

June 16, 2021

EXPLORE EARTH

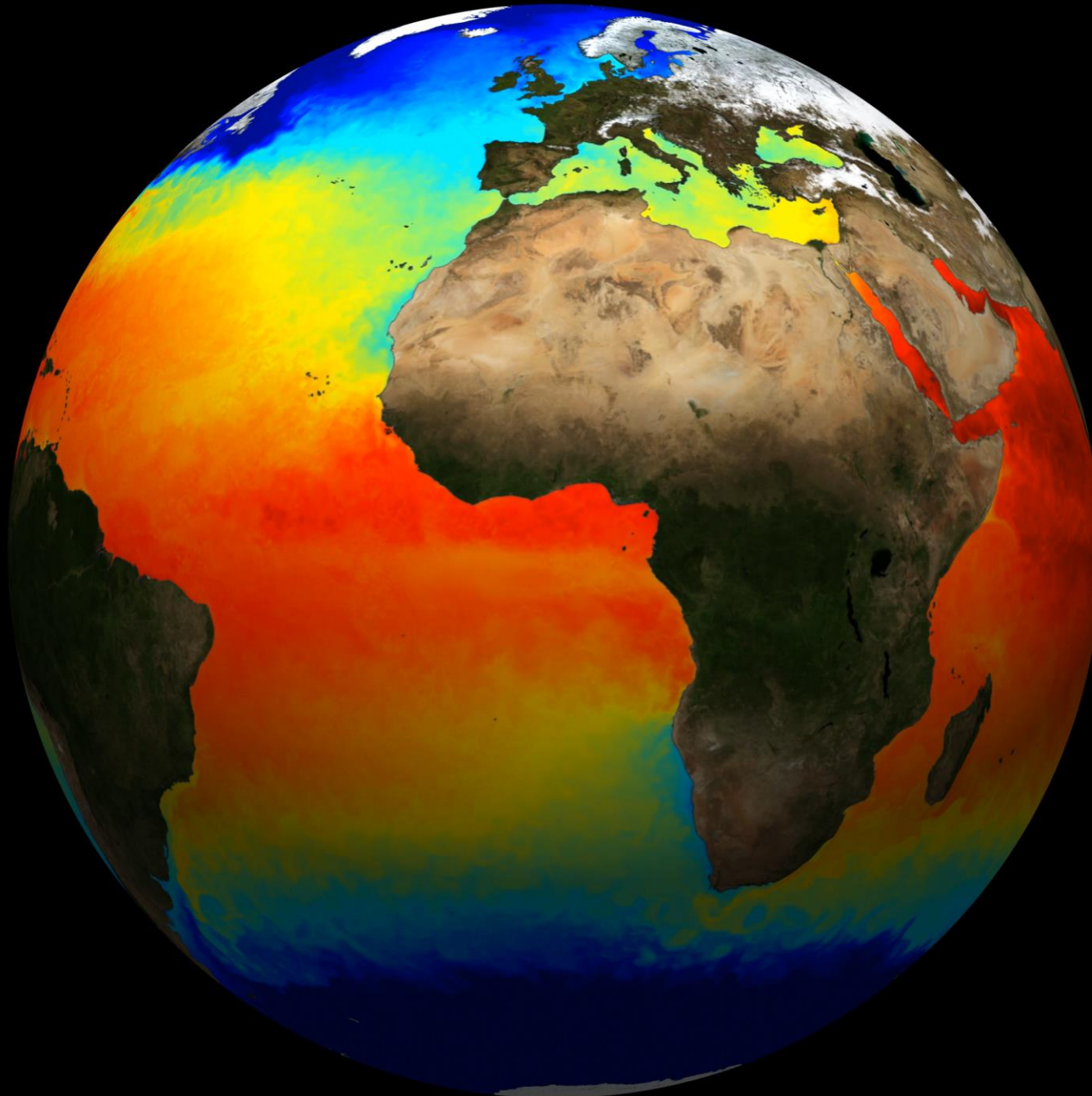
Laura Rogers
NASA Langley Research Center

Slides collected from numerous colleagues across NASA

Sea Surface Temperature

SST-MUR (JPL)

02 Jun 2014 00:00



NASA EARTH FLEET

OPERATING & FUTURE THROUGH 2023

SWOT (CNES)

LANDSAT-9 (USGS)

SENTINEL-6 B (ESA, EUMETSAT, NOAA)

TROPICS (6)

GEOCARB

NISAR (ISRO)

MAIA

TSIS-2

TEMPO

PREFIRE (2)

PACE (NSO)

GLIMR

SENTINEL-6 Michael Freilich (ESA, EUMETSAT, NOAA)

INVEST/CUBESATS

CSIM-FD

HARP

TEMPEST-D

CIRiS

CTIM

HyTI

SNOPi

NACHOS

ISS INSTRUMENTS

EMIT

CLARREO-PF

GEDi

OCO-3

TSIS-1

ECOSTRESS

LIS

SAGE III

JPSS-2, 3 & 4 INSTRUMENTS

OMPS-Limb

LIBERA

ICESAT-2

GRACE-FO (2) (GFZ)

CYGNSS (8)

NISTAR, EPIC (DISCOVER/NOAA)

CLOUDSAT (CSA)

TERRA (METI, CSA)

AQUA (JAXA, AEB)

AURA (NSO, FMI, UKSA)

CALIPSO (CNES)

GPM (JAXA)

LANDSAT 7 (USGS)

LANDSAT 8 (USGS)

OCO-2

SMAP

SUOMI NPP (NOAA)

(PRE) FORMULATION ●

IMPLEMENTATION ●

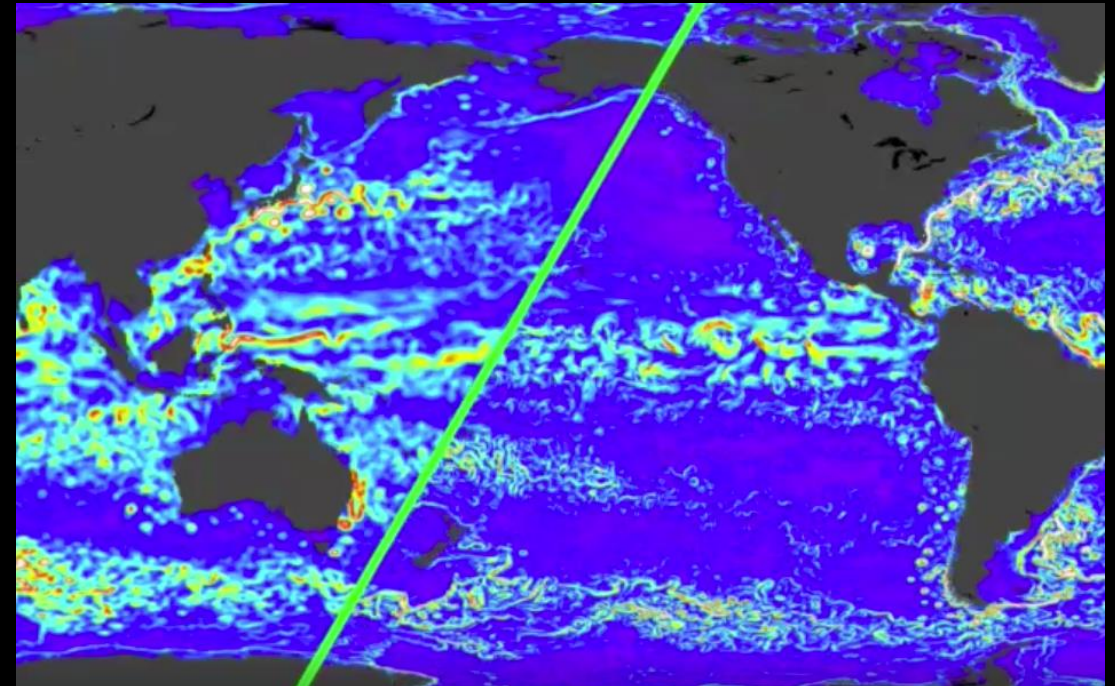
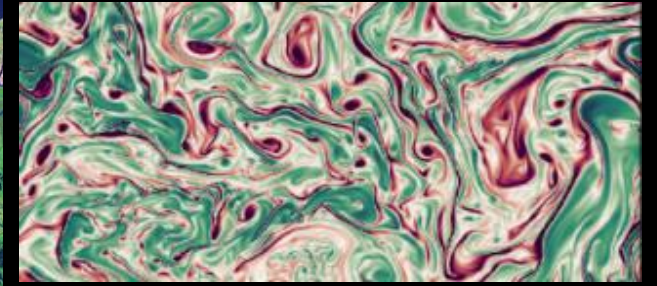
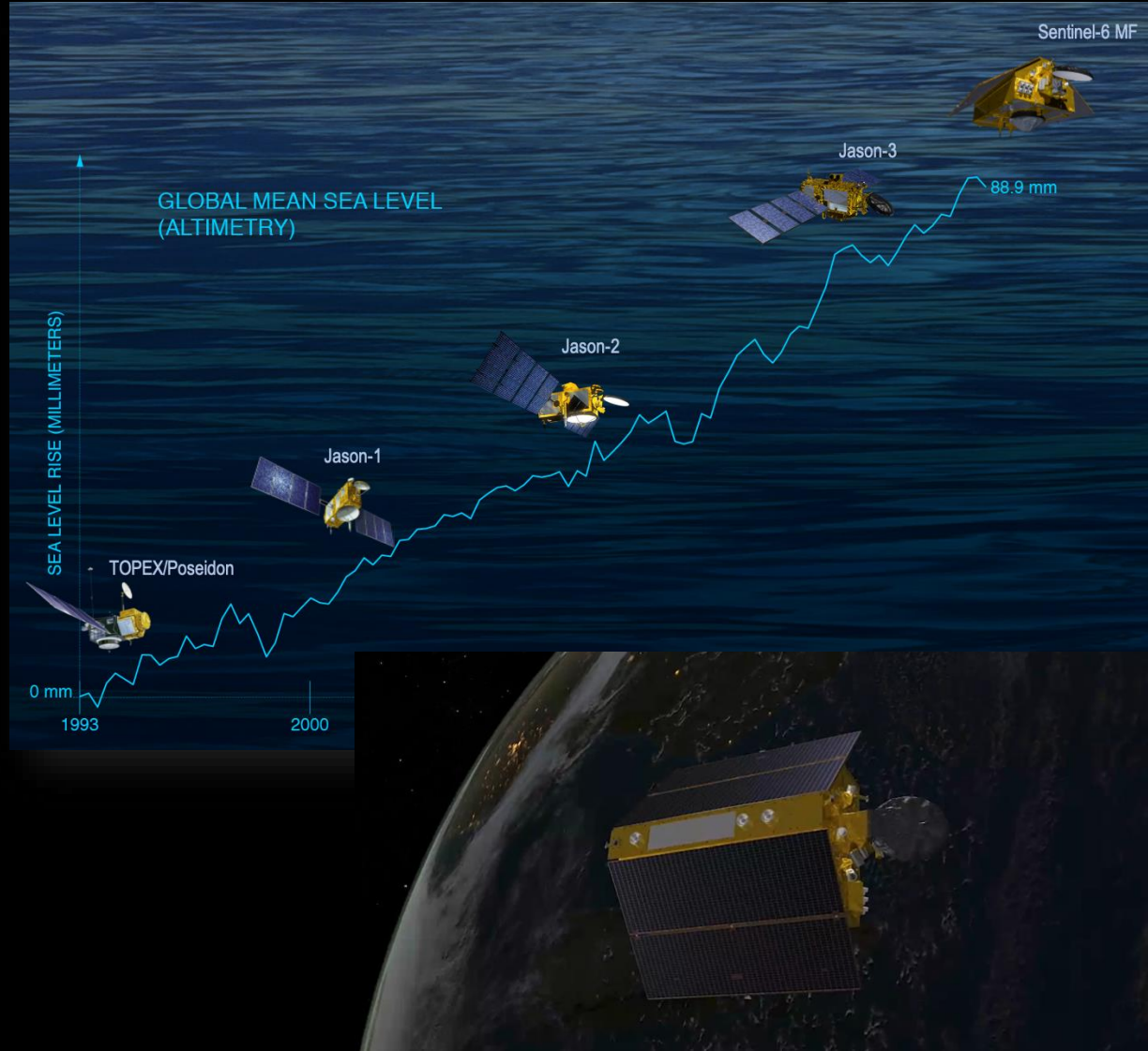
PRIMARY OPS ●

EXTENDED OPS ●

03.26.2021

Sentinel-6 Michael Freilich

Extending sea level climate records into 4th decade



SWOT SURFACE WATER AND OCEAN TOPOGRAPHY

New ways to track water cycle and sea level

Upcoming Satellite Missions



SWOT: Surface Water and Ocean Topography

Launches in 2022

NASA's first global survey of Earth's surface water, observing major lakes, rivers and wetlands while detecting ocean features with unprecedented resolution



PACE: The Plankton, Aerosol, Cloud, ocean Ecosystem

Launches in late 2023

Will advance the assessment of ocean health by measuring the distribution of phytoplankton, and will continue systematic records of key variables associated with air quality and climate



GLIMR: Geosynchronous Littoral Imaging and Monitoring Radiometer

Launches in the 2026-2027 timeframe

Will provide unique observations of ocean biology, chemistry, and ecology in the Gulf of Mexico, portions of the southeastern U.S. coastline, and the Amazon River plume

Field Campaigns



EXPORTS: EXport Processes in the Ocean from RemoTe Sensing

Field campaign will start its N. Atlantic deployment out of Southampton, UK, on May 1, 2021!

Develop a predictive understanding of the export and fate of global ocean net primary production (NPP) and its implications for present and future climates

<https://oceanexports.org/index.html>



Delta-X: Field Campaign in the Mississippi River Delta

Delta-X is studying why land is lost and why it is gained, so we can help make deltas grow.

Evaluate hydrological and ecological processes responsible for the resilience and vulnerability of river deltas to Relative Sea Level Rise (RSLR), and their relative contributions to soil elevation

<https://deltax.jpl.nasa.gov/about/>

Data Integration, Modeling, and Prediction

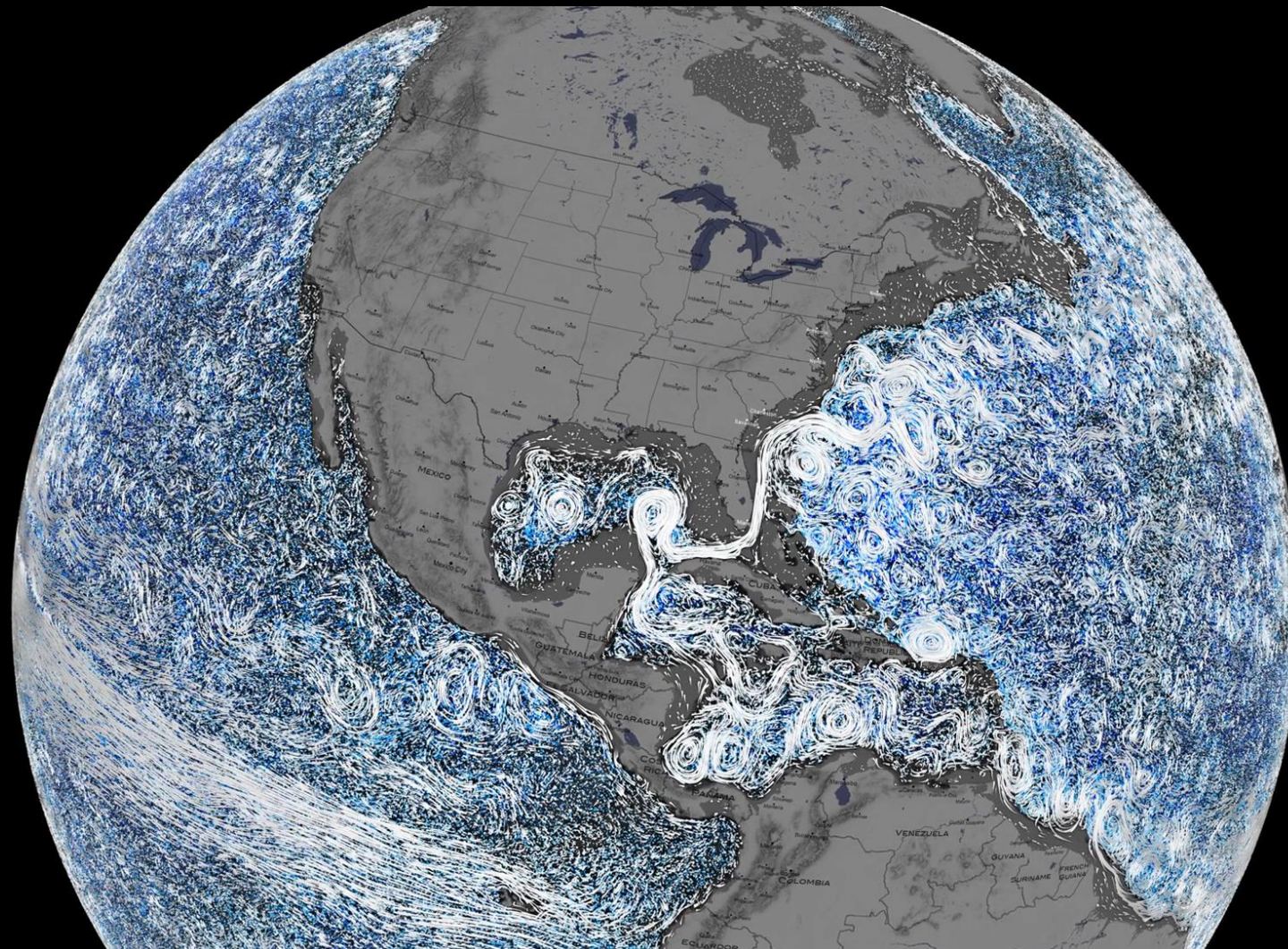
ECCO

GMAO

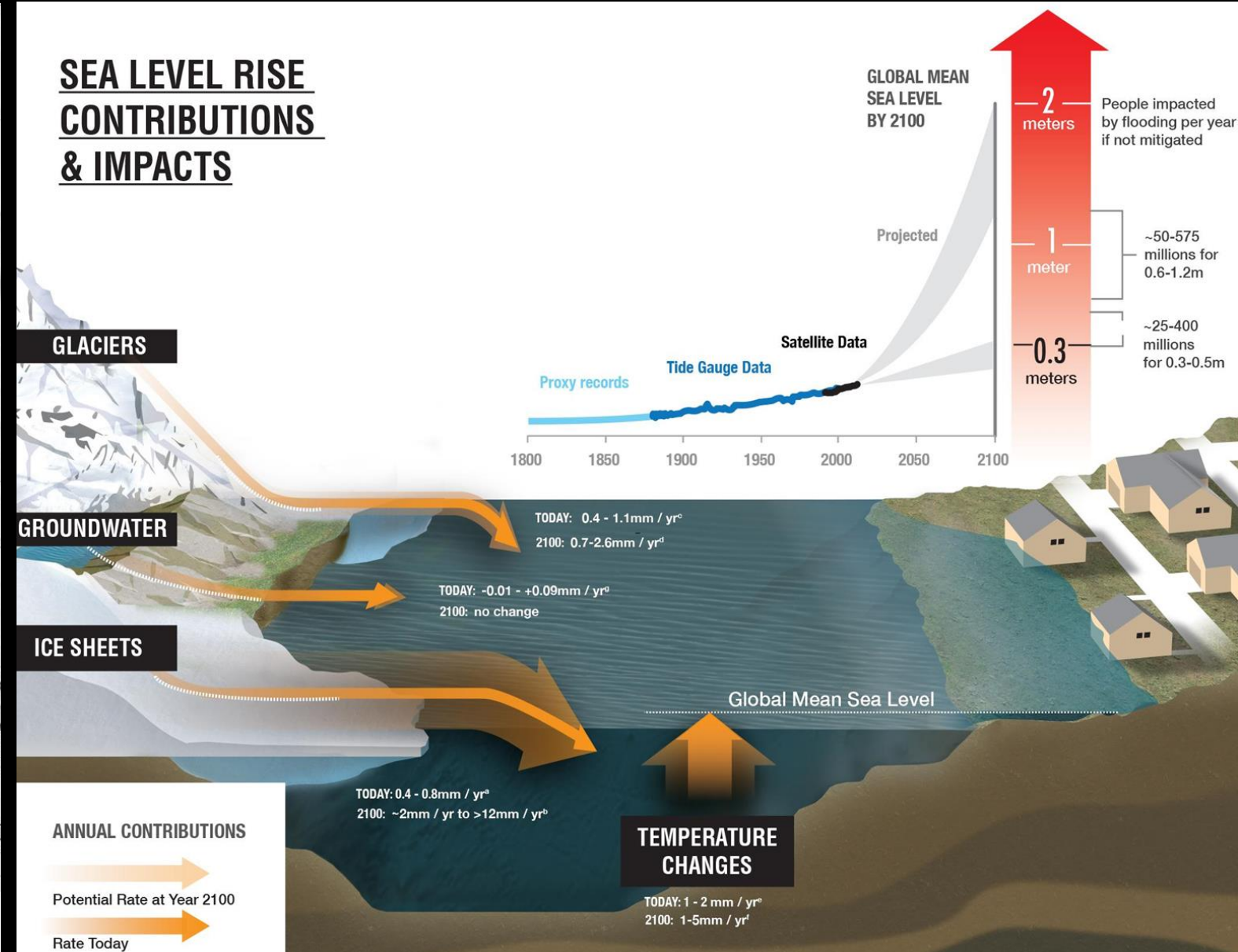
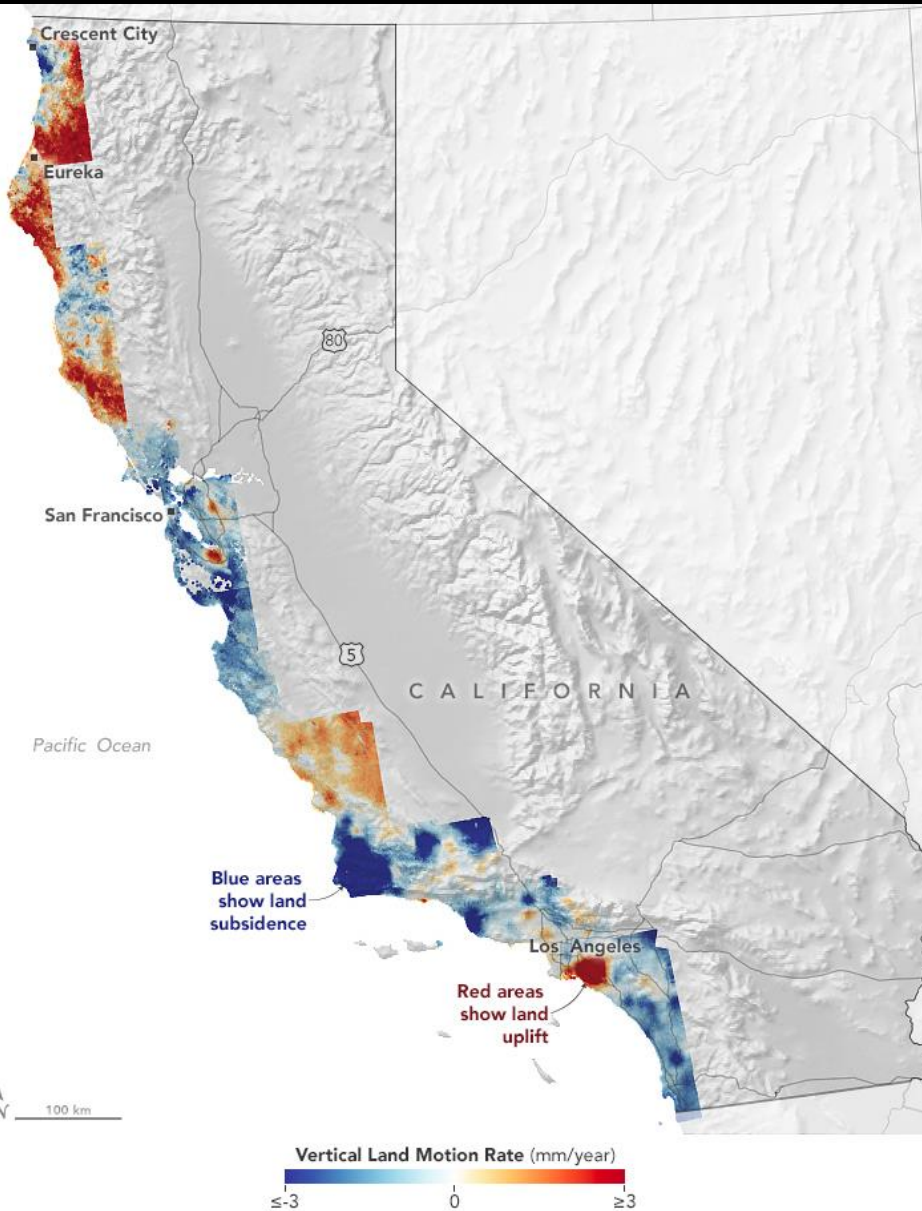
GOES-5

GISS

Machine
Learning



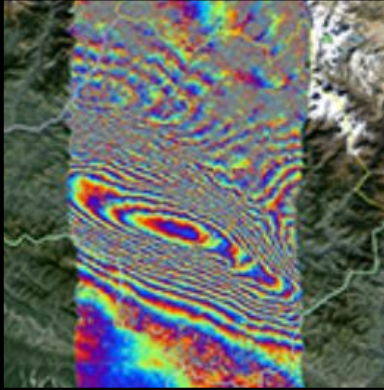
NASA Sea Level Change Team



NASA Disasters Program



Hurricanes &
Cyclones



Earthquakes



Floods



Wildfires



Volcanoes



Industrial
Incidents



Landslides



Severe & Winter
Weather



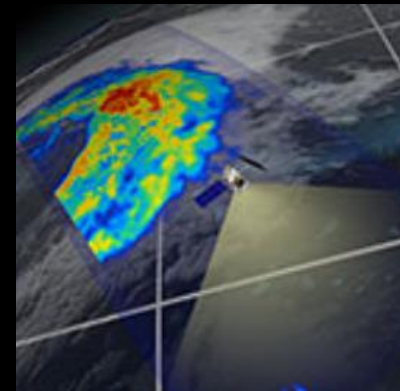
ISS Imagery



Risk Reduction



External
Resources

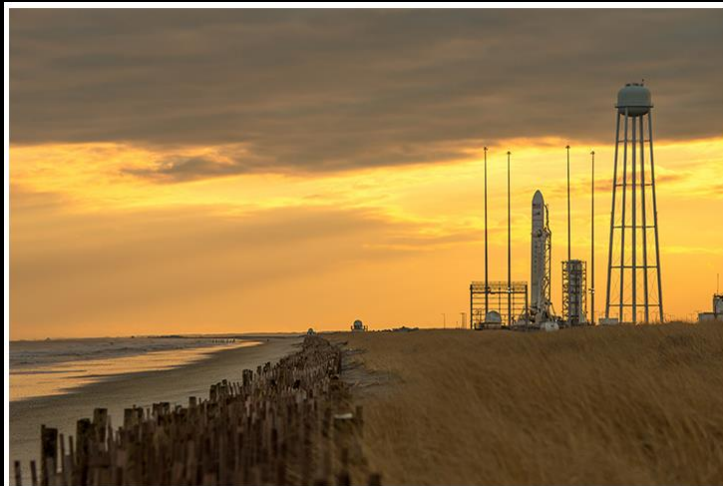


Near Real-time
Products

Should NASA be concerned?



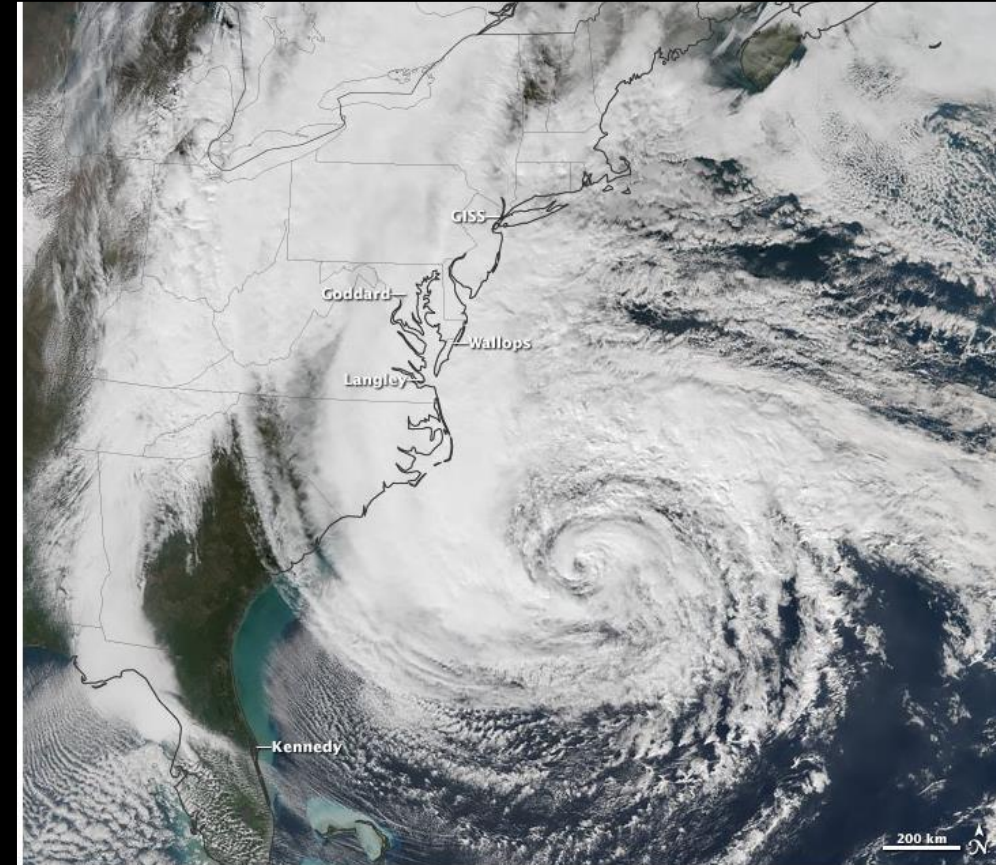
The Sun rises at Kennedy Space Center. The sea is steadily doing the same. (Photo by NASA/Andres Adorno)



Barrier beaches near the spaceport on Wallops Island, Virginia, have been receding by as much as 12 feet per year. (Photo by NASA/Bill Ingalls)



Launch Pad 39B at Kennedy Space Center has been the site of dozens of Apollo era and space shuttle launches. Future SLS and Orion spacecraft will lift off from this site. (NASA)



Hurricane Sandy had wind, wave, or water impacts on five NASA centers along the U.S. East Coast. (NASA Earth Observatory image by Jesse Allen, using Suomi NPP VIIRS data provided by NOAA Class)

Agency Resilience Planning

ENHANCING CLIMATE RESILIENCE AT NASA CENTERS

A Collaboration between Science and Stewardship

BY CYNTHIA ROSENZWEIG, RADLEY M. HORTON, DANIEL A. BADER, MOLLY E. BROWN, RUSSELL DeYOUNG,
OLGA DOMINGUEZ, MERRILEE FELLOWS, LAWRENCE FRIEDL, WILLIAM GRAHAM, CARLTON HALL,
SAM HIGUCHI, LAURA IRACI, GARY JEDLOVEC, JACK KAYE, MAX LOEWENSTEIN, THOMAS MACE,
CRISTINA MILES, WILLIAM PATZERT, PAUL W. STACKHOUSE JR., AND KIM TOUFECTIS

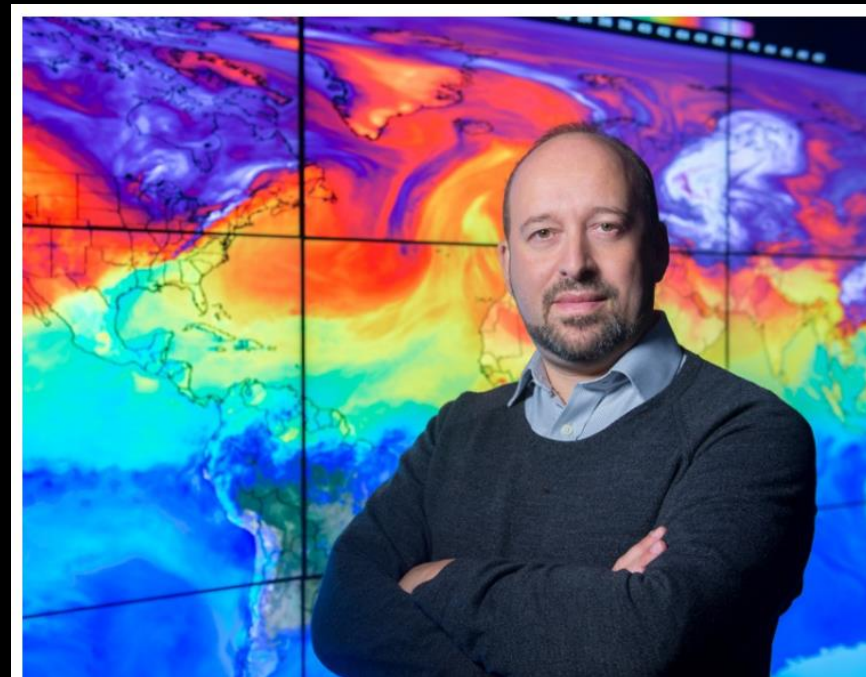
NASA has developed a partnership between its Earth scientists and its institutional stewards to prepare for a changing climate and growing climate-related vulnerabilities.

National Aeronautics and Space Administration (NASA) scientists have been instrumental in discovering the nature of weather and climate hazards, yet their agency also has direct experience with their impacts. Power outages and electrical system damage from the tornado outbreak of 27–28 April 2011 closed Marshall Space Flight Center in Huntsville, Alabama, for 10 days. The Station Fire of August–October 2009, which burned a modern-record 250 sq. miles in Los Angeles County, reached within a mile of the Jet Propulsion Laboratory's (California) main campus adjacent to Pasadena (Fig. 1). Air quality concerns closed the Center, and employees, their families, and neighbors experienced evacuations and stress.

Coastal storms are another threat: Hurricane Isabel flooded portions of Langley Research Center (Virginia) in September 2003. Hurricane Frances in 2004 damaged Kennedy Space Center's (Florida)



FIG. 1. Recent climate extremes that have impacted NASA Centers. (a) Hurricane Frances, Sep 2004; (b) Damage to the Vehicle Assembly Building at the Kennedy Space Center from Hurricane Frances in Sep 2004; (c) Station Fire, Sep 2009; (d) Wildfires outside of the Jet Propulsion Laboratory in Sep 2009.



Gavin Schmidt is NASA's first climate adviser. Credit: NASA

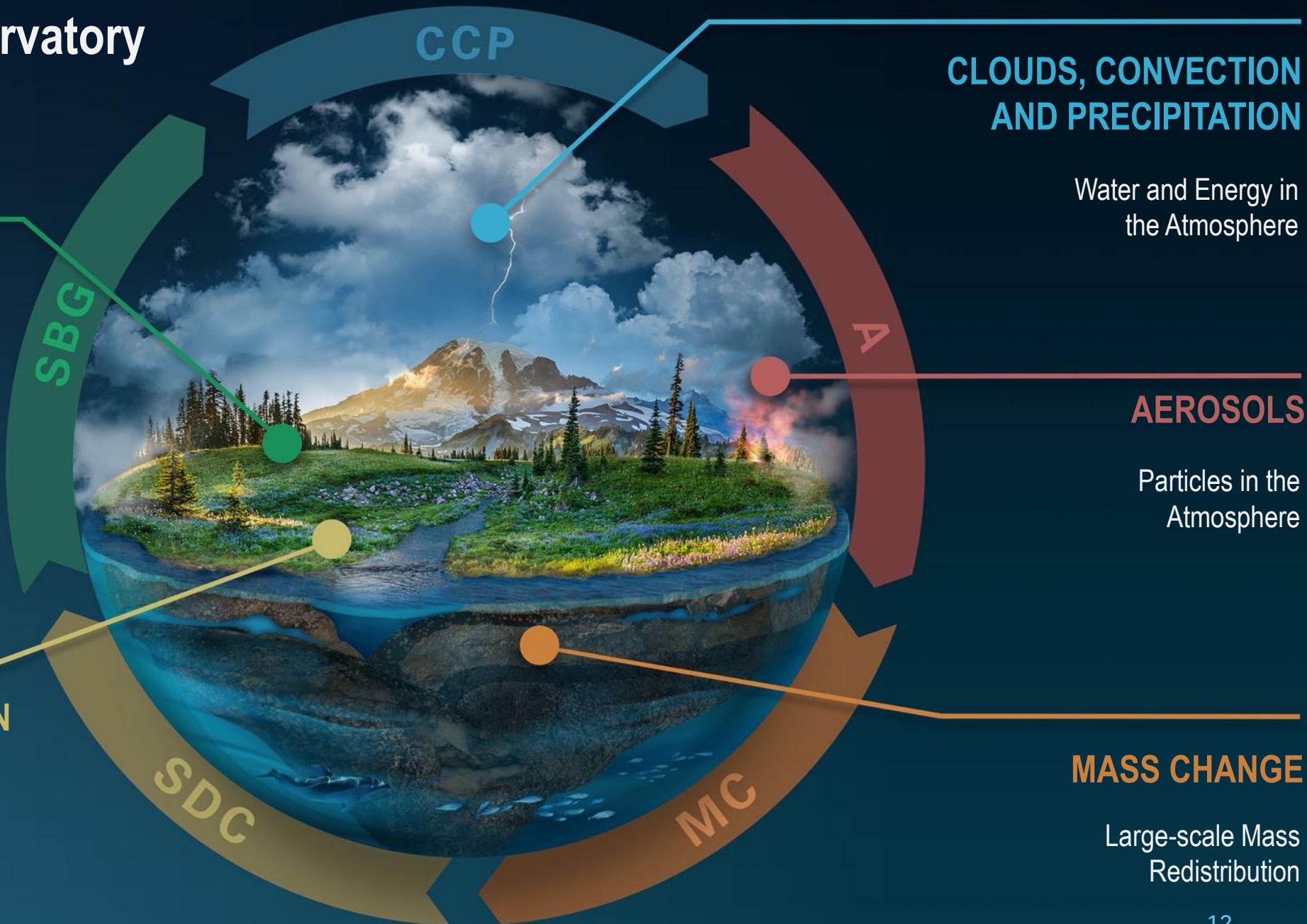
Earth System Observatory

SURFACE BIOLOGY AND GEOLOGY

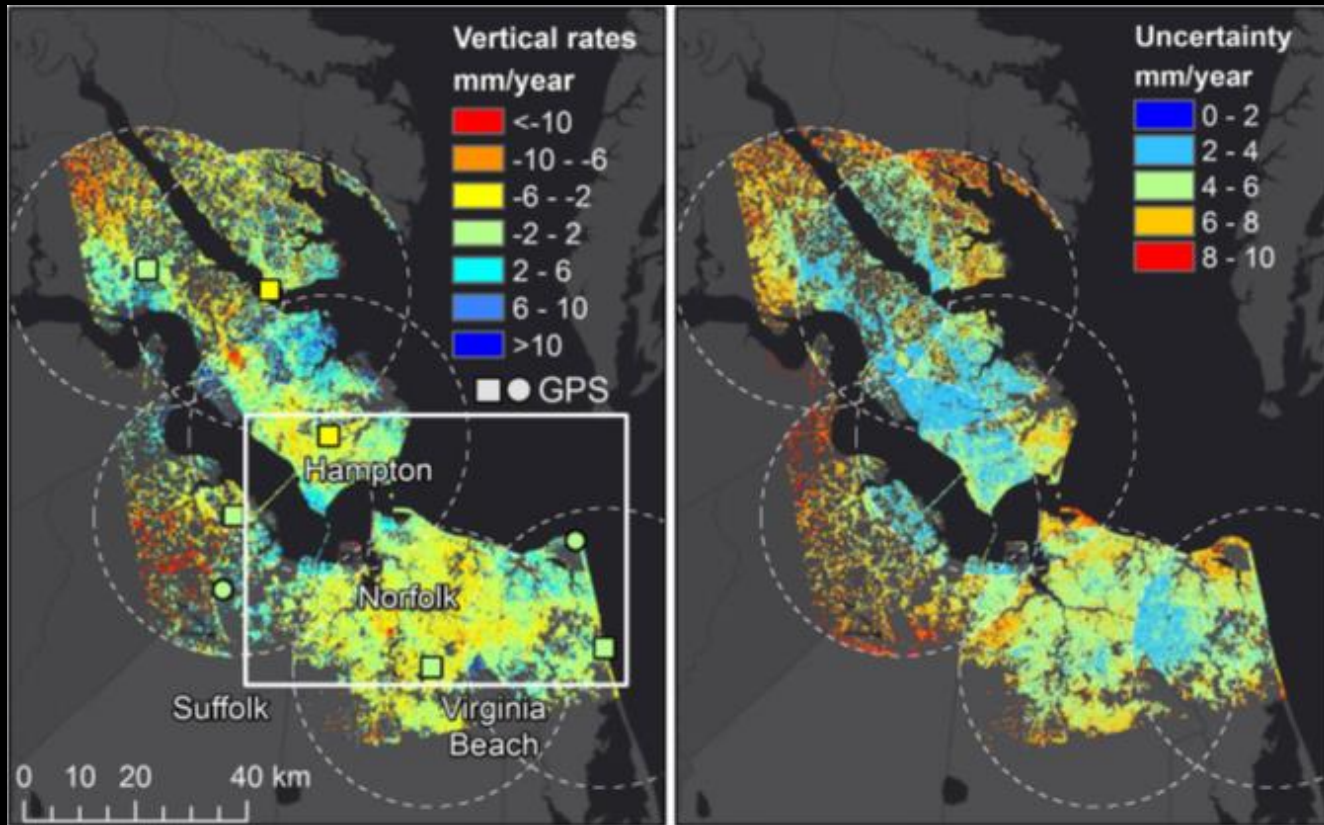
Earth Surface &
Ecosystems

SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics



Subsidence Mapping



Bekaert et al., Scientific Reports 2017



Mid-Atlantic Communities and Areas at Intensive Risk: Translating compounding hazards to societal risk

Demonstration Intent:

- Integrate satellite derived earth observations and physical models into **actionable, trusted** knowledge
- Create comprehensive understanding of **compounding risk** to enable **risk-informed decisions**

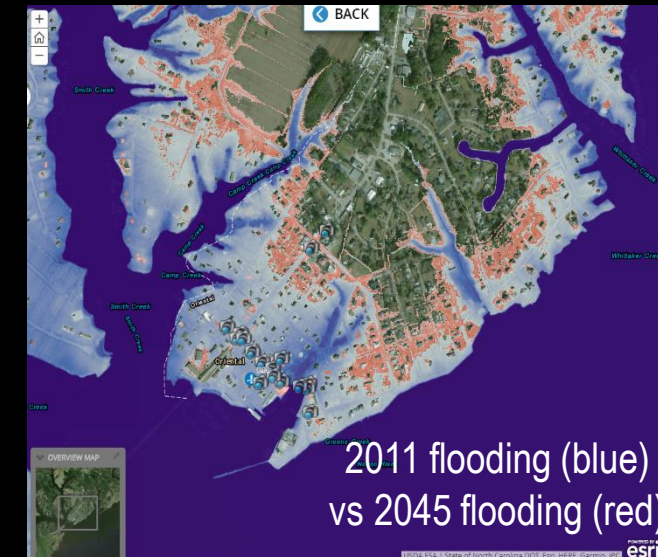
Working with the City of Norfolk and the Virginia Department of Emergency Management, the mid-Atlantic Communities at Intensive Risk (CAIR) project used a representative storm surge case (Hurricane Irene) to predict building level flood impacts at current day and for sea level rise (SLR) and subsidence scenarios in a changing climate.

Risk Visualization: Interactive Storymap

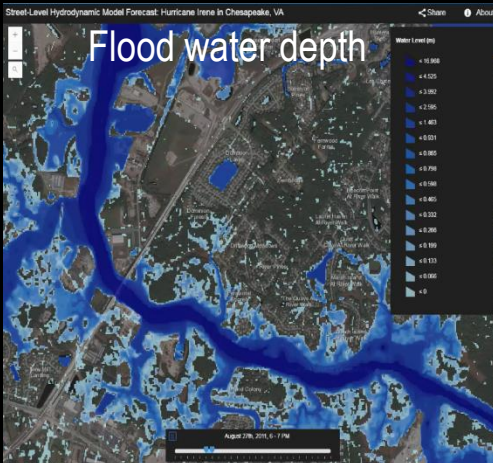
- Geospatially enabled – zoom, flood point depth, embedded photos
- Time-aware flood layers
- Buildings turn from green to red when first floor elevation flood level is exceeded
- Direct flood comparison today vs 2045 – extent and depth

Having that regional water depth map really helps us get a handle on what our future day to day looks like in Norfolk with sea level rise.

--Kyle Spencer, Norfolk Deputy Resilience Officer



Analysis of the town of Oriental, NC determined an additional 28% of the community will experience flooding above the first floor elevations by the year 2045



Virginia Specific Activities and Needs

Army Corps awards business \$23M beach renourishment contract at Wallops Island, helping protect space-flight facilities



A wide-angle view of an inert Minotaur V launch vehicle is erected on the Mid-Atlantic Regional Spaceport's pad 0B at NASA's Wallops Flight Facility in Virginia during a pathfinder exercise for NASA's Lunar Atmosphere and Dust Environment Explorer (LADEE) Mission.

Flood Impact Analysis New

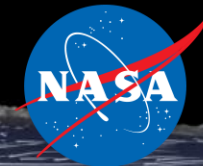


NASA Langley Research Center
Master Plan



Impervious Surface Tool





EXPLORE EARTH

Thank You!