JPSS Products

VIIRS Flood Detection Map
Quick Guide

What is the VIIRS Flood Detection Map?

The VIIRS Flood Detection Map, which is called VIIRS NOAA&GMU Flood Version 1.0 (VNG Flood V1.0), is a satellite-based flood extent product derived from daytime Suomi-NPP/VIIRS imagery with solar zenith angles less than 85 degrees. Its spatial resolution is 375 meters. Flood extent is represented in floodwater fractions (water fraction means percentage of water extent in a VIIRS 375-m pixel).

What is the VIIRS Flood Detection Map algorithm?

VIIRS Flood Detection includes a series of algorithms: a water detection algorithm based on decision-tree approach, a geometry-based cloud shadow removal algorithm, an object-based terrain shadow removal algorithm, a minor flood detection based on change detection algorithm and a water fraction retrieval algorithm with dynamic nearest neighboring searching method. Floodwater is determined by comparing the detected water against a water reference map derived from MODIS global 250-m water mask (MOD44W) and water layer in the 30-m National Land Cover Dataset.

Which spectral bands make up the algorithm?

The spectral bands used in the algorithms are Suomi-NPP/VIIRS Imager bands 1 (600~680 nm), 2 (850~880 nm), 3 (1580~1640 nm) and 5 (1050~1240 nm) with 375-m nominal resolution and I-band terrain-corrected geolocation data (i.e. GITCO) including longitude, latitude, solar zenith angles, solar azimuth angles, sensor zenith angles and sensor azimuth angles.

Data latency of VIIRS Flood Detection Map data?

The VIIRS flood detection system is running routinely at SSEC/UW-Madison and GINA/UAF using direct broadcasting VIIRS data. VIIRS near real-time flood maps have about a 1-hour latency after VIIRS daytime overpasses are received. Generally, VIIRS flood maps are available around 13:30pm local time in the lower 48 states - more frequent coverage is achieved in Alaska.

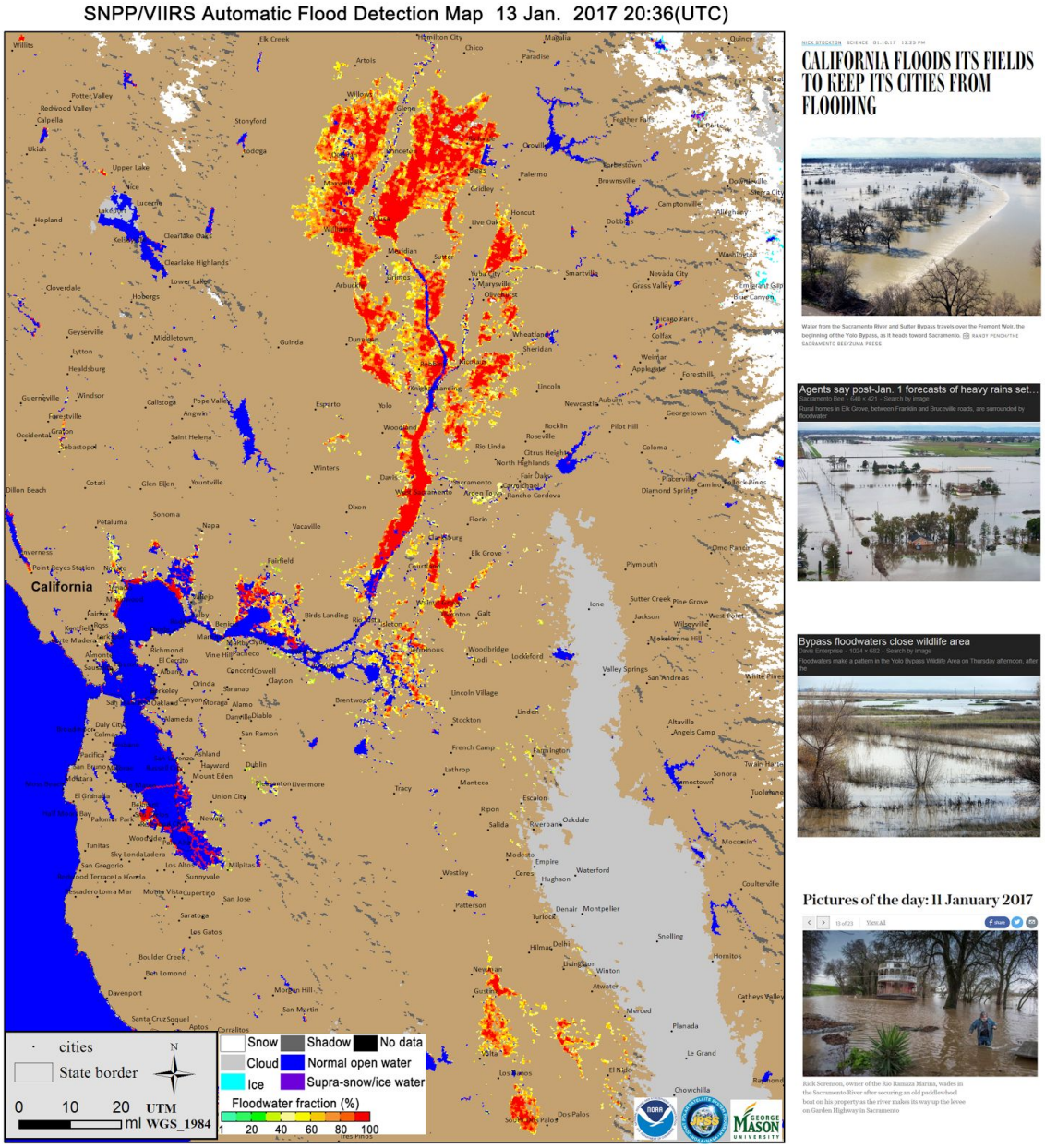
Available in AWIPS-II for National Weather Service Forecasters

Near real-time flood maps are distributed via the Unidata Local Data Manager (LDM) in AWIPS-II. The instruction document is here:
https://drive.google.com/open?id=1mEDFEXzIXCTEGXfb_coLGm2fkONdsPl9G0hj7xS2AYM
Please contact Jay Hoffman (jay.hoffman@ssec.wisc.edu) for any questions related to AWIPS-II.
Additionally, the latest 30-day flood maps are also available in SSEC's Real Earth:
CONUS: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-US
NERFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-NE
NCRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-NC
MBRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-MB

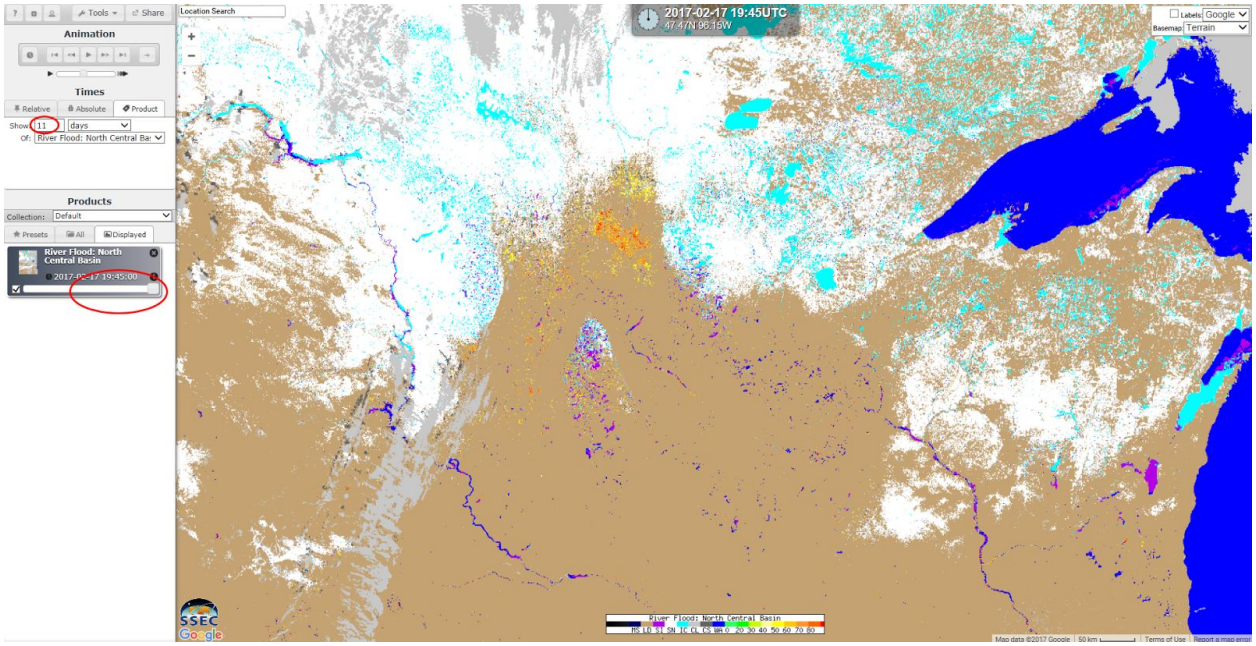
APRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-AP
WGRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-WG
SERFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-SE
NWRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-SE
CNRFC: http://realearth.ssec.wisc.edu/?products=RIVER-FLDall-SW

Examples of the VIIRS Flood Detection Map

There are eight pixel types in the VIIRS flood map: cloud (grey), snow cover (white), river/lake ice cover (cyan), shadows (dark grey), clear-sky land (brown), normal open water (blue), supra-snow/ice water or mixed ice & water (purple), and supra-veg/bare soil flooding water fractions (light cyan to red). Below are three examples of the VIIRS Flood Maps.



An example of VIIRS flood map (left) and pictures (right) of flooding in Northern California.

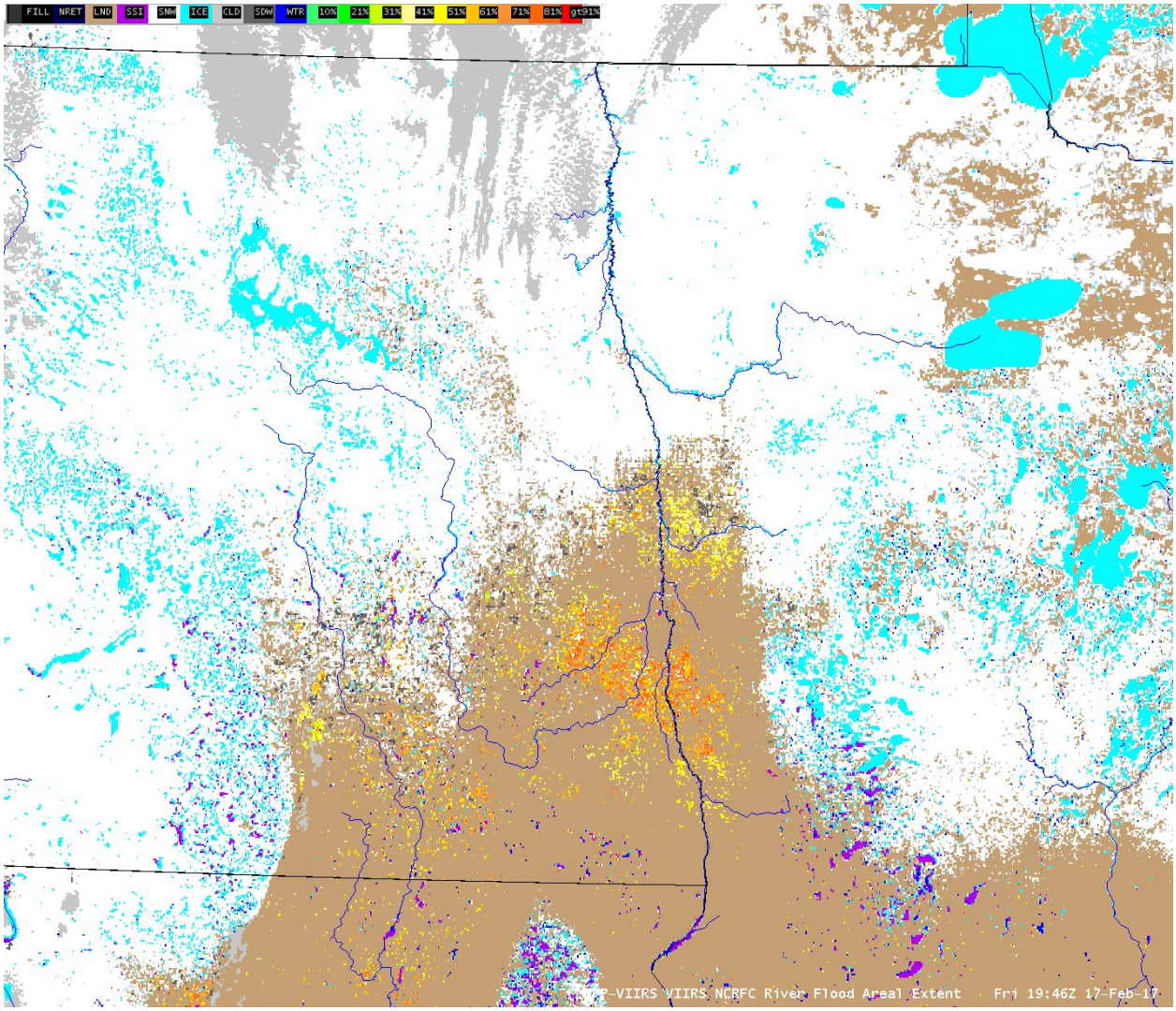


An example of VIIRS Flood map over North Central Region in Real Earth.

Legends of VIIRS flood maps in Real Earth:

MS: missing data (transparent)
LD: clear-sky land (brown)
SI: supra-snow/ice water or mixed ice&water (purple)
SN: snow cover(white)
IC: river/lake ice cover (cyan)
CL: cloud cover (grey)
CS: cloud shadow and terrain shadow (dark grey)
WA: open water (blue)
0-100: floodwater fractions (light cyan to red)

In Real Earth, from the control panel on the left, the transparency of VIIRS flood maps can be changed to derive the geographic information (as shown in the larger red circle in the above image), and the latest 30-day maps can be retrieved by changing the number of the days from the current date (as shown in the smaller red circle in the above image).



An example of VIIRS flood map of the Dakotas and Minnesota in AWIPS-II.

Legends of VIIRS flood maps in AWIPS-II:
FILL: missing data (transparent)
NERT: water without water fraction retrieval (dark blue)
LND: clear-sky land (brown)
SSI: supra-snow/ice water or mixed ice&water (purple)
SNW: snow cover(white)
ICE: river/lake ice cover (cyan)
CLD: cloud cover (grey)
SDW: cloud shadow and terrain shadow (dark grey)
WTR: open water (blue)
0-100: floodwater fractions (light cyan to red)

VIIRS Flood Product Testimonial

"The VIIRS River Flood Product has proven a valuable source of information at the North Central River Forecast Center over the past three years. It has repeatedly demonstrated its ability to depict areas of active snow melt and associated ponding of surface water, especially in remote areas with few observational datasets. This allows river forecasters to more accurately monitor the physical processes that determine how much water is retained over the land surface as opposed to running off in the river channels. It also is an indicator of how much water is infiltrating into the soil in regions where frozen ground is a factor. In addition to its original intended application in the northern plains, we've found it can also be valuable in other regions to monitor levee conditions during major floods across the midwest. We've actually been able to identify inundated areas behind breached levees that were previously undetected during ongoing flood events. This additional source of detailed geospatial intelligence has provided our forecasters with information needed to improve our model simulations, and subsequently provide more accurate and timely forecasts for stakeholders in flood planning and mitigation activities."

~ Mike DeWeese, DOH, NCRFC, Minneapolis, MN

Supplemental Information and Links

Some references related to VIIRS flood detection:

1. SanmeiLi, DonglianSun, Mitchell Goldberg & Bill Sjoberg (2015). Object-based automatic terrain shadow removal from SNPP/VIIRS flood maps, International Journal of Remote Sensing, Vol. 36, No. 21, 5504–5522
2. SanmeiLi, DonglianSun, Mitchell Goldberg & Antony Stefanidis (2013). Derivation of 30-m-resolution Water Maps from TERRA/MODIS and SRTM. Remote Sensing of Environment 134 (2013) 417–430
3. SanmeiLi, DonglianSun, YunyueYu, Ivan Csiszar, Antony Stefanidis, & Mitch D. Goldberg (2012). A New Shortwave Infrared (SWIR) Method for Quantitative Water Fraction Derivation and Evaluation with EOS/MODIS and Landsat/TM data. IEEE Transactions on Geoscience and Remote Sensing, Vol. 51, Issue 3
4. Sanmei Li, Donglian Sun & Yunyue Yu (2013). Automatic cloud-shadow removal from flood/standing water maps using MSG/SEVIRI imagery, International Journal of Remote Sensing, 34:15, 5487-5502
5. DonglianSun, YunyueYu, RuiZhang, SanmeiLi, and Mitchel D. Goldberg (2012). Towards Operational Automatic Flood Detection Using EOS/MODIS data. Photogrammetric Engineering & Remote Sensing, 78 (6)

Contact information

For any questions about flood product, please contact the JPSS Program Office and CIRA/CSU:
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