

Shedding a Little G-LiHT on the Matter of Forests

From April 17 - May 2, 2018, a team of scientists including **Ian Paynter** (618/USRA) along with **Matt Radcliff** (Office of Communications/USRA) were in Puerto Rico to collect airborne and field data. Using Goddard's Lidar, Hyper-spectral, and Thermal (G-LiHT) Airborne Imager, they collected high-resolution data from the same flight paths as data acquired in March 2017. Data from before and after Hurricane Maria provide 3D estimates of changes in forest structure, terrain elevation, and infrastructure. The 2018 G-LiHT campaign data will be used for investigating hurricane damage and recovery for various forest types. It also will contribute to prioritizing resources and restoration throughout the island. Additionally, the campaign's data will be shared via the G-LiHT Data Portal (<https://glihtdata.gsfc.nasa.gov/>) and map interface for the 4 cm resolution stereo air photos (<https://glihtdata.gsfc.nasa.gov/puertorico/index.html>). We had several questions for Dr. Paynter about the G-LiHT campaign, the team's findings, and his own interests and comments.

So, in April/May 2017, G-LiHT was measuring mangroves and rainforests, and then in Sept/Oct 2017, the hurricanes swooped in and devastated Puerto Rico. G-LiHT returned in April/May 2018 to revisit and collect data. What was the purpose of the 2017 study?

I was part of the initial study in 2017, prior to the hurricanes. Puerto Rico is a fascinating region for forests, because the island was almost entirely cut clear for the sugarcane industry around 80-90 years ago. However, as economics has driven different industries to replace agriculture, much of the island has become reforested. Therefore, Puerto Rico is our opportunity to study the timber potential, biodiversity, and carbon storage of a secondary tropical forest that has been allowed to regrow. Additionally, the unique rock types of Puerto Rico make for some unusual forest types, and this geology is very different across the island, as are the rainfall patterns, meaning that studying Puerto Rican forests is really good value in terms of the variety of forest types we could see.

In reviewing the G-LiHT Aerial photography (<https://gliht-data.gsfc.nasa.gov/puertorico/index.html>), much attention was focused on PM_EV. What was particular about this?

The EV stands for El Verde, an area of research forest inside the El Yunque National Forest. This region is steeply sloped, and contains a lot of different types of land-use histories. It is one of the most intense and longest-term research areas of forest anywhere on the island, and the two sides of the El Yunque mountain range have very different rainfall patterns and therefore forest types.

Who or what defines these flight paths? Once processed, what will the data tell the scientists?

The core flight paths were determined in collaboration with larger-scale institutions such as the Department of Forestry and the Tropical Institute. Then these flight paths were tweaked and expanded according to our extensive conversations with scientific entities and groups, encompassing as many ongoing research plots, and areas of interest as possible. Finally, the pilots and GLiHT flight crew adjusted and pruned the flight lines to ensure safe flying in areas where they could meet any flight restrictions, for example, around the San Juan airport. Aerial data for plots typically surveyed on the ground adds a lot of new information about the canopy, and can provide much-needed baseline information like the topography.

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G-LiHT Team. Ian Paynter at far left. Photo Credit: M. Radcliff (130/USRA)

(G-LiHT, cont'd)

However, since the hurricanes of 2017, the repeated flight-lines are a great place to start for assessing damage and recovery of forest ecosystems.

Are additional flight paths planned for 2018-2019 to follow up on recovery efforts?

I think there is a strong case to be made for continuing to monitor the recovery. Will the forests grow back as they were? Or differently? Will different species take the opportunity to dominate the new forest? Why did particular areas of forest experience such varying levels of damage, even in relatively small areas? These are all questions worthy of investigation, and the presence of such a rich dataset from before the hurricanes is multiplied in its value by every additional year of observations.

As shown on the interactive webmap (<https://glihtdata.gsfc.nasa.gov/>), G-LiHT data locations are scattered throughout North America, including Alaska, as well as Mexico and the Yucatan Peninsula. The mission has been collecting data since 2011.

What factors determine where and how long data is collected?

The primary reason G-LiHT gets deployed is in support of long-term projects, where the variety of instruments in the G-LiHT package is either adding a specific, important piece to a study, or is providing a whole suite of supporting and contextualizing data. However, since G-LiHT is a very flexible instrument package, which can be deployed on relatively short notice, some of what it does these days is respond to events like the 2017 hurricanes. Because of the sheer variety of complimentary data from G-LiHT, including structure from lasers, thermal measurements, high-resolution photography, and hyperspectral information, the instruments are sometimes deployed for one reason and end up fulfilling additional purposes for additional groups of scientists. For example, some forest biomass observations in Mexico were reprocessed to find ancient ruins!

Do you specifically study the Florida and Puerto Rico areas, or have you been involved with studying other locations?

The only consistent through-line in the last five years or so of my work has been the involvement of remote-sensing instruments and technology. The types of data that I have collected [...] and the places where I have collected them, or they have been collected, have been extremely varied. Therefore, I, and others like me, am reliant on strong collaborations with people that know their geographical regions and ecosystems really well. Having said that, I have worked with laser scanners more than anything else; and, forests just about edge out any other type of ecosystem I have worked with in terms of frequency, although my thesis was focused on saltmarshes.

What drives your curiosity in G-LiHT?

Specifically talking about the pre- and post-hurricane observations, I am really interested in what happens when ecosystems go through a blank-slate state, because of course, the slate is never really as blank as it looks. Species could be lurking for an opportunity to dominate a regrowing forest; the chemistry and biology of soil could have been drastically changed; light availability and competition is totally reset. Whether or not a forest regrows unchanged, or completely different, must depend on so many different factors, and is a really important question for our society, given the way we manage forests for timber, and the way our forests experience fires, storms, and other high-intensity events.

Any additional comments?

G-LiHT, thanks to its variety of instruments and data types, has something for everyone. However, it is at its strongest when those different data are used in a complimentary fashion, providing everything for someone. The ability to collect high-quality data simultaneously from a lot of different instruments, and with a lot of control of exactly when, and where, those data are collected, means G-LiHT can be a really incisive solution for ecosystem questions. In saltmarshes in New England, which have extreme tidal ranges, G-LiHT was able to fly specified regions exactly at the high and low points of the tide, to best characterize the submergence patterns of the vegetation, and the influence of the geomorphology on the saturation of the marsh.

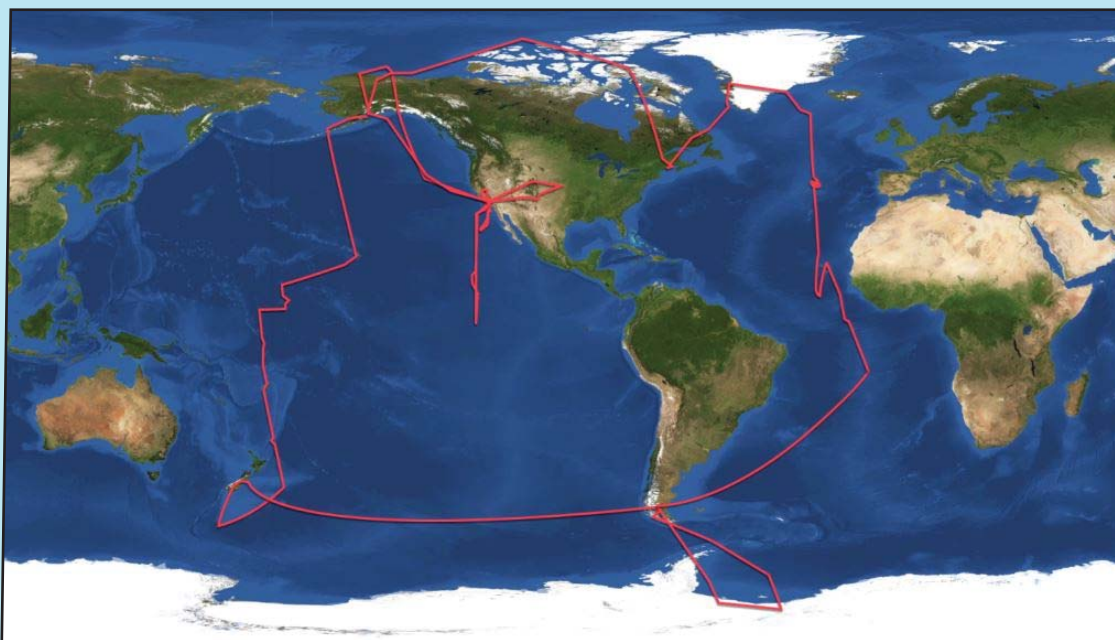
To learn more about this campaign, visit <https://gliht.gsfc.nasa.gov/>.

ATom at Rest

After three years and four (almost) month-long surveys, the DC-8 flying laboratory's wheels touched ground with the conclusion of the ATom mission. The Atmospheric Tomography Mission (ATom) studies atmospheric chemistry from a flying laboratory, the DC-8, which is loaded with more than 20 scientific instruments. To obtain a full range of samples, the DC-8 flew anywhere from 500 – 40,000 feet above the ocean. “The mission will measure more than 200 gases as well as airborne particles in the atmosphere over the oceans. The science team is trying to understand how greenhouse gases such as methane and [tropospheric] ozone, and poorly understood airborne particles such as black carbon, enter, transform and ultimately are removed from the atmosphere – processes essential for understanding Earth's climate today and in the future.” (Credit: Ellen Gray, NASA's Earth Science News Team.) ATom is funded by NASA's Earth Venture program and managed by the Earth Science Project Office (ESPO) at NASA Ames. A team of over 100 people across government agencies (NASA Ames, NCAR, NOAA, etc.) and universities (Harvard, University of Colorado – Boulder, CalTech, etc.) support the mission, both in the air and from the ground.

The first Atmospheric Tomography (ATom-1) was deployed July 28 – Aug 22, 2016 on a 26-day course, taking off from NASA's Armstrong Flight Research Center, Palmdale, CA, to the equator and back again; next, they flew towards the North Pole, to Anchorage, Alaska, followed by Kona, Hawaii, and American Samoa and then to the southern polar regions. After Christchurch, New Zealand, the mission headed east to Punta Arenas, Chile, and north up the center of the Atlantic, with a stopover at Ascension Island near the equator. After Terceira Island (off the coast of Portugal), they flew to Kangerlussuaq, Greenland for the final stop before crossing Canada and the U.S. back to Palmdale. The second survey (ATom-2) flew Jan 26 – Feb 22, 2017 from Alaska, over the Pacific Ocean, to New Zealand. Researchers were able to capture data of reactions over the ocean and during the height of the southern hemisphere's summer, ergo plenty of sunlight. The ATom-3 survey (Fall 2017) was deployed Sept 28 – Oct 26, 2017, and the ATom-4 flew Apr 24 – May 21, 2018, concluding the three-year mission. Check out “Measuring the Atmosphere on ATom's Final Flight Around the World”: <https://svs.gsfc.nasa.gov/12966> (Lead Producer: Katy Mersmann, 130/USRA).

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“ATom Flight Path 3”. Image from “ATom B-Roll”, <https://svs.gsfc.nasa.gov/12488>.

(ATom, cont'd)

GESTAR members involved with ATom over the past three years include **Leslie Lait** (614/MSU), Science Team Co-I on Mission Science; **Jin Liao** (614/USRA), Co-Investigator, In Situ Airborne Formaldehyde (ISAF); **Junhua Liu**, **Stephen Steenrod**, **Susan Strahan**, and **Sarah Strode** (all 614/USRA), Forecasters/Modelers; additionally, **Andrew Swanson** (614/USRA) and **Mark Olsen** (614/MSU) are involved with instrumentation and data analysis. Among other duties and responsibilities, the following is a glimpse into various contributions to the mission:

- Dr. Lait provided mission science meteorological support by designing flight plans, addressing operational issues or other climatological interference, and changing flight paths as necessary. For ATom-4, he participated in real-time communications with investigators on the NASA DC-8, delivering updated meteorological information. Subsequent to the final flight, Dr. Lait generated and submitted meteorological data files for each flight to the data archive.
- Dr. Strode provided chemical forecast briefings to the ATom team, which helped with anticipating the chemical conditions the team could encounter during the research flights. For the final flight, her forecasts included a new feature, the use of the GEOS-CF system, to provide forecasts of a broader range of trace gases, including ozone.
- Dr. Liu also worked with colleagues on the chemistry forecasting briefing using GEOS-5 and GEOS-CF forecasting simulations for ATom-4. These chemical forecasts provided insight into the chemical environments and source contributions for the diverse regions sampled by ATom campaigns.
- Dr. Olsen has begun to archive a record of the locations of the polar jet, subtropical jet, and intertropical convergence zone (ITCZ) for the flight days of the ATom mission.
- At NASA Armstrong, Mr. Swanson provided instrument integration and download support for the ATom-3 field campaign, which included preparing two of the lab's instruments, ISAF and CAFE, and integrating them into the NASA DC-8. At the campaign's end, he provided support by downloading the instruments and having them transported back to GSFC.

For more information on the mission and what's next, visit the ATom website: <https://espo.nasa.gov/atom>.

Science Highlights

2018 – Atmospheric Sciences

March: “High-frequency Polarized Microwave Measurements Show that Ice Crystal Microphysics Vary Diurnally” – **Jie Gong** (613/USRA), **D. Wu** (613/GSFC) and **Xiaowen Li** (612/MSU)

May: “Improved Ocean Wind Retrievals from Combined Active-Passive Microwave Remote Sensing” – **S. Munchak** (612/GSFC), **R. Meneghini** (612/GSFC), **W. Olson** (JCET/UMBC), and **Mircea Greco** (612/MSU)

May: “Atmospheric Gas Corrections for Aerosol Retrievals” – **Falguni Patadia** (613/MSU), **R. Levy** (613/GSFC), **S. Mattoo** (SSAI/GSFC)

2018 – Hydrosphere, Biosphere, and Geophysics

March: “Introducing the Cooperative Open Online Landslide Repository (COOLR), Landslide Viewer, and Landslide Reporter” – **D. Kirschbaum** (617/GSFC), **C. Juang** (SSAI/GSFC), **Thomas Stanley** (617/USRA)

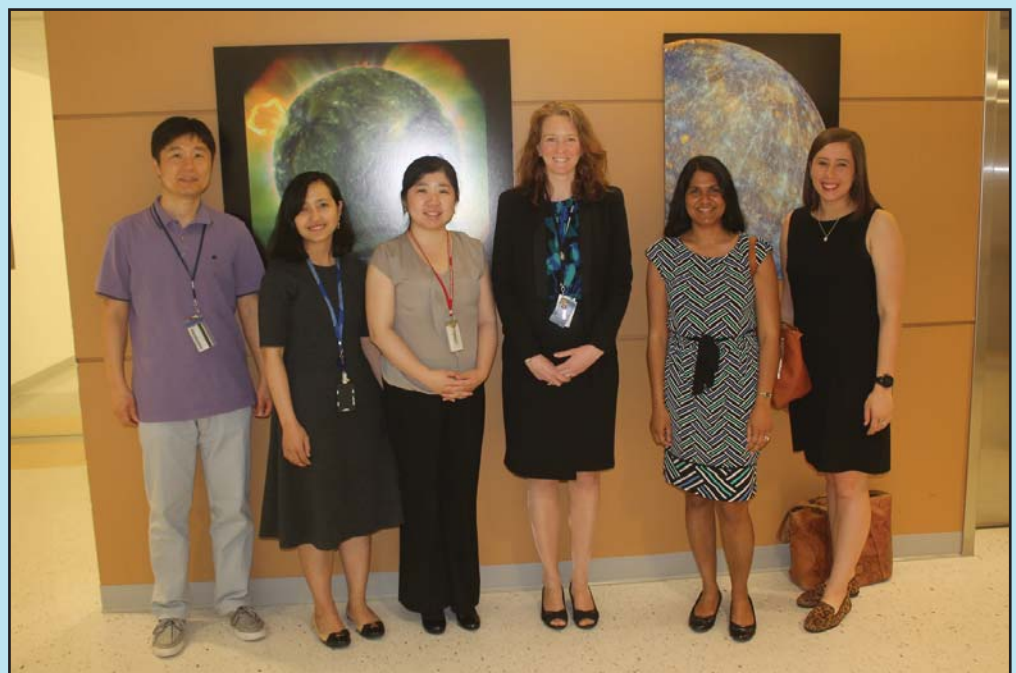
June: “Operational Support to Ocean Color Missions” – **B. Holben** (618/GSFC), **G. Zibordi** (JRC), **I. Slutsker** (618/GSFC), **D. Giles** (618/GSFC), **M. Sorokin** (618/GSFC), **Thomas Eck** (618/USRA), **A. Smirnov** (618/GSFC), **J. Schafer** (618/GSFC).

Events

In March 2018, **Pawan Gupta** (614/USRA) was in Jakarta, Indonesia to conduct Applied Remote Sensing Training (ARSET). He worked with the U.S. Embassy in Jakarta to conduct this training. After the session, the U.S. Embassy organized a public outreach event where Dr. Gupta presented along with other colleagues at @america Cultural Center at Pacific Place Mall, Jakarta, Indonesia. Among the attendees were government officials, civilians, and organization members. He and Dr. Bryan Duncan (614/GSFC) along with BMKG officials provided presentations on the topic “Checking Air Quality from Space”. Dr. Gupta provided an overview of space-based air quality measurements, discussed the ARSET program, and how NASA data and tools can be accessed. Also, **Melanie Follette-Cook** (614/MSU) provided a live demonstration of NASA’s Worldview tool. After, a Q&A session was held with the audience. The event was webcast live by @america.

On May 3, 2018, a GESTAR Colloquium was held at NASA Goddard, where presentations were given to USRA President Jeff Isaacson, Senior Vice President of Science Nick White, Vice President of Corporate Strategy & Development Vince DeFrancisci, as well as Morgan State University leadership and GESTAR Associate Directors from MSU and IMSG. The event began with overviews from Bill Corso, GESTAR Director, Russ Berard, GESTAR Business Manager, and Dagmar Morgan, GESTAR Program Liaison. The program then featured the following Scientific and Technical presentations:

- “Phytoplankton Diversity, Ocean Color and Carbon Cycle”, **Ivona Cetinic** (616/USRA)
- “NASA’s Scientific Visualization Studio”, **Tom Bridgman, Alex Kekesi, Ernie Wright** (606.4/USRA)
- “Diurnal Variation of Ice Microphysics Inferred from Polarimetric Microwave Measurements”, **Jie Gong** (613/USRA)
- “Air Quality Forecasts using the NASA GEOS Model”, **Emma Knowland** (610.1/USRA)
- “Remote Sensing Data as a Tool to Monitor Mosquito-borne Diseases”, **Radina Soebiyanto** (618/USRA)
- “Studies on Climate Variability and Climate Change Using the Global Climate Model and Assimilation Tools Developed by the GMAO”, **Young-Kwon Lim** (610.1/IMSG)
- “Social Media for Communication”, **Katy Mersmann** (130/USRA)
- “Soil Moisture Active Passive (SMAP) Microwave Radiometer Radio-Frequency Interference (RFI) Mitigation: On-orbit Results”, **Priscilla Mohammed** (555/MSU).



From left to right: Young-Kwon Lim, Radina Soebiyanto, Jie Gong, Emma Knowland, Priscilla Mohammed, and Katy Mersmann.

Photo Credit: A. Houghton

Awards & Accolades

Jie Gong (613/USRA) was recognized by AGU as one of 2017's outstanding reviewers for the journal *JGR-Atmospheres*: <https://eos.org/agu-news/in-appreciation-of-agus-outstanding-reviewers-of-2017>.

Sergey Korkin (613/USRA) was recognized by Elsevier as one of their Most Valued Reviewers for *Journal of Quantitative Spectroscopy & Radiative Transfer* (JQSRT): <https://www.journals.elsevier.com/journal-of-quantitative-spectroscopy-and-radiative-transfer/reviewers/thank-you-reviewers-jqrst-14>.

On April 10, 2018, at the NASA reception at the National Association of Broadcasters (NAB) convention in Las Vegas, NV, **Joy Ng** (130/USRA) received NASA's Videographer of the Year award for her work supporting NASA's SnowEx campaign. SnowEx is an Earth science field campaign in which scientists aim to better understand snow in different terrains and environments. She also took 3rd place in the Documentation category for her videography during the February 2017 science flights over Colorado. Some examples of her work can be found here: <https://svs.gsfc.nasa.gov/12549> and <https://svs.gsfc.nasa.gov/12511>. For more information on SnowEx, visit <https://snow.nasa.gov/snowex>.

Richard Damoah (618/MSU) was one of 55 scholars awarded a fellowship by the Carnegie African Diaspora Fellowship Program (CADFP) to travel to Ghana to work with Ms. Sharon Sappor, All Nations University (ANU), on the project "STEM Research Involving Earth Observation Data and its Analysis for Climate Change Monitoring in West Africa". Dr. Damoah's work also involves capacity building workshops on how to collect in-situ and satellite data for Climate Change Analysis. He will spend 44 days at ANU and team up with faculty on related research. The Institute of International Education, Inc. (IIE) collaborates with the US. International University-Africa on CADFP, which is funded by the Carnegie Corporation.

Genna Duberstein, Brian Monroe and Scott Wiessinger (all 130/USRA) were nominated for a Capital Emmy Award, part of The National Academy of Television Arts & Sciences. Their entry was in the category "Health/Science - No Time Limit": "Can Data from Space Save Dolphins?" - NASA Goddard/USRA, Genna Duberstein, Lead Producer/Editor/Videographer/Writer; Scott Wiessinger, Producer/Editor/Videographer/Writer/Narrator; Brian Monroe, Animator; William Corso, Executive Producer (see <http://www.capitalemmys.tv/wp-content/uploads/2018/05/60th-Capital-Emmy-Awards-Nominations-2017-Entries-v2.pdf>). While the award went to others, we congratulate them on being nominated. See the video for their entry here: <https://www.youtube.com/watch?v=1cAiLKP2F-U>.



From left to right: Genna Duberstein, Scott Wiessinger and Brian Monroe at the 60th Capital Emmy Awards, held on June 23, 2018.

Photo provided by S. Wiessinger.



maniac talks

GESTAR thanks the following scientists who presented talks in March, April, May and June: Dr. Elizabeth Middleton (Biospheric Sciences Laboratory/GSFC); Dr. Gavin Schmidt (Director, NASA GISS, NY); Mr. Dennis Andrucyk (Deputy Associate Director, SMD/NASA HQ); and Mr. Christopher Scolese (Director, NASA GSFC).

These talks are available online at the NASA Goddard Atmospheric Sciences page: <http://atmospheres.gsfc.nasa.gov/ext/maniacs/>. **Charles Gatebe** and Bill Hyrbyk are the team behind this successful seminar series.

New Hires

GESTAR welcomes the following member:
Fernande Vervoort, Natural Sciences Mgr./GEWEX

Moving On

Shivam Bijoria
Daniel Holdaway (JCSDA/NOAA)
Patricia Castellanos (Civil Servant/GSFC)
Amir Ibrahim (SSAI)
Dongjae Kim
Joshua Masters
Ishon Prescott
Xhafer Rama
Tian Yao
Cheng Zhang

Sippin' on Science

Bridget Seegers' proposal "Sippin' on Science Outreach" was funded recently by Universities Space Research Association (USRA) as a pilot outreach program for the planned Earth from Space Institute (EFSI). In August 2018, she will complete 2 ½ weeks of outreach in the lakes region of Wisconsin and Minnesota to discuss the Cyanobacteria Assessment Network (CyAN) project's local applications with a focus on small towns. This event combines hands-on science with a short presentation (30-45 minutes); the entire event will be 2 -3 hours, allowing time before or after the presentation for people to explore science tables and chat. There also will be trivia with prizes. The focus is on lake water quality and algae and will highlight locally relevant examples. One of the neat things she will share is a new CyAN app that is being developed that allows people to check in on their local lakes.

According to Dr. Seegers (616/USRA), "It's called Sippin on Science because the primary venues are bars, coffee shops, and breweries in smaller towns. [This way] folks can sip on a beverage of their choice and also learn a bit about the science. I'm originally from a small town in Wisconsin, so I am excited to do outreach there, especially since the CyAN project focuses on lakes, and over 30% of the lakes we can resolve with satellites are in the Wisconsin and Minnesota area." For more information on CyAN, visit <https://www.epa.gov/water-research/cyanobacteria-assessment-network-cyan>.

In The Press

Every year, **Katrina Jackson** (130/USRA) is on the scene to welcome and interview summer interns at NASA Goddard Space Flight Center. “The NASA Goddard Internship Program provides unique opportunities for students to contribute to NASA’s work in exploration and discovery. This summer, approximately 470 summer interns were selected from over 7,000 applicants – high school through doctoral level – to work across four Goddard campuses from June through August.” Check out her work and meet some of the interns in “NASA Interns Arrive at Goddard - Summer 2018” (<https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=12972&button=recent>).

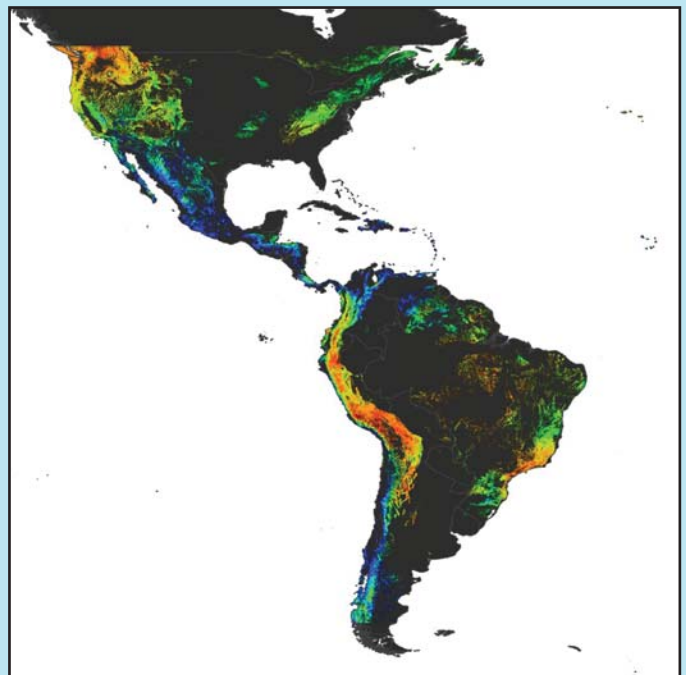
Assaf Anyamba (618/USRA) was interviewed for an article in *Scientific American* (lead author: Lois Parshley) titled “Climate change is accelerating the spread of disease—and making it much harder to predict outbreaks” (<https://www.scientificamerican.com/article/how-climate-change-is-making-it-harder-to-predict-outbreaks/>). This article features Dr. Anyamba's ongoing long-term research project in collaboration with EcoHealth Alliance on “Rift Valley fever in South Africa” funded by the Defense Threat Reduction Agency (DTRA).

Pawan Gupta (614/USRA) was featured in an EOS Research Spotlight: <https://eos.org/editor-highlights/new-strategies-to-protect-people-from-smoke-during-wildfires>.

Thomas Stanley's (617/USRA) and **Dalia Kirschbaum's** work was featured in an EOS Research Spotlight: https://eos.org/research-spotlights/a-near-real-time-tool-to-characterize-global-landslide-hazards?utm_source=eos&utm_medium=email&utm_campaign=EosBuzz051118.

Further, **Thomas Stanley** and the LHASA (Landslide Hazard Assessment model for Situational Awareness) were featured in an EO item: <https://earthobservatory.nasa.gov/IOTD/view.php?id=92018&src=ea-iotd>. In May, **Mr. Stanley** was interviewed by Voice of America: <https://www.voanews.com/a/can-landslides-be-predicted/4383264.html>.

The NASA Goddard feature, <https://www.nasa.gov/feature/goddard/2018/new-from-nasa-tracking-landslide-hazards-new-nasa-model-finds-landslide-threats-in-near-real>, is based on a March 2018 article by **Dalia Kirschbaum** and **Thomas Stanley** in *Earth's Future* titled “Satellite-Based Assessment of Rainfall-Triggered Landslide Hazard for Situational Awareness” (<https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1002/2017EF000715>). The issue's cover image was created by **Helen-Nicole Kostis** (606.4/USRA) (see below).



Genna Duberstein and **Scott Wiessinger** (both 130/USRA) were interviewed about Solarium by Maryland Public Television. The video was released on March 15, 2018: <http://www.mpt.org/digitalstudios/thedig/solarium/>.

Hiren Jethva (614/USRA) was featured in an Earth Observatory (EO) article: <https://earthobservatory.nasa.gov/IOTD/view.php?id=92309&src=ea-iotd>. **Dr. Jethva** also was interviewed for an article in *Times of India*: <https://timesofindia.indiatimes.com/india/large-parts-of-india-dotted-with-fires-nasa-images/article-show/63965686.cms>.

Recent Publications

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(Publications, cont'd)

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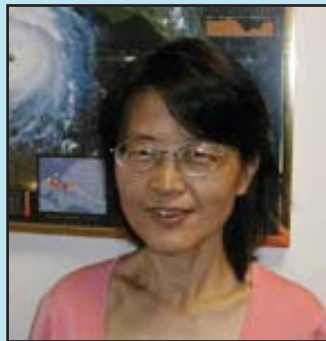
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