

# 2020 Highlights



EARTH SCIENCE  
APPLIED SCIENCES

In case you missed it, here's a highlight from each program area, with many more at [appliedsciences.nasa.gov](https://appliedsciences.nasa.gov).



Ecological  
Forecasting



Disasters



Water Resources



Health & Air Quality



Food Security  
& Agriculture



Capacity Building



## Ecological Forecasting Mapping Wildlife Sensory "Danger Zones"



This ash-throated flycatcher is one of the 142 North American bird species included in the NestWatch study.

The U.S. National Park Service is constructing Risk Maps to identify which wildlife habitats within the parks are most vulnerable to human activity. Early results show the effects of people on everything from cougars hunting their prey to birds nesting. Working with Ecological Forecasting, these maps include NASA satellite information of Earth at night, land use changes and other details as well as computer models of migration patterns, radio collars on 'apex predators' and a vast collection of data collected by the citizen scientist program [NestWatch](https://nestwatch.org).

**LOCATION:** U.S. National Park System

**DATA USERS AND COLLABORATORS:** U.S. National Park Service's Natural Sounds and Night Skies Division, conservation groups

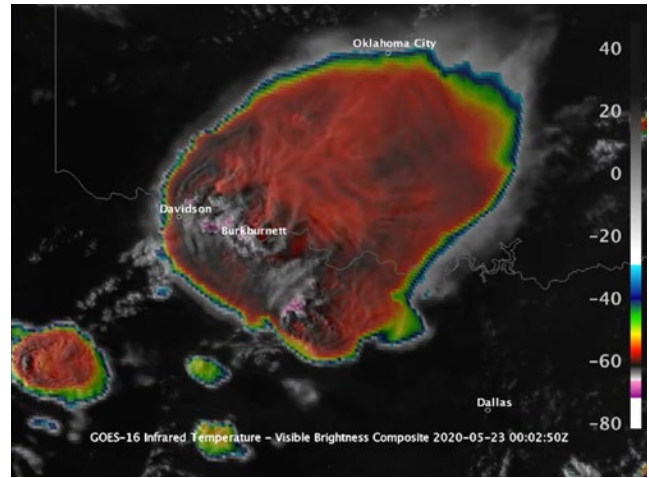
**PRODUCT:** [Risk Map](#)

**EARTH OBSERVATIONS:** VIIRS aboard Suomi NPP and additional NOAA satellites, Landsat, Terra, Aqua

[appliedsciences.nasa.gov](https://appliedsciences.nasa.gov)



## Disasters Tracking Hailstorms



This image from GOES-16 is color-enhanced of infrared wavelength temperature overlaid upon visible wavelength brightness imagery during a massive Midwest hailstorm on May 22-23, 2020.

Hailstorms cause catastrophic damage to homes, businesses, agriculture and infrastructure, making them the costliest severe storm hazard for the insurance industry. That makes reliable, long-term data necessary to estimate damage and assess risks. In a [first-of-its-kind project](#), the Disasters program area is bringing together commercial partners with satellite data to create long-term regional to global scale maps of severe storm occurrence, new methods of forecasting and catastrophe models. The project builds on data collected during a 2020 hailstorm in the American Midwest that set records for storm intensity and damage.

**LOCATION:** U.S. Midwest, South Africa

**DATA USERS AND COLLABORATORS:** Reinsurance Industry, Meteorologists

**PRODUCT:** South Africa CAT Model, Satellite Mapping and Analysis of Severe Hailstorms (SMASH)

**EARTH OBSERVATIONS:** GPM and related historical TRMM data, the GOES series of satellites, ESA's Copernicus satellites



### Water Resources

Transforming Water Management  
in the U.S. West



Nevada alfalfa farmer and OpenET contributor Denise Moyle.

Farmers, water managers and conservation groups worked with the Water Resources program area to create the [first-ever operational system](#) for data on freshwater use and availability at the scale of individual fields across the western United States. Launched in September 2020, OpenET compiles publicly available data and open-source computer models to provide satellite-based information on evapotranspiration (the “ET” in OpenET). The system is set to be available to the public in 2021, supplying evapotranspiration data across 17 western states.

**LOCATION:** U.S. Western States

**DATA USERS AND COLLABORATORS:** Farmers, water managers, the Environmental Defense Fund and other conservation groups

**PRODUCT:** [OpenET](#)

**EARTH OBSERVATIONS:** Landsat, Terra, Aqua and the GOES series of satellites



### Food Security & Agriculture

Monthly Crop Reports



Soybean fields like this are included in the Crop Reports developed by NASA Harvest.

[NASA Harvest](#) is NASA’s Food Security and Agriculture Program, a multidisciplinary consortium implemented by the University of Maryland. Spurred by the international [GEOGLAM](#) initiative, its mission is to enable and advance adoption of satellite Earth observations by public and private organizations to benefit food security and human and environmental resilience worldwide. In 2020 alone, record flooding and droughts greatly affected global agricultural outcomes, showcasing the need for improved agricultural monitoring. For example, GEOGLAM’s monthly [Crop Monitor Reports](#) provide expert consensus on science-based information for developing threats to crop production that could result in major food security and market implications. Reports like these were deemed so helpful to the agricultural community that they were released as often as every two weeks during the harvest season.

**LOCATION:** East Africa, South Asia

**DATA USERS AND COLLABORATORS:** USDA, Asian Rice Crop Estimation & Monitoring (Asia-RICE), U.N. Food and Agriculture Organization, Famine Early Warning System Network (FEWS Net)

**PRODUCT:** [GEOGLAM Crop Monitor](#)

**EARTH OBSERVATIONS:** SMAP, GPM, NOAA’s Advanced Very High Resolution Radiometer, GOES series of satellites



## Health and Air Quality

### Forecasting Dust Storms



Clear skies over Luis Muñoz Marín International Airport in San Juan, Puerto Rico on June 20 (top) and during a massive 2020 dust storm on June 23 (bottom).

A three-day air quality warning system is now in place in Puerto Rico, giving officials and doctors the time to prepare for the poor visibility and health effects of events like dust storms. This Health and Air Quality program area-supported project incorporated NASA satellite and other data into existing air pollution warning systems and was in place just in time for a historically large dust storm in the summer of 2020. Due to our warming world, dust storms are becoming more intense and more prolific. In the southwest U.S. they can spread the disease Valley Fever. In another dust-focused project the program is combining satellite data with innovative types of on-the-ground sensors in the U.S.

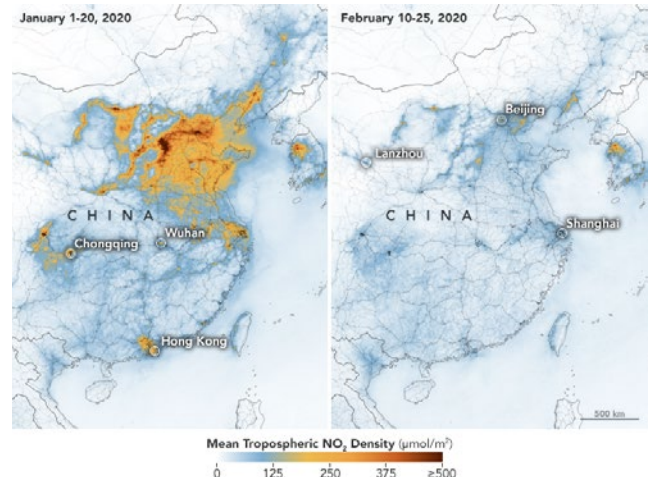
**LOCATION:** Puerto Rico, U.S. southwest

**DATA USERS AND COLLABORATORS:** Healthcare workers, meteorologists, public health officials, state departments of transportation, National Weather Service

**PRODUCT:** Puerto Rico Air Quality Warning System, U.S. National Dust Forecasting, Public Health Surveillance

**EARTH OBSERVATIONS:** VIIRS aboard Suomi NPP and additional NOAA satellites, Landsat, Terra, Aqua, the GOES series of satellites

## COVID-19 Response



Air quality changes were seen in China early in the COVID-19 pandemic.

Air and water quality changes, rescheduling field work and pivoting existing projects to new data were all impacts of the 2020 COVID-19 pandemic. The Health and Air Quality program area led data collaborations and adapted ongoing projects, for example, it moved to include coronavirus into an existing disease tracking project at Johns Hopkins University. The Capacity Building program area held topic-specific trainings; Ecological Forecasting reviewed biodiversity changes and Disasters supplied expertise in resource allocation. The entire Program, in particular NASA Harvest, also provided data to the tri-agency [COVID-19 Earth Observation Dashboard](#) as well as NASA's impact dashboards [air](#), [land](#), [water](#) and [climate](#).

**LOCATION:** Worldwide

**DATA USERS AND COLLABORATORS:** USGS, European Space Agency, Japan Aerospace Exploration Agency

**PRODUCT:** NASA dashboards: [air](#), [land](#), [water](#) and [climate](#). [COVID-19 Earth Observation Dashboard](#)

**EARTH OBSERVATIONS:** Terra, Aqua, the Landsat series of satellites, Suomi NPP and additional NOAA satellites, ESA's Sentinel satellites



## Capacity Building



Training on using NASA Earth science data at the SERVIR-Mekong hub in Thailand.

### SERVIR: Thailand Harnesses the Power of NASA Observations

In 2020 the Thai government unveiled its use of NASA satellite and other Earth science data into its decision-making process to improve on air pollution alerts and air monitoring. Working with the [SERVIR-Mekong](#) hub, the government brought together experts in air quality measurement, technology design, atmospheric modeling and civic engagement. It developed a [web-based platform](#) for tracking and forecasting air quality. SERVIR is a joint initiative between NASA and the [United States Agency for International Development](#) to boost environmental resilience and decision-making in developing regions around the world.

### ARSET: New Languages and Topics

ARSET stands for the Applied Remote Sensing Training program and in 2020 again trained a record number of people world-wide on how to access and interpret NASA Earth science data with more than 30 thousand people trained over the program 11 years. In 2020 ARSET expanded beyond English and Spanish trainings into French and held trainings on air quality as it relates to COVID-19 response, as well as new trainings on urban heat islands.



A water cistern at the Navajo Nation painted with "WATER IS LIFE."

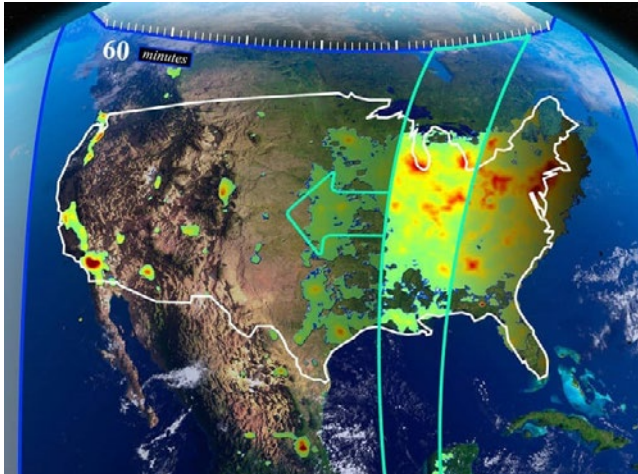
### Indigenous Peoples Pilot: Remote Training for Tribal Lands

Water managers in the drought-prone Navajo Nation now use NASA remote sensing data to better track and forecast freshwater resources. This Drought Severity Evaluation Tool ([DSET](#)) is an outcome of the [Indigenous Peoples Pilot](#), a project of [Capacity Building](#) and [Water Resource's](#) Western Water Application Office ([WWAO](#)). The Pilot is a project that continues to be scaled up from its origin a few-month long early career project. It now includes Navajo Nation [NASA interns](#), remote sensing trainings specific to the Navajo Nation, community engagement and ongoing work with other indigenous communities.

### DEVELOP: Pivoting to Virtual

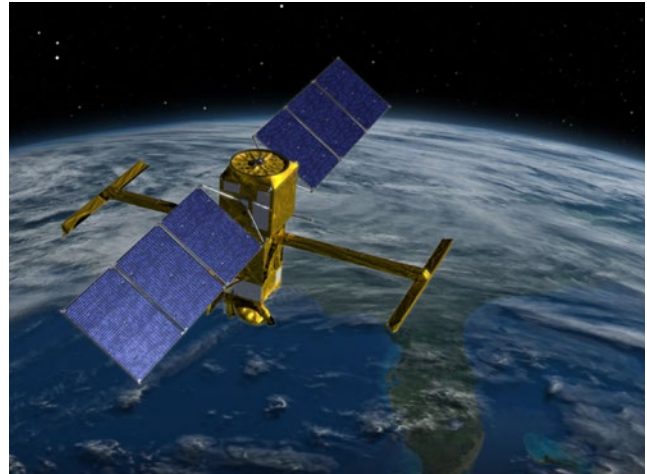
The early-career training program DEVELOP pivoted in 2020 to an entirely virtual process and still succeeded in bringing in more than 20 'DEVELOPers' for each term. Projects included working with the aptly named town of [Satellite Beach, Florida](#) on a goal of 100 percent renewable energy use and assisting [Bhutan](#) track global warming impacts on the Himalayas. The goal of DEVELOP is to increase use of Earth observations by early career scientists and in partner organizations, all to better address current and future challenges.

## Support for Mission Planning



Graphic overview of TEMPO mission.

Participants from the Minnesota Pollution Control Agency the Idaho Department of Environmental Quality were among the more than 100 participants from domestic and international organizations that took part in a Nov. 2020 [Early Adopters Workshop](#) for the [TEMPO](#) mission—Tropospheric Emissions: Monitoring of Pollution. Part of the Early Adopters program, this workshop showcased the latest information about synthetic data products, demonstrations, and examples of application experiment requests. Attendees shared and compared how TEMPO data could add value in their health applications and air quality forecasting and decision-making activities.



An artist's depiction of the upcoming SWOT satellite.

More than 30 computer programmers collaborated in a virtual Summer 2020 Hackathon to develop real-world applications of simulated data from the upcoming Surface Water and Ocean Topography ([SWOT](#)) satellite. This sprint-like event focused on real-time, rapid diagnoses of hurdles faced by early adopters of the data. In one-on-one sessions between these data users and SWOT trainers, more than 50% of diagnosed issues were successfully resolved in the first four hours. For example, in trying to apply SWOT for improving flood forecasting over the Godvari basin in India, the SWOT simulator was not producing information for the basin; the hackers revised the file and defined the correct directory for orbits to resolve the issue.