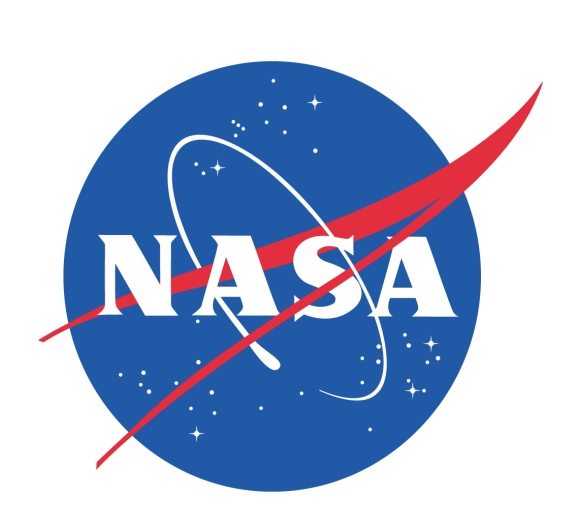# An Update on GPM Products and Services at GES DISC

NASA/Goddard EARTH SCIENCES DATA and INFORMATION SERVICES CENTER (GES DISC)

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Abstract

This poster describes our latest activities with regard to GPM, TRMM, and other precipitation products and services at the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC), including:

- Update on GPM products and data services
- New datasets and features in Giovanni
- Data and service access metric analysis
- Ongoing development activities
- Outreach activities

GES DISC Support to PMM: A Brief Overview

- The GES DISC is one of the **12 NASA EOSDIS DAACs** that manage, archive and distributes the Earth science data as part of NASA's Earth Science Data Information System (ESDIS) Program.
- The GES DISC is a **certified trusted repository** as a Regular Member of the International Council for Science (ICSU) World Data System (WDS).
- We provide the support for the archive and distribution of the data for **over 35 multiple satellite sensors, ground measurements, field campaigns, models**; as well as data developed by science community members.
- **Multi-disciplinary archive** in the 5 of 6 NASA Earth science focus areas of atmospheric composition, weather and atmospheric dynamics, climate variability and change, water and energy cycle, and carbon cycle.
- Archive over **1.5 PB** of data from **2500 data products**. Have disseminated over **23 PB** of data, including precipitation products from NASA satellite missions/projects (GPM, TRMM, MERRA-2, NLDAS, GLDAS, FLDAS, GPCP, etc.)
- Follow data publication process and ESDIS standards for metadata, format and citation recommendations including **Digital Object Identifiers (DOIs)**

Measuring Demands, Deciphering Needs:
- **Data distribution metrics:** Product distribution, user access and customizable by mission (see below)
- **Service metrics:** Create metrics by each service to identify products, variables, regions being subsetted
- **User ticket mining by mission:** Understand our user's need, such as what is missing or need to be improved in our data services, and determine if there are any common questions to improve outreach or user engagement
- **Publication mining:** Capture, extract and provide dataset citation information from publications to science teams
- **Outreach activities:** User Working Group, publications (e.g. journals, books), conferences/meetings/seminars, trainings, etc.

Help Growing the User Community "The broad global user community drives what we do":
- **Value-added products and services** based on user needs: subsetting, regridding, reformatting, data visualization and analysis, Web services (OPeNDAP, GDS, https, THREDDS, WMS, WCS, etc.)
- **User services assistance** – work with users in research and application communities around the world to utilize the data
- **Outreach** activities: social media, User Working Group, publications (e.g. journals, books), conferences/meetings/seminars, trainings, etc.

GES DISC Data and Service Access Metrics (FY2019)

Research and Application areas of GPM/TRMM data
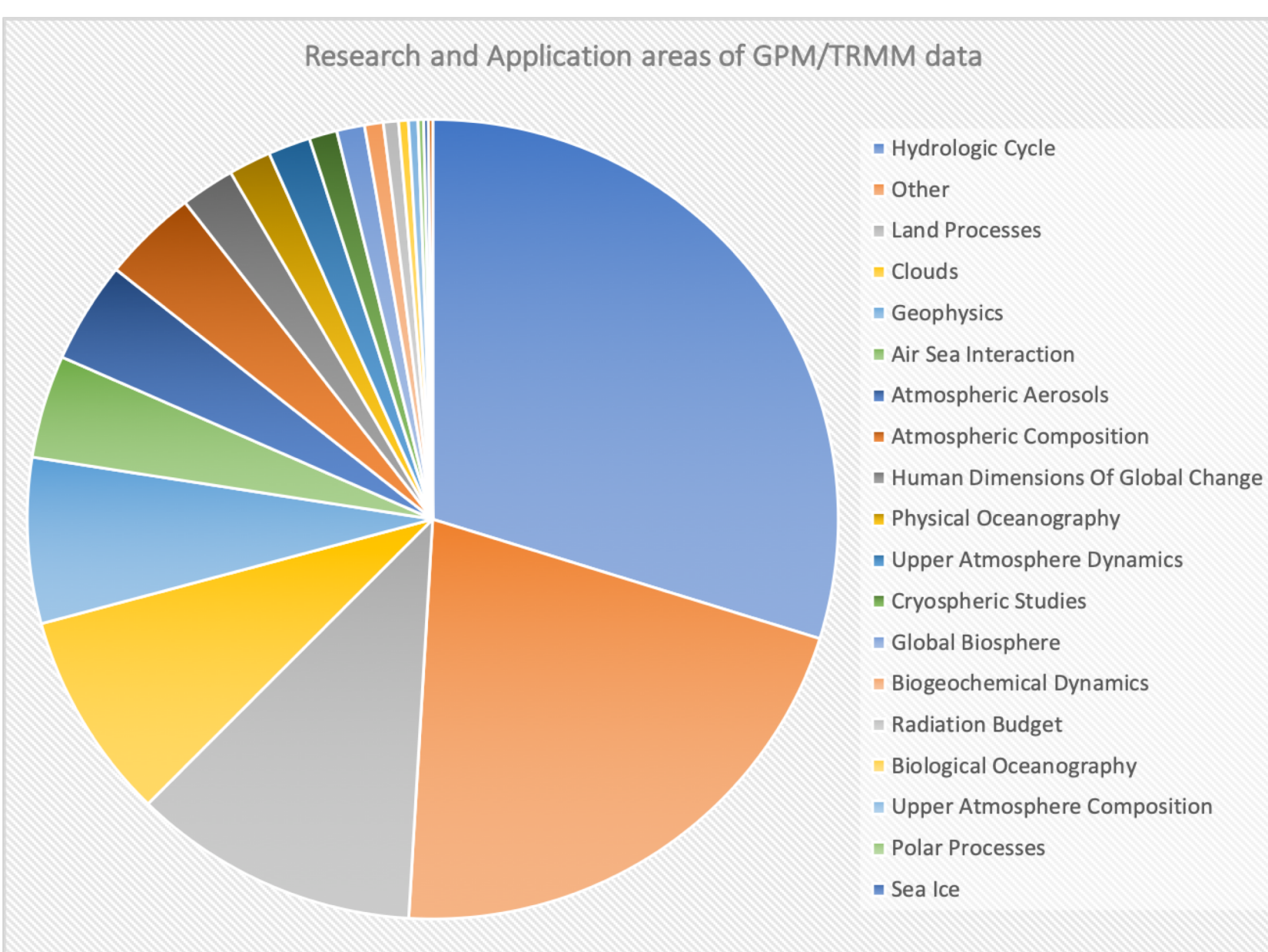
| FY2019	Users	Files	Volume (TB)
TRMM	5918	41 million	113
GPM	3302	71 million	553
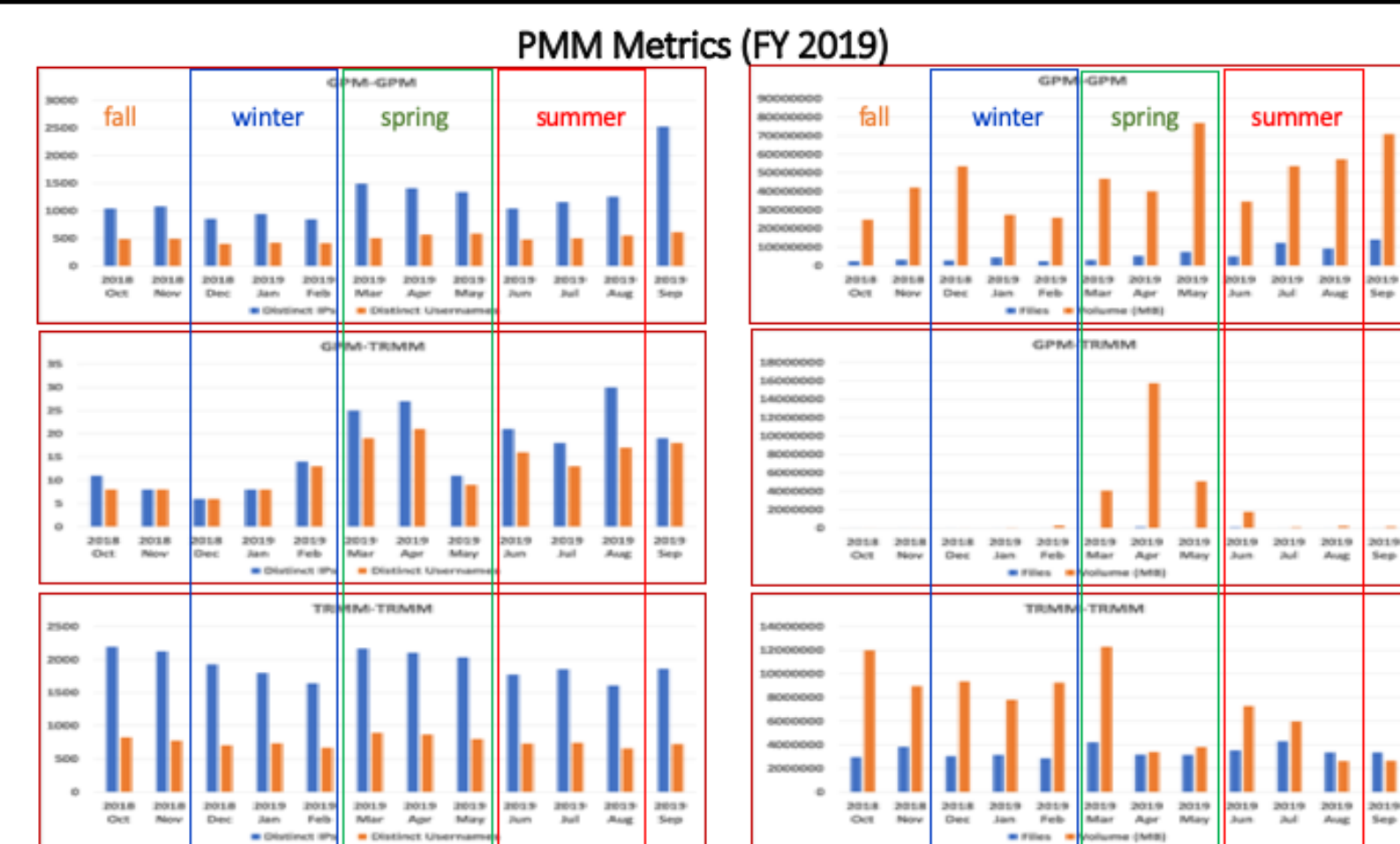
PMM Metrics (FY 2019)

Above: Monthly data access metrics for FY2019, including a) "GPM-GPM": GPM algorithms; b) "GPM-TRMM": GPM algorithms; and c) "TRMM-TRMM": TRMM algorithms.

Google Analytics 360 Metrics (FY2019)

The Google Analytics 360 has been installed recently at GES DISC for collecting and analyzing user data in order to better understand their needs and continue to improve data services. Some sample metrics for FY2019 are listed below. As you might see, "rainfall" tops the 25 dataset keyword searches. There is no surprise that both TMPA and IMERG are popular at GES DISC.

Data and Services:

- Improved GES DISC Web portal for data and information search and ordering
- Release of GPM IMERG Version 06B products for the TRMM era
- GPCP 3.0 (MEaSUREs) is available
- GPM DPR data supported by **Level 2 subsetting service** (box, circle, and point)
- Expanded support for GPM products (GPROF) with Level-2 subsetting service
- GPM ENV and TRMM products added to Level-2 subsetting support
- Regridding service (remapping types and grids) added to IMERG products

Radial Subset of GPM Surface Precipitation Rate
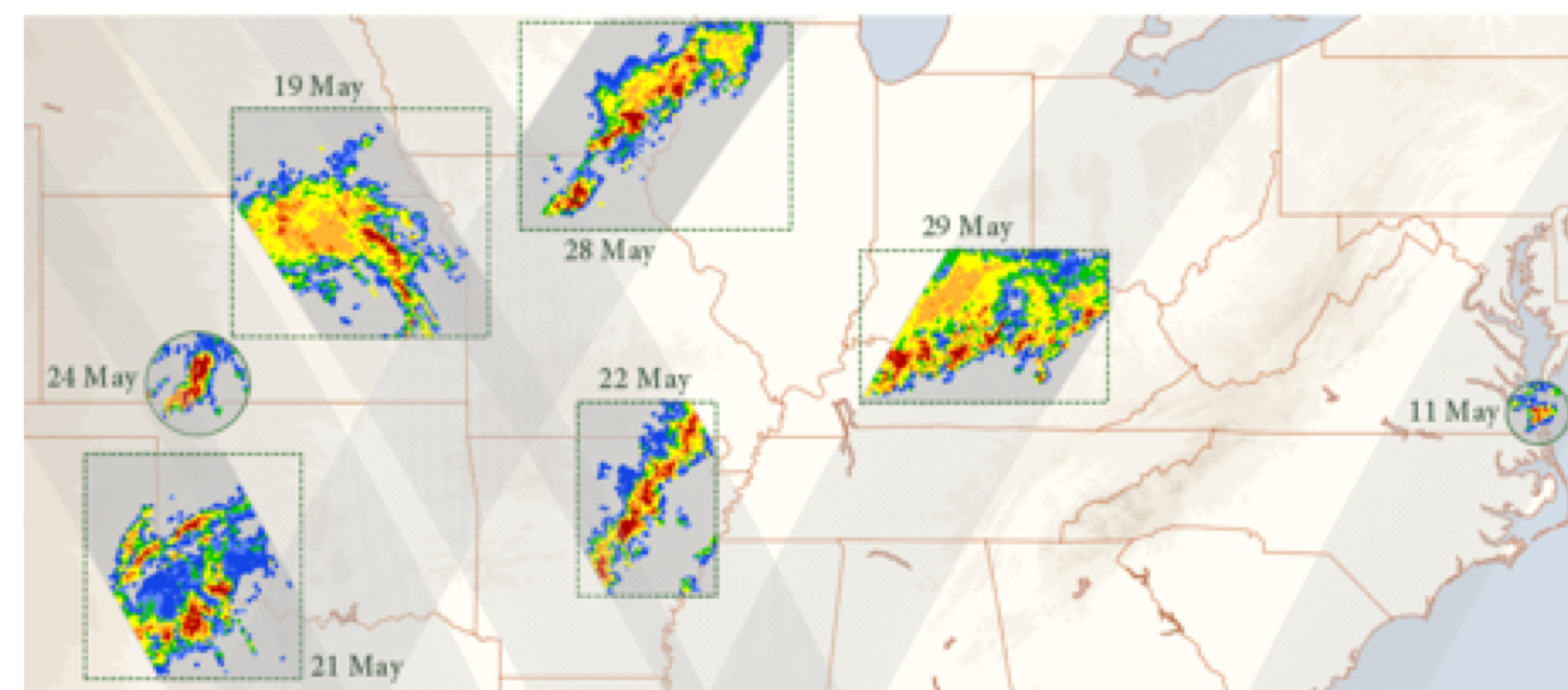
Top Left: GPM Dual-Frequency Precipitation Radar (DPR) observed occurrences of tornado outbreaks in the Midwestern and Eastern United States in May 2019. The image shows extreme rainfall accompanying the tornadoes reported on the dates shown. Red indicates rain rates greater than 25 millimeters (~1 inch) per hour. The light grey regions show the entire swath over the geographical area; darker grey regions containing precipitation contours show the **subsetted** portions of the full swaths. The data from May 19, 21, 22, 28, and 29 use a box subset, and the data from May 11 and 24 use a point/radius search subset.
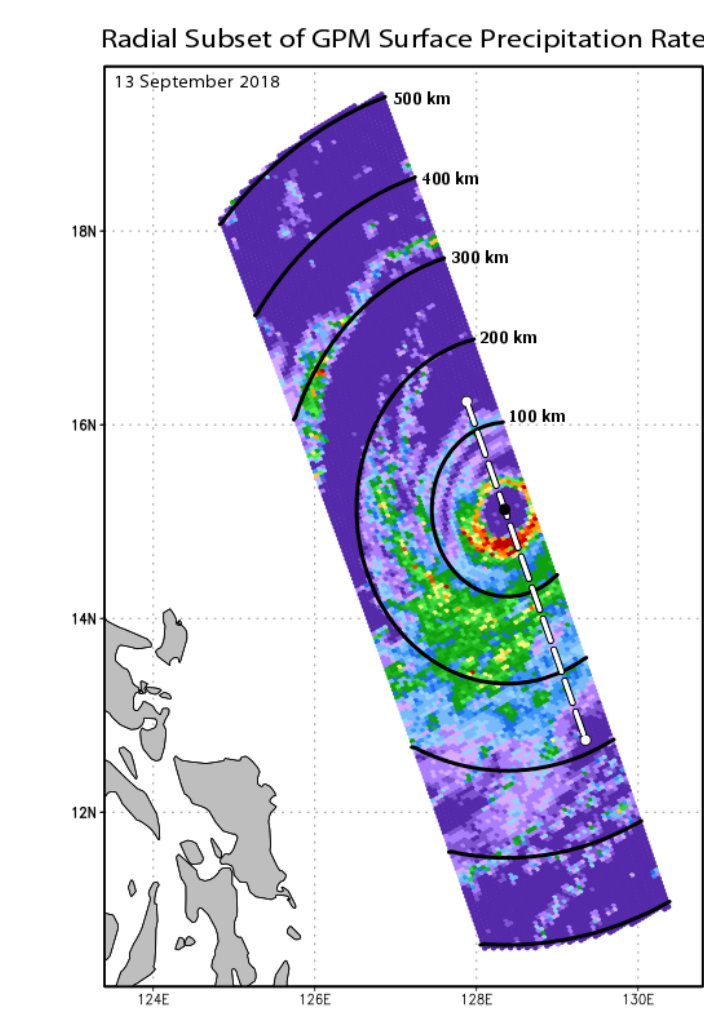
Top Right: GPM_2ADPR Near-Surface Precipitation Rate ("/NS/SLV/precipRateNearSurface") **subset** within 500 km of the eye of Typhoon Mangkhut on 13 September 2018.

(All images were generated with GrADS)

Above: A new regridding service is available for different data product grids to facilitate intercomparison and other activities. More features can be developed to enhance subsetting capabilities, such as time series subsetting for a given point, customized reprojection to facilitate model development, as well as model and satellite data comparison or evaluation, etc.

## GPM and TRMM Data Service Outreach Activities (FY2019):

- GES DISC News, Twitter, user forum (nearing implementation)
- News (articles, Twitters, YouTube)
- Book chapters
- Posters, talks, sessions in PMM, AGU Fall Meeting, AMS Annual Meeting, NASA AI conference, IPWG, and other conferences
- AGU Fall Meeting - Earth Informatics session on interdisciplinary data and services

Ongoing Book Chapters:
- Global Satellite-based Precipitation Products, in Rainwater Harvesting (in press)
- NASA Global Satellite and Model Data Products and Services for Tropical Cyclone Research in "Current Topics in Tropical Cyclone Research," edited by Dr. Anthony Lupo (published)
- NASA Global Near-Real-Time and Research Precipitation Products for Flood Monitoring, Modeling, Assessment, and Research, Flood Handbook by Taylor and Francis (in review)
- Giovanni book incl. history of TOVAS, examples of GPM products (in preparation)

Giovanni (visualization tool):

- New Version 06B IMERG datasets (Early, Late and Final) in the TRMM era are in Giovanni (06/2000 – present)
- GPCP 3.0 is in Giovanni (1983 – 2016). Other precipitation datasets (MERRA-2, NLDAS, GLDAS, etc. are also available.
- Persistent sessions, allowing a user to return to previous analysis results if a Giovanni browser session is ended either inadvertently or intentionally. Previous analysis results will remain available for 7 days.
- A new format for geographical entries to define the bounding box (region of interest). In addition to positive and negative entries (negative for South and West), the format now allows N,S,W, and E for latitude and longitude coordinates.
- Giovanni users who are not logged in are Giovanni guest users, who can access data and services, but are limited in the amount of data for each plot, and cannot download files produced by Giovanni.
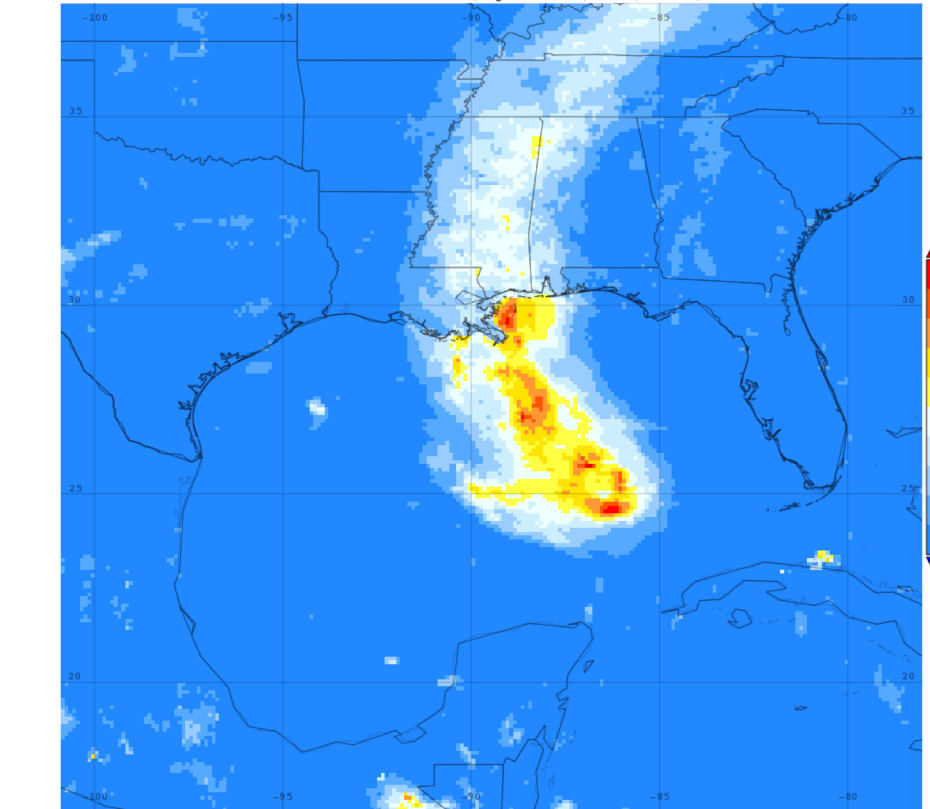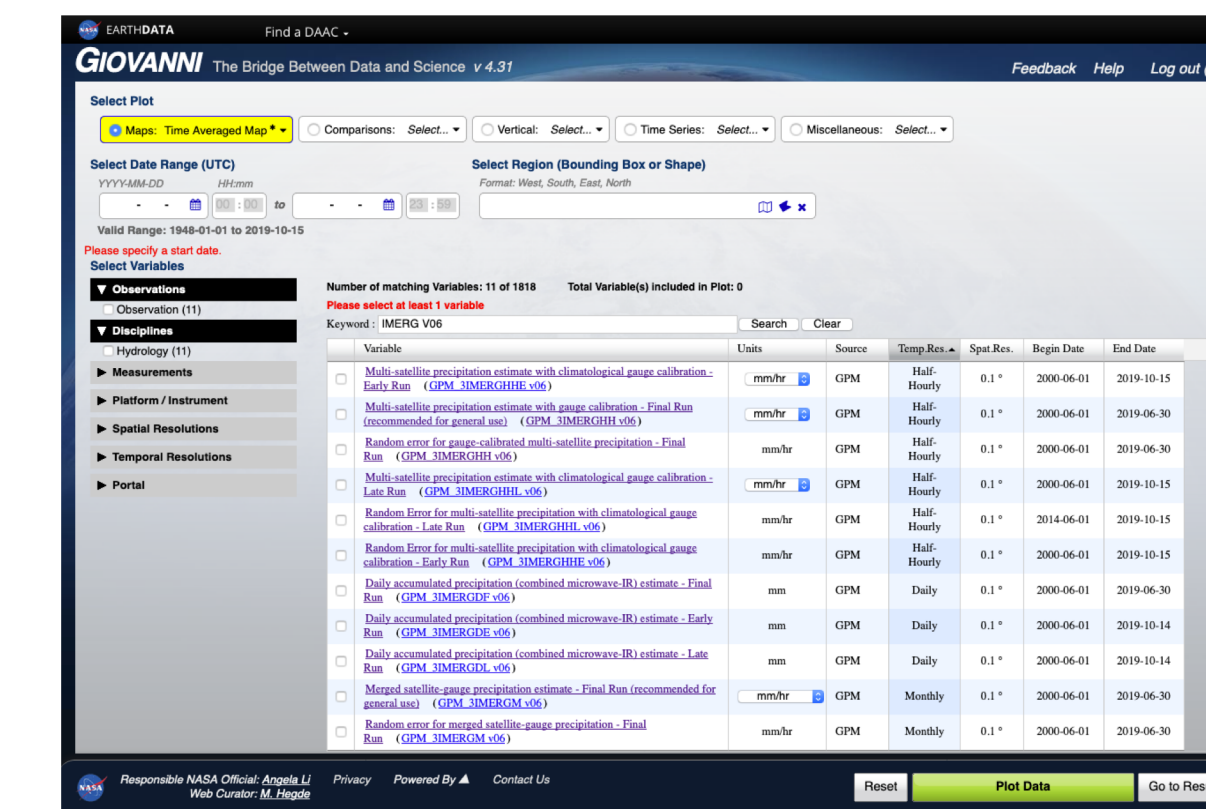

Top left: All V06B IMERG datasets (Early, Late and Final) in the TRMM era in Giovanni.
Top right: An example of accumulated rainfall from the Hurricane Katrina in August, 2005.

Ongoing development activities:

- IMERG in USDA Crop Explorer
- GeoTIFF is being added in subsetting
- Giovanni in the Cloud (see below)
- IMERG in Cumulus (see below)
- Continue to improve data and information access (e.g. using natural language processing to access data analysis and visualization)
- Improve the performance of GIS services with ESRI team.
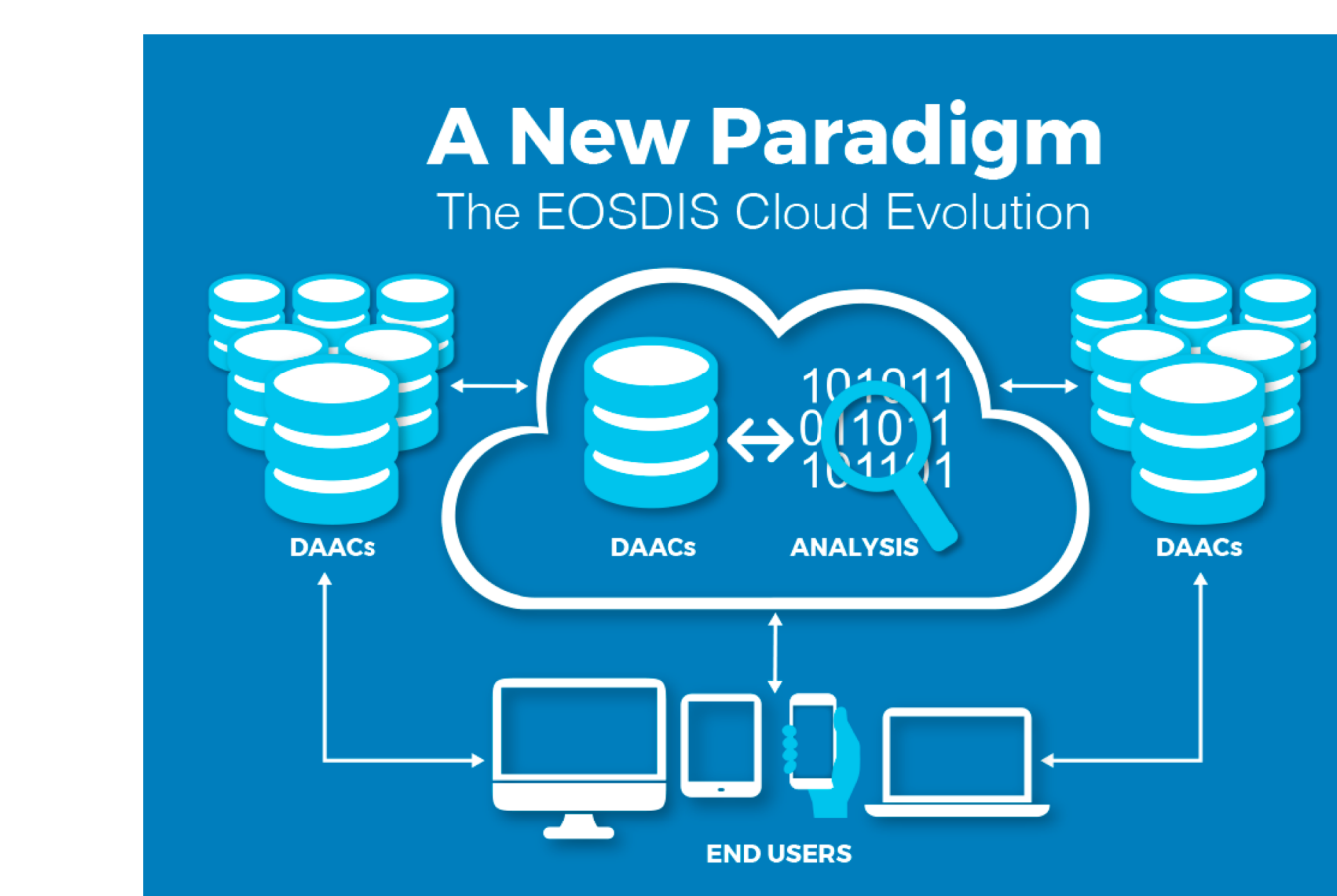

Giovanni in the Cloud (left):
- Growth in usage: Larger number of users than GES DISC OPeNDAP. Usage spikes during training, science meetings, etc.
- Giovanni without borders: user demand for supporting non-GES-DISC data (e.g. MOPITT, Ocean Color data sets)
- User requests for resource intensive services
  - Area statistics in area averaged time series
  - Increasing or removing spatio-temporal limits for services
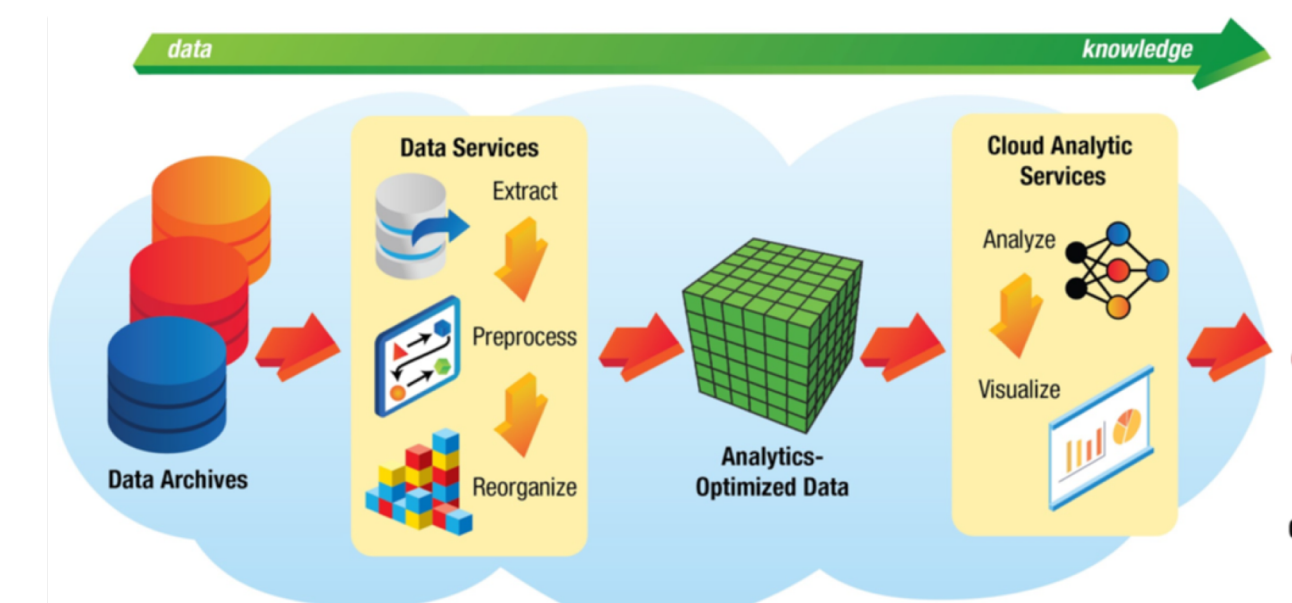
Goal: Deliver performance that exceeds on-premises Giovanni while addressing above requirements
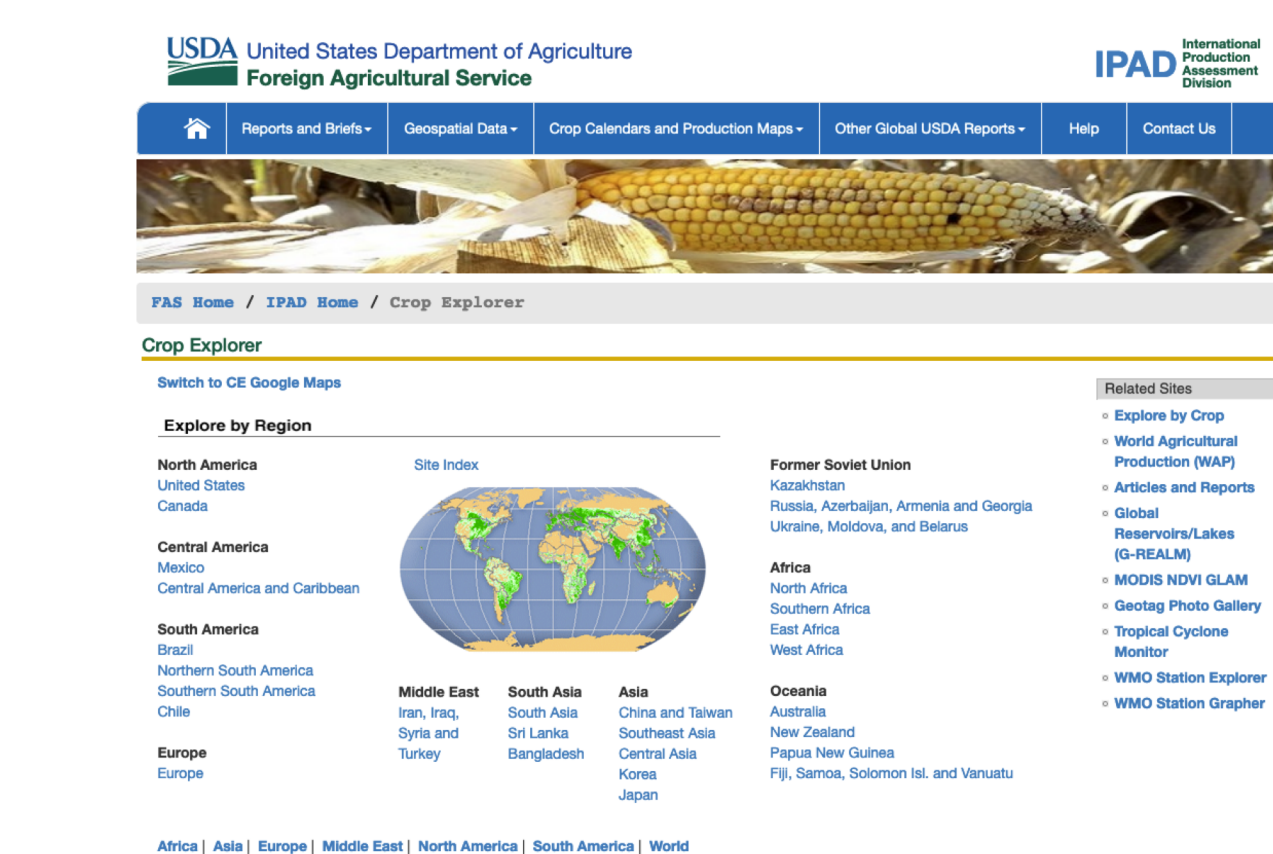
GES DISC has been supporting **the USDA Crop Explorer** since the TRMM era with the near-real-time TMPA product. We are working on replacing the TMPA with IMERG in Crop Explorer.
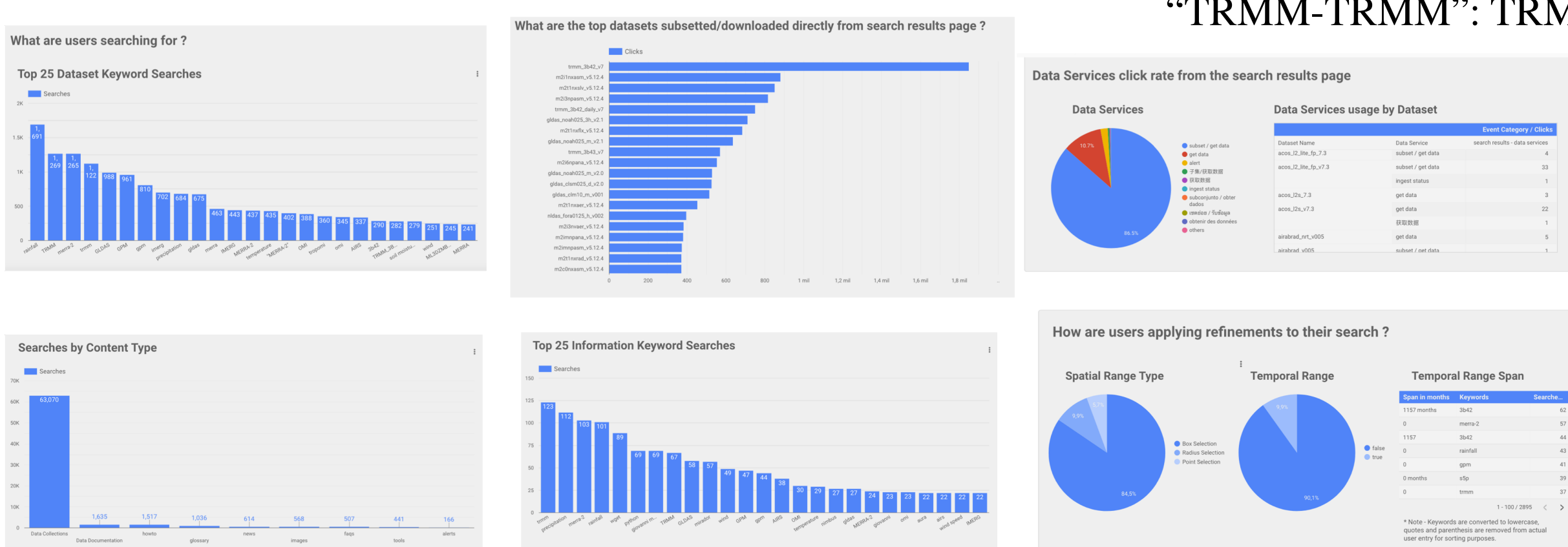

A New Paradigm — The EOSDIS Cloud Evolution

IMERG is being prepared and tested in **the EOSDIS Cumulus Project**. A primary feature of Cumulus is a cloud-based framework for data ingest, archive, distribution, and management.

Source: Earth Science Data in the Cloud: The EOSDIS Cumulus Project. Available online: https://earthdata.nasa.gov/eosdis-cumulus-project

GPM products: https://disc.gsfc.nasa.gov/datasets?keywords=GPM **Giovanni:** https://giovanni.gsfc.nasa.gov/ **GES DISC:** https://disc.gsfc.nasa.gov *Suggestions or subscription to our mailing list:* gsfc-help-disc@lists.nasa.gov