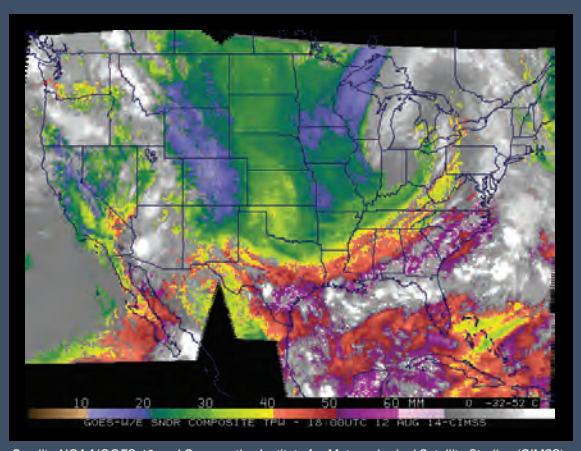
NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
MARCH S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	MAY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1	2	3	4
5 Easter	6	7	8	9	10	11
12	13 GOES-I launched, 1994	14	15	16	17	18
19	20	21	22 Earth Day	23	24	25 GOES-K launched, 1997
26	27	28 GOES-F launched, 1983	29	30		

Predicting heavy rain and flooding

Total precipitable water is the liquid equivalent of the amount of water vapor in an atmospheric column from the surface to the top of the atmosphere. It is derived from atmospheric moisture profiles. Visualization of this product can reveal "atmospheric rivers," which are long, narrow filaments of moisture that can persist in the atmosphere for several days and can transport as much water as the Amazon River.

The GOES-R Total Precipitable Water product will help to predict heavy rain events, such as that experienced by the Chesapeake Basin in August 2014.



Credit: NOAA/GOES-13 and Cooperative Institute for Meteorological Satellite Studies (CIMSS).

The NSSL Field Command vehicle observing a tornado in Goshen County, Wyoming, during the Verification of the Origins of Rotation in Tornadoes Experiment 2 (VORTEX2) operations on June 5, 2009. Photo by Michael Coniglio, NOAA/NSSL

May 2015

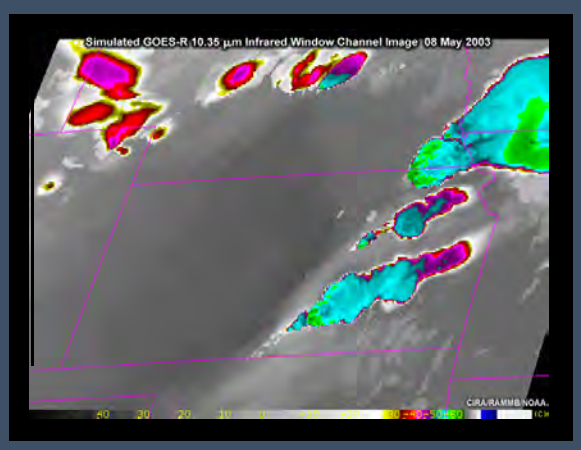
Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
APRIL S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30				1	2
3 GOES-G launched, 1986 GOES-L launched, 2000	4	5	6	7	8	9
10 Mother's Day	11	12	13	14	15	16
17	18	19	20	21	22 GOES-E launched, 1981	23 GOES-J launched, 1995
GOES-N launched, 2006 24 31	25 Memorial Day	26	27	28	29	30

Forecasting severe weather

The GOES-R Advanced Baseline Imager's 16 channels and frequent imaging will show changes in cloud top phase and particle size that can be used to assess storm growth and severity potential. The ABI's greater spatial resolution will provide a clearer picture of storm top signatures, such as "enhanced V" and overshooting tops, known to be associated with severe storms.



Credit: CIRA/RAMMB/NOAA

A simulated GOES-R infrared image from May 8, 2003, shows multiple mature thunderstorms with overshooting tops and "enhanced V" signatures indicating the potential for severe thunderstorm conditions.

A shot of the Augustine volcano in western Alaska toward the end of its long eruption that lasted several months in 2006. Credit: Cyrus Read, USGS

June 2015

Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	1 Atlantic hurricane season begins	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16 GOES-B launched, 1977 GOES-C launched, 1978	17	18	19	20
Summer Solstice 21 Father's Day	22	23	24	25	26	27 GOES-O launched, 2009
28	29	30				

MAY

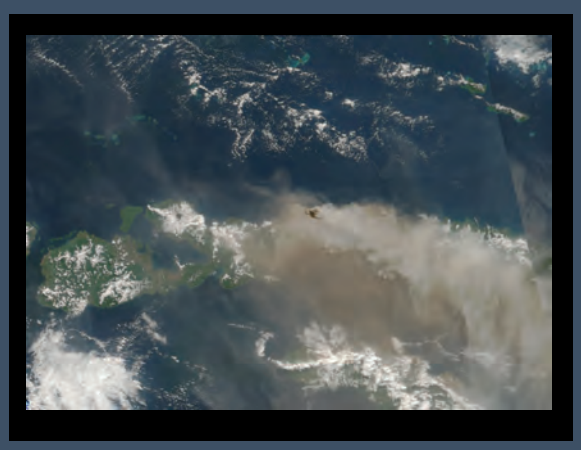
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

JULY

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Detecting volcanic ash in the atmosphere

Airborne volcanic ash has significant aviation, health, infrastructure, and economic impacts. It is important to monitor volcanic regions and promptly identify ash clouds. Both the advanced spectral, spatial, and temporal resolution of the GOES-R Advanced Baseline Imager, and the high-resolution imagery and global reach of JPSS's VIIRS instrument, will be used to generate a complete set of volcanic cloud detection and monitoring products, resulting in improved air and ground safety.



Suomi NPP VIIRS true-color image of the eruption of the Sangeang Api volcano in Indonesia on May 31, 2014.

Credit: NOAA/NESDIS

Breathtaking lightning storm over Mattoon, Illinois. Photo by Melinda L. Swinford

July 2015

Moon phases are Universal Time (UT)

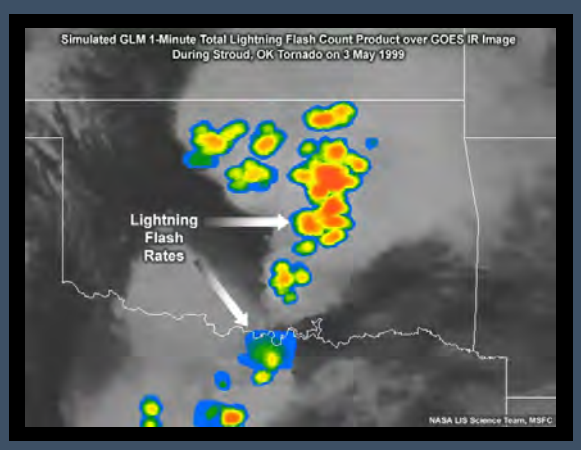
NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JUNE S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1	2	3	4 U.S. Independence Day
5	6 Aphelion	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23 GOES-M launched, 2001	24	25
26	27	28	29	30	31	

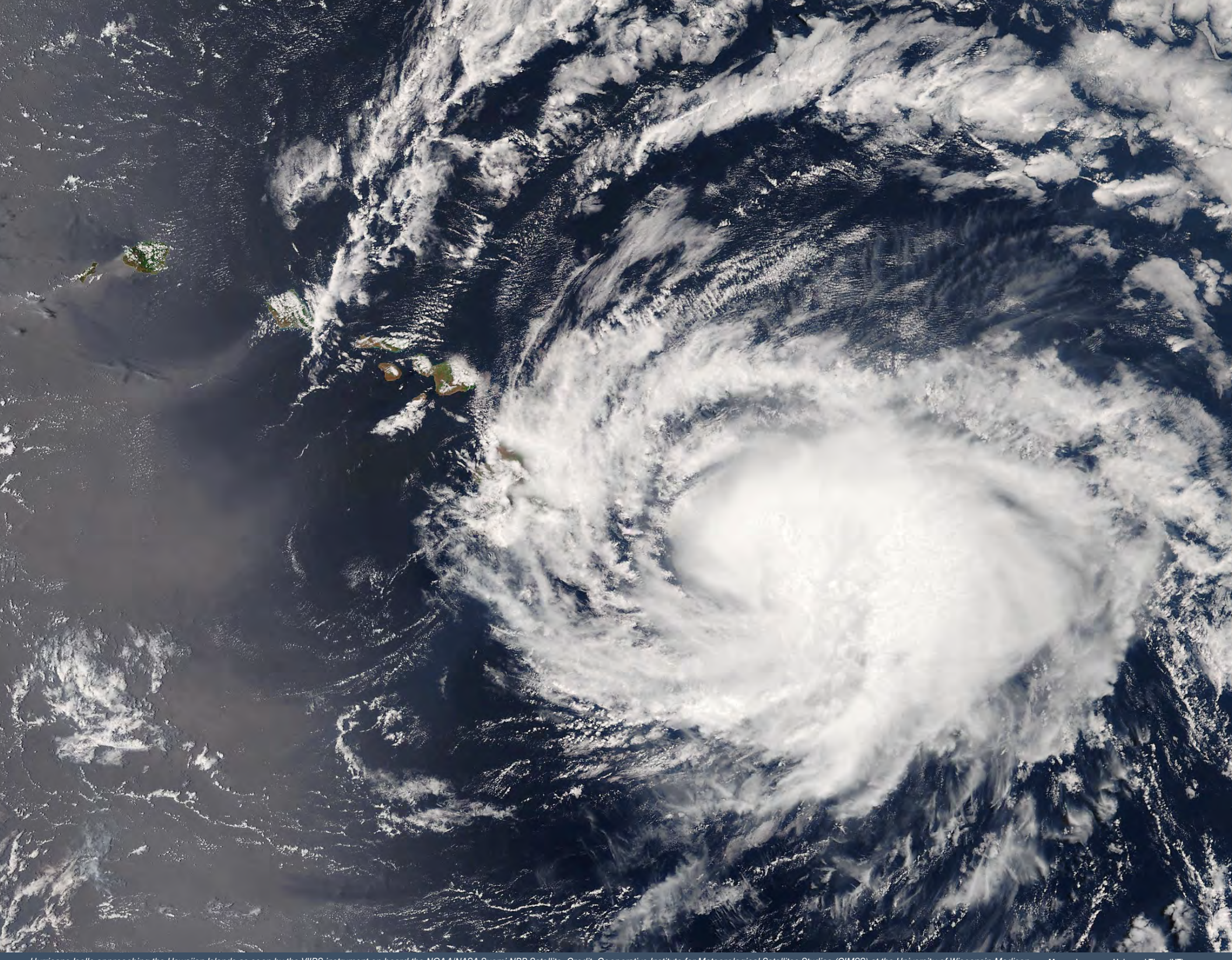
Detecting lightning

The Geostationary Lightning Mapper (GLM) on the GOES-R series will detect and map total lightning activity, which includes both cloud-to-ground and cloud-to-cloud lightning, over the Western Hemisphere and adjacent ocean regions. This data will help severe weatherforecasters identify rapidly intensifying thunderstorms and issue accurate and timely storm warnings. In addition, GLM measurements can provide early warning of lightning ground strike hazards, better detection and short range forecasts of heavy rainfall and flash flooding, and improved ability to monitor intensification/decay of severe storms.

Simulated GLM one-minute total lightning flash count product over GOES infrared image during a tornado in Stroud, Oklahoma, on May 3, 1999.



Credit: NASA Lightning Imaging Sensor Science Team, Marshall Space Flight Center



Hurricane Iselle approaching the Hawaiian Islands as seen by the VIIRS instrument on board the NOAA/NASA Suomi NPP Satellite. Credit: Cooperative Institute for Meteorological Satellites Studies (CIMSS) at the University of Wisconsin-Madison

August 2015

Moon phases are Universal Time (UT)

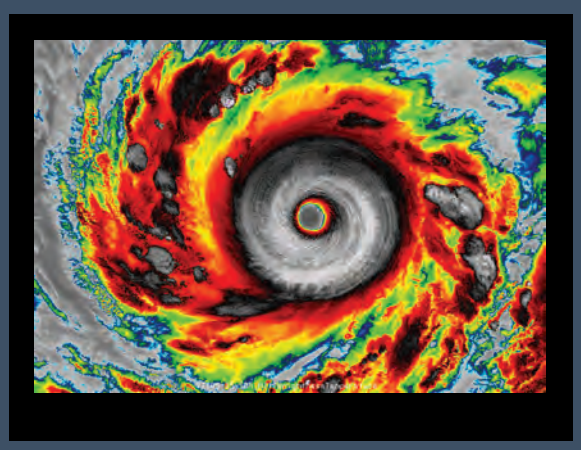
NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JULY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23 30	24 31	25	26	27	28	29

Better data for better predictions

Polar-orbiting satellite data, like the advanced weather prediction data generated by Suomi NPP, helped NOAA's National Weather Service forecasters and scientists accurately predict—more than five days in advance—Sandy's hurricane track and infamous 'left hook' landfall into New York and New Jersey. Without this data, models would have incorrectly predicted that Sandy would remain at sea and not make landfall in New Jersey. JPSS will allow for a continuation of these crucial observations to meet the ongoing challenges presented by severe weather.

The VIIRS instrument on the NOAA/NASA Suomi NPP satellite shows a highly detailed view of the eye of Super Typhoon Vongfong as it moves north towards Japan. Taken on October 7, 2014.



Credit: NOAA

This image, taken on July 24, 2014, shows swirls of plankton blooms in the Baltic Sea. This RGB color composite uses Suomi NPP's SVI1, SVM4 and SVI2 bands, each sensitive to different colors of light. Credit: NOAA Visualization Lab

September 2015

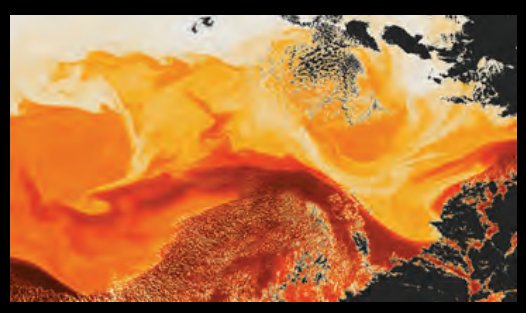
Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
AUGUST S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	OCTOBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1	2	3	4	5
6	7 Labor Day	8	9 GOES-D launched, 1980	10	11	12
13	14	15	16	17	18	19
20	21	22	23 Autumnal Equinox	24	25	26
27	28	29	30			

An eye on the whole Earth system

Satellites in the JPSS constellation will gather global measurements of atmospheric, terrestrial and oceanic conditions—including atmospheric temperature, atmospheric moisture, hurricane intensity, clouds, rainfall, dense fog, volcanic ash, fire locations, smoke plumes, sea and land surface temperatures, vegetation, snow and ice cover, and ozone.



In this Suomi NPP infrared image from April 2013, the Gulf Stream (dark orange) collides with cooler waters (lighter orange) about 180 miles off the coast of Atlantic City, NJ. Black areas are clouds.

Credit: NOAA Visualization Lab

Coast Guard rescue training exercise off the coast of Altlantic City, New Jersey. Credit: U.S. Coast Guard

October 2015

Moon phases are Universal Time (UT)

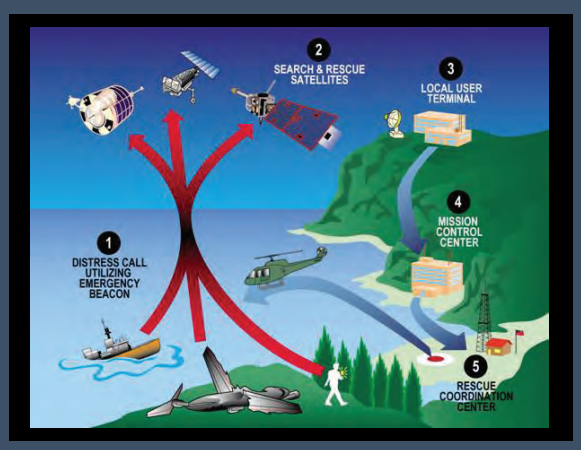
NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
SEPTEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			1	2	3
4	5	6	7	8	9	10
11	12 Columbus Day	13	14	15	16 GOES-A launched, 1975	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31 Halloween

Continuing a proud tradition

The GOES-R series will include dedicated Search and Rescue Satellite Aided Tracking (SARSAT) transponders to detect signals transmitted from emergency beacons on aircraft, maritime vessels, or carried by individuals in distress. The transponder provides constant coverage to immediately receive and relay a 406-MHz emergency beacon alert to ground stations called Local User Terminals. In turn, this signal is routed to a SARSAT Mission Control Center and then sent to the Rescue Coordination Center nearest the alert, which dispatches a search and rescue team to the location of the distress. The GOES-R series continues the legacy Geostationary SAR (GEOSAR) function of the SARSAT system carried on NOAA's GOES satellites since GOES-I (8). It has contributed to the rescue of thousands of individuals in distress in the United States and around the world.

Overview of the SARSAT system.



Credit: NOAA

The Fourmile Canyon wildfire west of Boulder, Colorado, burned for 10 days in September 2010. Photo: Dan Lack, NOAA/CIRES

November 2015

Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 Daylight Saving Time ends	2	3 Election Day	4	5	6	7
8	9	10	11 Veterans Day	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26 Thanksgiving Day	27	28
29	30 Atlantic hurricane season ends					

OCTOBER

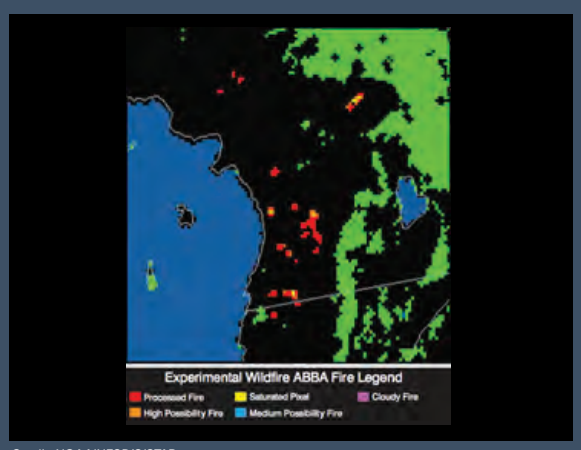
S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

DECEMBER

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Detecting fire from space

Fires produce a heat signature detectable by satellites such as the GOES-R series and JPSS even when the fires represent a small fraction of a pixel. Compared to the past GOES and POES imagers, the GOES-R Advanced Baseline Imager (ABI) and JPSS's Visible Infrared Imager Radiometer Suite (VIIRS) have the ability to detect such heat signatures with improved temperature, temporal and spatial resolution. In addition to monitoring the fires themselves, data from these satellites can help first responders and air quality experts prepare the public for the health hazards from the smoke.



Example of the GOES-R Fire/Hot Spot Characterization product using simulated GOES-R Advanced Baseline Imager data over Southern California from October 23, 2007.

Credit: NOAA/NESDIS/STAR

This image was created by the Day/Night Band of the VIIRS instrument on board the NOAA/NASA Suomi NPP Satellite. Credit: NOAA's National Geophysical Data Center/NASA Earth Observatory

December 2015

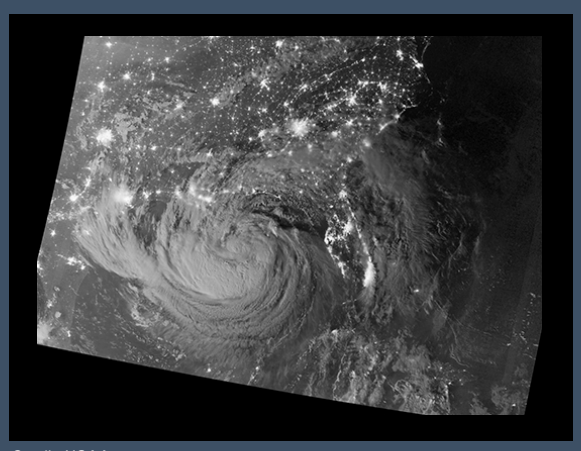
Moon phases are Universal Time (UT)

NEW MOON · FIRST QUARTER · FULL MOON · LAST QUARTER

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
NOVEMBER S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	JANUARY S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	1	2	3	4	5
6 ATS-1 launched, 1966	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22 Winter Solstice	23	24	25 Christmas Day	26
27	28	29	30	31		

A clear view night or day

JPSS's VIIRS instrument has a Day/Night Band to detect low levels of visible and near-infrared radiance. This means that low clouds, fog, snow cover, and other sources will be visible to JPSS at night. The Day/Night band capability has proven invaluable in the arctic regions for differentiating cloud, ice, and snow cover. The imagery has also been used with city light maps to model the distribution of economic activity and populations, monitor human development around parks, wildlife refuges and to observe blackout areas following hurricane landfalls.



An image of Hurricane Isaac taken by Suomi NPP's VIIRS instrument.

Credit: NOAA

Each month of this 2015 calendar has more information about the capabilities and products of GOES-R and JPSS.

For more information, visit the GOES-R and JPSS web sites at www.goes-r.gov and www.jpss.noaa.gov.

For information for students, visit NOAA's SciJinks web site at scijinks.gov.

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