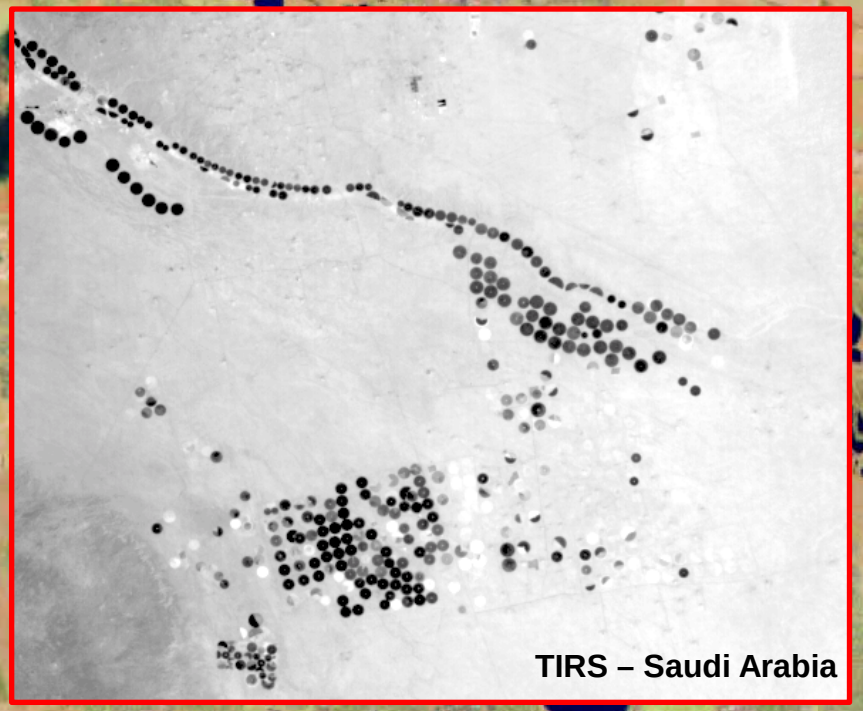
National Aeronautics and Space Administration

Earth Science



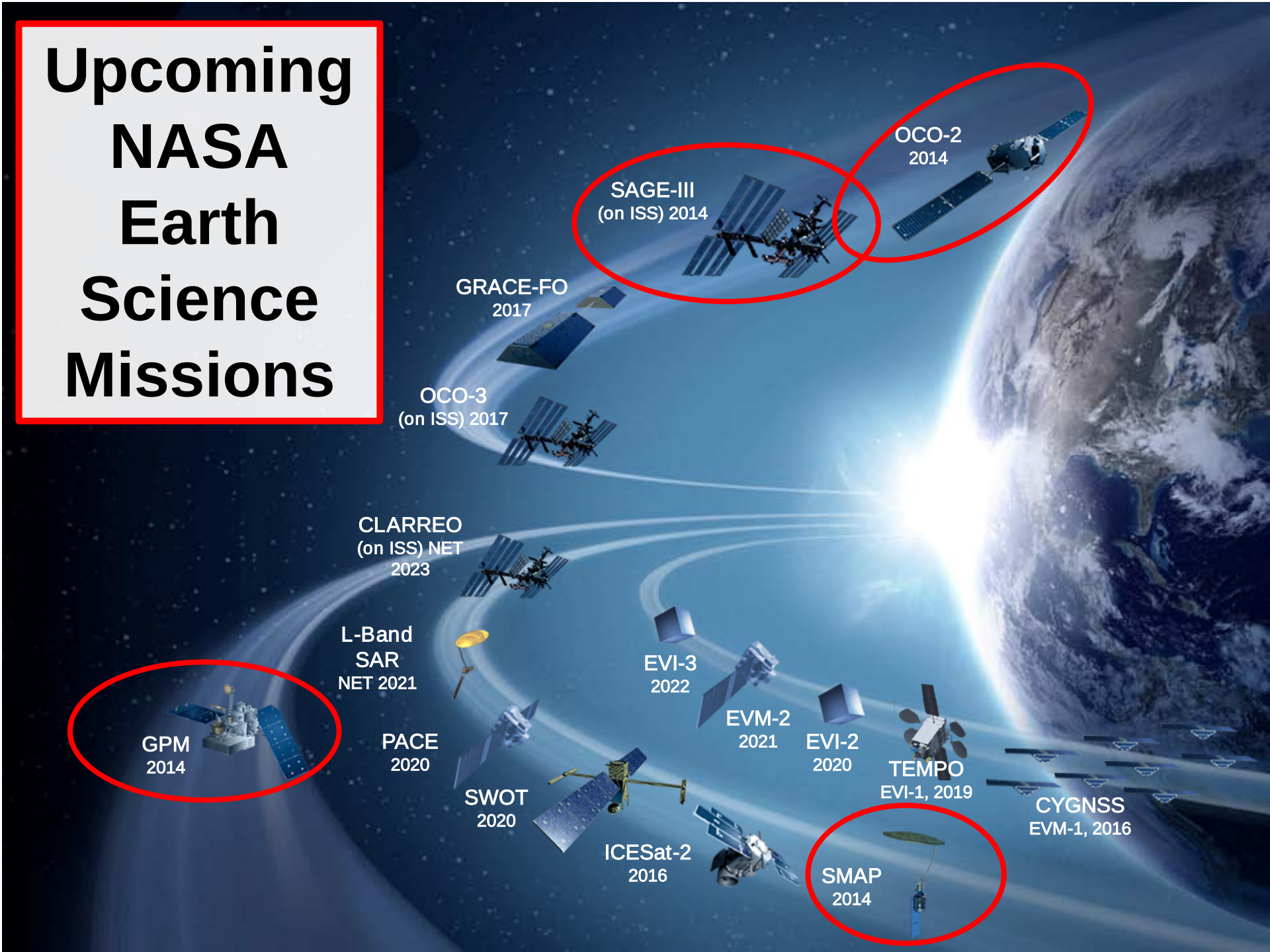
TIRS – Saudi Arabia

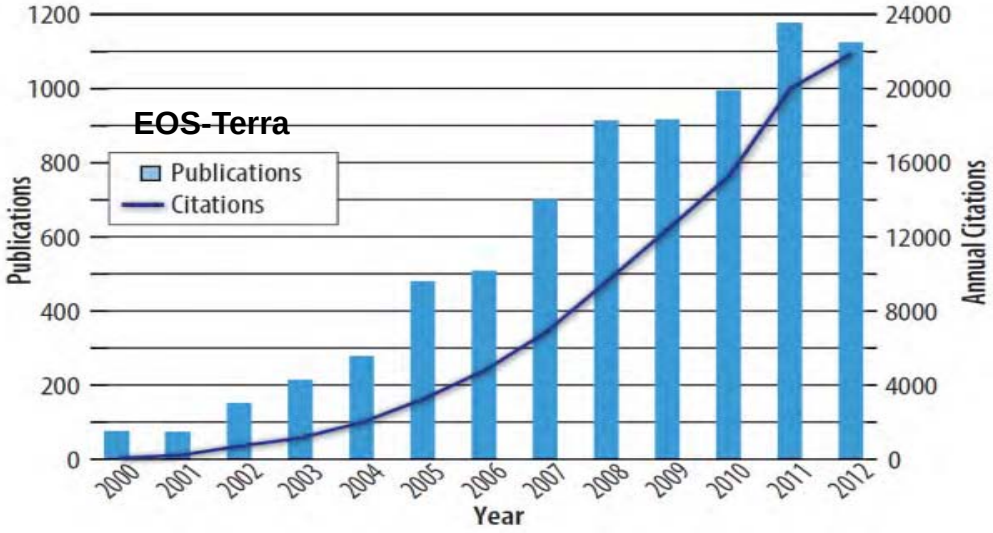
LDCM First-Light
OLI False-Color
Fort Collins, CO area

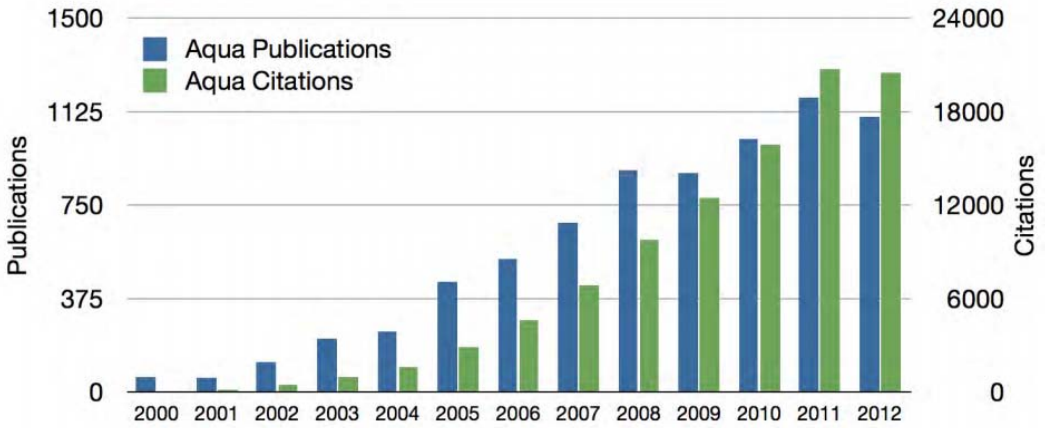
NASA Earth Science Highlights

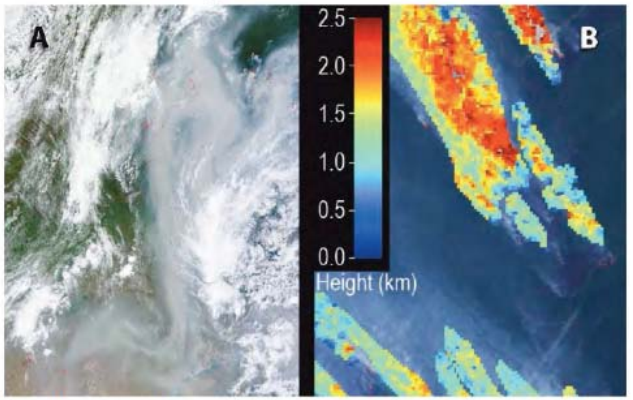
- Initiates new Land Imaging project for development of a national sustained Land Imaging Satellite System (with USGS)
- Expands Venture-Class competitive flight program
- Initiates **development of a program** for TSIS, OMPS-Limb, and "CERES" measurements starting in the JPSS-2 time frame – ex-NOAA climate sensors
- Completes integration of DSCOVR Earth observing instruments (EPIC and NISTAR) and initiates ground data system development in preparation for 2014 launch
- Ops funding for QSCAT, Jason-1, CloudSat, GRACE, SORCE in FY14 – ends all by FY18
- Advances development of SMAP, SAGE III/ISS, GRACE-FO, SWOT, CYGNSS, OCO-3, TEMPO, and ICESat-2 for launch before 2021
- Pre-formulation studies will continue for PACE, L-band SAR, and other US NAS Decadal survey-recommended and climate architecture missions

Bi-annual Senior Review Ongoing in 2013

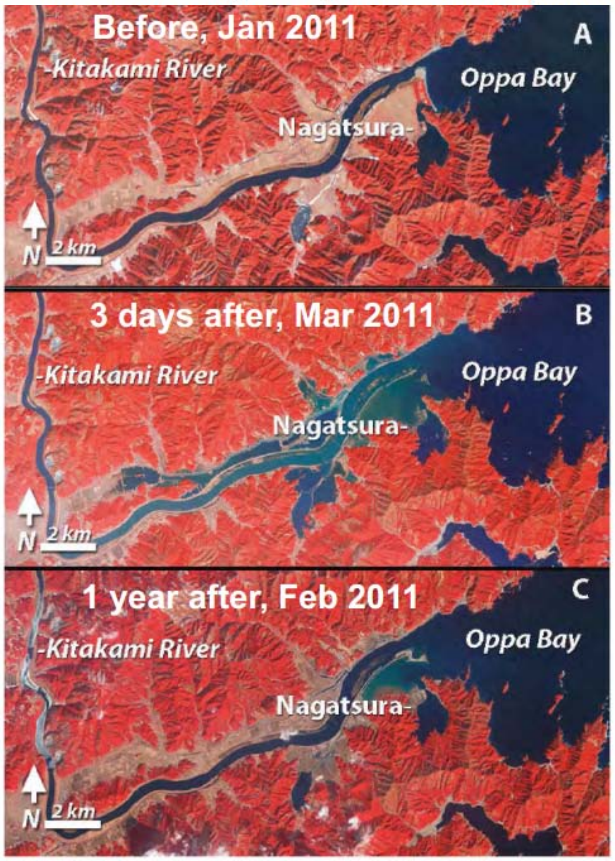

Upcoming NASA Earth Science Missions
OCO-2
2014
SAGE-III
(on ISS) 2014
GRACE-FO
2017
OCO-3
(on ISS) 2017
CLARREO
(on ISS) NET
2023
L-Band
SAR
NET 2021
EVI-3
2022
EVM-2
2021
EVI-2
2020
TEMPO
EVI-1, 2019
GPM
2014
PACE
2020
SWOT
2020
ICESat-2
2016
SMAP
2014
CYGNSS
EVM-1, 2016







2012 Siberian forest fires: A) MODIS image of heavy smoke near the Tomsk region; B) MISR smoke plume heights



Monitoring Tohoku tsunami damage in Japan with ASTER

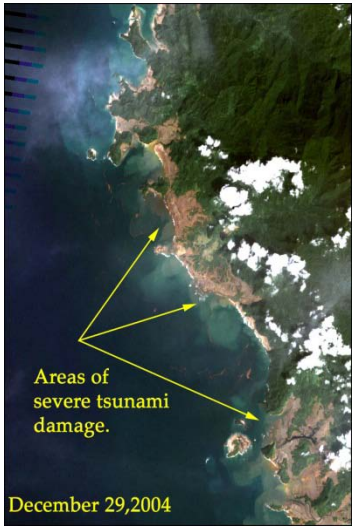
The Aqua and Terra Missions continue to provide an unprecedented amount of quantitative data to study the Earth as a system, discover how the Earth is changing and explore human interactions with these changes.

LDCM Overview

LDCM

Mission Objectives

- **Provide continuity in the multi-decadal Landsat land surface observations to study, predict, and understand the consequences of land surface dynamics**
  - **Land cover/use change**
  - **Human settlement and population**
  - **Ecosystem dynamics**
  - **Landscape scale carbon stocks**
  - **Resource management/societal needs**



Landsat 7 data used to aid Indonesian government with tsunami relief efforts (David Skole, Michigan State University)

LDCM Data Needed to Address NASA Earth Science Focus Areas, Questions, and Applications

Focus Areas	*Science Questions*
• Carbon Cycle, Ecosystems, & Biogeochemistry	- What are the changes in global land cover and land use, and what are their causes?
• Water & Energy Cycle	- How do ecosystems, land cover & biogeochemical cycle respond to and affect environmental change?
• Earth Surface & Interior	- What are the consequences of land cover and land use change for human societies and the sustainability of ecosystems ?
	- What are the consequences of increased human activities on coastal regions?

Instruments

- **Operational Land Imager – Ball Aerospace**
- **Thermal Infrared Sensor – NASA GSFC**

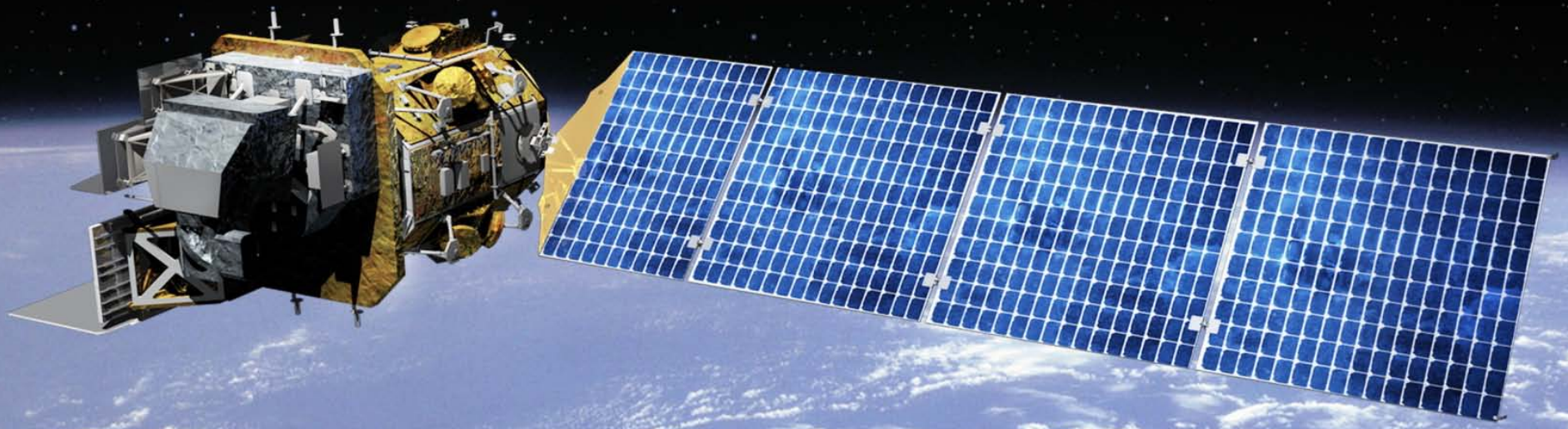
Spacecraft

- **Orbital Sciences Corporation**

Mission Team

- **NASA Goddard Space Flight Center**
- **Dept. of Interior's United States Geological Survey (USGS)**
- **NASA Kennedy Space Center**

LDCM Status Update



- All spacecraft and instrument systems continue to perform normally.
- Routine calibrations have continued along with OLI and TIRS instrument imaging.
- 16-day operational imaging and calibration test cycle (400 scenes/day) completed.

A Land Climate Data Record

Eric Vermote, Code 619, NASA GSFC

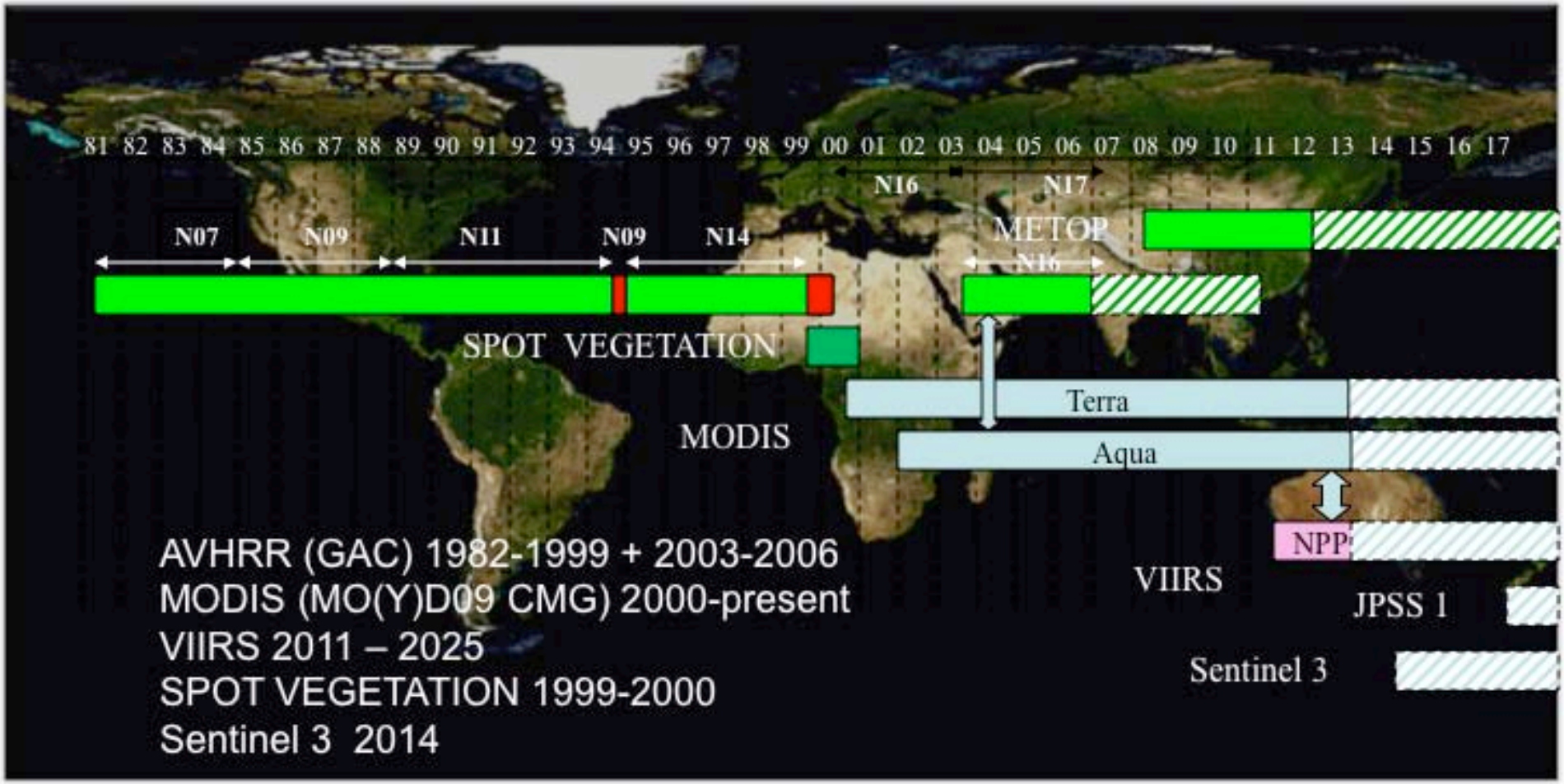
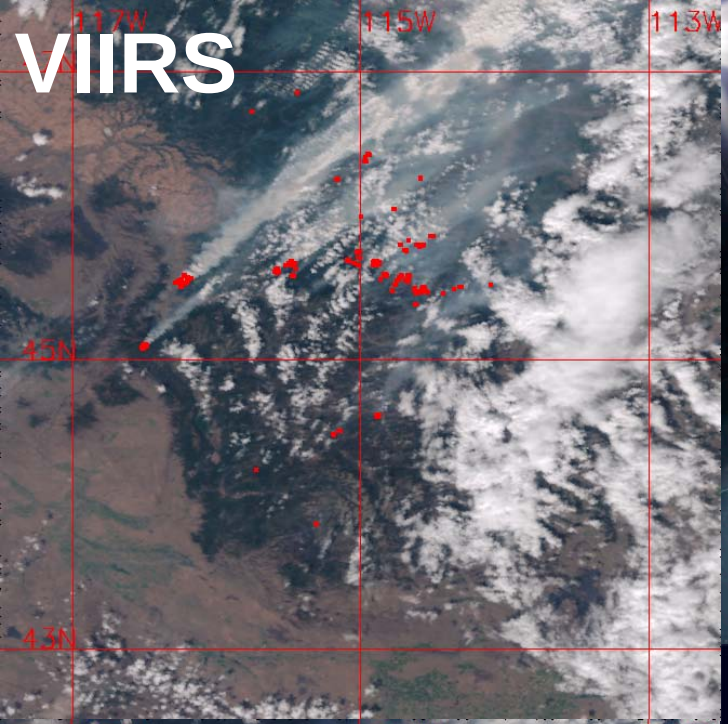


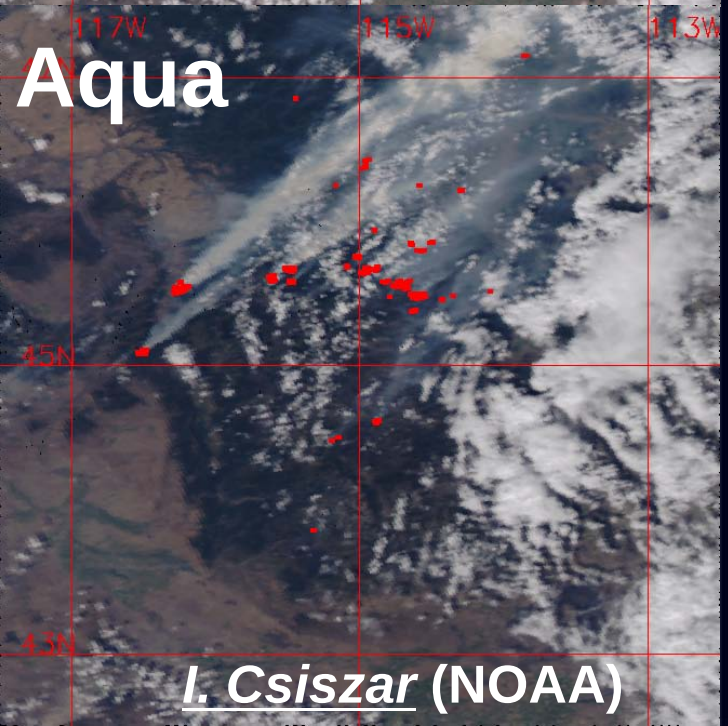
Figure 1: The generation of a Land climate data record (several decade) necessitates the use of multi instrument/multi sensor science quality data record. This record is used to quantify the trend and change in land surface parameter (e.g. Vegetation/Land Cover). A strong emphasis is put on data consistency which is achieved by careful characterization and processing of the original data rather than degrading and smoothing the dataset.

NASA Goddard SPACE FLIGHT CENTER

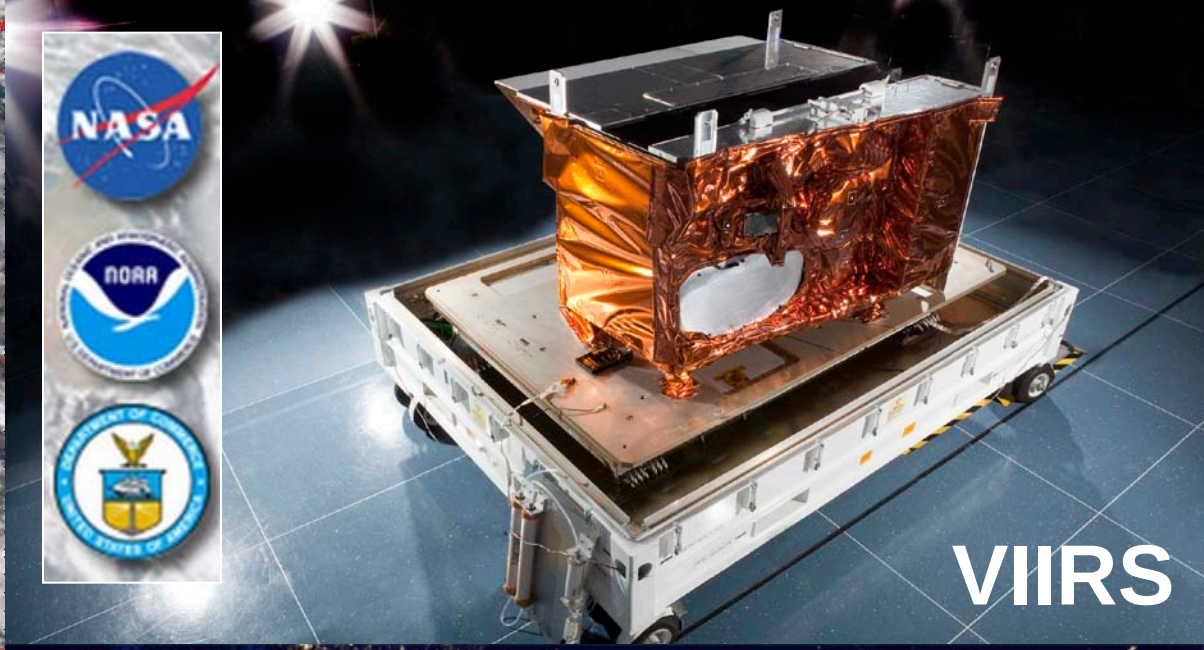
Suomi NPP – Revisiting the Blue Marble

2012 Blue Marble VIIRS

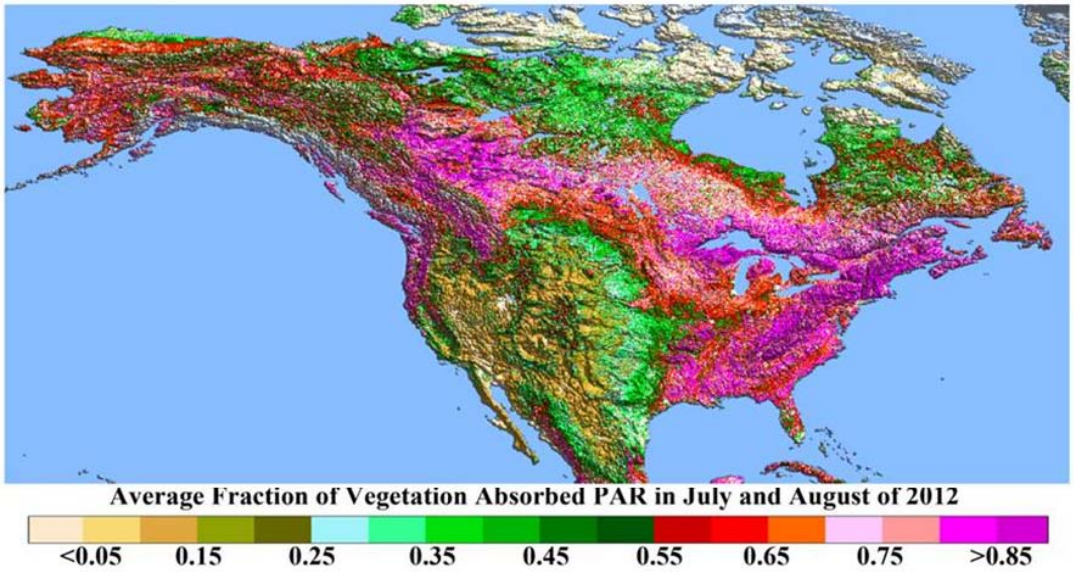




I. Csiszar (NOAA)

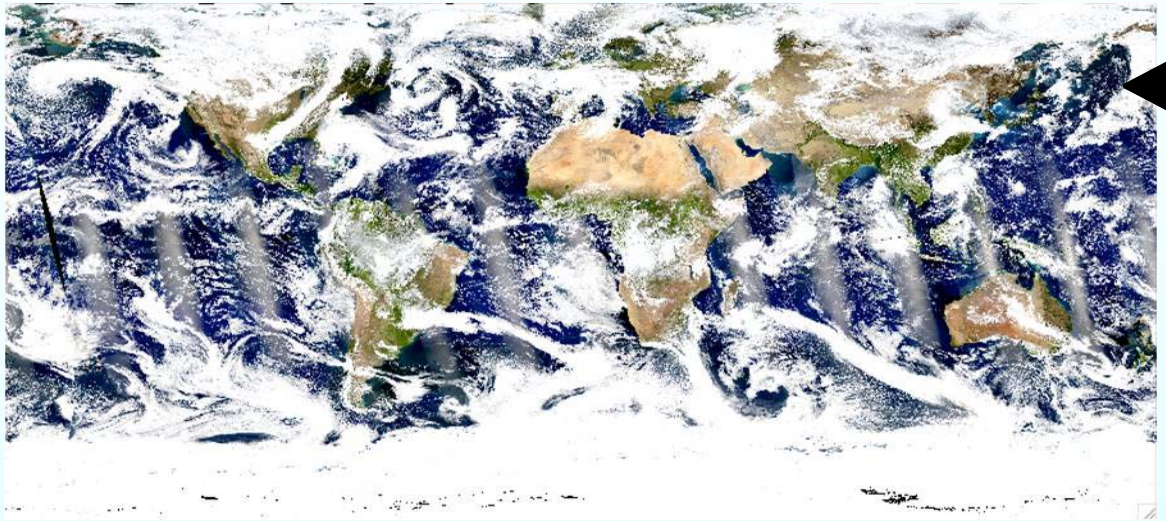


Continuation of the EOS record of Climate-Quality Observations



Conversion of MODIS code for Daily LAI/FPAR to VIIRS Land Science gridded product.

R. Myneni (BU)



Provision of spatially gridded VIIRS Surface Reflectance at both moderate (0.5 - 1.0 km) and CMG resolutions.

Land PEATE- adjusted version of VIIRS Surface Reflectance IP

E. Vermote (GSFC)

VENTURE-CLASS UPDATE/STATUS

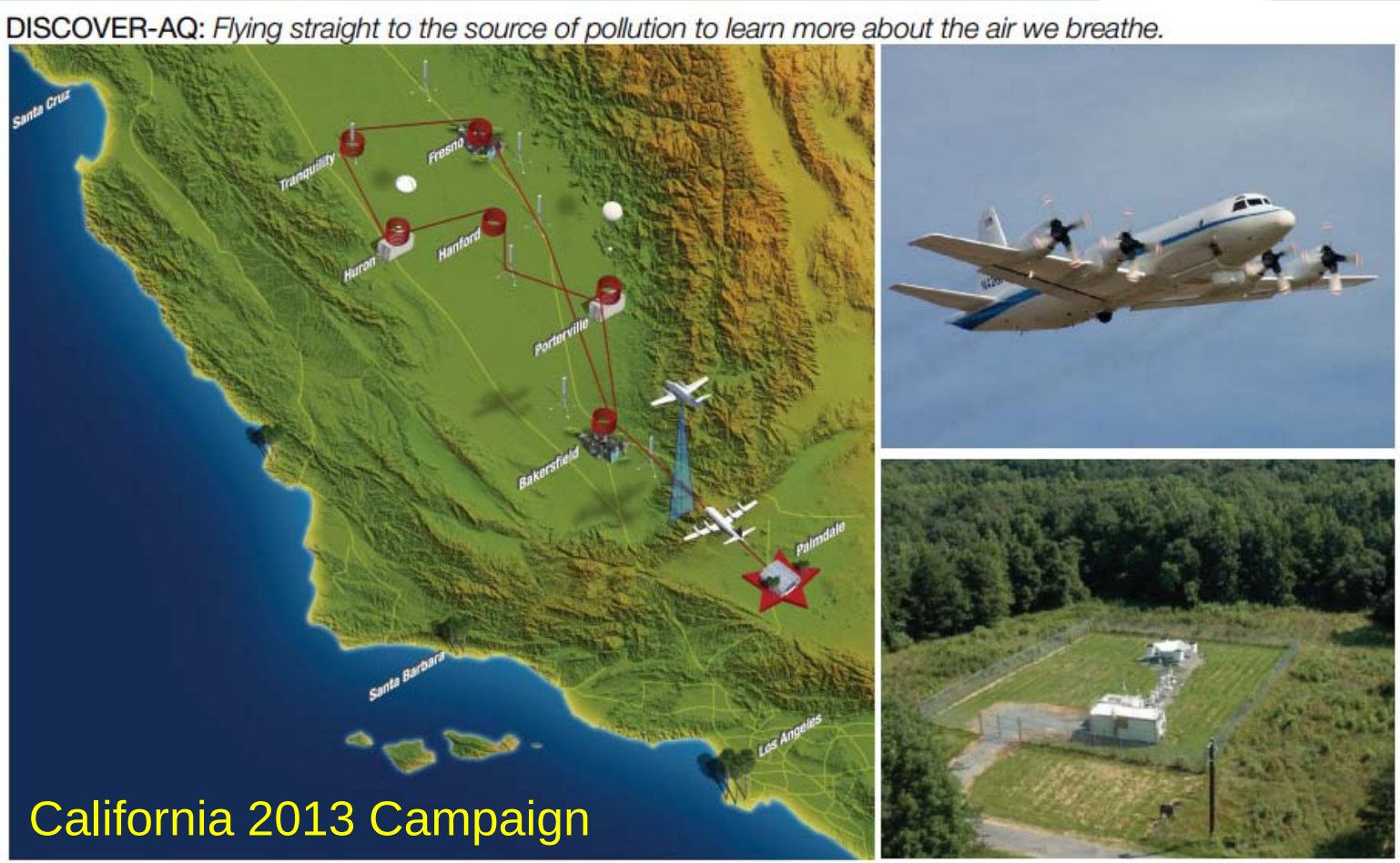
- **EV-1 ("EV-S" - Suborbital, Airborne)**
  - All 5 investigations have completed at least 1 sustained field campaign
  - All EV-1 investigations will fly during 2013
  - **Second EV-S solicitation funded, in preparation for release on schedule in mid-2013**

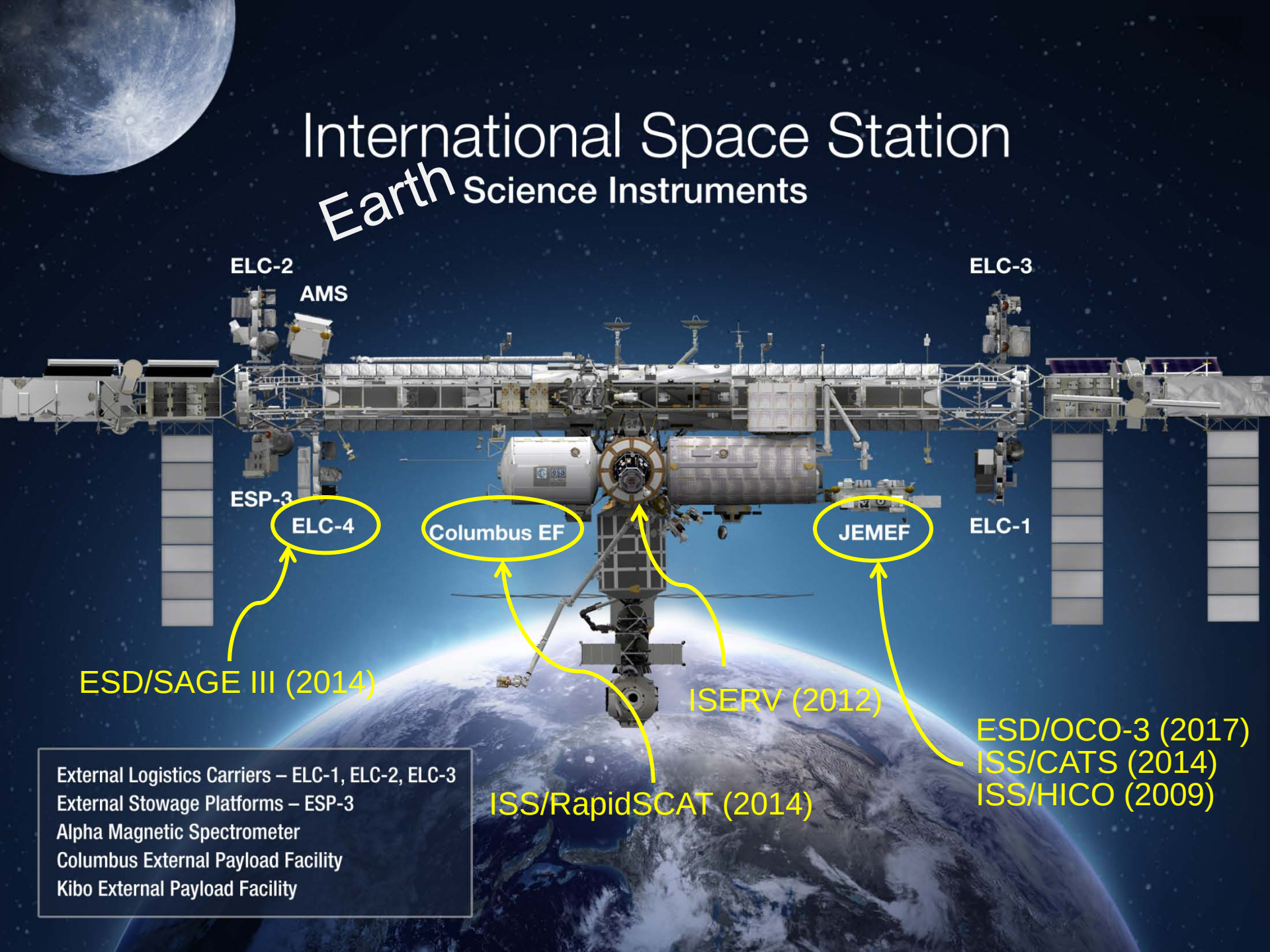
- **EV-2 ("EV-M" - Small-sat)**
  - **CYGNSS PI team and NASA program office making good progress, under contract 7 Dec 2012 (planned 2016-2017 launch)**
  - ESD/SMD developing detailed "Class D" management approaches and processes

- **EV-I (Instrument)**
  - **TEMPO selected for GEO hosted payload opportunity (2017 launch)**
  - ESD initiating formal host selection/negotiation process
  - **Second "EV-I/2" solicitation funded, on schedule for release**

VENTURE-CLASS UPDATE/STATUS

- **EV-1 Highlights: DISCOVER-AQ (**Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality)
  - Focuses on near-surface pollution, improving air quality forecasts, and determining the sources of pollutants in the air and fluctuations in emissions levels.




International Space Station
Earth Science Instruments
ELC-2
AMS
ELC-3
ESP-3
ELC-4
Columbus EF
JEMEF
ELC-1
ESD/SAGE III (2014)
ISERV (2012)
ESD/OCO-3 (2017)
ISS/CATS (2014)
ISS/HICO (2009)
ISS/RapidSCAT (2014)
External Logistics Carriers – ELC-1, ELC-2, ELC-3
External Stowage Platforms – ESP-3
Alpha Magnetic Spectrometer
Columbus External Payload Facility
Kibo External Payload Facility

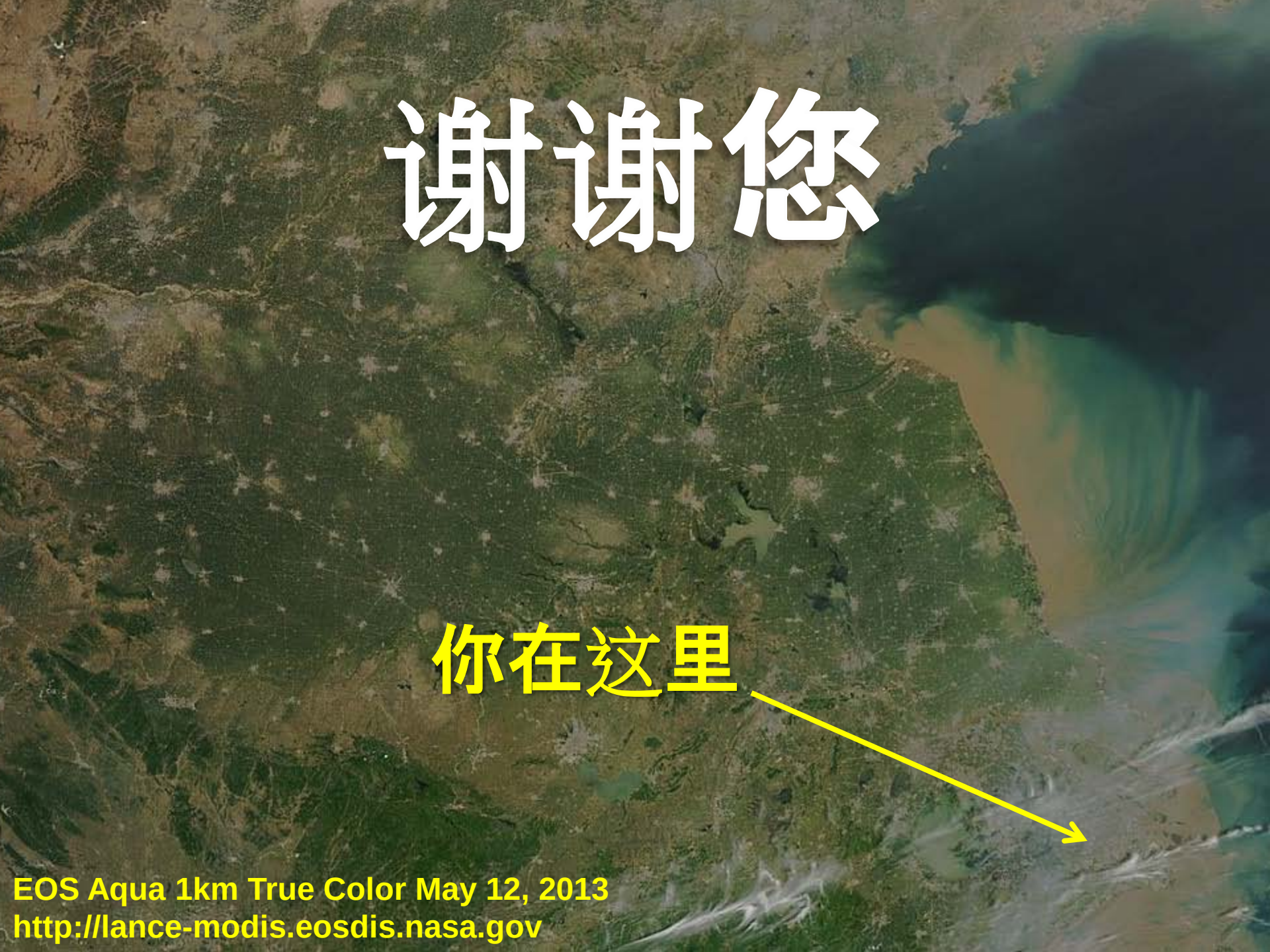
Earth Observations from the ISS: NASA/ESD Status and Plans

- On-orbit instruments funded by non-ESD sources, ESD funding for analysis
  - HICO (Hyperspectral Imager for the Coastal Ocean)
    - Launched September, 2009 on HTV; mounted on JEM-EF
  - ISERV (Digital Camera and Telescope)
    - Launched July, 2012 on HTV-3; mounted internally on WORF

- Planned instruments funded by NASA/HEOMD, ESD funding for analysis
  - CATS (Cloud-Aerosol Transport System for ISS)
    - LIDAR, summer 2013, HTV, JEM-EF
  - Rapid-Scat (Ku-band scatterometer)
    - Launch early CY2014, Falcon/Dragon
  - *Lightning Imaging Sensor (under consideration)*
  - *Hyperspectral Follow-on to HICO (under consideration)*

- Approved instruments funded by ESD
  - SAGE-III (Stratospheric Aerosol and Gas Expt)
    - In Phase-C; 12/2014 Launch on Falcon/Dragon; ESA provides hexapod pointing p'form
  - *OCO-3 (Orbiting Carbon Observatory-3 instrument only)*
    - *Phase-A November 2012; Launch Fall, 2017*

谢谢您



EOS Aqua 1km True Color May 12, 2013
http://lance-modis.eosdis.nasa.gov