



National Aeronautics and  
Space Administration



# ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

 @NASAARSET

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## Overview of Flood Monitoring and Mapping Tools

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Amita Mehta

# Learning Objectives

By the end of this presentation, you will be able to:

- Understand flood monitoring schemes
  - based on remote sensing of precipitation observations
  - based on remote sensing of land surface observations
- Use precipitation-based flood tools to monitor
  - flood potential based on accumulated precipitation
  - streamflow, runoff, flood intensity, and flood extent
- Use land surface-based flood tools to monitor
  - Inundation maps
  - media reports
  - a flood-related disaster alert system

# Remote Sensing-Based Flood Detection

<http://arset.gsfc.nasa.gov/disasters/webinars/advfloodwebinar>

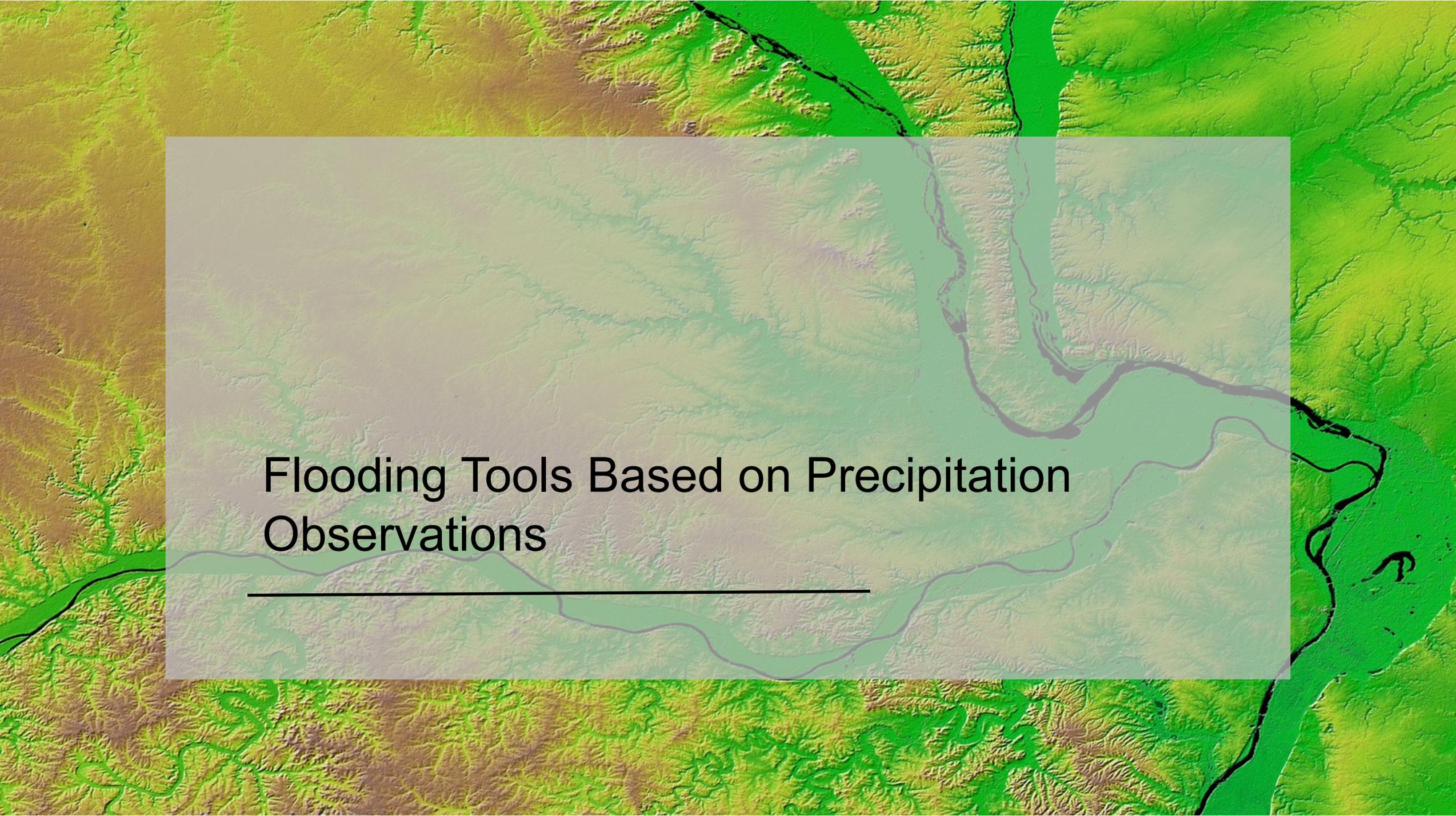
There are three approaches to using remote sensing observations for flood monitoring:

1. Hydrology models that derive streamflow and runoff, using precipitation and weather data from satellites and models
2. Infer flooding conditions using satellite-derived precipitation
3. Detect flood water on previously dry land surfaces using satellite-derived land cover observations

Note: Each flooding tool also uses model and/or surface-based data in addition to satellite data

# Outline

- Flooding Tools Based on Precipitation Observations
  - Global Flood Monitoring System (GFMS)
  - Extreme Rainfall Detection System-2 (ERDS2)
- Flooding Tools Based on Land Cover Observations
  - MODIS Near Real-Time (NRT) Flood Mapping
  - Dartmouth Flood Observatory (DFO, DFO River Watch)
  - Global Flood Detection System 2 (GFDS2)
- Global Disasters Alert and Coordination System (GDACS)
- Demonstration of GFMS, ERDS2 (before and during flooding events)
- Demonstration of MODIS-NRT, DFO, GDACS (during and after flooding events)

A topographic map of a river basin, showing a network of rivers and tributaries. The map uses a color gradient from green (low elevation) to brown (high elevation) to represent terrain. A semi-transparent white rectangular box is overlaid on the map, containing the title text. The river network is clearly visible, with a main river channel and several smaller tributaries. The text is centered within the box and is in a large, black, sans-serif font. A horizontal line is positioned below the text, extending across most of the width of the box.

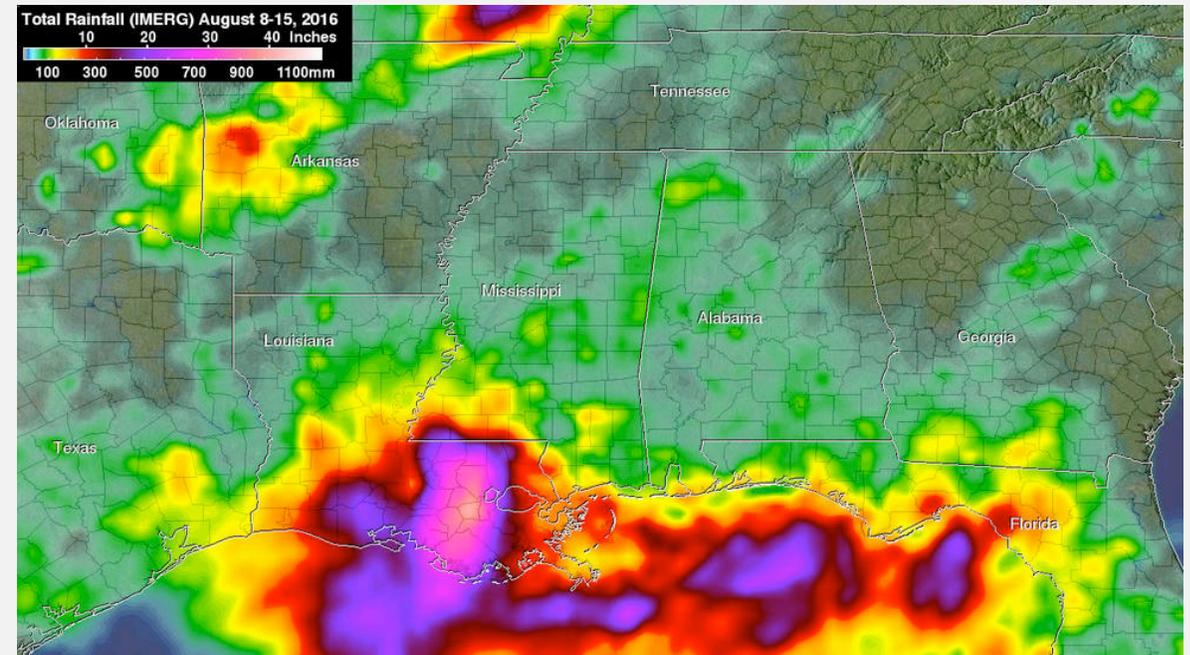
# Flooding Tools Based on Precipitation Observations

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# Precipitation-Based Flood Tools

- GFMS and ERDS2 use TRMM Multi-satellite Precipitation Analysis (TMPA) data
- GFMS is currently transitioning to using GPM-IMERG data

## Record-Setting Rain Cause Deadly Louisiana Flooding August 8-15, 2016



# TRMM Multi-satellite Precipitation Analysis (TMPA)

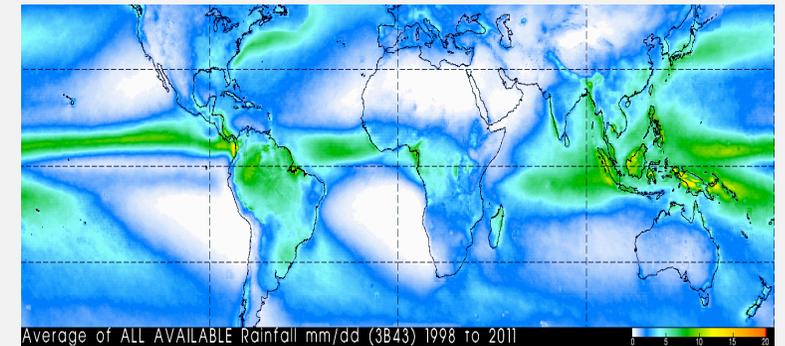
<http://trmm.gsfc.nasa.gov/>

- Combines precipitation from TRMM and several national/international satellites to obtain 3-hourly  $0.25^{\circ} \times 0.25^{\circ}$  resolution data with **global coverage between  $50^{\circ}\text{S}$  to  $50^{\circ}\text{N}$**
- Data are available since December 1997
- TMPA will be replaced with Integrated Multi-Satellite Retrievals for Global Precipitation Measurement (GPM) [IMERG] data with half-hourly  $0.1^{\circ} \times 0.1^{\circ}$  resolution data with **global coverage between  $65^{\circ}\text{S}$  to  $65^{\circ}\text{N}$**

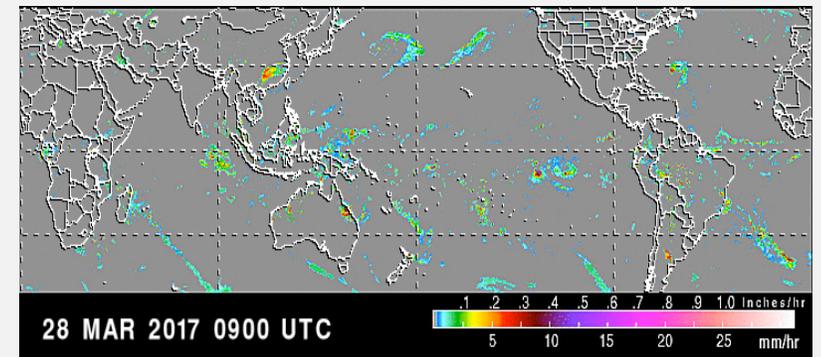
Note: TRMM is no longer flying, but TRMM-based calibration is used to provide near real-time rainfall from a constellation of national & international satellites for flooding applications. Near real-time IMERG data are available from:

<ftp://jsimpson.pps.eosdis.nasa.gov>

## TRMM Climatology



## TRMM 3-Hourly Precipitation

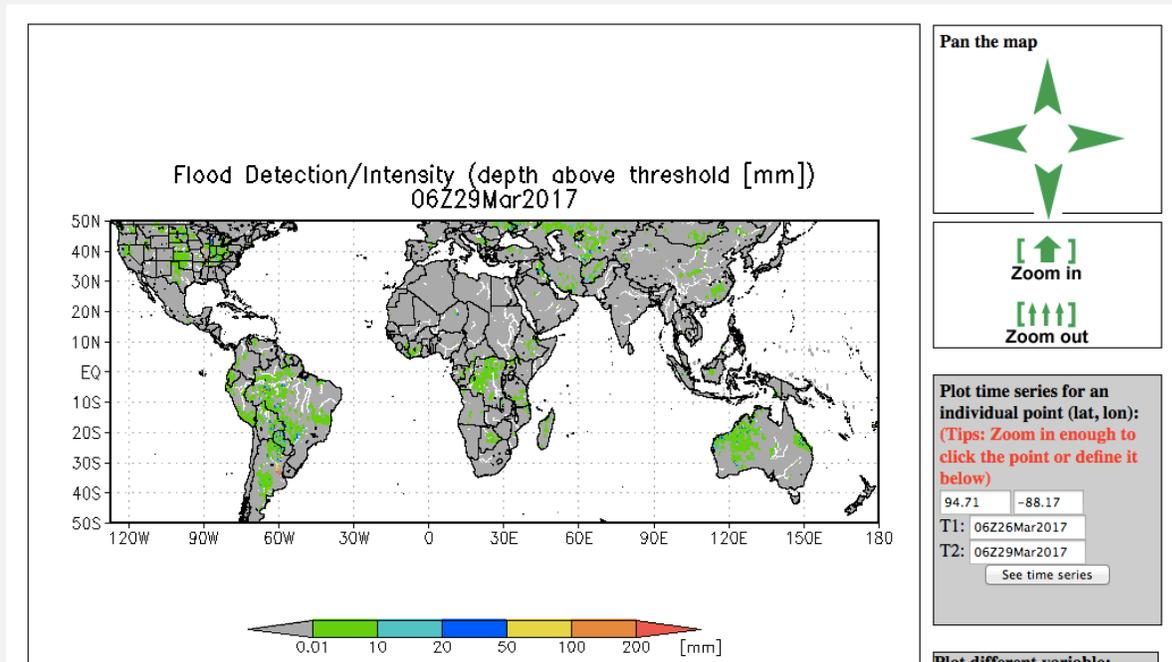


# Global Flood Monitoring System (GFMS)

<http://flood.umd.edu/>

- Provides global maps, time series, and animations (50°S-50°N) of:
  - instantaneous rain rate every 3 hrs
  - accumulated rain over 24, 72, and 168 hrs
  - streamflow rates and flood intensity at 1/8th degree (~12 km) and 1 km
  - Near real-time and archives since 2013

## Interactive Features



Note: TRMM is no longer flying, but TRMM-based calibration is used to provide near real-time rainfall from a constellation of national & international satellites for flooding applications. Near real-time IMERG data are available from: <ftp://jsimpson.pps.eosdis.nasa.gov>

# GFMS

<http://flood.umd.edu/>

- USES a hydrological model together with:
  - TMPA
  - surface temperature and winds from NASA reanalysis model, Modern Era Retrospective Analysis for Research and Applications (MERRA)
  - runoff generation from UW Variable Infiltration Capacity (VIC) model
  - Runoff routing model from UMD

## References:

Wu, H., R. F. Adler, Y. Tian, G. J. Huffman, H. Li, and J. Wang (2014), Real-time global flood estimation using satellite-based precipitation and a coupled land surface and routing model, *Water Resour. Res.*, 50, 2693-2717, doi:10.1002/2013WR014710.

Wu, H., R. F. Adler, Y. Hong, Y. Tian, and F. Policelli (2012), Evaluation of Global Flood Detection Using Satellite-Based Rainfall and a Hydrologic Model. *J. Hydrometeorol.*, 13, 1268-1284

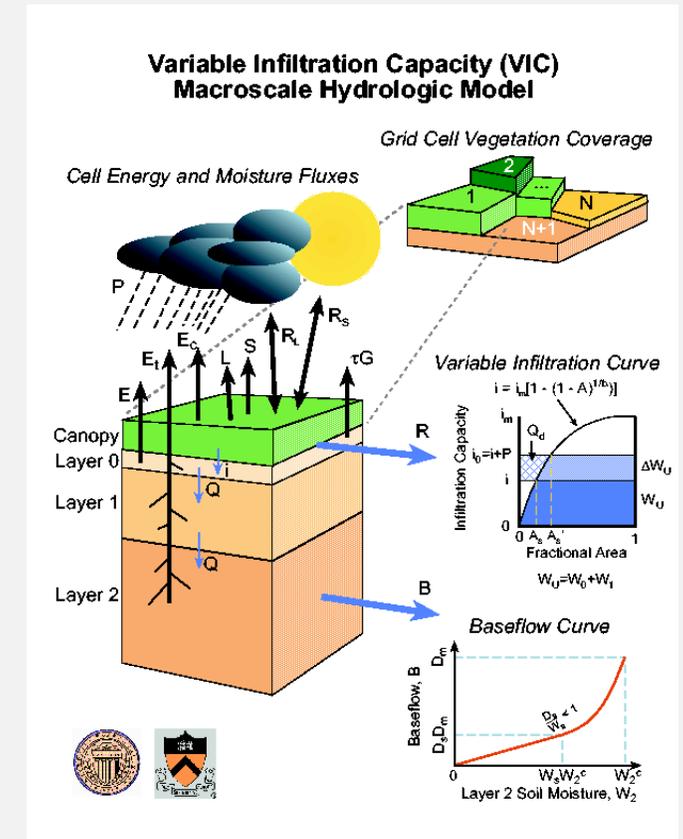
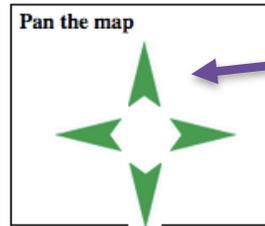
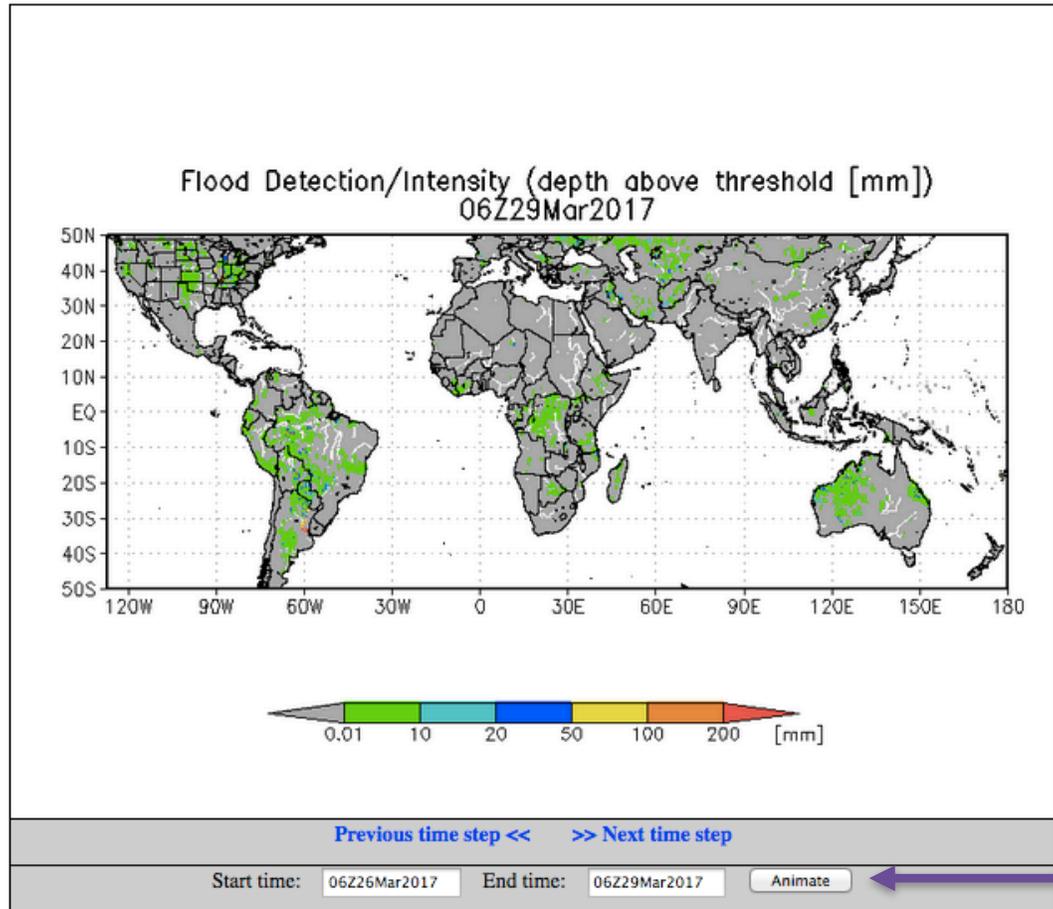


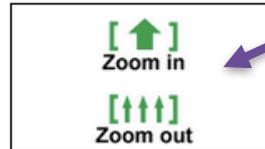
Image Credit: University of Washington VIC Macroscale Hydrologic Model  
<http://www.hydro.washington.edu/Lettenmaier/Models/VIC/Overview/ModelOverview.shtml>

# GFMS

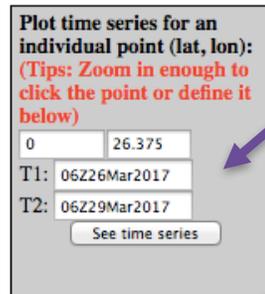
<http://flood.umd.edu/>



Map Navigation

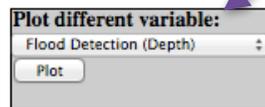


Zoom in/out



Select individual grid point for time series data

Plot different variables



3-hourly output



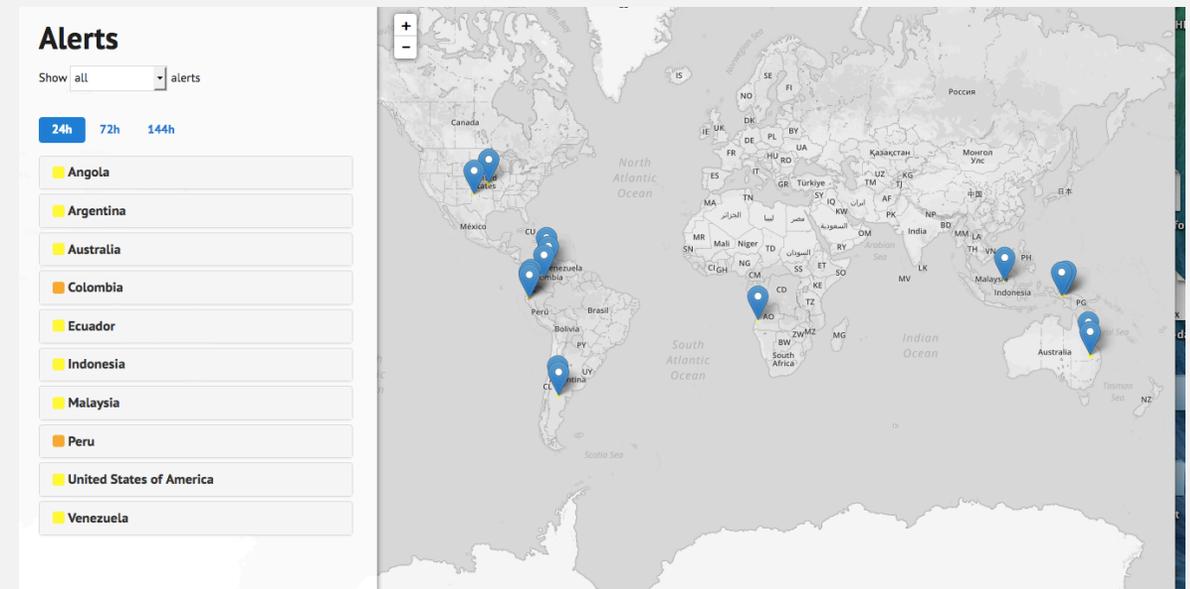
Animation

# Extreme Rainfall Detection System-2 (ERDS2)

<http://erds.ithacaweb.org/>

- Uses near real-time TRMM-TMPA and NOAA-Global Forecasting System (GFS) rainfall for monitoring and forecasting accumulated rainfall
- The TMPA historical archive is used as reference data to calculate extreme rainfall thresholds
- The combination of TMPA rainfall amount, GFS forecasted rainfall information, and the reference data, generates flooding information

- ERDS is one of the tools used by the UN World Food Programme (WFP) Emergency Preparedness Unit



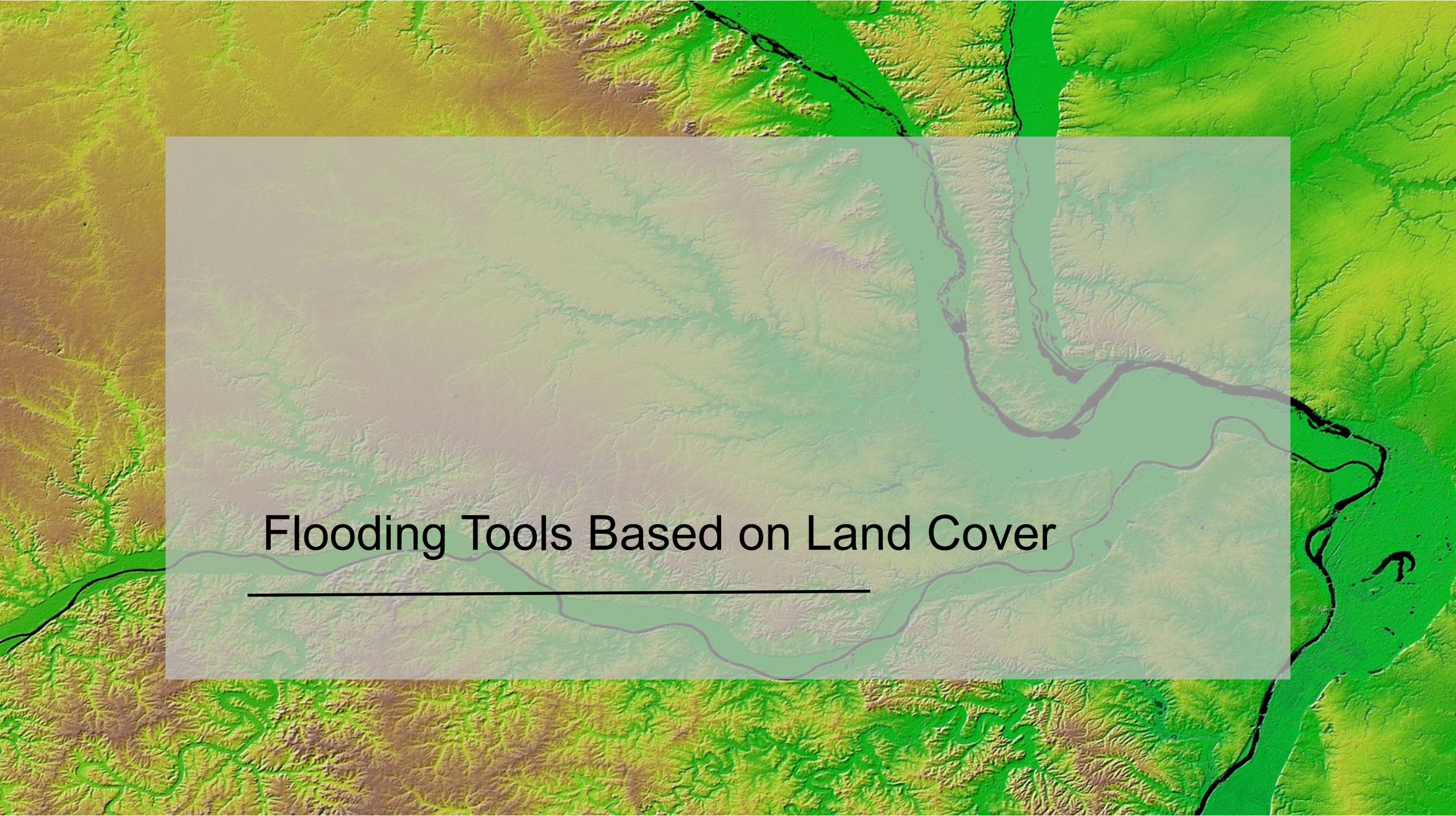
# Extreme Rainfall Detection System-2 (ERDS2)

<http://erds.ithacaweb.org/>

- Global maps and time series of near real-time (50°S-50°N) and forecasted accumulated rainfall
  - 24, 48, 72, 96, 120, and 144 hours
- Extreme rainfall alerts at 0.25°x0.25° levels and administrative district levels
- Event-specific information
  - list of affected countries
  - an estimation of affected population

## Value-Added Flood Information



A topographic map showing a river system with a semi-transparent rectangular overlay box in the center. The map uses a color gradient from brown (high elevation) to green (low elevation). The river is shown as a dark line winding through the landscape. The text 'Flooding Tools Based on Land Cover' is centered within the overlay box, with a horizontal line underneath it.

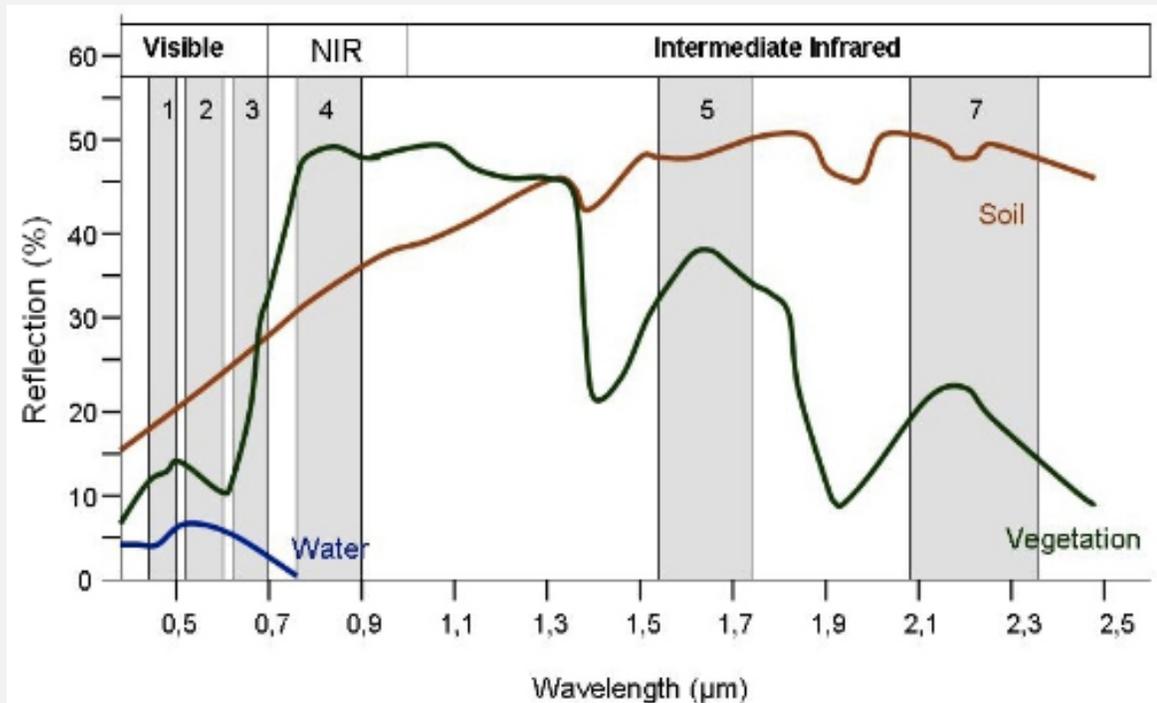
# Flooding Tools Based on Land Cover

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# Land Cover Based Flooding Tools

## Visible Radiation

- Reflected by the surface and depends on the surface type



## Used for Flood Mapping

- Source:
  - Terra/Aqua MODerate Resolution Imaging Spectroradiometer (MODIS) reflectance changes
- Tools:
  - MODIS NRT Flood Mapping
  - Dartmouth Flood Observatory

# Land Cover Based Flooding Tools

## Microwave Radiation

- Emitted by the surface and is influenced by the presence of water on the surface
- Sources:
  - Microwave (37 GHz) brightness temperatures from TRMM Microwave Imager (TMI)
  - GPM Microwave Imager (GMI)
  - GCOM-W based Advanced Microwave Scanning Radiometer 2 (AMSR2)
- Tools:
  - GFDS2 (GDACS)
  - DFO River Watch

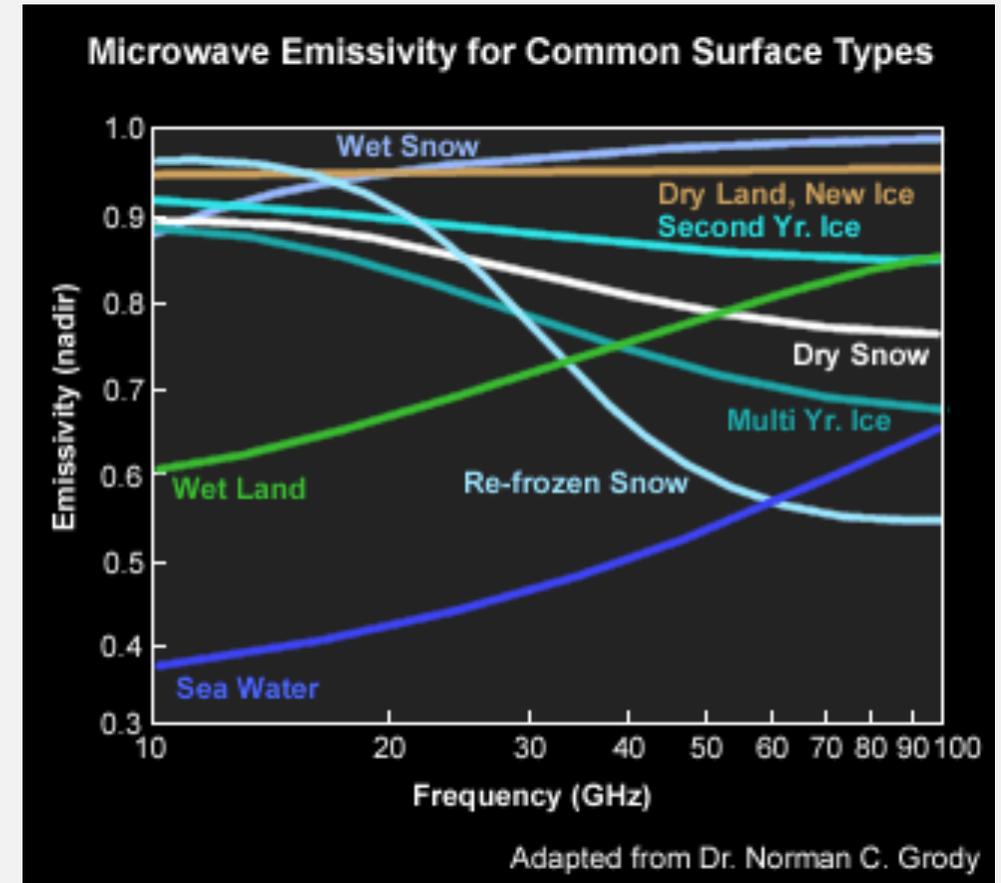
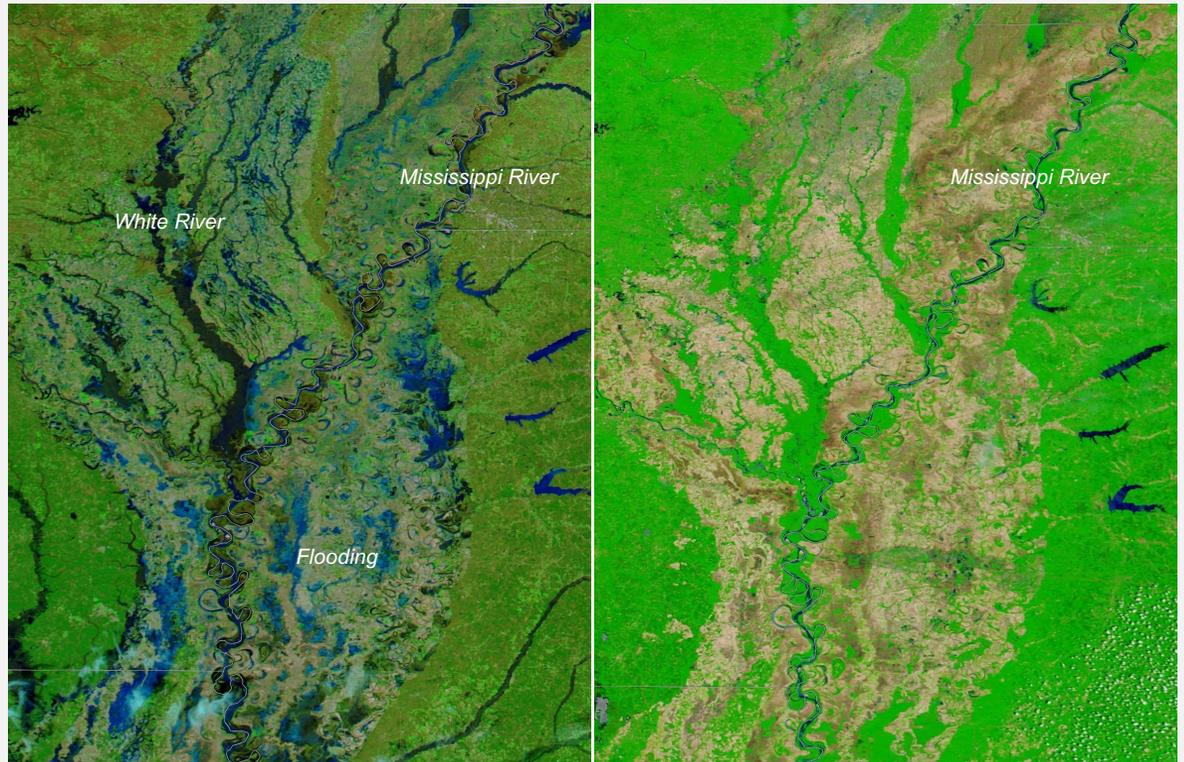


Image Source: [COMET MetEd](#)

# MODIS-Based Inundation Mapping

- MODIS provides observations 1-2 times per day
- Certain bands indicate water on previously dry surfaces:
  - Band 1: 620-670 nm
  - Band 2: 841-876 nm
  - Band 7: 2105-2155 nm
- Mapped with respect to a global reference database of water bodies
- MODIS cannot see the surface in the presence of clouds

## Mississippi River Flooding 2016



MODIS (Aqua)  
Mar 15, 2016

MODIS (Terra)  
May 13, 2016

# MODIS NRT Global Flood Mapping

<http://oas.gsfc.nasa.gov/>

- Based on MODIS reflectance at 250 m resolution composited on 2, 3, and 14 days
- Flood maps available on 10°x10° tile
- Permanent and surface flood water data available
- Cloud or terrain shadows can be misinterpreted as surface water
- Provides near real-time flood mapping since Jan 2013

NRT Global Flood Mapping

Data Viewer  
Product Description  
Documents  
Future Enhancements  
News/Status

Mailing list  
To subscribe to our mailing list to receive email notification of updates, please, click here.

Global Map  
Click for ArcGIS Portal map interface

10° Flood Map Tile Production

For more information, please contact floodmap at lists.nasa.gov  
**NOTE: THIS IS AN EXPERIMENTAL PRODUCT AND SYSTEM**

News/Status  
11-Nov-2014: ArcGIS Online Map available.  
10-Nov-2014: MODIS flood product evaluation report available.  
> Go to News/Status page

NASA Official: Frederick Policelli  
Page Last Updated: January 13, 2015  
Privacy Policy & Important Notices  
Contact Us

# MODIS NRT Global Flood Mapping: Available Quantities

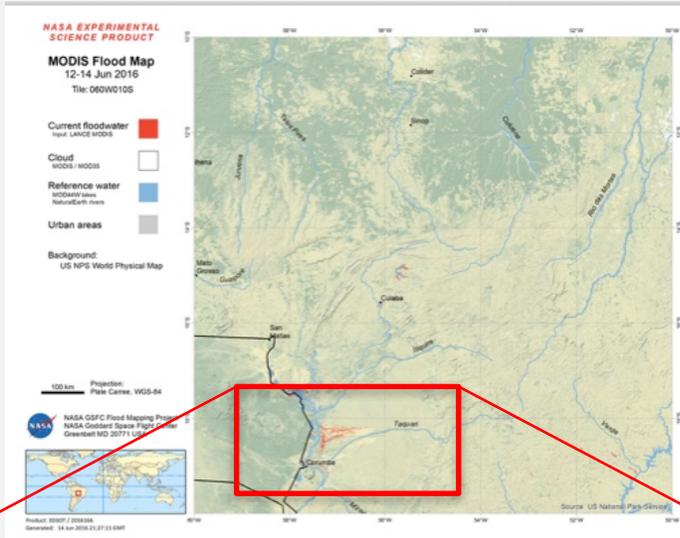
<http://oas.gsfc.nasa.gov/>

Products		Available Downloads	
MODIS Flood Map	MFM	png	
MODIS Flood Water	MFW	shapefile (.zip)	KMZ
MODIS Surface Water	MSW	shapefile (.zip)	KMZ
MODIS Water Product	MWP	geotiff	
README		pdf	txt

# MODIS Flood Mapping: Southern Brazil, June 12-14, 2016

<http://oas.gsfc.nasa.gov/>

## 3-Day Composites



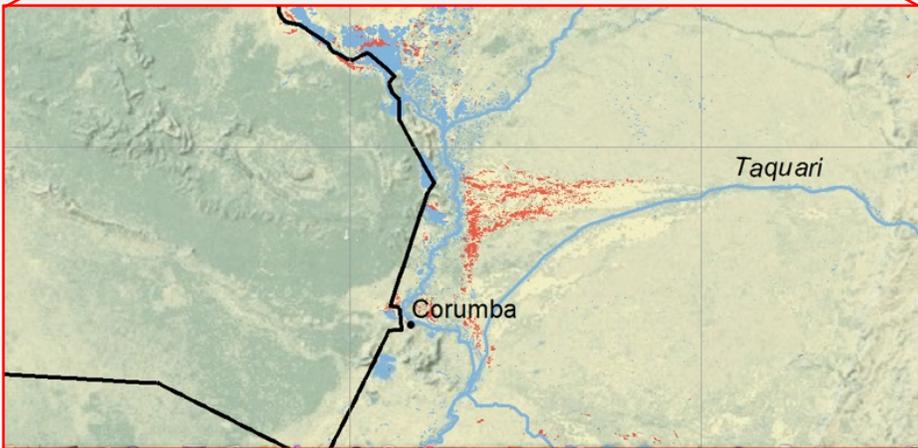
3 Day Composite | 2 Day Composite | 1 Day Composite | 14 Day Composite

<< June 2016 >>

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		

Products	Available Downloads	
MODIS Flood Map	MFM	<a href="#">png</a>
MODIS Flood Water	MFW	<a href="#">shapefile (.zip)</a>   <a href="#">KMZ</a>
MODIS Surface Water	MSW	<a href="#">shapefile (.zip)</a>   <a href="#">KMZ</a>
MODIS Water Product	MWP	<a href="#">geotiff</a>
README	<a href="#">pdf</a>	<a href="#">txt</a>

Check slide show for the last 10 days.



## Filename Convention

product\_date\_tile\_composite\_xtra.ext

MSW\_2012009\_020E000S\_3D30\_V.shp

MFM\_2012009\_020E000S\_2D20.png

yyyy doy  
 (year, day of year)

lon-lat

2 or 3 day  
 observations

# MODIS Flood Mapping: Southern Brazil, June 12-14, 2016

3 Day Composite 2 Day Composite 1 Day Composite **14 Day Composite**

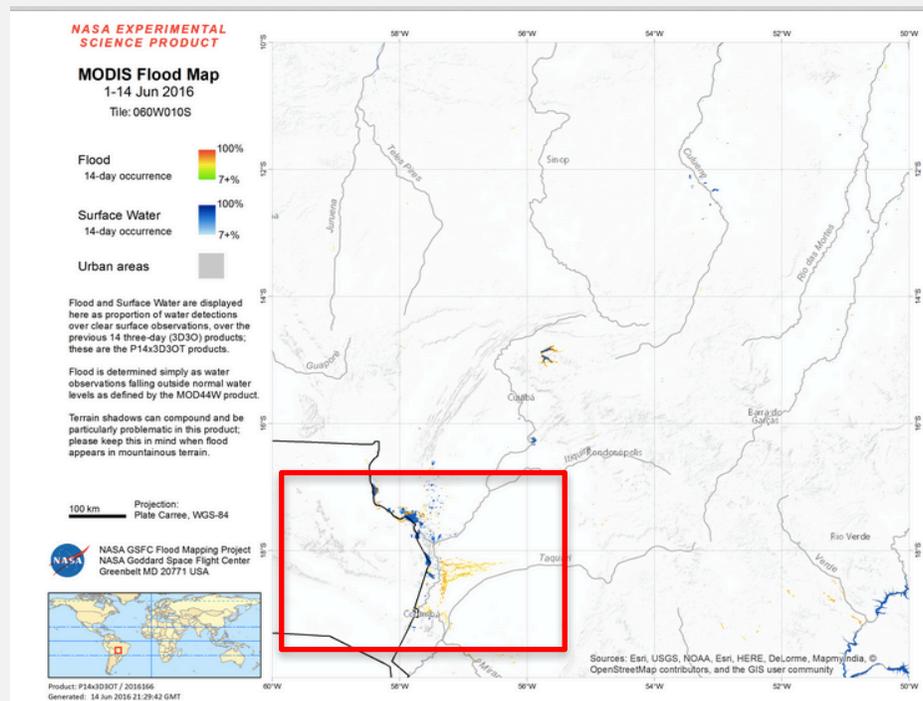
« June 2016 »

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		

Products		Available Downloads			
MODIS Flood Map	MFM	png			
MODIS Flood Water	MFW	percent (.tif)	any (.tif)	any (.shp)	any (.kmz)
MODIS Surface Water	MSW	percent (.tif)	any (.tif)	any (.shp)	any (.kmz)
README		pdf	txt		

## 14-Day Composites

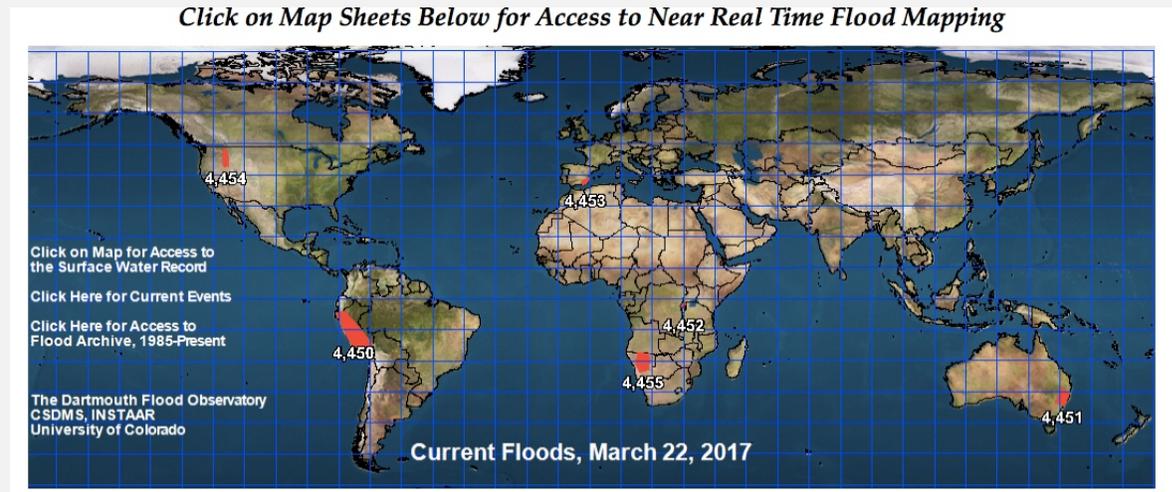
- Similar filename convention with additional processing for composite field
  - N: no shadow masking
  - T: terrain shadow masking
  - S: both terrain & shadow masking
- e.g. **2D2OT**
  - 2 days imagery, 2 observations required, terrain shadow masking applied
- Provides occurrence of water as percent clear observation over the last 14 days' products
- GeoTIFF are 0-1 images (1 if % water > 0)



# Dartmouth Flood Observatory (DFO)

<http://floodobservatory.colorado.edu/>

- Uses flood mapping based on MODIS reflectance
  - same as MODIS NRT
- Also uses Landsat 8, EO-1, and ASTER images
  - uses COSMO-SkyMed and Sentinel-1 synthetic aperture radar (SAR) when available)
- Current flood events are analyzed with multiple data sources (next two slides), including media report



- Provides near real-time, current, and past flood event mapping
- Red areas (above) indicate inundated surface

# DFO Current Flood Event: Peru

<http://floodobservatory.colorado.edu/>

Coastal flooding during local El Nino conditions (middle, Mar 27, 2017), compared to previous year (left image, Mar 27, 2016). Source: MODIS

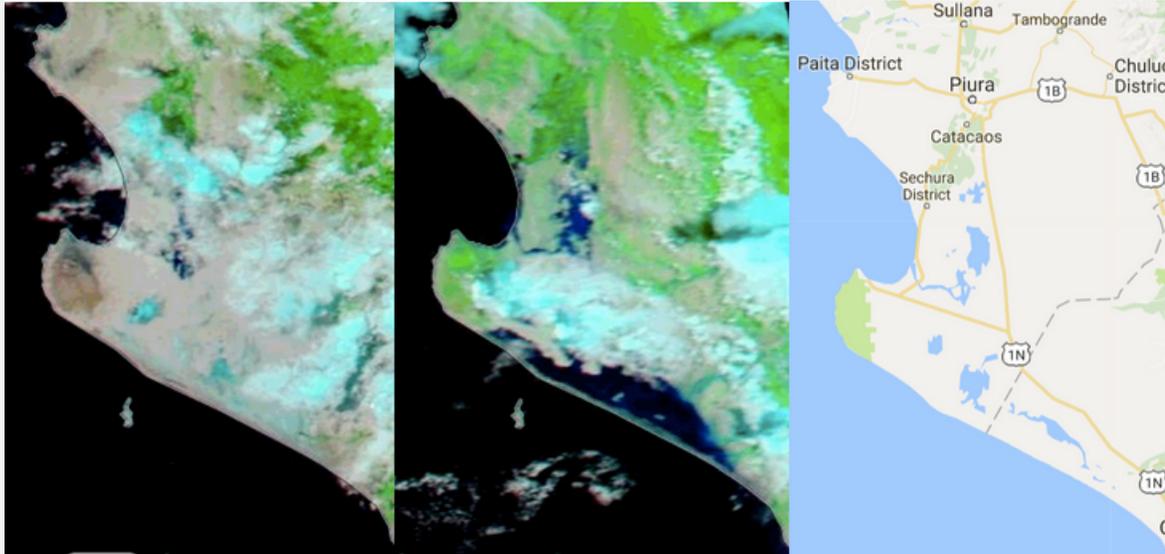


Image Sources: DFO

Flooding (red) from comparing Mar 20, 2017 and Jan 19, 2017.

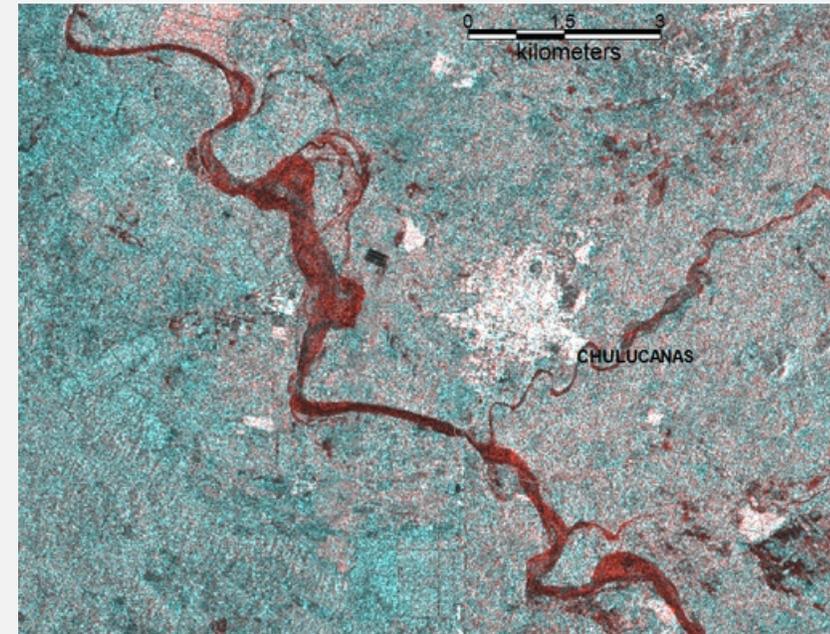
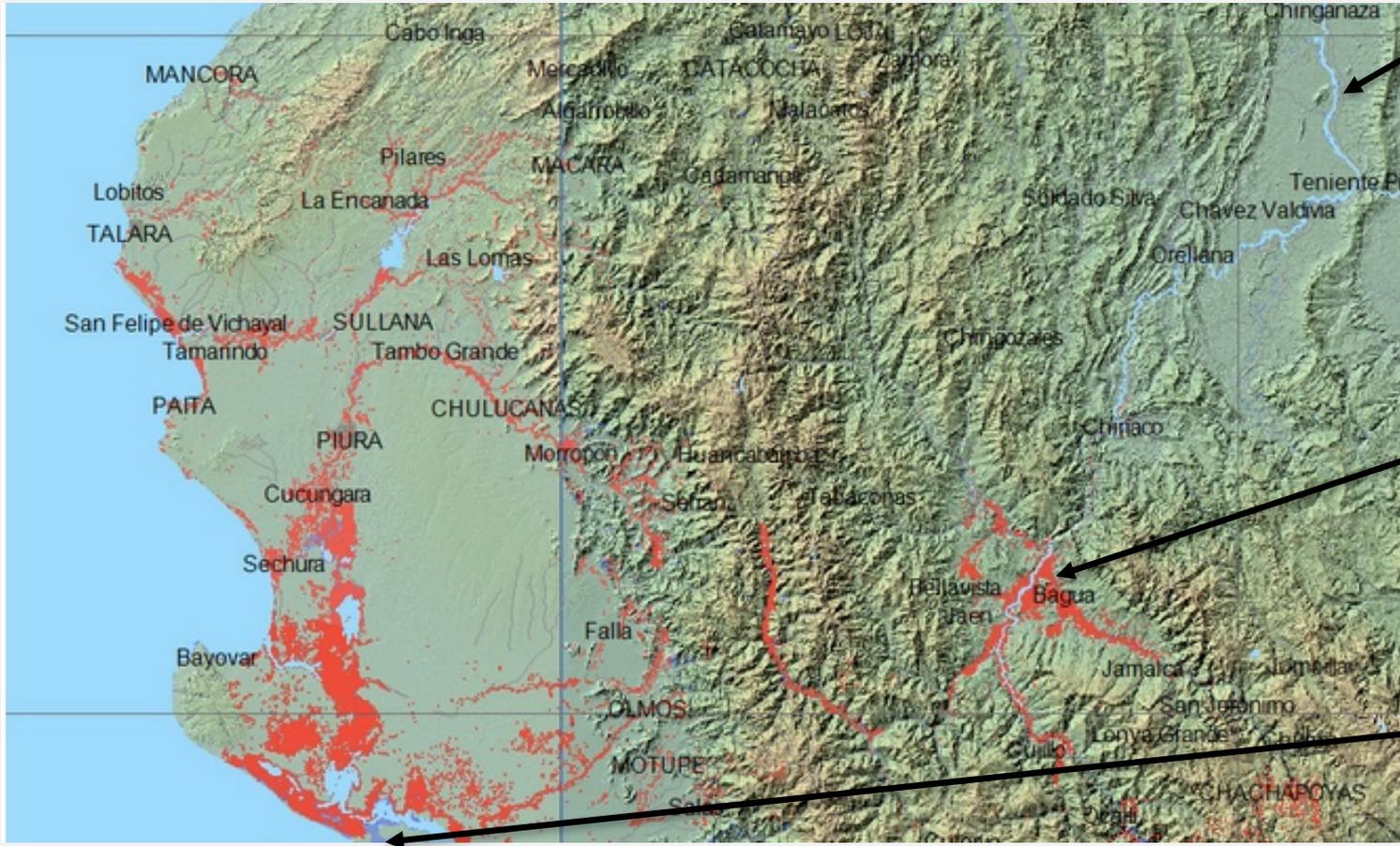


Image contains modified Copernicus Sentinel 1 data (2017), from Dartmouth Flood Observatory

# DFO Current Flood Event: Peru

<http://floodobservatory.colorado.edu/>



**Light Blue:** normal annual water extent from Feb 2000 (shuttle water boundary data)

**Red:** flood water mapped from ESA Sentinel-1 SAR

**Dark Blue:** previous flood extent

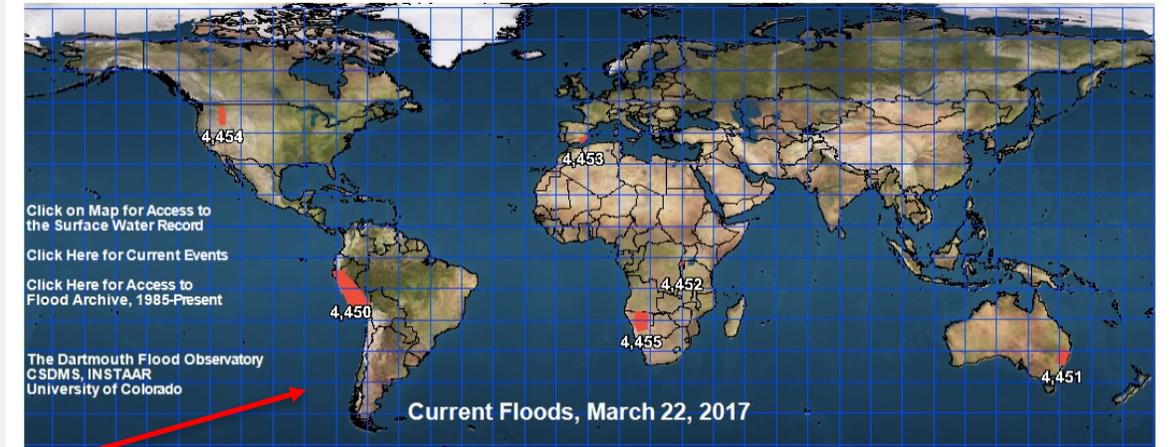
# DFO Surface Water Record

<http://floodobservatory.colorado.edu/Version3/120W050Nv3.html>

- Surface water (SW) is based on twice-daily images
  - from Terra and Aqua MODIS
  - 250 m resolution
  - composited over 14 days
- Change in SW from SWDB (shuttle water boundary data) since 2000 also provided
- Available in 10°x 10° grids

## SW Access Through the Map

*Click on Map Sheets Below for Access to Near Real Time Flood Mapping*

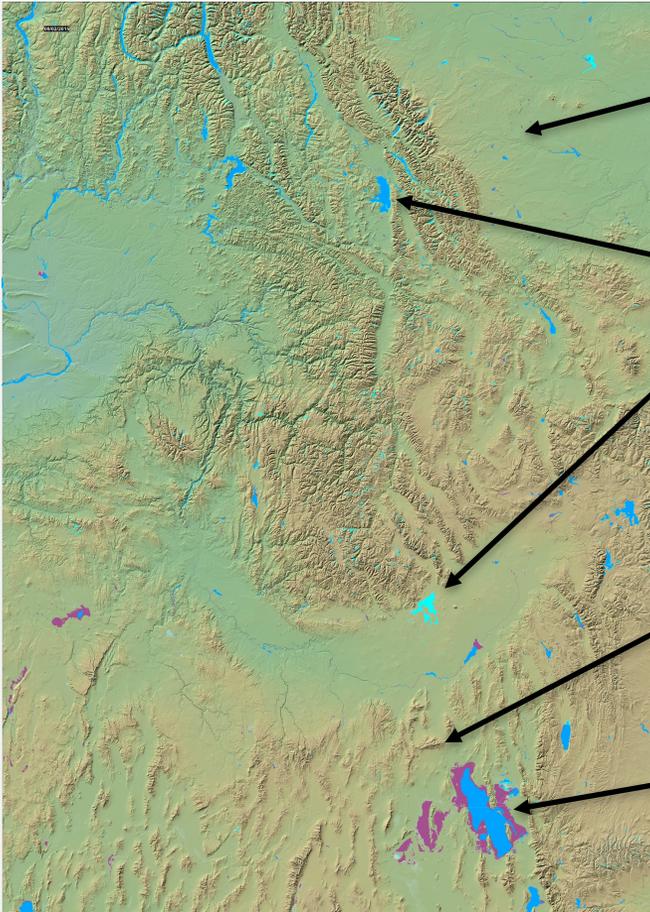


# DFO Current Surface Water Extent

<http://floodobservatory.colorado.edu/Version3/120W050Nv3.html>

## Map 120W050N

## Map Legend (at time of map date)



- small areas of purple:** water mapped by SWBD, but not resolved by MODIS
- dark blue:** current water imaged by MODIS
- bright blue:** flooding or expanded water areas mapped by MODIS compared to SWDB (any post-2000 reservoir or new water body is also depicted as bright blue)
- light blue-gray:** all previous flooding imaged and mapped by the Flood Observatory (now dry land)
- large areas of purple:** dry land (compared to SWBD)

## Error Notes from DFO

1. In mountainous regions, terrain shadows mimic surface water and are misclassified as water in our current algorithm. We are working to reduce such noise.
2. Reservoirs and impoundments constructed since yr 2000 appear permanently in red.
3. The observational record illustrated may not include all floods: prior to 2011 the records were obtained manually and focus was on major flood events

# Land Cover Based Flooding Tools

## Visible Radiation

- Used for flood mapping:
  - Terra/Aqua MODerate Resolution Imaging Spectroradiometer (MODIS) reflectance changes
- Used by:
  - MODIS NRT Flood Mapping
  - Dartmouth Flood Observatory
- Used to observe land cover changes:
  - Reflectance from Landsat
- Used by: NOAA Coastal Flood Watch



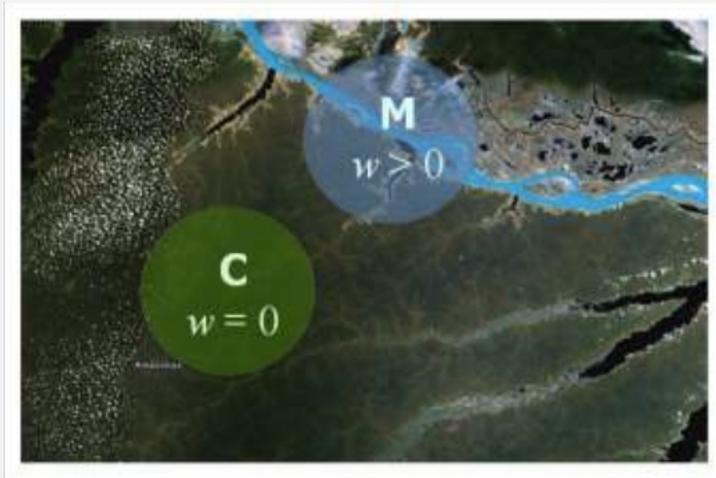
## Microwave Radiation

- Used to detect inundated surface:
  - Microwave (37 GHz) brightness temperatures from TRMM Microwave Imager (TMI)
  - GPM Microwave Imager (GMI)
  - GCOM-W based Advanced Microwave Scanning Radiometer 2 (AMSR2)
- Used by:
  - GFDS2 (GDACS)
  - DFO River Watch

# About GFDS2 and DFO River Watch

<http://floodobservatory.colorado.edu/technical.html>

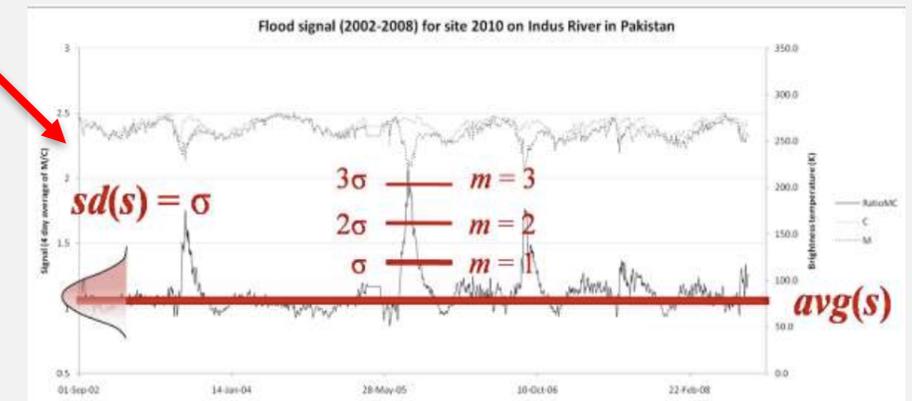
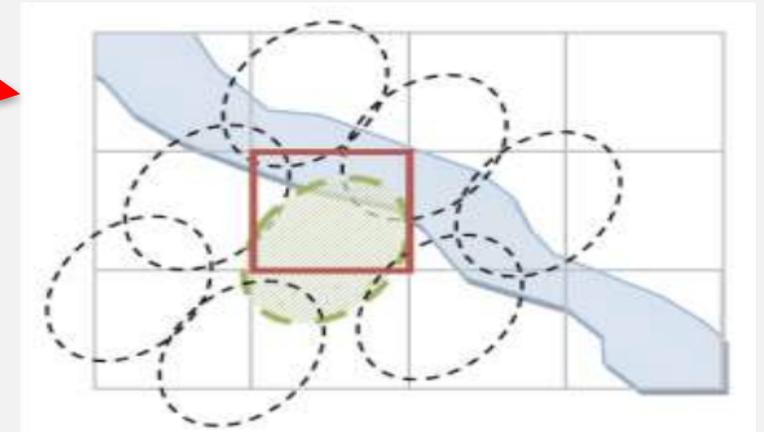
- GFDS2 and DFO River Watch are collaborative programs
- Use microwave brightness temperatures ( $T_b$ ) from TRMM, GPM, and GCOM-W satellites to detect surface inundation
- S: satellite-based flood signal
- M:  $T_b$  from a measurement pixel centered over the river and its floodplain
- C: daily calibrating value that represents the 95<sup>th</sup> percentile of the day's driest (brightest)  $T_b$  within a 9x9 pixel array surrounding the M pixel
- Departures from the mean value (anomalies) of the ratio is used to detect flooding conditions



# GFDS2 Flood Magnitude

[http://bit.ly/GFDS\\_specs\\_15](http://bit.ly/GFDS_specs_15)

- Joint Research Center (JRC) from the European Commission produces daily, 10 km grids of satellite signal (S) to be used by GFDS2 and DFO River Watch
- GFDS2 derives flood magnitude based on the anomalies of the ratio (S) compared to its value averaged over 7 years (records start in Jun 2002)
- GFDS2 flood magnitudes are used by GDACS to provide near real-time alerts



# Global Flood Detection System 2 (GFDS2)

<http://www.gdacs.org/flooddetection/>

GFDS2 flooding information is used by GDACS

The screenshot shows the website header with the logo 'GDACS Global Flood Detection System - Version 2' and the JRC European Commission GLOBESEC logo. A navigation bar includes links for Home, Current floods, Global map, Search areas, Custom areas, Regions, Download, and About. The main content area features a world map with a satellite view overlay and a list of monitoring sites. A detailed description explains the system's use of passive microwave remote sensing (AMSR-E and TRMM sensors) to detect surface water anomalies. It also includes a section for 'example' maps showing flood detection in the Caprivi and Kavango River regions of southern Africa, with mouse coordinates (174.28711, 41.67291) and a scale bar (5000 m).

This screenshot displays a list of flood monitoring sites under the 'Floods' tab. The list includes site numbers, names, and locations, such as 'Site 2248 in Indonesia (on river Simpang-Kiri)', 'Site 2278 in Japan (on river Onga)', and 'Site 15184 in Ethiopia (on river)'. A red arrow points from the text 'Developed for GDACS in collaboration with DFO' to the 'Darimouth Flood Observatory' logo at the bottom right of the page. The footer contains a disclaimer and copyright information for the European Commission Joint Research Centre.

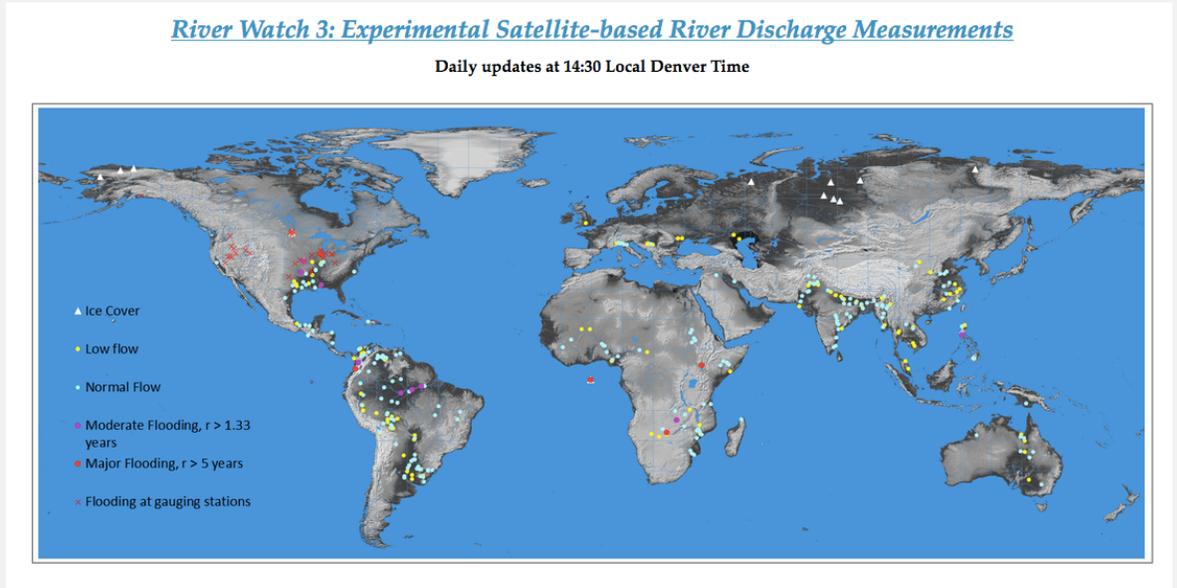
Developed for GDACS in collaboration with DFO

Interactive current flood map and flood list

# DFO River Watch

<http://floodobservatory.colorado.edu/GlobalRunoff.html>

- DFO River Watch system uses the JRC-powered satellite signal (S – microwave brightness  $T_b$  ratio) at specific surface river gauging locations
- S values are converted to river discharge by combining them with surface discharge measurements and then converted to runoff by using a Water Balance Model (WBM)

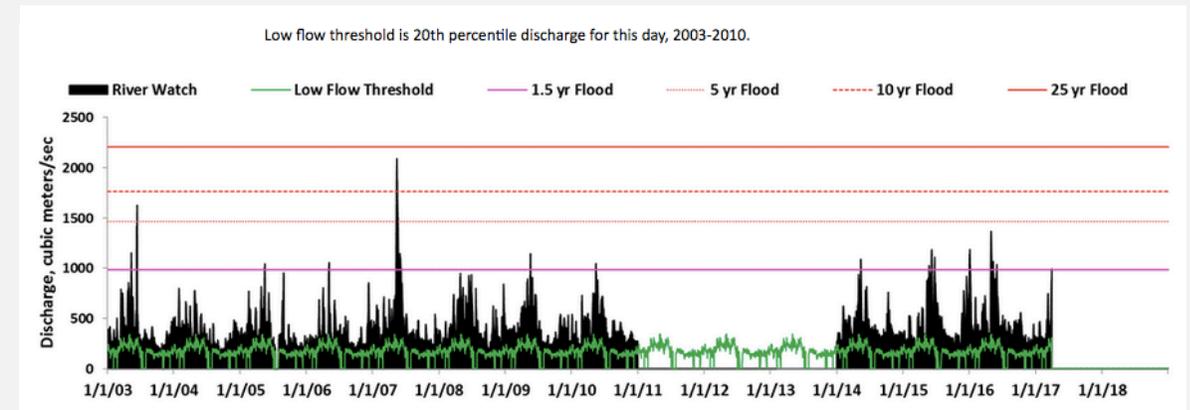


# DFO River Watch

<http://floodobservatory.colorado.edu/GlobalRunoff.html>

- Runoff calculations are available starting in 2003
- Satellite-derived runoff is compared to the 7 year (2003-2010) mean runoff record to decide low, normal, moderate, and major flooding
- Daily and monthly runoff time series are available at the river gauge sites
- Flood magnitude is assigned when runoff volume exceeds a threshold decided based on the recurrence period from the runoff record

## Missouri River Discharge



Reference: Merged AMSR-2 and GPM Passive Microwave Radiometry for Measuring River Discharge and Runoff. G. Robert Brakenridge, Son. V. Nghiem  
(<http://floodobservatory.colorado.edu/Publications/2016IEEEPaper.pdf>)

# DFO River Watch

<http://floodobservatory.colorado.edu/GlobalRunoff.html>

River  
Experim

[GFDS S](#)  
[GEE Tid](#)  
Last m  
Discha  
7-day  
Flood

## River Watch Version 3.4

DRAFT, In preparation, not calibrated to discharge and catchment area.

**Experimental Satellite-Based River Discharge Measurements using passive microwave radiometry**

Signal/Model agreement: **Poor**

S/N rating: **Excellent**

**GFDS Site Number** 497

[GEE Time Lapse](#)

**Last measured:** 30-Mar-17

**Discharge:** 994 m3/sec

**7-day Runoff** 2.0 mm

**Flood Magnitude:** 5.8 Scale of 0-10

Missouri  
USA

[Learn more about this river](#)

Status: **3**

**190%**

[Flood Magnitude Defined](#)

Center: -93.464 Long.

Center: 39.284 Lat.

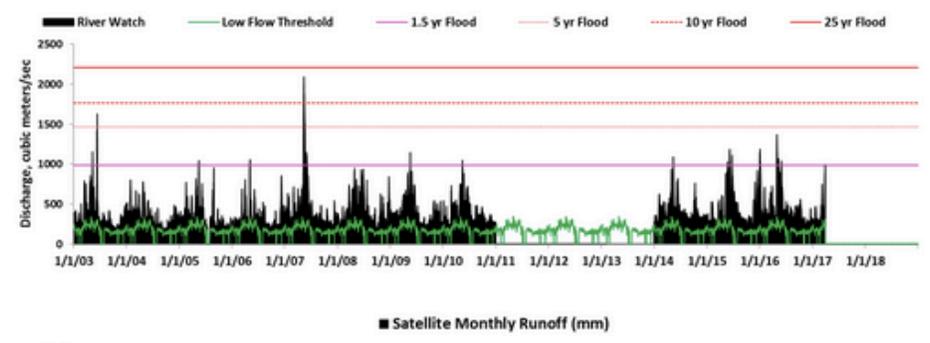
**219467** sq km Station contributing area

[Obtain Data](#)

(1, low; 2, normal flow; 3, moderate flood, r >1.5 y; 4, major flood, r >5 y)  
(7-day runoff compared to 8 y average for this date, 2003-2010)

[Technical Summary](#)

Notes: 4-day forward moving average is applied.  
Low flow threshold is 20th percentile discharge for this day, 2003-2010.

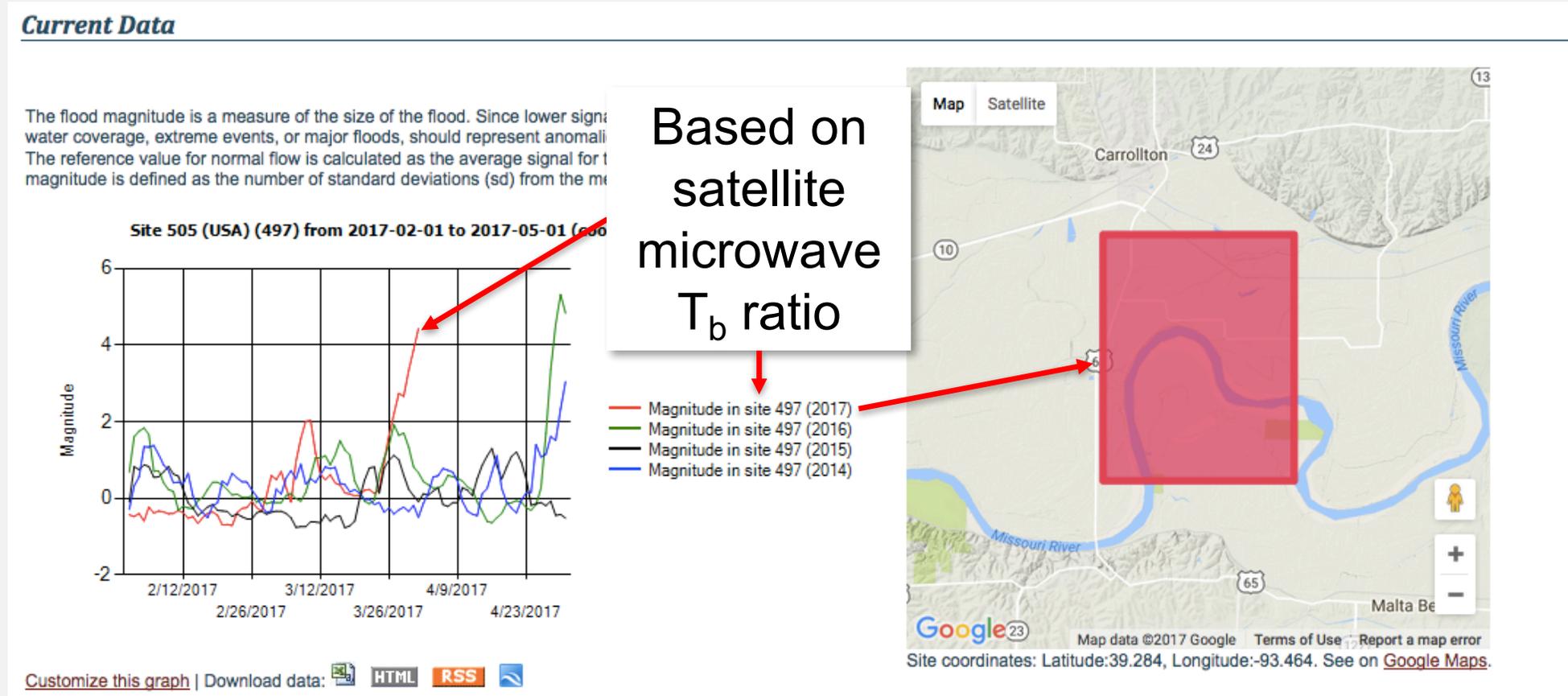


Reference: Merged AMSR-2 and GPM Passive Microwave Radiometry for Measuring River Discharge and Runoff. G. Robert Brakenridge, Son. V. Nghiem  
(<http://floodobservatory.colorado.edu/Publications/2016IEEEPaper.pdf>)

# GFDS2 Flood Magnitude for the Missouri River

<http://floodobservatory.colorado.edu/GlobalRunoff.html>

- GFDS2 flooding information is used by GDACS



A topographic map showing a river system. The river is highlighted in a dark blue color, winding through a landscape of varying elevations. The background is a color-coded topographic map where lower elevations are shown in shades of green and yellow, and higher elevations are shown in shades of brown and tan. The river starts from the top right and flows towards the bottom left, with several meanders and tributaries.

# Global Disasters Alert and Coordination System (GDACS)

<http://arset.gsfc.nasa.gov/disasters/webinars/GDACS17>

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# What is GDACS?

<http://www.gdacs.org/>

- A cooperation framework between the UN, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters
- Develops data tools and services that complement existing materials:
  - International Search and Rescue Advisory Group (INSARAG) Guidelines
  - UN Disaster Assessment and Coordination (UNDAC) Field Handbook
  - International Federation of Red Cross and Red Crescent Societies (IFRC) Publications
  - Standard Operating Procedures from the European Community Mechanism for Civil Protection
  - International Humanitarian Partnership (IHP)
  - Euro Atlantic Disaster Response Coordination Centre (EADRCC)

\* *Global Disaster Alert and Coordination System Guidelines* [PDF]. (2014). GDACS.org

# GDACS Tools and Services

<http://www.gdacs.org/>

GDACS is a cooperation framework between the United Nations, the European Commission and disaster managers worldwide to improve alerts, information exchange and coordination in the first phase after major sudden-onset disasters.

United Nations and the European Commission

GDACS  
Global Disaster Alert and Coordination System

HOME ALERTS VIRTUAL OSOCC DATA, MAPS & SATELLITE IMAGERY SCIENCE PORTAL ABOUT GDACS

**EARTHQUAKES**

- Guam (5.5M) 24 Jan 09:38UTC
- Papua New Guinea (5.6M) 22 Jan 04:44UTC
- Papua New Guinea (7.9M) 22 Jan 04:30UTC - DTS

**FLOODS**

- French Polynesia 24 Jan 00:00UTC
- Philippines 26 Jan 00:00UTC FL-2017-000010-PHL

**RECENT AND OPEN EMERGENCIES**

**LATEST NEWS**

report of current and ongoing satellite mapping activities related to humanitarian disasters is available

**Tropical Cyclone Matthew: 3 reports published**

06 Oct 08:00UTC JRC published 3 reports on the Tropical Cyclone Matthew, the last one produced yesterday. The reports show the situation and the

**LOG IN**

Username

Password

Log into

User name can be different for different services. To create an account, log in without username.

**Overview map of latest disaster alerts**

Map of disaster alerts in the past 4 days. Last 24 hours events are highlighted in yellow. Small earthquakes are shown as green boxes.

European Union, 2015. Map produced by EC-JRC. The boundaries and the names shown on this map do not imply official endorsement or acceptance by the European Union.

- Interactive map with near real-time disasters alerts
- Color coded alerts
  - white: minor events
  - green: moderate events
  - orange: potential local disasters
  - red: potentially severe disasters

# GDACS Disaster Alerts

<http://www.gdacs.org/>

- **Floods**

- inundation
- deaths
- displacement

- **Tropical Cyclones**

- winds
- heavy rains
- storm surge

- **Earthquakes and Tsunamis**

- intensity and magnitude
- hypocenter depth
- population within 100 km of epicenter
- vulnerability of affected countries

Various models and data are used to obtain this information: <http://portal.gdacs.org/Models>

# GDACS Disaster Alerts

<http://www.gdacs.org/>

- **Floods**

- inundation
- deaths
- displacement

- **Tropical Cyclones**

- winds
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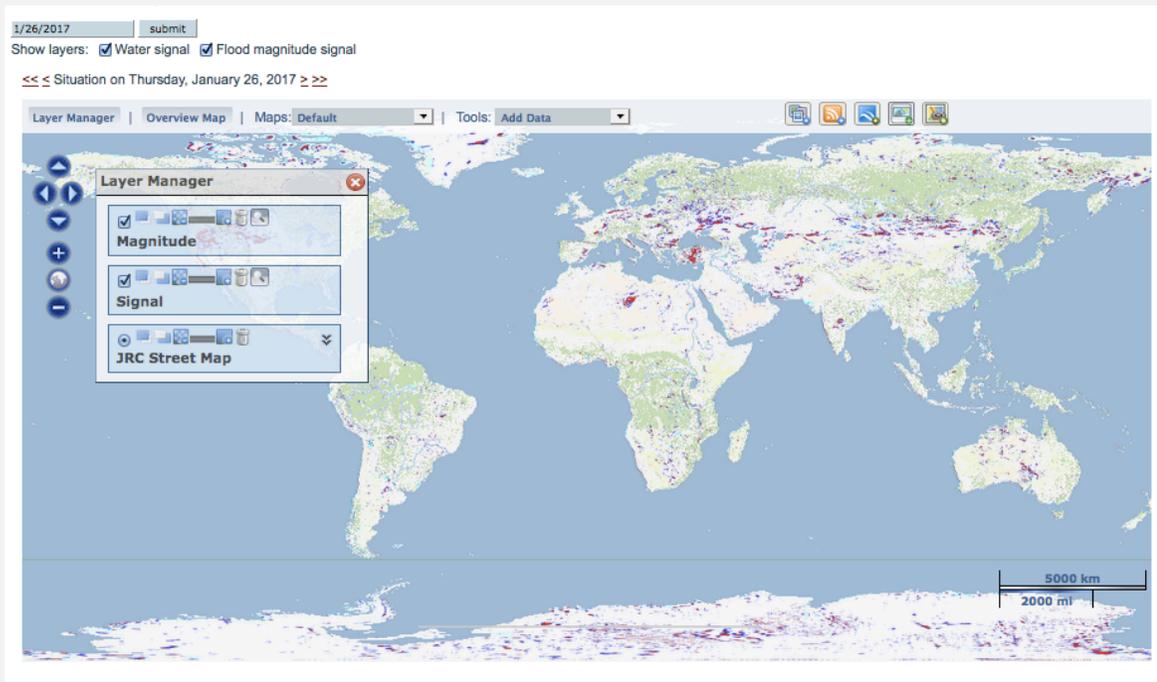
- **Earthquakes and Tsunamis**

- intensity and magnitude
- hypocenter depth
- population within 100 km of epicenter
- vulnerability of affected countries

# GDACS Approach for Disaster Alerts: Floods

<http://portal.gdacs.org/Models/>

Issues flood alerts and maps using satellite-based information from the GFDS2 and population data



Please note that the information provided on this website has no official status and does not replace local flood warnings. Please refer to the competent local hydrographic authorities for official information in each country.

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- **Red Alert**
  - more than 1,000 dead or 800,000 displaced
- **Orange Alert**
  - more than 100 dead or 80,000 displaced
- **Green Alert**
  - All other floods

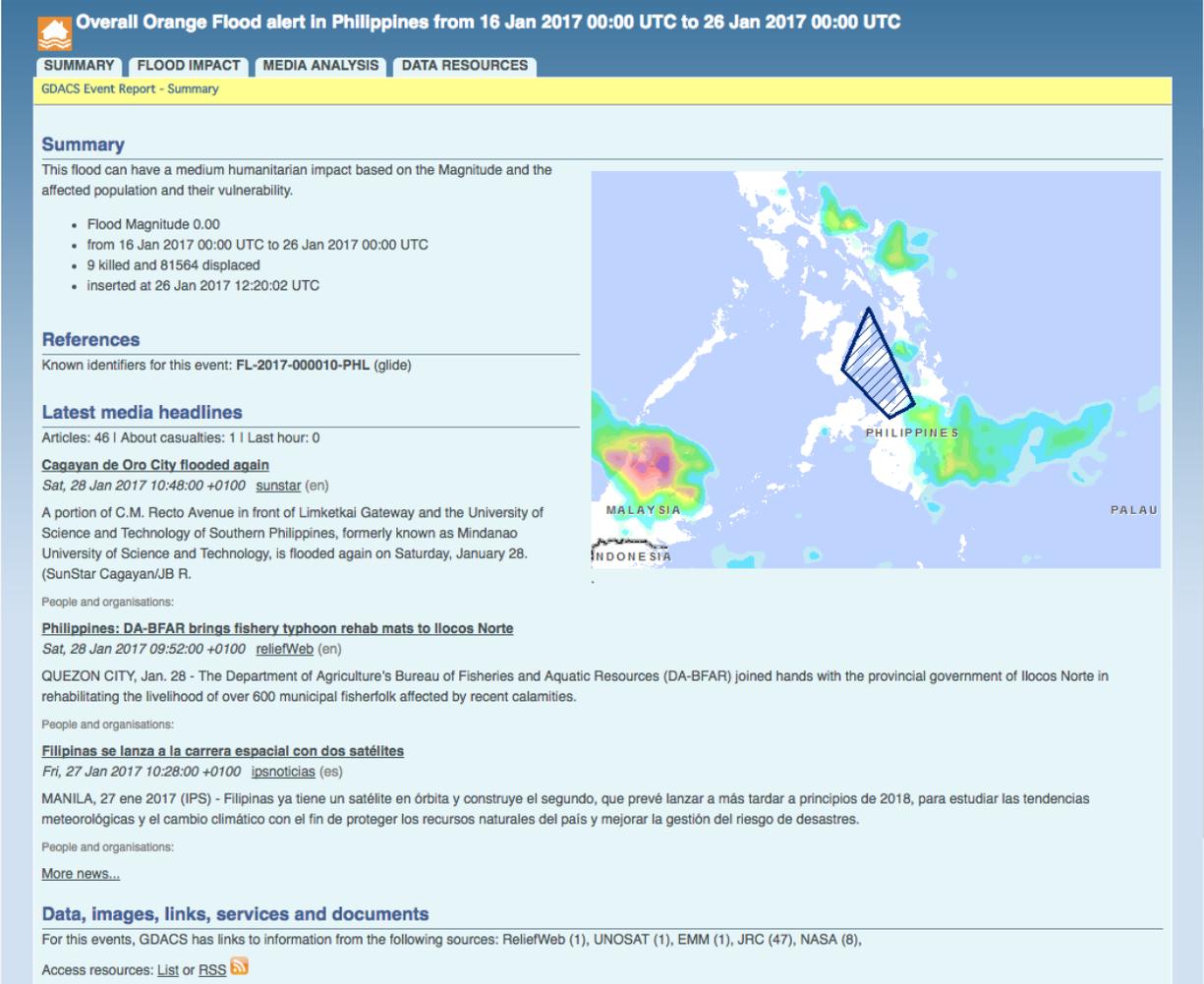
Image Credit: GFDS Version 2 [http://www.gdacs.org/flooddetection/global\\_map.aspx](http://www.gdacs.org/flooddetection/global_map.aspx)

# GDACS Virtual On-Site Operations Coordination Center (OSOCC)

<http://vosocc.unocha.org/>

## Recent Flood in the Philippines

- Summary Report:
  - deaths
  - displacement
- Latest news
- Data, Images, and Documents



**Overall Orange Flood alert in Philippines from 16 Jan 2017 00:00 UTC to 26 Jan 2017 00:00 UTC**

SUMMARY FLOOD IMPACT MEDIA ANALYSIS DATA RESOURCES

GDACS Event Report - Summary

### Summary

This flood can have a medium humanitarian impact based on the Magnitude and the affected population and their vulnerability.

- Flood Magnitude 0.00
- from 16 Jan 2017 00:00 UTC to 26 Jan 2017 00:00 UTC
- 9 killed and 81564 displaced
- inserted at 26 Jan 2017 12:20:02 UTC

### References

Known identifiers for this event: FL-2017-000010-PHL (glide)

### Latest media headlines

Articles: 46 | About casualties: 1 | Last hour: 0

#### Cagayan de Oro City flooded again

Sat, 28 Jan 2017 10:48:00 +0100 [sunstar](#) (en)

A portion of C.M. Recto Avenue in front of Limketkai Gateway and the University of Science and Technology of Southern Philippines, formerly known as Mindanao University of Science and Technology, is flooded again on Saturday, January 28. (SunStar Cagayan/JB R.

People and organisations:

#### Philippines: DA-BFAR brings fishery typhoon rehab mats to Ilocos Norte

Sat, 28 Jan 2017 09:52:00 +0100 [reliefWeb](#) (en)

QUEZON CITY, Jan. 28 - The Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) joined hands with the provincial government of Ilocos Norte in rehabilitating the livelihood of over 600 municipal fisherfolk affected by recent calamities.

People and organisations:

#### Filipinas se lanza a la carrera espacial con dos satélites

Fri, 27 Jan 2017 10:28:00 +0100 [ipsnoticias](#) (es)

MANILA, 27 ene 2017 (IPS) - Filipinas ya tiene un satélite en órbita y construye el segundo, que prevé lanzar a más tardar a principios de 2018, para estudiar las tendencias meteorológicas y el cambio climático con el fin de proteger los recursos naturales del país y mejorar la gestión del riesgo de desastres.

People and organisations:

#### More news...

### Data, images, links, services and documents

For this events, GDACS has links to information from the following sources: ReliefWeb (1), UNOSAT (1), EMM (1), JRC (47), NASA (8),

Access resources: [List](#) or [RSS](#)

# GDACS Satellite Mapping Coordinate System (SMCS)

<http://gdacs-smcs.unosat.org/>

- Led by UNITAR-UNOSAT
- Includes NASA and ESA satellite data
- A GIS-based tool of satellite imagery for specific disaster events
  - requires user registration
- Provides past and real-time imagery for an event
- Also offers:
  - baseline maps
  - situation specific maps
  - damage assessment maps
  - weather forecast maps

GDACS Satellite Mapping Coordination System - SMCS

Home Contact Help Login

Disaster Event Status

Only Archived

Only Active

Show Both

GDACS Reports

Search

by default showing events created in last 4 weeks

Esri, HERE, Garmin, NGA, USGS

OCHA Office for the Coordination of Humanitarian Affairs

UNITAR United Nations Institute for Training and Research

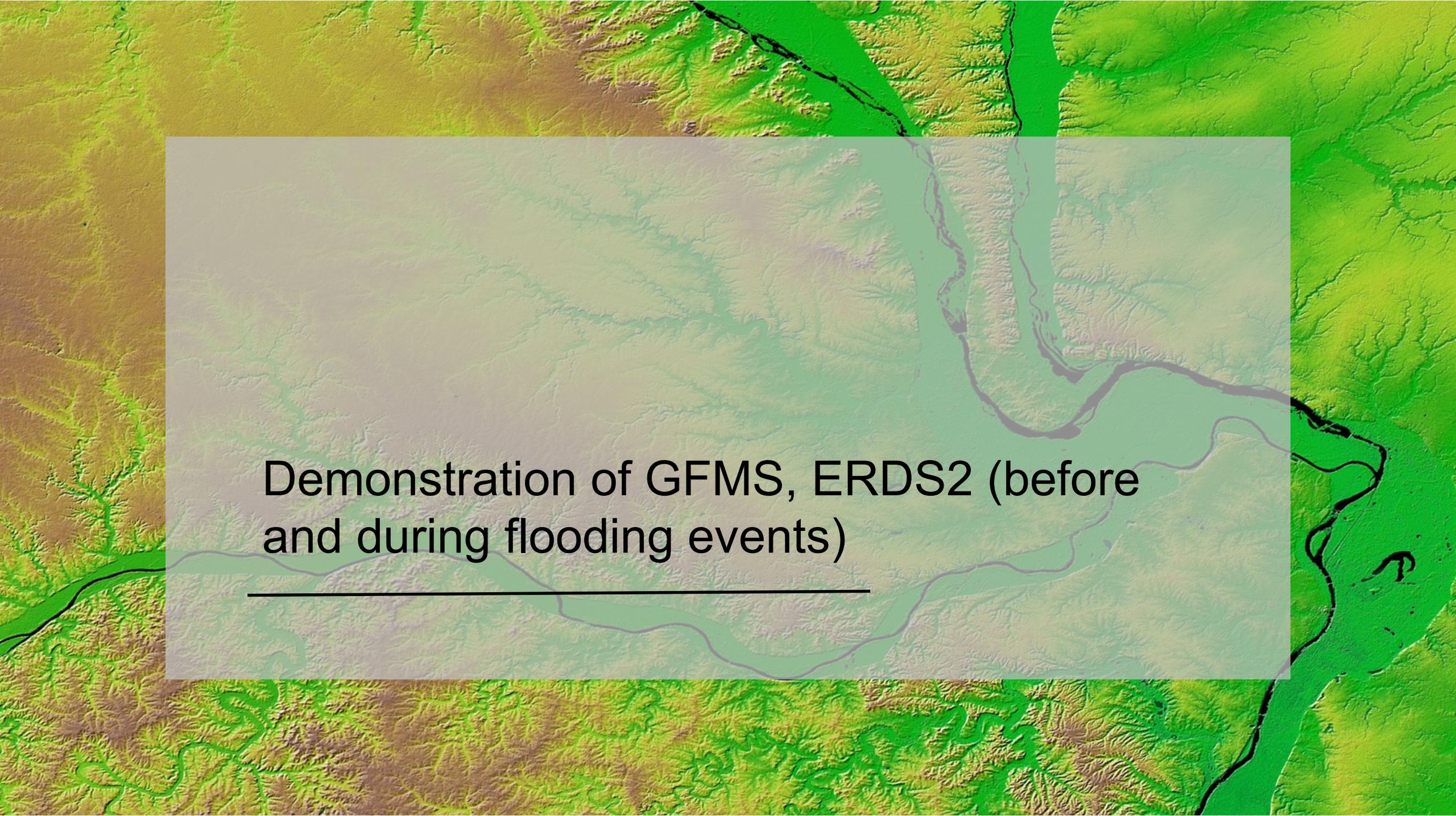
GDACS European Commission

# Summary of Flooding Web Tools Based on Precipitation

Flood Tool, Satellite, Instrument, or Model	Quantities Used as Inputs	Hydrological Model	Output	Spatial Coverage and Temporal Resolution
GFMS <ul style="list-style-type: none"> <li>• TRMM/ TMPA-RT</li> <li>• MERRA</li> </ul>	<ul style="list-style-type: none"> <li>• Rain rate</li> <li>• Surface temperature</li> <li>• Winds</li> </ul>	<ul style="list-style-type: none"> <li>• VIC-UMD DRTR</li> </ul>	<ul style="list-style-type: none"> <li>• Flood intensity</li> <li>• Streamflow</li> <li>• Accumulated rainfall</li> </ul>	<ul style="list-style-type: none"> <li>• 50°S-50°N</li> <li>• 12 km and 1 km</li> <li>• Jan 2001 – NRT 3 hr updates</li> </ul>
ERDS <ul style="list-style-type: none"> <li>• TRMM/ TMPA-RT</li> <li>• GFS</li> </ul>	<ul style="list-style-type: none"> <li>• Rain rate</li> </ul>		<ul style="list-style-type: none"> <li>• NRT &amp; Forecast flood alerts</li> <li>• Accumulated rainfall</li> <li>• Population affected</li> </ul>	<ul style="list-style-type: none"> <li>• 50°S-50°N</li> <li>• 0.25°x0.25°</li> <li>• NRT and up to 72 hr forecast, 3 hr updates</li> </ul>

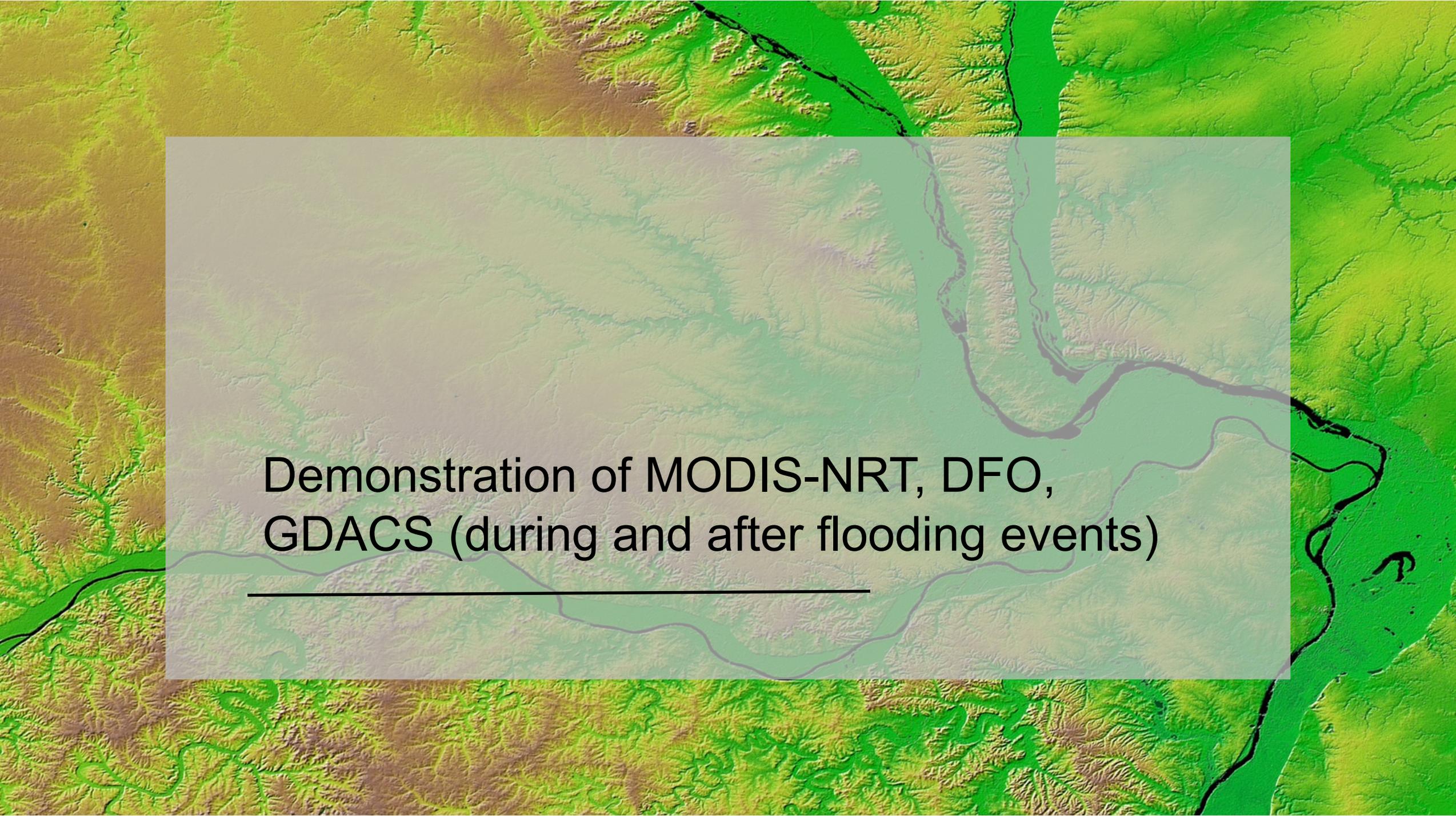
# Summary of Flooding Web Tools Based on Land Surface Observations

Flood Tool, Satellite, Instrument, or Model	Quantities Used as Inputs	Output	Spatial Coverage and Temporal Resolution
MODIS-NRT <ul style="list-style-type: none"> <li>Terra/Aqua MODIS</li> </ul>	<ul style="list-style-type: none"> <li>Reflectance Bands 1, 2, 7</li> </ul>	<ul style="list-style-type: none"> <li>Inundation map</li> <li>Flood water</li> <li>Surface water</li> </ul>	<ul style="list-style-type: none"> <li>Global 250 m</li> <li>NRT 2, 3, and 14 day composites</li> <li>2013-present</li> </ul>
DFO <ul style="list-style-type: none"> <li>Terra/Aqua MODIS</li> </ul>	<ul style="list-style-type: none"> <li>Reflectance Bands 1, 2, 7</li> </ul>	<ul style="list-style-type: none"> <li>MODIS Inundation map</li> <li>Images when available: SAR, EO-1, Landsat</li> </ul>	<ul style="list-style-type: none"> <li>Global 250 m</li> <li>14 day composite</li> <li>Flood catalog (since 1985)</li> </ul>
GFDS2 & DFO River Watch <ul style="list-style-type: none"> <li>Aqua/AMSR-E, TRMM/TMI, GCOM-W/AMSR2, GPM/GMI</li> </ul>	<ul style="list-style-type: none"> <li>Microwave Brightness Temperature (37 GHz)</li> <li>Water Balance Model</li> <li>River Gauge Discharge</li> </ul>	<ul style="list-style-type: none"> <li>Flood Magnitude</li> <li>River discharge time series at selected locations</li> </ul>	<ul style="list-style-type: none"> <li>Global, NRT</li> <li>Past flood since 2003</li> </ul>

A topographic map showing a river system. The map uses a color gradient from brown (high elevation) to green (low elevation). A semi-transparent white rectangular box is overlaid on the map, containing text. A horizontal line is positioned below the text.

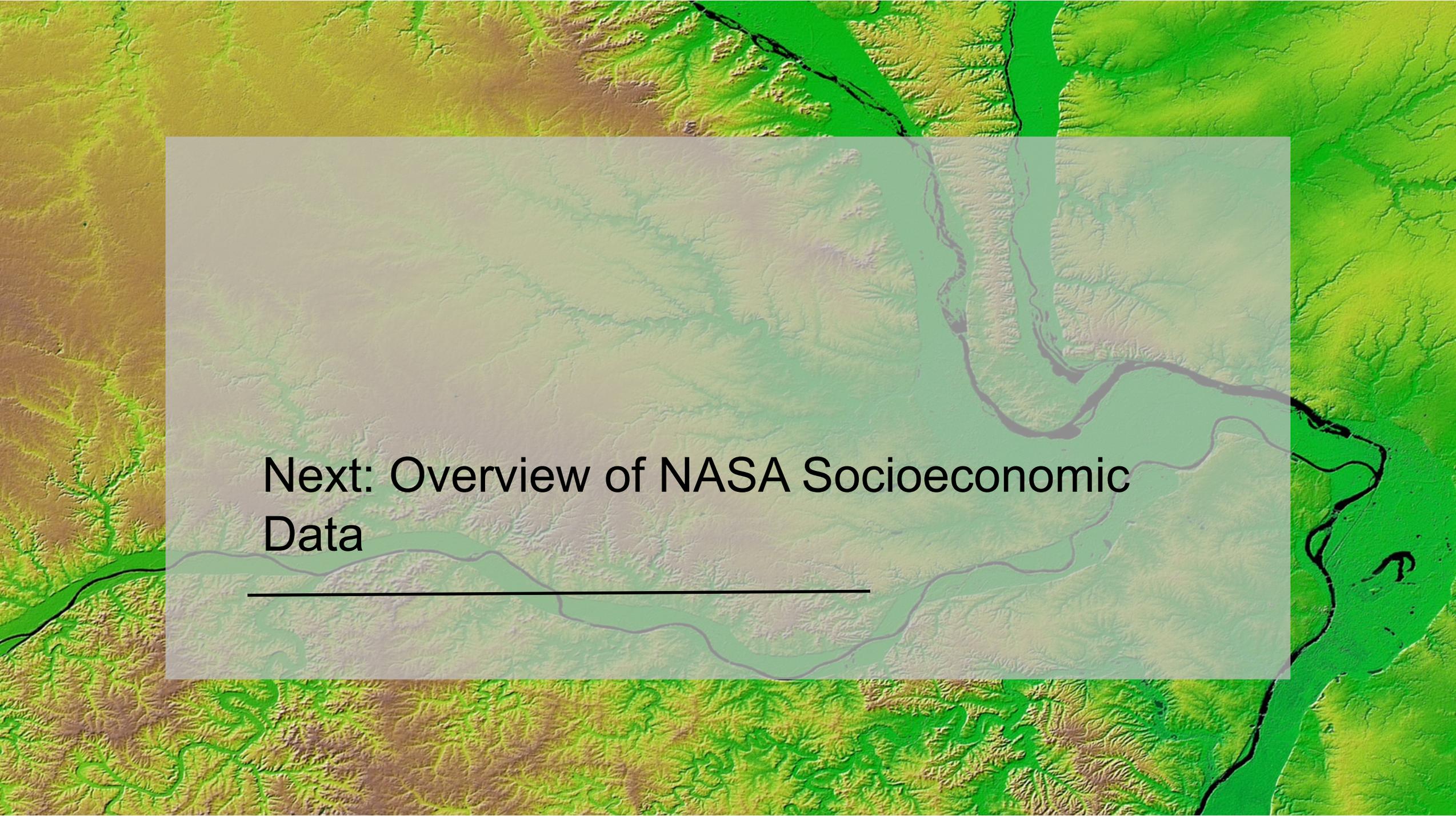
Demonstration of GFMS, ERDS2 (before  
and during flooding events)

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A topographic map of a river basin, showing a network of rivers and streams. The map uses a color gradient from brown (high elevation) to green (low elevation). A semi-transparent white rectangular box is overlaid on the map, containing text. A horizontal line is positioned below the text.

Demonstration of MODIS-NRT, DFO,  
GDACS (during and after flooding events)

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A topographic map of a river valley, likely the Amazon basin, showing a large river winding through a valley. The map uses a color gradient from green (low elevation) to brown (high elevation) to represent terrain. A semi-transparent white rectangular box is overlaid on the map, containing the text "Next: Overview of NASA Socioeconomic Data".

Next: Overview of NASA Socioeconomic  
Data

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