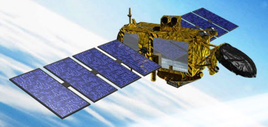
Earth Science and Applications

Using our unique expertise to better understand how Earth works as a system for the benefit of society



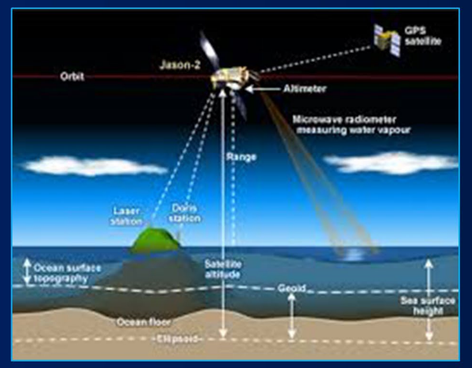
DISCOVER • INNOVATE • IMPACT • PERFORM

Jet Propulsion Laboratory
California Institute of Technology

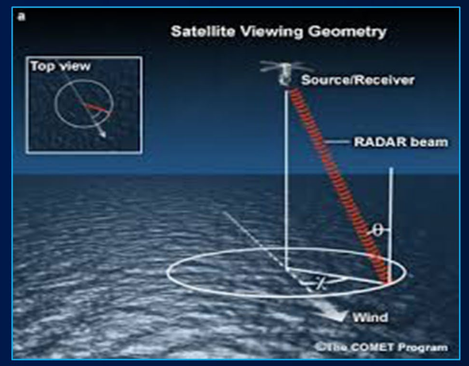
Authors: Duane Waliser & Jessica Neu

Four Decades of Innovation

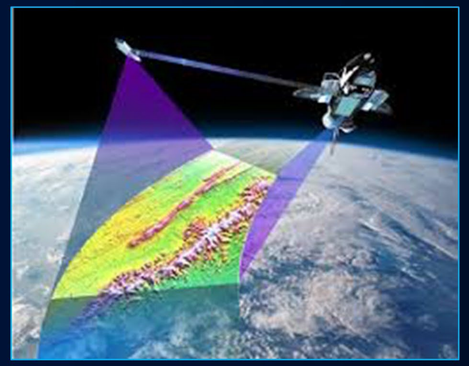
A SPECTRUM OF TOOLS



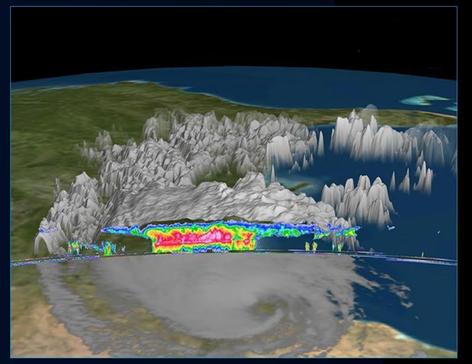
Sea Level Altimetry



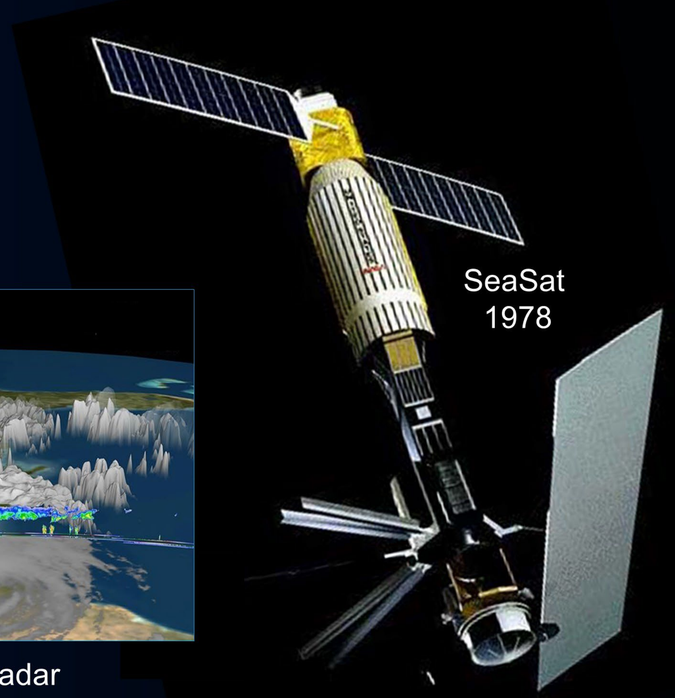
Ocean Wind Scatterometry



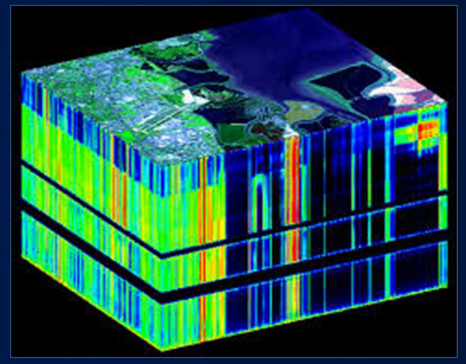
Radar for Surface Deformation



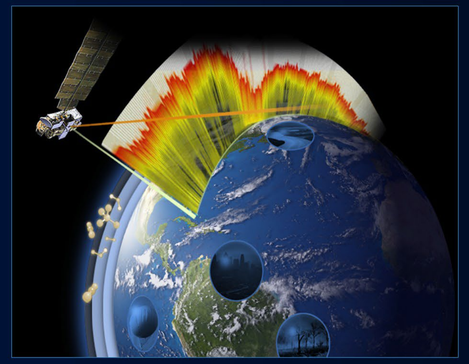
Cloud Radar



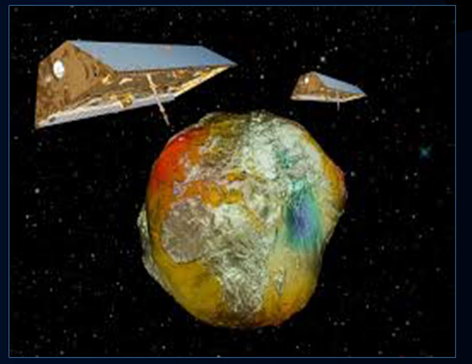
Multi-Angle Imagery



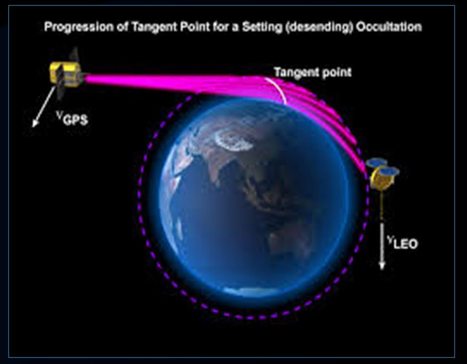
Imaging Spectroscopy



Atmospheric Sounding



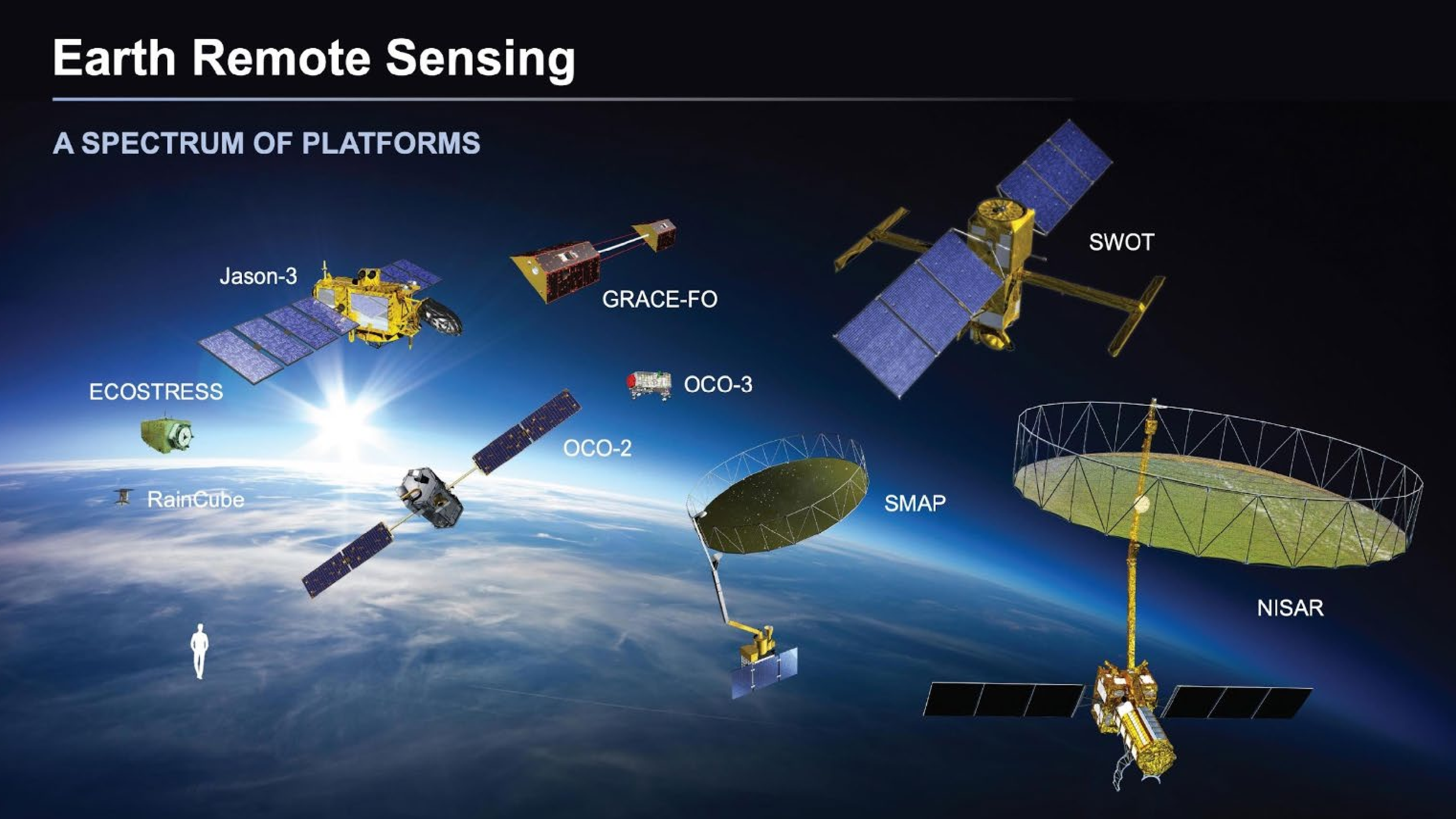
Gravity

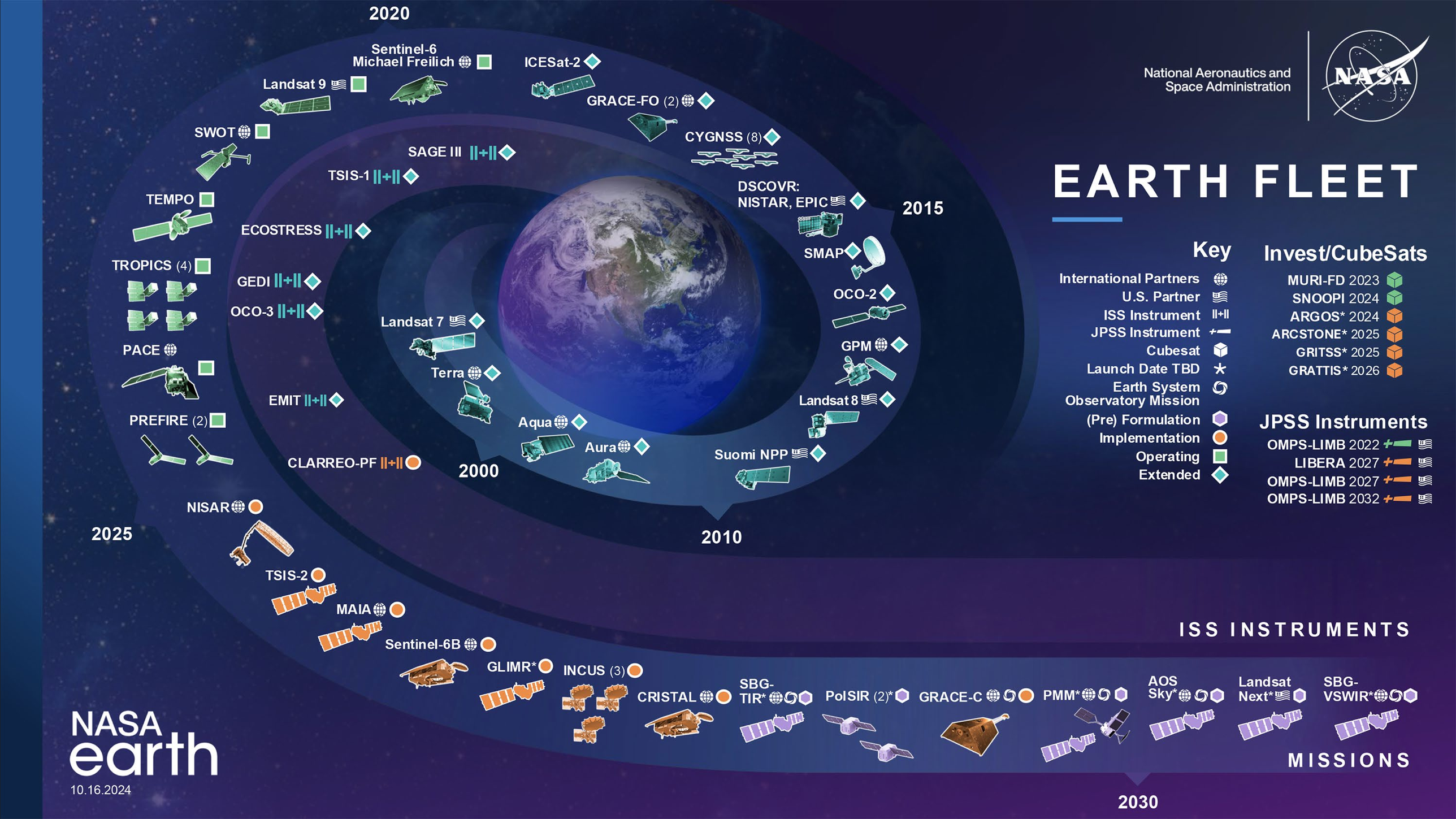


Radio Occultation

Earth Remote Sensing

A SPECTRUM OF PLATFORMS





National Aeronautics and Space Administration

EARTH FLEET

Key

- International Partners
- U.S. Partner
- ISS Instrument
- JPSS Instrument
- Cubesat
- Launch Date TBD
- Earth System Observatory Mission
- (Pre) Formulation
- Implementation
- Operating
- Extended

Invest/CubeSats

- MURI-FD 2023
- SNOOPI 2024
- ARGOS* 2024
- ARCSTONE* 2025
- GRITSS* 2025
- GRATTIS* 2026

JPSS Instruments

- OMPS-LIMB 2022
- LIBERA 2027
- OMPS-LIMB 2027
- OMPS-LIMB 2032

NASA earth

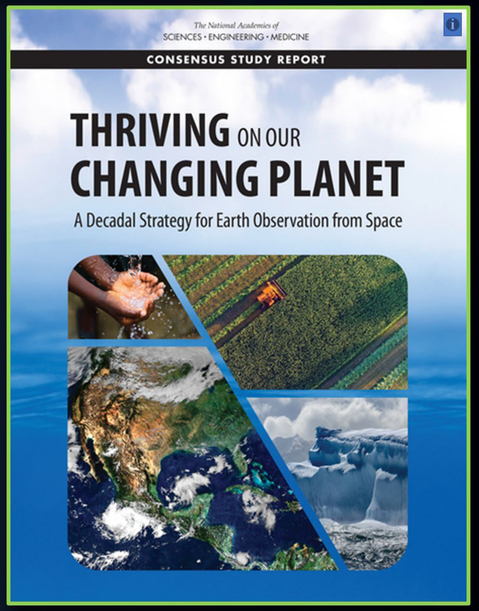
10.16.2024

Future JPL Missions

Mission Impacts

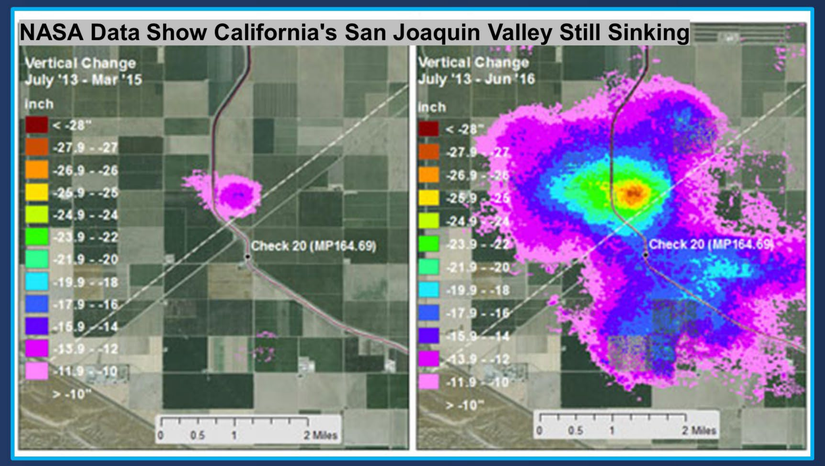
ENABLING FUNDAMENTAL ADVANCES IN EARTH SCIENCE

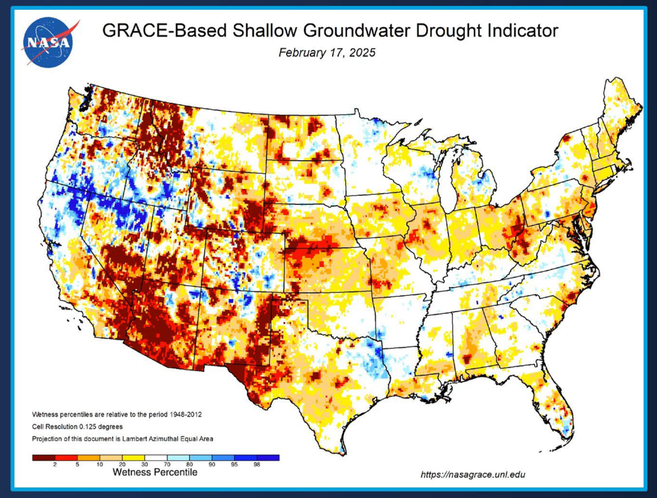
- Peer-reviewed science publications
  - > 400 publications/year involving JPL scientists
  - > 1000 publications/year based on JPL missions
- Training next generation Earth Science leaders
  - ~50 postdoctoral scientists
  - Over 700 summer interns annually
- Participation in the National Academy of Science and Engineering studies

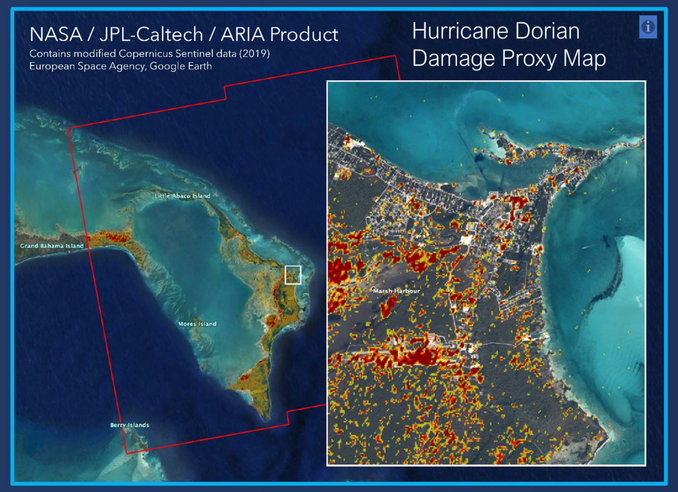


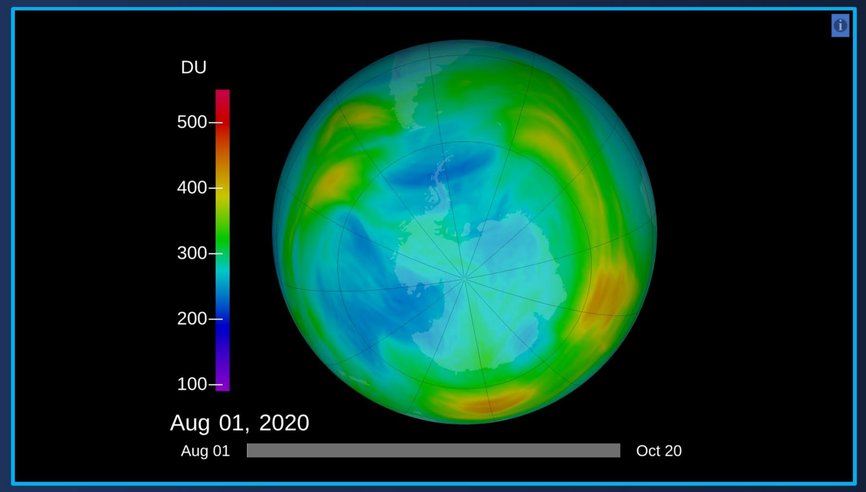
Mission Impacts

APPLYING OBSERVATIONS FOR REAL WORLD BENEFITS









- FEMA and U.S. Homeland Security
- National Drought Monitor
- California Seismic Safety Commission
- World Meteorological Organization (WMO)
- National Climate Assessment
- California Department of Water
- Contributor to the IPCC Assessments

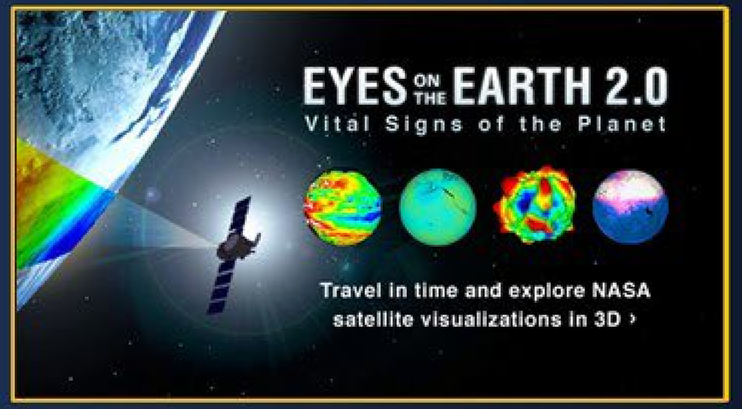
Mission Impacts

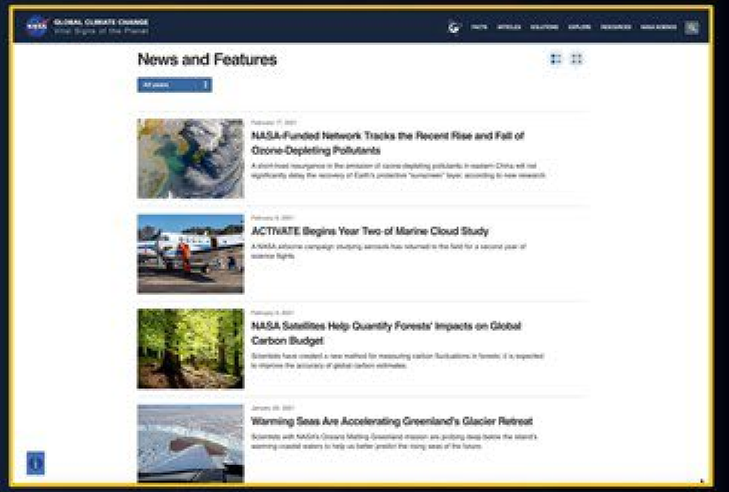
SHARING KNOWLEDGE AND DATA WITH THE PUBLIC

- Award-winning NASA Global Climate Change website:

  climate.nasa.gov

- Eyes on the Earth/Earth Now – real-time satellite and data for digital platforms
- In-person and social media outreach campaigns
- ~100 Earth Science press releases per year



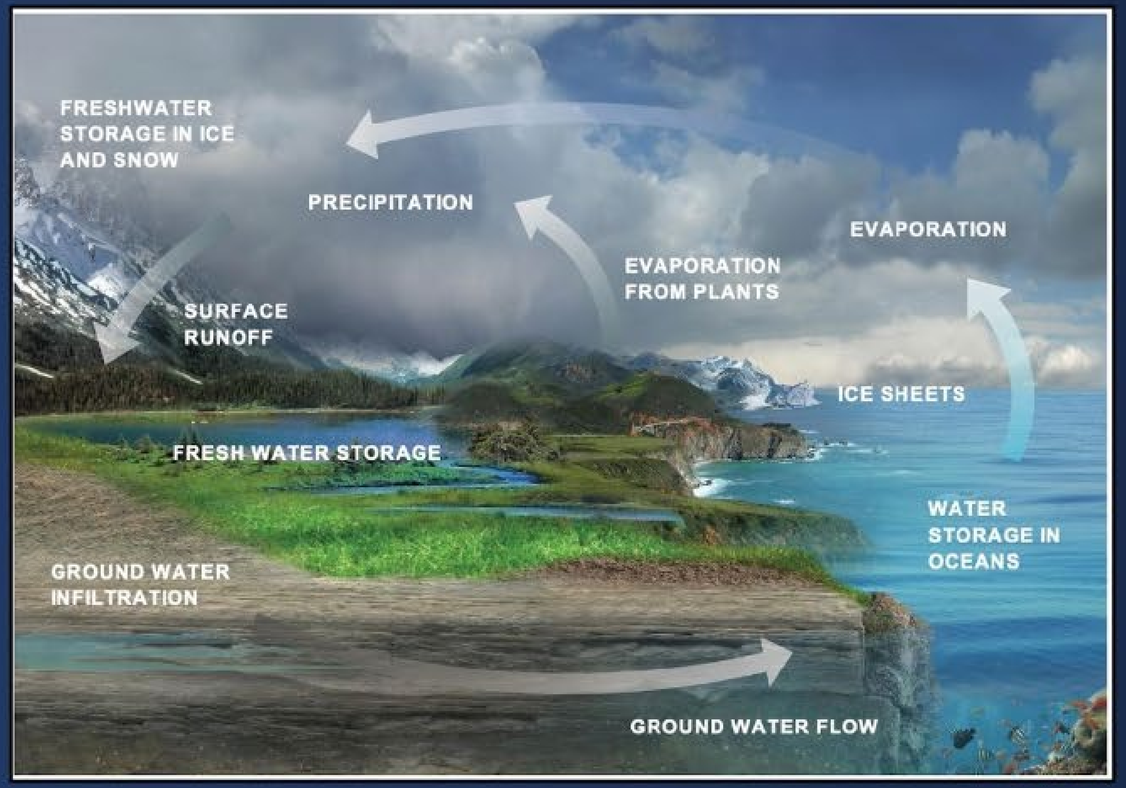


Back

Water Cycle

DEVELOP AND ENABLE PREDICTIONS FOR REGIONAL WATER SHORTAGES

INNOVATE • IMPLEMENT • IMPACT



Challenge

Develop useful predictions of regional water shortages for lead times from weeks to years

Approach

- Design and build first-of-a kind instruments/satellites
- Measure the components of the Earth's water cycle
- Understand and model the flow of water through the Earth system
- Develop integrated programmatic approach between science and engineering
- Partner with international, federal, state and local agencies to improve predictions of water

Satellite Missions

GRACE-FO, SMAP, ECOSTRESS, SWOT, AIRS, CloudSat, Jason-2/3, NISAR

Other Activities

Western Water Applications Office

Weather and Air Quality

ENABLE IMPROVEMENTS IN WEATHER FORECASTS AND AIR QUALITY ATTRIBUTION & FORECASTS

INNOVATE • IMPLEMENT • IMPACT

Other Activities

Cubesats (RainCube, Tempest-D), FIREX-AQ, atmospheric composition state and flux estimates, A-CCP Designated Observable Study, PBL Incubation Study, HAQAST, Subseasonal Atmospheric River Forecast Development.

Challenge

Increase the lead-time and accuracy for weather (Wx) for safeguarding life and property, and provide accurate air quality (AQ) attribution to improve health and environmental conditions.

Approach

- Develop new remote sensing capabilities to characterize atmospheric physical and chemical processes.
- Develop and improve data assimilation methods to better exploit Wx and AQ relevant satellite observations.
- Use these capabilities to enable more skillful Wx and AQ forecasts and improve AQ attribution to inform adaptation and mitigation efforts.

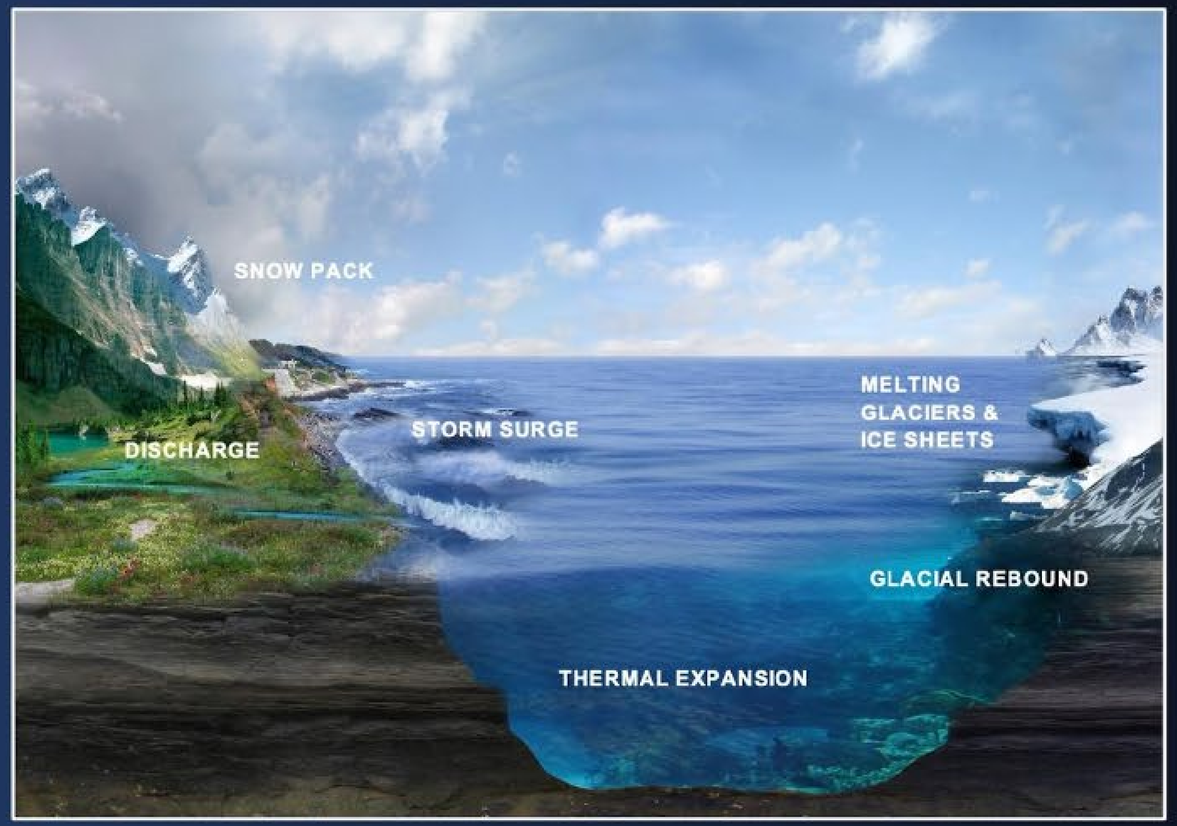
Satellite Missions

AIRS, GNSS-RO, MISR, Quikscat, MLS, RapidScat, SMAP, CloudSat, TES, MAIA

Sea Level

IMPROVE PREDICTIONS OF SEA LEVEL NEAR URBAN POPULATIONS

INNOVATE • IMPLEMENT • IMPACT



Challenge

Improve long-term projections of regional sea level rise to help mitigate the consequences to urban populations

Approach

- Measure global sea level variations, maintaining a record for continuity
- Develop measurement capabilities for regional sea level variations and rise
- Identify contributing processes to global and regional sea level variations
- Partner to improve predictions of sea regional level variations and global sea level rise

Satellite Missions

Jason-2/Jason-3, GRACE-FO, NISAR, SWOT

Other Activities

NASA Sea Level Portal, Oceans Melting Greenland, Delta-X

Natural Hazards

INCREASE DECISION SUPPORT INFORMATION FOR NATURAL HAZARD RESPONSE

INNOVATE • IMPLEMENT • IMPACT

Challenge

Develop forecast potential for natural hazard events and improve our capabilities for hazard response and preparedness

Approach

- Measure changes over the Earth surface to identify and characterize earthquakes, volcanoes, landslides, wild fire, etc.
- Improve our physical understanding of the Earth surface process to better model and predict natural hazards when/where possible
- Develop and provide decision support products for natural hazards preparation and response

Satellite Missions

GRACE-FO, ECOSTRESS, SWOT, NISAR, MISR, TES, EMIT

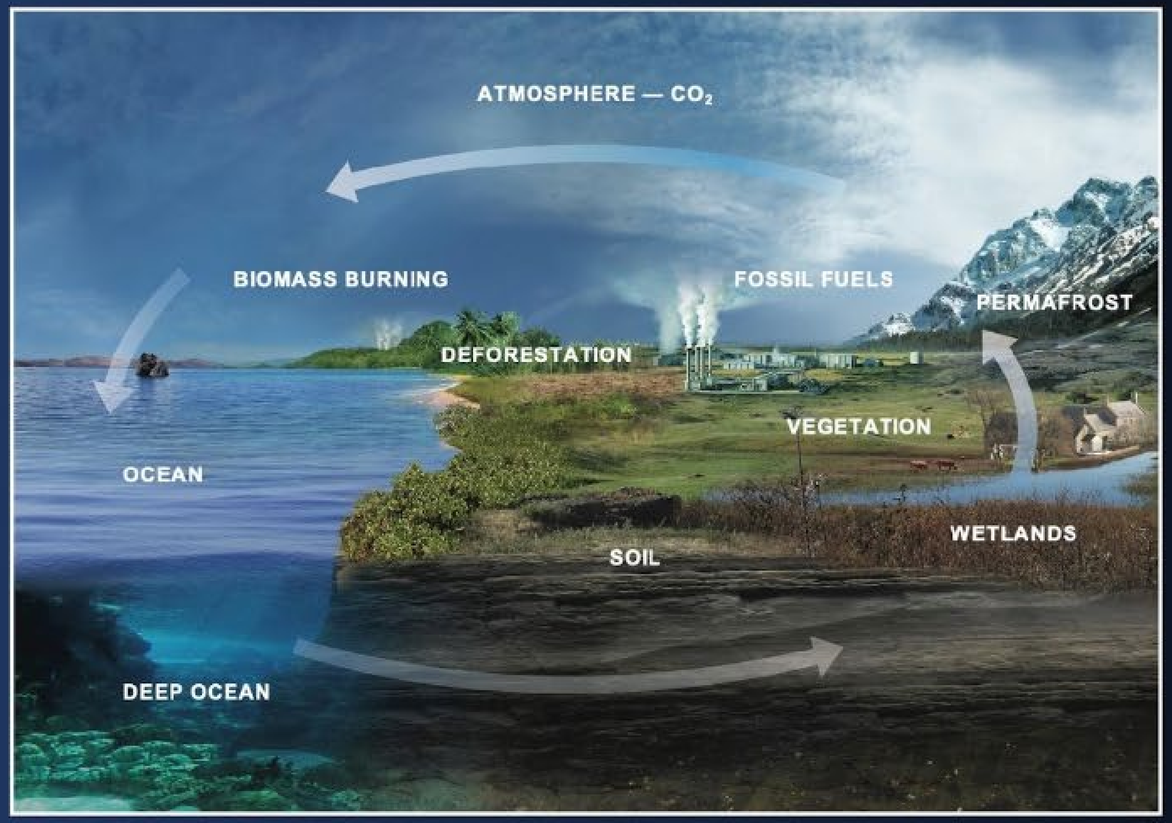
Other Activities

Advanced Rapid Image Analysis (ARIA)

Carbon and Ecosystems

PROVIDE ESTIMATES AND PROJECTIONS OF THE CARBON CYCLE AT DECISION-RELEVANT SCALES

INNOVATE • IMPLEMENT • IMPACT



Challenge

Provide actionable estimates and projections of the global carbon system, considering natural ecosystems and anthropogenic emissions

Approach

- Measure the components of the Earth's carbon cycle
- Understand and model the flow of carb on through the Earth system
- Partner to develop predictions of land, ocean and atmospheric carbon for decision-relevant scales (e.g. seasonal to decadal)

Satellite Missions

OCO-2, OCO-3, ECOSTRESS, TES, SMAP, NISAR

Other Activities

Carbon Management System, California Methane Survey, CORAL, Delta-X