

DEVELOP Summer Students Learn Firsthand the Practical Application of NASA Earth Science Research

Anup Myneni, *DEVELOP National Program, Langley Research Center, Anup.Myneni@nasa.gov*

Phoebe Doty, *DEVELOP National Program, Phoebedoty@yahoo.com*

Nate Makar, *DEVELOP National Program, Nathaniel.I.Makar@nasa.gov*

During the Summer 2011 term, 23 DEVELOP projects were conducted under the guidance of NASA science advisors and partner organizations, all looking to maximize NASA's Earth Science investments by enabling and empowering the next generation of young professionals.

Introduction

This summer 140 students and young professionals had the opportunity to conduct research on the application of NASA science technology to real-world environmental issues. The DEVELOP National Program, a NASA Applied Sciences training and development program, provides domestic and international students and young professionals with experience in examining satellite remote sensing data and integrating results of their analyses into decision-making support tools. The program hosts domestic and international students from high school through graduate school, at nine locations across the U.S. and one in Monterrey, Mexico. Students have the opportunity to apply NASA Earth observing satellite data to local environmental concerns, bridging the gap between NASA's remote sensing capabilities and the public good for communities around the globe. In this way, the DEVELOP program demonstrates the practical benefits of NASA Earth Science research. DEVELOP teams collaborated with partner organizations at the local,

regional, and international levels, working on project teams with topics ranging from agricultural monitoring in the Midwest U.S. to water quality in Kenya.

Six of the nine U.S. locations are at NASA centers—Ames Research Center (ARC), Goddard Space Flight Center (GSFC), Jet Propulsion Laboratory (JPL), Langley Research Center (LaRC), Marshall Space Flight Center (MSFC), and Stennis Space Center (SSC)—while three are located in regional offices—Mobile County Health Department (MCHD) in Alabama, the Great Lakes and St. Lawrence Cities Initiative in Illinois, and the Wise County



DEVELOP students at Langley Research Center tour Langley's new Headquarters building, "New Town", a platinum LEED building.

Clerk of Court's Office in Virginia. During the Summer 2011 term 23 projects were conducted under the guidance of NASA science advisors and partner organizations, all looking to enhance NASA's Earth Science investments by enabling and empowering the next generation of young professionals.

Langley Research Center

The Langley Research Center—headquarters of the DEVELOP program—hosted 62 students during the summer term. Several LaRC DEVELOP teams focused their research on natural disasters and related environmental phenomena. The Russia Disasters and Human Health Team used data from the Ozone Monitoring Instrument (OMI) on the Aura spacecraft and the Multi-angle Imaging SpectroRadiometer (MISR) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on the Terra spacecraft to monitor the widespread impacts of the 2010 Russian wildfires. Another LaRC team studied pumice rafts caused by shallow marine

volcanism in the Pacific Ocean. According to student researcher Lindsey Honaker, the team worked to “identify and monitor hazards in the Pacific in ways that enable future groups to protect ships and coastal communities.” This student project used data from OMI and the Ocean Surface Topography Mission/Jason-2, and Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellites in its work, which was completed in partnership with the Smithsonian Institute Global Volcanism Program. A third LaRC team investigated the capabilities of NASA Earth observations to detect, monitor, and mitigate the destruction caused by the March 2011 Japanese earthquake and tsunami. The Japan Disaster Team focused on the creation of unique visualizations to display the extent of damage and to demonstrate the feasibility of using NASA EOS data in similar disaster situations.

DEVELOP projects at LaRC spanned a wide array of scientific research areas and concerns, including public health and water quality. For example, the Midwest Agriculture and Climate Team created a methodology for identifying tillage practices using data collected by the Hyperion imaging spectrometer on the Earth Observing (EO)-1 satellite, the ASTER instrument onboard Terra, and the Thematic Mapper and Enhanced Thematic Mapper on Landsat 5 and 7, respectively. This newly developed methodology improves decision-making processes for end users, such as analyses relating to carbon crediting in the U.S. Department of Agriculture. Another team of LaRC students monitored the impacts of forest fragmentation on bird populations in the greater Washington, DC area. The team partnered with the U.S. Fish and Wildlife Service to use Landsat satellite data along with data collected from ASTER and the two orbiting Moderate Resolution Imaging Spectroradiometer (MODIS) instruments to improve endangered species monitoring and land management. An additional LaRC team partnered with the National Ocean Service and the National Oceanic and Atmospheric Administration (NOAA) to investigate the impact of climate change on water quality and algal blooms in the Atlantic Ocean. This project made use of NASA remote sensing technology, including the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), MODIS, and NOAA’s Advanced Very High Resolution Radiometer (AVHRR). LaRC’s Highly-portable Immersive Virtual Environment (HIVE) team developed a lightweight and portable immersive visualization system, which was used by student researchers to display Earth science data and engineering models to help convey other teams’ project methodologies and results.

Stennis Space Center

NASA’s Stennis Space Center in Mississippi hosted nine students who conducted two different research projects. Using the data collected, students were able to gain an understanding of ways to potentially influence policy makers concerned with marine debris along the Gulf coast. One team investigated the impacts of climate change on coral reefs in the Florida Keys using data from SeaWiFS and the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) instrument onboard the Aqua

satellite. Student researchers analyzed sea surface temperature information as well as chlorophyll and turbidity data to monitor and quantify impacts of climate change on the region. This project was completed in partnership with the Florida Keys National Marine Sanctuary and NOAA. The second team monitored the dispersal of marine debris in coastal areas, and was conducted in partnership with NOAA’s Marine Debris Program. This project examined currents in the Gulf of Mexico by using data from the European Remote Sensing (ERS)-1 and -2 satellites and Environmental Satellite (Envisat)-1.



Stennis Summer 2011 Team:
[left to right] Candis Mallett,
Jason Jones Shelby Barrett,
Aaron Albin, Renane Bur-
bank, Ross Reahard Brandie
Mitchell, Logan Shultz, and
Cheri Miller.

The Ames Summer 2011 Groundwater Team attended a meeting at the California State Capitol on June 14, 2011. Team members include: [left to right] Abdelwahab Bourai, Joseph Skiles[mentor], Joshua Randall, Bridget Floyd, William Brandt, Amber Kuss, and Michelle Newcomer.



Marshall Space Flight Center

In collaboration with NASA's Marshall Space Flight Center, the DEVELOP National Program at the University of Alabama at Birmingham (UAB) hosted 12 summer students who conducted two projects related to water quality and environmental change. One of the projects monitored fish habitat and correlated population change along the Cahaba River in Alabama using Landsat 5 and 7 satellite data as well as aerial photography from Digital Globe, a commercial vendor of space imagery. The project, which has the potential to strengthen local water and land management decision-making processes, allowed the student researchers to partner with the Cahaba River Society and the UAB. A second research team used NASA Earth observations, including measurements acquired by instruments on the Landsat 5 and 7 satellites as well as ASTER onboard Terra, to identify locations of endangered and/or threatened species in Georgia's Providence Canyon. Working alongside officials from Georgia State parks and other historic sites, these students mapped the habitat of several rare species in Georgia, including the plumleaf azalea.

Ames Research Center

The DEVELOP team at Ames Research Center hosted 18 students who investigated diverse environmental issues using NASA remote sensing technology. Students at Ames were able to explore unique issues involving ecology, climate, and agriculture through the use of data from NASA satellites and partnerships with influential organizations. The California Climate and Ecology Team researched regional meteorological patterns, such as the spatial distribution of fog along the California coast. Students partnered with the National Park Service and used the AVHRR to supplement images taken from MODIS to map meteorological patterns and to demonstrate patterns and change along the coast. Students in a second ARC project worked alongside the U.S. Geological Survey (USGS) and conservation groups to map the invasive pepperweed species. The

team used data collected by instruments on the Landsat satellites as well as MODIS and ASTER to record the distribution of pepperweed in the South San Francisco Bay Salt Ponds. The third ARC research team investigated water availability for California's Central Valley by collecting data from Landsat instruments, as well as MODIS and ASTER instruments. This team partnered with the USGS Groundwater Resources Program and the California Department of Water Resources to create crop models that help evaluate crop distributions based on water supplies.

Goddard Space Flight Center

The Goddard Space Flight Center provided 10 students the opportunity to research water management, public health, and ecological forecasting issues. The three groups of students at GSFC used NASA technology to collect data that could potentially influence public health and ecology, providing the students excellent learning opportunities while solving real-world environmental issues. One project partnered with Maryland Department of Natural Resources to focus on Maryland's ecology to investigate the distribution of native as well as invasive Maryland species. This

team used data from Shuttle Radar Topography Mission (SRTM), MODIS, and Landsat instruments to model and detect habitat suitability for invasive species such as wavyleaf basketgrass. The second team of students sponsored by GSFC used data provided by MODIS and SRTM to research water surface inundation. Working with the U.S. Department of Agriculture's Conservation Effects Assessment Project, this group used digital elevation models to map areas prone to flooding. The third GSFC team, working with the Bangladesh Human Health and Water Team, investigated NASA Earth observations in relation to public health. These students partnered with University of Maryland to use data collected by AVHRR, MODIS, and instruments on the Jason-2 satellite, to map cholera outbreaks and to improve understanding their correlation with salinity and chlorophyll estimates.

Mobile County Health Department

Established in 2003, the DEVELOP office at the MCHD in Alabama has continued to host and support student research through the present Summer 2011 term. The team in Mobile this summer conducted two projects and hosted nine individuals. One project utilized SRTM, Tropical Rainfall Measuring Mission (TRMM), and AMSR-E data to analyze tropical cyclone-induced precipitation and flooding in the Gulf of Mexico, in partnership with the Center for Hurricane Intensification and Landfall Intensification. This project monitored and analyzed the impacts of weather patterns and precipitation rates to potentially improve flood mapping in the region.

The second team of students at the MCHD investigated the water quality of Lake Victoria in Kenya through Earth observations, including data from the Advanced Land Imager (ALI), Hyperion, and AVHRR. Partnered with the Lake Victoria Basin Commission, the team's work may provide tangible benefits for policymakers and communities with a strong interest in preserving Lake Victoria's natural resources and its use as a source of drinking water.

Jet Propulsion Laboratory

The Jet Propulsion Laboratory hosted a team of three students this summer. They investigated the effects that urban forest processes and urban heat islands have on human health. These students helped the Million Tree Initiative, a campaign initiated to plant one million trees in the city over the next few years, by raising awareness concerning urban forest processes and its effects on Los Angeles's tree population. Using data from instruments on the Landsat 5 and 7 and CALIPSO satellites, this group of students collected data to reveal the significance of urban heat islands and further discussed their effects on public health. The team used NASA technology to explore links between these urban issues and health risks such as heat stroke and pre-respiratory illnesses. Given the opportunity to work alongside the Los Angeles Conservation Corps Education Program, this group of students provided data that could potentially impact the application of important decision support tools to help maintain vegetation around the city.

Great Lakes and St. Lawrence Cities Initiative

One of DEVELOP's newer locations, the Great Lakes and St. Lawrence Cities Initiative DEVELOP team, hosted two students during this summer term. The team



MCHD DEVELOP students participate in a teleconference with science advisors from NASA's SERVIR Program on June 21. [*back row, left to right*] Naresh Aligeti, Hunter Winstanley, Tharini Jeyaprakash. [*front*] Josh Stodghill [MCHD—Center Lead].

JPL's Summer 2011 DEVELOP team: [left to right] Caitlin Kontgis, Asya Hollins, and Katrina Laygo [JPL Center Lead].



studied the habitats and spread of Asian carp, an invasive species, in the Great Lakes. These students used MODIS, Jason-1, and TOPEX/Poseidon data to construct a methodology for mapping potentially at-risk areas to assist fishery managers

and to enhance support for eradication efforts. The team's research, completed in conjunction with the U.S. Fish and Wildlife Service, USGS, and NOAA, may help to assess the threat to the Great Lakes caused by Asian carp and aid in the control of this invasive species.

Wise County, VA, and Monterrey, Mexico

DEVELOP's team in Wise County, VA, which is the second oldest DEVELOP node outside LaRC, has concluded its second semester of work on an international science venture that seeks to positively impact environmental and public health in Mexico. Wise DEVELOP students, working alongside a team of students in Mexico, conducted three separate projects designed to provide



DEVELOP student Charley Follett, Center Lead of the Great Lakes and St. Lawrence's Cities Initiative (GLSLCI) DEVELOP team attended the GLSLCI 2011 Annual Meeting presenting his team's research results related to invasive species risk in the Great Lakes. Pictured here are [left to right] Dave Ullrich [GLSLCI—Executive Director], Charley Follett, Kenton Ross [SSAI@NOAA NESDIS—DEVELOP Science Advisor], and Jonathan Gleason [NASA—DEVELOP alumnus].

data and unique insight into major issues of concern to Mexican citizens and their government's agencies. One team studied the impact of industrial discharges on the health of the Lerma River, one of the largest rivers in Mexico. They monitored the spread of algal blooms in an effort to create a model that could predict future pollution. Another project recorded the effects of air pollution in and around Monterrey to study impacts on the ozone layer. In particular, the team studied the effects that wind patterns and the jet stream have on pollution in the area. The last of the three projects studied was dengue fever, a potentially deadly disease spread by mosquitoes, in six Mexican states. Working in collaboration with researchers from the University of Miami, the team created a mathematical model to predict future outbreaks using data that address the influences that humidity and seasonal change have on the disease's spread. In each of these three projects, the international collaboration among DEVELOP students represents a tangible step towards improving environmental and human well-being.



The Summer 2011 Wise DEVELOP team presented information on their work at the Southwestern Virginia Technology Council Gala during the first week of the Summer 2011 term.

Conclusion

DEVELOP continues to provide students a unique opportunity to conduct research in numerous fields, from disaster management to ecological forecasting to air quality, while maturing as young professionals. The students' experiences are unique in that they are able to focus on real-world issues through the lens of NASA's satellite and airborne Earth observation systems. The program cultivates well-rounded young professionals who learn the importance of teamwork, gain experience in presenting meaningful results to a variety of audiences, and who are fluent in the use of NASA Earth observations and remote sensing capabilities. Using NASA Earth observations in innovative and resourceful ways, students have conducted projects that have the potential to impact communities nationwide, while providing students the opportunity to learn firsthand the benefits and practical applications of NASA Earth Science activities.

For more information, please visit: develop.larc.nasa.gov/. ■

The NASA CloudSat/GPM Light Precipitation Validation Experiment (LPVEx)

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- A robust assessment of the uncertainties in rainfall intensity estimates from these sensors.
- An archive of high-quality microphysics and rainfall intensity measurements in high-latitude precipitation systems to improve the underlying assumptions in satellite rainfall algorithms, and to facilitate the development of algorithms for future sensors.
- A better overall understanding of high-latitude precipitation processes and their implications for satellite remote sensing. These project objectives and light-rain-centric outcomes are necessary to

ultimately reconcile differences in current satellite rainfall products at high-latitudes, to meet the mutual goals of the CloudSat and GPM programs.

More information about the LPVEx campaign and associated datasets can be obtained through the CloudSat LPVEx website at: lpvex.atmos.colostate.edu. DSD and rain-rate observations and associated documentation from the surface sites are also available through the GPM Ground Validation Data Portal at: gpm.nsstc.nasa.gov/lpvex/index.html. Information about the GPM mission is available at: gpm.nasa.gov. ■