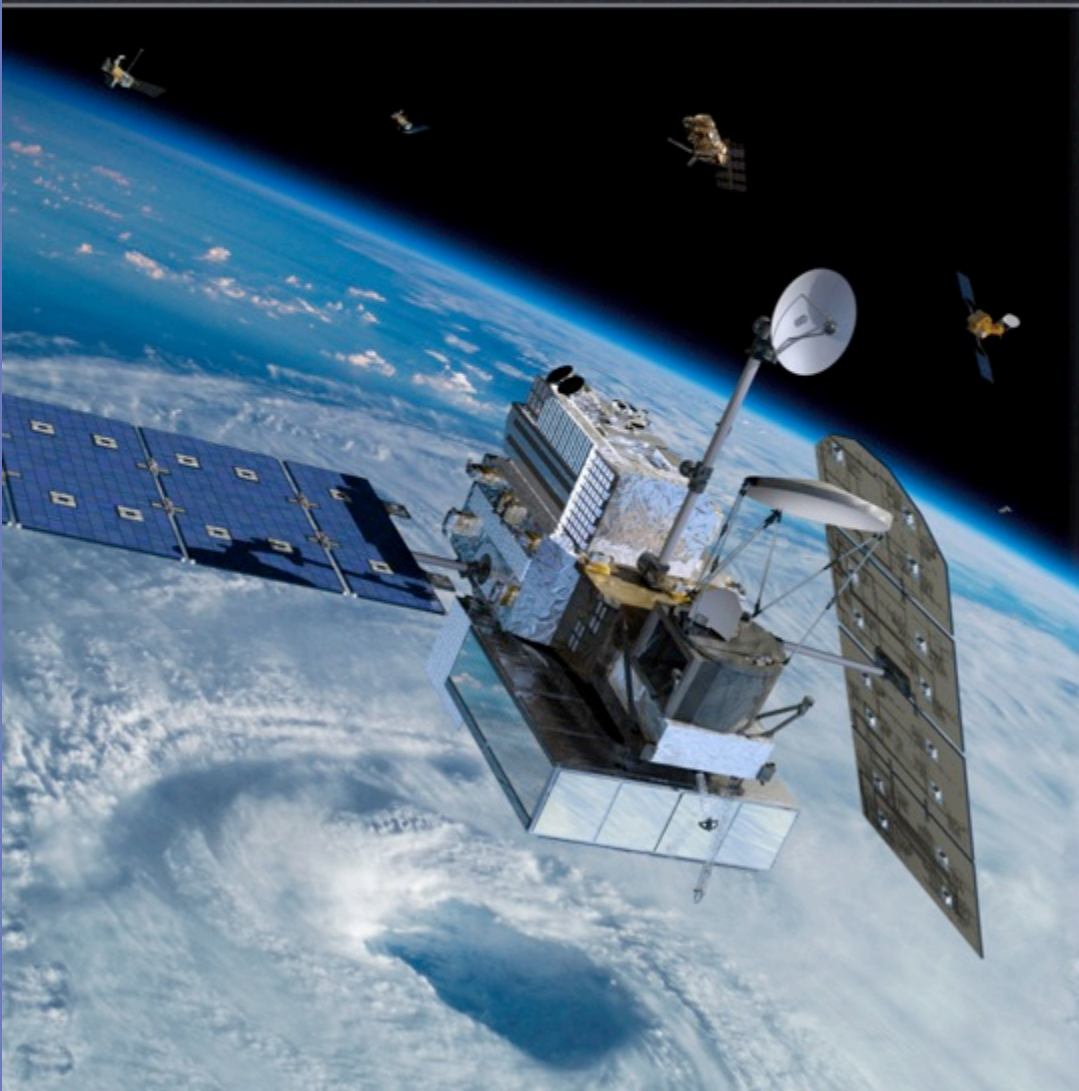




From TRMM to GPM: Advancing Precipitation Observations for Science and Society

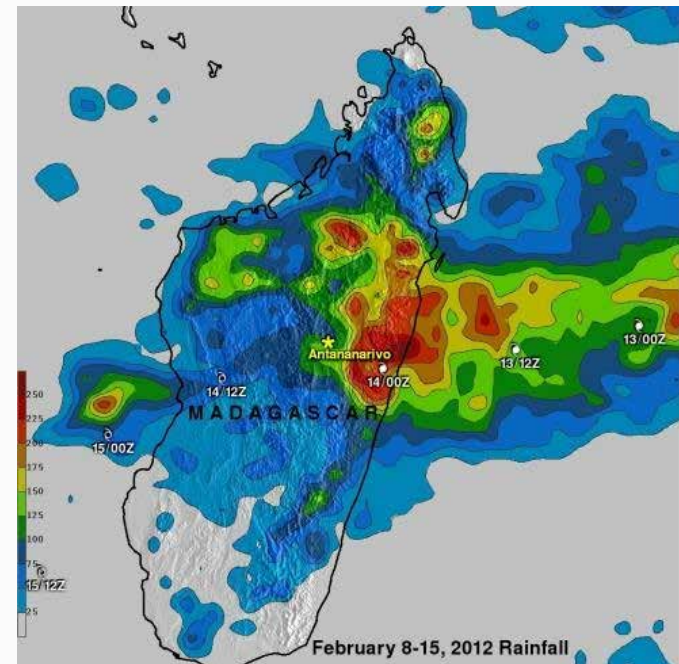
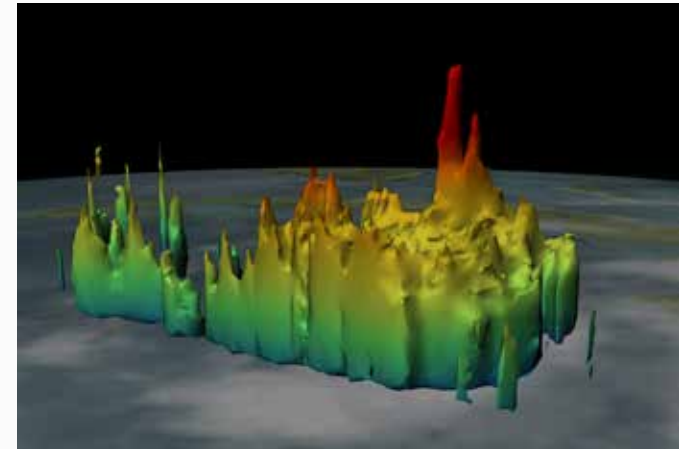


Gail Skofronick Jackson
GPM Project Scientist
NASA Goddard Space
Flight Center
Greenbelt, MD USA

- Launched in 1997 to measure tropical rainfall
- Currently has a 17-year record of precipitation from $\sim 35^\circ$ North to 35° South
- Partnership between NASA and the Japan Aerospace Exploration Agency (JAXA)
- Data at <http://trmm.gsfc.nasa.gov>

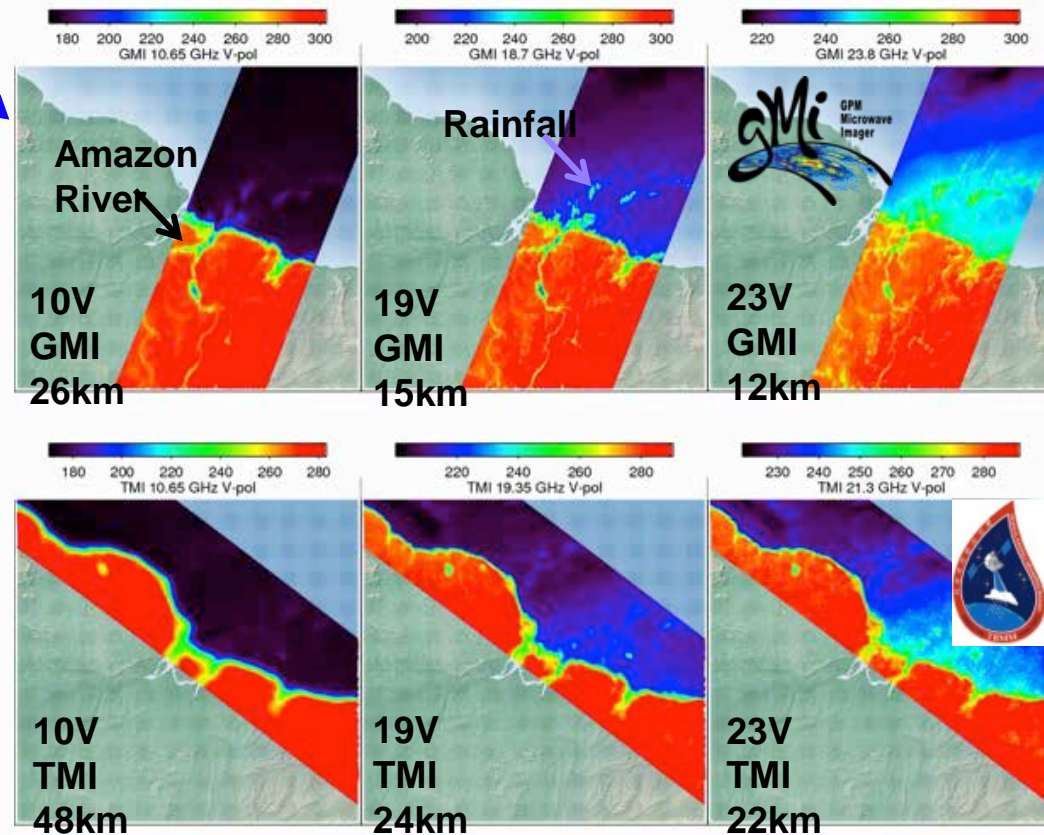
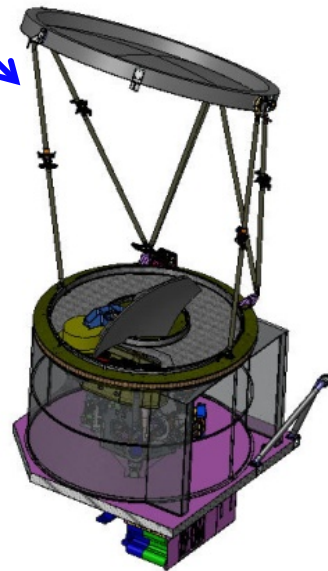
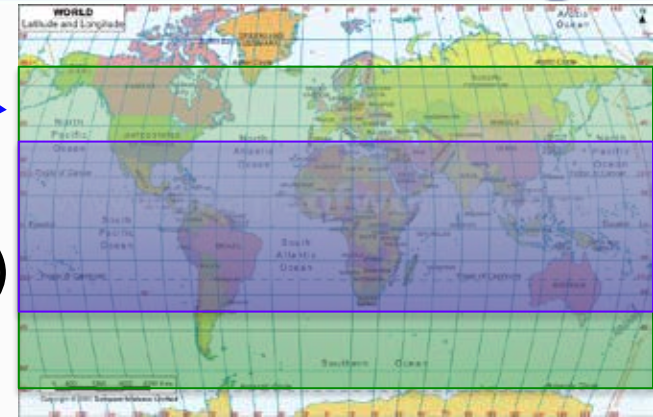
GPM instrument enhancements and improved retrievals estimate light rainfall and snow typically found in higher latitudes

Hot Towers observed in Hurricane Wilma



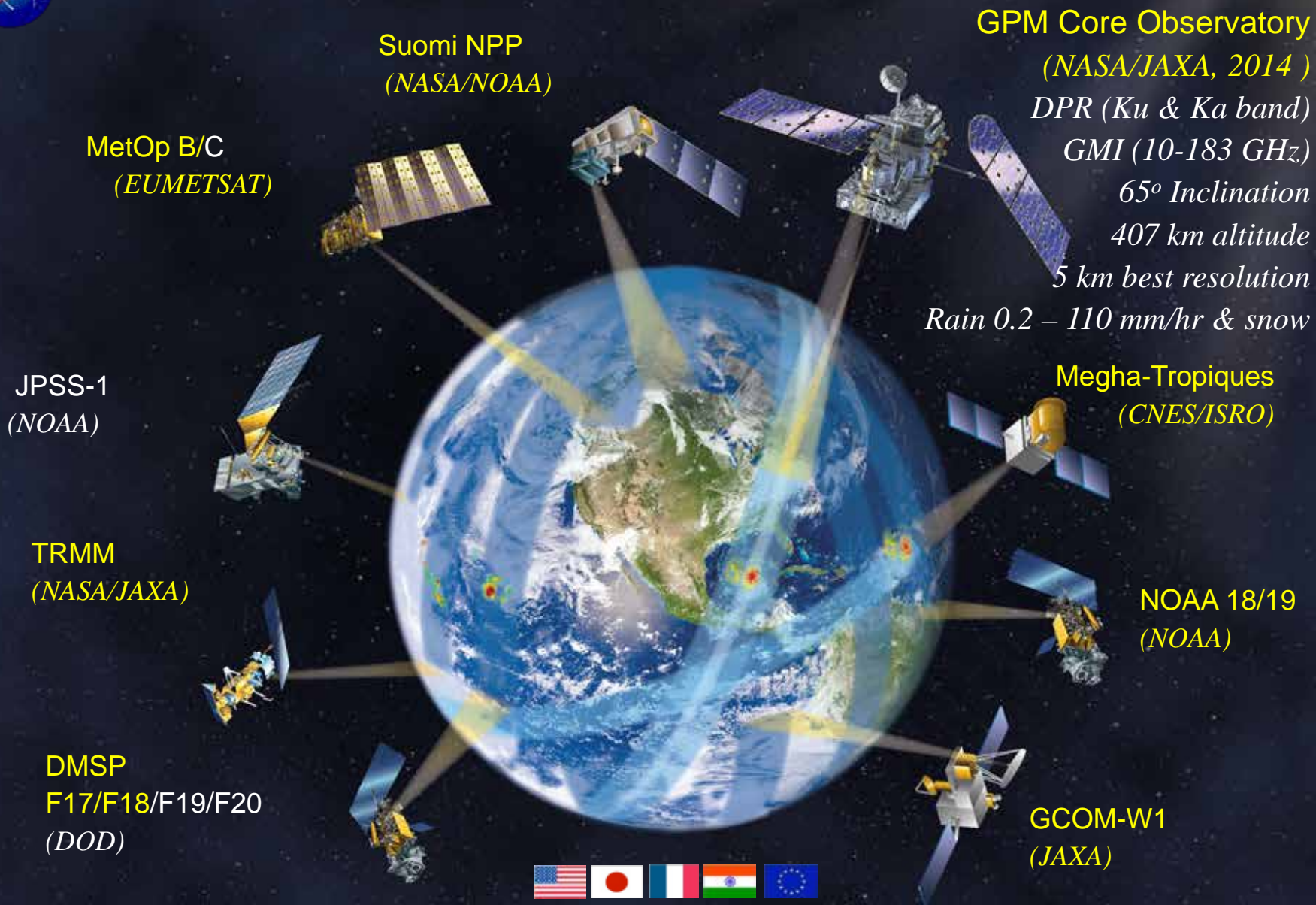
Rainfall Accumulation from Tropical Cyclone Giovanna, triggering deadly floods in Madagascar

- Increased Earth Coverage
- Advanced Instruments
 - Dual Freq. Precipitation Radar (DPR)
 - GPM Microwave Radiometer (GMI)
- Finer spatial resolution
- Well designed GMI radiometer (unifies partner estimates)





GPM Constellation Concept



Next-Generation Unified Global Precipitation Products Using GPM Core Observatory as Reference

Science Objectives:

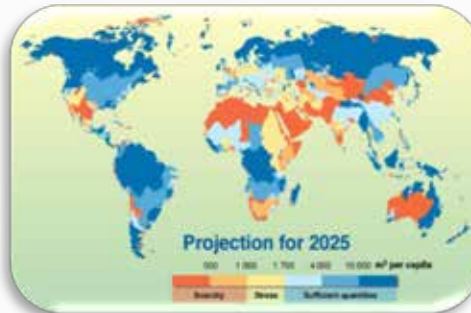
- § New reference standards for precipitation measurements from space
- § Improved knowledge of water cycle variability and freshwater availability
- § Improved numerical weather prediction skills
- § Improved climate prediction capabilities
- § Improved predictions for floods, landslides, and freshwater resources

Societal Benefits:

Floods and Landslides



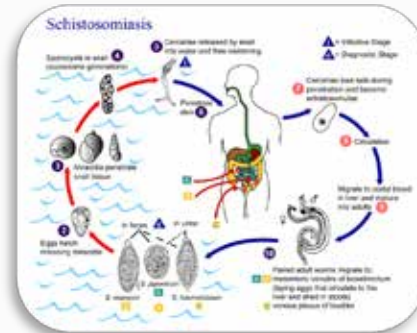
Freshwater Availability/ Agriculture/Famine



Extreme Events

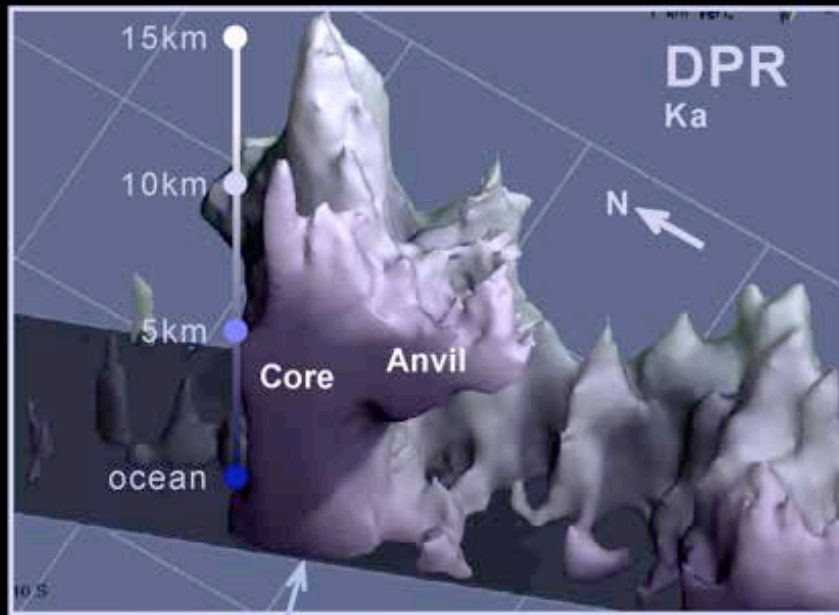


World Health



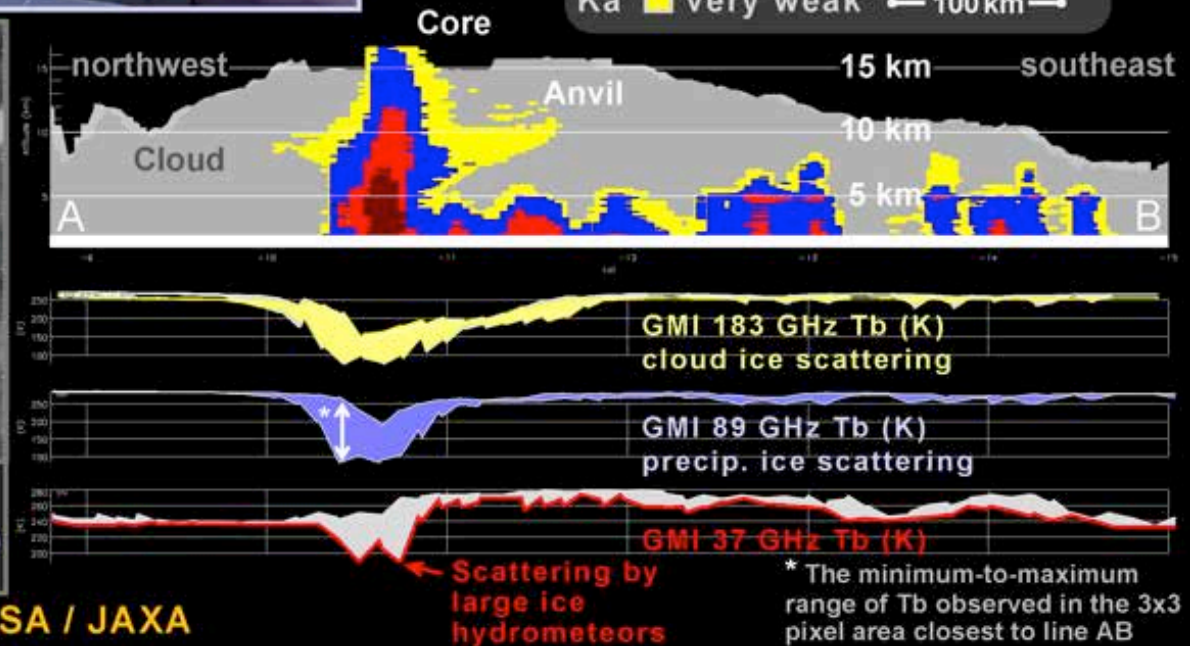
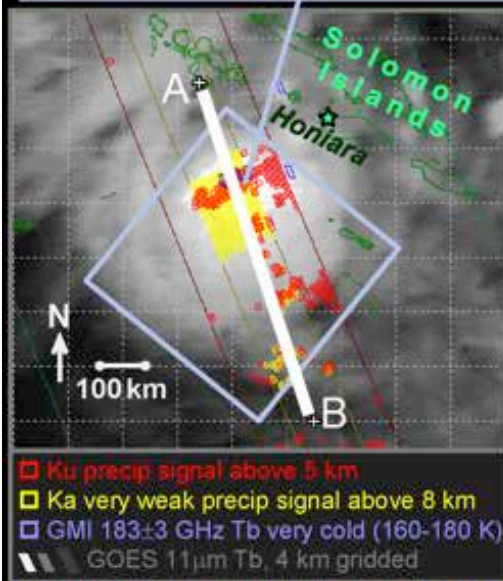
Applications & Users:

Cyclones, Re-insurance, Famine Early Warning, drought, water resource management, Agriculture, Numerical Weather Prediction, Land System Modeling, Global Climate Modeling Disease tracking, Animal migration, Food Security

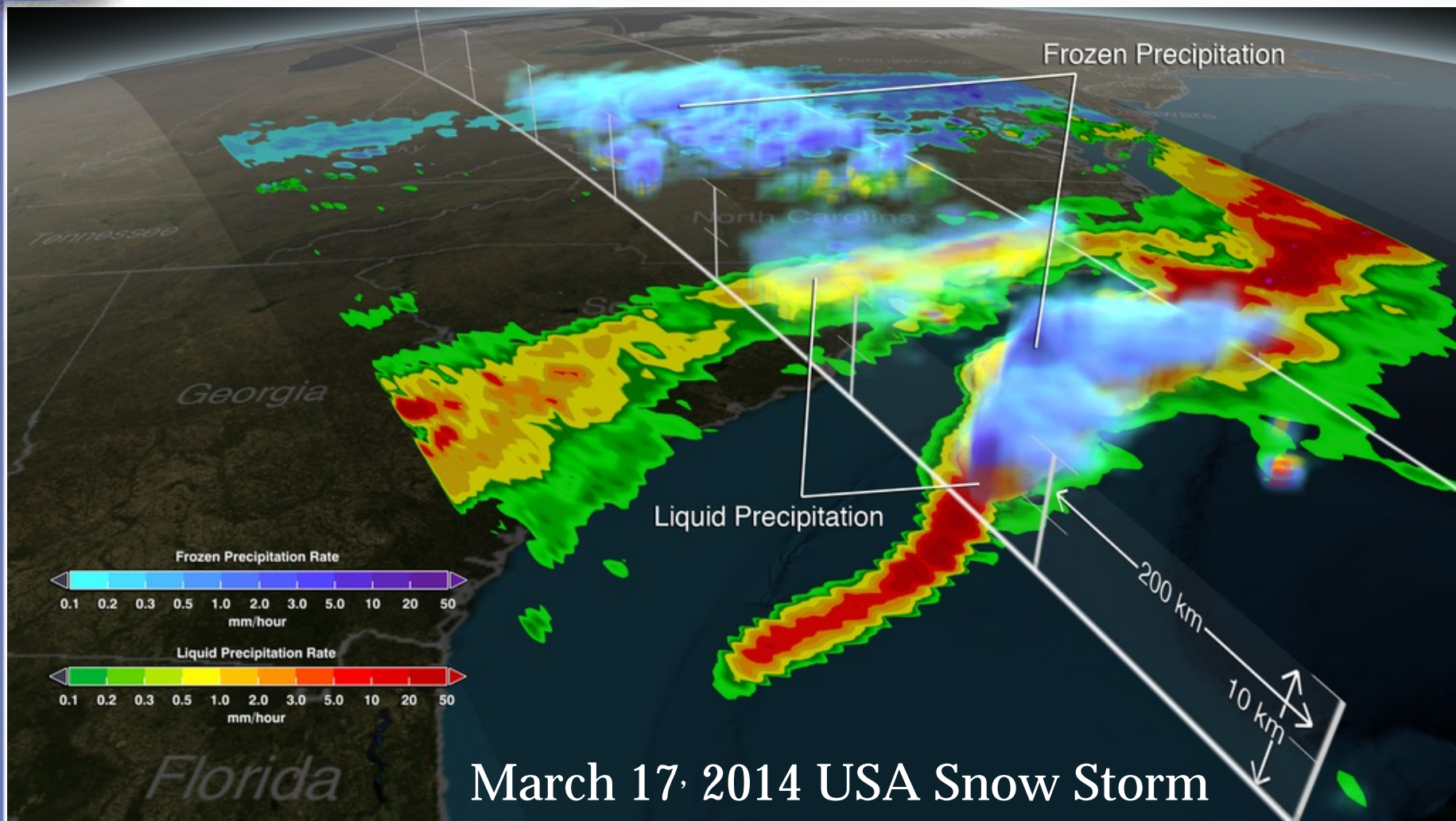


One day after flooding the Solomon Islands, the precursor to Tropical Cyclone Ita is seen by GPM
4 April 2014 0853 UTC 12°S 158°E

Precipitation Signal Strength
Ku ■ weak ■ mid ■ strong
Ka ■ very weak — 100km —



GPM data courtesy of NASA / JAXA



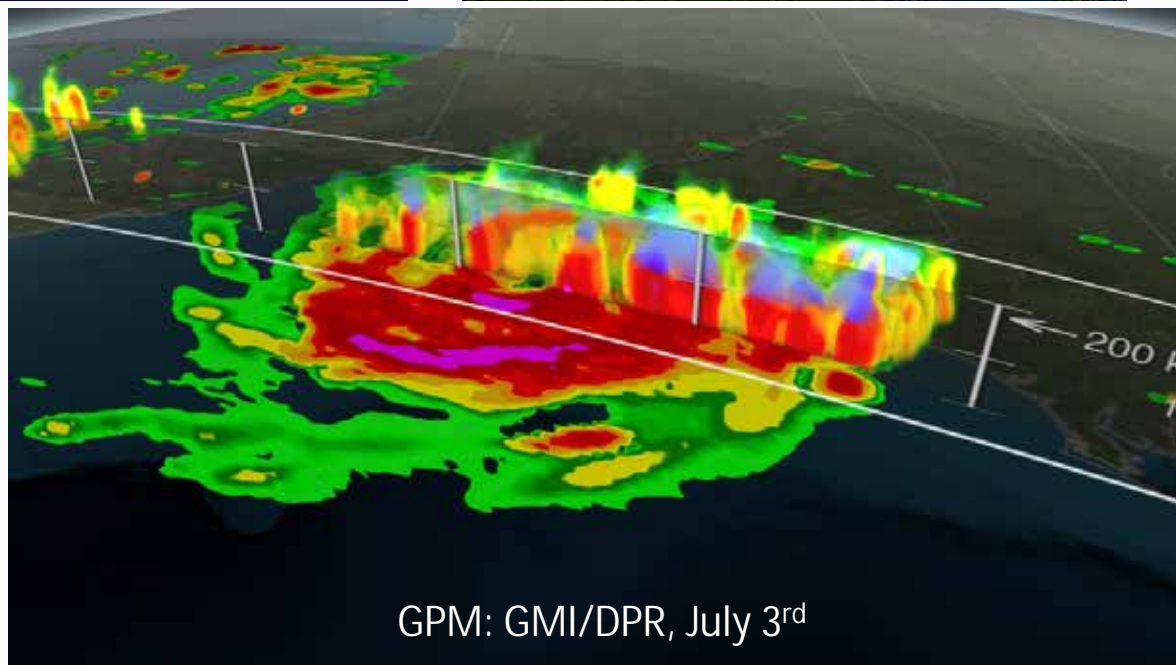
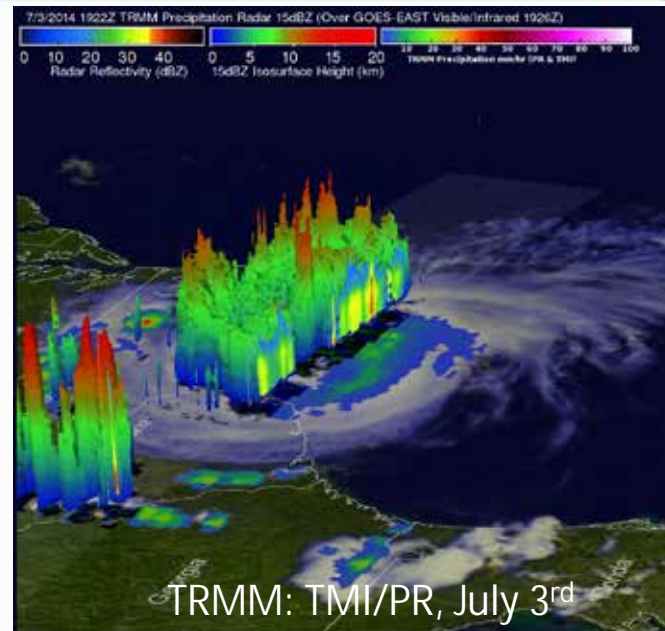
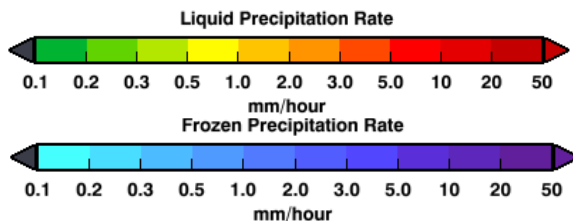
On March 17, 2014 the Global Precipitation Measurement (GPM) mission's Core Observatory flew over the East coast's last snow storm of the 2013-2014 winter season. This was also one of the first major snow storms observed by GPM shortly after it was launched on February 27, 2014. Visualization: <http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=41737>

GPM's additional imaging extent
(relative to TRMM)



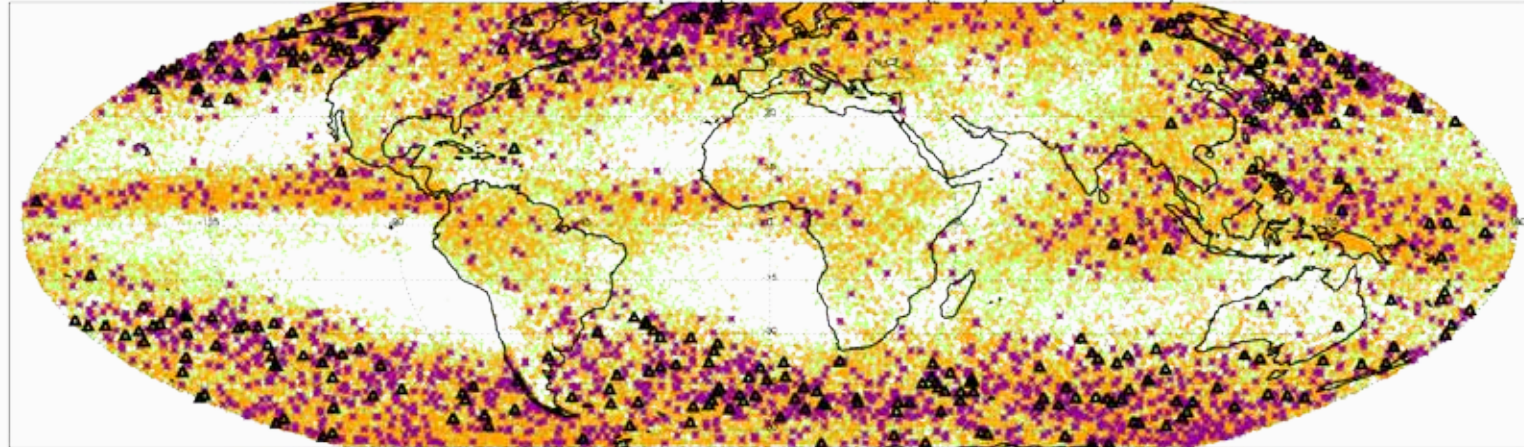
Hurricane Arthur Track

Hurricane Arthur affected the East Coast of the U.S. from July 1-7th. TRMM and GPM viewed the storm multiple times throughout its lifecycle. GPM was able to view the storm as it progressed poleward



The most extensive precipitation systems are found over mid and high latitude ocean

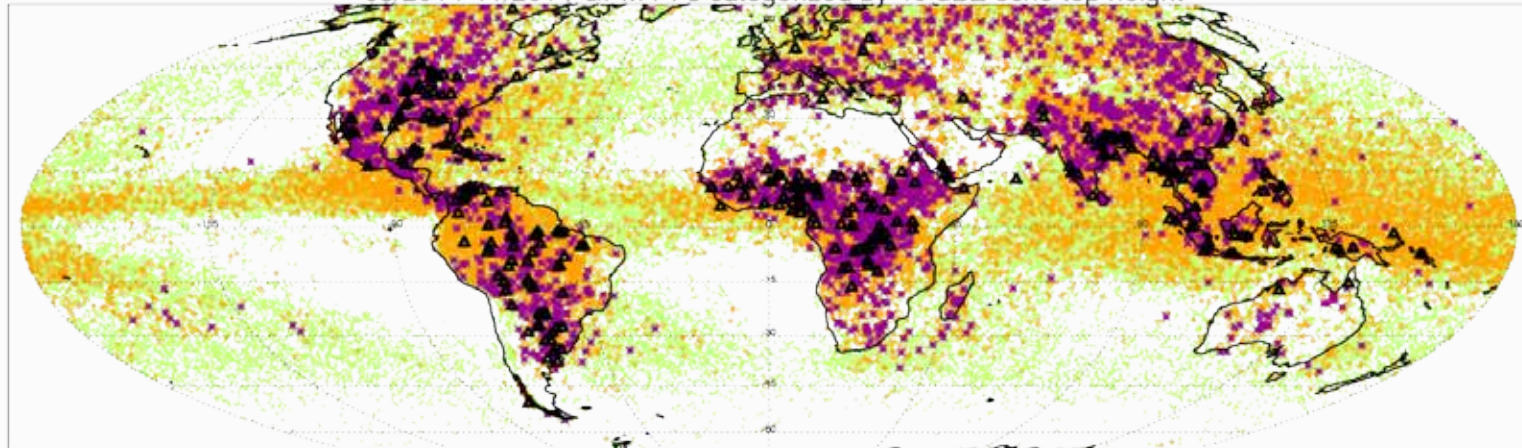
03/2014-11/2014 GPM precipitation features (PFs) categorized by size



Size of events	81 - 899 km ²	899 - 7034 km ²	7034 - 52167 km ²	52167 - 122679 km ²	122679 - 378263 km ²	Percent of Events
	90.13% (1354524 PFs)	7.87% (118257 PFs)	1.80% (27021 PFs)	0.1799% (2704 PFs)	0.0200% (301 PFs)	

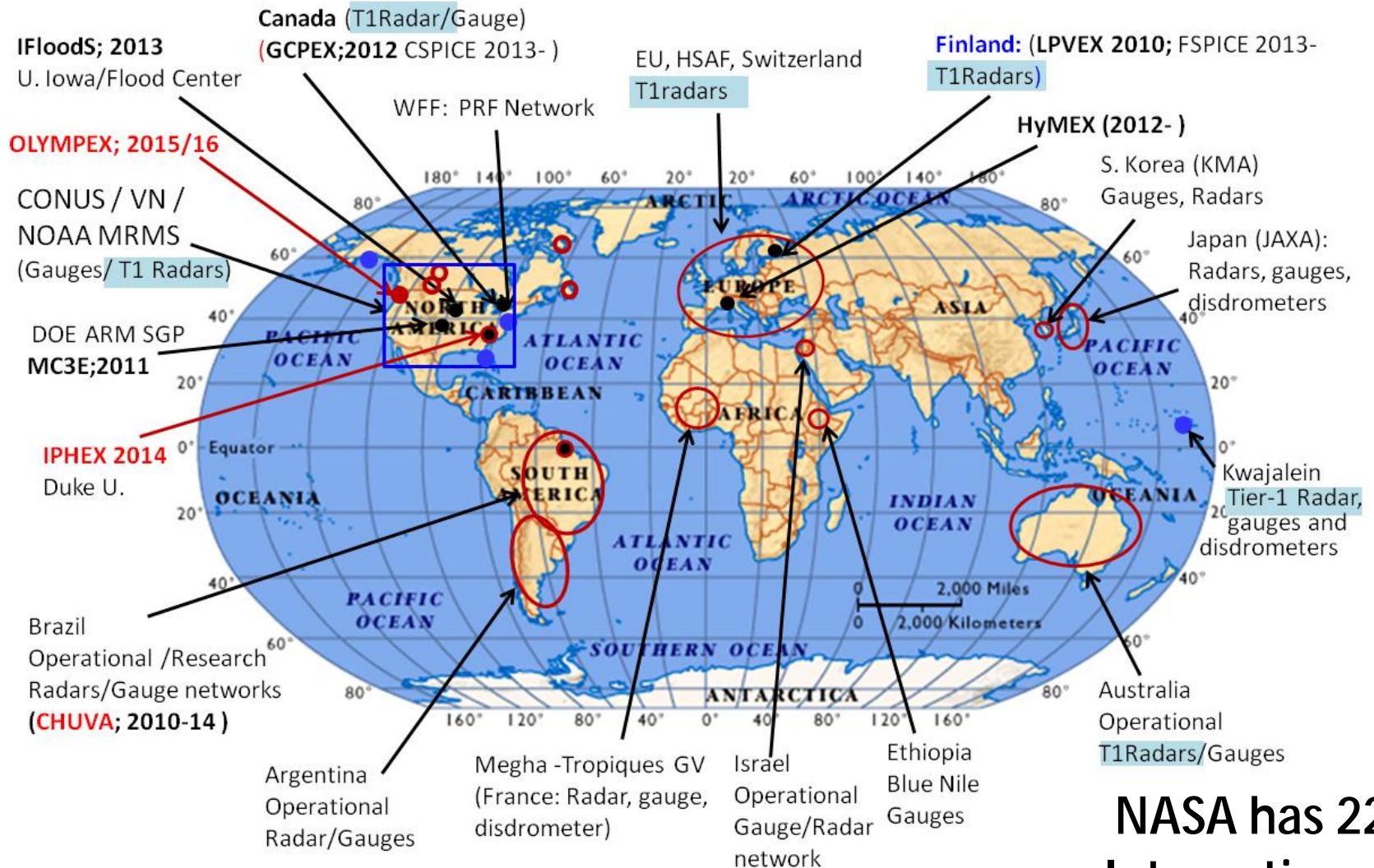
The strongest storms such as hailstorms and lightning storms are dominant over land

03/2014-11/2014 GPM PFs categorized by 40 dBZ echo top height



0.0 - 2.4 km	2.4 - 5.6 km	5.6 - 9.0 km	9.0 - 13.6 km	13.6 - 18.4 km
90.46% (1359445 PFs)	7.67% (115200 PFs)	1.68% (25285 PFs)	0.1718% (2582 PFs)	0.0196% (295 PFs)

GPM is a global mission with an international team



**NASA has 22
International
Partners**

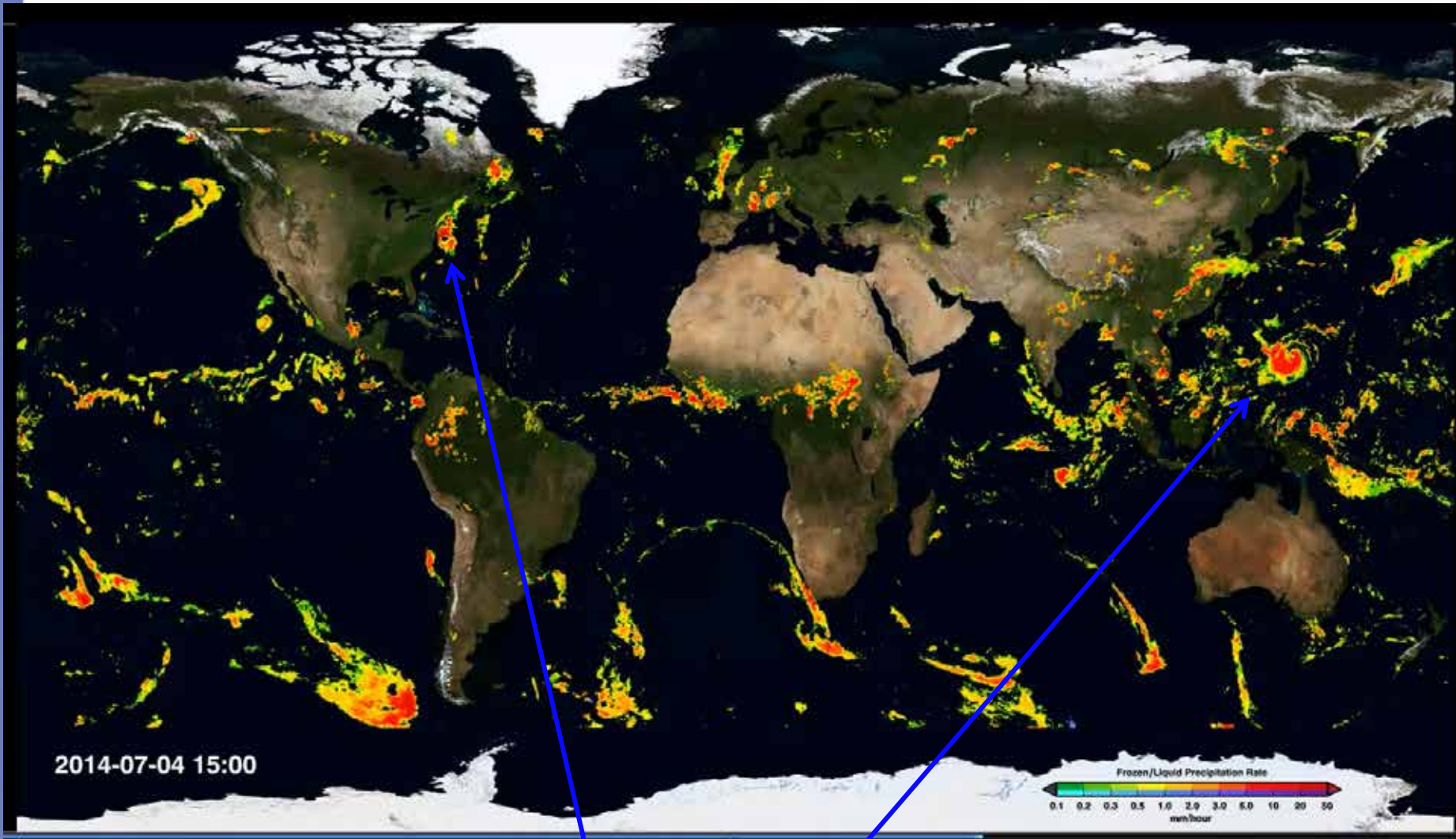


- **June/July 2014 (early release):** GMI Data with precipitation rates released as swath data to the public
- **September 2014:** DPR & Combined DPR+GMI precipitation rate data released
- **January 2015:** NASA's Integrated Multi-Satellite Retrievals for GPM (IMERG) released
- **March 2015:** Release of IMERG Real-time products
- **Early 2016:** Expect to compute the first-generation TRMM/GPM-based IMERG archive, 1998-present

All data is freely distributed through NASA's Precipitation Processing System (PPS) at GSFC: <http://pps.gsfc.nasa.gov>

GMI products were released early due to exceptional GMI performance and to support operational forecasters for the 2014 Hurricane Season (e.g., Navel Research Lab)

IMERG: Integrated Multi-satellitE Retrievals for GPM

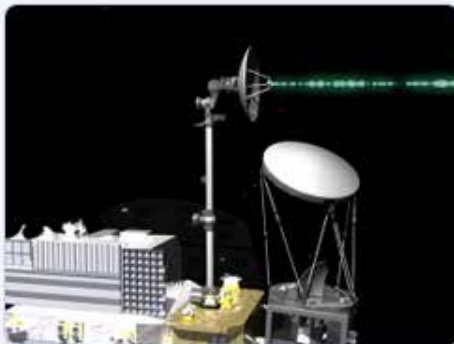


Hurricane Arthur

Typhoon Neoguri

Videos

The Data Downpour



In a data-processing room at NASA's GSFC, racks of high-powered computers are getting ready to make a global map.

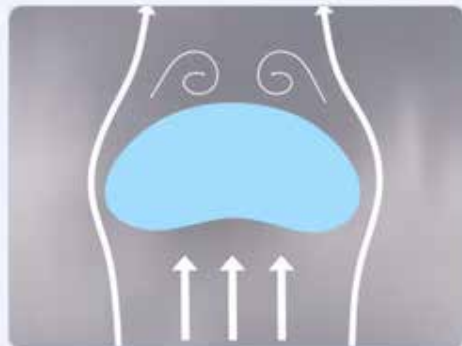
[Link](#)

Show Me The Water



Just three percent of the water on our planet is freshwater. This video explores how our most precious resource is used, [Link](#)

The Anatomy of a Raindrop



Raindrops are actually shaped a hamburger bun. This new video from GPM explains why. [Link](#)

Feature Articles

Rain Gauges in the Smoky Mountains



Rain gauges and other rain monitoring equipment are set up thru the Appalachians to capture rainfall for the GPM ground validation to June 15, 2014.

[Learn more about IPHEx](#)

Bird Migration to be Tracked by GPM Radar

By Ellen Gray, NASA Goddard Space Flight Center

Original www.nasa.gov Press Release (published 6/7/12)

NASA and Nature Conservancy Agreement Supports Precipitation and Migratory Bird Research



NASA Satellites Predict Zebra Migrations



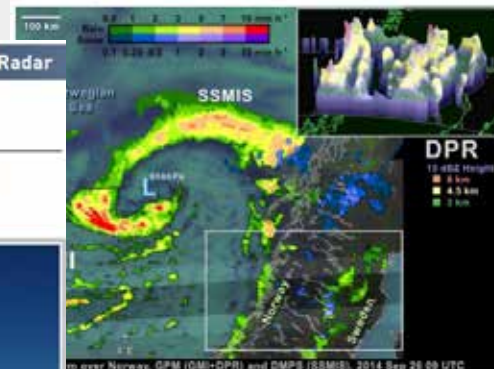
Zebra in the Makgadikgadi grasslands.

Image Credit: Hattie Bartlett-Brooks

Of stars and stripes: NASA satellites used to predict zebra migrations

GPM Satellite Sees a Windstorm over Norway

On September 26, the Global Precipitation Measurement (GPM) satellite flew over an extra-tropical cyclone whose center was approaching Norway. The Norwegian weather service reported that this storm brought gale-force winds to parts of Norway's coast and mountains (20 m/s in the mountains and 50 m/s just off-coast, late at night on September 26).



Over Norway, GPM (GMI+DPF) and DMPs (SSMIS), 2014 Sep 26 00 UTC

<http://gpm.nasa.gov/education>

For more information on the TRMM and GPM Missions:

<http://gpm.nasa.gov>; <http://gpm.nasa.gov/education>

www.nasa.gov/gpm

Twitter: NASA_Rain (11K followers) Facebook: NASA.Rain (>20K)



PMM Science