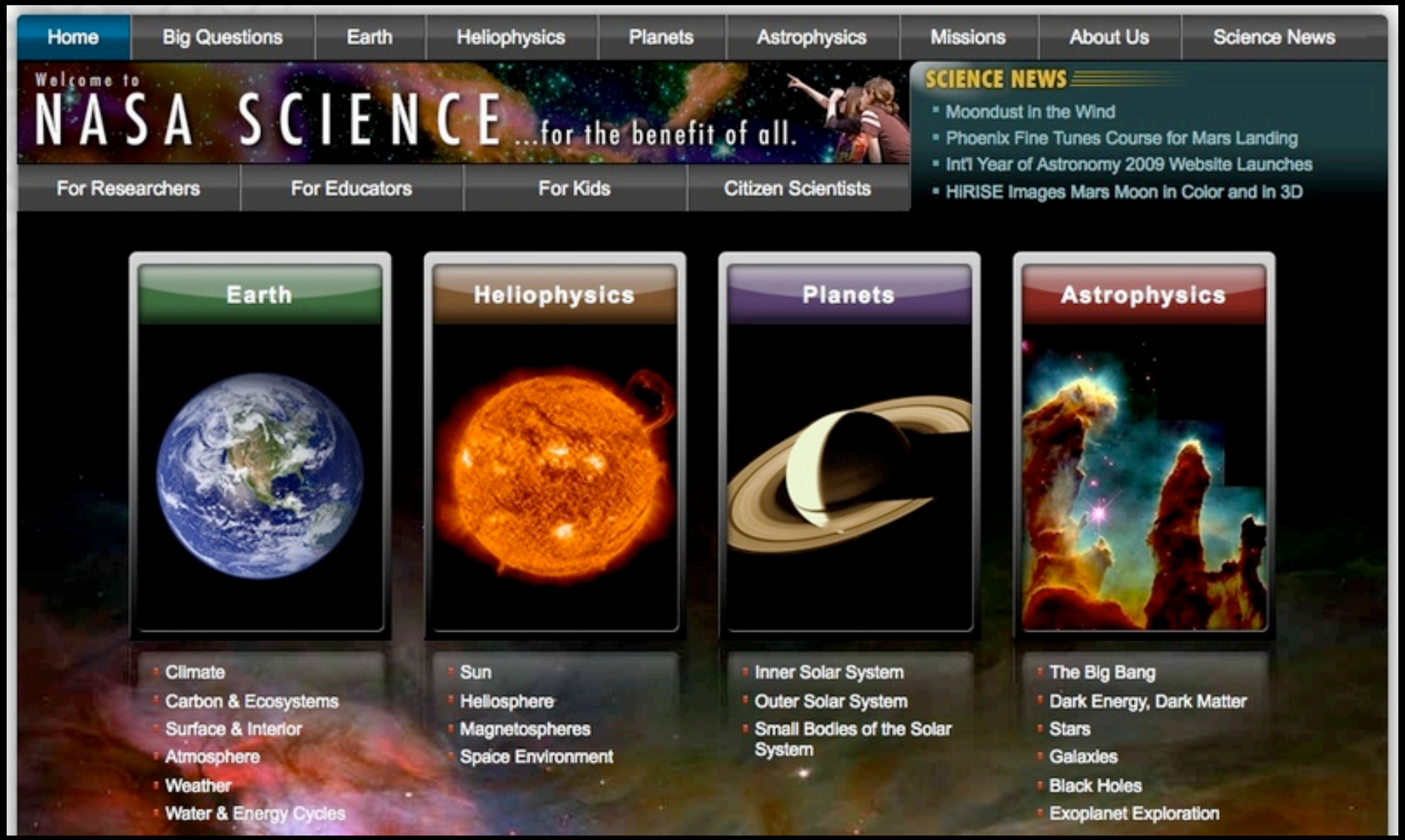
NASA Earth Science

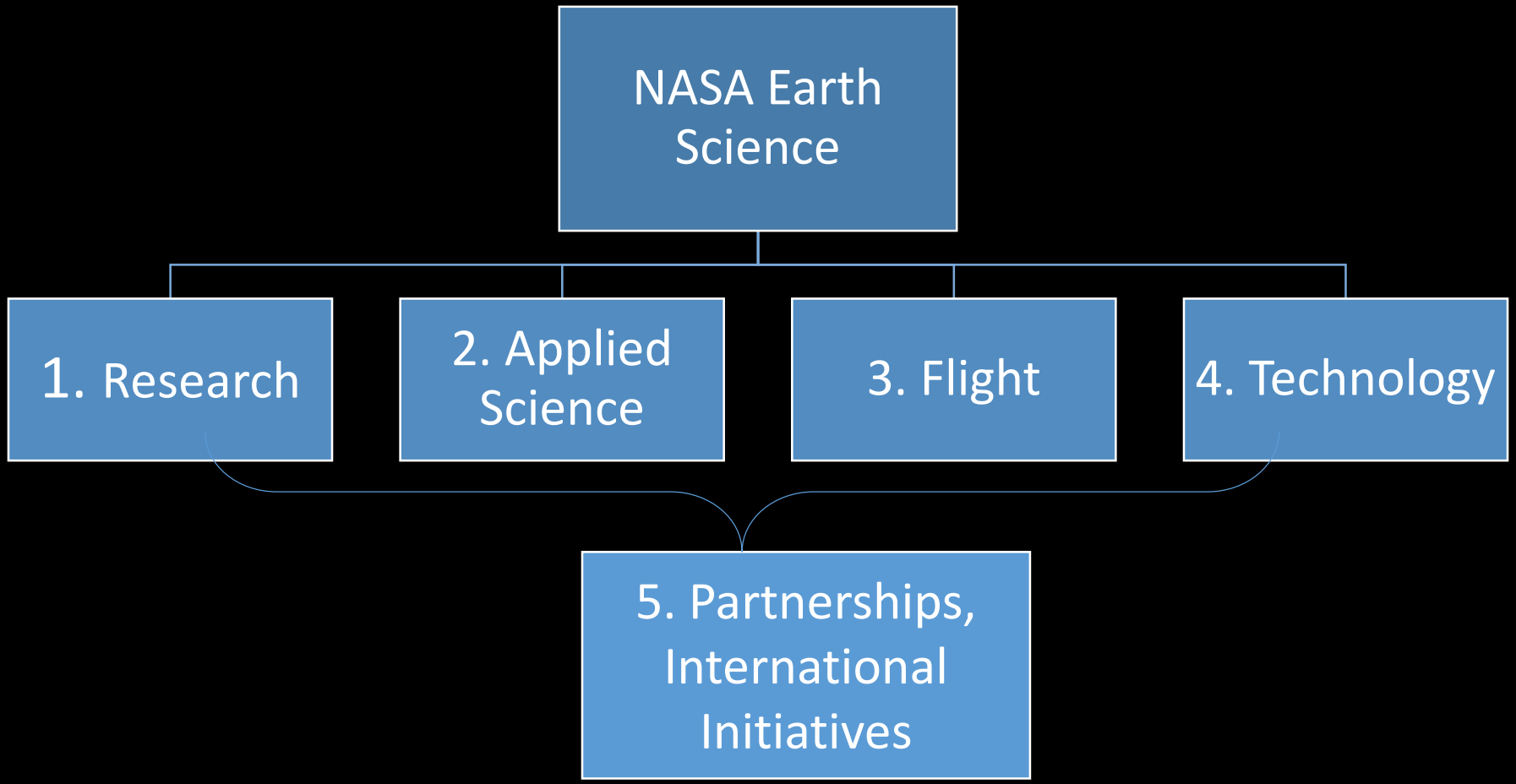
Dalia Kirschbaum, NASA Goddard Space Flight Center

NASA-Rio Workshop

NASA Science Mission Directorate

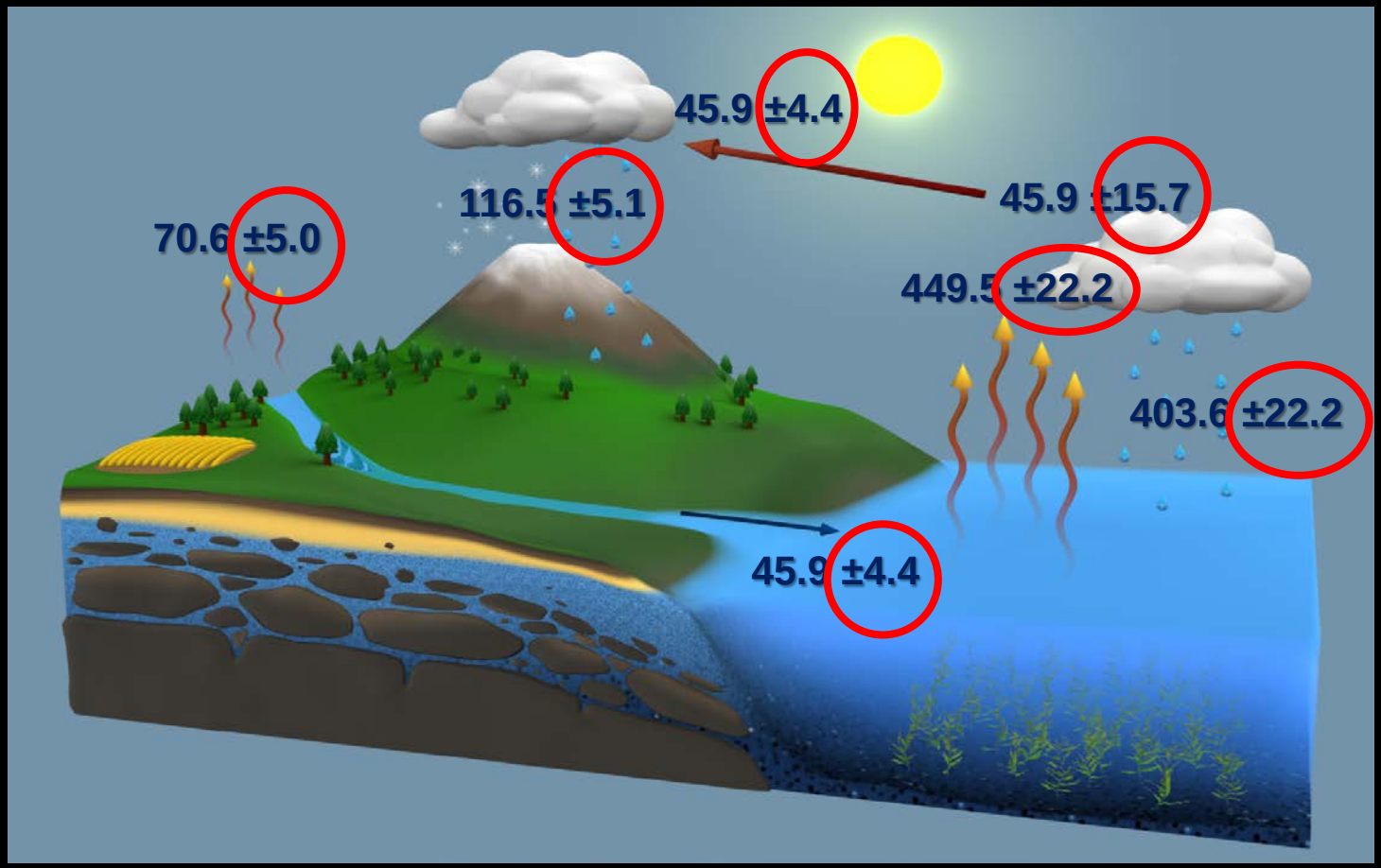


NASA Earth Science




Earth System Science
Land
Ocean
Atmosphere
Ice
Changing Planet

The Global Water Cycle



Global mean water fluxes (1,000 km^3/yr) at the start of the 21st century, based on NEWS analysis of satellite and ground-based observations and data integrating model output (*Rodell et al., 2014*).

The most noticeable impacts of climate change will be changes in the water cycle

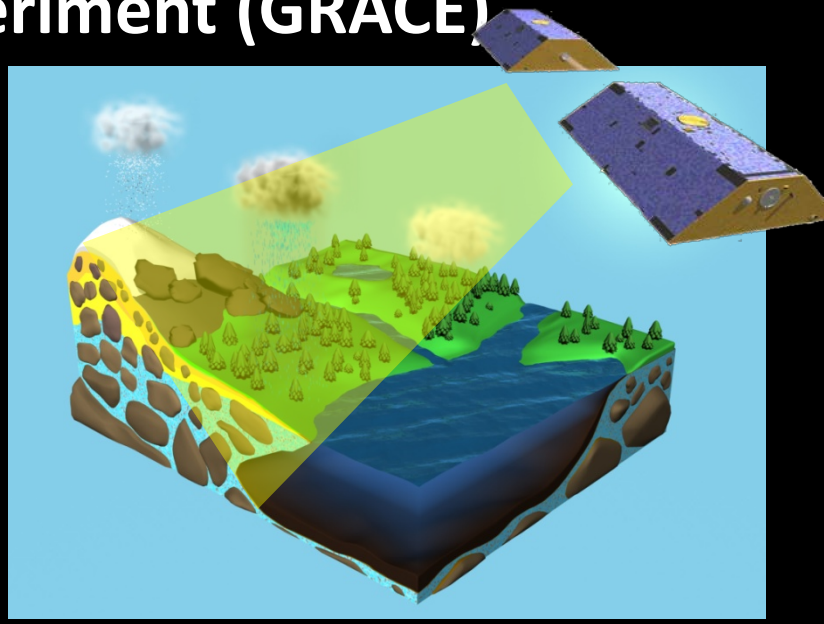
Current and Planned Missions

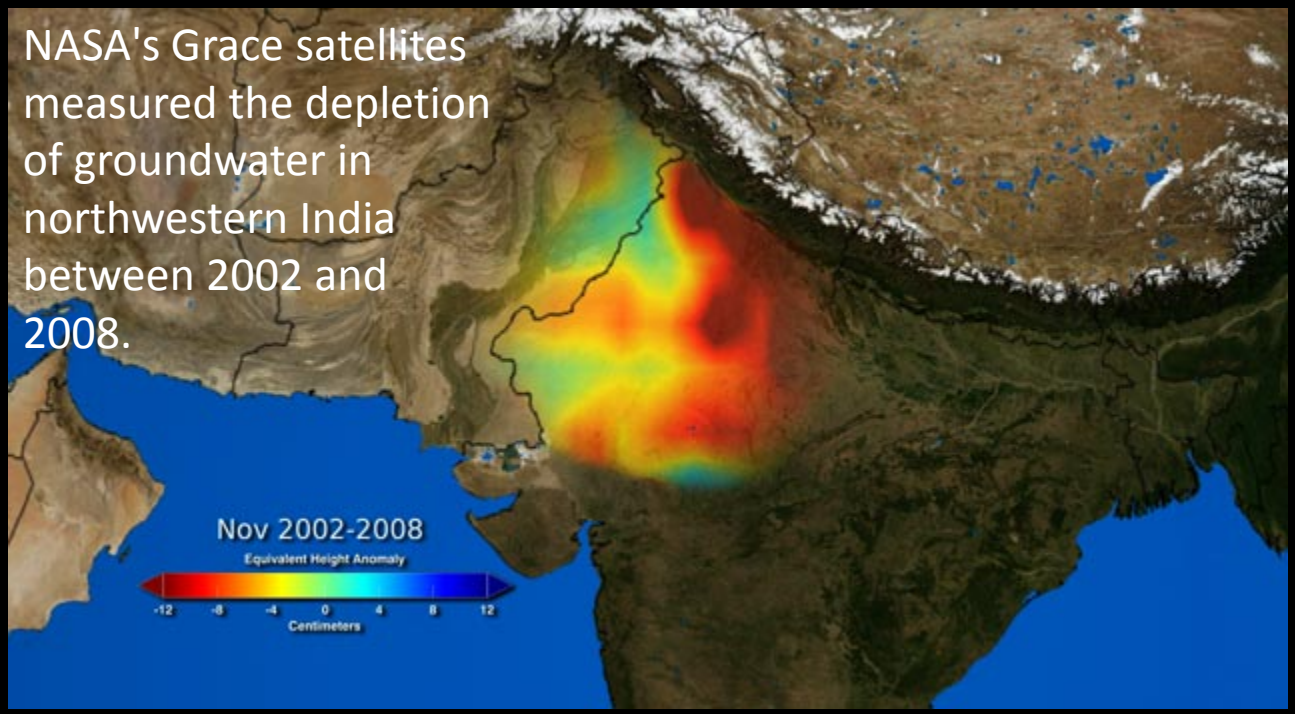
Landsat – NASA & USGS

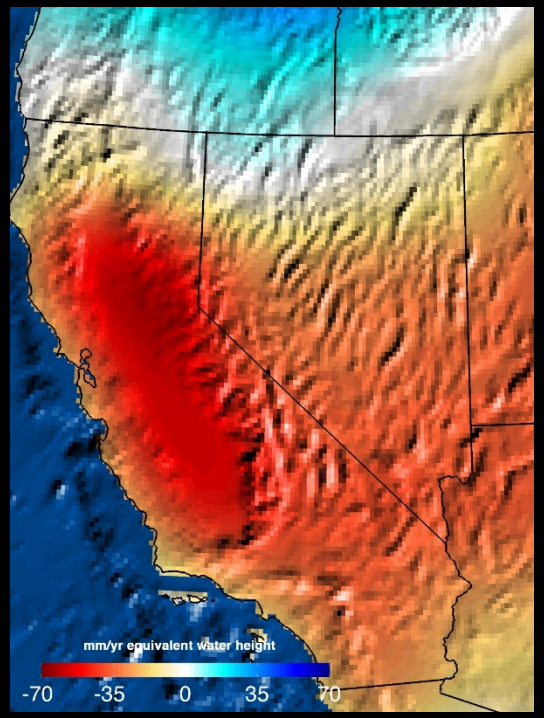
Landsat

Gravity Recovery and Climate Experiment (GRACE)

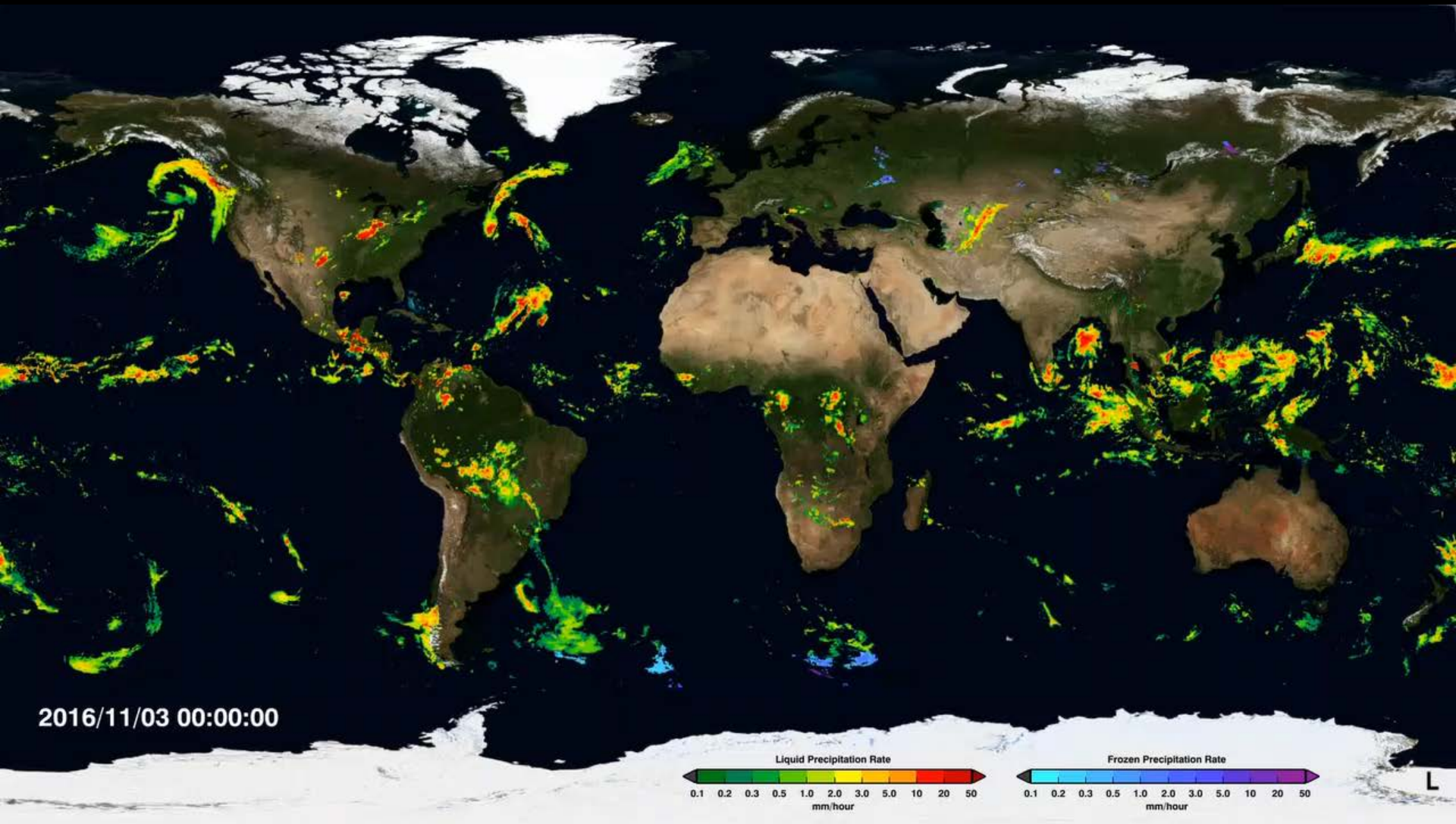
GRACE measures changes in total terrestrial water storage, including groundwater, soil moisture, snow, and surface water.





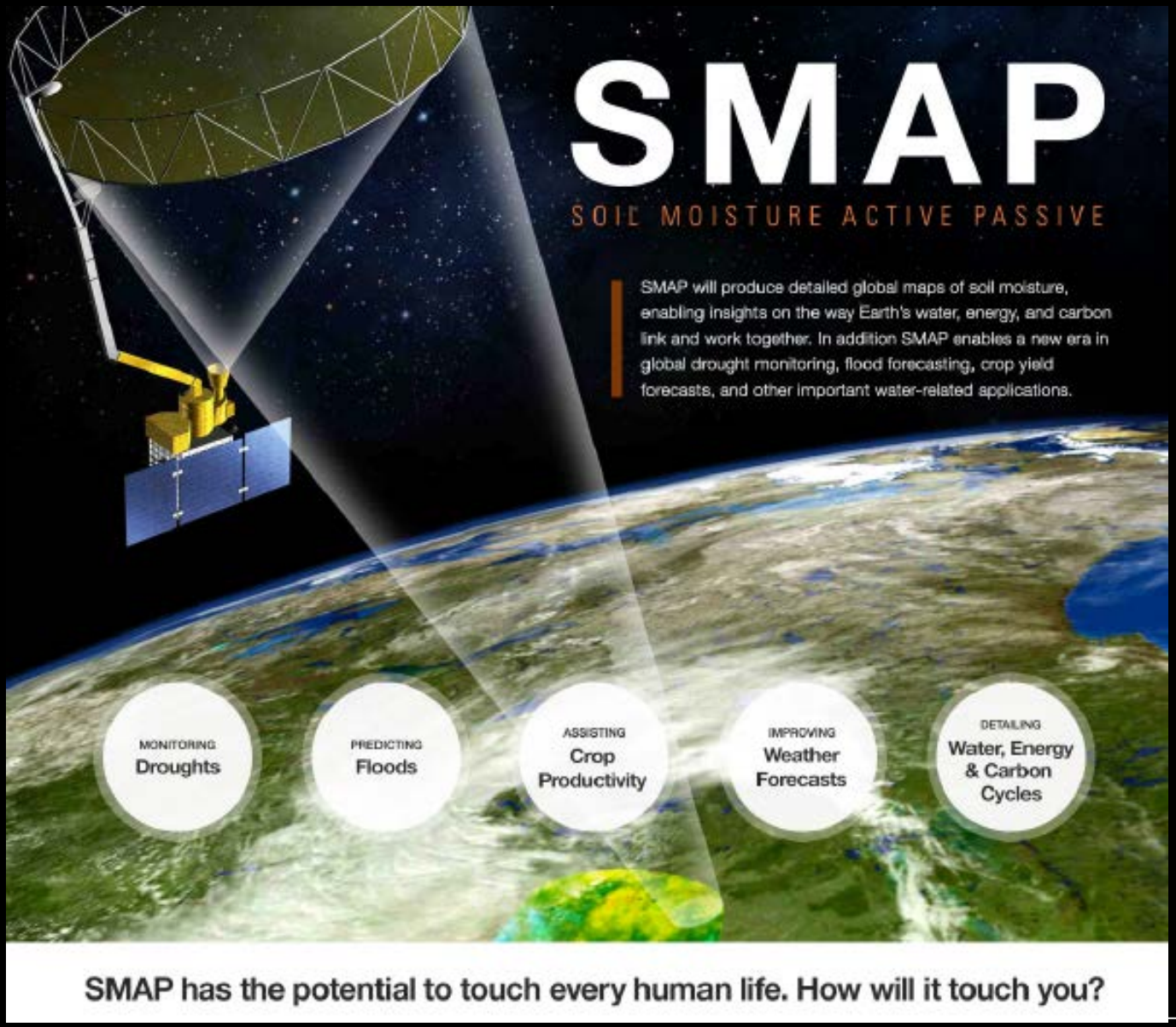


Global Precipitation Measurement: Near real-time global rainfall



http://svs.gsfc.nasa.gov/4285

Soil Moisture Active Passive (SMAP)

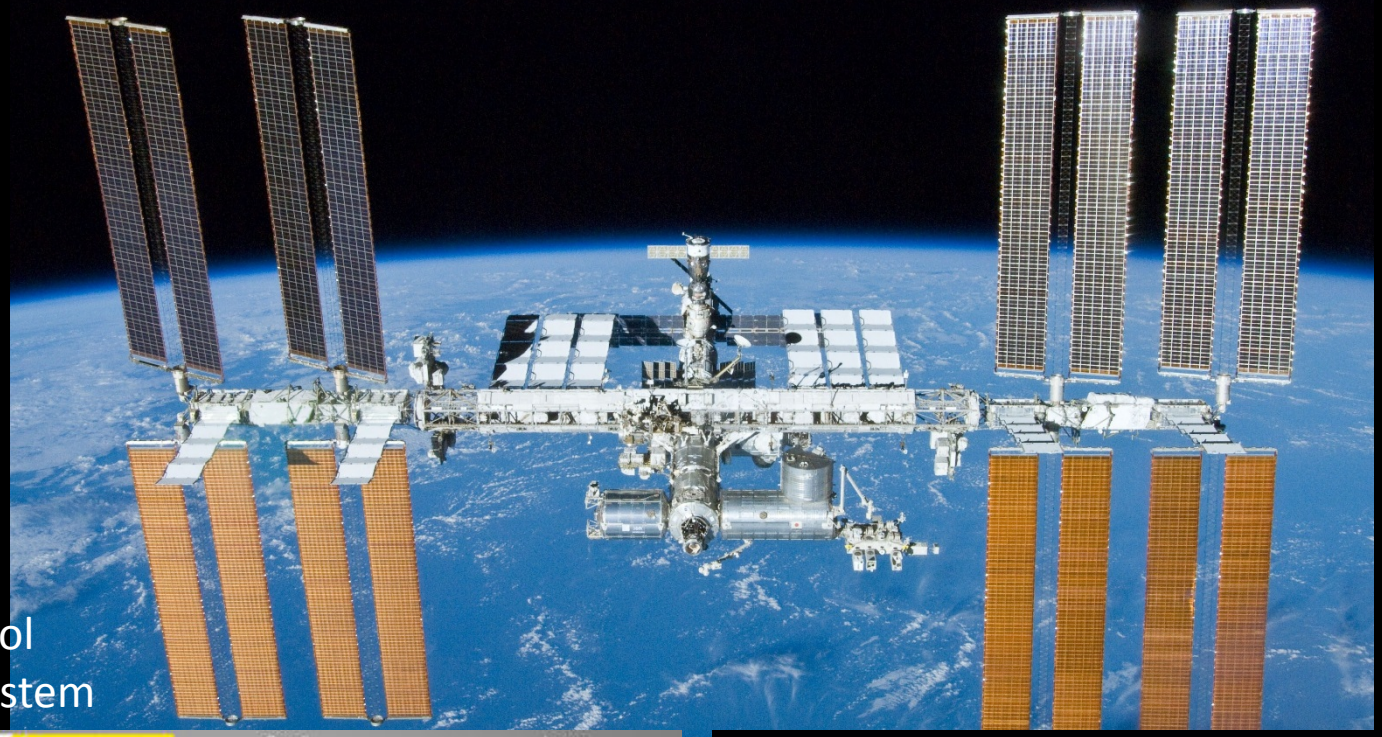


Primary Science Objectives:

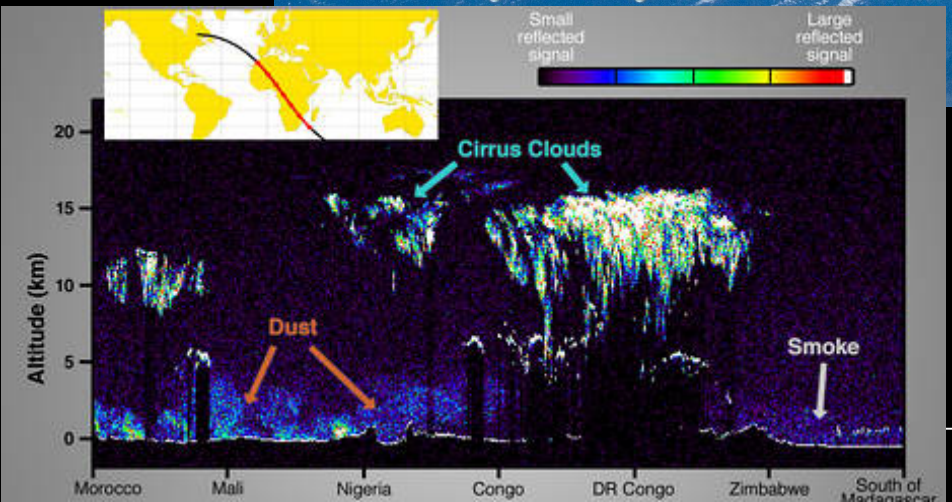
- **Global, high-resolution mapping of soil moisture and its freeze/thaw state to**

Launched: January 31st 2015 from Vandenberg Air Force Base, CA

International Space Station



Cloud-Aerosol Transport System

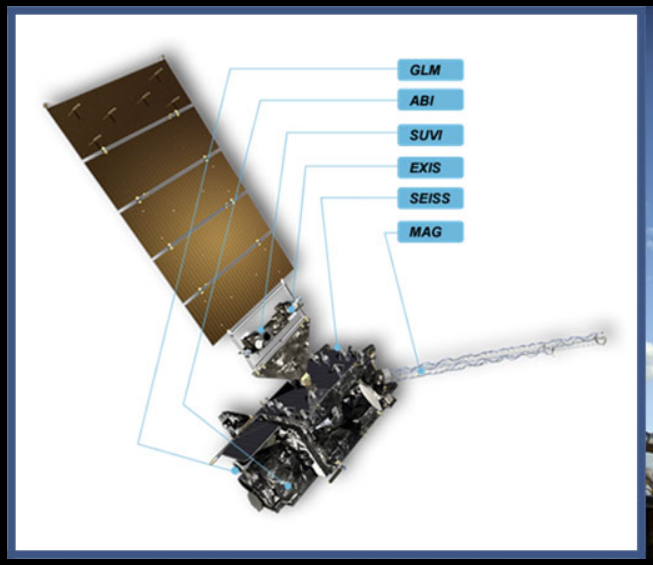


RapidScat

GOES-R

The Geostationary Operational Environmental Satellite-R Series (GOES-R) is NOAA's next generation of geostationary weather satellites.

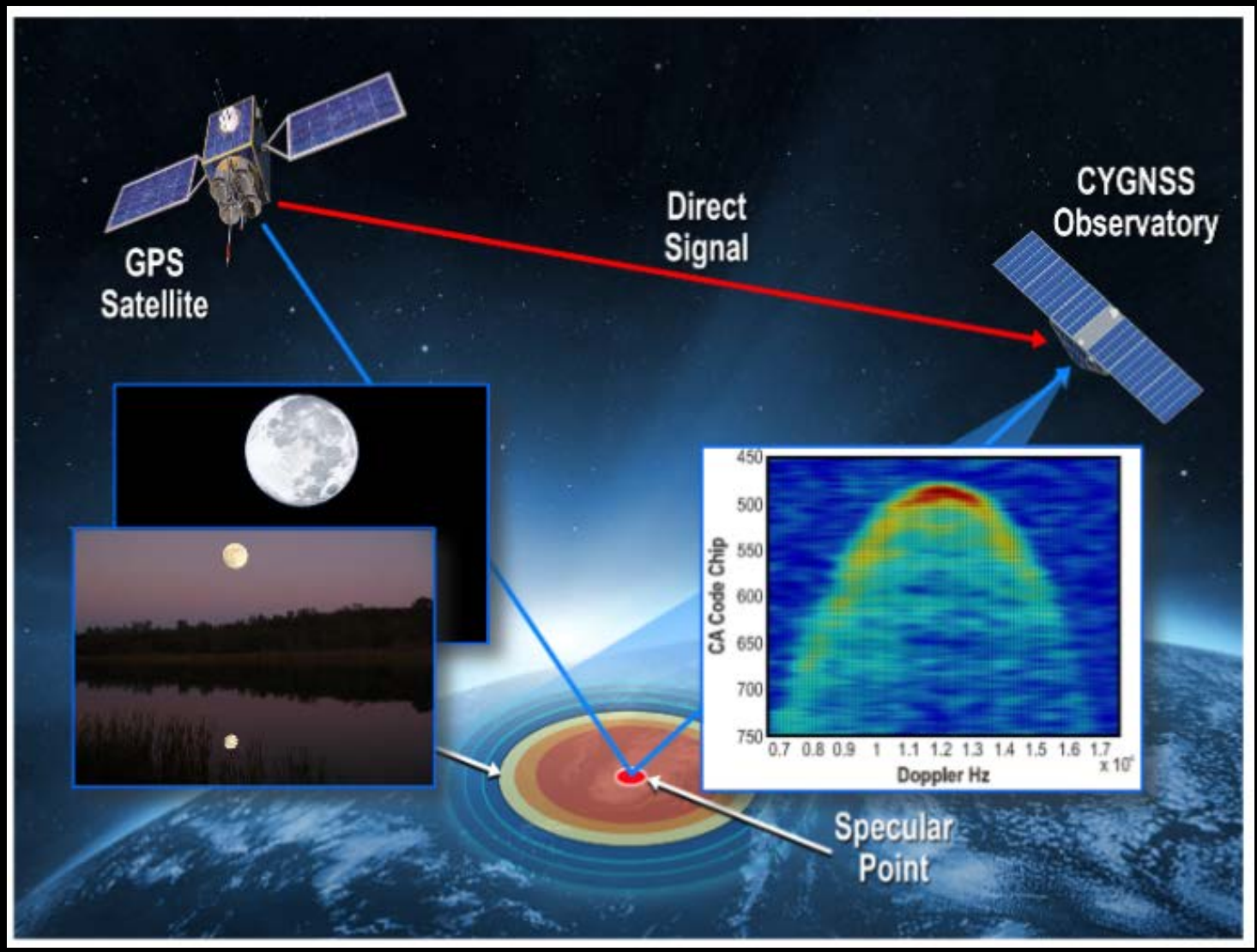
- Improved hurricane track and intensity forecasts
- Increased thunderstorm and tornado warning lead time
- Improved aviation flight route planning
- Improved air quality warnings
- Improved solar flare warnings for communications and navigation disruptions
- More accurate monitoring of energetic particles responsible for radiation hazards to humans and spacecraft
- Better monitoring of space weather to improve geomagnetic storm forecasting



Launched November 19th, 2016

Cyclone Global Navigation Satellite System (CYGNSS)

- Improve extreme weather prediction
- Constellation of eight small satellites
- Launch: December 12th, 2016!



National Aeronautics and Space Administration

EARTH SCIENCE DATA OPERATIONS

MISSION OPERATIONS

DATA TRANSPORT TO DATA CENTERS/SIPSs

SCIENCE OPERATIONS

DATA ACQUISITION

EOS Spacecraft

Direct Broadcast (DB)

Direct Broadcast/ Direct Readout Stations

Tracking and Data Relay Satellite (TDRS)

FLIGHT OPERATIONS, DATA CAPTURE, INITIAL PROCESSING, BACKUP ARCHIVE

EOS Data Operations System (EDOS) Data Processing

White Sands Complex (WSC)

EOS Operations Center (EOC) Mission Control

EOS Polar Ground Stations

SCIENCE DATA PROCESSING, DATA MANAGEMENT, INTEROPERABLE DATA, ARCHIVE, AND DISTRIBUTION

EOSDIS Data Centers

Instrument Teams and Science Investigator-led Processing Systems (SIPSs)

Infrastructure (Search, Order, Distribution)

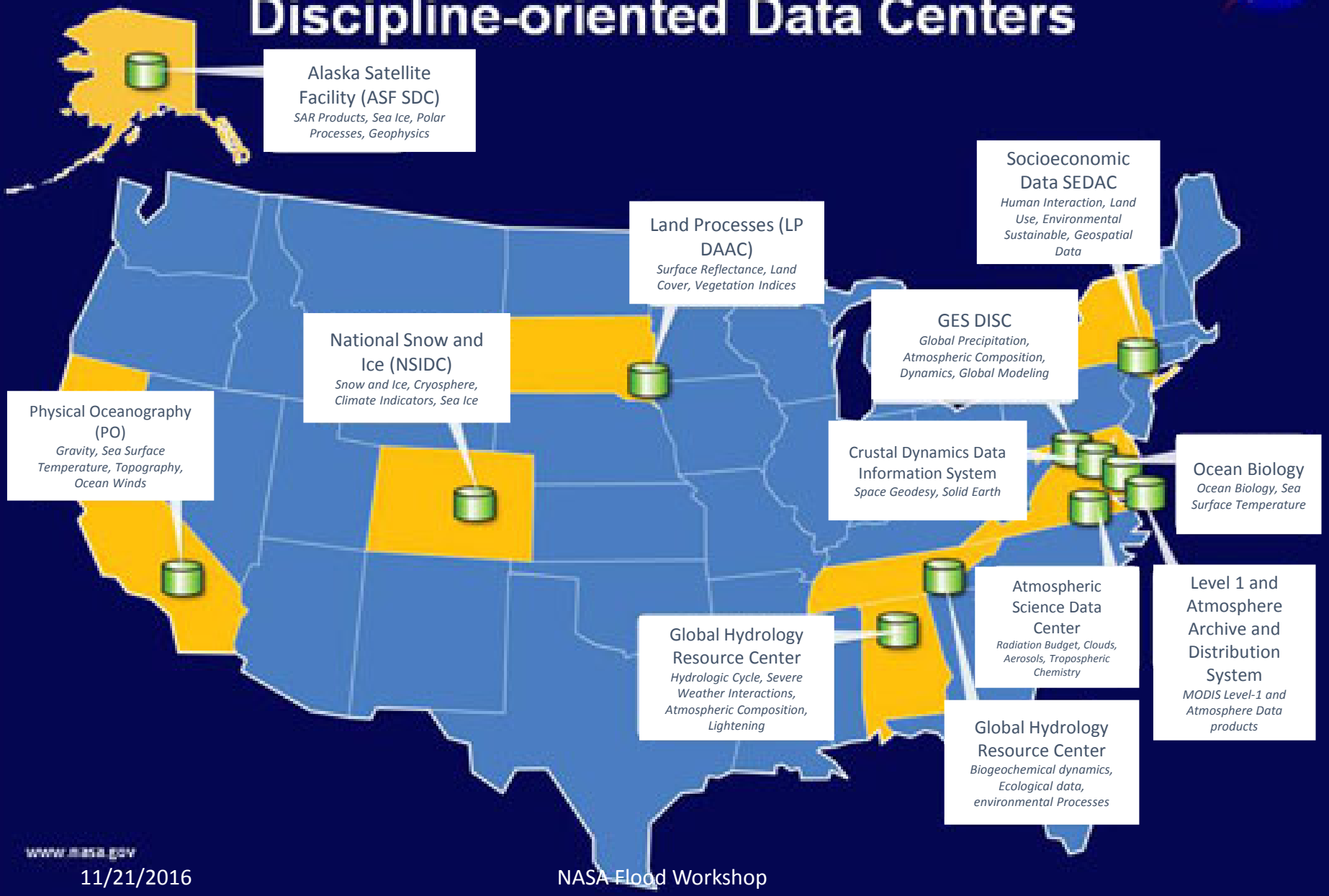
DISTRIBUTION AND DATA ACCESS

- Research
- Education
- Value-Added Providers
- Interagency Data Centers
- Earth System Models
- International Partners
- Decision Support Systems

NASA INTEGRATED SERVICES NETWORK (NISN) MISSION SERVICES

National Aeronautics and Space Administration

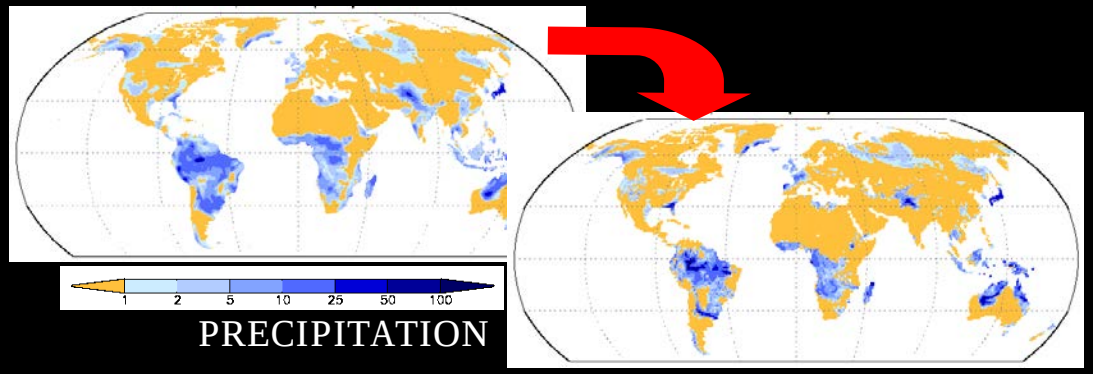
Discipline-oriented Data Centers



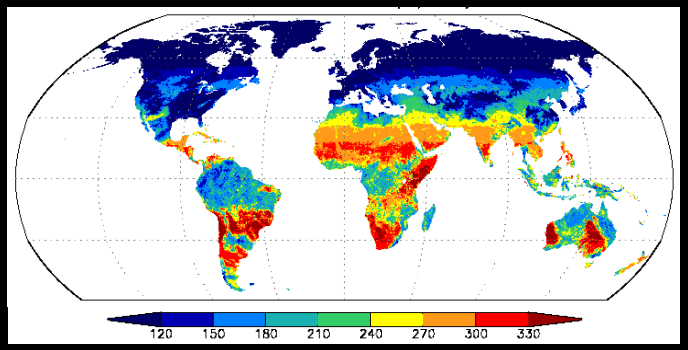
www.nasa.gov

Data Integration Within a Land Data Assimilation System (LDAS)

INTERCOMPARISON and OPTIMAL MERGING of global data fields

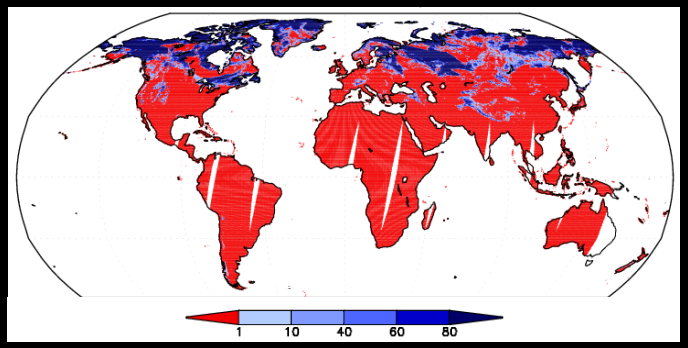


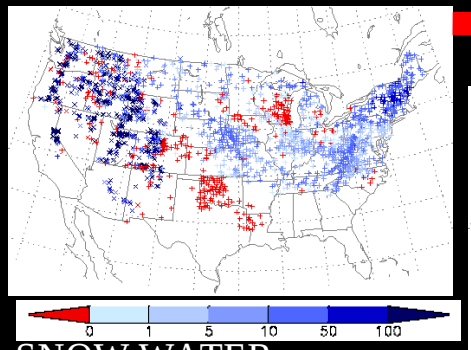
PRECIPITATION



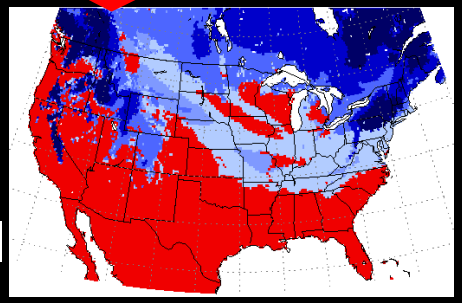
Satellite derived meteorological data used as land surface model **FORCING**

ASSIMILATION of satellite based land surface state fields (snow, soil moisture, surface temp, etc.)





SNOW WATER EQUIVALENT

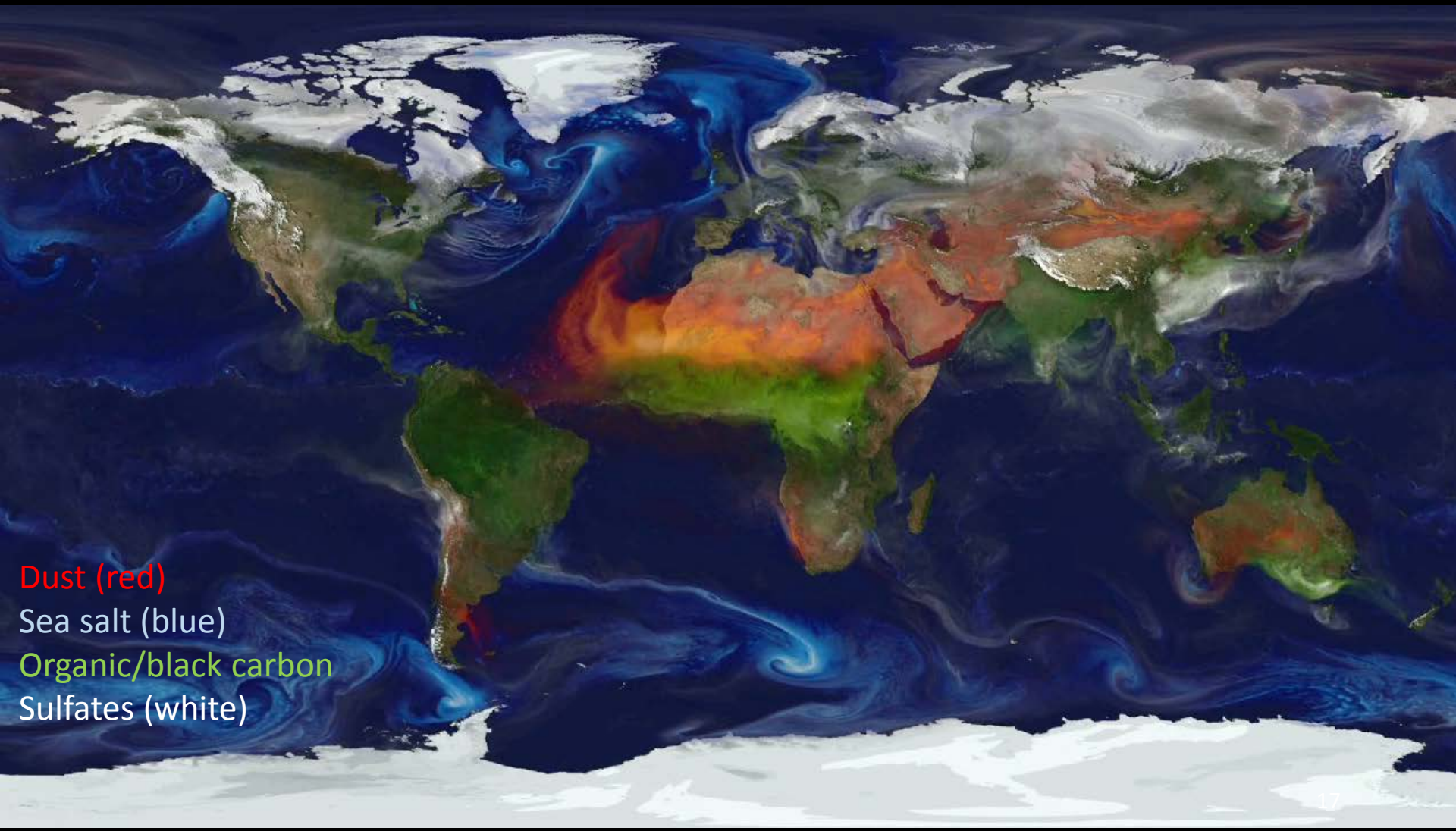


Ground-based observations used to VALIDATE model output

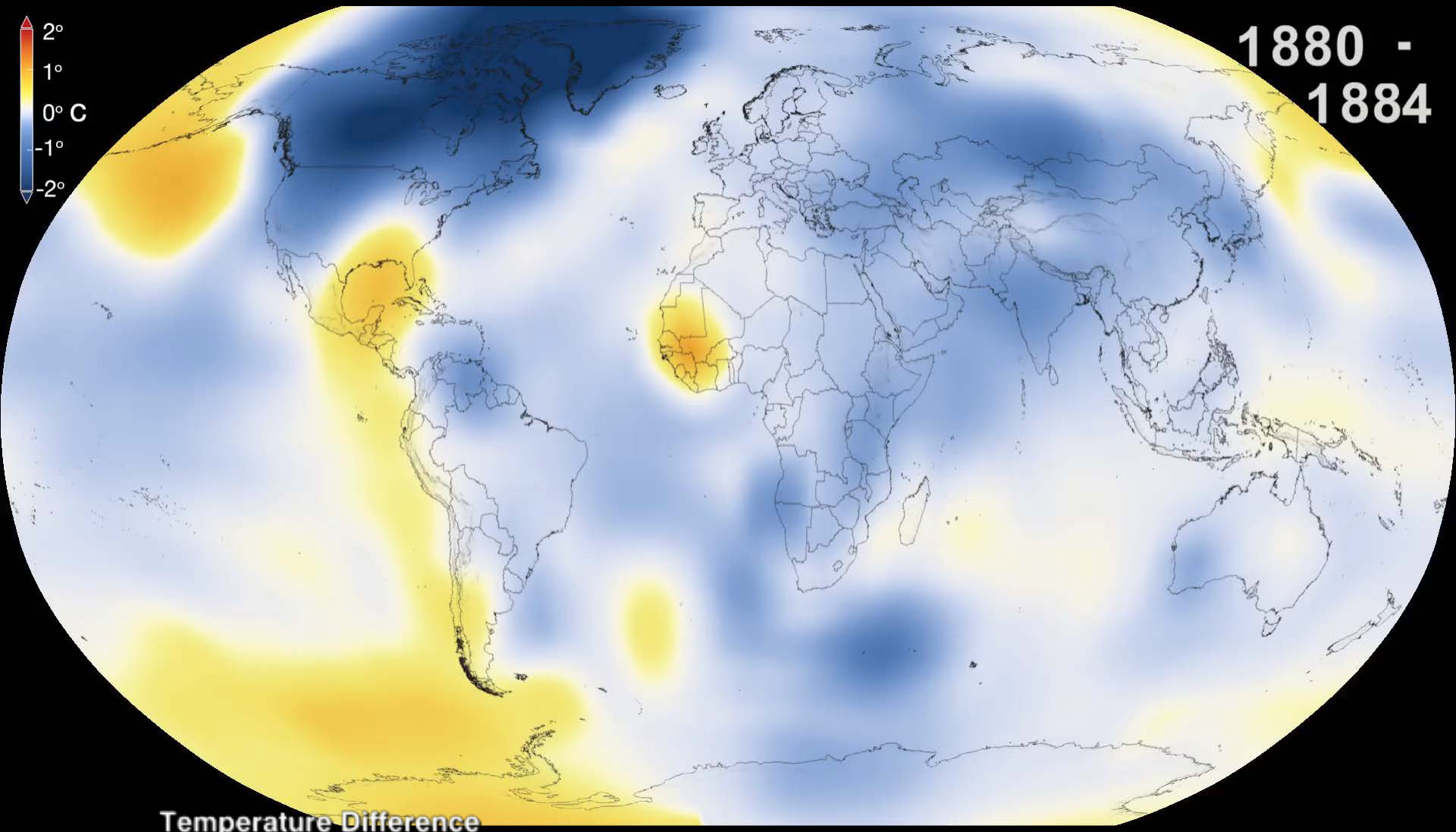
Examples from NASA's GLDAS
http://ldas.gsfc.nasa.gov/

Matt Rodell
NASA GSFC

Simulating the Transport of Aerosols with GEOS-5



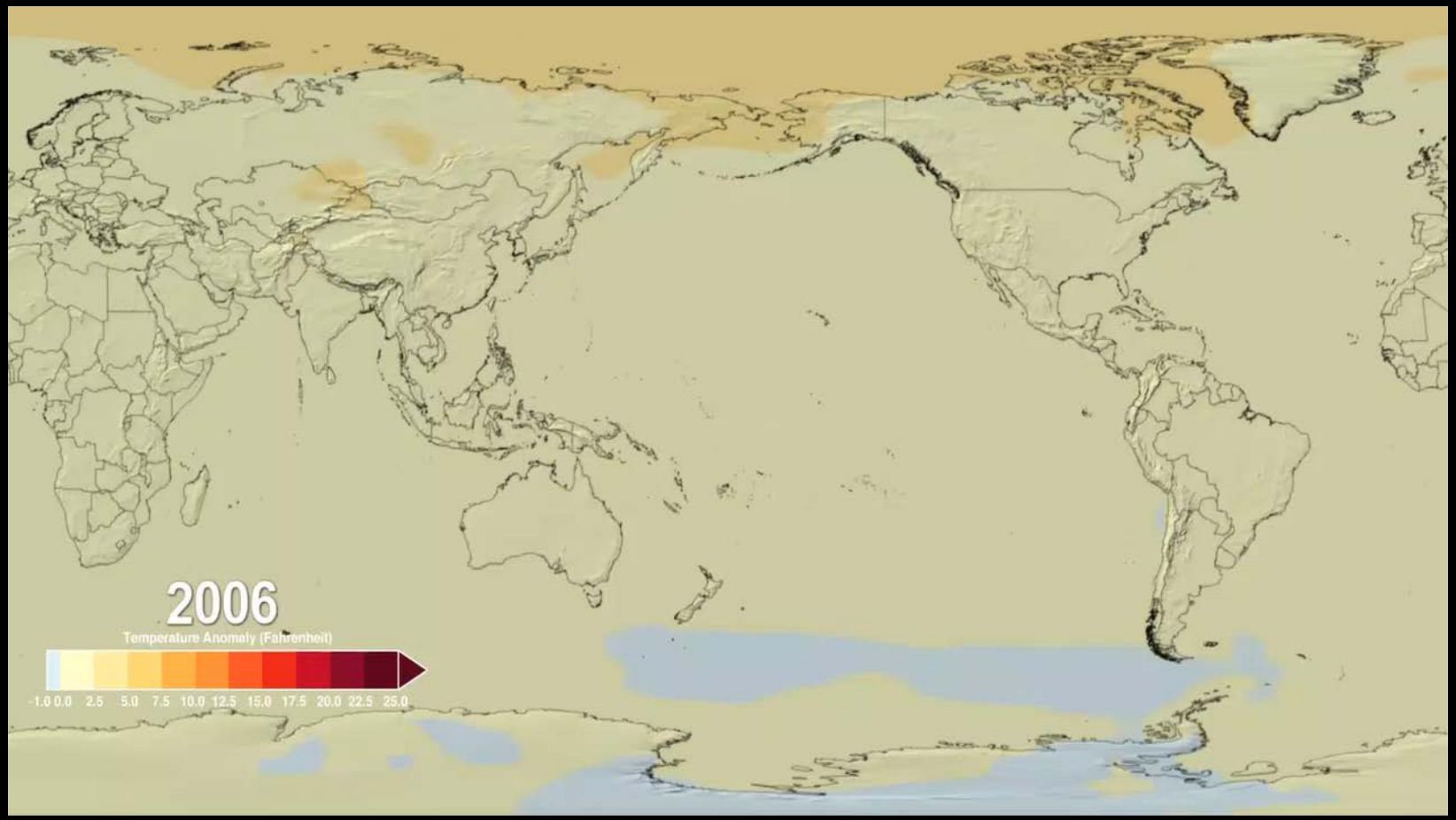
The year 2015 ranks as Earth's warmest since 1880



5-year global temperature anomalies

https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=4419

CMIP5: 21st Century Temperature Scenarios



Composite sequence of ensemble RCP 8.5

https://svs.gsfc.nasa.gov/4105

Global Fire Activity

Fire Information for Resource Management (FIRMS)

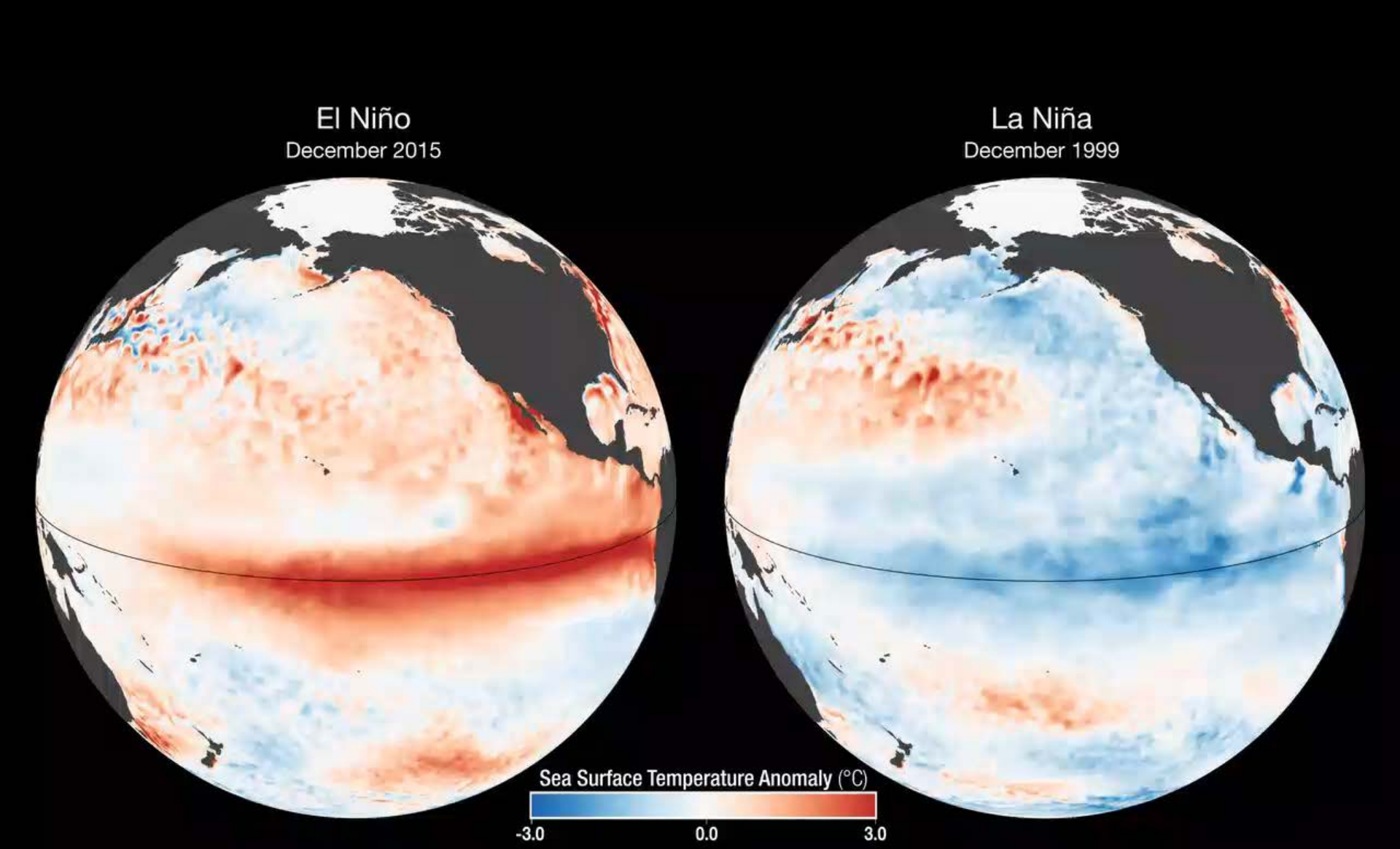
https://svs.gsfc.nasa.gov/3868

Weekly Animation of Arctic Sea Ice Age with Two Graphs: 1984 - 2016

https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=4522&button=recent

Landsat 1972-present

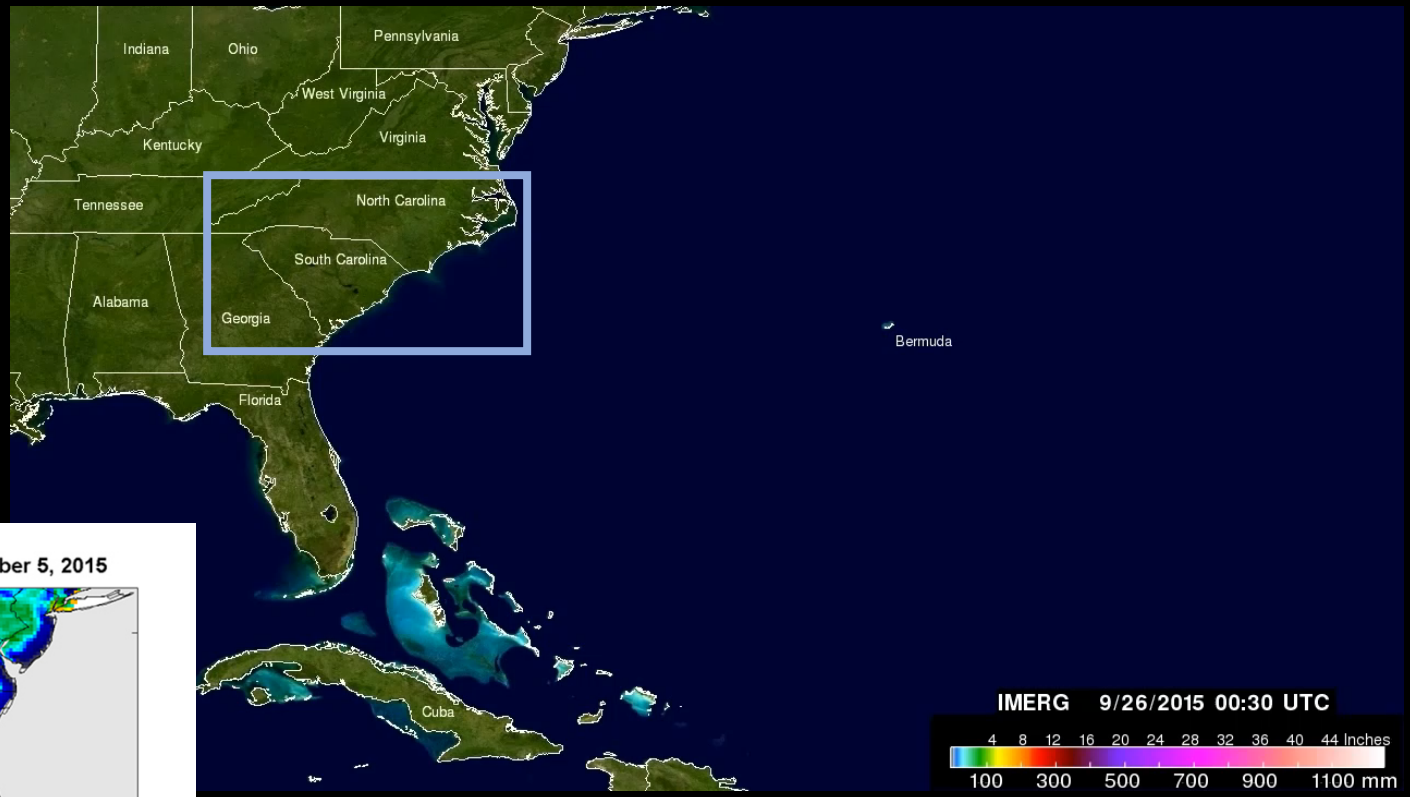
https://svs.gsfc.nasa.gov/10721

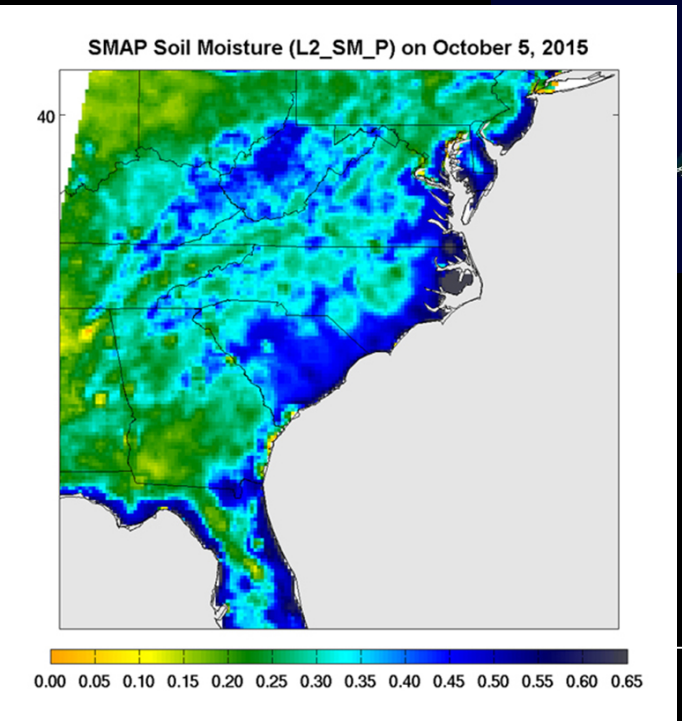


https://svs.gsfc.nasa.gov/30747

Hurricane Joaquin

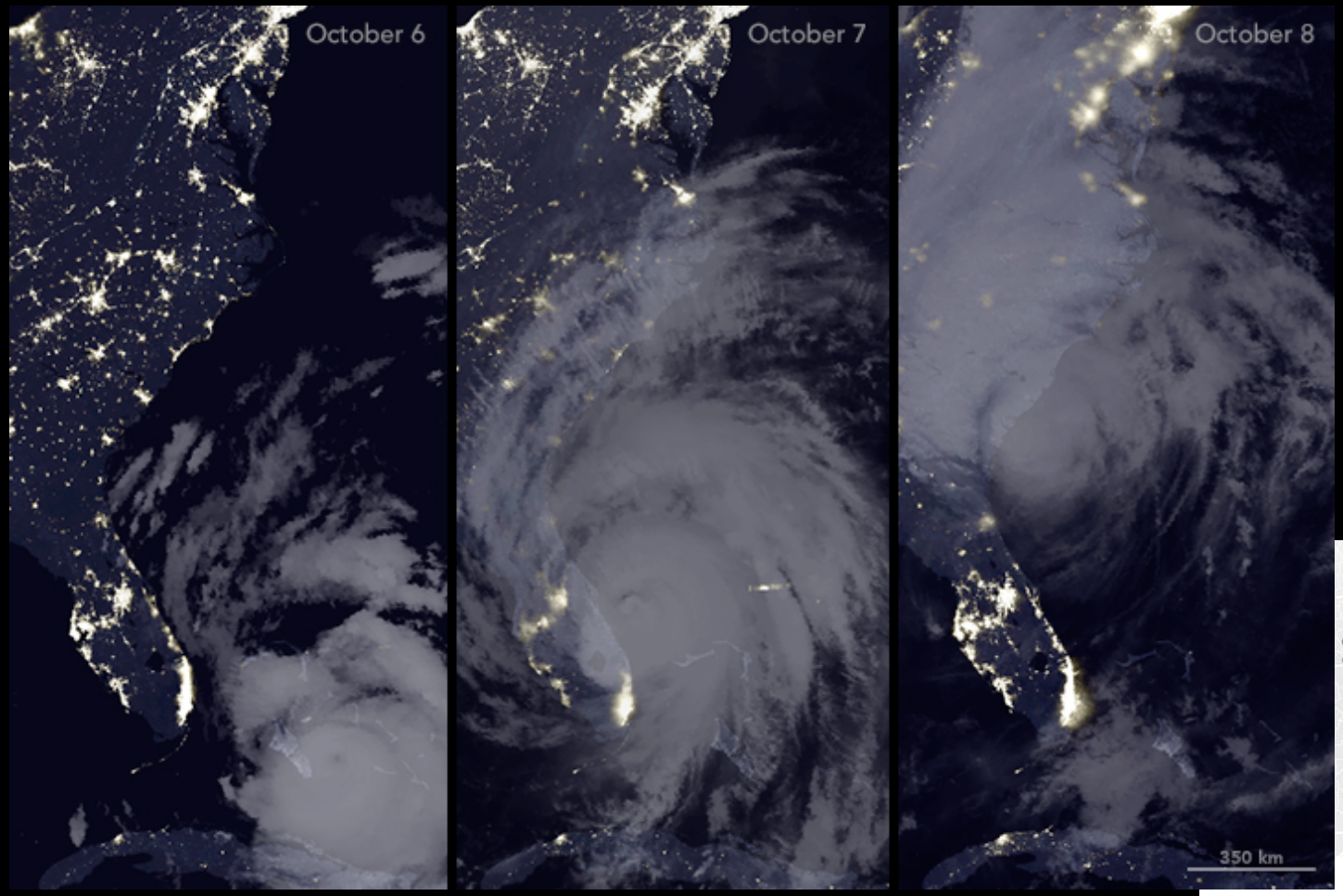
September-
October, 2015



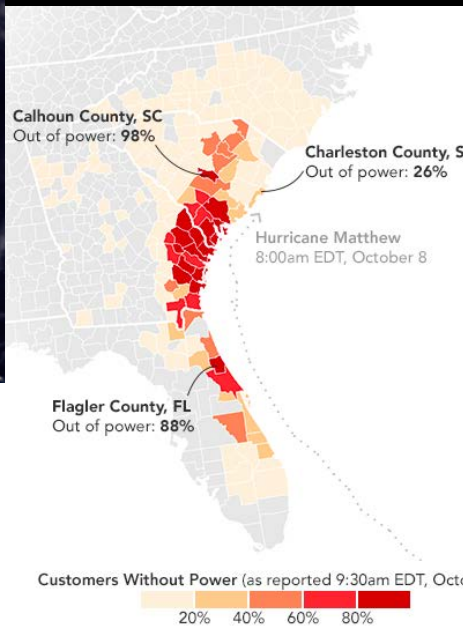


A "fire hose" of moisture has been pumped into the Carolinas from Hurricane Joaquin resulting in wide spread flooding. Over two feet of rain have been reported in South Carolina.

Hurricane Matthew Power Outages detected by VIIRS



The VIIRS on the Suomi NPP satellite captured three nighttime images of the Atlantic coast. The image on the left was acquired at 3:14 a.m. Eastern Daylight Time (07:14 Universal Time) on Oct. 6, 2016; the middle image shows the same area at 3:14 a.m. on Oct. 7; the image on the right was acquired at 2:14 a.m. on Oct. 8.

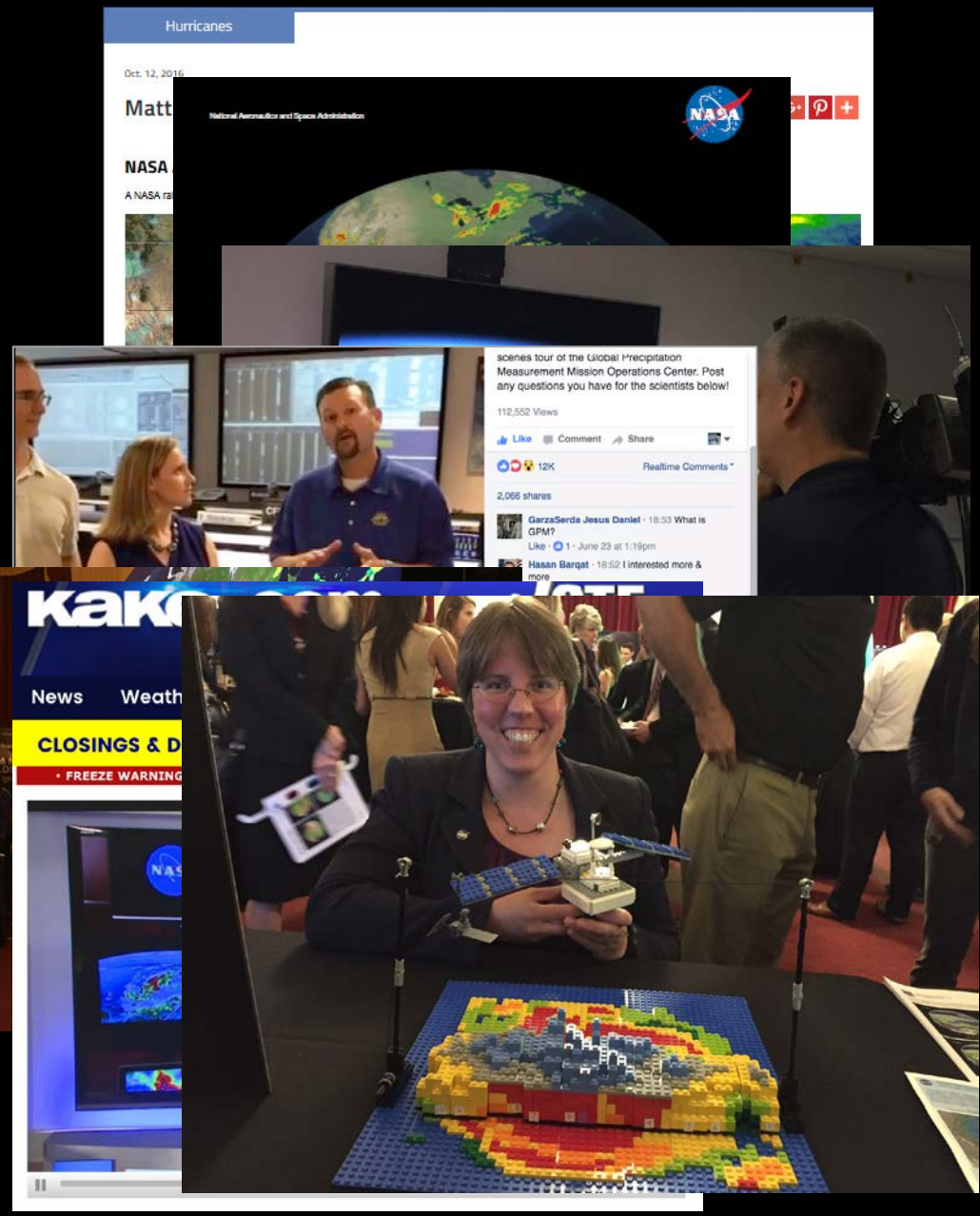


http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=88896

Data from Direct Read Laboratory, GSFC

NASA Communication and Outreach

- NASA Feature Articles
- Print materials
- Media Interviews
- Facebook Live
- Hyperwall talks
- Live Shots
- School Visits
- Tables at events
- Social Media



Know Your Earth

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