

# Status report on the current and future satellite systems by NASA

Presented to CGMS-42 Plenary Session

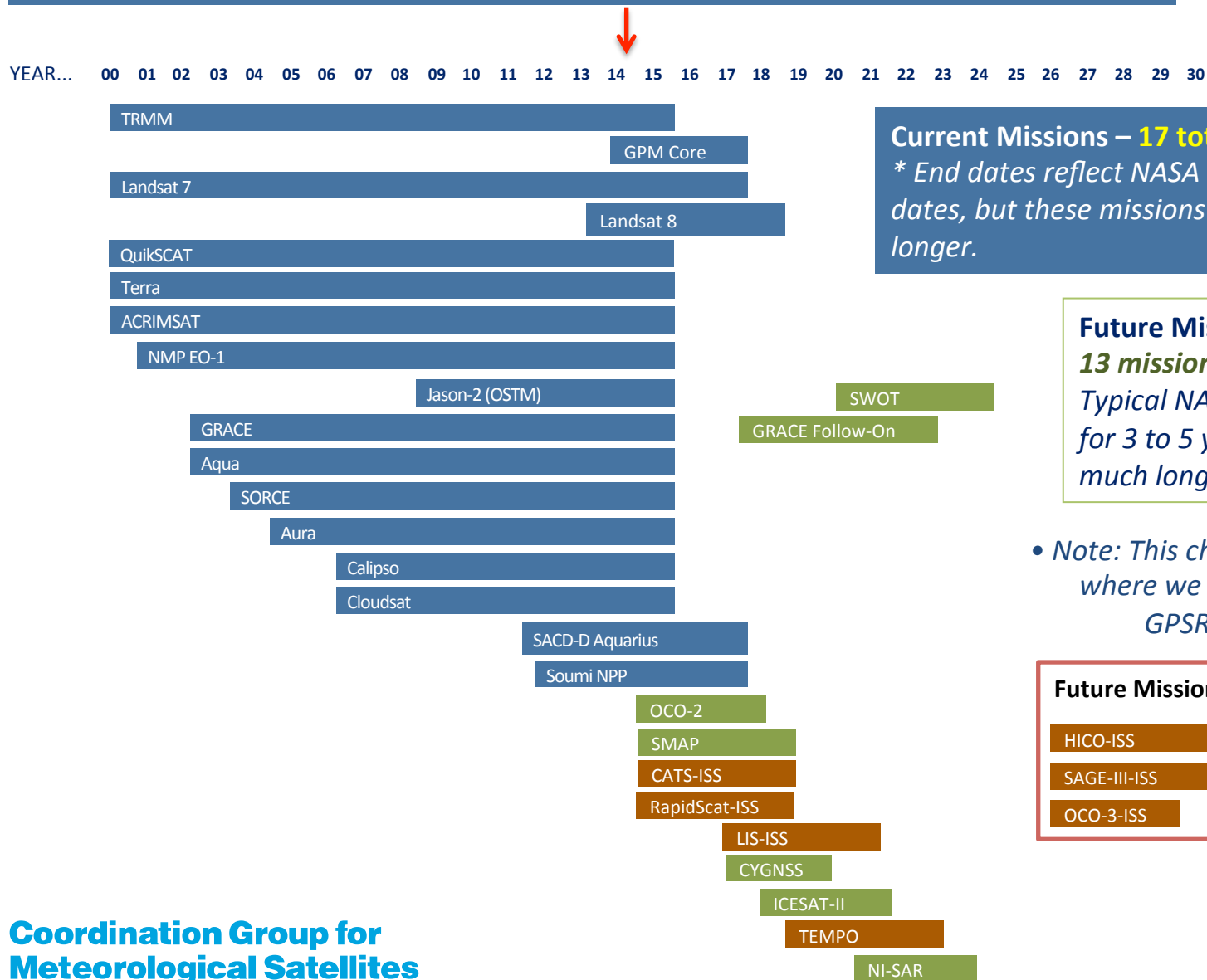
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Cheryl Yuhas, NASA HQ



# Coordination Group for Meteorological Satellites - CGMS

## Overview of NASA's current and future satellite systems



**Current Missions – 17 total** (as of May, 2014)  
 \* End dates reflect NASA "Senior Review" approved dates, but these missions will likely operate much longer.

**Future Missions**  
**13 missions and 7 instruments.**  
 Typical NASA missions are planned for 3 to 5 years life but have lived much longer in the past.

• Note: This chart does not include cases where we have one instrument (e.g., GPSRO) on a partner's satellite.

**Future Missions/Instruments: TBD or >2020**

HICO-ISS	GEO-CAPE	ACE
SAGE-III-ISS	HyspIRI	ASCENDS
OCO-3-ISS	CLARREO	PACE



# NASA Earth Science Operating Missions 2014



### CURRENT NASA LEO and R&D SATELLITES ... Non-Mission News

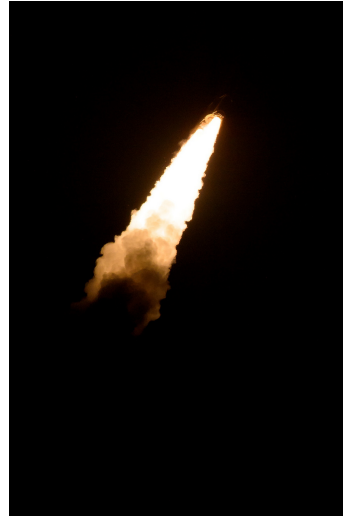
- NASA's missions were conceived as research missions, but have supported **operational and near-real-time applications** due to their recognized value, longevity, sustained calibration and validation, and data quality.
- Continued operation of the missions is determined through a biennial science review process, called the “**Senior Review**”, which considers operational use but primarily uses science for defining factor for continuation. Continued operations (2 more years) was approved for all NASA missions in May 2013. The next Senior Review is scheduled for 2015.
- **Direct Broadcast** is currently available for three NASA missions including: Aqua, Terra, and Suomi-NPP. More information can be found at NASA's Direct Readout Laboratory (DRL) website: <http://directreadout.sci.gsfc.nasa.gov>. See NASA Working Paper 5 for more details.
- NASA also provides access to **Near Real-Time (NRT)** products from the MODIS (on Terra and Aqua), OMI and MLS (on Aura), and AIRS (on Aqua) instruments in less than 2.5 hours from observation from the Land and Atmosphere Near real-time Capability for EOS (LANCE) data system at <http://earthdata.nasa.gov/lance>. See NASA Working Paper 3 for more details.



# GPM Launched 2/27/14!



GPM launching from Tanegashima, Japan – 2/28/14



GPM climbing to its altitude just over 400 km

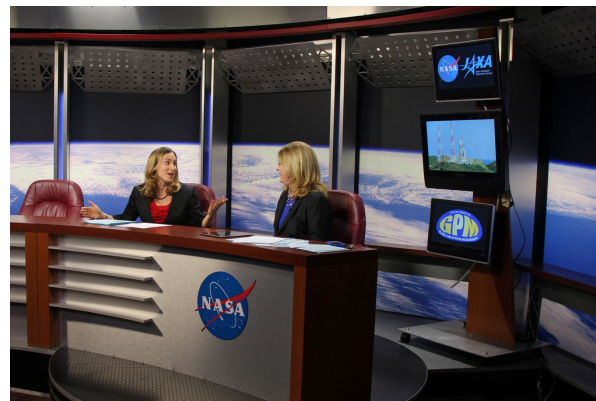


US Ambassador Caroline Kennedy speaking after launch



GPM Program Scientist Ramesh Kakar speaking in Japan

**Coordination Group for Meteorological Satellites**

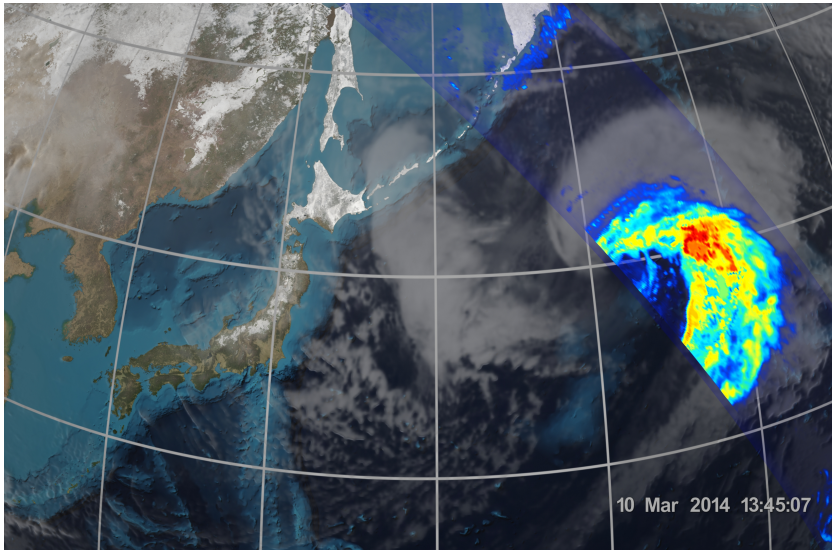


NASA TV Coverage of GPM launch with Daliia Kirschbaum (left) and Aries Keck (right)

“Launch party” for GPM at NASA Goddard Visitors’ Center

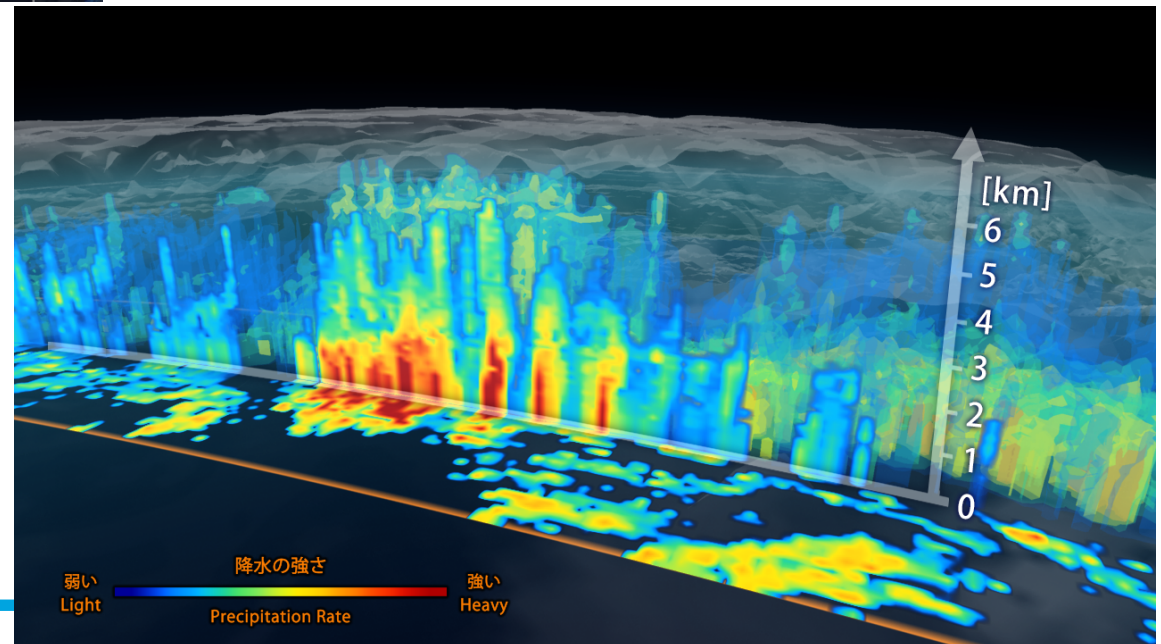


# GPM First Light Images



An extra-tropical cyclone seen off the coast of Japan, March 10, 2014, by the GPM Microwave Imager. The colors show the rain rate: red areas indicate heavy rainfall, while yellow and blue indicate less intense rainfall. The upper left blue areas indicate falling snow.

3D view inside an extra-tropical cyclone observed off the coast of Japan, March 10, 2014, by GPM's Dual-frequency Precipitation Radar. The vertical cross-section approx. 4.4 mi (7 km) high show rain rates: red areas indicate heavy rainfall while yellow and blue indicate less intense rainfall. Image Credit: JAXA/NASA



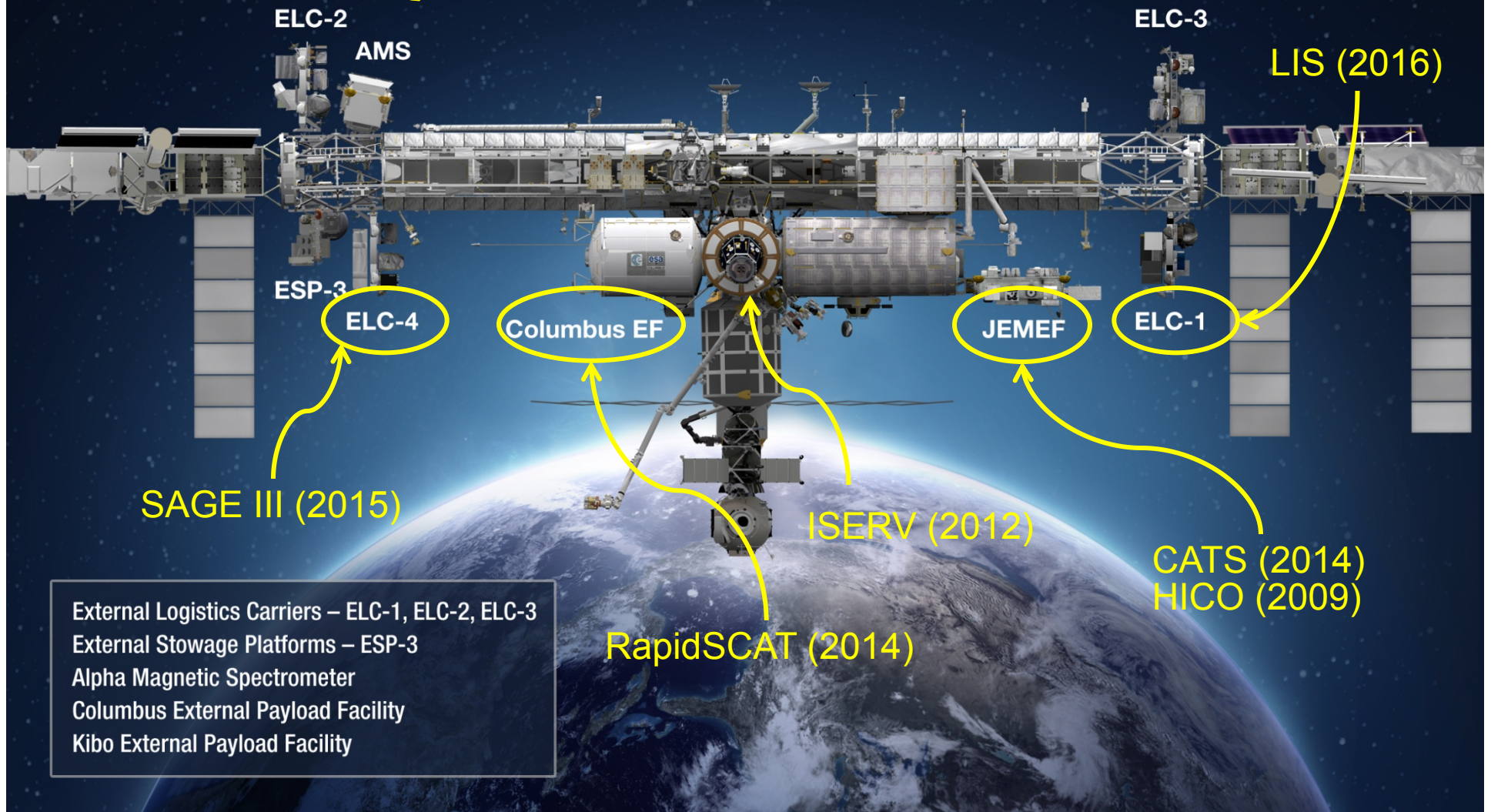
**Coordination Group for  
Meteorological Satellites**

3 ESD-developed EO missions launch in CY 2014  
2 ISS-developed EO instruments in 2014, 1 in 2016  
9 more ESD EO launches before 2022



# International Space Station

## Earth Science Instruments

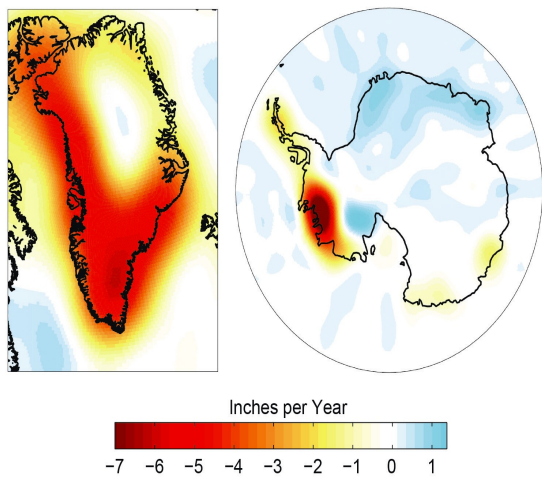






# NASA in the US National Climate Assessment Report

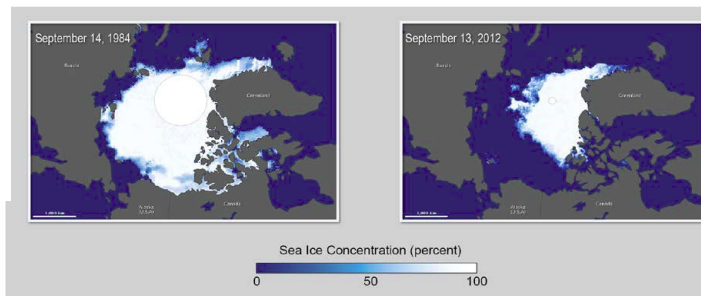
Ice Loss from Greenland and Antarctica



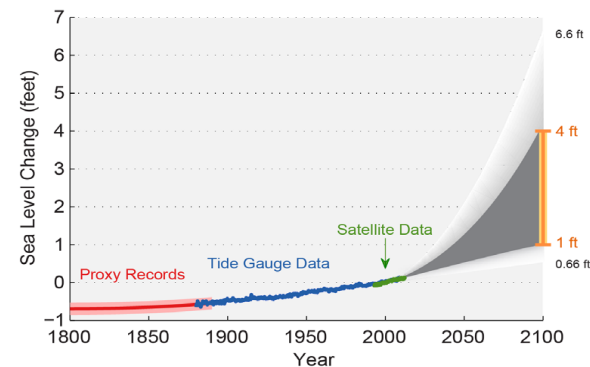
Chapter 2:  
Our Changing Climate

Appendix 3:  
Climate Science

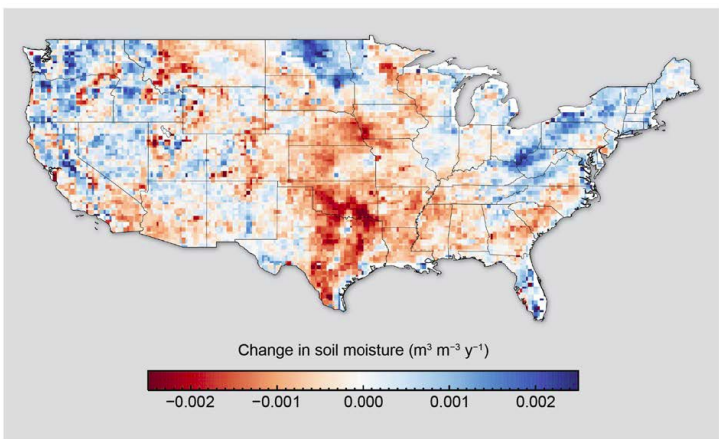
Sea Ice Cover Reaches Record Low



Past and Projected Changes in Global Sea Level



Annual Surface Soil Moisture Trends

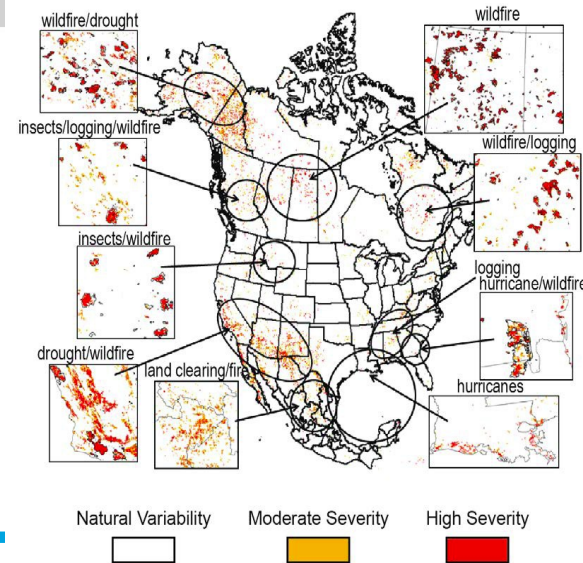


Chapter 12:  
Indigenous Peoples

Chapter 7:  
Forests

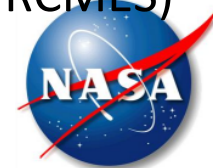
Chapter 3:  
Water Resources

Forest Ecosystem Disturbances



## Related Research-Oriented Activities

- Continuation of Entities focused on R-O with related solicitations (.e.g, NASA Data for Operation and Assessment) for community participation:
  - Joint Center For Satellite Data Assimilation (JCSDA)
  - Short-Term Prediction Research and Transition Center (SPoRT)
- Continuation of initial implementation of Satellite Calibration (Interconsistency Studies (SCIS – see NASA WP 06) and plan for recompetition in 2015
- Biennial opportunity for US Participating Investigator (USPI) with call open in FY14 (ROSES14 A.28, proposals due 8/28/14)
- Continued support for calibration facilities and ground networks
- Continued support for airborne instruments to support cal/val and process studies (incl. AITT program) broadening spectral coverage (e.g., PRISM in UV, HyTES in IR), enhancement of other sensors e.g., (AVIRIS-ng, e-MAS), and support for others (e.g., NAST-I)
- NASA/ESA Joint Program Planning Group has Cal/Val subgroup; relevant airborne campaigns completed/planned
- Continued/expanded support for tools to facilitate access to NASA data and utilization in model intercomparisons (NEX, Obs4MIPs, RCMES)



# Backup



### CURRENT NASA LEO and R&D SATELLITES ... Mission News

- NASA is currently operating **17 Earth Science missions**. 2 missions are operational LEO (Jason-2, NPP) and 15 are R&D satellites.
- Most **recent launch** was the **Global Precipitation Measurement (GPM)** on Feb 27, 2014.
- 7 of NASA's 17 operating missions utilize **international partnerships**.
- 4 of NASA's missions (Aqua, Aura, Calipso, Cloudsat) are part of the international **"A-Train" Constellation** with OCO-2 planning to join the A-Train in 2014.
- **NASA's missions are aging** ... except for Suomi-NPP (Oct 2011), SAC-D/Aquarius (Jun 2011) and Landsat 8 (Feb 2013), and GPM (Feb 2014), all missions have passed their nominal design life, and are currently in extended operations.
- **Battery aging** is observed in ACRIMSAT, QuikSCAT, TRMM, GRACE, CloudSat, and SORCE, which reduces data sampling.
- Instruments with **reduced capability** are Landsat-7 ETM+ (failed Scan Line Corrector), QuikSCAT's SeaWinds (antenna no longer rotates, used primarily to cross-calibrate with other on-orbit scatterometers), Terra's ASTER (SWIR module is no longer functional), Aqua AMSU (Channels 4,5,7 have failed), Aura's TES (no global survey) and Aqua AMSR-E (cross-calibration only).
- Instruments that are **not operating** are Aqua's HSB, TRMM's CERES, and Aura's HIRDLS.



### FUTURE NASA LEO and R&D SATELLITES

- NASA's **Earth Systematic Mission (ESM)** program includes 5 missions in formulation or development ...
  - Ice, Cloud, and Land Elevation Satellite (**ICESat-2**), Soil Moisture Active-Passive (**SMAP**), Stratospheric Aerosol and Gas Experiment (**SAGE**)-III, Gravity Recovery and Climate Experiment Follow-On (**GRACE-FO**) and Surface Water Ocean Topography (**SWOT**) missions.
  - NASA continues with the pre-formulation studies, formulation, and development of 7 other missions with launch dates that extend well beyond 2020 (see tables in paper).
- NASA's **Earth System Science Pathfinder (ESSP)** program provides competitive opportunities for small and innovative instruments and missions. ESSP currently includes two satellites and one instrument and also includes the **Earth Venture-class (EV)** line of competitive opportunities:
  - The Orbiting Carbon Observatory (**OCO-2**) mission will launch in 2014, the Cyclone Global Navigation Satellite System (**CYGNSS**) in 2016 and the Tropospheric Emissions: Monitoring of Pollution (**TEMPO**) instrument will be launched in 2018 as a hosted GEO payload.
  - Future solicitations for will be released every 4 years (EVS-science, EVM-mission) and >18-month intervals for EVI-instrument (EVI-I). The next planned release is EVM-2 and EVI-3 in 2015.

