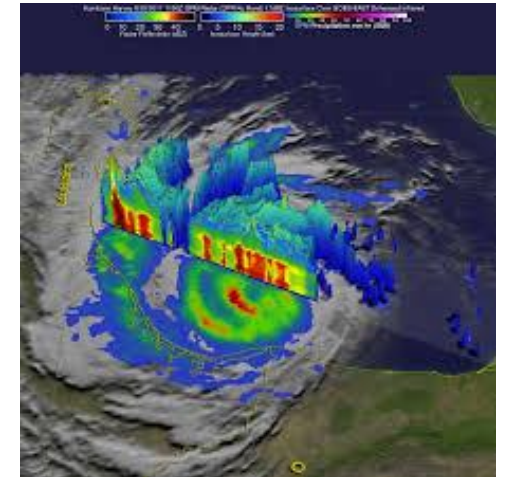
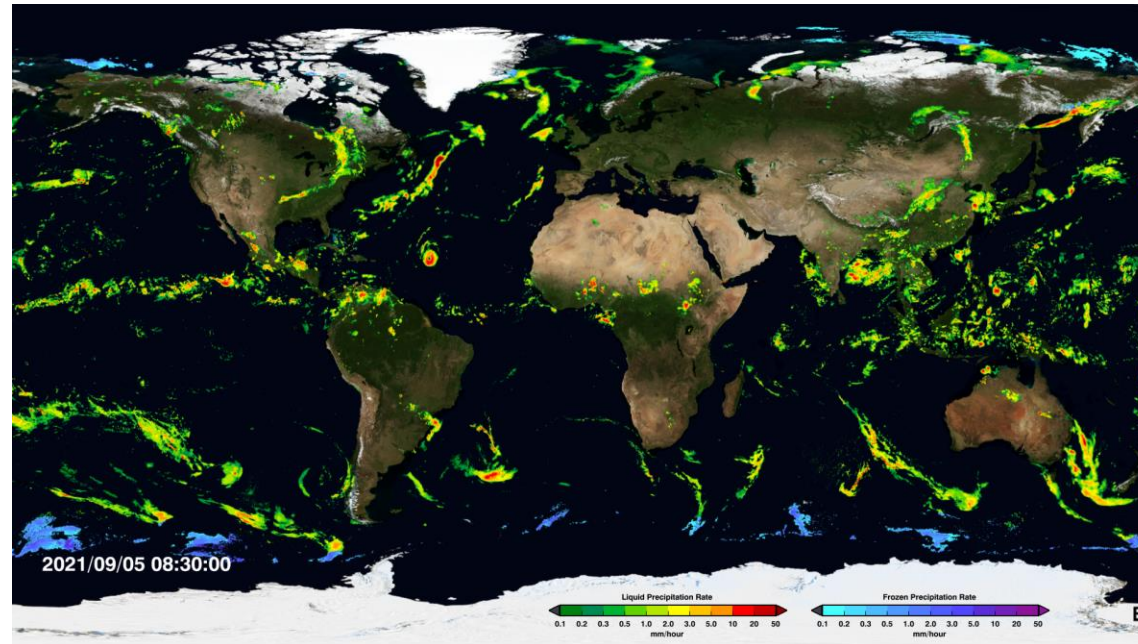


Part 2: GPM Precipitation Data Applications



Today's Training Conveners:
Andrea Portier, NASA GSFC- SSAI
Amita Mehta, NASA GSFC-UMBC-JCET

- Become familiar with GPM resources and learn how to access GPM data
- Description of GPM's IMERG data record, data access, analysis, and visualization
- View examples of GPM precipitation applications, highlighting a case study of GPM and Google Earth Engine

Session 1

September 8th

Introductory session on the International Precipitation Working Group (IPWG):

- Focused on operational and research satellite based quantitative precipitation measurement issues and challenges
 - Validation, research, applications, data assimilation, scattering
- Data access:

<http://ipwg.isac.cnr.it/data/datasets.html>



Session 1

September 8th

- Overview of Precipitation Measurement Missions (PMM)

Past and Current Missions:

TRMM: Tropical Rainfall Measuring Mission

11/1997 – 04/2015

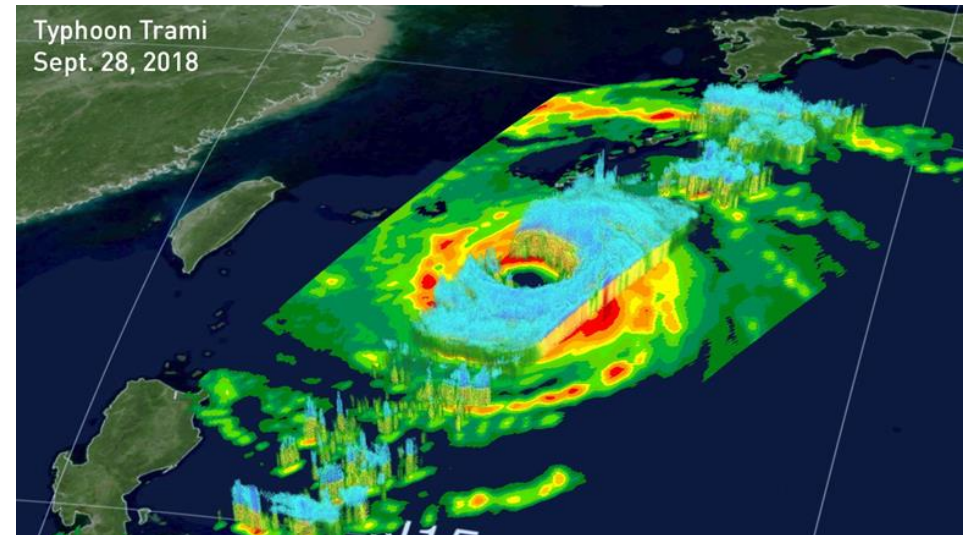
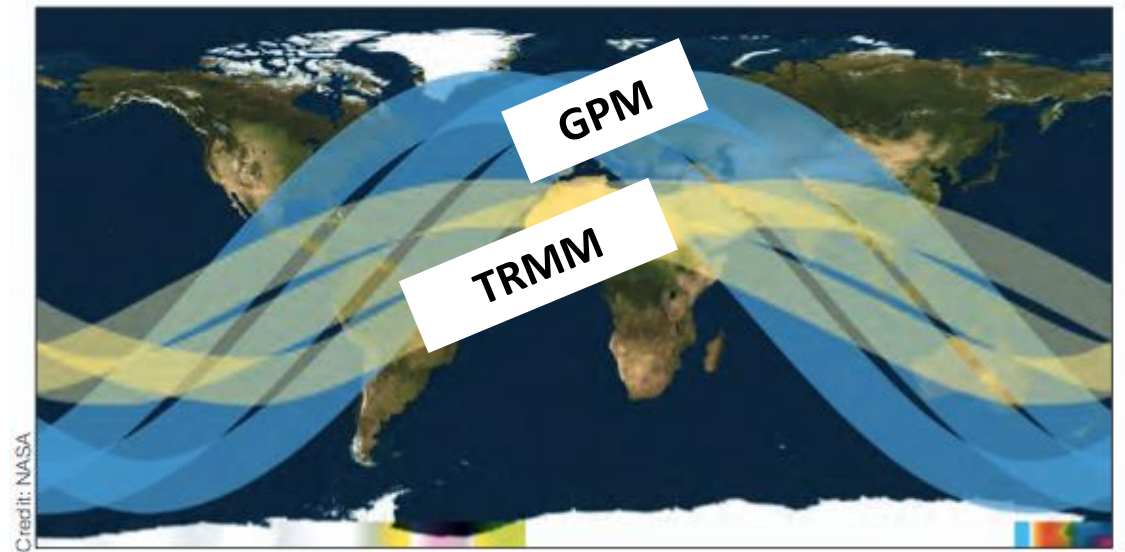
GPM: Global Precipitation Measurement Mission

02/2014 – present

- Data Products (e.g., Integrated Multi-satellitE Retrievals for GPM (IMERG))

<https://gpm.nasa.gov/>

- Core satellite launched Feb 27, 2014
 - Non-polar, low-inclination orbit
 - Altitude: 407 km
- TRMM to GPM
 - TRMM was designed to measure heavy to moderate rainfall in the tropics and subtropics
 - GPM can measure everything from light rain to heavy rain and falling snow
- Sensors:
 - GMI (GPM Microwave Imager)
 - DPR (Dual Precipitation Radar)
- A consortium of international satellites contribute measurements to GPM mission
 - GPM has a revisit time of 2-4 hrs. over land



- GPM Core satellites are used to calibrate microwave observations from a constellation of national and international satellites
- Multiple runs for different user requirements for latency and accuracy
 - “Early” – 4 hr. (flash flooding)
 - “Late” – 14 hr. (crop forecasting)
 - “Final” – 3 months (research)
- Time intervals are half-hourly , daily and monthly (final only)
- 0.1° global grid
- Extends from June 2000 to present
- Overall calibration is provided by TRMM and GPM Combined Radar-Radiometer Algorithm. TRMM June 2000-May 2014, GPM thereafter.

Applications = innovative uses of mission data products in decision-making activities for societal benefit.

- Mission Applications take a satellite's data products and expand them into areas where they can help inform policy or decisions.

*GPM precipitation products help advance societal applications by addressing the needs of end users and to support decision-making.

*GPM precipitation observations can be quickly and easily accessed via various data portals.



GPM Societal Benefit Areas

Energy Infrastructure and Management

- Energy infrastructure and management
- Alternative energy development/management

ENERGY

Water resources, Agricultural Forecasting, and Food Security

- Drought
- Water resource management
- Food security

WATER AND AGRICULTURE

Disasters and Risk Management

- Flooding
- Landslides
- Tropical Cyclones
- Re-insurance
- Wildfires
- Disaster Response

DISASTERS

Development and Public Health

- Disease Tracking
- Transportation

HEALTH

Weather, Climate, and Land Surface Modeling

- Numerical Weather Prediction
- Climate variability and change
- Land Surface Modeling

WEATHER

Ecological Management

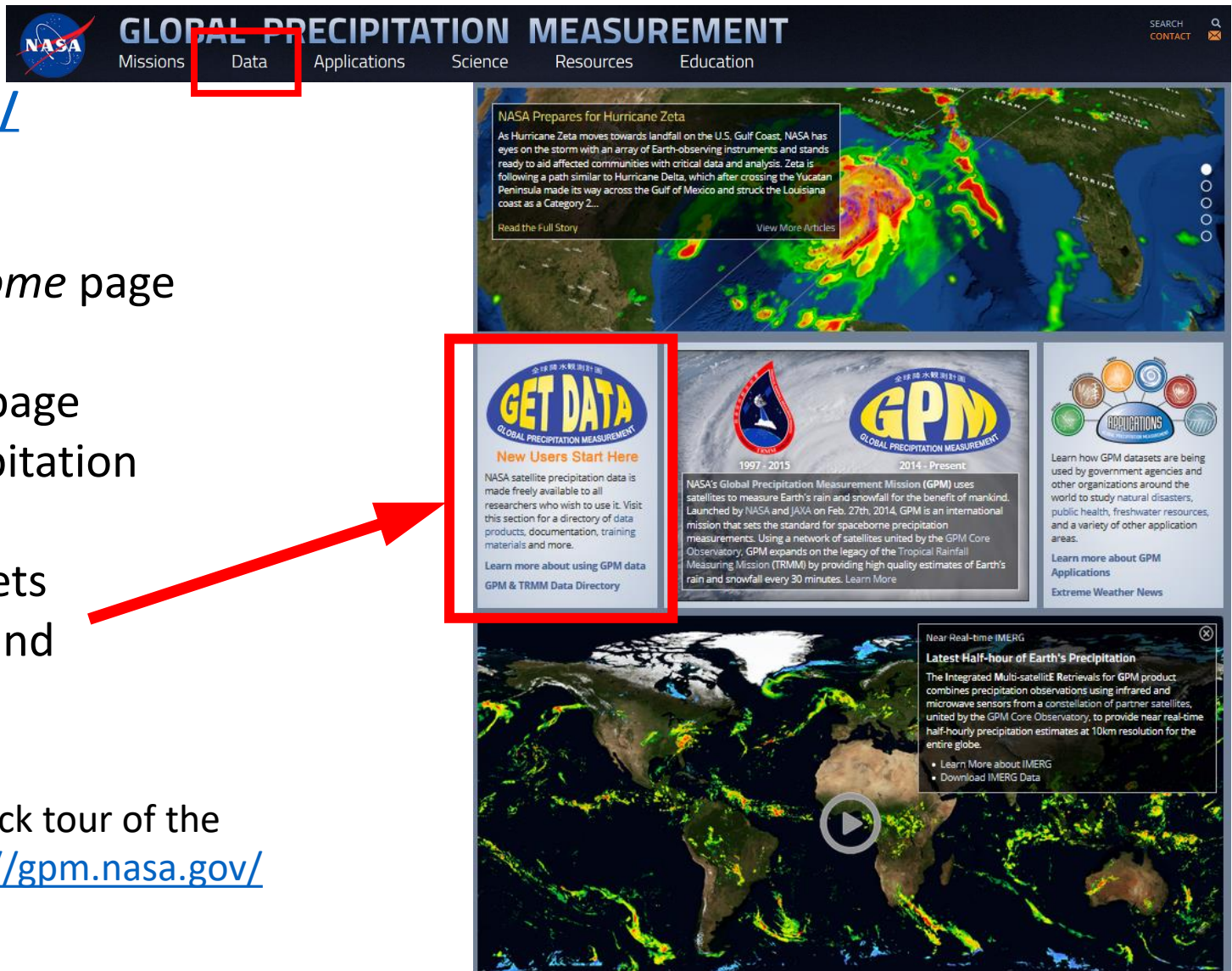
- Animal Migration
- Ecological Management and Sustainability

ECOLOGY

APPLICATIONS
GLOBAL PRECIPITATION MEASUREMENT

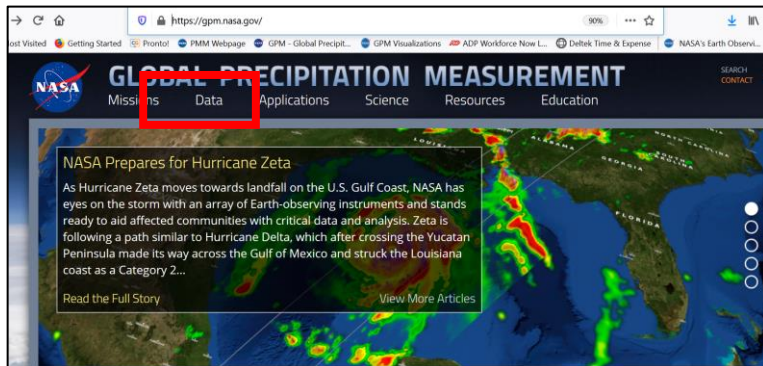
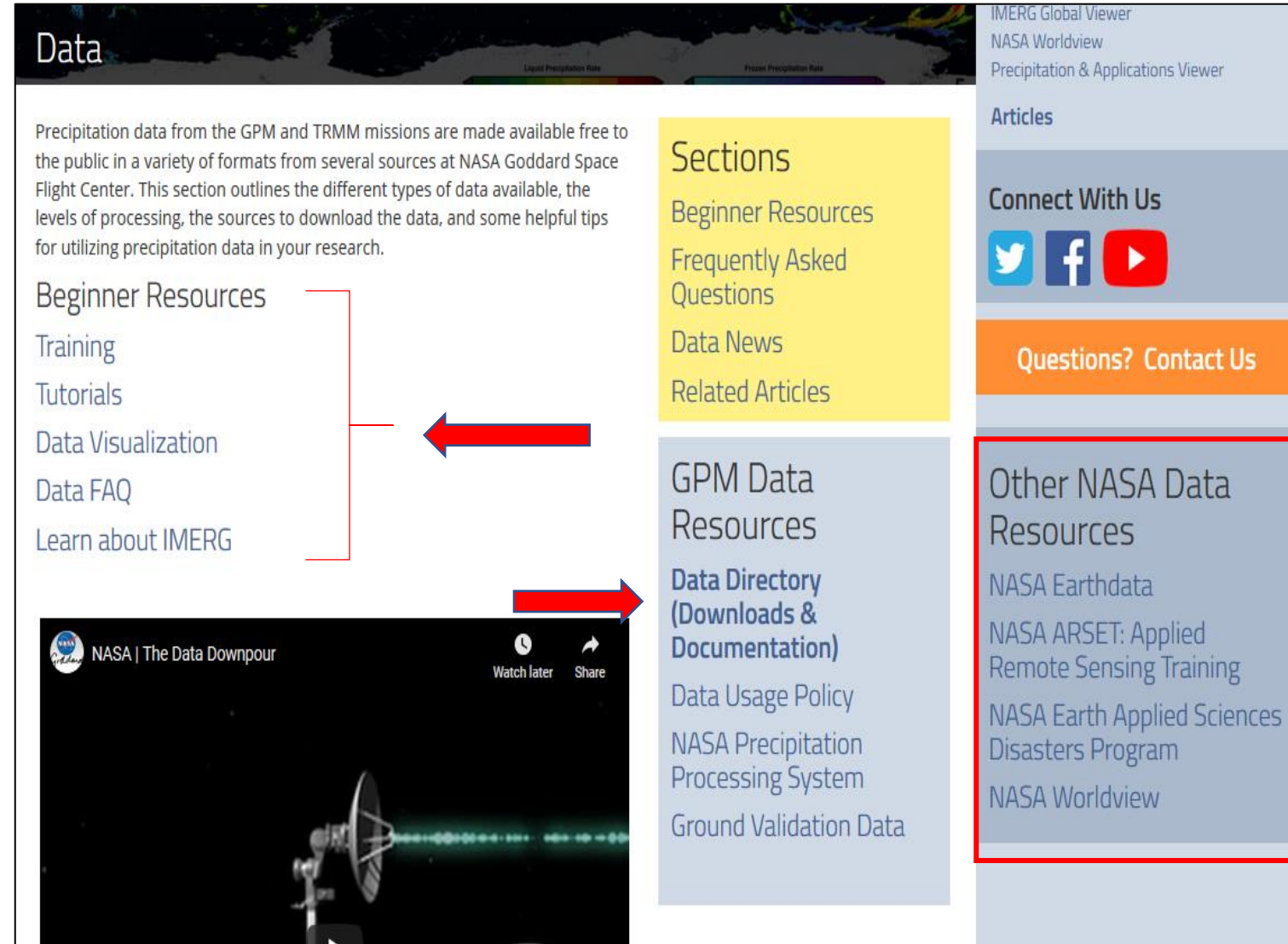
- GPM Webpage: <https://gpm.nasa.gov/>
- Mobile friendly layout
- Handful of resources on the GPM *Home* page
 - Latest GPM coverage stories
 - Direct link to GPM Applications page
 - Latest Half-hour of Earth's Precipitation
 - Upcoming Events
 - Latest @NASA Atmosphere Tweets
 - Direct access to data resources and downloads

Let's take a look.... A quick tour of the NASA GPM Page, <https://gpm.nasa.gov/>



<https://gpm.nasa.gov/data>

- Multiple data access sources for GPM
 - Beginner resources: trainings, tutorials, data visualization, FAQ
 - Data directory (downloads), <https://gpm.nasa.gov/data/directory>
 - Link to other key NASA resources

Data

Precipitation data from the GPM and TRMM missions are made available free to the public in a variety of formats from several sources at NASA Goddard Space Flight Center. This section outlines the different types of data available, the levels of processing, the sources to download the data, and some helpful tips for utilizing precipitation data in your research.

Beginner Resources

- Training
- Tutorials
- Data Visualization
- Data FAQ
- Learn about IMERG

Sections

- Beginner Resources
- Frequently Asked Questions
- Data News
- Related Articles

GPM Data Resources

- Data Directory (Downloads & Documentation)
- Data Usage Policy
- NASA Precipitation Processing System
- Ground Validation Data

Other NASA Data Resources

- NASA Earthdata
- NASA ARSET: Applied Remote Sensing Training
- NASA Earth Applied Sciences Disasters Program
- NASA Worldview

IMERG Global Viewer
 NASA Worldview
 Precipitation & Applications Viewer

Articles

Connect With Us

Twitter Facebook YouTube

Questions? Contact Us

<https://gpm.nasa.gov/data/training>

Beginner Resources

Training

Tutorials

Data Visualization

Data FAQ

Learn about IMERG

Training

Beginner Training Sessions

Overview of Global Precipitation Measurement (GPM) Mission, Data Products and Data Access Tools

Topics Covered:

- Learn about the GPM Core Observatory satellite: Orbital Configuration, Sensors ([GMI](#), [DPR](#)) GPM Constellation Satellites
- Learn about GPM precipitation data products: Level-2 to Level-3 Data Sets from GMI, DPR and Combined GMI-DPR, IMERG Filename Conventions, Formats Spatial and Temporal Resolutions and Coverage Data Search and Access Web-tools Data Quality Potential Data Applications

Training Resources:

- View a recording of the webinar
- Download the webinar slides (pdf)

Introductory Webinar: Overview and Applications of Integrated Multi-Satellite Retrievals for GPM (IMERG) Long-term Precipitation Data Products

Topics Covered:

- Become familiar with the TRMM / GPM Missions, GPM data products, and GPM applications
- Understand IMERG and the strengths and caveats of the long-term IMERG data record
- Find previous training webinars related to GPM precipitation
- Learn to access, analyze, and visualize IMERG precipitation data using NASA web-tools

Recent Training Sessions

(2017 - 2020)

Expand All

Advanced Webinar: Applications of GPM IMERG Reanalysis for Assessing Extreme Dry and Wet Periods +

Introductory Webinar: Overview and Applications of Integrated Multi-Satellite Retrievals for GPM (IMERG) Long-term Precipitation Data Products +

Using NASA Earth Observations to Predict and Monitor Vector-borne and Water-related Diseases - Advanced Level +

Using NASA Earth Observing Data for Monitoring and Response to Vector-borne and Water-borne Diseases +

GPM Agricultural Applications Workshop +

Status of Global Precipitation Measurement (GPM) Mission Data Products and Applications +

NASA Remote Sensing for Flood Monitoring and Management +

Older Training Sessions

(2015 - 2016)

<https://gpm.nasa.gov/data/tutorials>

Beginner Resources

Training

Tutorials

Data Visualization

Data FAQ

Learn about IMERG

Data Tutorials

Visualize GPM Precipitation Radar Data in 3D Using STORM Virtual Globe

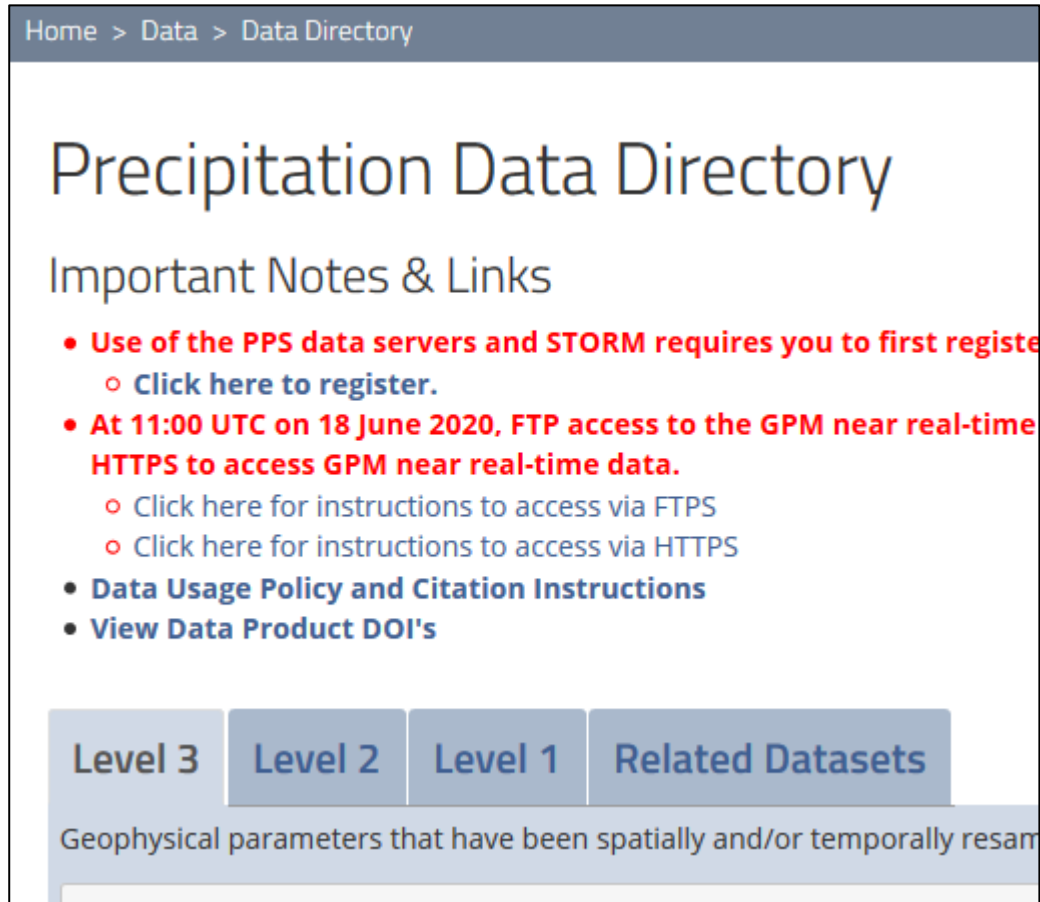
Create a Map or Graph of Rainfall Totals for a Specific Date Range and Location Using GES DISC Giovanni

Read GPM IMERG Data Using Python

Display GPM / TRMM HDF Data Files Using THOR

Import Gridded GPM / TRMM Data in NetCDF Format into ArcGIS

<https://gpm.nasa.gov/data/directory>

A screenshot of the GPM Data Directory website. The page has a breadcrumb trail 'Home > Data > Data Directory'. The main heading is 'Precipitation Data Directory'. Below it is a section titled 'Important Notes & Links' containing several bullet points: 'Use of the PPS data servers and STORM requires you to first register' with a link to register; 'At 11:00 UTC on 18 June 2020, FTP access to the GPM near real-time HTTPS to access GPM near real-time data.' with links for FTPS and HTTPS instructions; 'Data Usage Policy and Citation Instructions'; and 'View Data Product DOI's'. At the bottom, there are four buttons: 'Level 3', 'Level 2', 'Level 1', and 'Related Datasets'. Below these buttons, the text 'Geophysical parameters that have been spatially and/or temporally resam' is partially visible.

GPM Data Directory

- Access to all 3 GPM product levels (geolocated data to gridded precip products)
- Each product level provides information:
 - Description of product
 - Dates covered
 - Latency
 - Resolution
 - Technical documentation

<https://gpm.nasa.gov/data/directory>

Level 0 Raw Instrument Data



Level 1 Geolocated and Calibrated



Level 2 Geophysical Data Product
Derived from L1 Data



Level 3 Composites Of Level 2
Data Products

Level 1 and 2 Orbital Data

Highest spatial/temporal resolution

Precipitation Data
L-2 and L-3

Level 3 Gridded Data

Lower spatial/temporal resolution but
gridded and may be available at
multiple spatial/temporal resolutions

<https://gpm.nasa.gov/data/directory>

Level 3	Level 2	Level 1	Related Datasets
<p>Derived geophysical parameters at the same resolution and location as those of the Level 1 data.</p> <p>As of the GPM Version 6 reprocessing cycle, the radars on both the TRMM and GPM satellites have their data products written in the HDF5 file format. Also as of Version 6 the research products are stored in the same FTP archive for both satellites, ftp://pps.gsfc.nasa.gov/. The FTP archive is organized into directories whose names are "yyyy/mm/dd/radar/" where yyyy, mm, and dd are the four-digit year and the two-digit month and day of month, respectively. In prior reprocessing cycles, TRMM and GPM data products were stored in different FTP archives. As of May 2020, PPS distributes near-realtime GPM data via FTPS and HTTPS rather than FTP. A similar switch is expected to occur with research data products later in 2020.</p>			
<div>2B Combined<ul style="list-style-type: none">Single-orbit rainfall estimates from combined radar/radiometer data (GPM GMI & DPR, TRMM TMI & PR)</div>			
<div>2A Radar<ul style="list-style-type: none">Single-orbit radar rainfall estimates for GPM DPR, Ka, Ku and TRMM PR</div>			
<div>2A Radiometer (GPROF & PRPS)<ul style="list-style-type: none">Single-orbit radiometer rainfall estimates from GPM GMI, TRMM TMI, and constellation microwave radiometers</div>			

Three Algorithms and Products:

- Dual Precipitation Radar
- Microwave Radiometer
- Combined Radar & Radiometer

<https://gpm.nasa.gov/data/directory>

Level 3	Level 2	Level 1	Related Datasets
Geophysical parameters that have been spatially and/or temporally resampled from Level 1 or Level 2 data.			
IMERG Early Run			
▸ Near real-time low-latency gridded global multi-satellite precipitation estimates			
IMERG Late Run			
▸ Near real-time gridded global multi-satellite precipitation estimates with quasi-Lagrangian time interpolation			
IMERG Final Run			
Research-quality gridded global multi-satellite precipitation estimates with quasi-Lagrangian time interpolation, gauge data, and climatological adjustment			
3B Combined			
▸ Gridded rainfall estimates from combined radar/radiometer data (GPM GMI & DPR, TRMM TMI & PR)			
3A Radar			
▸ Gridded rainfall estimates from radar data (GPM DPR, TRMM PR)			
3A Radiometer (GPROF)			
▸ Gridded rainfall estimates from GPM GMI, TRMM TMI, and constellation microwave radiometers			

Uniformly Gridded Products:

- Radar, Radiometer, and Combined Level-3 data
- IMERG: Multi-satellite Merged Algorithm and Data product
 - Long temporal coverage combined with TRMM data
 - Widely used for a variety of applications

<https://gpm.nasa.gov/data/directory>

- Multiple ways to view and analyze data
- Each product provides:
 - Data source (GPM downloaded from two NASA primary data archive servers, GES DISC and PPS)
- Option to download in format of your choice

Data Source ^	Instruments	Primary Unit / Variable	Data Format(s)	Temporal Resolution	Instructions / Notes	Download URL
GES DISC	Multisatellite	Precipitation Rate (mm/hr) / precipitationCal	Visualization, GeoTIFF, HDF5, NetCDF, OPeNDAP	30 Minute, 1 Day, 1 Month	<ul style="list-style-type: none"> • On GES DISC site, see gray "Data Access" box in top right for download links • To generate data visualizations, click the blue "Giovanni" button • Allows for data subsetting 	30 Minute: https://disc.gsfc.nasa.gov/datasets/GPM_30M 1 Day: https://disc.gsfc.nasa.gov/datasets/GPM_3IMERG 1 Month: https://disc.gsfc.nasa.gov/datasets/GPM_3IMERG
PPS Research	Multisatellite	Precipitation Accumulation (mm)	GeoTIFF	30 Minute, 1 Day, 1 Month	<ul style="list-style-type: none"> • Click here to register for PPS data access • Read documentation for using IMERG GeoTIFF + Worldfiles • Files located in <code>./[yyyy]/[mm]/[dd]/gis/</code> • 30 minute, 1 day and 1 month files are all available in the same directory, with the timespan indicated within the filename (e.g. 3B-DAY-GIS.MS.MRG.3IMERG.20170101-S000000-E235959.0000.V06B.zip is a 1 day file) • 1 month files are located in the folder corresponding to the first day of each month. • Precipitation values are scaled by a factor of x10 (0.1mm) for 30 minute and 1 day files, and are scaled by a factor of x1000 (.001mm) for 1 month files. • When you download and unzip the *.zip files of Final IMERG GIS, you will find *.tif files that contain precipitation accumulations and other *.tif files that contain precipitation averages. 	ftp://arthurhou.pps.eosdis.nasa.gov/gpmdata/

Let's take a look.... A quick tour of the GPM Directory page, <https://gpm.nasa.gov/data/directory>

<https://gpm.nasa.gov/data/sources>

[PPS Near Real-time and Research](#)

[GES Disc](#)

[Giovanni](#)

[PPS Storm](#)

[Worldview](#)



Bulk Data Download

Analysis and Visualization

Visualization

Visualization

Demonstration: Precipitation Processing System

PPS Near Real-time and Research

Precipitation Processing System (PPS)

[PPS Home](#)[GPM Home](#)[TRMM Home](#)[GPM Instrumentation](#)[Related Links](#)[Contact Us](#)

About PPS, GPM and TRMM

Data

Tools

PPS/GPM Documentation

PPS/GPM ATBD (Algorithm Theoretical Basis Documents)

PPS/TRMM Documentation

Other Documentation

Quick Links

- > News and Updates
- > PMM (Precipitation Measurement Missions)
- > JAXA (Japan Aerospace Exploration Agency)
- > GES-DISC (GSFC Earth Sciences Data and Information Services Center)
- > Colorado State Univ/PPS MEaSURES Products
- > Data Search, Custom Subsets and Subscriptions (STORM)


Welcome to the PPS (Precipitation Processing System) Public Website

The Precipitation Processing System (PPS) evolved from the Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS). The purpose of the PPS is to process, analyze and archive data from the Global Precipitation Measurement (GPM) mission, partner satellites and the TRMM mission. The PPS also supports TRMM by providing validation products from TRMM ground radar sites. All GPM, TRMM and Partner public data products are available to the science community and the general public from the TRMM/GPM FTP Data Archive. Please note that you need to [register](#) to be able to access this data.

You can quickly register with PPS at our registration portal: [Register with PPS](#)

Please note, that this registration requirement is now mandatory per NASA policy and the new metric requirements. We do not accept email addresses that require us to take a manual action (Boxbe, etc.) to complete this process. Please do not use a university address, etc. that is a reflector to gmail but use the direct gmail address instead.

Once registered with us, you can use your registered Email address as both your user name and password to access our public data archive. Registered researchers can access our "arthurhou" data archive here: [PPS TRMM/GPM Public Data Archive](#)



BREAKING NEWS

[The PPS \(Precipitation Processing System\) will be down on Tuesday November 03, 2020 from 8:00am - TBD EST \(1:00z - TBD\) for scheduled routine maintenance. Click \[here\]\(#\) for further details.](#)

IMPORTANT: Please be aware that at the end of 2020 (est: Dec. 29, 2020) FTP access to 'ftp://arthurhou.pps.eosdis.nasa.gov/' will be replaced with FTPS and HTTPS access. This change is mandated by NASA/GSFC Internet Security.

[The PPS GPM NRT has transitioned from FTP to FTPS and https data retrieval as of June 18, 2020 on jsimpson](#)

Please reference IMPORTANT GPM NRT documents at the [GPM NRT Information](#) page for full details. These documents include the following: [FTP to FTPS Transition](#), [jsimpsonhttps retrieval](#) and [SDPF Transition from FTP to FTPS](#). The

Demonstration: Precipitation Processing System Science Team On-Line Request Module (STORM)

<https://storm.pps.eosdis.nasa.gov/storm/>



[- HOME](#)
[+ DATA ACCESS](#)
[+ TOOLS](#)
[+ PRODUCT INFORMATION](#)
[+ REGISTRATION](#)

Home

Need Help?

- STORM User Guide
- Help Desk

News

08/27/2020 - The GPM spacecraft experienced an anomaly that caused an interruption of all science instrument data beginning on 8/19/2020 around 1200 UTC. As of 8/26/2020, all data collection was resumed and instruments are in good condition. Click here for details.

07/07/2020 - PPS will start reprocessing the GPM Spectral Latent Heating (SLH) V06B L2 and L3 data on Tuesday, July 7, 2020, to correct a bias between the KuPR near-surface precipitation and vertically integrated latent heating in V06A.

07/06/2020 - PPS is announcing a new TKIO-3.97 release which includes the latest production formats including

Notice on the PPS transition from FTP to FTPS (July 2020):
At the end of 2020, FTP access to all production data on <ftp://arthurhou.pps.eosdis.nasa.gov/> will be replaced with FTPS and HTTPS access only. This change is a NASA/GSFC security mandate. In the interim, orders processed through STORM will include FTP, FTPS, and HTTPS options. We encourage you to transition your code to FTPS and HTTPS as soon as possible to avoid any data access gaps once the FTP server is shut down. See these documents on [the PPS transition of NRT data to FTPS](#) and [arthurhouhttps access](#) for more information. Please contact the [PPS Help Desk](#) if you have any questions.

PPS Data Access - to search for GPM and TRMM data, order custom subsets and set up subscriptions.

PPS Public Archive - to access GPM and TRMM standard products via online ftp.

These are the products available to the public. To retrieve data go to [PPS Data Access](#) or [PPS Public Archive](#).

Data Type	Algorithm	Satellite	Instrument	Primary Content
3A	3HSLHT	TRMM	PR	Latent Heating
3A	3HSLHT	TRMM	PR	Latent Heating
3B	3IMERGD_GIS	AQUA,F16,F17,F18,F19,GC	AMSRE,SSMIS,SSMIS,SSM	Precipitation
3B	3IMERGHH	AQUA,F16,F17,F18,F19,GC	AMSRE,SSMIS,SSMIS,SSM	Precipitation
3B	3IMERGHH_GIS	AQUA,F16,F17,F18,F19,GC	AMSRE,SSMIS,SSMIS,SSM	Precipitation
3B	3IMERGM	AQUA,F16,F17,F18,F19,GC	AMSRE,SSMIS,SSMIS,SSM	Precipitation
3B	3IMERGM_GIS	AQUA,F16,F17,F18,F19,GC	AMSRE,SSMIS,SSMIS,SSM	Precipitation
3A-ASC	3PR	TRMM	PR	Precipitation
3A-DES	3PR	TRMM	PR	Precipitation
3A	3PR	TRMM	PR	Precipitation
3A	3PRD	TRMM	PR	Precipitation
3A	3PRPSSAPHIR	MT1	SAPHIR	Precipitation
3A	3PRPSSAPHIR	MT1	SAPHIR	Precipitation
3A-CLIM	3PRPSSAPHIR	MT1	SAPHIR	Precipitation
3A-CLIM	3PRPSSAPHIR	MT1	SAPHIR	Precipitation
0	ATT_TRMM_ORB	TRMM	NONE	Satellite Position
0	CT_CORIOLIS	CORIOLIS	NONE	Satellite-Ground Coincidence
0	CT_CORIOLIS_XML	CORIOLIS	NONE	Satellite-Ground Coincidence
0	CT_F16	F16	NONE	Satellite-Ground Coincidence
0	CT_F16_XML	F16	NONE	Satellite-Ground Coincidence
0	CT_F17	F17	NONE	Satellite-Ground Coincidence
0	CT_F17_XML	F17	NONE	Satellite-Ground Coincidence
0	CT_F18	F18	NONE	Satellite-Ground Coincidence
0	CT_F18_XML	F18	NONE	Satellite-Ground Coincidence



Precipitation Processing System (PPS)



Global Precipitation Measurement Mission (GPM)



Tropical Rainfall Measuring Mission (TRMM)



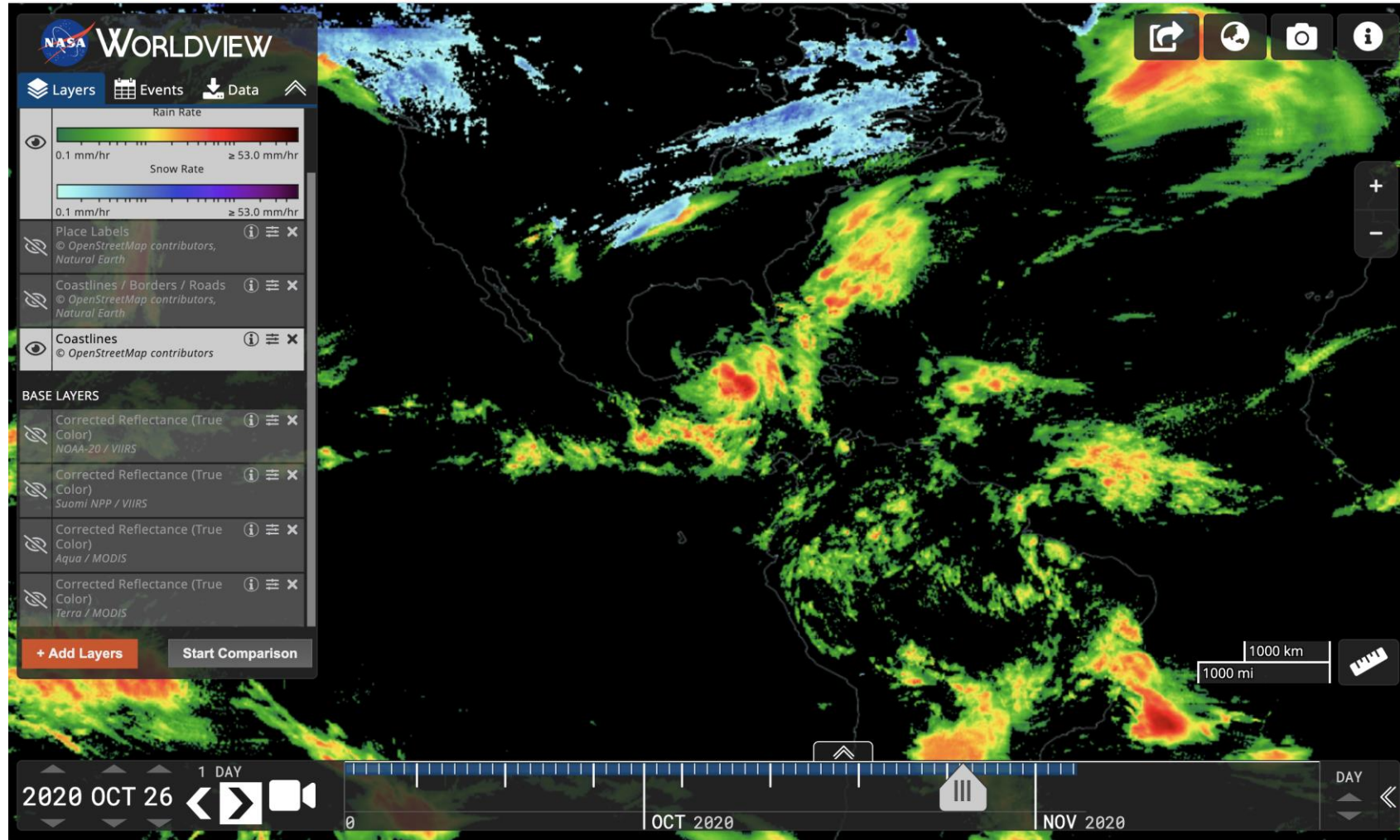
GPM Ground Validation Data



GPM Field Campaign Data

Demonstration: Worldview

<https://worldview.earthdata.nasa.gov/>



GPM Beginner Resources: Visualizations

Quick ways to view GPM data

Beginner Resources

Training

Tutorials

Data Visualization

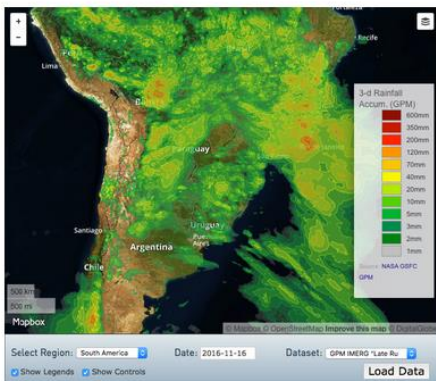
Data FAQ

Learn about IMERG



IMERG Global Viewer

View the latest near-realtime GPM IMERG global precipitation datasets (30 minute, 1 day, 7 day) on an interactive 3D globe in your web browser.



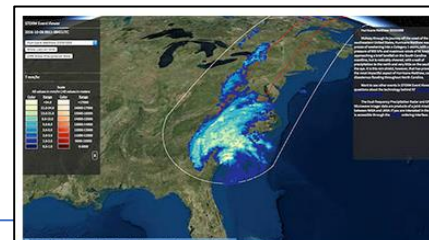
Precipitation & Applications Viewer

View and download various precipitation and applications datasets from the past 60 days (30 minute, 1 day, 3 day, 7 day precipitation, floods nowcast, landslides nowcast). Download datasets in various popular formats (TIF, SHP, arcJSON, geoJSON, topoJSON) and learn how to directly access the data via the PMM Publisher API.

IMERG Global Viewer: View the latest IMERG global precipitation accumulations on an interactive 3D globe

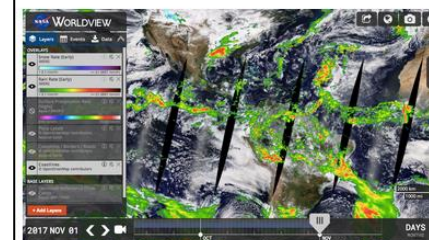
Precipitation & Applications Viewer: Download datasets in various popular formats (TIF, SHP, arcJSON, geoJSON, topoJSON) and learn how to directly access the data via the PMM Publisher API.

- **STORM Event Viewer:** View latest extreme weather events on an interactive globe.
- **NASA Worldview:** Browse global, full-resolution satellite imagery and then download the underlying data, including data from GPM.
- **GIOVANNI:** view, analyze, and download multiple Earth science datasets (including GPM) from within your web browser.



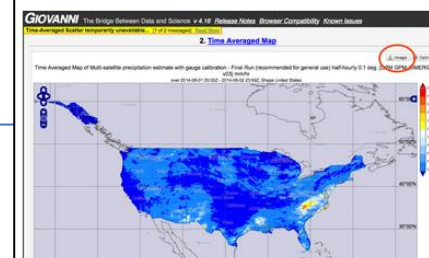
STORM Event Viewer

View 2D GMI and 3D DPR data from the latest extreme weather events on an interactive 3D globe in your web browser. ([click here for mobile version](#))



NASA Worldview

This tool from NASA's Earth Observing System Data and Information System (EOSDIS) provides the capability to interactively browse global, full-resolution satellite imagery and then download the underlying data, including data from the Global Precipitation Measurement Missions.



GES DISC Giovanni

This website from the NASA GES DISC provides a powerful tool for viewing, analyzing, and downloading multiple Earth science datasets (including TRMM and GPM) from within your web browser. This tool is capable of generating custom time averaged maps, animations, multi-variable correlations, regional subsetting, and much more.

[Click here for a tutorial on creating precipitation maps using Giovanni](#)

<https://gpm.nasa.gov/data/visualization>

GPM Application Examples

Using GPM to inform decision-making that directly impacts society

Statement of the Problem:

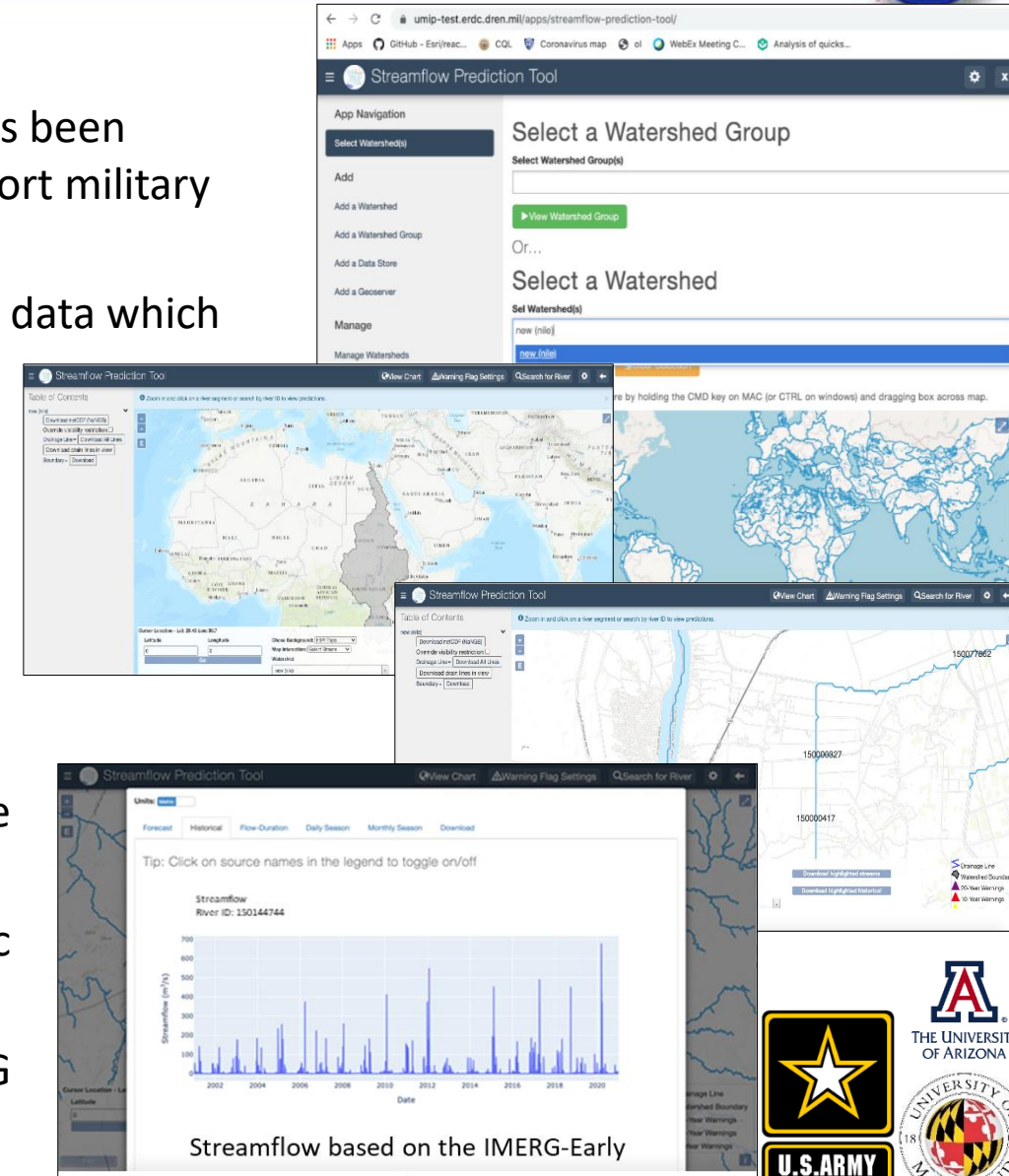
- The U.S. Army Engineer Research and Development Center (ERDC) has been maintaining and developing Streamflow Prediction Tool (SPT) to support military costumers and first responders.
- The SPT framework for flood prediction is lacking NASA observational data which can enhance the SPT capability to predict real-time streamflow and flood mapping simulations.

Use of GPM data:

- IMERG is the key source of global precipitation data that can be used for near real-time flood simulation at high spatiotemporal resolution.

Outcomes:

- IMERG was successfully integrated into SPT system to produce streamflow prediction at very high resolution needed by Army.
- Developed interactive map-based web interface to make the hydrologic information easily accessible and comprehensible for decision making.
- IMERG Final produces reasonable streamflow simulations, but IMERG early and late show overestimation in late winter and early spring.
- Efforts are underway to advance the system and make it more accessible by commanders.

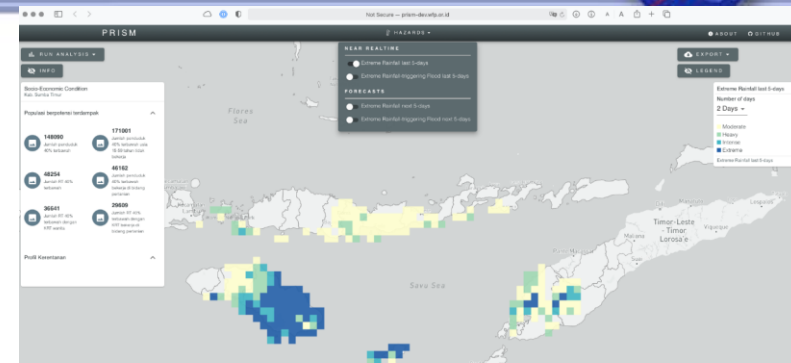


Representatives from World Food Programme Indonesia and BMKG (Met agency) are utilizing IMERG within the Platform for Real-time Impact and Situation Monitoring ([PRISM](#)).

IMERG half-hourly and daily products are used to provide daily precipitation information including precipitation extremes.

This information is then used to assess the potential risk and forecasts the impact of climate hazards, especially droughts and floods on food security in the most vulnerable communities throughout Indonesia, in order to design risk reduction activities and target disaster responses.

Screenshot of the PRISM prototype on extreme rainfall monitoring during Tropical Cyclone Seroja



Flowchart of IMERG at WFP Indonesia for decision-making

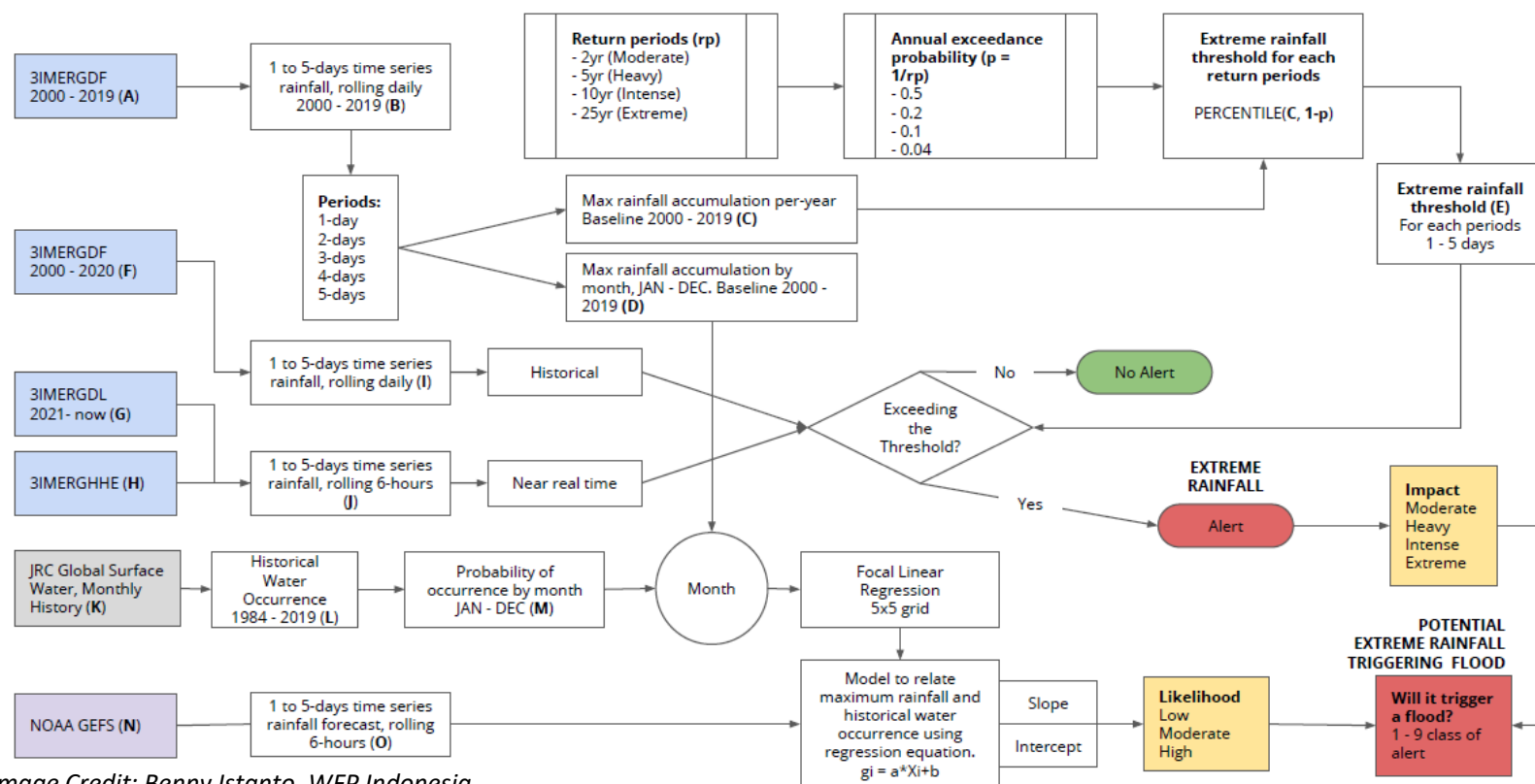


Image Credit: Benny Istanto, WFP Indonesia

- To make NASA EO data more accessible for electric utility end user needs, Battelle developed a StoryMap to directly support energy applications.
- GPM data, products and tutorials are provided to support these electric utility end users.
- This StoryMap was designed to offer actionable information on applications for electric utility end user needs; including third party or private sector organizations providing related services to utilities within the U.S. and internationally.
- Check out the StoryMap [HERE!](#)

NASA Earth Observations for Electric Utility Applications

A Story Map **BATTELLE**

Home Case Studies **Datasets** Definitions Tutorials

Energy Infrastructure & Assets Elevation Evapotranspiration Fire & Burn Products Groundwater & Soil Moisture Land Cover/Land Use Change

Precipitation

A Story Map **esri**

3 Multi-satellite Precipitation Models (GPM IMERG)

The [Global Precipitation Measurement \(GPM\)](#) mission is an international network of satellites that provide the next-generation global observations of rain and snow. The [Integrated Multi-satellitE Retrievals for GPM \(IMERG\)](#) algorithm combines information from the GPM satellite constellation to estimate precipitation over the majority of the Earth's surface. This algorithm is particularly valuable over the majority of the Earth's surface that lacks precipitation-measuring instruments on the ground. Now in the latest Version 06 release of IMERG the algorithm fuses the early precipitation estimates collected during the operation of the TRMM satellite (2000

WORLDVIEW

Layers Events Data

OVERLAYS

Precipitation Rate
IMERG

Rain Rate

☐ Group Similar Layers

+ Add Layers **Start Comparison**

2018 FEB 24 1 DAY

18 MAR 2018

2000 km
2000 mi

Screenshot of the StoryMap Portal highlighting GPM tools that are available for stakeholders to use for electric utility applications.



MiCRO, a reinsurance company, is increasing climate resilience to extreme events among 20K+ individuals and small and micro-entrepreneurs throughout Central America with the help of NASA satellite data.

Through data modeling, MiCRO develops index-based insurance products that are based on analysis of environmental parameters. As such, NASA GPM precipitation data was used to create a reliable and credible index on which to trigger a policy and client payouts when severe drought or excess precipitation occurs.



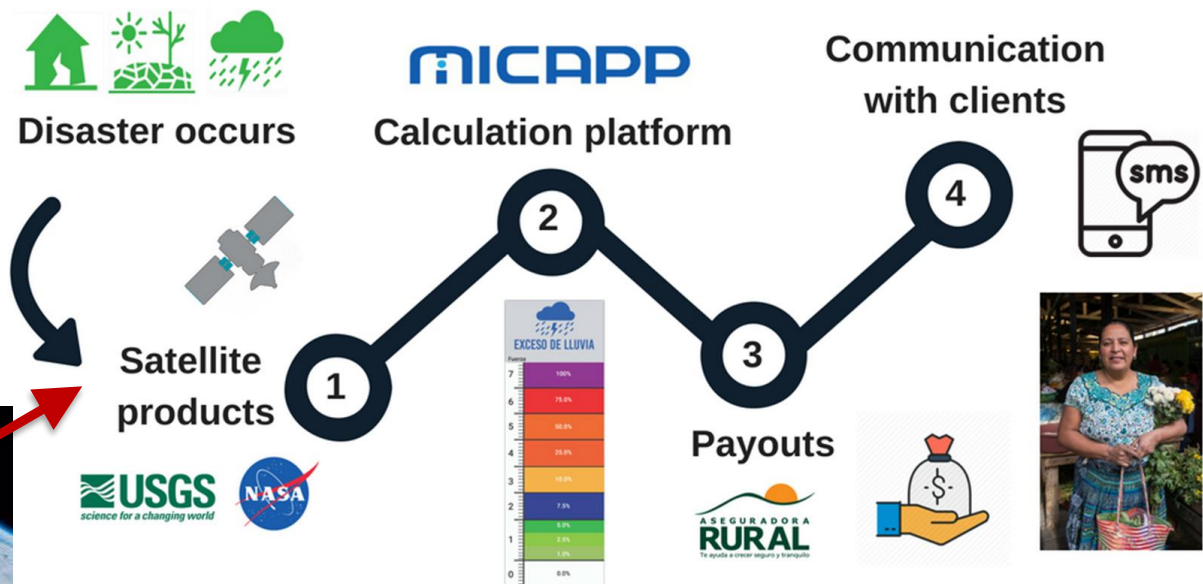
The Earth observing satellite data from NASA is used to determine whether a client will receive a payout from a climatic event (such as drought or excess rainfall). This data is processed in real-time in order to allow objective, transparent and efficient payouts. -Iker Llabres, MiCRO



FROM SPACE TO MICROINSURANCE



Increasing the resilience to natural disasters of the most vulnerable



MiCRO's flow chart depicting how they determine the amount of a payment to insured clients when a disaster strikes: NASA satellite data (1) is used to design payout triggers (2). When disasters occurs and depending on its severity, payment is determined (3) and clients are informed via text (4).

Climacell, a weather technology company, routinely uses GPM IMERG data for model validation and calibration for their global urban flood forecasting operations. Climacell is also exploring the use of IMERG as input into their Global Urban and Flash Flood Forecasting (CGUFF) System. Their forecasts help communicate flooding severity for a given area where severity levels from level 1 (common) to 8 (severe) are communicated to the public through an app and online broadcasts. This system is used to communicate potential flooding events throughout the world (900+ cities), helping hundreds of millions across Asia, South America and Africa.

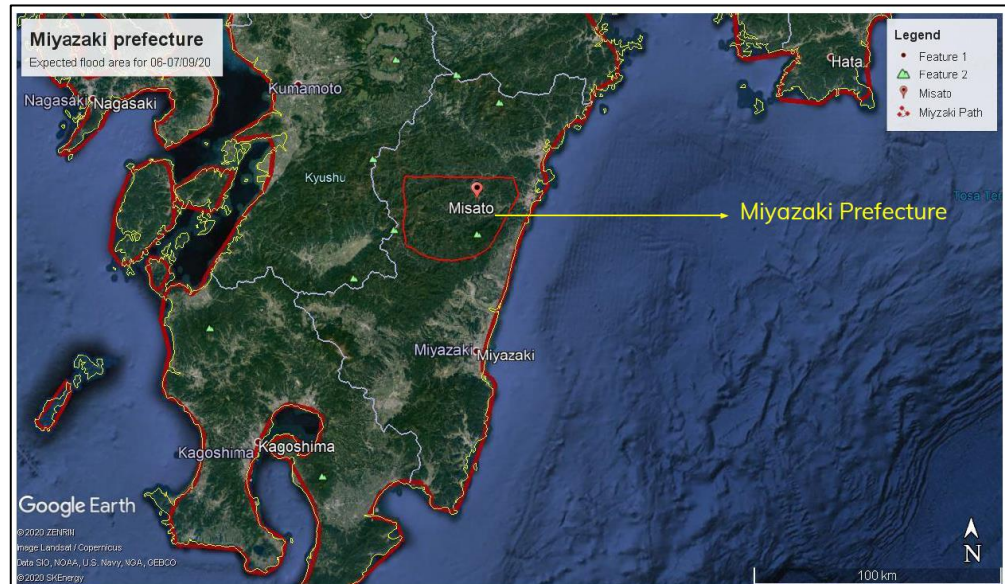


Figure 1: Expected area with very high probability for urban flooding in the Miyazaki prefecture

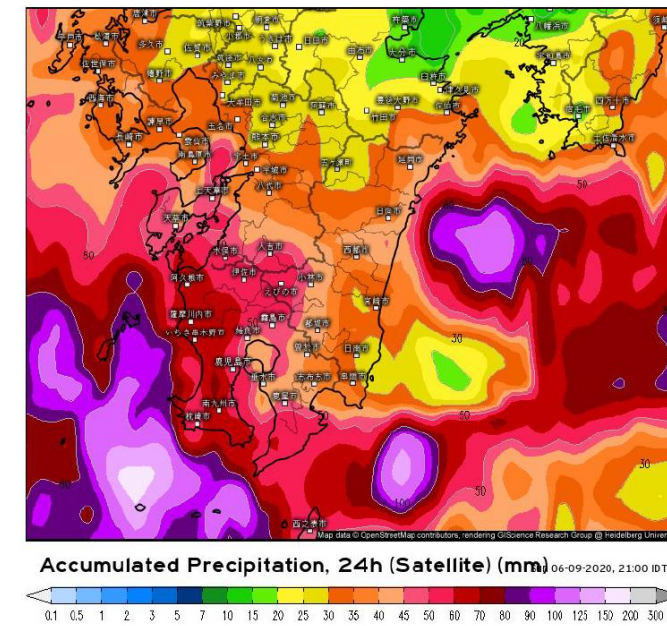
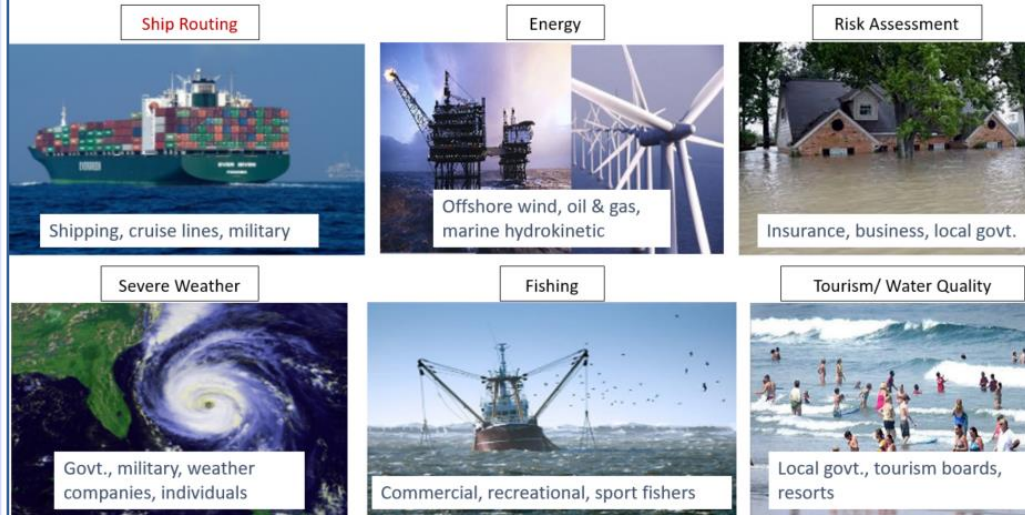


Figure 3: Observed 24h accumulated precipitation for Typhoon Haishen, the Miyazaki Prefecture, Japan

Climacell example: Typhoon Haishen made landfall in southern Japan on Sept. 6-7, 2020. The precipitation forecasts that fed Climacell's flood model projected rainfall estimates between 250-500 mm in 24hr around the Miyazaki Prefecture (image left). The observed precipitation was much lower, around 70-80 mm, and IMERG corroborated these rainfall totals within the Miyazaki Prefecture (image right). Images provided by Amir Givati, Climacell, www.climacell.co/urban-flooding-forecast/.

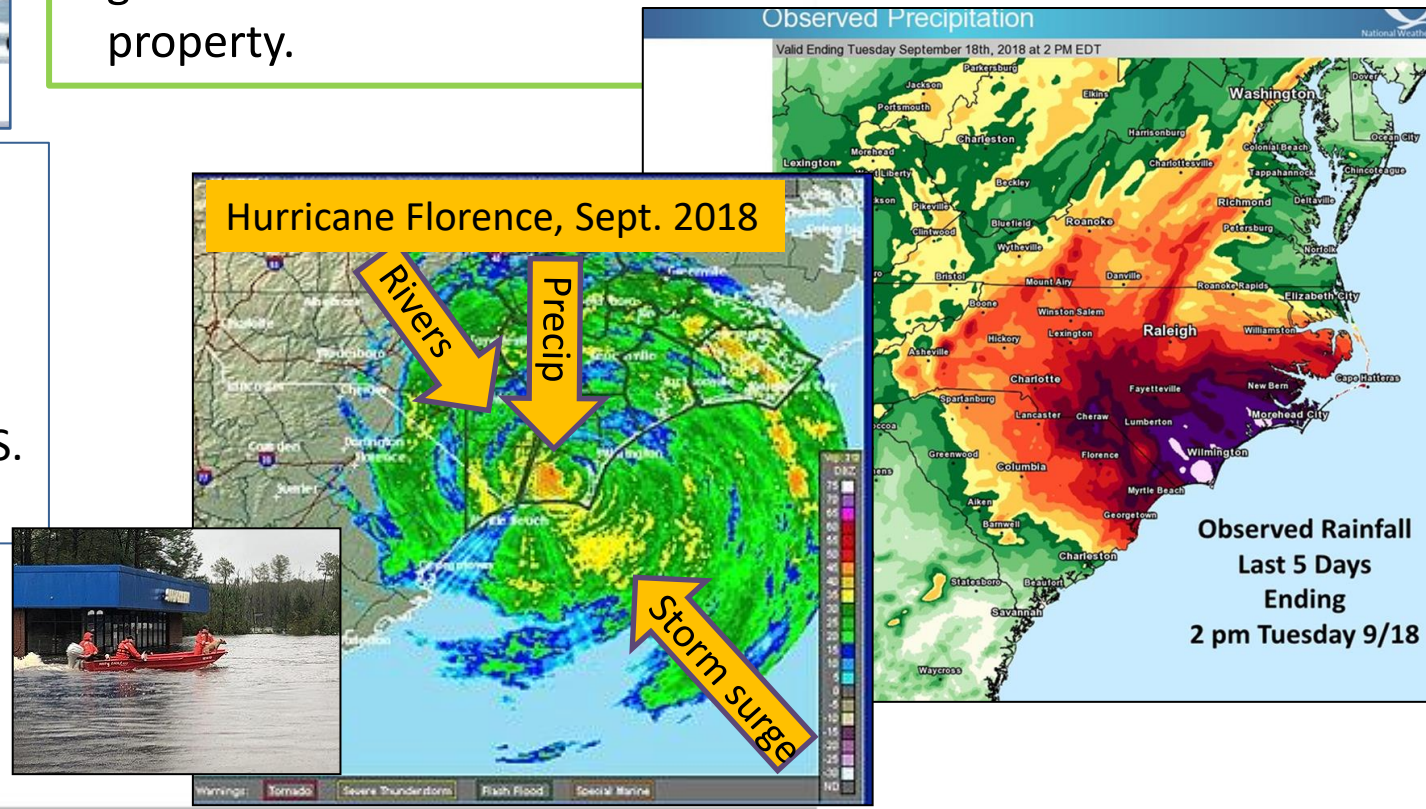
Sectors Fathom Science Serves



- ❖ Reps from Fathom Science participated at the 2020 GPM-ACCP Transportation Workshop.
- ❖ Fathom's proprietary system ingests real-time observations, including satellite data, into their coupled marine environment model covering U.S. coastal oceans, Gulf of Mex. and Caribbean.

- Fathom used GPM data to model the arrival of Hurricane Florence and forecast **compound flooding** in N.C. in Sept. 2018.
- Compound flooding = local precipitation + storm surge + increased river runoff
- *The area around Wilmington, NC received over half its annual rainfall in 5 days, leading to major compound flooding.
- Forecasts of events like this are of critical importance to local governments and other users to minimize the risk to life and property.

Hurricane Florence, Sept. 2018

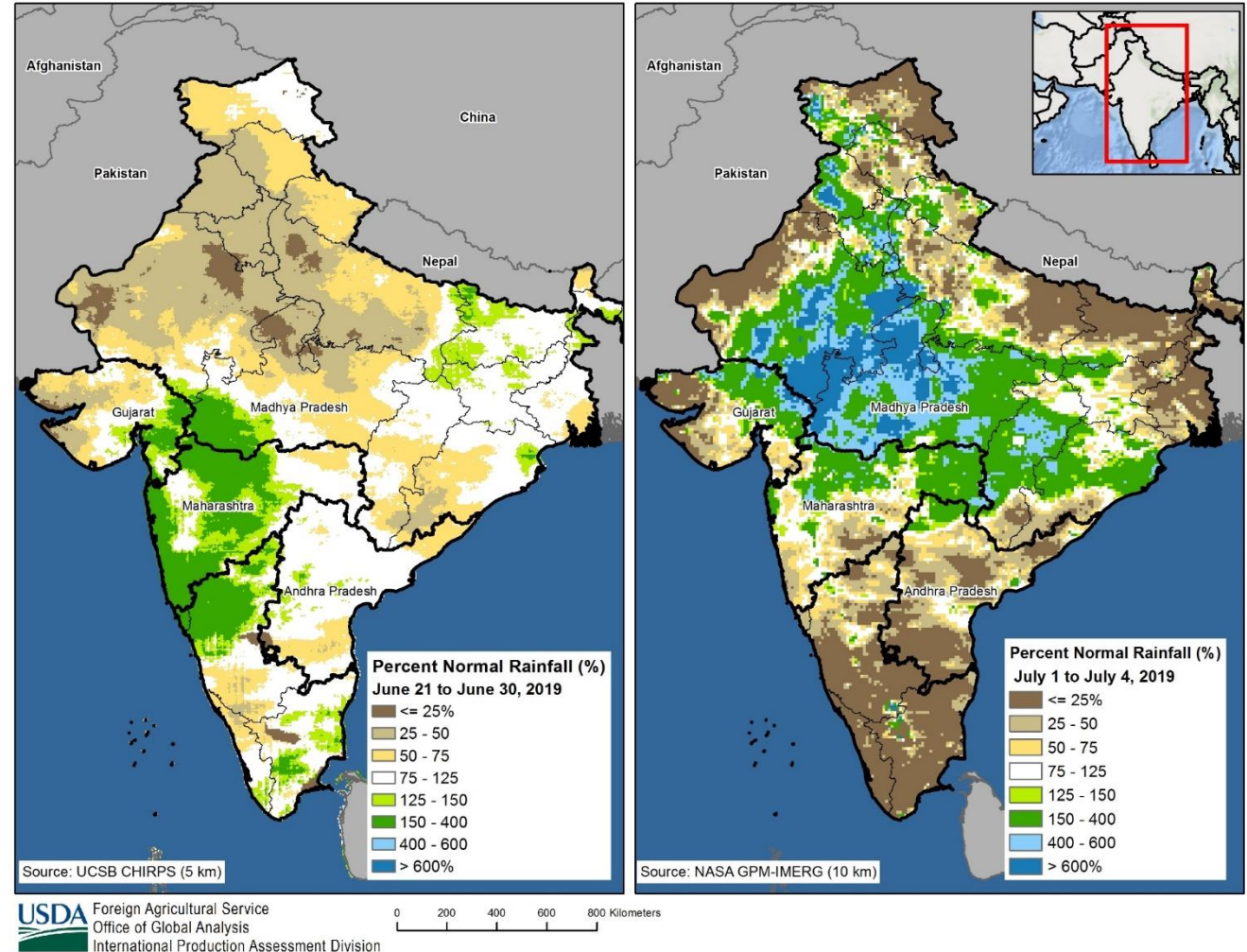


For the full Fathom Science presentation and recording:
<https://gpm.nasa.gov/science/meetings/2020-transportation-workshop>

While [CHIRPS](#) and World Meteorological Organization (WMO) station data serve as primary precipitation data sources for the USDA Foreign Agricultural Service ([FAS](#)), GPM IMERG data have supported FAS operations in multiple ways:

- IMERG estimates are routinely evaluated against WMO station data used by USDA FAS above 50°N latitude for consensus to produce crop assessments in those regions.
- USDA evaluates crop production estimates monthly. At this time, handful of countries and agricultural commodities are chosen for further evaluation, and quick turnaround of products is necessary. IMERG estimates have provided a timely precipitation product for this evaluation. See example at right and comment below.

“IMERG was able to provide a timely product where we didn’t have a 10-day product from the CHIRPS data stream yet.”



Previous CHIRPS and then IMERG estimates that corroborate reports of heavy rains after a prolonged drought in the Madhya Pradesh region in 2019. Credit: Justin Blackburn, USDA FAS

GPM Case Study

*A video and presentation from NASA
Scientist, Amber McCullum,
highlighting her use of NASA data for
decision-making*

Questions?
Comments?

Thank you!