CSPP VIIRS Flood Detection

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A Flood Detection Product That You Can Produce Yourself!

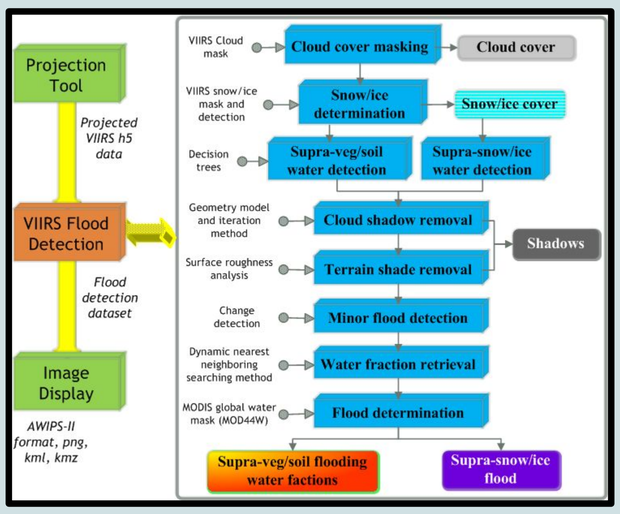
Why Floods?

- Floods are the most frequent natural disasters around the globe.
- They have caused more loss of life and property in the USA than any other kind of natural disaster.
- Detecting, monitoring, and mitigating flooding is a challenge that requires a large network of river gauges, human observations, and other data points.
- **Satellite data - and VIIRS in particular - is uniquely suited to fill in the gaps.**
- Global, daily daylight passes allow many more chances for cloud-free observations in remote areas.
- With the new 375 meter SVI bands VIIRS is capable of detecting medium and larger river flooding events.

Sunken cars near 12th Ave and M Street in Cedar Rapids during the Iowa Flood of 2008. Photography credit Don Becker, USGS.

The CSPP VIIRS Flood Detection Package

- Available soon as a package from CSPP.
- All of the complexity in the diagram on the right reduced to a single command-line call.
- All dependencies included as our users have come to expect.
- Requires the SVI bands & accompanying GITCO geolocation created by CSPP SDR as input.
- Writes a single, gridded HDF4 file as output.
- Also includes an optional script to convert the output to a basic GeoTIFF image.
- Direct broadcast lets individual stations create this product and disseminate it to their local flood managers ASAP.

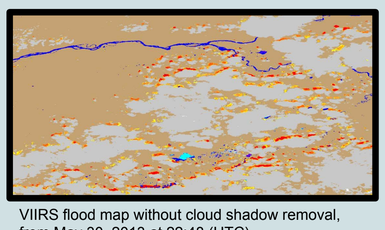


Principles, Some Challenges, & Solutions

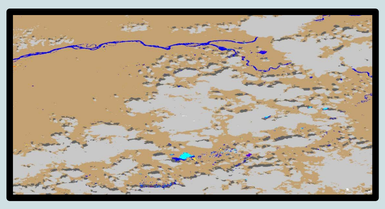
- Without contamination from sun glint, open water surface has higher reflectance in visible (VIS) (VIS) than in near-infrared (NIR) and short-wave infrared (SWIR) channels.
- The reflectance of a water surface changes with suspended matter content: clean < moderate turbid < turbid < severe turbid.
- Most flood water is a mixture of open water and other land types such as vegetation, soil, or snow & ice.

- **Cloud shadow** is the biggest challenge for automatic near real-time flood detection using optical satellite imagery.
- Cloud shadows share spectral similarity to flood water, and thus it is unable to be removed based on spectral features.
- The algorithm uses post cloud shadow removal from water pixels based on a geometry-based method (Li. et al., 2013), using the geometric relationship between cloud and cloud shadows over a spherical surface, and an iteration method is applied to decrease uncertainty of cloud heights.

- **Terrain shadow** is the second biggest challenge, and is also spectrally similar to flood water.
- Terrain shadows are formed in mountainous areas with large surface roughness, while flood water accumulates in low-lying areas with small surface roughness.
- The software uses an object-based method (Li. et al., 2015) instead of a pixel-based method to remove these terrain shadows from the flood maps.



VIIRS flood map without cloud shadow removal, from May 30, 2013 at 22:48 (UTC)



VIIRS flood map after cloud shadow removal, from May 30, 2013 at 22:48 (UTC)

What is CSPP?

The Community Satellite Processing Package (CSPP) supports the Direct Broadcast (DB) meteorological and environmental satellite community through the packaging and distribution of open source science software, like CLAVR-x. All of the software we release is provided over the internet and available for free to the user, which also makes it a great resource for students, educators, atmospheric scientists, and others to learn about and utilize some of the latest advancements in meteorological and environmental science.

CSPP is funded through NOAA JPSS.

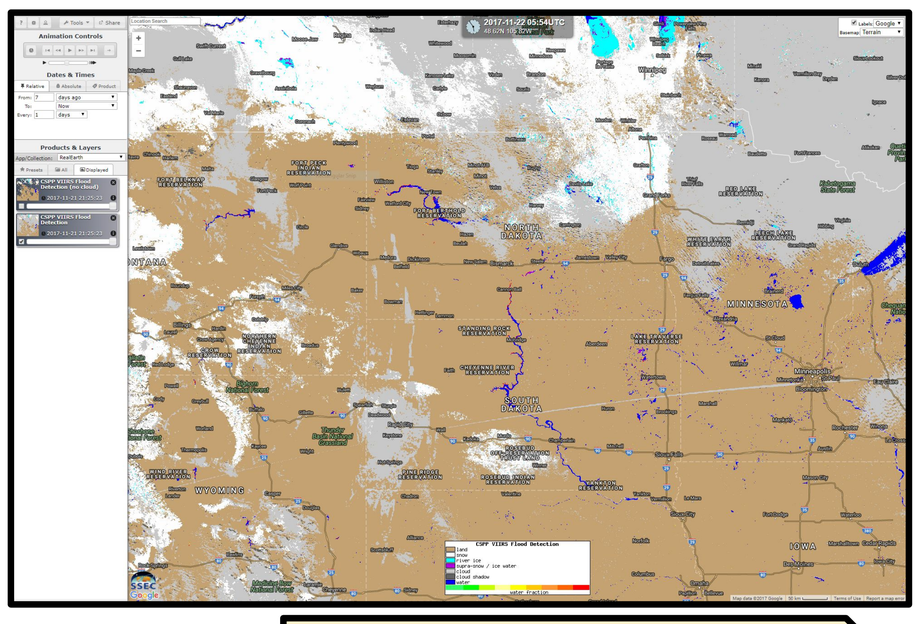
http://cimss.ssec.wisc.edu/cspp/

A JPSS Proving Ground & Risk Reduction Initiative

- The Proving Ground & Risk Reduction (PGRR) Program was established in early 2012, following the launch of the Suomi National Polar Partnership (SNPP) satellite.
- The primary objective is to maximize the benefits and performance of S-NPP/JPSS data, algorithms, and products for downstream operational and research users
- The River Ice and Flooding Initiative was the first attempt at this new partnership and it was established in response to Galena, AK flooding in May 2013.
- The Initiative included River Ice and River Flooding Project teams, direct broadcast SMEs, and National Weather Service River Forecast Center forecasters. Based on feedback from RFCs the VIIRS River Ice and River Flood products were changed to improve their operational value.

RealEarth

- RealEarth is a collaboration and outreach tool developed at UW-Madison SSEC/CIMSS, with a particular emphasis on visualizing and sharing real-time satellite data.
- It is a available for free as a virtual machine that can be run on commodity hardware, or users can view SSEC's own constellation at http://realearth.ssec.wisc.edu.
- SSEC/CIMSS supports a Google maps interface, standard WMS, WCS, & WTS requests to interface with scripts and GIS tools, a RealEarth mobile app on iOS and Android, and JPSS & GOES-R tailored apps.
- It has been a crucial tool for putting the VIIRS River Ice and River Flood products in front of river forecast centers and gathering feedback, and these products are all available to the public as well.



See current, DB-produced products: https://re.ssec.wisc.edu/s/4F6Qo

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