

NASA Earth Science Division, Applied Sciences Program

Capacity Building Program

Summary of Calendar Year 2012

Overview

The Capacity Building Program (CBP) sponsors programs and projects that improve the skills and capabilities of current and future decision makers, community leaders, and resource managers in the United States and abroad related to accessing and apply Earth observations. CBP builds capacity across all nine Group on Earth Observation (GEO) societal benefit areas, including (1) Disasters, (2) Ecological Forecasting and Biodiversity, (3) Health and Air Quality, (4) Water Resources, (5) Agriculture, (6) Climate, (7) Oceans, and (9) Weather.

CBP defines capacity building as activities that strengthen or contribute to the strengthening of the U.S. and developing world capacity to use NASA Earth observations data/products in decision making, including human, scientific, technological, organization, institutional, and resource-based capacities. CBP was formed in fall of 2011 by combining the following existing Center-led projects into a new line of business within the Applied Sciences Program:

1. **Applied Remote Sensing Training (ARSET):** increases utility of NASA Earth science and model data by providing training to decision makers and applied science professionals in water resources and air quality areas.
2. **DEVELOP:** supports young and transitioning professionals in working on applied science projects with NASA science advisors and end users.
3. **Gulf of Mexico Initiative (GOMI):** addresses coastal management issues and enhance the ecological and economic health of the Gulf region.
4. **SERVIR:** provides Earth observation data and science applications to help developing regions improve their environmental decision making through a partnership with the U.S. Agency for International Development (USAID).

Capacity Building Program (CBP) had its first full year in 2012 as a Program. CBP experienced both growth and realignment this year, both at the level of its program elements as well as the program level. CBP worked to integrate and leverage across the four projects, as well as to identify potential other capacity building elements needed within the program. Several new partnerships and opportunities were explored and are being developed. Overall program highlights for 2012 include:

- The CBP organized and held an independent review of the program in May 2012 to identify gaps, overlaps, and areas to consider in future planning.
- ARSET had an outstanding year, with a record number of participants and several “firsts” in course development (more than doubling from 166 in 2011 to 350 participants in 2012).
- DEVELOP had a record-breaking year in 2012, having sponsored 337 participants, 69 projects (27-30% growth since 2011). The program partnered with 128 unique

organizations throughout the 2012 both in the United States as well as in the developing world.

- GOMI had an active 2012, supporting approximately 200 scientists to bring their 44 projects to completion. These projects span the northern Gulf of Mexico region and the southeastern United States, bridging between science and society by linking technical experts with regional decision-makers.
- SERVIR had an expansive growth year. The overall project underwent an important realignment, enabling more effective and efficient operations with respect to partner hub institutions; USAID brought a new team on board to address “demand”-related activities, NASA brought on the SERVIR Applied Sciences Team, comprised of 11 new investigator teams and projects. All the while, the hubs and SERVIR Coordination Office continued to co-develop applications based on regional needs.

Major Accomplishments

CY2012 was an important year for the Capacity Building Program, with a number of critical activities that were pursued:

- The Capacity Building Program Assessment (May 7-9, 2012) was an important strategy and reflection meeting that was used to identify gaps and opportunities to grow, and begin to develop a plan to address areas in which CBP could be strengthened and made more cohesive. For example, an area identified that we are addressing is to develop an overall CBP strategic framework in addition program-element level strategic frameworks.
- The Capacity Building Program pursued a number of partnerships to broaden the reach of the program and to contribute to the goal of broadening the utility and use of NASA Earth observation across traditional and non-traditional partners. Some highlights of these activities include:
 - U.S. Water Partnership (USWP) participation. The USWP was launched in June 2012 in conjunction with RIO+20 to *“unite and mobilize the best of U.S. expertise, resources, and ingenuity to address global water challenges, with a focus on developing countries where needs are greatest.”* Members include USG, NGOs, and private sector. CBP has been very involved in this partnership, including participating in the USWP-sponsored water side meeting at the 67th United Nations General Assembly and USWP member meetings to build awareness of the use of remote sensing to address water issues in the developing world.
 - In 2012, we initiated collaborative discussions with two USWP partners, World Resources Institute and Skoll Global Threats, which were interested in developing a better understanding of how to use NASA satellite data, tools, and products to improve estimates of water risk for the business sector as well as for regional focused water efforts.
 - CBP participated in InterAction Forum in 2012. This annual meeting allows the leadership of NGOs, governments, philanthropy, corporations, and civil society to engage and forge common solutions to improve the lives of the world’s poor and marginalized, moving us toward a sustainable planet that works for all. Initial discussions were held with World Vision about its work

drilling wells in Africa that were continued within our mutual participation in the USWP.

- CBP participated in several interagency and international working groups.
 - U.S. Group on the Earth Observations (GEO) Capacity Building Working Group. The purpose of this working group is to develop and promote a U.S.-based strategy to improve building the capacity to use Earth observations. Participation in this activity (for example, at the U.S. GEO Capacity Building Working Group monthly discussions) was important for communicating and building upon the NASA Capacity Building Program efforts.
 - Committee on Earth Observations (CEOS) Working Group for Capacity Building and Data Democracy (WGCapD). NASA CBP is supporting WGCapD's ongoing efforts (such as at the CEOS WGCapD Annual Meeting in March 2012) to communicate NASA's capacity building activities. Support was provided to the definition of a training workshop in Kenya to use digital elevation models in flood models as well as to an e-learning course led by the Brazilian Space Agency INPE.
- CBP responded to several specific requests from countries needing additional information regarding the use of Earth science data, products, and tools to address their country specific needs, including Peru and Vietnam.

Workshops, Communications, Outreach

The CBP participated in two society meetings, in addition to all the activities described below by the specific program elements:

Institute of Electrical and Electronics Engineers (IEEE) Global Humanitarian Technology Conference. October 21-24, 2012. CBP participated in the Societal Benefits and Impacts panel.

American Geophysical Union. December 2012. CBP chaired a capacity building session as well as presented "Dimensions of Capacity Building: Lessons Learned from the Applied Science Program."

Looking Ahead

In 2013, the CBP looks forward to continuing to address the CBP findings. Strategic planning discussions will be held, leading to a five-year plan. CBP will delve into understanding limitations and difficulties in using Earth science data, products, and tools. CBP will explore other domestic and international capacity building activities that might be leveraged, as well as map boundary organizations that could help CBP increase impact because they already work with key end user groups. CBP will continue to explore new partnerships and build awareness regarding Earth science assets and their usefulness to address environmental issues both in the U.S. and abroad. CBP will define methodologies to track impact at the program as well as program element level. And, CBP will continue to work with the program element teams to ensure they have what they need to continue to do their great work, and to integrate and leverage each other's work. Read ahead to learn about all their great accomplishments in 2012, building capacity around the world.

**NASA Applied Sciences Program
Capacity Building Program**

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To learn more about the Applied Sciences Program:

<http://appliedsciences.nasa.gov/>

All of NASA's data is free and available at:

<https://earthdata.nasa.gov/>

NASA Earth Science Division, Applied Sciences Program

ARSET

Summary of Calendar Year 2012

Overview

Applied Remote Sensing Training (ARSET) provides professional training in remote sensing and the application of Earth observations. In 2012, ARSET provided professional workshops in air quality and water resources, working directly with state, federal, and tribal agencies as well as the private sector to develop and conduct both in-person and online courses. The courses train professional practitioners how to access, visualize, and apply Earth science data to inform decisions.

ARSET had an outstanding year, with a record number of participants and several “firsts” in course development.

ARSET expanded its online courses in 2012, and it more than doubled the number of online and in-person participants from 166 in 2011 to 350 in 2012. Overall, ARSET conducted a total of 10 online and in-person courses. Eight courses were on air quality (<http://airquality.gsfc.nasa.gov>) and two were on water resources, covering uses of flooding tools and precipitation products (<http://water.gsfc.nasa.gov>).

Air Quality

For the first time, online webinars were a prerequisite for in-person air quality courses. These webinars occurred weekly for four to five weeks, providing background for the hands-on exercises conducted during the subsequent in-person training. The in-person sessions employed tailored case studies that demonstrated uses of Earth observations for the specific environmental management topics of interest to course attendees. ARSET held a hands-on training in March for Lake Michigan Air Directors Consortium (LADCO) member states, one in June for the Desert Research Institute (DRI), and one in October with Canadian environmental professionals at Environment Canada. ARSET held five-week online courses preceding each of these. When asked about the value of the online course experience, one end user stated, “For me, the greatest value in attending these events was to learn about all the possible applications of remote sensing in the different fields of air quality.”

The program also offered its first advanced-level course online in 2012, addressing special topics in air quality remote sensing. A five-week course in July and August covered a step-by-step methodology for using aerosol and carbon monoxide observations from MODIS and *Aqua*/AIRS to analyze air pollution due to fires. The course focus was the 2012 summer season wildfires in Colorado, Utah, and Montana and their effect on receptor sites in Iowa and Illinois. More than 50 individuals from 29 different government agencies, universities, and organizations participated in the course. It had attendees from six past ARSET in-person courses, including LADCO, DRI, and the California Air Resources Board.

In 2012, ARSET played a key role in facilitating interactions between the Air Quality Applied Sciences Team (AQAST) and regulators from state air quality agencies in the United States. AQAST team members participated in ARSET training activities, where they had opportunities to share their research knowledge and tools with the air quality managers. At the request of course participants, ARSET organized a NASA session in October at the Central States Air Resource Agencies' annual meeting that featured presentations on AQAST projects.

Water Resources

In June, the National Weather Center at the University of Oklahoma, Norman, hosted an in-person ARSET course for water resources managers. This training addressed flood analysis using *TRMM* and MERRA products. The course included case studies specific to drought and flooding in Oklahoma using *TRMM* rainfall, AIRS and MODIS cloud data, NLDAS soil moisture, and MERRA wind and humidity products. Participants learned how to access, visualize, and analyze Earth observations to detect inter-annual rainfall variability and associated effects on large-scale soil moisture and evapotranspiration over Oklahoma. Among the participating organizations were the Oklahoma Water Resources Board, Oklahoma Department of Environmental Quality, Chickasaw Nation, USGS, University of Oklahoma Center for Spatial Analysis, and Association of Central Oklahoma Governments.

In a five-week, online training late in 2012, ARSET reached 65 end users from across the world on applications of Earth observations to flooding, hydrologic modeling, and droughts. It was the first online ARSET course for water resources managers. The course included participants from Belize, Jamaica, and Bolivia, SERVIR hubs in East Africa and the Hindu Kush–Himalayan region, NOAA, and USAID representatives engaged in capacity building. The sessions also contributed to U.S.–World Bank remote sensing efforts by enabling the participation of 15 World Bank staff and partners in Africa and the Middle East. Case studies covered uses of decision support tools and data sets in the United States, South America, East Africa, and Southeast Asia.

Evaluating the Program

ARSET began a formal evaluation process in 2012 to help assess progress to date and inform future directions. Interviews with ARSET participants from the past three years revealed that ARSET helped inform many organizations' executives of the scope of applications of Earth science data. End users reported benefits to their professional development, such as research and data collaboration projects formed as a result of ARSET training. The trainings also enabled them to articulate topics of interest for subsequent ARSET courses.

Most notably, the trainings catalyzed their use of Earth observations and remote sensing products. One air quality manager stated, "Our upper management was not very familiar with that aspect [of air quality remote sensing] and they were pretty impressed by the end of the presentation, that there is something out there we could get easily and use. From there, it was very helpful that they would allow us to do these things. Everything went smoothly from there."

Looking Ahead

In addition to air quality and water courses, ARSET plans an increased focus in 2013 on courses for disaster applications, especially tools for flood potential monitoring. ARSET also plans to offer courses on the application of NASA snow products to water resources management in the western United States., and to develop training modules on land products. The ARSET team will also develop a trainer's manual, which will provide guidance on ways to communicate Earth science research within a capacity building framework.

Feature Story

In March 2012, ARSET conducted a three-day training on the use of NASA satellite data for air quality applications in Madison, Wisconsin, reaching 20 attendees from federal agencies in the United States and Canada as well as state agencies in the Great Lakes region, Utah, and Oklahoma. Participating agencies included the Minnesota Pollution Control Agency, Michigan Department of Environmental Quality (DEQ), Indiana Department of Environmental Management, Wisconsin Department of Natural Resources, Idaho DEQ, Oklahoma DEQ, Region 5 of the U.S. Environmental Protection Agency, Michigan Tech Research Institute, and Environment Canada. LADCO co-sponsored the event.

The program requires participation in an ARSET webinar prior to attending in-person training, so for many participants this was their second ARSET course. A five-week ARSET webinar held in February provided participants with the knowledge necessary to identify their topics and data products of interest for the subsequent March course, allowing ARSET to tailor the Madison course to Midwestern environmental management challenges. One case study featured during the course examined the Pagami Creek Fire (Minnesota, September 2011) and how to utilize Aqua/AIRS carbon monoxide, *Terra and Aqua*/MODIS aerosols and *Aura*/OMI nitrogen dioxide imagery to monitor the fire and smoke emissions in Minnesota and neighboring Great Lakes states. One ACAST member joined the ARSET team to demonstrate use of a tool for comparing *Aura*/OMI nitrogen dioxide observations to air quality model data.

According to Sara Strachan, the Idaho DEQ “got an enormous amount of benefit” from the course. The course in Madison enabled the Idaho DEQ to apply MODIS smoke imagery and AIRS carbon monoxide observations to air quality forecasts during the summer wildfire season of 2012. Strachan explained: “I followed the case study template developed by ARSET to develop our own methodology/sequence for accessing and analyzing satellite data, that I would go through every day (about two hours’ time). I then used the satellite and monitor information to produce a daily a report that I provided to the forecasters. I put NASA image layers of smoke and carbon monoxide into GIS and combined them with fire detection data and our own monitor data. The summaries helped us understand smoke behavior, and our forecasters found them very helpful. We will also be using what we learned in the NASA ARSET course for our exceptional event demonstrations.” And she added: “It’s amazing that NASA offers this course for free. NASA is doing the right thing, if you want people to use your data, you have to show them how to use it—otherwise it is intimidating to use.”

Selected Publications and Conference Presentations

Kleidman, R., Ana I. Prados, and Pawan Gupta, "Best Practices in Using Satellite Data for Air Quality," EPA-sponsored Satellite Observations for Air Quality Management meeting, University of Maryland Baltimore County, January 11, 2012.

Prados, Ana I., "Connecting NASA Science to Policy through Capacity Building," NASA Education and Public Outreach Seminar, NASA GSFC, January 19, 2012.

Prados, Ana I. and Amita V. Meta, "NASA Applied Remote Sensing Training: Building Capacity to Integrate NASA Earth Science into Water Resources Management Applications," U.S.–World Bank Remote Sensing Workshop, Washington, D.C., February 29, 2012.

Prados, Ana I., "NASA Sponsored Workshop on Evaluating the Impact of Earth Science," *The Earth Observer*, Volume 24, Issue 2, March–April 2012.

Prados, A. I., "The NASA Applied Remote Sensing Training Program," NASA ACAST Meeting, June 13–15, 2012.

Duncan, B., and A. I. Prados, "Creating an Objective 'ACAST Recommendations from Air Quality Satellite Missions' Document for NASA Mission Planners," NASA ACAST Meeting, June 13–15, 2012.

Liu, Y., A. Prados, R. Kleidman, P. Gupta, and J. Witte, "NASA's Applied Remote Sensing Training Program," NASA Health and Air Quality Applications Program Review, September 20, 2012.

Gupta, P., Ana I. Prados, R. Kleidman, J. Witte, and Y. Liu, "NASA's Applied Remote Sensing Training Program," *Aura* Science Team Meeting, October 1–3, 2012.

Prados, A. I., "NASA's ARSET Training Program: From the Classroom to Real-World Satellite Applications," *Earthzine*, October 2012.

Prados, A. I. and Amita Mehta, "NASA's Applied Remote Sensing Training (ARSET) Program," Hydrology Applications Joint Mission Tutorial for *SMAP* with *GPM*, *GRACE-FO* and *SWOT*, USGS National Center, Reston, Virginia, October 17–18, 2012.

Kleidman, R., A. Prados, P. Gupta, and Y. Liu, "Updates on NASA Applied Remote Sensing Training Program," NASA ACAST Meeting, November 29–30, 2012.

Acronyms

AIRS: Atmospheric Infrared Sounder

ACAST: Air Quality Applied Sciences Team

ARSET: Applied Remote Sensing Training

DEQ: Department of Environmental Quality

DRI: Desert Research Institute

EPA: U.S. Environmental Protection Agency
GIS: geographic information system
GPM: Global Precipitation Measurement
GRACE: Gravity Recovery and Climate Experiment
GRACE-FO: GRACE Follow-On
GSFC: Goddard Space Flight Center
LADCO: Lake Michigan Air Directors Consortium
MERRA: Modern-Era Retrospective analysis for Research and Applications
MODIS: Moderate Resolution Imaging Spectroradiometer
NASA: National Aeronautics and Space Administration
NLDAS: North American Land Data Assimilation System
NOAA: National Oceanic and Atmospheric Administration
OMI: Ozone Monitoring Instrument
SMAP: Soil Moisture Active Passive
SWOT: Surface Water Ocean Topography
TRMM: Tropical Rainfall Measuring Mission
USAID: United States Agency for International Development
USGS: United States Geological Survey

NASA Applied Sciences Program
ARSET

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NASA Earth Science Division, Applied Sciences Program

DEVELOP

Summary of Calendar Year 2012

Overview

DEVELOP addresses environmental and public policy issues through interdisciplinary research projects that apply the lens of NASA Earth observations to community concerns around the globe. Bridging the gap between NASA Earth Science and society, DEVELOP builds capacity in both participants and partner organizations to better prepare them to handle the challenges that face our society and future generations. Teams of DEVELOP participants partner with decision makers to conduct rapid feasibility projects that highlight fresh applications of NASA's suite of Earth observing sensors, cultivate advanced skills, and increase understanding of NASA Earth Science data and technology.

Combining a mission for societal benefit, a vision to expand the use of scientific research, and a commitment to the values of innovation, passion, professionalism, and collaboration, DEVELOP participants gain experience that fosters personal strengths and service to others, promoting a balance of leadership and teamwork in order to successfully address community needs.

Major Accomplishments

2012 was a record breaking year for DEVELOP. The program sponsored 337 participants conducting 69 projects, surpassing records set in 2011 for participants (259) and projects (54) by roughly 30 percent and 27 percent, respectively. Through project and participation activities the program encompassed 46 U.S. states and 32 countries in 2012, DEVELOP's broadest reach yet. The program partnered with 128 unique organizations throughout the 2012 (20 State, 15 Local, 3 Regional, 41 Federal, 12 Academic, 26 International, and 11 NGOs).

During the annual DEVELOP Strategic Planning and Leadership Retreat, DEVELOP personnel from around the country gathered virtually to discuss the current and future plans for the program. This three-day virtual meeting resulted in the DEVELOP National Program Strategy 2012–2022, which will guide the program for the next decade.

Assuming the role of national science advisor, Dr. Kenton Ross began working full-time with DEVELOP's national program office to oversee the scientific merit of DEVELOP projects and manage science advising across all DEVELOP locations. He also oversaw an expansion of DEVELOP's class of young professionals (recent college graduates), which was initiated to assist the national program office in achieving the program's strategic goals, as well as increasing institutional knowledge at DEVELOP locations across the country. Fourteen young professionals participated in the program, an increase from four in 2011.

DEVELOP began a collaboration with the Embassy of Rwanda, hosting multiple Rwandan Presidential scholars at the DEVELOP office in Wise, Virginia. The scholars partnered with participants at DEVELOP's Langley Research Center office to conduct projects focusing on the use of NASA Earth observations to assist in reforestation and agricultural monitoring in Rwanda. Further international activity was expanded with the DEVELOP-SERVIR partnership, which grew to three collaborative projects addressing issues in Nepal and Colombia, such as fire risk mapping and monitoring the impacts of climate change on agriculture yield. The partnership allowed DEVELOP to expand the international community benefiting from the program and NASA Earth observations.

In 2012, Bernard Eichold II, DEVELOP mentor at the Mobile County Health Department in Alabama, received NASA's Exceptional Public Achievement Medal. Dr. Eichold was recognized for his "outstanding achievement in engaging students and young professionals to extend the use of NASA Earth science data for community education and societal benefit."

DEVELOP expanded its online presence with a new website with increased interactivity, innovative features such as a video wall, DEVELOP's podcast (D-POD), and live feeds.

DEVELOP continued its "virtual poster sessions" each term, during which project teams created unique and insightful videos about their work and the capabilities of NASA Earth observations. The program also launched a newsletter, *The DEVELOPer*, to serve as a news source for program activities.

Looking Ahead

DEVELOP plans to expand the number of participants in 2013, primarily by enlarging its ranks in the spring and fall terms. The program will establish a new center at the University of Georgia, and plans to increase collaboration with academia and Federal boundary organizations for enhanced science advising and recruiting.

Selected Projects

Project: Mississippi River Disasters: NASA Radar Assessments of Water Extent along River Levees (Spring 2012)

Sensor Used: Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR)

Partner: U.S. Army Corps of Engineers

Description: Every spring, precipitation and snowmelt in the central United States leads to high water levels in the Mississippi River and its tributaries. Concurrent flooding and levee damage are almost yearly events. There is value to NOAA, the agency responsible for flood prediction, and the U.S. Army Corps of Engineers, the agency responsible for flood control, in the application of remote sensing to flood mapping, both along the main rivers and along small tributaries that feed into them. This project utilized high resolution radar (NASA UAVSAR), with a particular focus on LiDAR-derived digital elevation models to determine the accuracy and resolution with which flooding could be located. The project focused on determining the flood water height, developing an algorithm to detect areas of increased soil moisture, and to finalize flood map end products, which decision makers (including non-experts) will be able to use with widely available software.

Link: <http://www.earthzine.org/2012/03/22/nasa-radar-assessments-of-water-extent-along-river-levees>.

Project: Great Lakes Water Resources: Stormwater Runoff in the Great Lakes (Fall 2012)

Sensors Used: *Aqua*/MODIS, *TRMM*/Precipitation Radar

Partner: Great Lakes and St. Lawrence Cities Initiative

Description: As population and urban sprawl increase in the Great Lakes region, the interaction between humans and the near-shore habitat is escalating. These factors have contributed to the Great Lakes facing substantial stormwater runoff. In order to effectively govern the impact of stormwater runoff, policy makers are in need of a more thorough and scientifically based understanding of the effects of the issue. This project provided a synoptic view of the near-shore interaction by using NASA Earth observations to map and monitor both the land and water environments. To monitor water quality levels following extreme rainfall/snowmelt events, the team generated a time series of maps of chlorophyll anomalies and total suspended sediment (TSS) using MODIS products. The team analyzed the maps for relationships between shoreline-adjacent land cover and near-shore water quality to improve understanding of that interaction for policy makers and assist in the establishment of a baseline for future sustainable growth.

Link: <http://www.earthzine.org/2012/11/27/satellites-over-troubled-waters-stormwater-runoff-in-the-great-lakes>.

Project: Louisiana Ecological Forecasting: Mapping Restoration Sites in Louisiana (Summer 2012)

Sensors Used: *Terra*/ASTER, *EO-1*/Hyperion, AVIRIS, *Landsat 5 & 7*

Partners: St. Bernard Wetlands Foundation and Meraux Foundation

Description: St. Bernard Parish, in southeast Louisiana, continues to lose coastal forests and wetlands due to a variety of natural and anthropogenic disturbances. After Hurricane Katrina, multiple nongovernmental organizations focused on rebuilding destroyed dwellings and the ecosystems that once protected St. Bernard Parish. Coastal forests, which play a key role in this strategy, have greatly diminished in recent decades. This project created a comprehensive GIS to identify suitable planting sites in St. Bernard Parish. Using NASA Earth observations and ancillary data, along with field surveys, the team created maps of suitable planting sites to aid in unifying these organizations. The final products demonstrated the application of NASA Earth observations for the rebuilding and monitoring of coastal ecosystems in Louisiana, and provided a useful template for other ecological forecasting applications.

Link: <http://www.earthzine.org/2012/08/13/where-have-all-the-cypress-gone-mapping-restoration-sites-in-louisiana>.

Publications

Ahlen, Ande and Beth Brumbaugh, "NASA DEVELOP: North Carolina Disasters and Ecological Forecasting," *Directions Magazine*, October 18, 2012: www.directionsmag.com/articles/nasa-develop-north-carolina-disasters-and-ecological-forecasting/284901.

Anonymous, "Directions Magazine Shares NASA DEVELOP Program Research with the Geospatial Community," press release, *Directions Magazine*, September 18, 2012: www.directionsmag.com/pressreleases/directions-magazine-shares-nasa-develop-program-research-with-the-geos/279462.

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Johnson, Evan et al., "NASA Ames Research Center DEVELOP Program, Summer 2012," *BAAMA Journal*, Volume 6, Issue 2 (Fall 2012): http://www.baama.org/Resources/Documents/BAAMA_Journal_V6I2_LR.pdf.

Jones, Jason, "Mapping a Bright Economic Future for the South," Southern Growth Policy Board 40th Anniversary Commentaries, April 2012: <http://www.southerngrowth.com/pubs/pubs.html#Jones>.

Keeton, Tiffany and Kirstin Cooksey, "NASA DEVELOP: Middle East Public Health and Air Quality," *Directions Magazine*, November 28, 2012: <http://www.directionsmag.com/articles/nasa-develop-middle-east-public-health-and-air-quality/291765>.

Luizza, Matthew and Steve Chignell, "NASA DEVELOP: Colorado Ecological Forecasting," *Directions Magazine*, November 15, 2012: <http://www.directionsmag.com/articles/colorado-ecological-forecasting/289041>.

Reahard, Ross, "NASA DEVELOP: Louisiana Ecological Forecasting," *Directions Magazine*, November 1, 2012: www.directionsmag.com/articles/louisiana-ecological-forecasting/285160.

Acronyms

ASTER: Advanced Spaceborne Thermal Emission and Reflection Radiometer

AVIRIS: Airborne Visible/Infrared Imaging Spectrometer

EO-1: Earth Observing-1

GIS: geographic information system

LiDAR: Light Detection And Ranging

MODIS: Moderate Resolution Imaging Spectroradiometer

NASA: National Aeronautics and Space Administration

NOAA: National Oceanographic and Atmospheric Administration

TRMM: Tropical Rainfall Measuring Mission

TSS: total suspended sediment

UAVSAR: Uninhabited Aerial Vehicle Synthetic Aperture Radar

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DEVELOP**

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NASA Earth Science Division, Applied Sciences Program

GOMI

Summary of Calendar Year 2012

Overview

The Gulf of Mexico Initiative (GOMI) promotes the use of Earth observations to help local, state, and federal leaders in the Gulf region make informed decisions, establish effective policies, and respond to crises. GOMI focuses on regional priorities defined by the Gulf of Mexico Alliance, a collaboration of Alabama, Florida, Louisiana, Mississippi, Texas, and 13 federal agencies, to enhance the ecological and economic health of the Gulf region. Bridging the gap between science and society at large, GOMI links technical experts with regional decision makers to develop the techniques and tools needed to address high priority issues.

Major Accomplishments

In 2012, GOMI had 44 active projects spanning the northern Gulf of Mexico region from the Florida Keys to the Texas-Mexico border and the southeastern United States. The projects included approximately 200 scientists and engineers across the country and efforts were distributed across eight societal benefit areas: agriculture (7.3%), climate (13.6%), disasters (13.6%), ecological forecasting (17.3%), health and air quality (6.4%), oceans (14.5%), water (19.1%), and (aviation) weather (8.2%). Twenty-two of these projects were completed in 2012.

GOMI created and deployed a new website, <http://GulfOfMexicoInitiative.nasa.gov>, to provide centralized access to information about the ROSES projects, GOMI workshops and other items of interest to the coastal research community.

In May 2012, GOMI worked with Google, Inc., to hold a seminar that demonstrated Google geospatial tools for Gulf-related topics for novice and advanced users. The seminar, held at NASA Stennis Space Center in Mississippi, had more than 85 participants from 25 organizations. Participants included managers, IT professionals, scientists, engineers, and others representing industry, nonprofits, academia, and federal and state agencies. Google engineers familiarized the audience with the mapping and analytical capabilities of widely used, freely available tools such as Google Earth, Maps, and Fusion Tables. They also shared expert tips to solve common data analysis problems and improve analytical performance.

At the 2012 AGU Fall Meeting, GOMI organized oral and poster sessions on remote sensing ocean and coastal applications. The sessions examined topics such as ocean surface oil slick detection using MODIS and SAR inputs, detecting suspended sediments using *Landsat* and MODIS data, and analyzing algal blooms with data and imagery from *Aqua* and *Jason-2*. These projects provide information for coastal officials seeking to protect water quality for fisheries and beaches, support coastal and wetland conservation, and much more. GOMI also participated in a session that NASA Applied Sciences' Capacity Building program

organized at the AGU Fall Meeting, presenting examples of tools and products created by the GOMI teams that decision makers in the Gulf region are using.

In 2012, Duane Armstrong, chief of the Applied Science & Technology Project Office at Stennis Space Center and program manager for the Gulf of Mexico Initiative, received NASA's Exceptional Service Medal. Mr. Armstrong was recognized for his "exceptional contributions to NASA's mission in the areas of technology innovation and applied sciences."

Looking Ahead

The Gulf of Mexico Initiative plans to organize and host the GOMI ROSES workshop in New Orleans, Louisiana in January 2013. This meeting will present the results of the work conducted so far by the projects. Additionally, at the Gulf Oil Spill & Ecosystem Science conference to be held in New Orleans, Louisiana in January 2013, GOMI will organize and host oral and poster sessions on the use of remote sensing to detect and monitor oil spills in the ocean.

Selected Projects

Project: [Aiding Mobile Bay, AL Conservation and Restoration with Landsat Data from 1974-Present](#)

Sensor(s) Used: MODIS and *Landsat*

Partner: University of South Carolina, NASA Stennis Space Center, Mobile Bay National Estuary Program, and the Alabama Department of Conservation and Natural Resources

Description: In a partnership with the Alabama Department of Conservation and Natural Resources, Mobile Bay National Estuary Program, and NOAA, a project provided the first up-to-date assessment of land use practices in the Mobile Bay region in decades. The project team utilized MODIS and *Landsat* imagery to provide accurate assessments of the growth of urban areas along the coast of Mobile Bay, as well as changing land use practices over three decades. The team also provided data on impervious cover, which directly affects water quality in the bay, and on habitat stability, which is particularly important for sensitive, critical habitats such as wetlands. Areas such as the Upper Dog River experienced significant urbanization. In 1974, impervious cover was primarily located along the primary corridors and boundaries. By 2008, impervious cover blankets all but the southernmost corner of the Upper Dog River area. This type of development occurred in other places around Mobile Bay and had a significant negative impact on water quality. In 2012 the Mobile Bay National Estuary Program integrated the project's results into its overall conservation and management plan.

Project: [Mapping and Forecasting of Pelagic *Sargassum* Drift Habitat in the Gulf of Mexico and South Atlantic Bight for Decision Support](#)

Sensor(s) Used: *Landsat*

Partner: University of South Florida, Texas A&M University at Galveston, Florida Fish & Wildlife Conservation Commission, Florida Atlantic University, Texas Coastal Managers

Description: This project created a system that, for the first time, predicts *Sargassum* seaweed landings on Texas beaches. The *Sargassum* Early Advisory System (SEAS) uses *Landsat* data, Navy HYCOM ocean circulation model outputs, and NOAA wind data. The

system started in January 2012, and five Texas coastal managers had adopted this decision support tool by year's end to better plan their resources instead of simply reacting to unanticipated events. "The ability to know how much *Sargassum* is offshore has never been available before," said Reuben Trevino, coastal resources manager, City of South Padre Island. "[SEAS] has really improved our ability to prepare . . . [for] what is headed in our direction." Utilizing Landsat, HYCOM and other tools such as Google Earth, coastal managers now have advance notice of *Sargassum* landings which enables optimal deployment of resources and reduced cleanup costs.

Project: [Improved Levee Management via Remote Sensing](#)

Sensor(s) Used: UAVSAR

Partner: Mississippi State University, U.S. Army Corps of Engineers (USACE), Department of Homeland Security

Description: This project used UAVSAR-derived soil moisture and other data to improve levee management along the Mississippi River. Interferograms of UAVSAR data collected at the same site but at different times can show landslides that weaken a levee. In 2012, the project team built and demonstrated to the Mississippi Levee Board a tool that uses the data and machine learning algorithms to monitor the condition of levees. By identifying damage or threats to levees, the tool enables more efficient monitoring and inspection of the thousands of miles of levees that protect riverside communities. The Department of Homeland Security provided some funding for this project, and USACE is evaluating the tool for its use.

Project: [Assessing Trajectories, Patterns and Stressors in Marsh Loss at the Landscape Level](#)

Sensor(s) Used: MODIS and UAVSAR

Partner: University of Maryland, USGS National Wetlands Research Center, Jet Propulsion Laboratory, Louisiana State University, Louisiana Department of Environmental Quality, USACE, Fish & Wildlife Service, and the Louisiana Department of Natural Resources

Description: Using *Landsat* data and modeling to track vegetation, this project concluded that due to the amount of nutrients dissolved in the water, river diversions (the presumptive method for restoring coastal marshes) may not help restore marshes, and in some cases may even harm the current vegetation. Analysis showed that excess nutrients in the river water can reduce the root mass of beneficial marsh vegetation and trigger the growth of algae and invasive species such as hyacinth. If confirmed, this work would have significant impact on coastal restoration efforts across Louisiana.

GOMI ROSES Project Portfolio

The following table contains links to information on the project teams, study sites and accomplishments for the complete GOMI ROSES project portfolio.

<u>PI</u>	<u>Organization</u>	<u>Project Title</u>
James Aanstoos	Mississippi State University	Improved Levee Management via Remote Sensing

Rebecca Allee	National Oceanographic and Atmospheric Administration	<u>Characterizing Pelagic Habitats within U.S. Gulf of Mexico Coastal Waters Using Satellite Derived Data and Machine Learning Algorithms</u>
Susan Bell	University of South Florida	<u>Mapping and Characterization of Seagrass Habitats Using Spacecraft Observations</u>
Ronald Blom	Jet Propulsion Laboratory	<u>Gulf Coast Subsidence: Insight for Decision Makers from InSAR, Geodesy, and Geophysical Modeling</u>
Huaqing Cai	National Center for Atmospheric Research	<u>Short-Term Storm Forecasting Over the Gulf of Mexico by Blending the Satellite-Based Extrapolation Forecasts with Numerical Weather Prediction Results</u>
Paul Carlson	Florida Fish and Wildlife Conservation Commission	<u>Remote Sensing Decision Support for Water Quality Assessment and Seagrass Protection and Management in Florida's Big Bend Region</u>
Daniel Cohan	Rice University	<u>Application of Satellite Observations to Ozone Attainment Planning in Texas</u>
William Cooke	GeoResources Institute	<u>Coastal Fire Assessment in the Northern Gulf of Mexico</u>
Zhiqiang Deng	Louisiana State University	<u>Development of Sensor Assisted Water Quality Nowcasting and Forecasting Environment for Coastal Beaches</u>
Sergio deRada	Naval Research Laboratory	<u>Decadal-Scale Changes in Oceanic Heat Content for the Gulf of Mexico: A Model Study with Multi-disciplinary Implications to Climate Change</u>
Timothy Dixon	University of Miami	<u>Subsidence and Land Loss in Southern Louisiana</u>
Gregory Eason	University of Mississippi	<u>Seagrass Health Modeling and Prediction with NASA Science Data</u>
Jean Ellis	University of South Carolina	<u>Aiding Mobile Bay, AL conservation and restoration with Landsat data from 1974-present</u>
Maurice Estes	Universities Space Research Association	<u>The Application of Remotely Sensed Data and Models to Benefit Conservation and Restoration along the Northern Gulf of Mexico Coast</u>
Xingang Fan	Western Kentucky University	<u>Sustainable Management of Coastal Forest Ecosystems under a Changing Climate in the Northern Gulf of Mexico</u>
Pat Fitzpatrick	Mississippi State University	<u>An Analysis of Storm Surge Attenuation by Wetlands Using USGS, FEMA, and NASA Data</u>

Troy Frisbie	NASA Stennis Space Center	Evaluation of Hurricane Evacuation Routes Resiliency to Storm Damage
Sonia Gallegos	Naval Research Laboratory	Oil Slick Detection Using NASA Active and Passive Sensors
Sara Graves	University of Alabama in Huntsville	SANDS - Sediment Analysis Network for Decision Support Project Summary
Darrell Grimes	The University of Southern Mississippi	Remote Sensing to Assess Microbial Water Quality at Beaches and Shellfish Beds
Shahid Habib	NASA Goddard Space Flight Center	Improved Hypoxia Modeling for Nutrient Control Decisions in the Gulf of Mexico (Hypo-G)
Scott Hagen	University of Central Florida	Establishing the Application of High Resolution Satellite Imagery to Improve Coastal and Estuarine Models
Robert Hetland	Texas A&M University	Origins and mechanisms of Karenia brevis bloom formation along the Texas coast
Chuanmin Hu	University of South Florida	Enhancing Estuarine Water Quality Management Through Integrating Earth Science Research Results: A Targeted Project for Tampa Bay, Florida
Chuanmin Hu	University of South Florida	Mapping and Forecasting of Pelagic Sargassum Drift Habitat in the Gulf of Mexico and South Atlantic Bight for Decision Support
Haig Iskenderian	Massachusetts Institute of Technology Lincoln Laboratory	Demonstration of Satellite-based Lightning Initiation Nowcasts toward Enhancing FAA Tactical Forecasts for Improving Ground-based Airport Operations
Jason Jolliff	Naval Research Laboratory	High-Resolution Subsurface Physical and Optical Property Fields in the Gulf of Mexico: Establishing Baselines and Assessment Tools for Resource Managers
Dave Jones	StormCenter Communications, Inc.	Establishing a Prototype Decision Support Tool Using NASA and other Data for the Gulf of Mexico Alliance (GOMA)
Maria Kalcic	CSC	Monitoring Coastal Marshes for Persistent Flooding and Salinity
Michael Kearney	University of Maryland	Assessing Trajectories, Patterns and Stressors in Marsh Loss at the Landscape Level
Brian Lapointe	Harbor Branch Oceanographic Institute at Florida Atlantic University	Nutrient linkages between South Florida rivers and coastal habitats: Integrating water quality sampling with satellite remote sensing to enhance management

ZhongPing Lee	Northern Gulf Institute	Demonstration of Innovative Satellite Products for Improving Decision Making
Jason Lenos	University of South Florida	Multi-model Simulations with Data Assimilation for Harmful Algal Blooms in the Eastern Gulf Of Mexico
Mark Mark Lewis	Naval Research Laboratory	Use of MODIS Time Series Data Products to Improve Management of Forest Damage and Recovery from Hurricane Katrina
Richard McNider	University of Alabama in Huntsville	Use of Satellite Data and Model Products in Improving the Categorization, Delineation and Mitigation of Agricultural Drought
John Mecikalski	University of Alabama in Huntsville	Improved Convective Initiation Forecasting in the Gulf of Mexico Region
Katherine Milla	Florida A & M University	Enhancing NASA's COAST Online Application for Agricultural Best Management Practices Decision Support
Deepak Mishra	University of Georgia	A MODIS Based Decision Support Tool for Gulf Coast Salt Marsh Conservation and Restoration
Paul Montagna	Texas A&M University - Corpus Christi	Establishing Standard Water Quality Criteria Using Satellite Products for Texas
Doug Mooney	Battelle	Managing Runoff: A Tool to Evaluate Potential Impacts of Climate and Land Change on Pathogen and Nutrient Concentrations in Weeks Bay
Udaysankar Nair	University of Alabama in Huntsville	DEMAND: DSS Environment for Modeling of Atmospheric Nutrient Deposition
Udaysankar Nair	University of Alabama in Huntsville	Satellite Data Driven Modeling System for Predicting Air Quality and Visibility during Wildfire and Prescribed Burn Events
Christopher Osburn	North Carolina State University	Geospatial Synthesis of Chromophoric Dissolved Organic Matter Distribution in the Gulf of Mexico for Water Clarity Decision Making
Ofemi Osidele	Southwest Research Institute	A Collaborative Geospatial Decision Support System for Managing Coastal River Basins
Nathaniel Plant	United States Geological Survey	Decision Support for Vulnerability to Future Storms at NASA Kennedy Space Center
Alex Ruane	NASA Goddard Institute for Space Studies	Climate Decision Support in the Gulf States: Assessing the Impacts of Key Uncertainties in End-to-End Assessments
Joseph Spruce	CSC	Use of NASA satellite data to improve coastal cypress forest management

Linda Young University of Florida

[Asthma and Air Quality in the presence of Fires - a Foundation for Public Health Policy in Florida](#)

Acronyms

AGU: American Geophysical Union
COAST: Coastal Online Assessment and Synthesis Tool
FAA: Federal Aviation Administration
GOMA: Gulf of Mexico Alliance
GOMI: Gulf of Mexico Initiative
HYCOM: HYbrid Coordinate Ocean Model
InSAR: Interferometric Synthetic Aperture Radar
MODIS: Moderate Resolution Imaging Spectroradiometer
NASA: National Aeronautics and Space Administration
NOAA: National Oceanographic and Atmospheric Administration
ROSES: Research Opportunities in Space and Earth Sciences
SAR: Synthetic Aperture Radar
SEAS: *Sargassum* Early Advisory System
UAVSAR: Uninhabited Aerial Vehicle Synthetic Aperture Radar
USACE: United States Army Corps of Engineers
USGS: United States Geological Survey

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NASA Earth Science Division, Applied Sciences Program

SERVIR

Summary of Calendar Year 2012

Overview

SERVIR is a joint venture of NASA and USAID. It consists of a global network of partners providing satellite and geospatial data to developing countries and helping them apply that information to environmental challenges. SERVIR helps scientists, educators, project managers, and policy makers make better-informed decisions about issues such as agricultural development, biodiversity conservation, water resources, and disaster management.

Regional SERVIR hubs include the Regional Center for Mapping of Resources for Development (RCMRD) in Nairobi, Kenya, and the International Center for Integrated Mountain Development (ICIMOD) in Katmandu, Nepal. A Mesoamerican hub operated under the auspices of SERVIR from 2004 to 2011 at the Water Center for the Humid Tropics of Latin America and the Caribbean, or CATHALAC, in Panama. It now operates independently, while continuing to tap SERVIR data and applications.

Major Accomplishments

SERVIR had an expansive growth year. The overall project underwent an important realignment, enabling more effective and efficient operations with respect to partner hub institutions; USAID brought a new team on board to strengthen end user engagement and other "demand"-related activities; and, we selected the SERVIR Applied Sciences Team (SERVIR AST), welcoming 11 new investigator teams and projects geared towards partnering with in-region institutions that comprise the SERVIR hub network. Also in 2012, NASA, together with SERVIR partner hub institutions, co-developed various science applications using NASA data to address regional concerns including flood forecasting, fire monitoring, and land cover change.

SERVIR PROJECTS: Selected Accomplishments

SERVIR-Africa

In 2011 and 2012, SERVIR trained officials in Africa to use a tool for gathering stream-flow information critical to African nations where too much or too little rainfall harms farmers' productivity. SERVIR made available the Coupled Routing and Excess Storage (CREST) model, enabling early warnings of agricultural production deficits, which help aid workers better plan for and respond to food emergencies. This CREST project prompted the Kenyan Department of Water Resources (KDWR), historically reticent to share its data because of costs and other factors, to take an unprecedented step: making data available to SERVIR from 840 river gauging stations to help improve and calibrate the CREST model. Hydrologists trained at SERVIR-Africa workshops now advocate the model's use in their daily stream-flow and soil moisture monitoring and flood forecasting operations. Several countries have requested additional training and/or expanded operations of the CREST model in managing critical watersheds in

their countries. In collaboration with the Kenyan Meteorological Department, SERVIR-Africa has expanded the CREST model to include hydrologic forecasting. These data sets are becoming vital tools for KDWR for identifying potential flooded areas several hours in advance. SERVIR has created a flood mapping tool that enables users to visualize the extent of flood damage on key rivers. Plans are to incorporate flood alerts into SERVIR's planned mobile text-alert system.

The GHG **Land Cover Mapping** project is enabling six African countries—Malawi, Zambia, Rwanda, Tanzania, Botswana, and Namibia—to produce land cover and land use change maps as an input for their bi-annual communication towards the U.N. Framework Convention on Climate Change. The maps are based on a classification of *Landsat* satellite data as well as data from land use surveys, agricultural censuses, and forest maps. This project also supports the U.S. Environmental Protection Agency GHG (greenhouse gas) Inventory capacity building efforts in East and Southern Africa by providing training for national GHG teams and providing baseline data in the form of *Landsat* imagery and land cover maps. In 2012, the SERVIR-Africa team completed the mapping project in Malawi and Rwanda. It is continuing work on the other four countries.

A **biodiversity mapping project** is filling vast knowledge gaps about the richness of species in East Africa and increasing understanding of the effects of climate change on that richness. The African Conservation Center and the National Museums of Kenya, in conjunction with SERVIR-Africa, used ground- and satellite-based data to develop range maps for selected flora and fauna as a baseline for assessing possible impacts of climate change on species numbers and distribution. A biodiversity mapping visualization tool, available on SERVIRGlobal.net, incorporates the range maps to display the spatial distribution of plants, fish, reptiles, and birds in the region and will serve as a basis for future land use and climate change planning discussions. This first phase of the biodiversity project was so successful that biodiversity organizations in the region requested a Phase II follow-on, which began at the end of 2012, expanding the activities to other countries in the region and increasing the number of species monitored and mapped.

SERVIR is working with the World Bank to provide seamless integration between the SERVIR portal and GeoNode—an open source GIS mapping platform whose aim is to enable collaborative sharing of data collected by humanitarian and development agencies. Motivated by SERVIR's work at RCMRD, the World Bank, through the Open Data for Resilience Initiative, has set up a **GeoNode instance** there (available at horn.rcmr.org) that aims at sharing all the data collected by agencies working on the Horn of Africa drought response. This project synchronizes the GeoNode's offerings with SERVIRGlobal.net. Representing a tremendous improvement in access to geospatial information for decision making in Africa, this integration of external Web services into the SERVIR Global platform increases the amount and variety of spatial information available to end users and enables them to easily integrate information from a variety of sources.

SERVIR-Himalaya

SERVIR-Himalaya, in close collaboration with the Nepalese Department of Forests, has developed a **Forest Fire Detection and Monitoring System** for Nepal based on satellite

imagery. Launched in March 2012, the new system automatically downloads active fire data from MODIS sensors onboard NASA's *Terra* and *Aqua* satellites. The system adds important information such as administrative unit (i.e., district, village development committee, and ward number), protected area identification, land cover, elevation, and slope. The MODIS active fire data and road network data are used to identify the affected areas and provide such information as the distance to the nearest road. Along with district-level fire count statistics, the application allows visualization of an active fire on any given day via MODIS true color images. The user can also overlay this with land cover and land use data to assess the damage caused by the forest fire. And in the interactive mapping application, there is a time-slider tool for selecting and viewing fires that occurred over a specified time period. The forest Fire Detection and Monitoring System sends email notifications about fires to about 180 subscribers. In addition, some 200 text message (SMS) subscribers, including district forest officers and focal persons of the Federation of Community Forestry Users, receive fire alerts on their mobile telephones if a fire incident is detected in their district. The U.S. Forest Service is working to document forest burn severity from fires by using *Landsat* images of nearby Bhutan. The Forest Service plans to expand its effort to include bordering regions. Such information in Nepal will complement SERVIR's Forest Fire Detection and Monitoring System by adding historical perspective for fire-prone forest areas.

SERVIR's Himalaya **land cover mapping** of three decades (1990, 2000, and 2010) began in 2011 and continued in 2012 to produce *Landsat*-based land cover mapping at 30 m resolution for Bhutan, Nepal, Pakistan, and Bangladesh. Land cover assessment and monitoring of land cover dynamics are essential for environmental protection, biodiversity conservation, and sustainable management of natural resources. They are also important for developing sustainable livelihoods, particularly for the rural communities in the Hindu Kush-Himalayan region. The land cover data is used as a basis for applications on biomass estimation using multi-resolution satellite data and a GHG inventory of Nepal (see next paragraph).

Biomass estimation using multi-resolution satellite data: The Reducing Emissions from Deforestation and Forest Degradation (REDD) mechanism is a great hope for saving the world's forests. Geospatial technology has immense potential for baseline forest biomass (carbon) assessment and monitoring. Several forestry projects in Nepal are collecting extensive field-based biomass information at community forests, sub-national, and national levels. Through these initiatives, multi-sensor remote sensing data is also available. SERVIR-Himalaya is developing a hierarchical geospatial framework to link and harmonize local, regional, and national level forest biomass estimations, dovetail these efforts into operational use, and build synergy among different national initiatives.

Snow is an important component of the cryosphere and, unlike glaciers, is characterized by high inter-annual, intra-annual, and seasonal variability. Snowmelt contributes significantly to the water budget in some of the major river systems of the Himalaya, so a study of snow trends is essential for understanding regional climate change and managing water resources. This application provides interactive **snow cover mapping** in the Himalaya along with major basin and sub-basin statistics important for the study of snow budget for

agriculture, water-based industries, environment, land management, water supplies, and other sectors. Snow cover maps have been generated using the MODIS eight-day snow product with improvements. The data is presented in an interactive environment with basin-wide statistics useful for visualizing comparative trends over the last decade. The snow cover data is presented for 92 sub-basins from the 10 major river basins of the Hindu Kush-Himalaya. Users can view basin and sub-basin snow cover statistics for different elevation zones, slopes, and aspects. A time-slider tool can be used to display snow cover maps for a particular date or specified time period.

Air quality is emerging as a serious concern in the Hindu Kush-Himalaya. Transboundary air pollution has become one of the concerns in the Himalaya and a product is needed to provide a picture of air quality over the entire region. This SERVIR application uses satellite information for a quick assessment of air quality. The application combines near real-time MODIS visible bands, active fires, and aerosol optical depth products to generate an air quality index. Information from AERONET (AEROSOL ROBOTIC NETWORK) stations is integrated into the system. These products are useful for assessing atmospheric air pollution and its impacts on human health and agriculture.

Assigned a high priority for conservation, the Phobjikha Valley in Bhutan is an important wetland and a key habitat for the black-necked crane. The area has experienced significant land use change over the past 20 years, from a summer grazing land to permanent settlement and cultivation. The **Phobjikha Wetland Ecosystem** application, developed in collaboration with the Royal Society for Protection of Nature of Bhutan, provides important information and a basis for management zoning of the Phobjikha Valley for conservation efforts.

Major Accomplishments for SERVIR Applied Sciences Team

The SERVIR AST was formed in the second half of 2012. The project kick-off meeting was held in October in Huntsville, AL to coincide with the SERVIR Summit, a global meeting of SERVIR collaborators and participants. All SERVIR AST PIs presented at this meeting. Additionally, several SERVIR AST PIs participated and collaborated during an informal gathering during AGU Fall Meeting in December.

SERVIR AST Project Portfolio

The following table provides a listing of the SERVIR AST projects. For more information on the SERVIR AST projects, visit:

<https://www.servirglobal.net/Global/About/OurTeam/SERVIRScienceTeam.aspx>

PI	Organization	Title
Allen Blackman	Resources for the Future	Using Earth Observation Data to Improve REDD+ Policy in Mesoamerica and the Dominican Republic

Pietro Ceccato	Columbia University	Development and Implementation of Flood Risk Mapping, Water Bodies Monitoring and Climate Information for Disaster Management and Human Health (integration within SERVIR)
Stephanie Granger	JPL	East Africa Drought and Agricultural Productivity Assessment and Prediction System
Faisal Hossain	Tennessee Tech University	A Satellite-based Early Warning, Mapping and Post-Disaster Visualization System for Water Resources of Low-lying Deltas of the Hindu Kush-Himalayan region
Amy Huff	Battelle Memorial Institute	Applications of Satellite Products for Air Quality Monitoring, Analysis, Forecasting, and Visualization in the SERVIR Mesoamerica and Himalaya Regions
Jeff Kargel	University of Arizona	Interdisciplinary science applications to glacier and alpine hazards in relation to development and habitation in the Hindu Kush-Himalaya: SERVIR Science Team project
Dalia Kirschbaum	NASA GSFC	Landslide Hazard Assessment and Forecasting System using near real-time remote sensing information over SERVIR-Mesoamerica
Nadine Laporte	Woods Hole Research Center	Forest carbon assessment for REDD in the East Africa SERVIR region
Pete Robertson	NASA MSFC	Leveraging CMIP5 and NASA / GMAO Coupled Modeling Capacity for SERVIR East Africa Climate Projections
Juan Valdes	University of Arizona	SERVIR Water Africa-Arizona Team (SWAAT)

Jim Verdin	USGS	A Long Time-Series Indicator of Agricultural Drought for the Greater Horn of Africa
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Workshops, Events, and Outreach

Workshops: To help build the capacity of local decision makers in using geospatial data and applications to make informed environmental choices, SERVIR workshops trained 171 people at the two hubs in 2012.

- In Africa, representatives from 17 institutions in 13 countries were trained at events for the CREST model and biodiversity tool.
- In the Himalaya, stakeholders were trained at events such as Youth Forums in Bhutan, Pakistan, and Bangladesh, and an air quality workshop in Nepal. Representatives from 20 institutions from four countries were trained.
 - The Youth Forums incorporate educational activities that are integral to SERVIR’s mission to build host nations’ capacity to incorporate GIS and Earth observation technologies into future decision making.
 - The air quality workshop, held to augment air quality assessment efforts in the Himalaya, trained participants to use MINX (MISR Interactive eXplorer) to interpret plume images from the Multi-angle Imaging Spectroradiometer (MISR) sensor on NASA’s *Terra* satellite. MINX is unique software for analyzing plumes of smoke, dust, and volcanic ash. Together, MISR and MINX show plumes in 3-D and even indicate their motion, allowing the user to determine a plume’s height, wind speeds, and structure. Since the height a smoke, ash, or dust plume reaches in the atmosphere affects how far and how fast the aerosols travel and how long they stay up in the air, this information is critical to predicting its impact. The MINX data becomes part of a database forecasters can draw from to model how these plumes will move and what areas they will affect, so the public in those places can be warned about what is coming their way. Participants learned how to use MINX to tell where a cloud of dust, smoke, or ash has traveled from its source, and whether the cloud originated from a desert, fire, or volcanic eruption.

Summit: SERVIR’s first annual **summit**, October 15-19, 2012, in Huntsville, Alabama, brought together team members from existing SERVIR hubs, the former hub, and the Coordination Office, as well as program leaders from USAID and NASA and members of two new SERVIR teams: the DAI Demand Team and the Applied Sciences Team. The summit served as a working meeting and forum for the sharing of ideas and experiences across regions. Attendees discussed the status of their projects, exchanged knowledge, got to know one another, and began developing plans for future projects.

Selected Conference Presentations

Irwin, Dan et al., “Bridging Space to Village through the SERVIR Regional Visualization and Monitoring System,” SERVIR Side Session, U.N. Conference on Sustainable Development (Rio+20), June 18-24, 2012.

Anderson, Eric, "Using GIS to Prepare Study Abroad Students for New Environments," Esri Education GIS Conference, July 21-22, 2012.

Flores, Africa, "Teaching GIS for Disaster Management in the International Development Context," Esri Education GIS Conference, July 21-22, 2012.

Shrestha, Basanta, "Enhancing Earth Observation Capacity in the Himalayan Region," NASA Capacity Building Session, AGU Fall Meeting, December 3-7, 2012.

Irwin, Dan, "SERVIR Science Applications for Capacity Building," NASA Capacity Building Session, AGU Fall Meeting.

Ceccato, Pietro, "How the Use of Remote Sensing is Transferred to Diverse User Communities Through Capacity Building at Columbia University," AGU Fall Meeting.

Albers, Cerese, "SERVIR: Connecting Space to Village," Ignite@AGU event, December 5, 2012.

Selected Publications

Published 51 news stories on SERVIRGlobal.net during 2012.

Coulter, Duana, "A DisasterCam for the ISS," Science@NASA, June 27, 2012 (features ISERV): http://science.nasa.gov/science-news/science-at-nasa/2012/28jun_disastercam.

Eilperin, Juliet, "U.S. climate aid reaches across globe," *Washington Post*, December 2, 2012 (cites SERVIR as "one of USAID's most successful programs" in climate change field): http://articles.washingtonpost.com/2012-12-02/national/35584932_1_climate-aid-climate-change-rich-countries.

New Website

- In 2012, SERVIR launched a redesigned website, **SERVIRGlobal.net**. The new design makes it easier for users to find and access available resources. For example, SERVIR's Data Catalog now provides improved searching and easier access to geospatial data, information products, and services from SERVIR's hubs and partner organizations. The new Interactive Mapper tool enables website visitors to access SERVIR data and functionality, choose specific data sets and information, display them on a base map, and further manipulate them for analysis. The enhanced website also showcases training and capacity building materials; videos; and customized applications for mapping or interpreting Earth observations. In addition, the site highlights the capabilities and achievements of SERVIR's global network of regional partners with news, success stories, and other features.
- SERVIRGlobal.net also introduces a new behind-the-scenes system (called **Reference Node**) offering standardized 'recipes' that transform various types of data and imagery into a form that is easy to visualize, understand, and use for addressing specific environmental issues. This new back-end system helps SERVIR and its

partners bring new products online faster and more reliably, and provides information and tools to instill confidence in our data products and support their appropriate use.

Awards

SERVIR's **ISERV Team** received the prestigious **NASA Silver Achievement Medal** in 2012. This Agency medal is awarded for stellar achievement that supports one or more of NASA's Core Values: Safety, Excellence, Teamwork, and Integrity.

SERVIR Applied Sciences Team member **Faisal Hossain** received the **2012 Charles S. Falkenberg Award** at the AGU Fall Meeting Honors Ceremony, December 5, 2012, in San Francisco. Hossain earned this recognition for performing research to support a remote sensing-based flood warning system for developing nations where applicable data is often hard to come by. For SERVIR, Hossain is working on a real-time visualization system for water resources of low-lying deltas of the Hindu Kush-Himalayan region.

New Technologies

SERVIR is exploring use of the unique vantage point provided by the International Space Station (ISS) to benefit hub regions with a new NASA-developed Pathfinder system called **ISERV**, installed in the ISS Destiny module's Earth-facing window in late 2012. Short for ISS SERVIR Environmental Research and Visualization System, ISERV receives and acts on commands from the ground to acquire high-resolution images of specific areas of the Earth's surface as the space station passes over them. A future system and perhaps even ISERV Pathfinder itself will provide satellite imagery and data to help developing nations make environmental decisions and assess and monitor impacts of disasters. But Pathfinder's main purpose is to help scientists gain experience and expertise to deploy an enhanced system in the future.

SERVIR's new **wireless sensor network (WSN)** is a ground-based network of sensors that can be placed around floodplains, volcanic slopes, frost-prone agricultural landscapes, or other areas of interest. Spread out in grids two to four sensors per square mile, the sensors can transmit moisture levels, rainfall, seismic activity, or other data periodically to a central location for processing and analysis. These low-watt sensor-transmitter sets can operate for up to two years on little more than a couple of AA batteries each. These sensors provide improved ground validation for satellite-based observations and enable better applications for our end users. ICIMOD received a request from the Center for Environmental and Geographic Information System and UNDP-Bangladesh to develop a flash flood early warning system to be deployed in Bangladesh. The system was tested in Huntsville, Alabama, with a planned deployment of May 2013. Other requests for demonstrations for WSN-based early warning systems for various disaster applications (embankment breach, frost, landslide and flooding) have also been received by RCMRD and ICIMOD.

SERVIR is also developing a **mobile phone application** that will enable end users in regions that lack standard computer Internet access to retrieve SERVIR products through the use of a cellular phone's data connection and will download and plot or map near real-time monitored information for decision makers.

2012 Assessment/2013 Look Ahead

Since its inception in 2004, SERVIR has grown exponentially. And in that time the program has experienced the excitement of success, the challenges of growth, and the sense of responsibility that comes with a mounting awareness of our potential for positive worldwide impact. As we take on the challenges associated with expansion, we recognize that our success continues to be rooted not only in the quality, state-of-the-art NASA science and USAID development expertise we provide access to, but also in the complementary strengths of each of our regional centers.

In 2012, SERVIR strengthened its regional hubs' capacities to better respond to a range of issues including disaster management, air quality, agricultural development, biodiversity conservation, climate change, and more.

The year prepared the entire SERVIR team to move forward in ever more efficient and productive ways. SERVIR is ready for 2013 and beyond, as we continue to bring space to village, making our world a better place for years to come.

Acronyms

AERONET: AErosol RObotic NETwork

AGU: American Geophysical Union

CREST: Coupled Routing and Excess Storage

GHG: greenhouse gas

GIS: geographic information system

ICIMOD: International Center for Integrated Mountain Development

ISERV: ISS SERVIR Environmental Research and Visualization System

ISS: International Space Station

KDWR: Kenyan Department of Water Resources

MINX: MISR Interactive eXplorer

MISR: Multi-angle Imaging Spectroradiometer

MODIS: Moderate Resolution Imaging Spectroradiometer

NASA: National Aeronautics and Space Administration

RCMRD: Regional Center for Mapping of Resources for Development

REDD: Reducing Emissions from Deforestation and Forest Degradation

SMS: Short Message Service

UNDP: United Nations Development Program

USAID: United States Agency for International Development

WSN: wireless sensor network

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