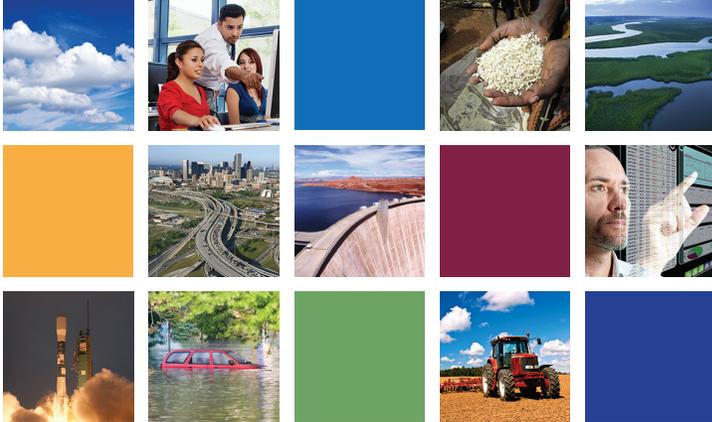


National Aeronautics and Space Administration



2014 ANNUAL REPORT

NASA Earth Science
Applied Sciences Program

For the full report, visit <http://appliedsciences.nasa.gov/ar2014>.

NASA Applied Sciences

We discover and demonstrate innovative and practical uses of Earth science data and knowledge. Our applied research and applications projects foster new opportunities and effective ways to apply Earth science to benefit all humankind.

All Program activities support goals to deliver near-term uses of Earth observations, build new capabilities, and contribute to new satellite missions. Our projects work in partnership with businesses, governments, NGOs, and end users to inform decisions and enable sustained benefits. Applications areas address disasters, ecological forecasting, health and air quality, water resources, and wildfires. Capacity building activities to improve capabilities in applying Earth observations include SERVIR for developing countries, DEVELOP for state and local governments, and ARSET for professional-level training.

This booklet just touches on some highlights from 2014.

Please see our full report online, showcasing many ways that Earth science serves society:
<http://appliedsciences.nasa.gov/ar2014>.

To see the complete 2014 Annual Report online,
visit <http://appliedsciences.nasa.gov/ar2014>.

TABLE OF CONTENTS



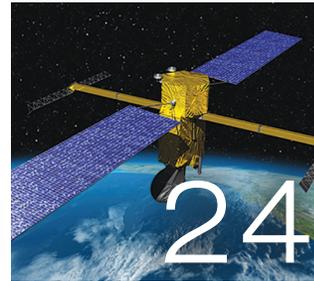
Applications

Disasters
Ecological Forecasting
Food Security
Health & Air Quality
Water Resources
Wildfires



Capacity Building

ARSET
DEVELOP
GOMI
SERVIR



Satellite Missions

Applications Planning
Launches



Program Management

Performance
Awards
Looking Ahead



Disasters

We led NASA's disaster response support for 109 flood events and 20 other disasters globally, such as landslides, volcanoes, and tropical cyclones. NASA provided satellite products to support 37 activations of the International Charter on Disasters and Space.

Several of our disaster projects aided the response to the American Canyon earthquake that struck California. A ground deformation map derived from COSMO-SkyMed radar data helped field responders discover surface rupture and infrastructure damage.



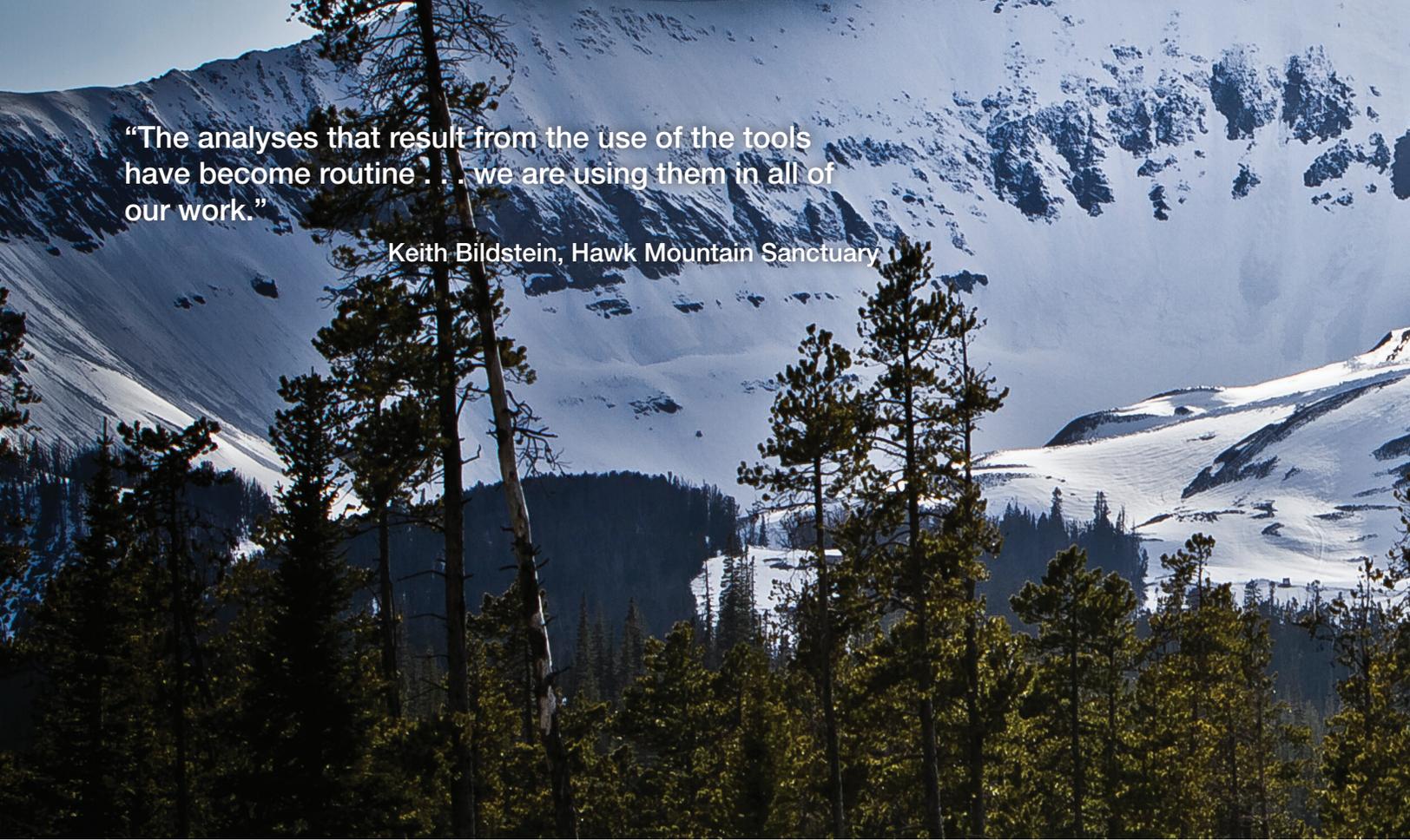
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“We were able to provide imagery, data, and other information products to support decision making in response to more than 150 disaster events in 2014. By targeting application science results and creating strong partnerships prior to these events, NASA’s Earth observations were available to assess risks, predict impacts, and enable recovery for those communities and regions most vulnerable.”

David Green, Applied Sciences Program

A scenic view of a snow-capped mountain range with evergreen trees in the foreground. The mountains are covered in patches of snow and are set against a clear blue sky. The foreground is filled with tall, dark green evergreen trees, some of which are in sharp focus. The overall scene is bright and clear, suggesting a sunny day in a high-altitude environment.

“The analyses that result from the use of the tools
have become routine . . . we are using them in all of
our work.”

Keith Bildstein, Hawk Mountain Sanctuary

Ecological Forecasting

Managers from the U.S. Fish and Wildlife Service and other organizations used new wildlife monitoring tools involving *TRMM*, MODIS, ASTER, and other Earth observations to better assess animal migration and inform conservation management decisions.

Our WhaleWatch project with the National Marine Fisheries Service applied environmental data from *Aqua*, *Jason-2*, and other sources to characterize whale habitats and predict whale presence, helping reduce ship strikes while maintaining fishing and shipping activity.



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Food Security

The Group on Earth Observations Global Agricultural Monitoring initiative, GEOGLAM, continued its monthly production and dissemination of information about global crop conditions and outputs, which helps stabilize markets and reduce price volatility.

The GEOGLAM team refined its monthly Crop Monitor reports to improve the presentation of results, developed a set of crop calendars, held training workshops, and began work on an early warning crop monitor. Follow @GEOCropMonitor for the latest information.



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“In the case of agriculture, improved production forecasts will reduce price volatility, which ultimately will create a more food-secure world — something for which we all should strive.”

Barbara Ryan, GEO Secretariat



“We’ll be able, based on satellite data, to determine how much we need to reduce phosphorus, first in the Western Basin of Lake Erie to eliminate harmful algal blooms.”

Jeffrey Reutter, Ohio Sea Grant College Program



Health & Air Quality

Officials in Ohio applied MODIS chlorophyll observations to help assess public health risks from, and target responses to, freshwater algal blooms. Our project with the Louisiana Department of Health and Hospitals used *Aqua* sea surface temperature data to predict risk of oyster norovirus outbreaks, helping authorities protect public health.

Members of our Air Quality Applied Sciences Team unveiled new *Aura* satellite images of nitrogen dioxide to demonstrate reductions in air pollution across the United States since 2005.



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Water Resources

We worked with the California Department of Water Resources on using *Landsat* imagery for within-season mapping of drought effects on agricultural production in the Central Valley, helping inform the state's allocation of drought emergency funds to counties to support social services for farmworkers and their families.

We selected nine new applications projects to advance the long-term (30-180 day) outlooks of water supply anomalies and their effective use by water managers and decision makers.



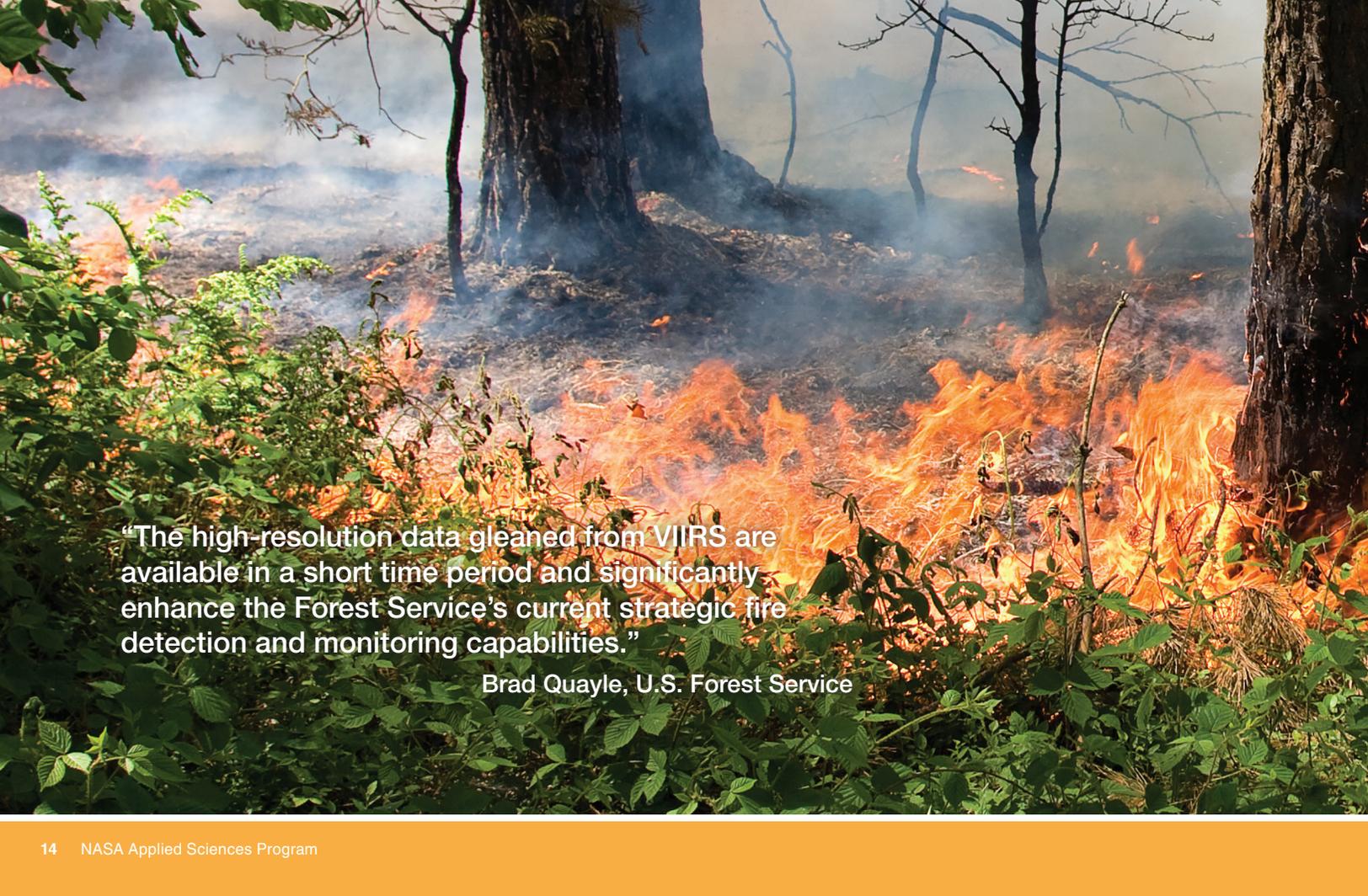
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“We see this project as a first step in improving our use of remote sensing information over the long term. The ability to monitor conditions in close to real time is a major step forward in capacity.”

Jeanine Jones, California Department of Water Resources

A photograph of a forest fire. In the foreground, there are green ferns and other vegetation. In the middle ground, a large fire is burning, with bright orange and yellow flames rising from the ground. Several large, dark tree trunks are visible, some of which appear to be charred or partially consumed by the fire. The background is filled with smoke and more trees, some of which are bare and skeletal. The overall scene is one of a severe forest fire.

“The high-resolution data gleaned from VIIRS are available in a short time period and significantly enhance the Forest Service’s current strategic fire detection and monitoring capabilities.”

Brad Quayle, U.S. Forest Service



Wildfires

The U.S. Forest Service integrated *Suomi NPP* satellite data for enhanced fire detection and fire progression prediction as well as post-fire assessment. The new tool provides wildland fire managers improved ability to determine fire scene boundaries, monitor outbreaks earlier, protect firefighters and resources, and advance timely ecosystem restoration.

The Autonomous Modular Sensor, which we helped transfer to the U.S. Forest Service, made its debut to help incident command teams allocate resources to fight wildfires.



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ARSET

Our Applied Remote Sensing Training program conducted 11 training sessions and webinars, involving over 1,000 participants in 46 U.S. states and 90 countries. New webinars about satellite data products for water quality and land management attracted people from around the world and included a session and materials in Spanish.

Participation increased 71 percent over the previous year. Trainees included managers and specialists from conservation groups, government agencies, regulatory entities, and research institutions, among others.



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“I was able to immediately incorporate my new knowledge of accessing, analyzing, and visualizing satellite data into my day-to-day duties.”

ARSET Course Participant

A woman with long blonde hair, wearing a dark blazer over a white top, is speaking at a podium. A man in a dark suit and tie stands to her left. In the background, there is a red and white striped flag and a blue screen with some text. The scene is lit with stage lights.

“The NASA DEVELOP team . . . provided valuable analysis, data, mapping, and field work to the Miami-Dade Western Greenway planning project. Their contributions assisted the decision-making process and were used to inform the greenway routing.”

**Alissa Turtletaub, Miami-Dade County Parks,
Recreation and Open Spaces Department**

DEVELOP

Our DEVELOP program had its highest number of participants and projects; 379 people conducted 83 applications projects reaching 160 end-user organizations that benefitted from uses of Earth observations.

One project helped Miami-Dade County officials incorporate *Terra* land cover data in the planning for a proposed greenway to help protect the Florida Everglades. In another, biologists used *Landsat* data to identify critical habitats for the cotton-top tamarin, supporting conservation strategies to protect this endangered monkey.



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Gulf of Mexico Initiative

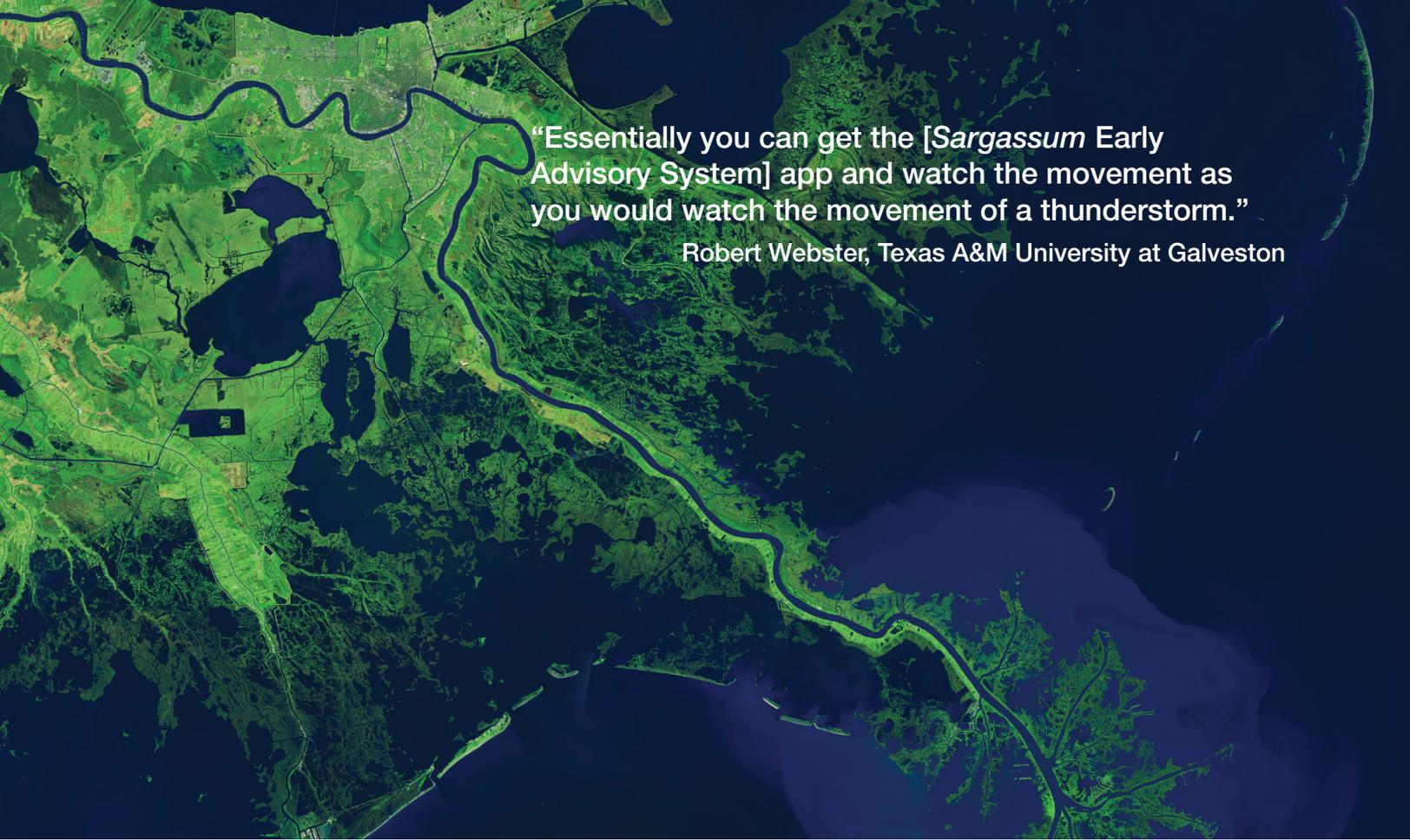
The GOMI-sponsored *Sargassum* Early Advisory System, SEAS, continued providing *Landsat*-based seaweed landing alerts. The SEAS team expanded beyond Texas to the west coast of Florida and issued 100 *Sargassum* alerts to help managers better prepare for landings.

We worked with NOAA to further develop uses of MODIS data in detection of ocean oil spills. We worked on *Landsat*-based applications of automated impervious cover identification, providing information for urban planners, real estate developers, and environmental managers.



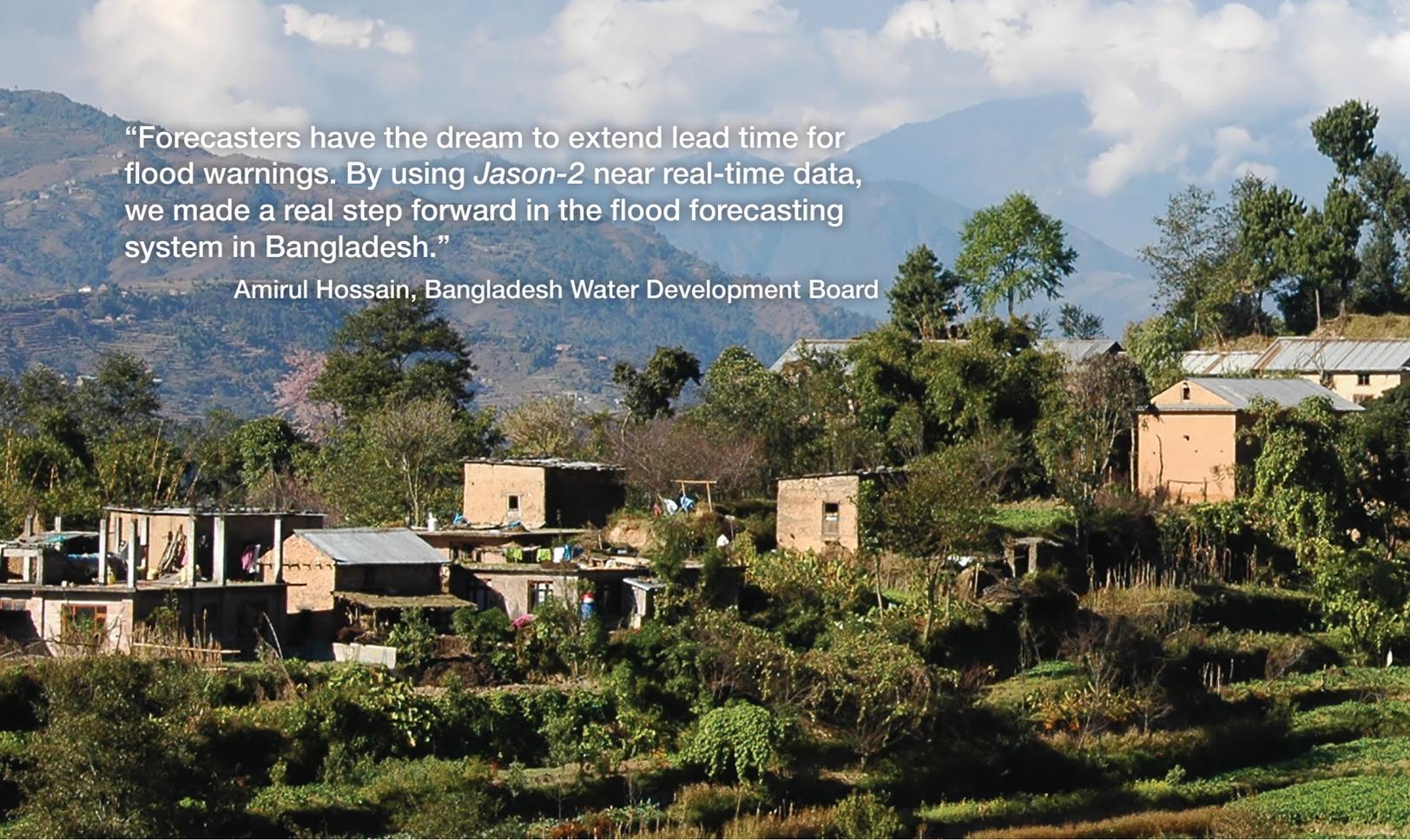
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An aerial satellite image of a coastal region, likely the Gulf of Mexico coast. A prominent river winds through a green, marshy landscape. The river starts in the upper left and flows towards the bottom right, eventually meeting the ocean. The surrounding land is a mix of green vegetation and some developed areas. The ocean is visible on the right side of the image.

“Essentially you can get the [*Sargassum* Early Advisory System] app and watch the movement as you would watch the movement of a thunderstorm.”

Robert Webster, Texas A&M University at Galveston



“Forecasters have the dream to extend lead time for flood warnings. By using *Jason-2* near real-time data, we made a real step forward in the flood forecasting system in Bangladesh.”

Amirul Hossain, Bangladesh Water Development Board

SERVIR

NASA and USAID announced a new hub for the Lower Mekong River Basin. We also launched a SERVIR online product catalogue, and SERVIR's activities reached 44 countries and 159 institutions.

In Bangladesh, the Flood Forecasting and Warning Centre used *Jason-2* satellite data of river heights to extend its forecasts to eight days, enabling earlier warnings to the public. Six African countries adopted *Landsat*-derived maps on land use/cover change, supporting natural resource management and many other uses.



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http://appliedsciences.nasa.gov/ar2014](http://appliedsciences.nasa.gov/ar2014)

Applications and Satellite Mission Planning

We had record levels of events to support Earth science missions, introducing new users to the satellites, exploring potential applications, and helping increase benefits from the missions.

We held applications workshops for *OCO-2*, *SMAP*, *HyspIRI*, and *NISAR*. *ICESat-2* and *SMAP* expanded their Early Adopters activities. *SWOT* completed its applications plan, *PACE* formed an applications group, and *GRACE-FO* promoted applications at many events. The CDC hosted a special *SMAP* workshop on health and disease applications.

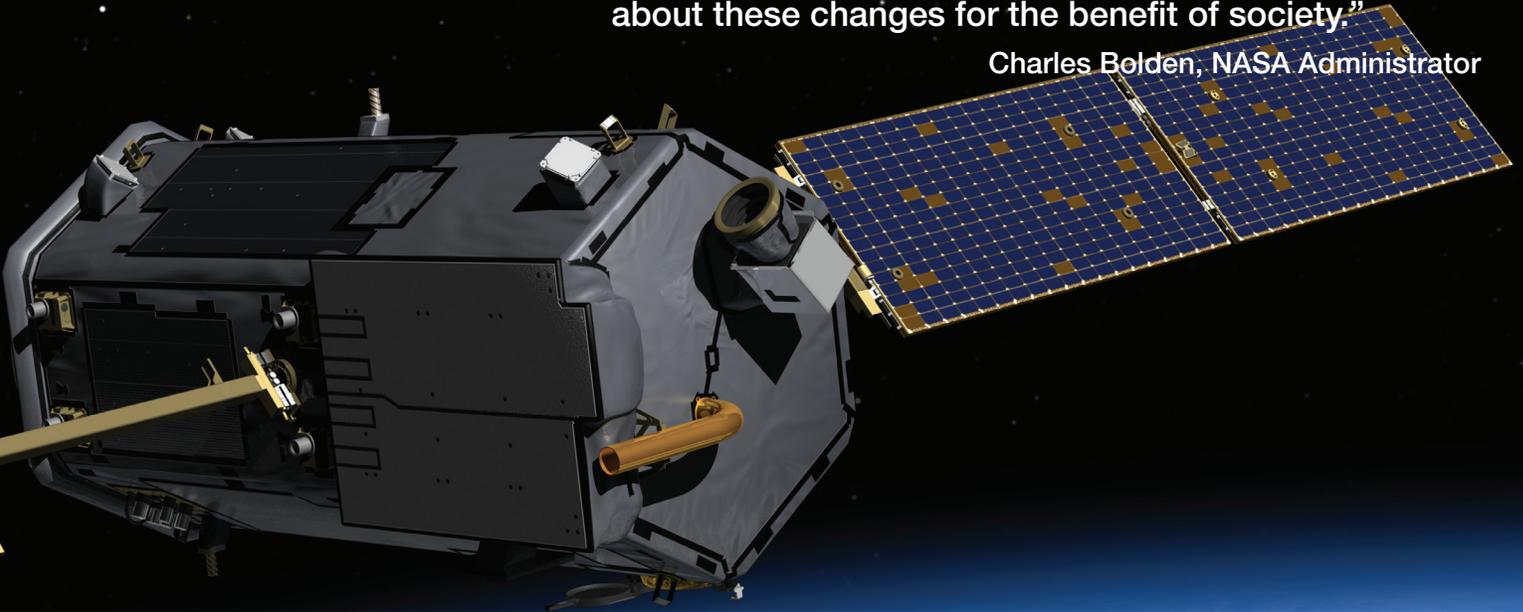


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“Climate change is the challenge of our generation. With OCO-2 and our existing fleet of satellites, NASA is uniquely qualified to take on the challenge of documenting and understanding these changes, predicting the ramifications, and sharing information about these changes for the benefit of society.”

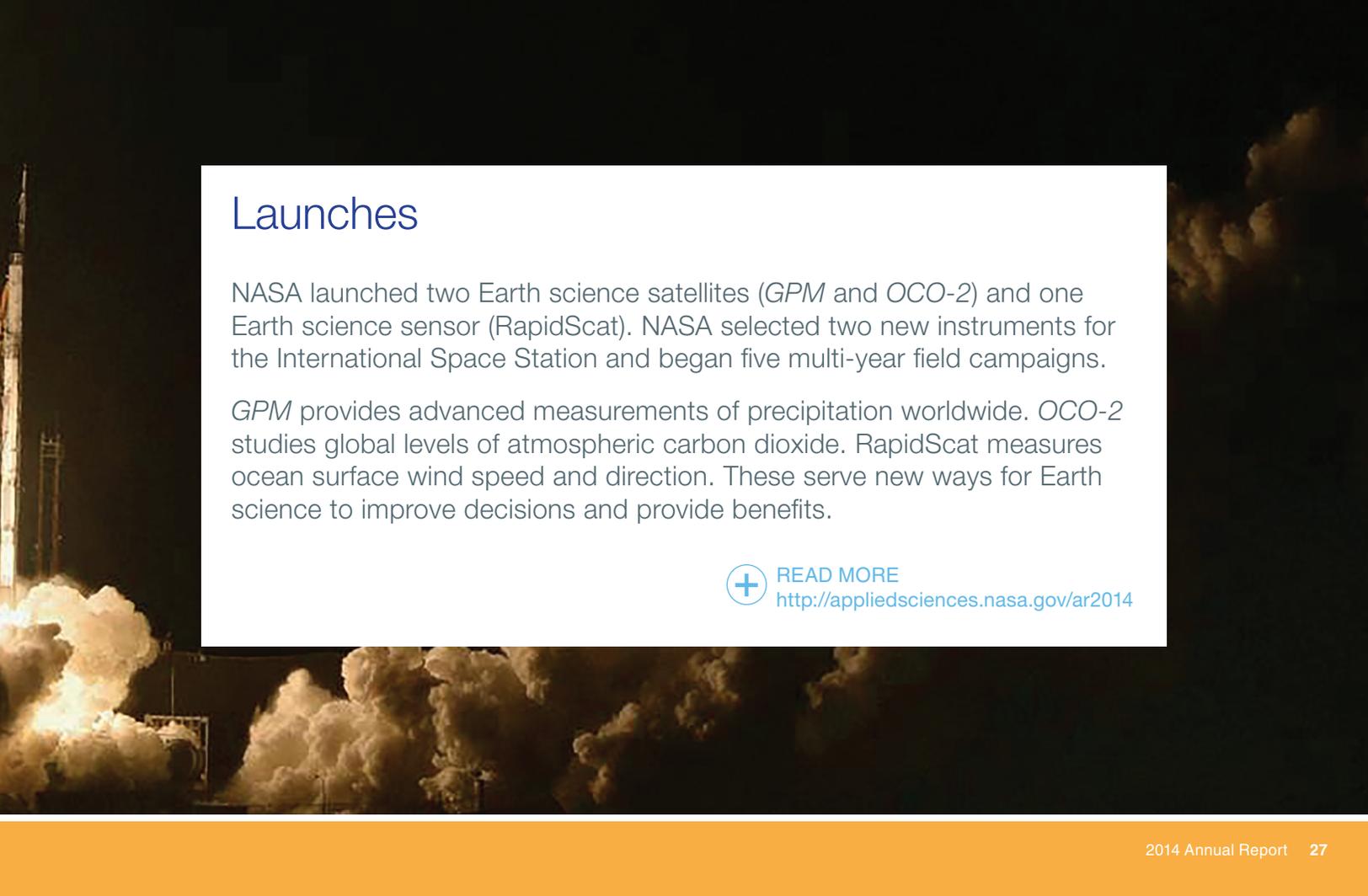
Charles Bolden, NASA Administrator



“With this [*GPM* satellite] launch, we have taken another giant leap in providing the world with an unprecedented picture of our planet’s rain and snow. *GPM* will help us better understand our ever-changing climate, improve forecasts of extreme weather events like floods, and assist decision makers around the world to better manage water resources.”

Charles Bolden, NASA Administrator





Launches

NASA launched two Earth science satellites (*GPM* and *OCO-2*) and one Earth science sensor (*RapidScat*). NASA selected two new instruments for the International Space Station and began five multi-year field campaigns.

GPM provides advanced measurements of precipitation worldwide. *OCO-2* studies global levels of atmospheric carbon dioxide. *RapidScat* measures ocean surface wind speed and direction. These serve new ways for Earth science to improve decisions and provide benefits.



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Performance

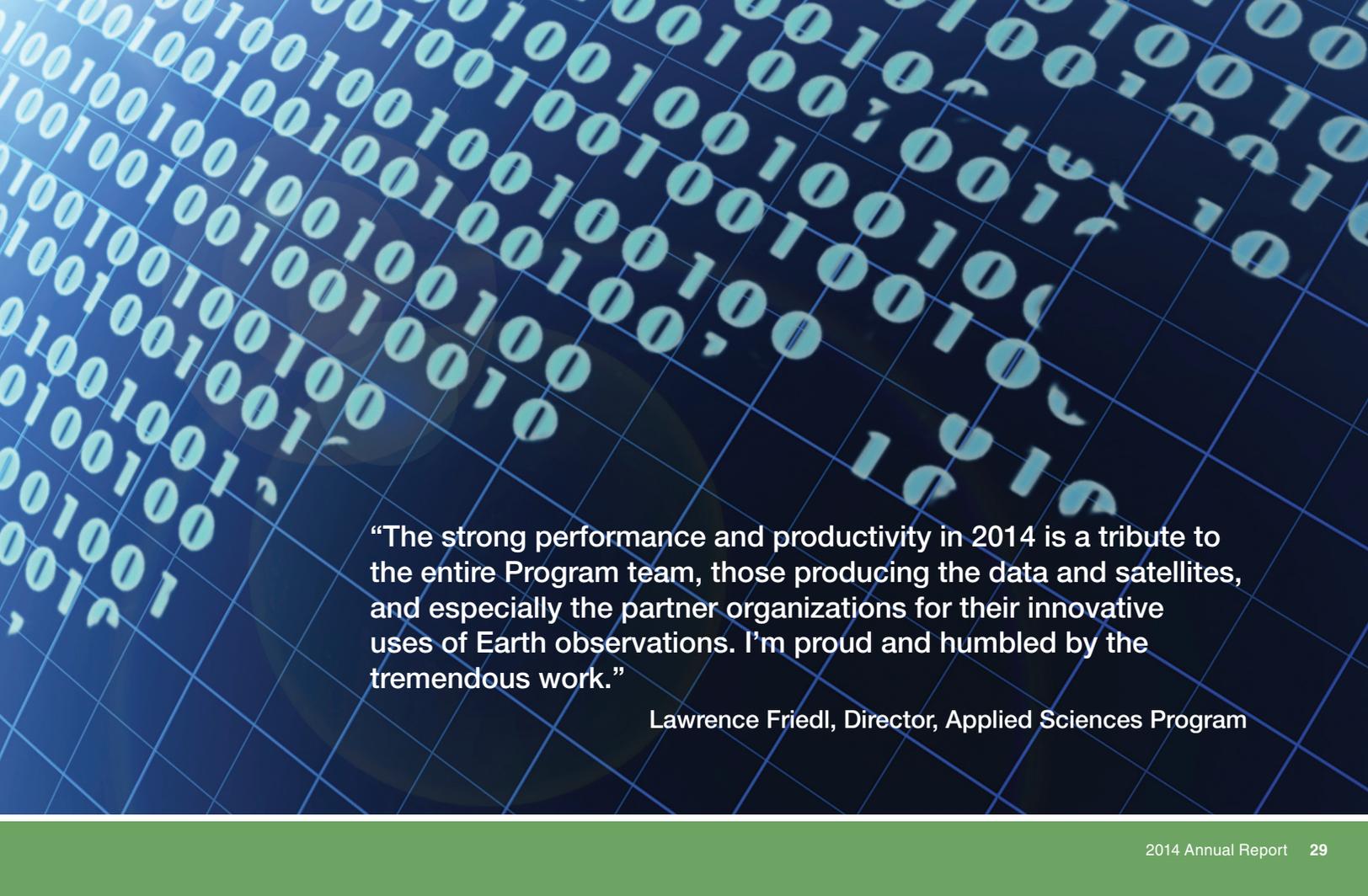
We achieved our 2014 performance goal to advance 25 percent of our Earth science applications projects by one Application Readiness Level (ARL). Overall, 59 percent of the projects advanced one ARL, and four projects reached ARL 9, the highest level.

DEVELOP had its highest number of participants and projects ever, and ARSET reached over 1,000 trainees. The Wildfires and Disasters areas each selected a subset of feasibility studies to continue as in-depth applications projects.



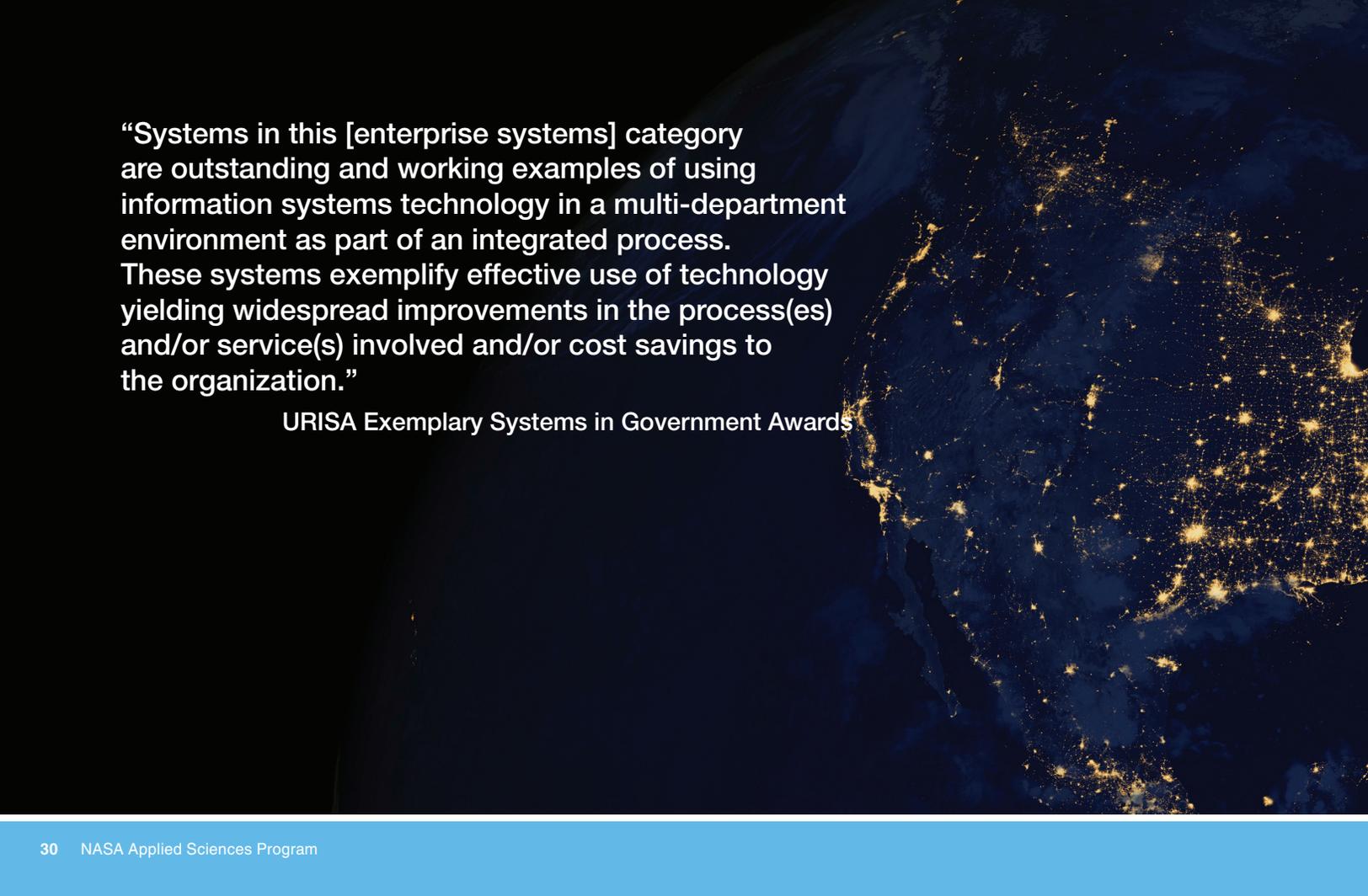
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“The strong performance and productivity in 2014 is a tribute to the entire Program team, those producing the data and satellites, and especially the partner organizations for their innovative uses of Earth observations. I’m proud and humbled by the tremendous work.”

Lawrence Friedl, Director, Applied Sciences Program

A satellite view of Earth at night, showing the Western Hemisphere. The landmasses are dark, while the cities and urban areas are illuminated with bright yellow and white lights. A network of glowing lines connects various points across the continents, suggesting a global network or data flow. The background is a deep, dark blue, representing the night sky.

“Systems in this [enterprise systems] category are outstanding and working examples of using information systems technology in a multi-department environment as part of an integrated process. These systems exemplify effective use of technology yielding widespread improvements in the process(es) and/or service(s) involved and/or cost savings to the organization.”

URISA Exemplary Systems in Government Awards

Awards

Our DEVELOP program received a Learning! 100 Award in recognition of excellence and innovation in learning. Keith Weber, a wildfires investigator we sponsor, received an Exemplary Systems in Government Award from URISA, the Urban and Regional Information Systems Association.

Esri honored the host organization for SERVIR-Himalaya with a Special Achievement in GIS Award. Our program received a gold 2014 Hermes Creative Award from the Association of Marketing and Communication Professionals.



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Looking Ahead

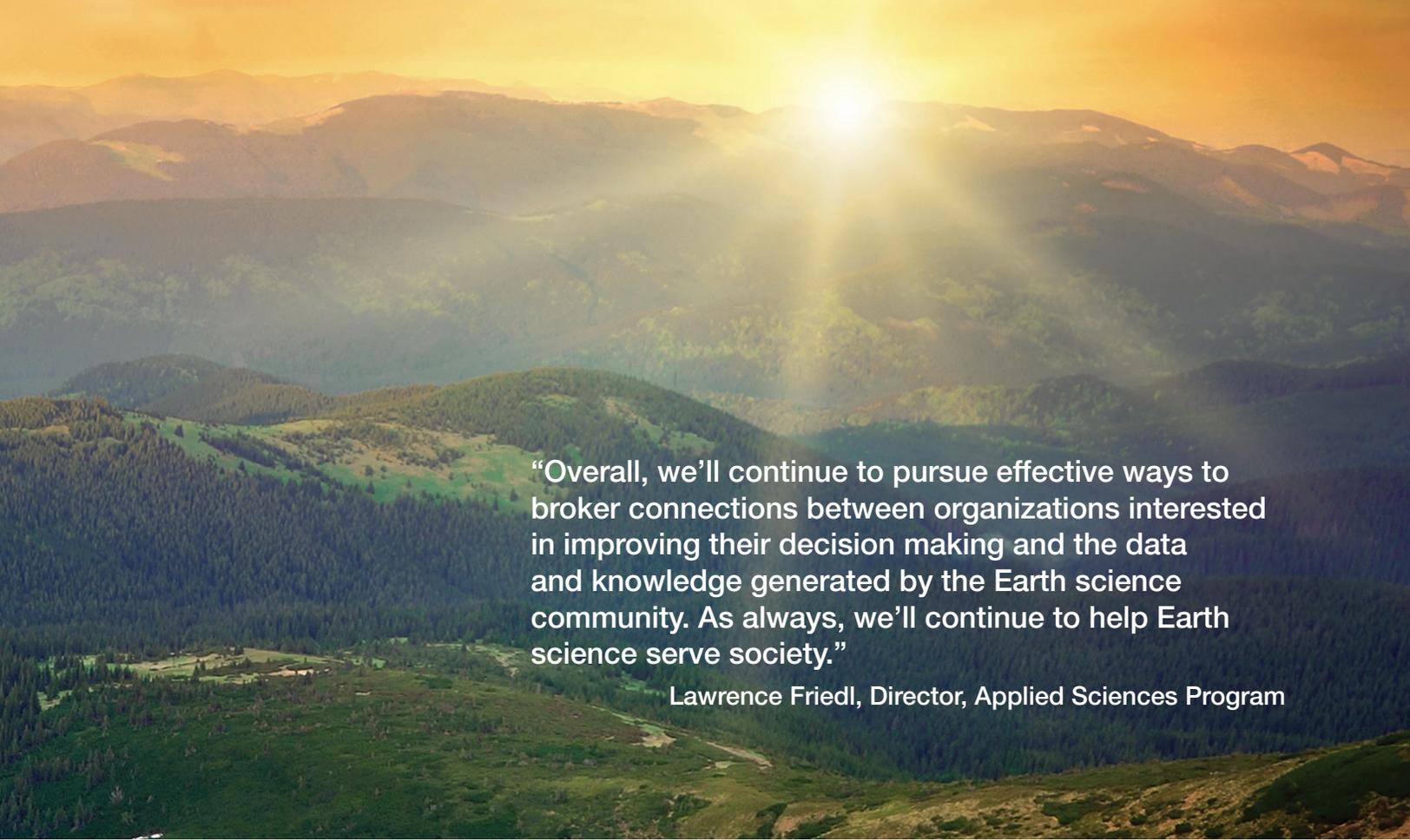
We're excited for more successes in 2015 and beyond. New projects in the Water Resources and Health & Air Quality areas will begin. ARSET will conduct its first training on wildfires, and the SERVIR-Mekong hub will begin operations in earnest.

We will hold applications workshops with the *ICESat-2*, *CYGNSS*, *HyspIRI*, *GPM*, and *NISAR* missions, among others. Our community will contribute to the second Earth Science Decadal Survey. The *SMAP* and *CATS* missions will launch, adding new opportunities to benefit society.



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“Overall, we’ll continue to pursue effective ways to broker connections between organizations interested in improving their decision making and the data and knowledge generated by the Earth science community. As always, we’ll continue to help Earth science serve society.”

Lawrence Friedl, Director, Applied Sciences Program





NASA Earth Science Applied Sciences Program

<http://AppliedSciences.NASA.gov>

To see the full 2014 Annual Report with videos and other content,
visit *<http://appliedsciences.nasa.gov/ar2014>*.

Image credits: U.S. Army (flooding, pp. 4–5); Jane Baker (mountain, pp. 6–7); NASA (launch images, depictions of satellites, depiction of global vegetation data, DEVELOP presenters, imagery from satellites, cover through p. 34). All other images are from Thinkstock.

The Applied Sciences Program is part of the Earth Science Division of the NASA Science Mission Directorate.

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