



NASA Headquarters View

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Earth Science Measurements



MESOSPHERE

Acrimsat • 12/99
Solar Output
ACRIM

Terra • 12/99
Energy Budget
CERES
Albedo, Aerosols, Vegetation
MISR
Lower Atmospheric Chemistry
MOPITT
Surface Imaging
MODIS, ASTER

Aqua • 5/02
Energy Budget
CERES
Atmospheric Sounders
AMSU-E, AIRS, AMSU/HSB
Surface Imaging
MODIS

SORCE • 1/03
Solar Irradiance
TIM, SIM, XPS, Solstice

Aura • 7/04
Trace Gases
TES
Atmospheric Composition
HIRDLs, MLS, OMI

TRMM • 11/97
Energy Budget
TMI, VIRS, LIS

Jason • 12/01
Ocean Altimetry
Poseidon 2/JMR/DORIS

GRACE • 3/02
Gravity Field
GPS, KBR

CloudSat • 4/06
Cloud Properties
CPR

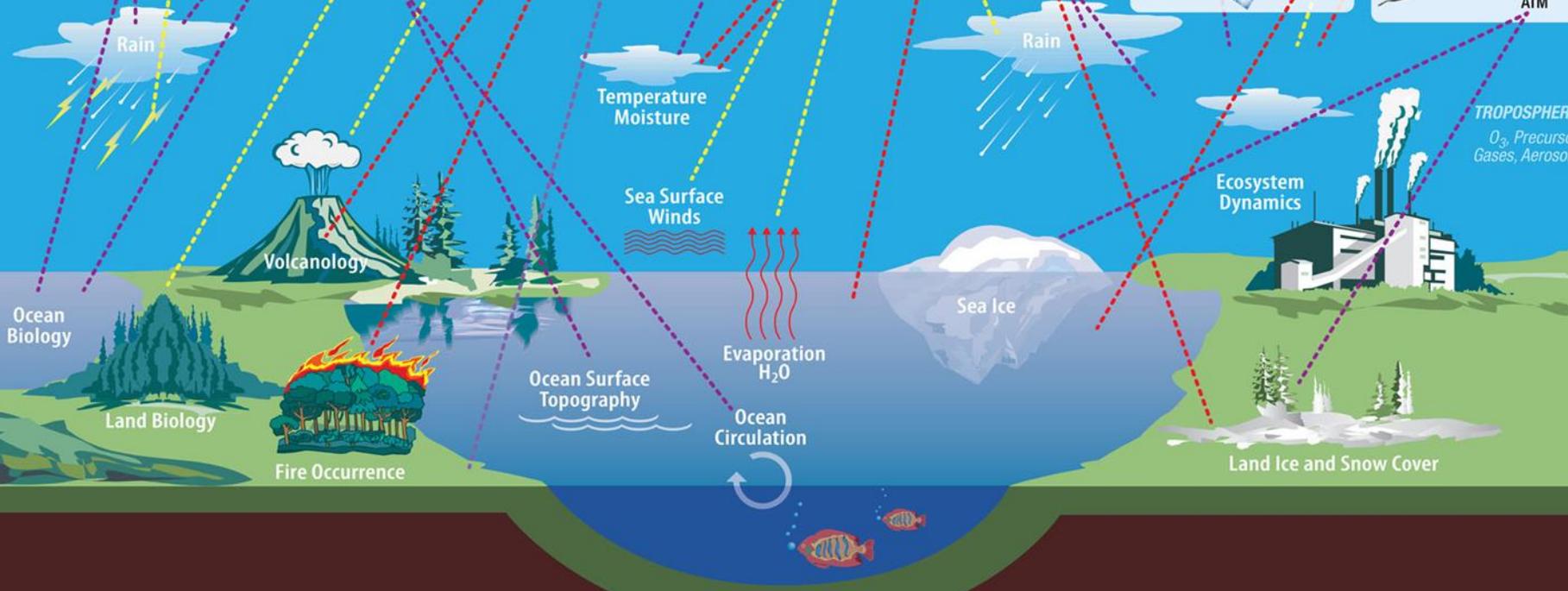
CALIPSO • 4/06
Cloud, Aerosol Properties
CALIOP

OSTM • 6/08
Ocean Altimetry
Poseidon 3/AMR/DORIS

Ice Bridge • 10/09
Ice Topography and Altimetry
ATM

STRATOSPHERE
O₃, ClO, BrO, OH, Trace Gases, Aerosols

TROPOSPHERE
O₃, Precursor Gases, Aerosols



Extensive Data Collection



- EOSDIS data collection includes over 6800 data types
 - Land
 - » Cover & Usage
 - » Surface temperature
 - » Soil moisture
 - » Surface topography
 - Atmosphere
 - » Winds & Precipitation
 - » Aerosols & Clouds
 - » Temperature & Humidity
 - » Solar radiation
 - Ocean Dynamics
 - » Surface temperature
 - » Surface wind fields & Heat flux
 - » Surface topography
 - » Ocean color
 - Cryosphere
 - » Sea/Land Ice & Snow Cover



- Human Dimensions
 - » Population & Land Use
 - » Human & Environmental Health
 - » Ecosystems



NASA Earth Science Fleet 2014





Decadal Survey Venture Line

“... As part of this strategy, to restore more frequent launch opportunities and to **facilitate the demonstration of innovative ideas and higher-risk technologies**, NASA should create a new Venture class of low-cost research and application missions (~\$100M to \$200M). These missions should focus on fostering revolutionary **innovation and on training future leaders** of space-based Earth science and applications.

EV-:S
Sustained Sub-
Orbital
Investigations

EV-I:
Full function,
facility-class
instruments
Missions of
Opportunity
(MoO)

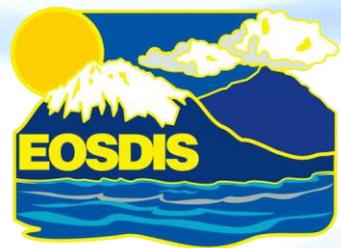
EV-M:
Complete,
self-contained,
small missions

- EV-M specifically allows NASA’s ESD to pursue higher risk (Class D missions) with high potential science return

The NASA Earth Observing System Data and Information System (EOSDIS)



**NASA Earth Science Data &
Information Systems Project**

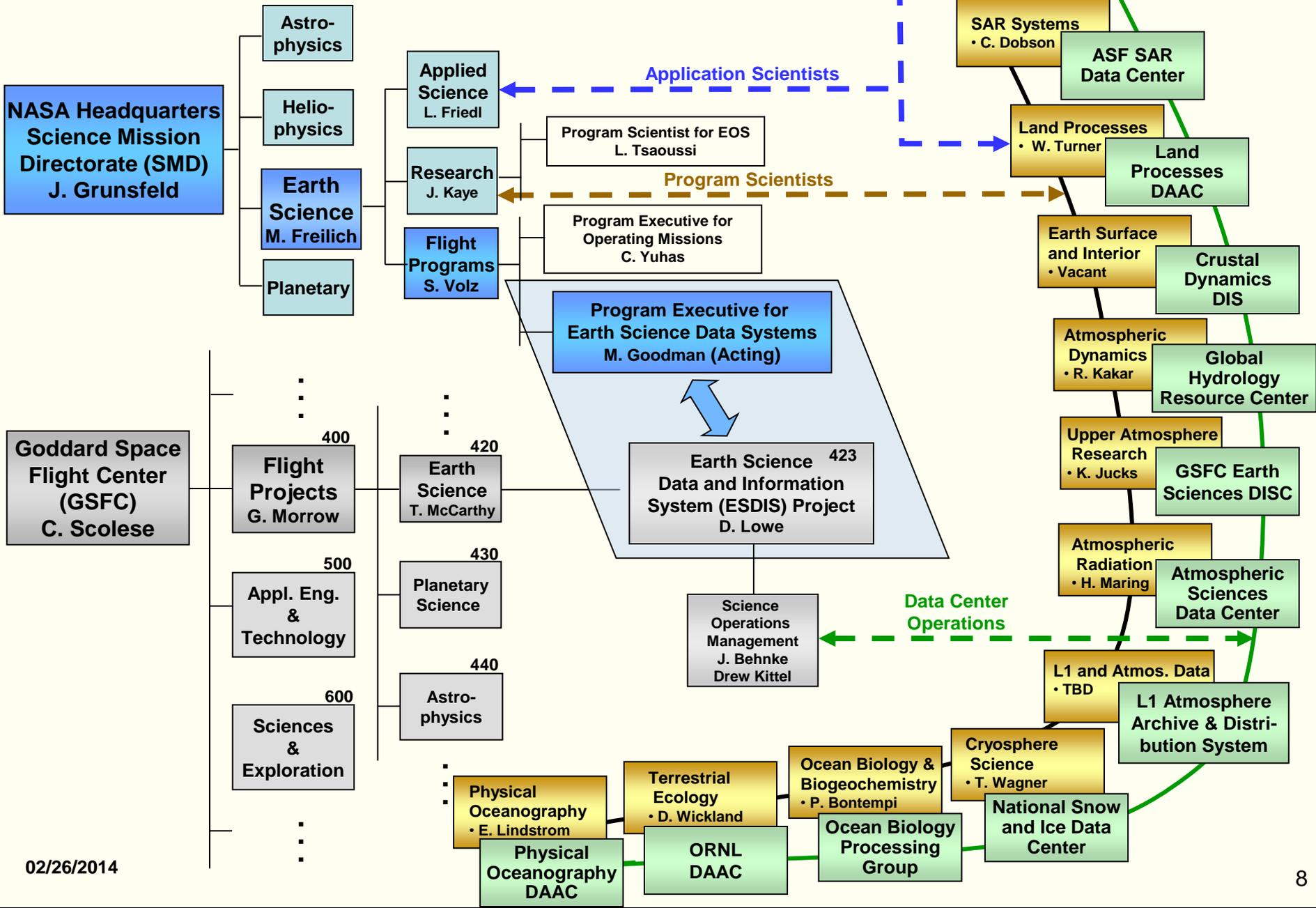


Role of EOSDIS

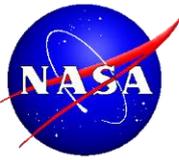


- “Advance Earth system science to meet the challenges of climate and environmental change.” -- *2011 NASA Strategic Plan*
 - NASA’s Earth Science Data Systems directly support this objective by providing end-to-end capabilities to deliver data and information products to users
- NASA’s Earth Science Data Policy promotes usage of data by the community
 - No period of exclusive access
 - Data available at no cost to all users on a non-discriminatory basis, except where agreed upon with international partners
- EOSDIS provides:
 - Interoperable Distributed Data Archives
 - Science Data Processing
 - Data Management
 - On-Line Data Access Services
 - Earth Science Discipline-Oriented User Services
 - Network Data Transport to distributed System Elements

Earth Science & Data Systems



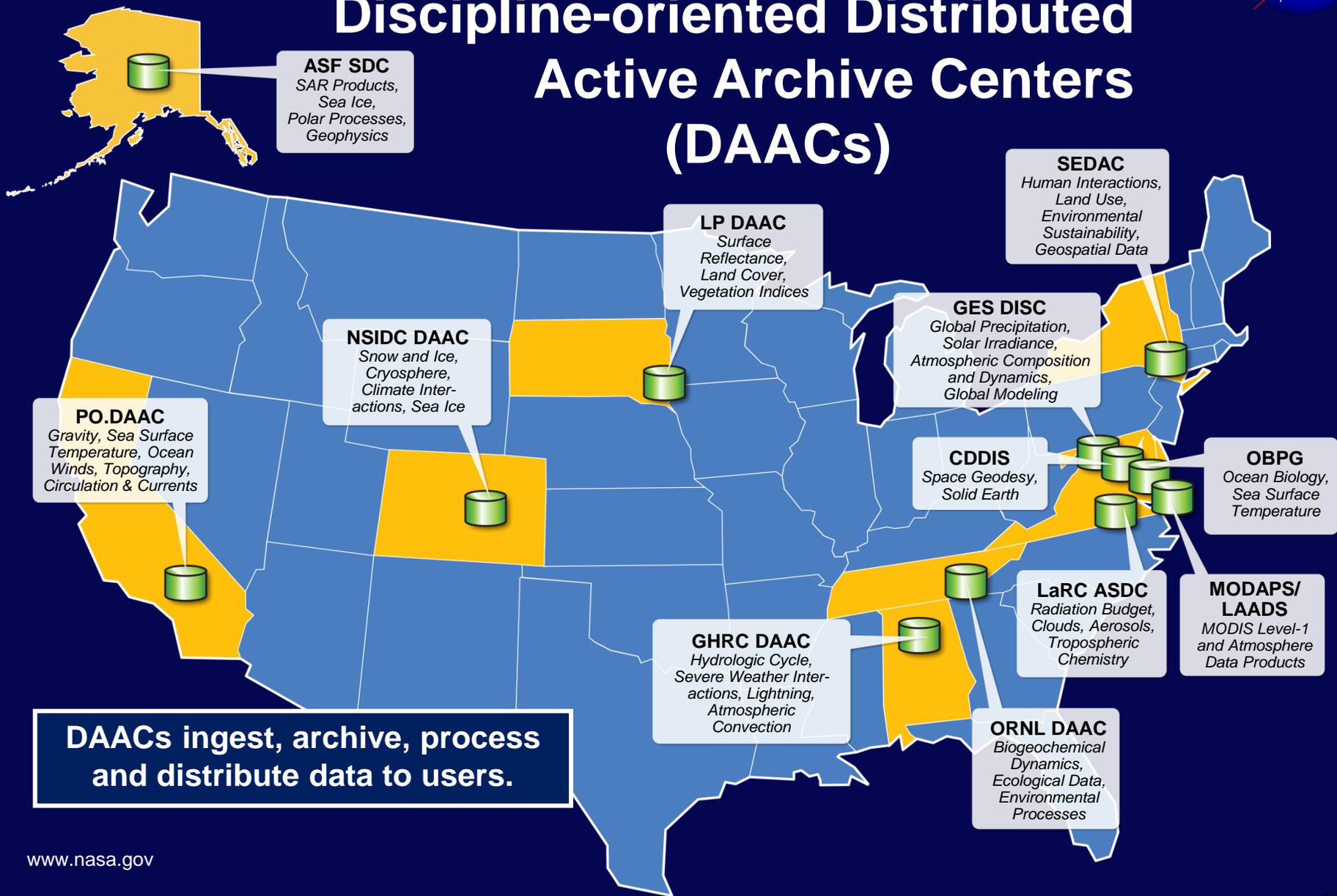
Discipline Specific Data Centers



- NASA's Earth Observing System collects data for specific parameters associated with the 24 EOS measurements as defined by the NASA Earth Science community (through NASA HQ ESMD)
 - *A major component of NASA's Earth Science Division is a coordinated series of satellite and airborne missions for long-term global observations of the land surface, biosphere, solid Earth, atmosphere, and oceans.*
 - *This coordinated approach enables an improved understanding of the Earth as an integrated system.*
- Data Centers (DAACs) were selected based on science discipline expertise and provide unique support and expert services to their user communities.
- DAACs provide data and services to the research community for comprehensive cross-discipline studies needed to understand Earth as an inter-related system.
- DAACs ensure safe stewardship of NASA's data



Discipline-oriented Distributed Active Archive Centers (DAACs)





NASA Hurricane Field Experiments

Field programs coordinated with other Federal Agencies

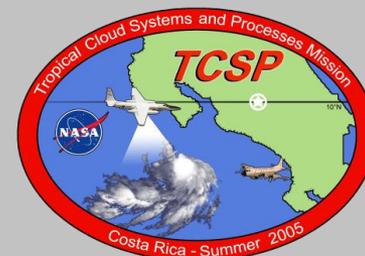
1998



2001



2005



2006



2010



2012-2014*



NASA sponsored field campaigns have helped us develop a better understanding of many hurricane properties including inner core dynamics, rapid intensification and genesis

* Years of field deployment only



Earth Venture-2

(CYGNSS) Cyclone Global Navigation Satellite System

Principal Investigator: Chris Ruf
University of Michigan, Ann Arbor, MI

Cost: NASA – \$150M BY14, Launch ~October 2016

- CYGNSS Science Goal
 - Understand the coupling between ocean surface properties, moist atmospheric thermodynamics, radiation, and convective dynamics in the inner core of a tropical cyclone (TC)

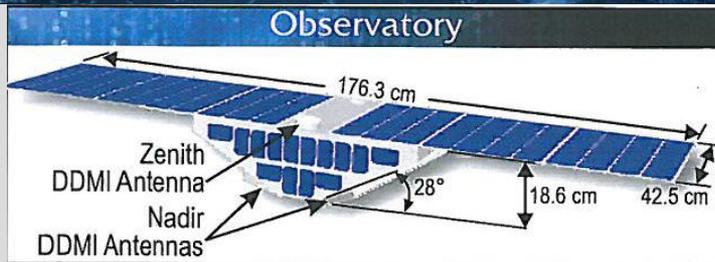
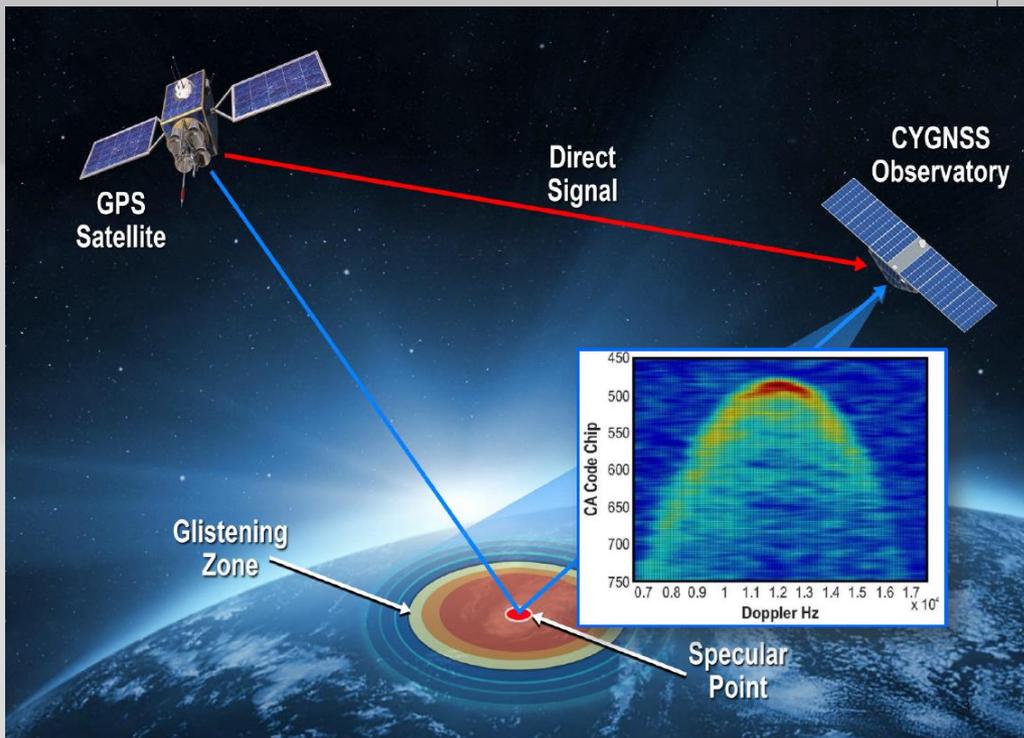
CYGNSS Objectives

- Measure ocean surface wind speed **in all precipitating conditions**, including those experienced in the TC eyewall
- Measure ocean surface wind speed in the TC inner core **with sufficient frequency to resolve genesis and rapid intensification**

Game Changing Capabilities

- Traditional satellite remote sensing of surface winds cannot penetrate intense precipitation
 - Active (radar) and passive (radiometer) sensors operate at 1-5 cm wavelength – too much scattering and attenuation
- Traditional LEO polar orbiters have >12 hr revisit time – too infrequent to observe rapid intensive phase of TC development

- CYGNSS uses a new measurement technique and a new satellite mission architecture





Work performed at DAACs

- Mission support: new datasets evaluation, expertise in discipline datasets, data conversion/fusion, metadata development/checking, support to Science Team
- Software development: specific code for data management systems, error checking, set up automation, integration into existing tools, web presence
- Tool and User interface development and testing (e.g., web presence; mission/discipline/ data specific search and access tools, subsetting tools)
- Archive/distribution/operations: day-to-day monitoring; metrics collection & reporting
- User services: documentation, FAQ, outreach, content management system
- Systems engineering: scheduling, network management, test management, reporting, systems admin, web development, security

NASA Earth Science Data Policy



- NASA commits to the full and open sharing of Earth science data obtained from NASA Earth observing satellites, sub-orbital platforms and field campaigns with all users as soon as such data become available.
- There will be no period of exclusive access to NASA Earth science data. Following a post-launch checkout period, all data will be made available to the user community. Any variation in access will result solely from user capability, equipment, and connectivity.
- NASA will make available all NASA-generated standard products along with the source code for algorithm software, coefficients, and ancillary data used to generate these products.
- All NASA Earth science missions, projects, and grants and cooperative agreements shall include data management plans to facilitate the implementation of these data principles.
- NASA will enforce a principle of non-discriminatory data access so that all users will be treated equally. For data products supplied from an international partner or another agency, NASA will restrict access only to the extent required by the appropriate Memorandum of Understanding (MOU).
- <http://science.nasa.gov/earth-science/earth-science-data/data-information-policy/>

UWG = User Working Group



- UWGs were conceived by NASA HQ to provide science community input into the operation of the DAAC and EOSDIS
- They are convened for each DAAC:
 - Charters were established for each UWG and are reviewed annually for any changes. There is no standard UWG charter, they are customized per DAAC.
 - UWG members comprise premiere scientists that represent their discipline-based user community
 - » By invitation from HQ Program Scientist, ESDIS and the DAAC Manager
 - Recommendations from UWGs are 'folded' into DAAC work plans.
- Meet in person at least once per year; plan about 2+ telecons per year.



Role of UWGs

- Assist in defining and accomplishing the DAAC's science goals; e.g. support for new research; assess values of new science products
- Provide guidance on DAAC data management priorities;
- Provide oversight and guidance on DAAC activities, including data set acquisition, development of value-added products, user support, development activities, and operational functions;
- Provide recommendations about annual work plans and long-range planning;
- Coordinate science issues with the ESDIS Project staff and Program Scientists.