NASA DIRECT READOUT CONFERENCE (NDRC) WEBINAR

April 1, 2020

MINUTES

Purpose/Objectives of the NDRC Webinar Series
At 11:00 a.m. Brad Quayle (USDA FS GTAC) convened the NASA Direct Readout Conference (NDRC) Webinar. He reviewed the purpose of the NDRC, activities to date, and objectives going forward. This webinar agenda featured Dan Slayback's (NASA/GSFC) presentation, "Global Near Real-Time MODIS-based Flood Mapping - Upcoming Improvements and Transition to LANCE."

Mr. Quayle's presentation, including webinar wrap-up slides, is available here:
https://directreadout.sci.gsfc.nasa.gov/links/rsd_eosdb/PDF/NDRC_Webinar_Series_20200401 - Quayle.pptx

Global Near Real-Time MODIS-based Flood Mapping - Upcoming Improvements and Transition to LANCE. Flooding is the most destructive, frequent, and costly natural disaster faced by modern society, and is expected to increase in frequency and damage with climate change, sea-level rise, and population growth. Every year new record floods are widely reported; the unusual is becoming the normal. The toll of these events, in financial costs, displacement of individuals, and deaths, is substantial and continues to rise as climate change generates more extreme weather events.

The disaster management community requires frequently updated and easily accessible information to better understand the extent of flooding and better coordinate response efforts. With funding from various NASA programs over the past decade, we have developed and operated the Near Real-Time Global Flood Mapping System (https://floodmap.modaps.eosdis.nasa.gov). The system applies a water detection algorithm to low latency MODIS imagery provided by NASA LANCE and outputs critical flood extent information for global events. Using imagery from both the Terra and Aqua platforms allows an initial daily assessment of flooding extent by late afternoon, and more robust assessments after accumulating cloud-free imagery over 2 or 3 days. Cloud cover is the primary limitation in detecting surface water from MODIS imagery, by both obscuring the surface, and false positives due to cloud shadows . Other issues include the relatively coarse scale of the MODIS imagery, the difficulty of detecting flood waters in areas with continuous canopy cover, confusion of terrain shadows with water, and accurately identifying detected water as flood as opposed to normal water extents.

The Near Real-Time Global Flood Mapping System is currently transitioning from a PI-managed system at Goddard to LANCE-MODIS and includes optimization and improvements to several elements of the system. Anticipated results include lower-latency products, improved removal of false-positives, and an assessment of whether reported flood is "regular" (e.g., recurring due to normal annual hydrological cycles), or unusual (e.g., likely of most concern as a disaster). The LANCE integration will also leverage the ESDIS Worldview interface to visualize Global Flood Mapping System products for current and previous flood events in the context of other NASA EOS science data.

Question and Answer Session with Mr. Slayback

Q: Very nice presentation Dan! I have a question regarding the Height Above Nearest Drainage (HAND) mask method. This looks at height above drainage, and every flood above a certain value will be deleted. By doing so, don't you remove pluvial flooding (so rain induced flooding)?

A: We need to look at this a little more closely before we implement later this year. In theory if water is sticking around long enough that it would be captured with MODIS twice daily observations, it is probably not going to be masked out by HAND. Personally I prefer to improve the terrain shadow masking. This may be solvable within the LANCE and MODAPS production systems.

Q: What version of the Shuttle Radar Topography Mission (SRTM) data set are you using for the HAND method? Have you considered using the Multi-Error-Improved Terrain (MERIT) - SRTM processed by Dai Yamasaki (if you don't already use this)?

A: We tried a couple of different Digital Elevation Models (DEMs). The original HAND DEM is a couple of years old. It was the latest version then, and is likely based on the original version of the SRTM dataset. It is worth looking at currently available DEM datasets now that are updated/newer. We looked at HydroSHEDS datasets as well, but those were increasingly out of date.

Q: What percentage of the 250m pixel has to be covered for it to register as being flooded?

A: That is a difficult question to answer. It really depends upon what the heterogeneity/homogeneity of land cover is (and spectral response) for the pixel. For example, the product fails in urban areas because of so many bright objects, like roofs in a city.

Q: What are the thoughts/potential plans on the use of active sensor remote sensing data such as Synthetic Aperture Radar (SAR) for mapping flooding?

A: It is more complicated when using SAR data for flood analysis, as a "dry" scene and "wet" scene are needed to accurately conduct change detection analysis. We need to consider available data sources [e.g., Sentinel-1, RADARSAT, and the NASA-ISRO SAR Mission (NISAR)]. NASA is working with the Indian Space Research Organisation (ISRO) to launch the NISAR in a couple of years. We would need an NRT radar data product, which would be challenging among currently available sources, plus cost for commercial sources (RADARSAT). So there is a higher barrier to getting data, and it is generally not going to be daily, due to tasking requirements to acquire data for areas of interest.. It can be quite valuable if you have the SAR data and a dry scene for comparison.

Q: What are the noticeable effects of MODIS view angle/Bidirectional Reflectance Distribution Function (BRDF) on flood detection?

A: Yes, there are effects, but we have not specifically looked at those to address them. In the far north in winter where sun and view angles get low, you can get some false positive detections, but I think we screen most of those out now. Another issue is that it is not always 250m, it can be potentially larger if the look angle is high on the edge of the swath scan. This is not really an angular effect, but you can also get specular reflectance off of water bodies. These are things we would like to work on, as they are improvable with some effort.

Q: Have you thought about dilating/expanding the terrain shadow mask a few pixels? It looks like most of the false positives it currently misses are right on the edge.
A: We may already do this as part of our methodology, I know we have looked into it, and we are doing a lot of it with our cloud shadow mask. I need to verify that. Cloud shadows are really difficult, and I would like to focus on terrain shadow improvements.

Q: Are there thoughts/plans on the future integration and use of other moderate resolution optical remote sensing assets such as S-NPP/JPSS-1 VIIRS, or the Sentinel-3 Ocean and Land Colour Instrument (OLCI) to map flood areas?
A: Yes. We want to make the product operational before asking for funds to improve it. Incorporation of VIIRS should not be too difficult, and in 5 years perhaps we would only use VIIRS, as Aqua and Terra are getting old. We need to study the incorporation of VIIRS more closely.

Q: Does your application provide response for specific disaster events in coordination with the NASA Disasters program?
A: Our partners Bob Brackenridge and Al Kettner at the Dartmouth Flood Observatory often coordinate with the NASA Earth Science Disasters program to provide custom/tailored, best-available flood maps for particular events.

Q: Is there an interest in using crowd sourcing information to get feedback on the performance of the application/products and to support validation efforts?
A: Yes, we would like to use crowd source information if we can equip ourselves to do that in the future. Presently we are happy to receive all feedback from users via email. If you see that the product does not work well in a particular case, please let me know, especially if you compare the product to clear MODIS imagery and you believe there is an issue.

Q: Is the recurring flood product static or is it recomputed on a regular basis? I am very interested in the product.
A: The recurring flood product will not be a product that is available initially in LANCE. However, once integrated, it will be updated on an annual basis.

Q: There are other MODIS flood maps out there, like the Joint Research Centre (JRC) product and US Geological Survey (USGS) product. Have you compared your product with those?
A: Not lately, but we do want to look at those. I did look at the JRC map in the past, but I thought that was more of a static than an operational product.

Mr. Slayback's presentation is available here:
https://directreadout.sci.gsfc.nasa.gov/links/rsd_eosdb/PDF/Slayback_MODISFloodMapping_NDRC_01April2020_v5-31Mar2020.pdf

Meeting Wrap-up
Mr. Quayle thanked Mr. Slayback for his presentation, as well as Webinar participants for all of their great questions. Mr. Quayle also thanked the DRL for providing logistics support. Mr. Quayle stressed the value of participant feedback as we evaluate future software technologies and algorithms, and prioritize resources accordingly to meet the needs of the global user community. He invited participants to submit feedback and suggestions for future webinar topics via email to NDRC organizing committee members (refer to Mr. Quayle's presentation for addresses). Mr. Quayle adjourned the webinar at 12:20 p.m.

Next Webinar
The next webinar is planned for July 1, 2020. Additional details will be provided via the Direct Broadcast Users email alias.