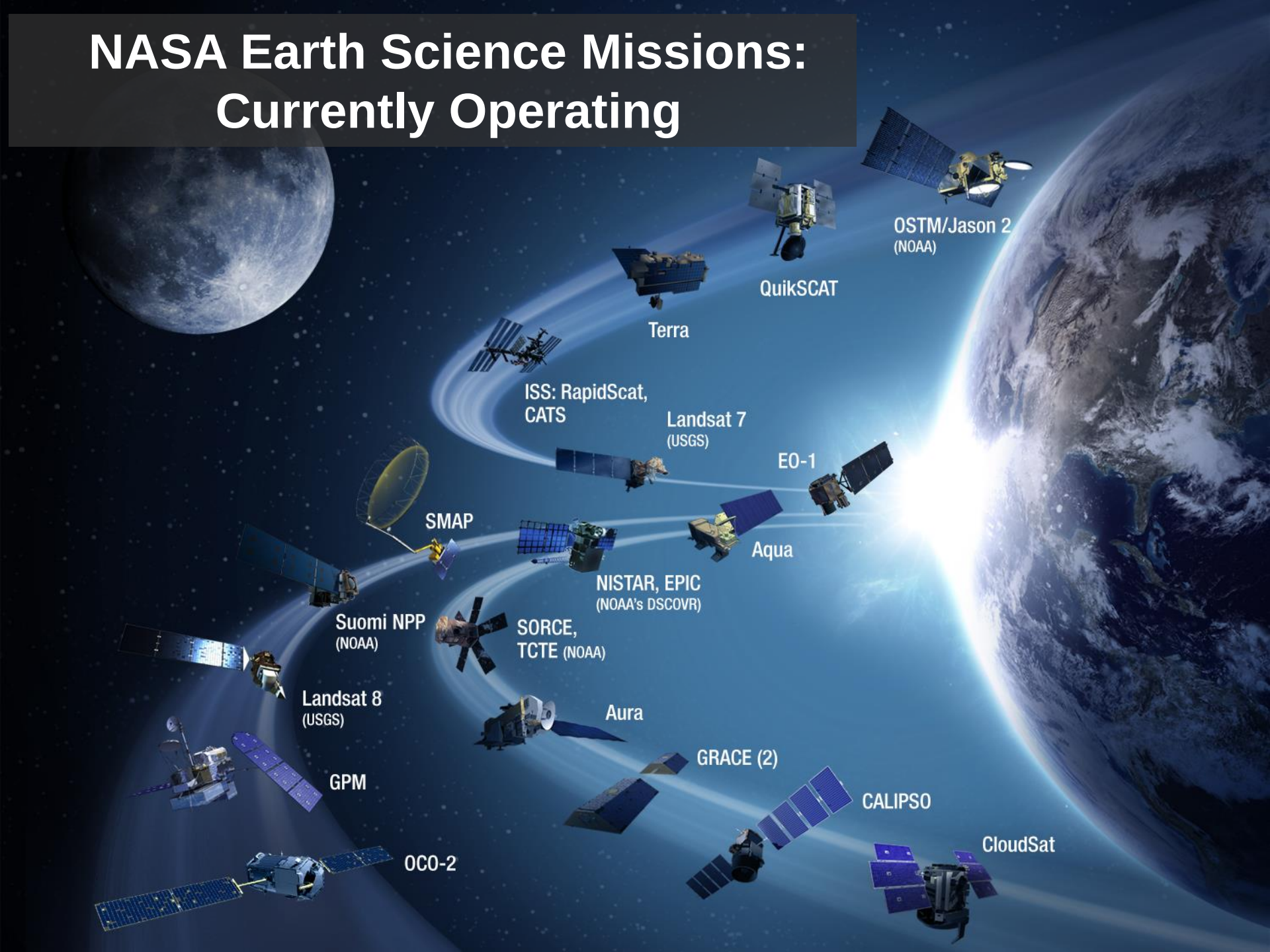
NASA Earth Science Applications for Water Resource Management

Danielle Wood & Brad Doorn

National Aeronautics and Space Administration

NASA’s current Earth-observing fleet

NASA Earth Science Missions: Currently Operating



Applications Areas

NASA
Earth Science

Emphasis in 5 Applications Areas

Health &
Air Quality

Water
Resources

Ecological
Forecasting

Disasters

Wildland Fires
(through 2017)

Support opportunities in additional areas

Agriculture / Food Security

Energy

Transportation

Climate & weather play into all themes

NASA's Capacity Building Program (CBP)

Engaging current and future decision makers in a spectrum of activities to improve skills and capabilities in the United States and developing countries to access and apply NASA Earth science

ARSET

Online and hands-on NASA remote sensing training

Led by NASA Goddard

DEVELOP

Dual workforce capacity building using collaborative feasibility projects

Led by NASA Langley

SERVIR

Building international capacity in developing countries

Led by NASA Marshall

Applied Remote Sensing Training (ARSET)

NASA
Earth Science

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

GOAL: To Increase utilization of NASA observational and model data for decision-support through training activities for environmental professionals.

Application Areas: water resources, disasters, air quality, and land management.

Online courses: Live and recorded, 4-6 weeks in length.

In person training courses: In a computer lab, 2- 4 days.

Train the Trainers: Courses and training manuals for organizations interested in conducting their own remote sensing training, beginning in 2015

Accomplishments
(2008 – 2014)

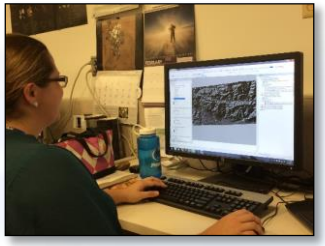
- 35 trainings completed
- 1700+ participants worldwide
- 500+ Organizations

NASA's DEVELOP National Program

NASA
Earth Science

"Shaping the future by integrating Earth observations into global decision making."

DEVELOP bridges the gap between NASA Earth Science and society, building capacity in both participants and end-user organizations to better address environmental challenges.



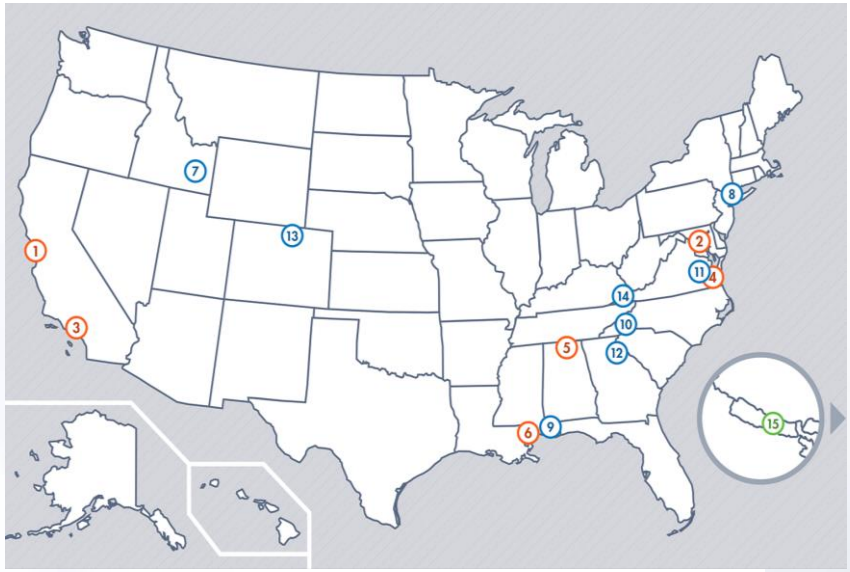
Participants

+

Earth Observations

+

Decision Makers



15 DEVELOP Locations

NASA Center Locations

1. NASA Ames Research Center – *Moffett Field, CA*
2. NASA Goddard Space Flight Center – *Greenbelt, MD*
3. NASA Jet Propulsion Laboratory – *Pasadena, CA*
4. NASA Langley Research Center – *Hampton, VA**
5. NASA Marshall Space Flight Center at NSSTC – *Huntsville, AL*
6. NASA Stennis Space Center – *Stennis, MS*

* *The DEVELOP National Program Office is located at Langley.*

Regional Locations

7. BLM at Idaho State University GIS TReC – *Pocatello, ID*
8. International Research Institute for Climate and Society – *Palisades, NY*
9. Mobile County Health Department – *Mobile, AL*
10. NOAA National Centers for Environmental Information – *Asheville, NC*
11. Patrick Henry Building – *Richmond, VA*
12. University of Georgia – *Athens, GA*
13. USGS at Colorado State University – *Fort Collins, CO*
14. Wise County and City of Norton Clerk of Court's Office – *Wise, VA*

International Location

15. International Centre for Integrated Mountain Development – *Kathmandu, Nepal*

FY2015: 407 Participants, 91 Projects, 156 Partners

The Global Precipitation Measurement (GPM) Mission Applications Examples

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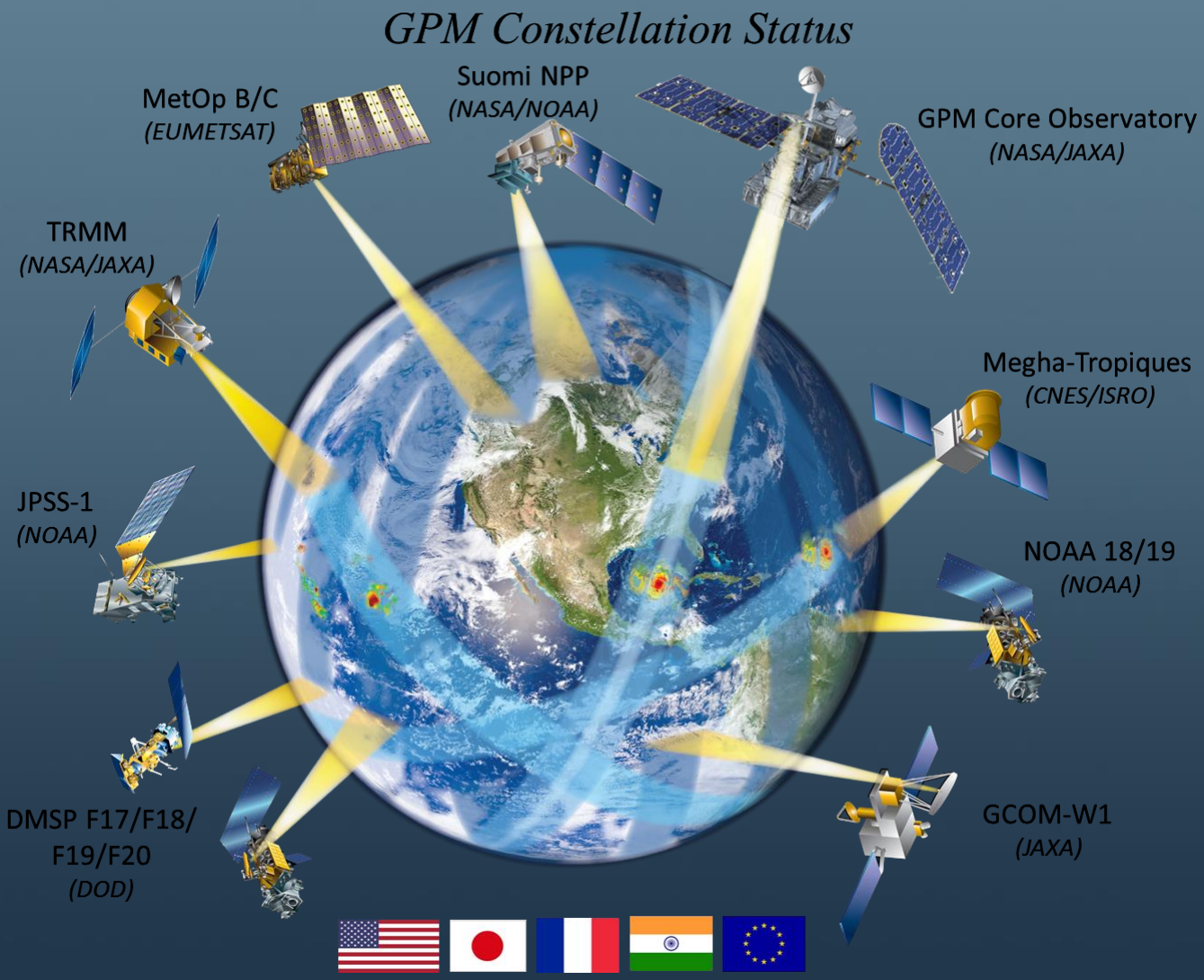
www.nasa.gov/gpm

Twitter: NASA_Rain

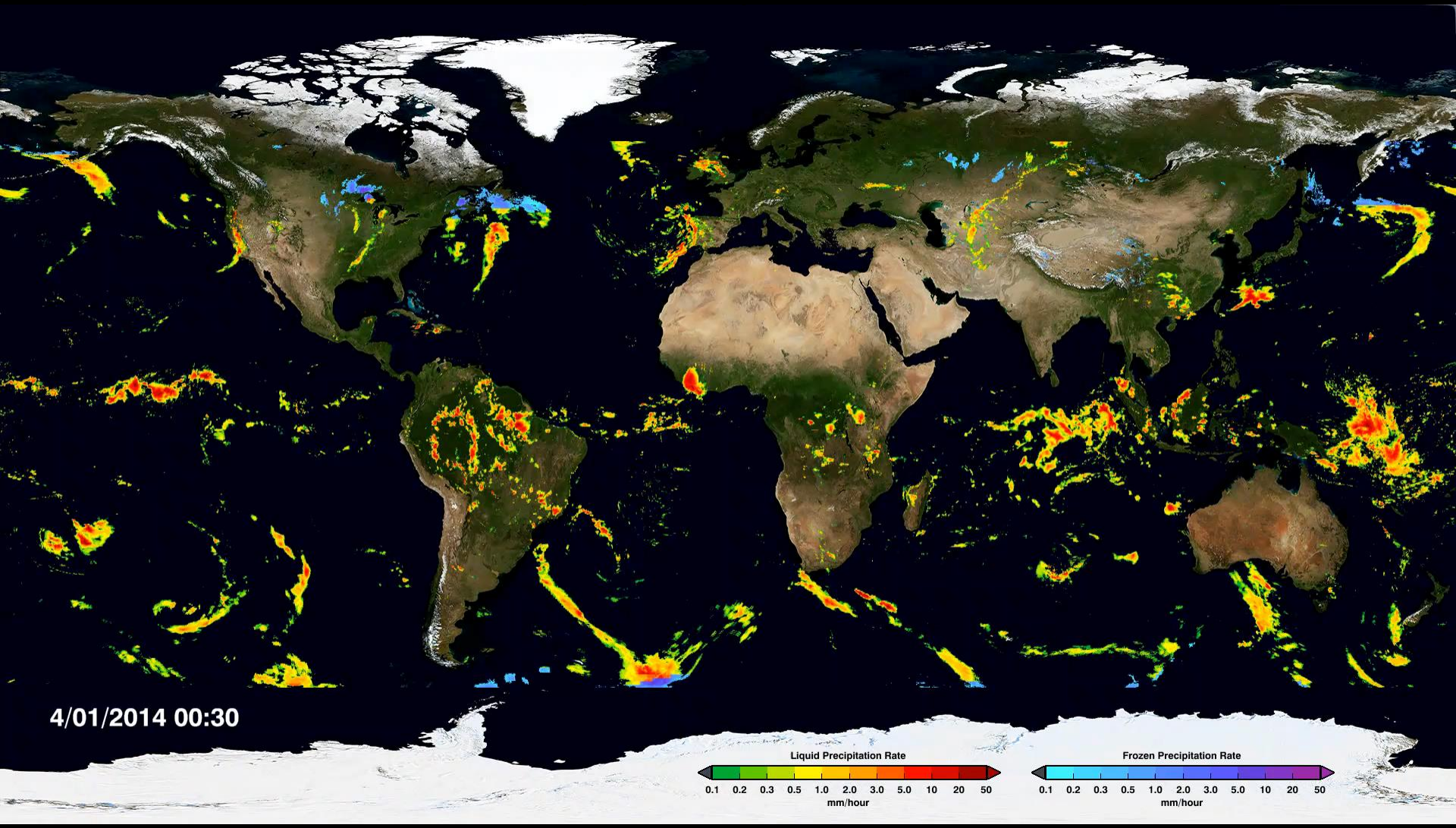
Facebook: NASA.Rain

Global Precipitation Measurement (GPM) Constellation



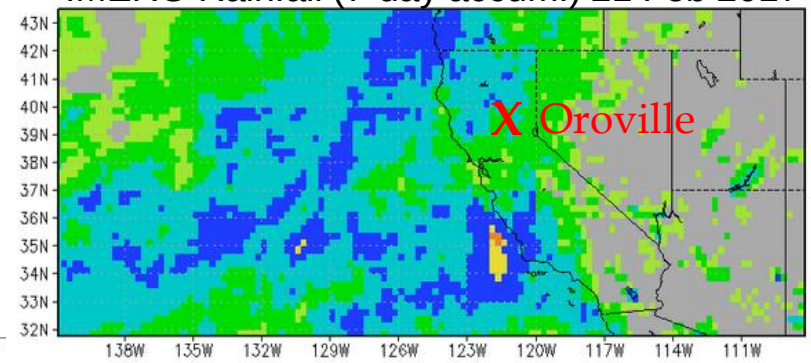
Goddard Space Flight Center

GPM IMERG rainfall and snowfall, April to September 2014

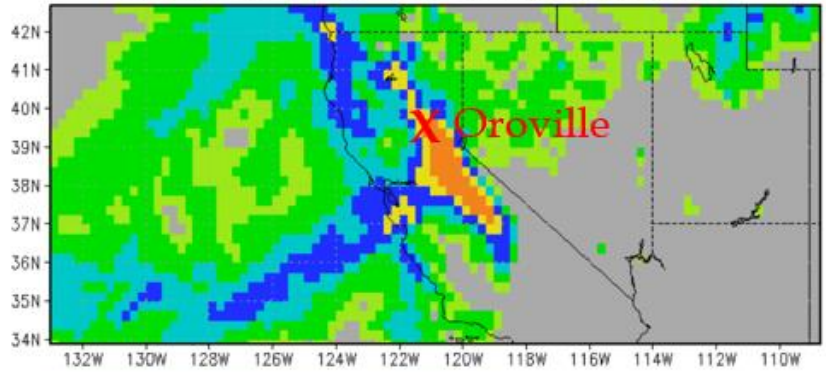


GPM used for Flood Estimation for Oroville Dam, February 2017

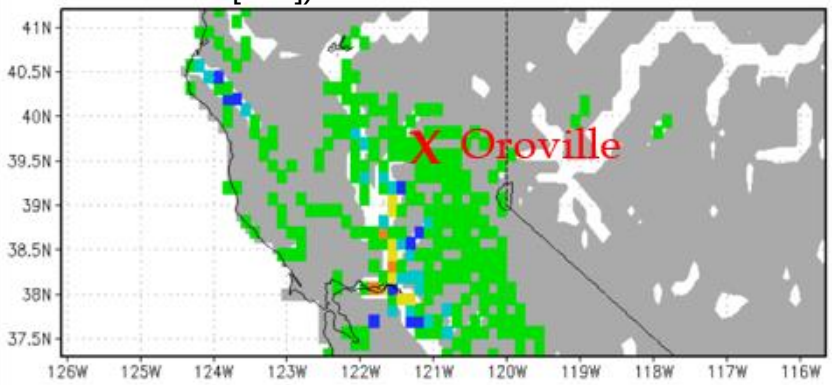
IMERG Rainfall (7-day accum.) 21 Feb 2017



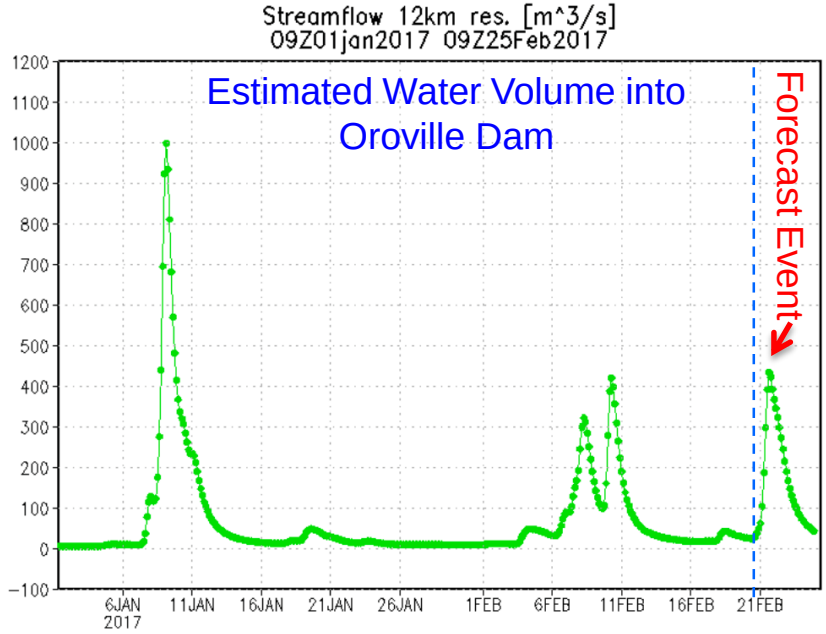
GEOS-5 Rainfall Forecast (3-day accum.) 22 Feb 2017



Flood Detection/Intensity (depth above threshold [mm]) Forecast for 22 Feb 2017

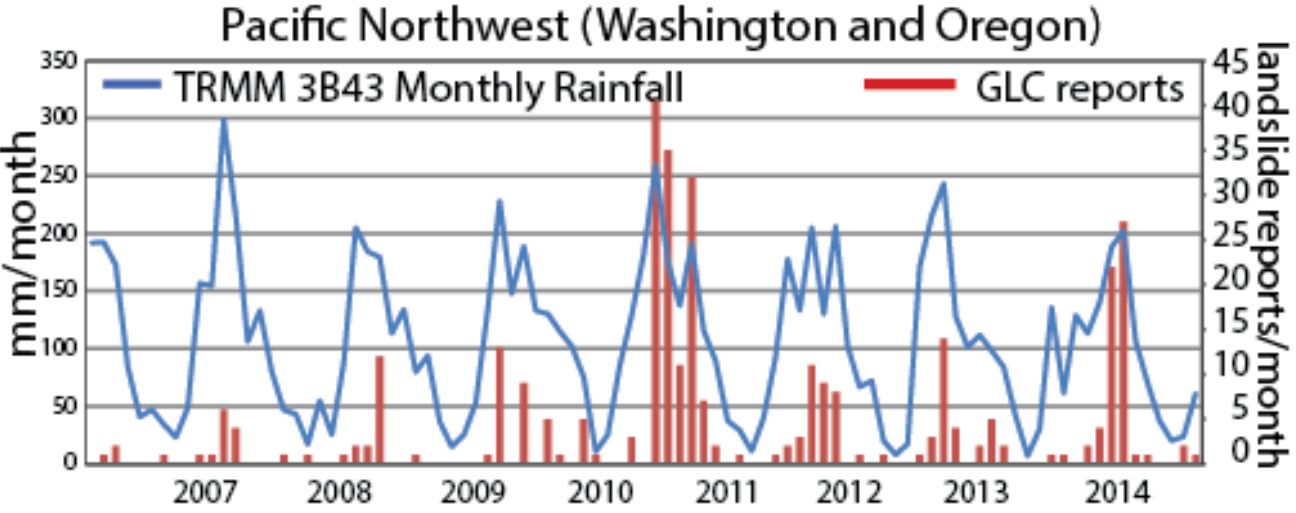


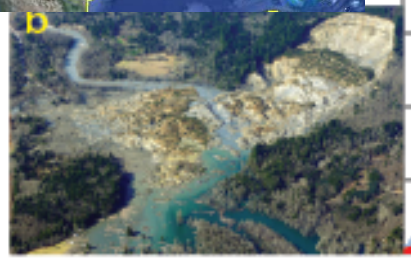
GPM IMERG precipitation is used by the Global Flood Monitoring System (GFMS) to detect potential flooding conditions and estimate intensity. This system also uses GEOS-5 forecast to estimate streamflow within affected areas. Top left shows the 7-day IMERG rainfall totals over California ending on 21 Feb. 2017. Top middle plot shows forecasted 3-day rainfall from the GEOS-5 model near the Oroville Dam area. Bottom left plot shows the forecasted flood detection/intensity for 22 Feb. 2017, forecasts over northern California are estimated to be over 200 mm for the 22 Feb. 2017 (bottom). This information is valuable for improving situational awareness of floods. This capability can be applied anywhere globally, especially where conventional data and methods are not available.

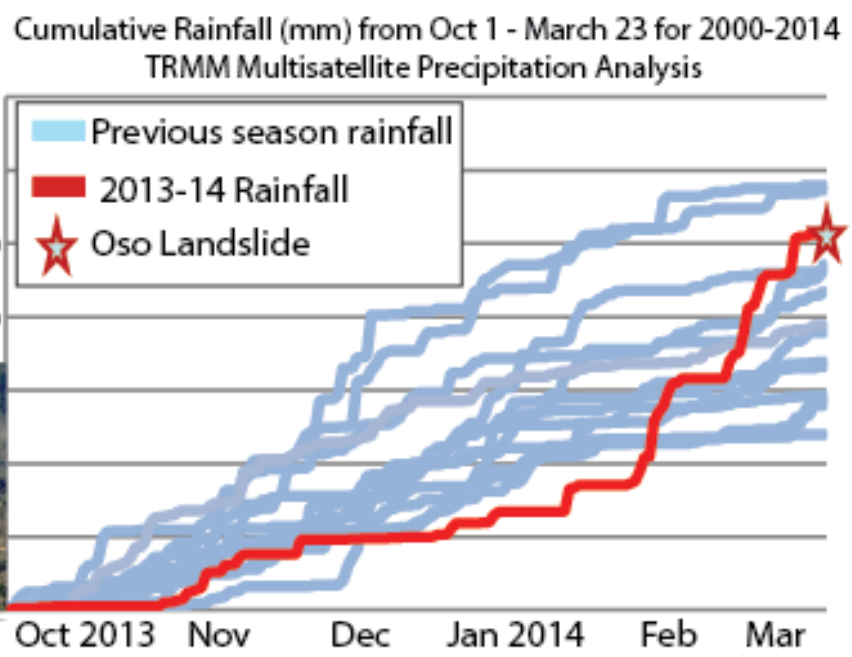


Rainfall Analysis for Oso, Washington Landslide – March 2014

TRMM precipitation data was used to estimate monthly rainfall over Oso Washington, where a major landslide that killed 49 people occurred in March, 2014. Analysis of the TRMM seasonal rainfall compared to previous years on record suggested that the 45 days leading up to the event ranked 3rd highest on record since 2000. GPM data is vital for improving this long record to evaluate seasonal variability of landslide triggering.







NASA Western Water Applications Office Overview

Accelerating the application of NASA observations and scientific analysis techniques to tangible, important, and timely water management problems

Integrates NASA assets for optimal solutions

- ARSET
- SERVIR
- DEVELOP
- GLOBE
- NASA Mission Early Adopters

Capacity Building, Mission Applications, and Education

Remote Sensing and Earth Observations

- 18 Operational Satellite Missions
- Airborne and Instrument Missions

WWAO Custom Solutions

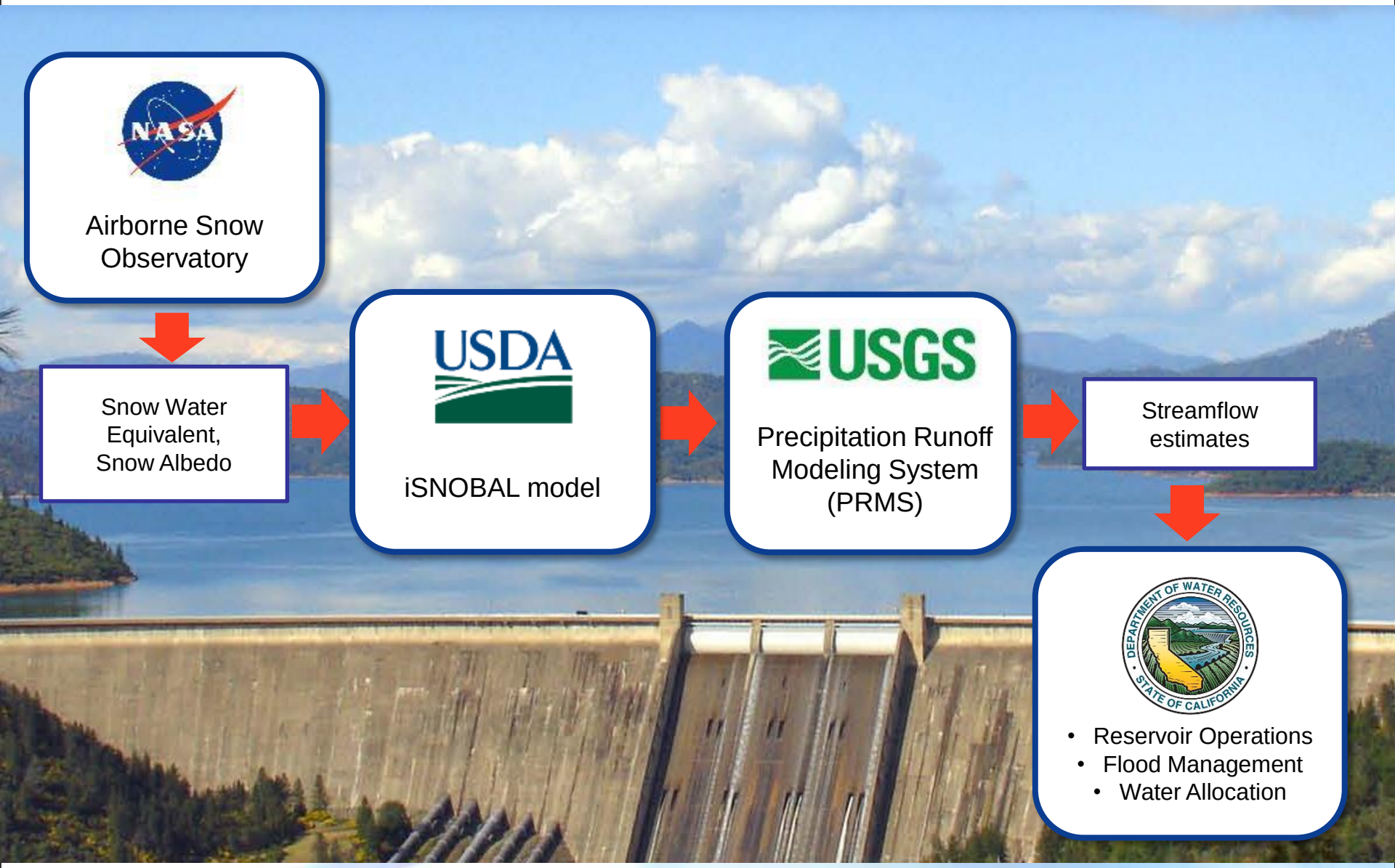
Applications and Models

- NASA Goddard LIS (Land Information Systems)
- Hydrology Models
- Science Applications:
  - Subsidence Mapping
  - Flood Mapping
  - Evapotranspiration
  - Groundwater
  - Global Precipitation
  - Seasonal & Subseasonal Precip Forecasting
  - MODIS & VIIRS Snow Cover
  - Fallowed Land Mapping
  - Etc…

Computing and Data Systems

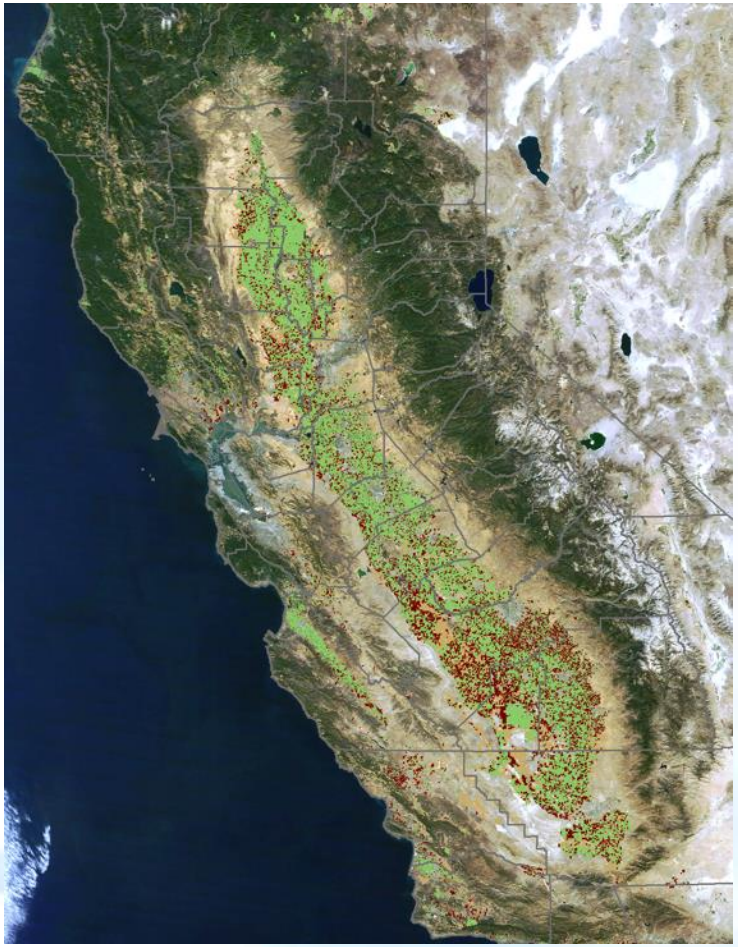
- NASA Supercomputers
- NASA DAAC Data Archives
- NEX Collaborative Platform
- Western States Water Mission

WWAO Pilot Projects:
ASO iSNOBAL Model Integration

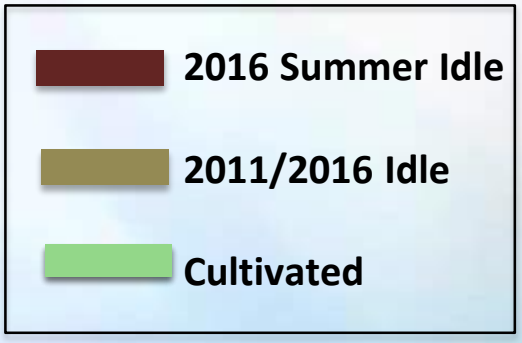


Determining the Extent of Fallowed Land with Satellite Imagery

PROJECT TEAM: NASA Ames Research Center, USGS, USDA National Ag. Statistics Service, California Dept. of Water Resources, NOAA, California State University Monterey Bay



2016 Summer Land Fallowing



https://nex.nasa.gov/nex/projects/1372/

science for a changing world

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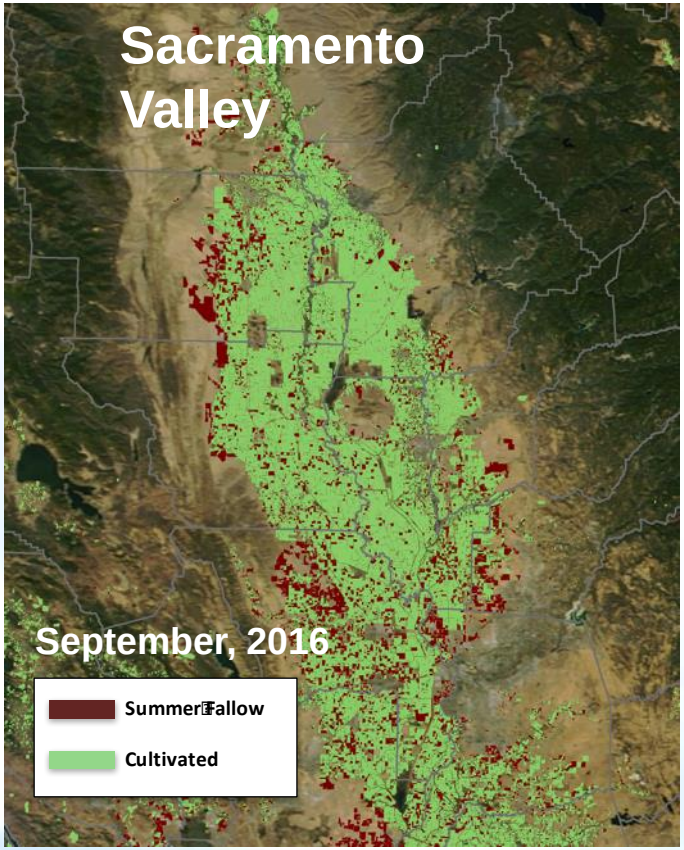
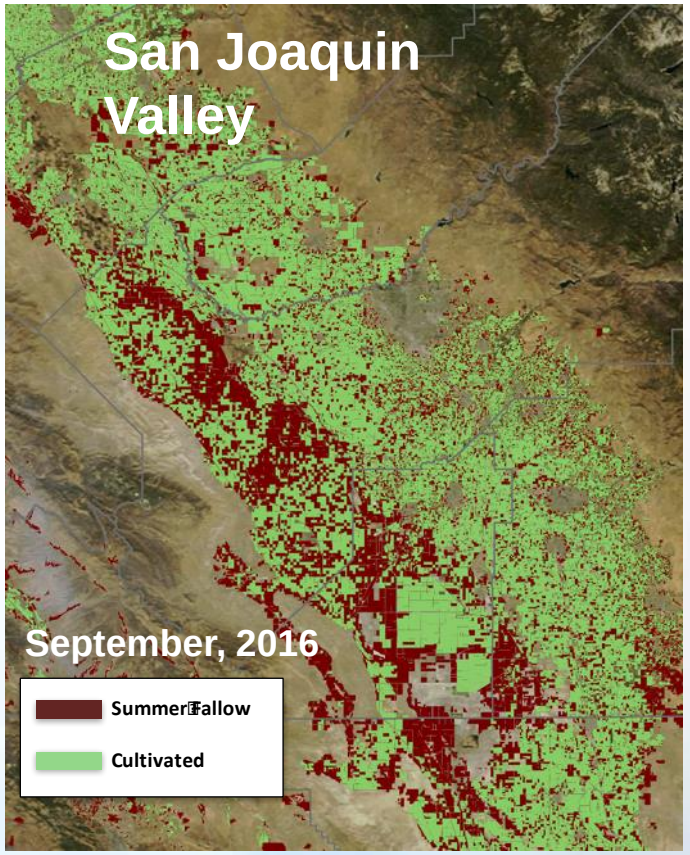




science for a changing world

NASA Contributes to Food Security

Earth Topics
Air
Climate
Hazards
Water, Oceans and Ice
Land
Benefits on Earth
Addressing Global Challenges
Related Topics
All Topics A-Z

Food Security

Our planet can produce enough food to feed everyone, although more than 800 million people still suffer from chronic hunger. In many of the world's critical growing areas—from California's Central Valley to Iowa farms to the plains of sub-Saharan Africa—erosion and drought are damaging arable land. In parts of the world these are creating a "dust bowl" situation.

The world needs innovative new ways to grow food with limited amounts of water. While the world's emphasis has focused for decades on building water supplies and irrigation to bolster crop yields, a new era is dawning that places equal emphasis on creating early warning systems, restoring degraded waters, and enhancing the efficiency of water use. NASA's system of Earth-observing satellites plays a unique role at the forefront of this evolution.

Satellite Data Help Australian Ranchers Meet Rising Food Demand

From a Roadside View to a Global View

How Remote Sensing Can Help Address Food Security Around the World

https://www.nasa.gov/content/esd-food-security

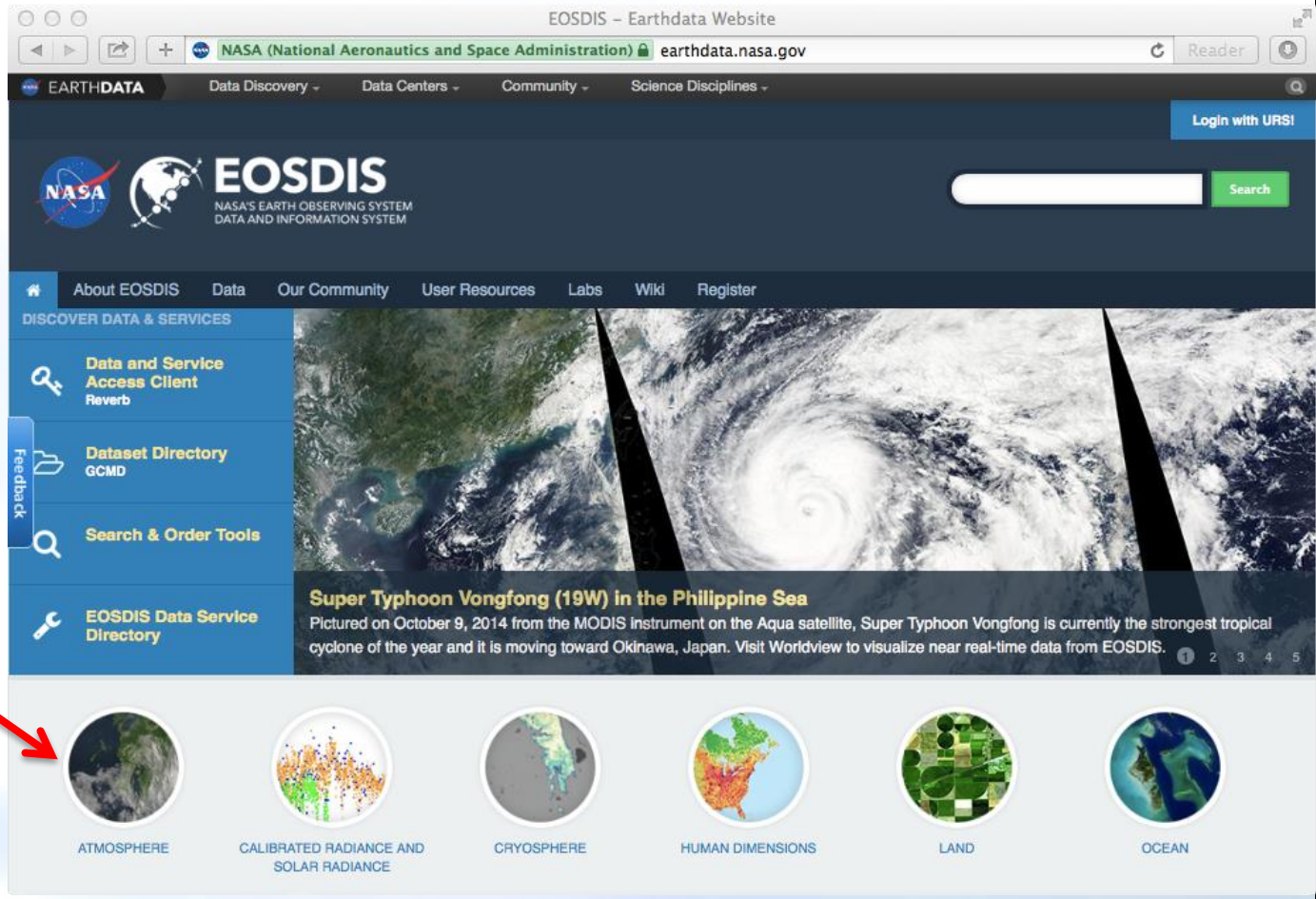
Useful sites for NASA Earth Science Data and Products

NASA
Earth Science

- NASA Earth Science Data: http://earthdata.nasa.gov
- NASA Near Real Time Data: http://earthdata.nasa.gov/lance
- NASA Worldview: http://earthdata.nasa.gov/worldview
- Fires: http://earthdata.nasa.gov/firms
- Flooding: http://floodobservatory.colorado.edu/
- NASA Images and Earth News: http://earthobservatory.nasa.gov

NASA Earthdata Website

- Once a mission flies, we refer to its data by the **instrument**
- We organize the data **thematically** in archive centers



Start at earthdata.nasa.gov to see what's available and find what you're looking for!

NASA Worldview Tool

- **Explore** NASA Earth science imagery in a Google Maps-like manner
- **Create** mash-ups
- **Download** the underlying data
- **Compatible** with Google Earth, ArcGIS desktop, ArcGIS Online, etc…

Thank you!