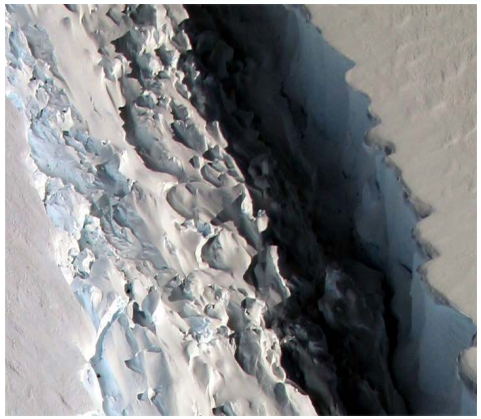
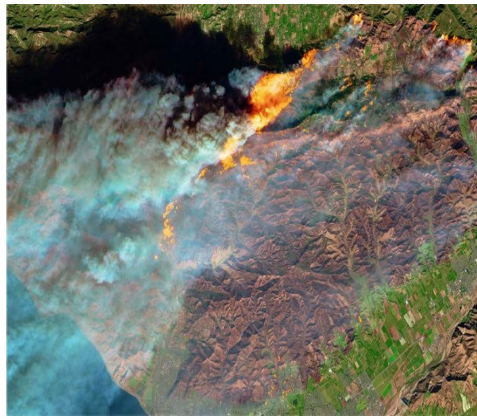
National Aeronautics and Space Administration

SCIENCE



BIG STORIES in Earth Science

Lin Chambers[1] and Theresa Schwerin[2]

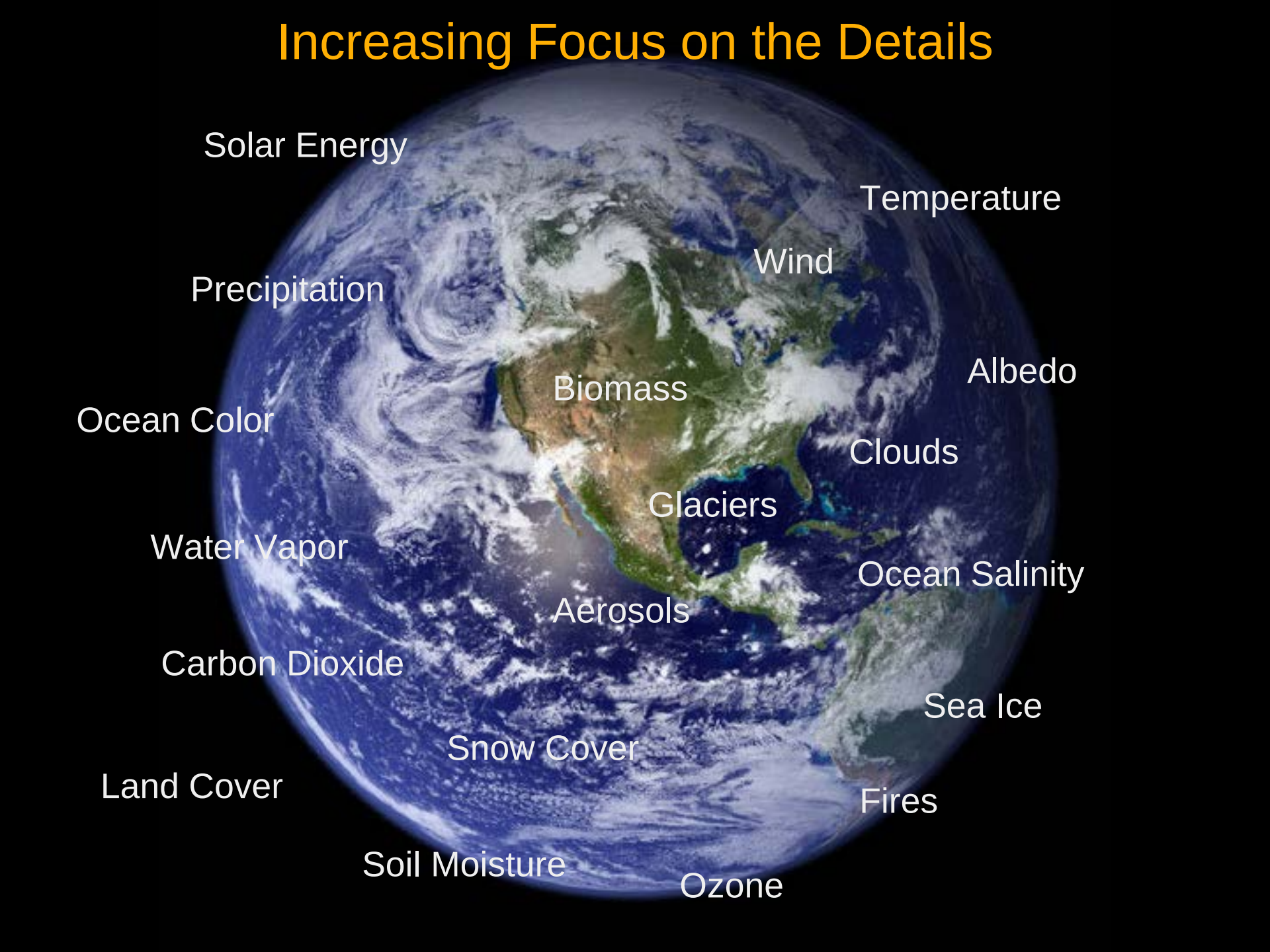
[1]Science Education Integration Manager
[2]PI, NASA Earth Science Education Collaborative

February 2019

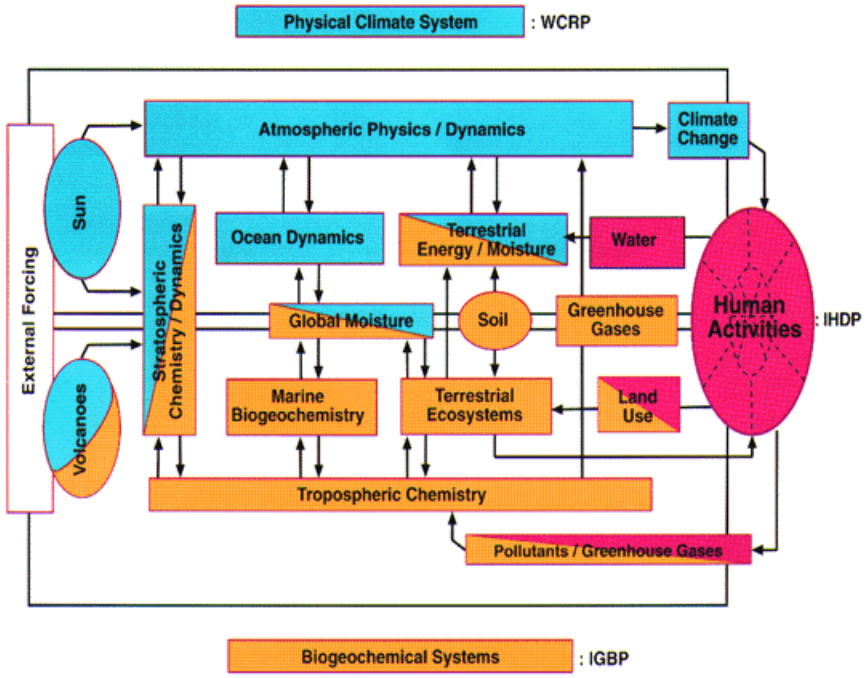
1965


December 24, 1968
https://svs.gsfc.nasa.gov/4593

Increasing Focus on the Details



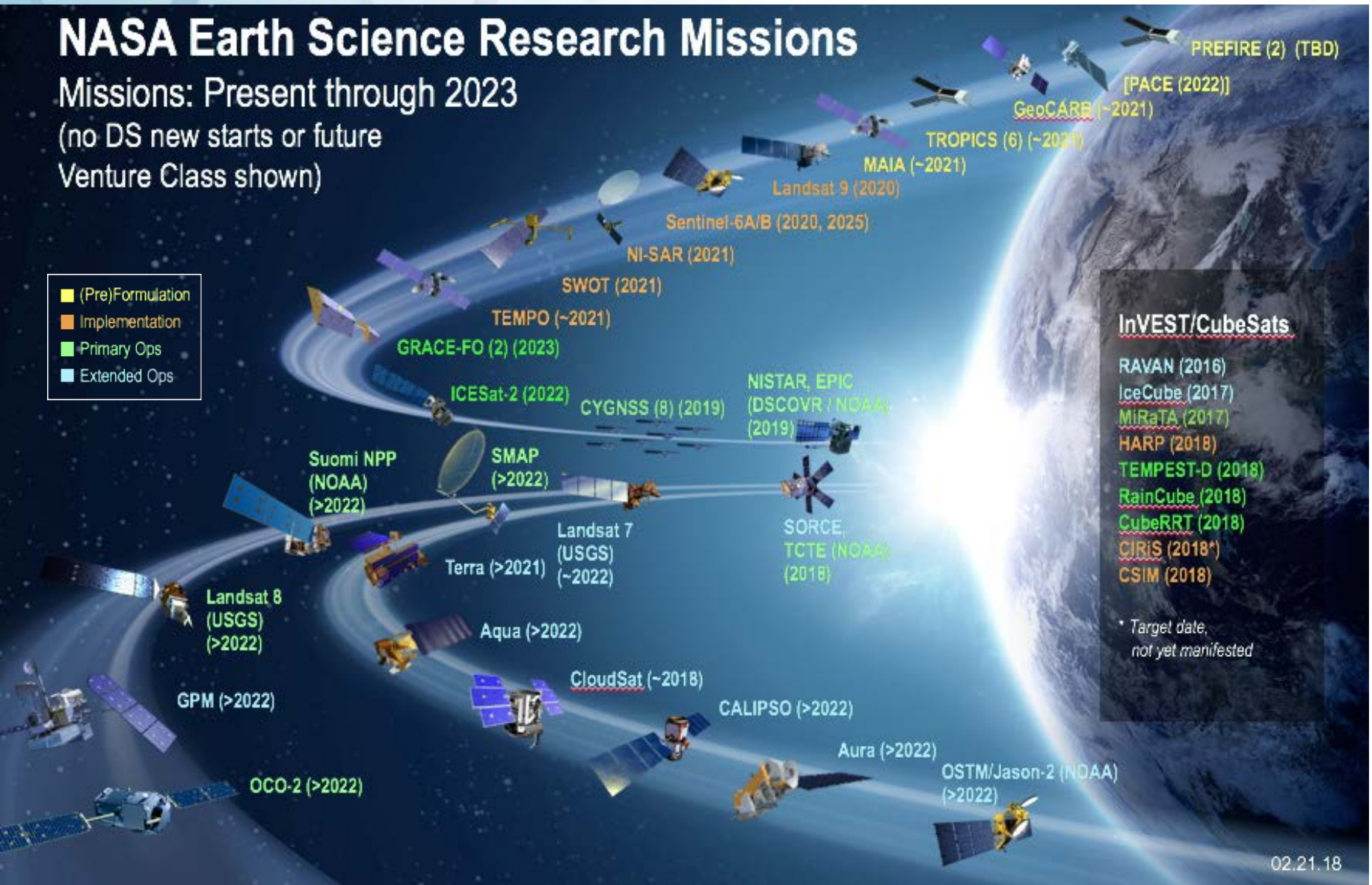
Big questions of NASA *Earth System* Science



The Bretherton Diagram
(mid 1980's)

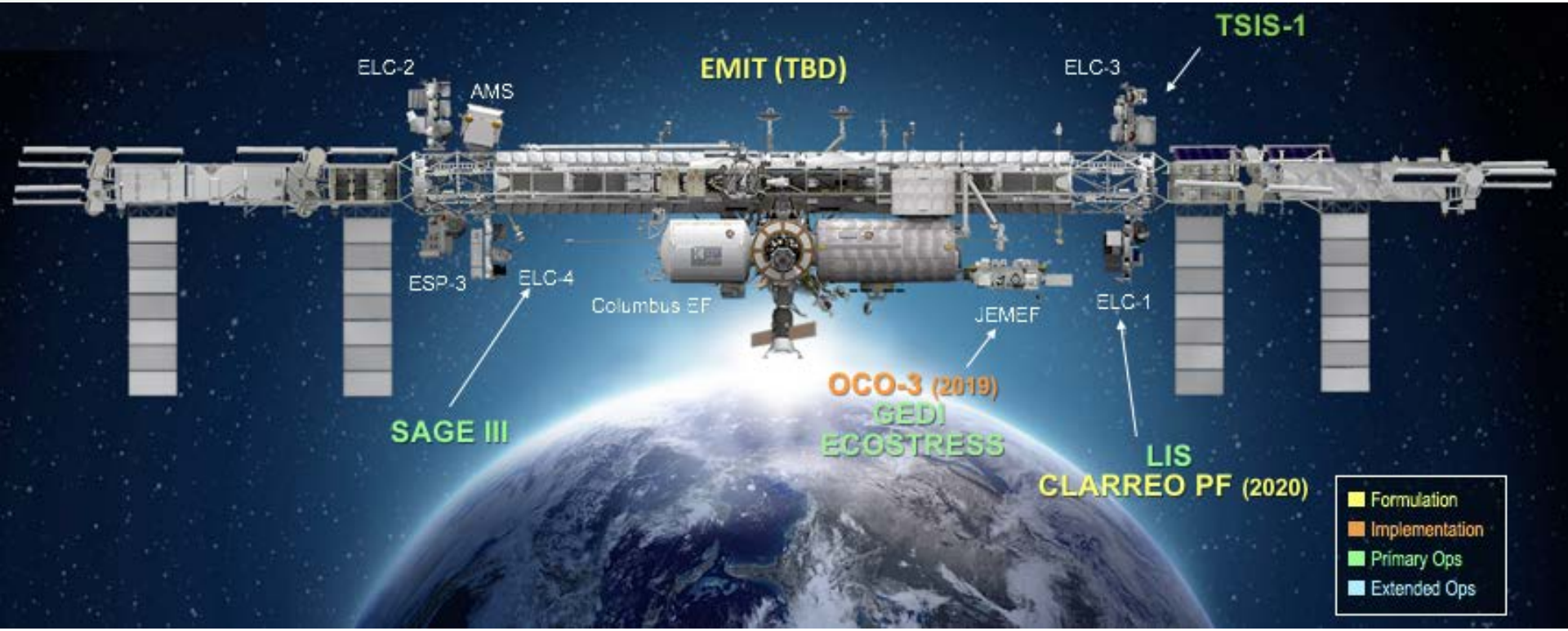
- How is the global *Earth system* changing?
- What causes these changes in the *Earth system*?
- How will the *Earth system* change in the future?
- How can *Earth system* science provide societal benefit?

An Evolving System to Observe the Earth System

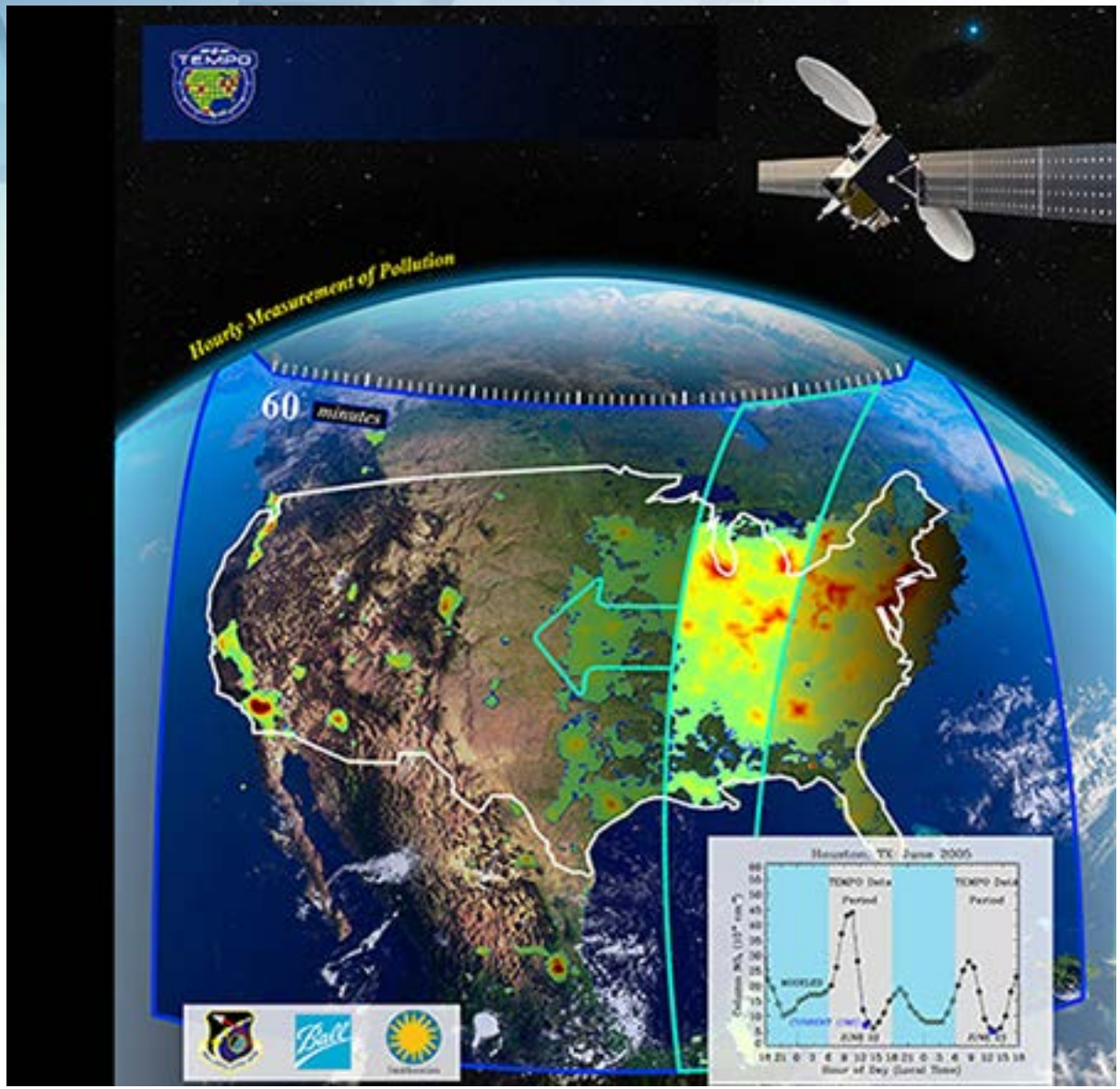


Emerging Approaches: Earth Science from the ISS

- Increasing number of Earth Observing instruments:
  - 2017: SAGE III, LIS, TSIS-1
  - 2018: GEDI, ECOSTRES
  - 2019: OCO-3

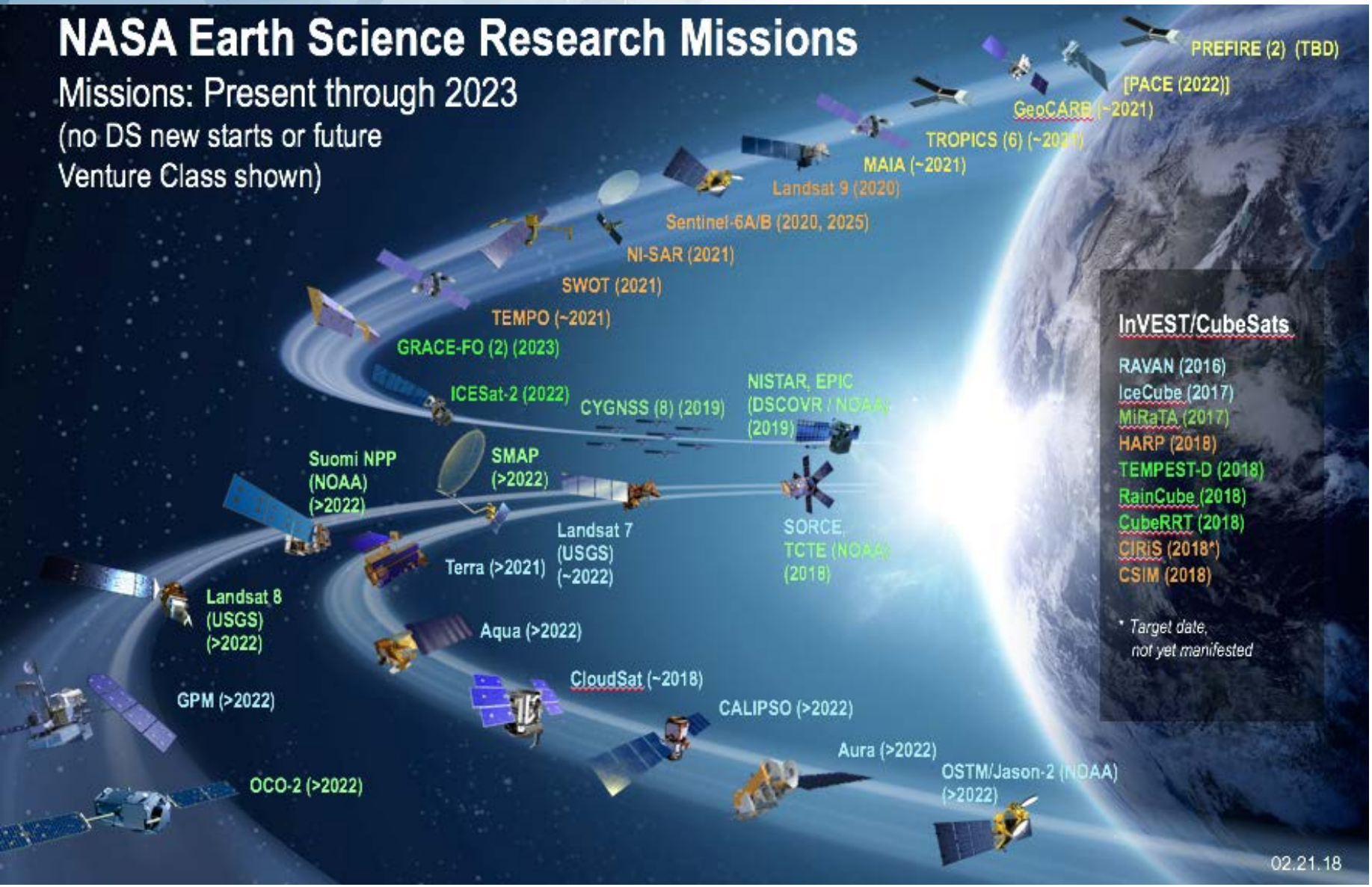


New Observation Modes: TEMPO (goal 2019/21? launch)



First space-based instrument to monitor major air pollutants across the North American continent every daylight hour at high spatial resolution.

Increasing role for CubeSats

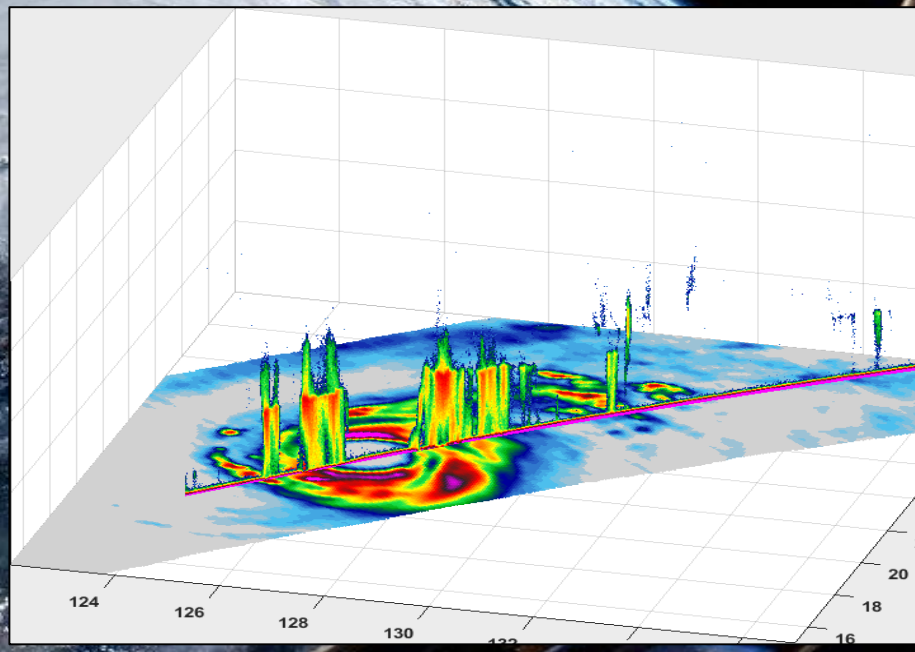


CubeSat example: TEMPEST-D and RainCube

- September 28, 2018, TEMPEST-D and RainCube overflew Typhoon Trami < 5 minutes apart

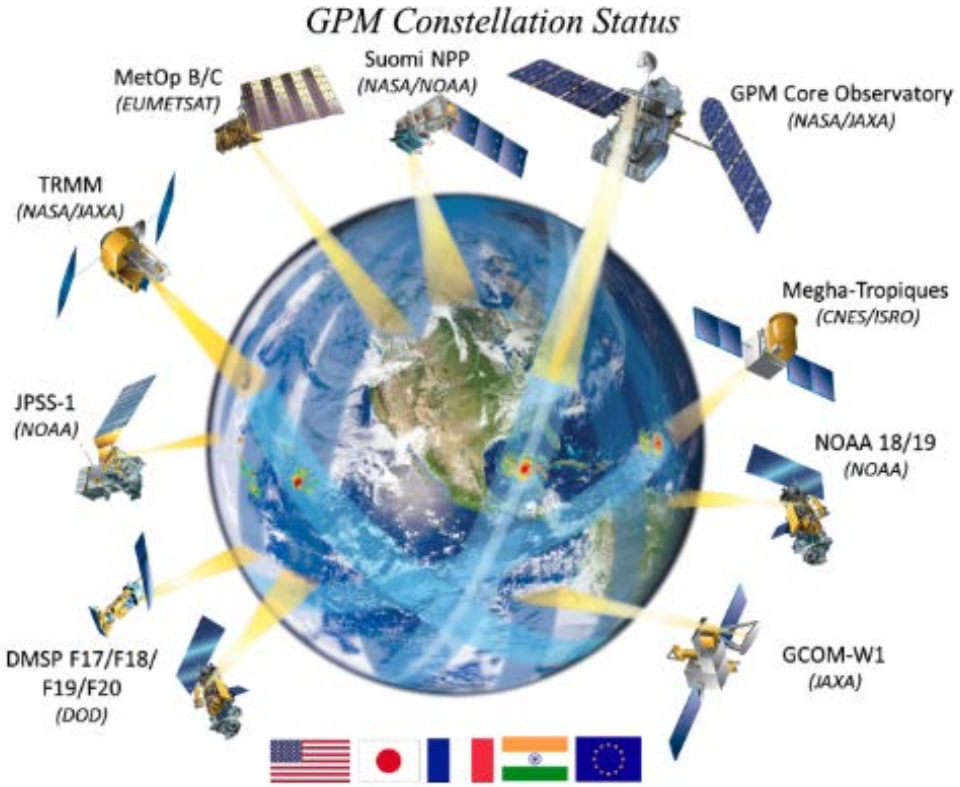
- RainCube nadir Ka-band reflectivity shown overlaid on TEMPEST-D 165 GHz brightness temperature illustrating complementary nature of these sensors in constellation for observing precipitation

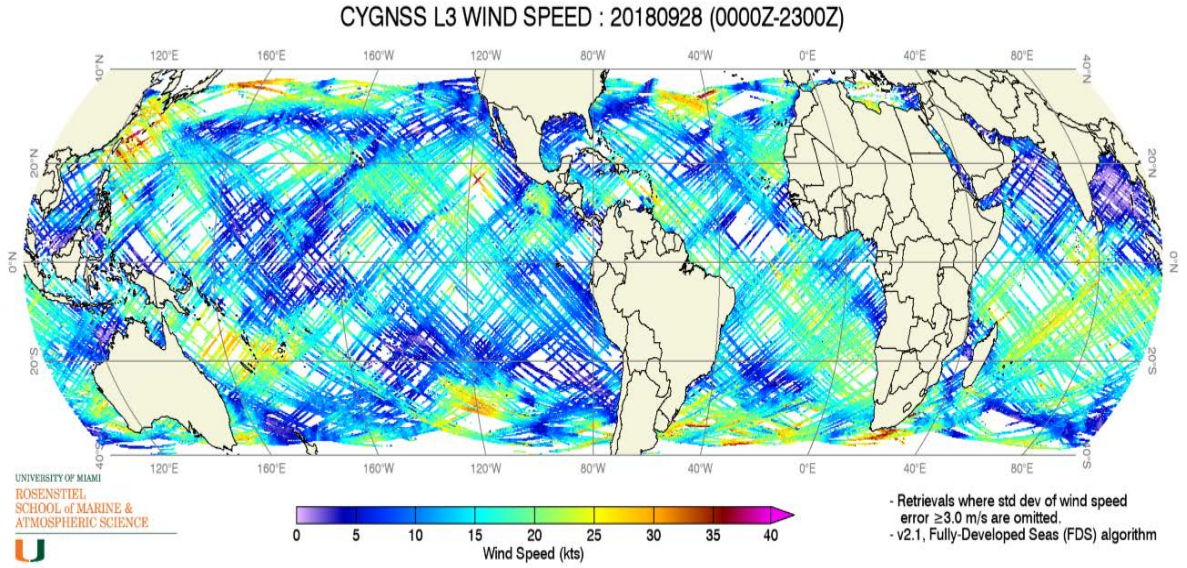
- Trami observed shortly after it had weakened from Cat 5 to Cat 2



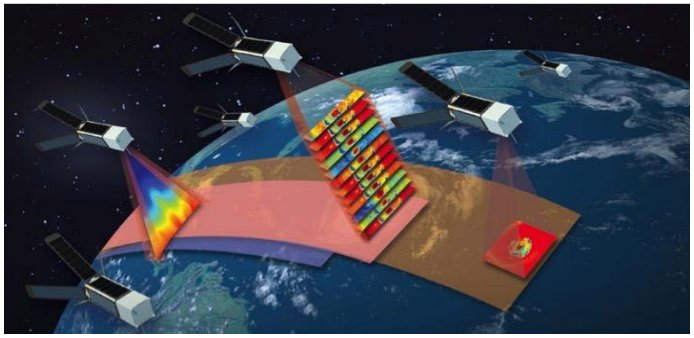
… and Constellations

GPM: International network of satellites anchored by the core observatory



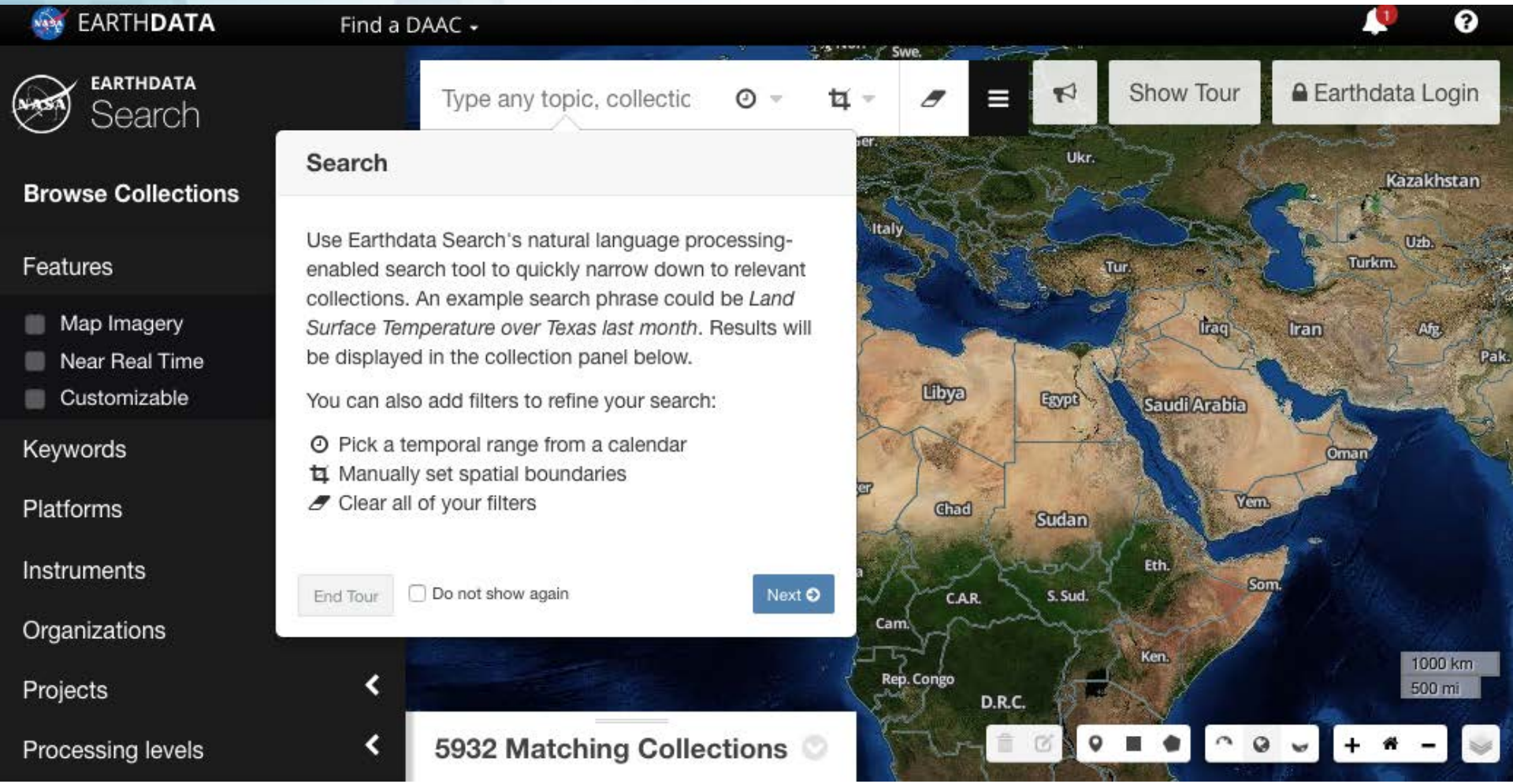


CYGNSS 8-satellite constellation



Increasing usability: EarthData

https://search.earthdata.nasa.gov/search



Connecting the Public to NASA Earth Science Stories, Data, People

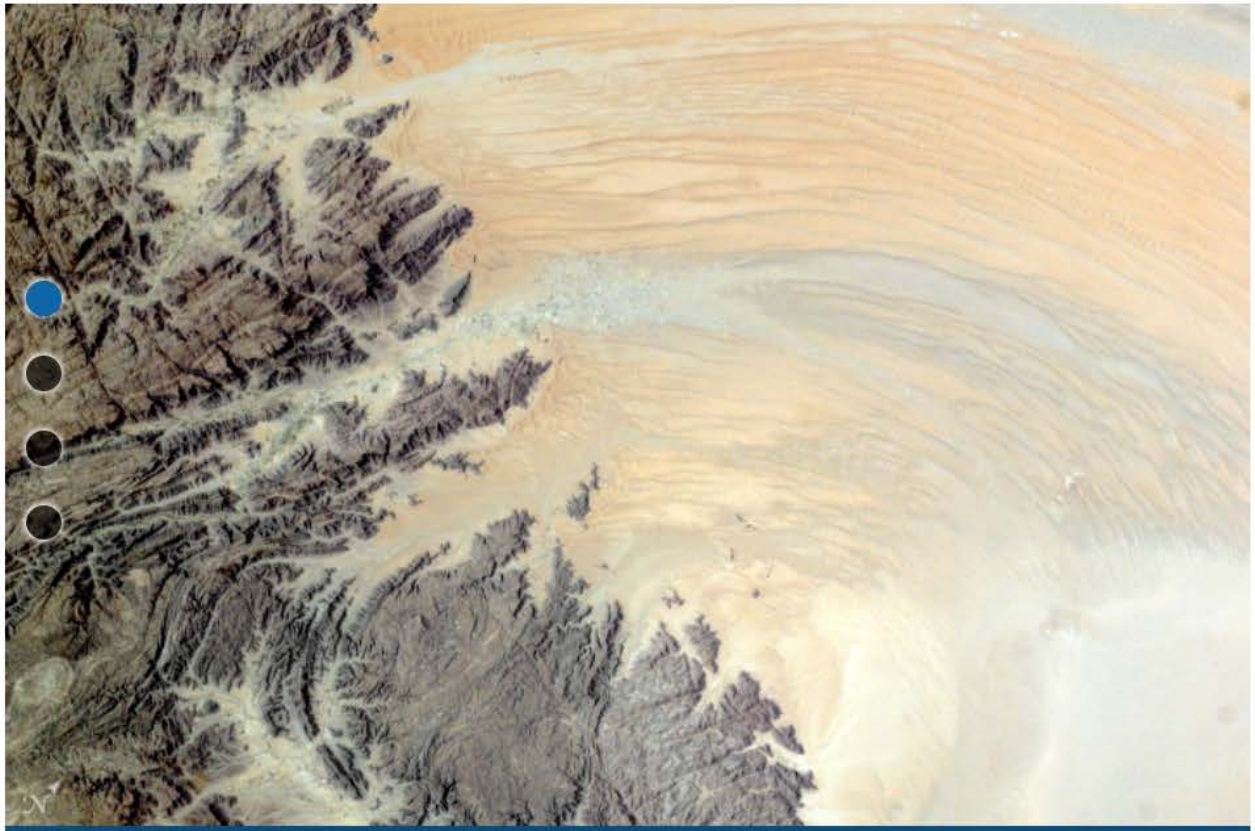
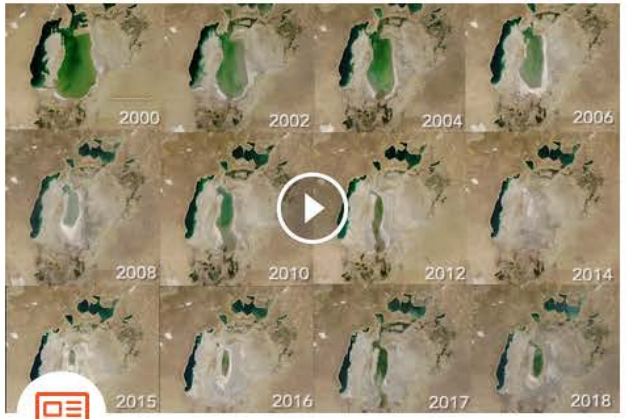


Image of the Day for Feb 10, 2019

Ancient Rocks, Modern Dunes

In the arid interior of Yemen, ancient rocks stand astride dry river beds and mighty sand dunes.

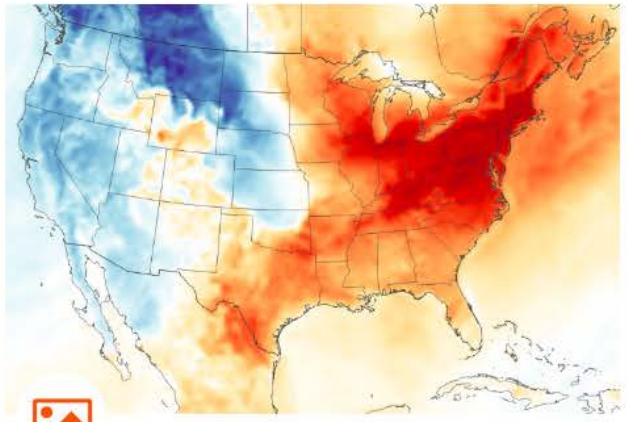


Featured Article Published Dec 5, 2018

Shrinking Aral Sea

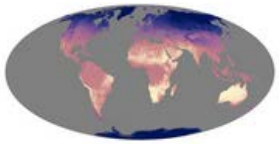
Once the fourth-largest lake in the world, the Aral Sea has been slowly disappearing since the 1960s. View how the lake has shrunk over the past few decades.

Land Water



Natural Event Published Feb 6, 2019

Images | Global Maps | Articles | Blogs | NASA earth observatory | Topics



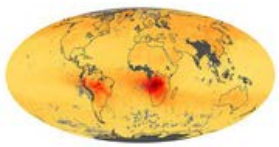
Global Maps

Feb 2000 – Nov 2018

Land Surface Temperature

Land surface temperatures rise and fall with the heat of the Sun, and they represent how hot or cold the surface would feel to touch. These maps show daytime land temperatures as measured from space.

Heat | Land



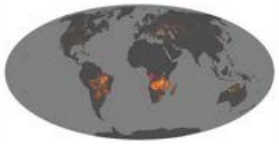
Global Maps

Mar 2000 – Feb 2017

Carbon Monoxide

When fuels such as coal, wood, and oil burn incompletely, they produce carbon monoxide. The gas is spread by winds and circulation. These maps show monthly averages of CO in the lower atmosphere.

Atmosphere



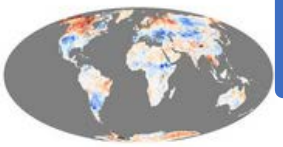
Global Maps

Mar 2000 – Nov 2018

Fire

Whether started by humans (farming, logging, or accidents) or by nature (lightning), fires are always burning somewhere on Earth. These maps show the locations of fires burning around the world each month.

Land



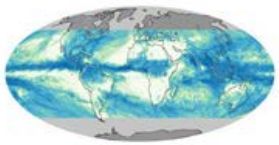
Global Maps

Feb 2000 – Nov 2018

Land Surface Temperature Anom

These maps depict anoma in land surface temperatur (LSTs); that is, how much hotter or cooler a region w compared to the long-term average. LST anomalies c indicate heat waves or col spells.

Heat | Land

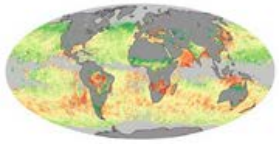


Global Maps

Jan 1998 – Aug 2016

Total Rainfall

These maps depict monthly total rainfall around the world. Rainfall is the primary source of fresh water for humans,



Global Maps

Jan 2005 – Sep 2016

Aerosol Size

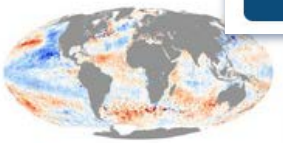
Sea salt, volcanic ash, dust, wildfire smoke, and industrial pollution are types of airborne aerosols. Natural aerosols tend to be larger than human-made

Global Maps

Feb 2000 – Nov 2016

Net Primary Productivity

These maps show the 'metabolism" of Earth's plants and trees. Net primary productivity is the difference between the amount of carbon



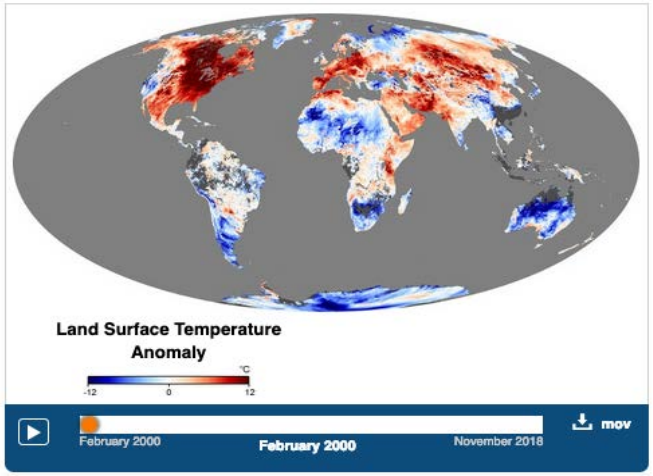
Global Maps

Jun 2002 – Sep 2011

Sea Surface Temperature Anomaly

These maps depict how much hotter or cooler an ocean basin was compared to the long-term

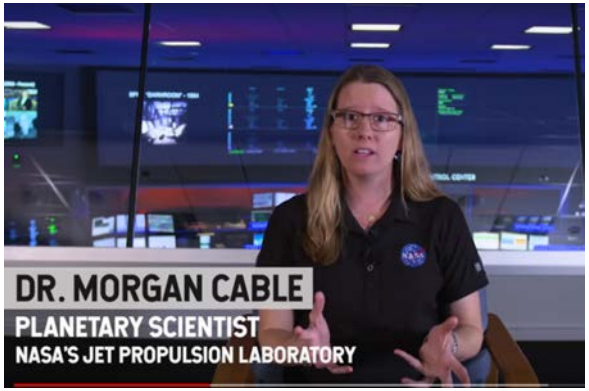
Land Surface Temperature Anomaly



NASA Earth Observations (NEO)

Follow NASA Earth on Social

@NASAEARTH

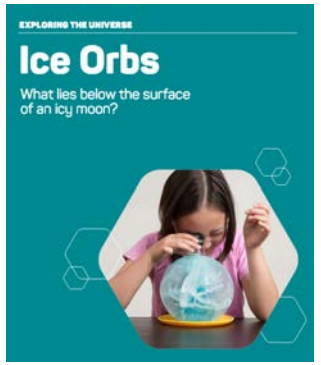


NASA Explorers: Glacial Pace
https://www.youtube.com/watch?v=oFHy8vaP_Bw

facebook watch

YouTube

Earth & Space Toolkit Connections:



NASA Earth Science Education Collaborative

Creating **authentic STEM** experiences & resources, based on **NASA Earth Science**, delivered through **strategic partnerships and collaborations**

- Institute for Global Environmental Strategies (PI)
- NASA Goddard (Co-I)
- NASA Langley (Co-I
- NASA JPL (Co-I)

Partners & Collaborators Include:

NISE NETWORK
NATIONAL INFORMAL STEM EDUCATION

american CAMP association

STAR*net*

girl scouts in association with scistarter

THINK LIKE A CITIZEN SCIENTIST

ASTC

Smithsonian Science Education Center

Citizen Science: Engaging the Public in NASA Science


NASA
ARE YOU UP FOR A CHALLENGE?
Collect observations of clouds to win!
March 15 - April 15, 2018
GLOBE Observer
The GLOBE Program


LAND COVER CHALLENGE
SEPT. 22 – OCT. 1
NASA
Land Cover
Top 10 WIN a NASA shout out and certificate!
GLOBE Observer
observer.globe.gov


NASA
Diseases carried by mosquitos kill millions of people every year.
Learn how people within high-risk countries are fighting back this Thursday.
Tune in July 5, 2018
10:30 am EDT/3:30 pm UTC
facebook.com/NASAearth
GLOBE Observer
LIVE


"I do citizen science with GLOBE OBSERVER because I love making STEM a reachable dream for anyone to achieve."
– Marilé Colón Robles
NASA
GLOBE Observer


NASA
PEDER NELSON
LAND COVER SCIENTIST &CITIZEN SCIENTIST
Read about his work: https://bit.ly/2MvFwvh
GLOBE Observer


NASA GLOBE Observer
February 11 at 9:00 AM
#MeetACitScientistMonday Meet Dr. Rusty Low! She puts the scientist in #citizenscientist and she needs your #mosquito observations to help with her research.
https://observer.globe.gov/.../obsscientis.../19589576/rusty-low
NASA - National Aeronautics and Space Administration, NASA Earth, The GLOBE Program... See More

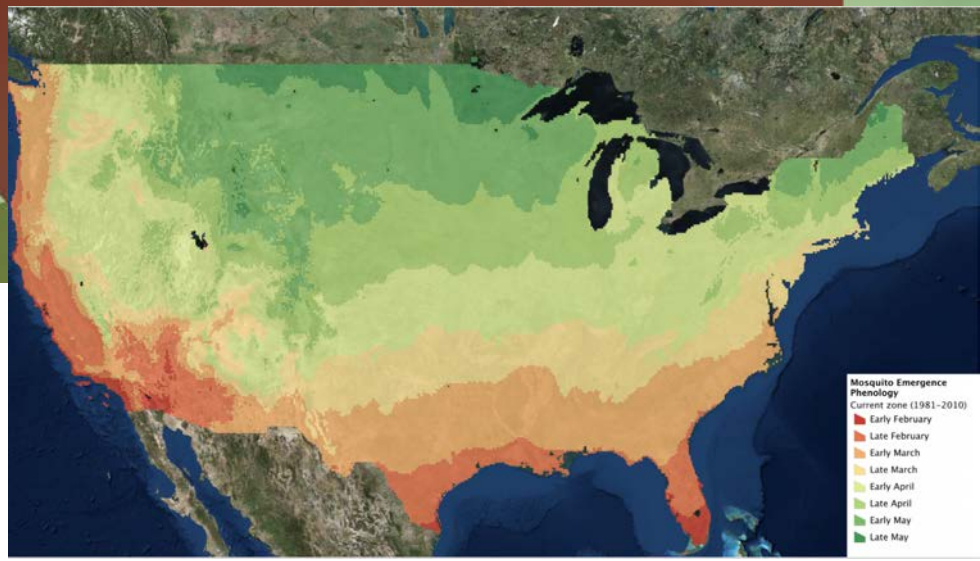
Follow us!

GLOBE

Mission Mosquito

Upcoming Webinar: Join the Mosquito Mapping Project and build a mosquito trap!
February 20, 2:00 p.m. ET / 11:00 a.m. PT

This webinar launches the GMM Phenology project where citizen scientists in this campaign will create a map of first appearances of mosquitoes in USA- and changes in the mosquito season in the Southern Hemisphere. We will provide a short tutorial on how to use the app and make a mosquito trap.



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NASA Earth Observatory
earthobservatory.nasa.gov

NASA Earth Observations (NEO)
neo.sci.gsfc.nasa.gov/

NASA Earth on Social
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NASA Explorers
Facebook Watch and Youtube (https://youtu.be/4IjlUbP2cgs)