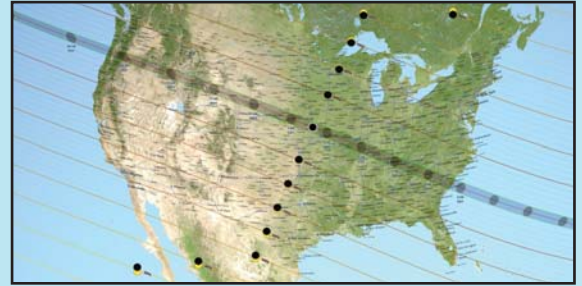


The Great Solar Eclipse of 2017

In case you missed it, millions of people across the United States saw a total or partial eclipse of the Sun on August 21, 2017. This eclipse was especially exciting as it had been 38 years since the last solar eclipse had made its way across the contiguous U.S. For at least a year prior, **Ernie Wright** (606.4/USRA) had been preparing and releasing visualizations detailing the eclipse maps, the path of totality, the percentage of totality, the explanation of why the umbra is occurring, and the history of solar eclipses. He participated in several outreach events as well as interviews with online media, radio stations, local and national television outlets, and he provided data or expertise to National Geographic, PBS Nova, NOAA, the Department of Energy, the Department of Homeland Security, NPR, Google Earth, and the solar eclipse mailing list on Yahoo Groups.



*“2017 Total Solar Eclipse and Shapefiles”,
<https://svs.gsfc.nasa.gov/4518>, Lead Visualizer Ernie Wright. Photo Credit: NASA’s SVS.*

Ernie observed the eclipse at Homestead National Monument near Beatrice, Nebraska, where he was a member of a NASA outreach team that included Anita Davis (NASA Earth to Sky), Andrea Jones (Lunar Reconnaissance Orbiter) and several others. He and Andrea gave a talk to the Friends of Homestead, a volunteer group of Beatrice residents who had helped prepare Homestead for the eclipse, and he spoke to the public at Homestead. We caught up after the fact with Ernie to revisit the experience and look ahead.

When is the next eclipse event, which will have a path from SW to NE, rather than NW to SE? And why the change in direction?

Across the globe, the next total solar eclipse is on July 2, 2019, and will be visible in Chile and Argentina. Eclipse chasers are already making their plans. The next total solar eclipse in the U.S. will occur April 8, 2024. The maximum duration will be about 4 ½ minutes, 2 minutes longer than the 2017 eclipse. The path will pass over Dallas, Indianapolis, and Cleveland. The change in direction is due to the tilt of the Earth relative to the orbit of the Moon. The difference is pretty large between these two eclipses because 2017 was in late August and 2024 will be in early April, when the Earth is tilted “the other way” (near-autumn versus spring).

What were some of the most common questions you received? I understand there was some confusion since the sun rises in the east and sets in the west, yet we were following the Path of Totality from west to east.

That confusion about the motion of the shadow resulted in a very common question. And the explanation is that the Moon’s west-to-east motion in its orbit is several times faster than the rotation of the Earth. Some other popular questions: How often do total solar eclipses happen? About every 18 months somewhere on Earth. In any particular spot, the average is about every 350 years, but it varies widely. Carbondale, IL, happens to be at the point where the 2017 and 2024 paths cross, for example. Also: Is there any science in total eclipses? Yes, and much of what scientists observed, collected, explored and analyzed from the eclipse is detailed here: <https://eclipse2017.nasa.gov/science>.

While you were in Nebraska, did you follow the comments of others who experienced totality before the eclipse made it to you? We were in the middle of an open prairie, away from most of the crowd at Homestead, and with really bad cell coverage. As we were driving back to Lincoln, NE, after the event, my phone lit up with [earlier] messages from colleagues in Oregon and Idaho The weather at Homestead was dicey the whole morning prior to totality; in fact, it rained on us about a half-hour before. We got lucky and saw totality through breaks in the clouds. I was there with my wife and grown children, along with my sister’s family who’d flown up from Texas. ... Totality is glorious - no photo can do it justice.

(Eclipse, cont'd)

What was the significance of observing the eclipse at Homestead National Monument?

Homestead commemorates the U.S. westward expansion during the 19th century, the frontier of that era. For the visit by us NASA people, the rangers drew a direct connection between that and the 21st-century frontier of space science. On a more personal note, my great-great-grandmother Lucy is buried in the nearby town of Beatrice, NE. Her father fought in the Revolutionary War, and at the time of her death, she was one of the last so-called real Daughters [Daughters of the American Revolution]. So I was able to combine my interest in genealogy with an opportunity to contribute to a major NASA public outreach event.

What kind of work are you currently doing related to the Lunar Reconnaissance Orbiter (LRO)?

Noah Petro, the LRO Project Scientist, recently co-wrote a major paper with Apollo 17 astronaut Harrison “Jack” Schmitt, the only scientist to walk on the Moon. The paper revisits his analysis from that time in light of new data from LRO, and we’ll be highlighting a few of those results. The Schmitt and Petro et al. paper is available here: <http://www.sciencedirect.com/science/article/pii/S0019103516308089>. We’re also coming up on the 50th anniversary of the Apollo missions. Apollo 8, the first to reach the Moon, was launched in December of 1968. The LRO team will of course play a role in NASA’s activities related to the anniversary.

What attracted you initially to work on lunar-related items and events?

I just got lucky! Apollo 11 happened when I was 6, and my dad let us stay up late to see Neil and Buzz walk on the Moon. I’ve always had the interest, but when I applied for the job in the SVS in 2008, it just so happened that they were spinning up support for LRO, and I was a good fit for that.

The 2017 eclipse also made its way into baseball history. Three minor league baseball teams had games scheduled which coincided with the event and worked the eclipse into the ballpark experience. David Ladd (130/USRA) traveled to Oregon to film, produce, and edit the video “Baseball Hits an Eclipse,” which showcased the partnership between the LRO mission team and the Salem-Keizer Volcanoes Minor League Baseball team in putting on an “EclipseFest” for the 2017 Total Solar Eclipse. The Volcanoes’ stadium was a unique location to view the solar eclipse as it sat directly within the path of totality, and the team had arranged for the *first-ever* “Eclipse Delay” in professional baseball history. The video showed all of the excitement that happened in the stadium for “EclipseFest”. Released in September, this video also was featured in a film festival in Cooperstown, NY at the National Baseball Hall of Fame. “Baseball Hits and Eclipse” can be seen on the Goddard YouTube page: <https://www.youtube.com/watch?v=S07FO4GH0zc>. David also built the Scientific Visualization Studio’s gallery page “LRO & Solar Eclipse Events,” which features multimedia resources for all of the 2017 Solar Eclipse Events being sponsored by the LRO mission (<https://svs.gsfc.nasa.gov/Gallery/LROSolarEclipse.html>). This gallery is a terrific resource for revisiting the eclipse of 2017.



Ernie Wright, shown speaking with the public at Homestead National Monument, Beatrice, Nebraska, on Saturday, Aug 19, 2017. Fun fact: “That NASA straw hat was purchased at Kennedy Space Center gift shop on the day that LRO was launched, June 18, 2009. The Hawaiian shirt is monogrammed with the LRO logo. The idea for those shirts came from Cathy Peddie, the Deputy Project Manager for LRO at the time and a native of Hawaii.” (Photo Credit: Sue Wright, Ernie’s wife)

Best of Goddard Summer Film Festival 2017

The 8th Annual Goddard Film Festival, shown in Building 36 on Thursday, July 6, 2017, was curated by **Katie Mersmann** (130/USRA) this year. The festival's poster was created by Jenny Hottle, a Pathways trainee (Pathways is a year-long internship program). Several GESTAR members were involved with these videos in various roles. The following is a list of the videos included in the festival, and the visualizations are available for viewing here: https://www.youtube.com/playlist?list=PL_8hVmWnP_O1OldbeoQioC4SFETOG9cZX.

- 1) Science Comes Alive at NASA Goddard: Producers, Writers, Videographers and Talent from KBRwyle, NASA/GSFC, AIMM, and NASA/WFF.*
- 2) Coming Soon: The Latest Tracking and Data Relay Satellite, TRDS-M: Producers, Animators and Technical Support from HTSI, NASA/GSFC and ADNET Systems.*
- 3) Tracing the 2017 Solar Eclipse: **Genna Duberstein** (USRA), Lead Producer and Lead Editor; **Ernie Wright** (USRA), Lead Visualizer and Lead Narrator.
- 4) Seasonal Changes in Carbon Dioxide: **Joy Ng** (USRA), Narrator; **Brad Weir** (USRA), Scientist; **Heather Hanson** (GST), Writer.
- 5) One Year on Earth – Seen From 1 Million Miles: **Kayvon Sharghi** (formerly USRA), Producer, Animator, Video Editor, Co-Narrator.
- 6) Javier Colon & Matt Cusson: The Moon and More (NASA Collaboration): **David Ladd** (USRA), Lead Producer, Lead Video Editor and Lead Cinematographer.
- 7) Join the Search for New Nearby Worlds: **Scott Wiessinger** (USRA), Lead Producer; **Krystofer Kim** (USRA), Lead Animator; **Genna Duberstein** (USRA), Support.
- 8) Hubble Explores the Final Frontier: **Katrina Jackson** (USRA), Lead Producer, Editor and Host.
- 9) Ocean Tides and Magnetic Fields: **Matt Radcliff** (USRA), Lead Producer and Writer; **Brian Monroe** (USRA), Lead Animator; **Michael Lentz** (USRA), Artistic Director.
- 10) X-ray Echoes Map a Black Hole's Disk: **Scott Wiessinger** (USRA), Lead Producer, Editor, Narrator, Animator; **Brian Monroe** (USRA), Animator.
- 11) Showstopper Nov. 14 Supermoon is the Closest Moon to Earth since 1948: **Michelle Handleman** (USRA), Producer.
- 12) NASA's Global Tour of Precipitation in UHD (4K): **Alex Kekesi** (GST), Data Visualizer; **Joy Ng** (USRA), Lead Producer and Editor; **Ryan Fitzgibbons** (USRA), Producer.
- 13) Snapshots from the Edge of the Sun: **Genna Duberstein** (USRA), Lead Producer; **Lisa Poje** (formerly USRA), Lead Animator; **Adriana Manrique Gutierrez** (USRA), Animator.

*Asterisk denotes those videos without any GESTAR affiliation.



2017 Film Festival Poster, created by Jenny Hottle.
 (Image provided by G. Duberstein.)

Science Jamboree at NASA GSFC

On Wednesday, July 12, 2017, the Goddard Science Jamboree was held in the Building 28 Atrium and featured interactive and innovative displays and demonstrations from divisions across the Goddard disciplines. The event included hyperwall presentations in the NCCS Data Visualization Theater*, plus tours of the NASA Center for Climate Simulation (NCCS), the Goddard TV Studio and the Conceptual Imaging Lab. Food trucks were onsite as well. This year, the event kicked off with remarks by Colleen Hartman, SED Director, and Mark Clampin, SED Deputy Director.

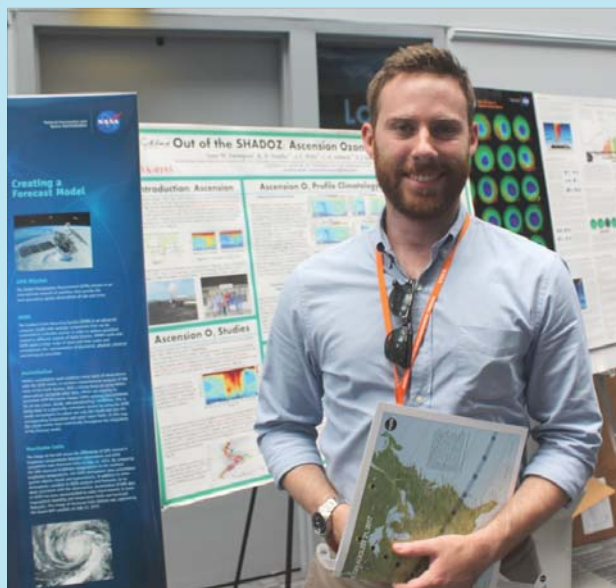
Several GESTAR members staffed booths for their respective disciplines; those working with the Scientific Visualization Studio presented on Virtual Reality and the new 360-degree camera products. Others came out to explore the Jamboree's exhibits.



Representing Code 610.1/GMAO, Abhishek Chatterjee (USRA) (top), Emma Knowland & Allison Collow (both USRA) (bottom) display the MERRA-2 Cube. The six-sided cube shows images of the Arctic, the Pacific, Asia, Africa, the Americas, and Antarctica. Photo Credit: A. Houghton



Bridget Seegers (616/USRA), ready to discuss PACE and the color of the ocean. Photo Credit: A. Houghton



Perry Oddo (617/USRA), perusing the posters at the Jamboree. Photo Credit: A. Houghton

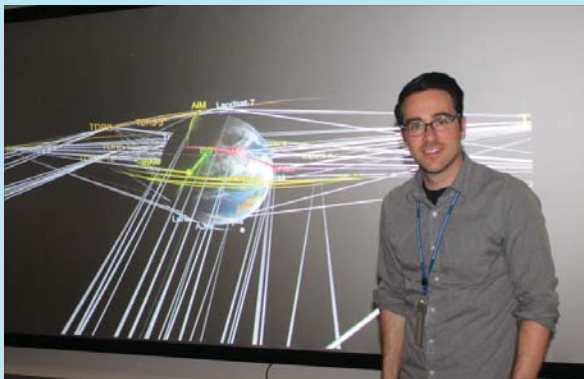
(Jamboree, cont'd)

*Note: On July 17, 2017, NASA Goddard Space Flight Center dedicated the NASA Center for Climate Simulation's Data Visualization Theater to Dr. Piers Sellers, whose career spanned that of scientist to astronaut to leader in the Sciences and Exploration Directorate (SED). At the dedication ceremony, Center Director Chris Scolese delivered opening remarks, Colleen Hartman, SED Director, spoke to attendees, and Phil Webster, Chief of the Goddard Computational and Information Science and Technology Office, discussed the operational features of the hyperwall. The Dr. Piers J. Sellers Data Visualization Theater is on the second floor of Building 28, where a quote of his is posted: "To reach a safer future, we will need the resources of everybody here. The scientists, the policy makers, and the industrialists, all working together towards a common goal. And that goal is a planet that can continue to support life, including all of us."

- Piers Sellers (1955–2016)



Photo Credit: A. Houghton



*Kel Elkins (606.4/USRA), sharing information on the new 360-degree camera work being done in the SVS.
 Photo Credit: A. Houghton*



Ed Nowotnick (614/USRA) visiting the Scientific Visualization Studio. Photo Credit: A. Houghton



Sushel Unninayar (617/MSU), exploring the exhibits at the Jamboree. Photo Credit: A. Houghton



*Michelle Handleman (130/USRA) stops by!
 Photo Credit: A. Houghton*

Young Scientist Forum

On October 30, 2017, the Young Scientist Forum was held in Building 36 in two separate rooms, C211 and N207. The forum is open to scientists who have obtained their degree in the last 10 years. They give oral presentations as well as poster presentations. Additionally, a mid-day Q&A session with senior scientists was held; this year's scientists were Mark Clampin, Deputy Director, GSFC SED (600); Eftyhia Zesta, Lab Chief, Geospace Physics Laboratory (673); and Avi Mandell, PI, Exoplanet and Analysis Center – EMAC (693).

Manisha Ganeshan (613/USRA) was a Co-Chair of both the Heliophysics Session and the Remote Sensing and Modeling of Clouds and Precipitation Sessions, **Manuela Giroto** (610.1/USRA) was a Co-Chair of the Natural Hazards Session, and **Ed Nowotnick** (614/USRA) was a Co-Chair of both the Pollution Observations and Forecasts Session and the Astrophysics Session.

GESTAR scientists who delivered oral presentations are listed here:

Yingxi Shi (613/USRA): “Characterizing optically thick aerosol events over 2015 Indonesia forest fire and their impacts using multi-sensor observations and models”;

Allison Collow (610.1/USRA): “Classification of Meteorological Influences Surrounding Extreme Precipitation Events in the United States using MERRA-2 Reanalysis”;

Christoph Keller (610.1/USRA): “Improved air quality forecasting using NASA GEOS-5 multispecies data assimilation system of tropospheric constituents”;

K. Emma Knowland (610.1/USRA): “Air pollution forecasts using the NASA GEOS model: A unified tool from local to global scales”;

Fei Liu (614/USRA): “Emission trends over Chinese cities estimated from OMI observations during 2005 to 2015”.



*Manisha Ganeshan at the Young Scientist Forum.
 (Photo: A. Houghton)*

Poster Session contributors from GESTAR are listed here:

Yuni Lee (699/USRA): “Seasonal and Spatial Variability of the M2 Layer observed by MAVEN”;

Perry Oddo (617/USRA): “Socioeconomic Impact Evaluation for Near Real-Time Flood Detection in the Lower Mekong River Basin”;

Thomas Stanley (617/USRA): “Assessment of rainfall thresholds for landslide triggering in the Pacific Northwest: extreme short-term rainfall and long-term trends”;

Deepthi Achuthavari (610.1/USRA): “Prediction and predictability of the Madden Julian Oscillation in the NASA GEOS-5 seasonal-to-subseasonal system”;

Eunjee Lee (610.1/USRA): “Impact of a regional drought on terrestrial carbon fluxes and atmospheric carbon: results from a coupled carbon-cycle model”;

Tomohiro Oda (610.1/USRA): “Cities in the Dark: Mapping Human-induced Carbon Dioxide Emissions using Observations from Space”.

(Young Scientist Forum, cont'd)



Clockwise, from left: Allison Collow & Manuela Giroto; Fei Liu; Yingxi Shi; and Christoph Keller. Photos: A. Houghton



Maniac Talks

GESTAR thanks these speakers who presented talks this past summer and fall: *Belay Demoz*, JCET/UMBC (July 2017); *Antonio Busalacchi*, University Corporation for Atmospheric Research (UCAR) (August 2017), and *J. Marcos Sirota*, Sigma Space Corporation (October 2017). When possible, each talk is videotaped and posted on the SED Highlights page under Presentations: <http://science.gsfc.nasa.gov/sci/presentations>.

Thanks to **Charles Gatebe**, **Assaf Anyamba** and **Bill Hrybyk** for coordinating and taping these well-attended events.

New Hires

GESTAR welcomes the following members:
Kevin Durham (GST), Sr. Science Exhibition Specialist
Thomas Fauchez (USRA), Scientist II
MinJeong Jo (USRA), Visiting Scientist
Jackson Tan (USRA), Visiting Scientist II

Moving On

Valentina Aquila (American University)
 Nathan Arnold (610.1/GSFC)
 Junchang Ju (University of Maryland)
 Maudood Khan (Univ. of Alabama, Huntsville)

Awards

Code 100 Peer Awards

The Office of the Director (Code 100) held its Peer Awards ceremony at the GEWA Recreation Center on Thursday, June 22, 2017. GESTAR members **Michelle Handleman** (130/USRA), Live News Producer, and **Katrina Jackson** (130/USRA), Science Video Producer, were both recipients of a Peer Award. Michelle was recognized in the category of “Excellence in Leadership” and Katrina was recognized in the category “Collaboration and Teamwork”.

Code 610AT Awards

The Earth Sciences Division - Atmospheres (Code 610AT) Awards Ceremony was held on Friday, September 22, 2017, at NASA Goddard and three GESTAR members were recognized for their achievements. Each recipient received a plaque, and representatives from USRA and MSU presented individual certificates.

- **Jie Gong** (613/USRA) was recognized for Best Senior Author Publication: “For advancing our understanding of polarized microwave radiation from atmospheric frozen particles: Gong, J. and D.L. Wu, 2017, Microphysical properties of frozen particles inferred from Global Precipitation Measurement (GPM) Microwave Imager (GMI) polarimetric measurement, *Atmos. Chem. Phys.*, 17, 2741-2757.”
- **Hiren Jethva** (614/USRA) was recognized for Best Science Highlight: “A Global and Decadal Record of Optical Depth of Absorbing Aerosols Above Clouds from OMI’s Near-UV Observations” (April 2017).
- **Hyokyung Kim** (612/MSU) was recognized For Outstanding Performance – Science Software Development: “For GPM/DPR (Global Precipitation Mission/Dual-Frequency Precipitation Radar) Software Development.”

In the Press

In July, **Assaf Anyamba** (618/USRA) was interviewed by George Putic (Voice of America [Science and Technology Reporter]) on the application of NASA Earth Science Satellite Data in Disease Monitoring and Early Warning Systems. The event was coordinated by Suraiya Farukhi (Director, External Communications; USRA) and Rani Gran of the GSFC PAO. Click here to watch the video: <https://www.voanews.com/a/3957850.html>.

Manisha Ganeshan (613/USRA), an International Arctic Science Committee (IASC) Atmosphere Working Group Fellow, was profiled in the IASC September Newsletter. IASC Fellows are researchers who actively participate in selected activities of the IASC working groups. See <https://iasc.info/outreach/news-archive/351-manisha-ganeshan-atmosphere-wg-fellow-2017>.

Young-Kwon Lim (610.1/USRA) conducted research along with Siegfried Schubert, **Oreste Reale**, Andrea Molod, **Max Suarez**, and Benjamin Auer on the large-scale controls on the Atlantic hurricane activity on seasonal time scales, which

resulted in a 2016 publication in *Journal of Climate* (<https://doi.org/10.1175/JCLI-D-16-0098.1>). In July 2017, a video on this work titled “Building a Hurricane Season in the Atlantic Ocean” was posted on YouTube and the NASA Goddard Scientific Visualization Studio page: <https://www.youtube.com/watch?v=TEen6qktfz-A&t=3s> and <https://svs.gsfc.nasa.gov/12628>.

Brian Monroe (130/USRA) was featured in *Smithsonian’s Air & Space Magazine*: <http://www.airspacemag.com/as-next/oct-nov-as-next-180964761/>.

Oreste Reale (610.1/USRA) contributed to a NASA Earth Observatory item: <https://earthobservatory.nasa.gov/IOTD/view.php?id=90654&src=eoa-iotd>.

Andy Sayer (613/USRA) was featured in the ‘Conversations With Goddard’ series : <https://www.nasa.gov/feature/goddard/2017/andrew-sayer-takes-a-world-view>.
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(Press, cont'd)

An article in the journal Nature features an image from the studies of **Thomas Stanley** (617/USRA) and Dalia Kirschbaum (617/GSFC) regarding the landslide on the Pacific Coast Highway: <http://www.nature.com/news/creeping-earth-could-hold-secret-to-deadly-landslides-1.22485>.

Guoyong Wen (613/MSU) discussed the transmission of energy to and from Earth during the solar eclipse in a NASA Goddard feature: <https://www.nasa.gov/feature/goddard/2017/nasa-looks-to-the-solar-eclipse-to-help-understand-the-earth-s-energy-system>.

Science Highlights (SED at GSFC)

2017 – Atmospheric Science

July: “A Dual-Wavelength Space-/Air-borne Radar Technique to Detect Hydrometeor Phases”, **Liang Liao** (612/MSU) and R. Meneghini (GSFC)

July: “Searching for Aerosol Effects on Clouds Using MODIS Regimes”, L. Oreopolous (GSFC), **Nayeong Cho** (613/USRA) and **Dongmin Lee** (613/MSU)

July: “Simulation of the Ozone Monitoring Instrument Aerosol Index using the NASA Goddard Earth Observing System Aerosol Reanalysis Products”, P. Colarco (GSFC), **Santiago Gassó** (614/MSU), C. Ahn (SSAI), **Virginie Buchard** (610.1/USRA), A. da Silva (GSFC), O. Torres (GSFC)

August: “Cross-calibration of VIIRS against MODIS Aqua decreases aerosol retrieval error and improves data consistency”, **Andrew Sayer** (613/USRA), N. C. Hsu (GSFC), C. Bettenhausen (SSAI), J. Lee (ESSIC/UMD)

August: “Alaska, Greenland, Iceland and Patagonia are Active Dust Producing Regions”, **Santiago Gassó** (614/MSU)

September: “Making Better Estimates of Extreme Precipitation with TRMM Data”, L. Demirdjian (UCLA), **Yaping Zhou** (613/MSU), G. Huffman (GSFC)

October: “Making Better Estimates of Extreme Precipitation with TRMM Data”, N. C. Hsu (GSFC), **Andrew Sayer** (613/USRA), J. Lee (ESSIC)

GESTAR Anniversary Party

GESTAR kicked off its **7th** year with an anniversary party on Thursday, August 24, 2017, at the NASA Goddard Rec Center. **Carol Ball** (GESTAR/USRA) organized a wonderful celebration, with breakfast and brunch served from 10am – 12pm. GESTAR scientists, administration and staff mingled and reflected on the past year’s accomplishments and the year ahead.



GESTAR Celebratory Brunch at the NASA GSFC Barney and Bea Recreation Center (Photo: C. Ball)

2017 –Hydrosphere, Biosphere, and Geophysics

August: “Costa Rica Tree Heights from EcoSAR and Tandem-X”, B. Osmanoglu, **Tobias Bollian** (618/USRA), S.K. Lee (UMD), R. Rincon (GSFC), L. Fatoyinbo (GSFC), J. Ranson (GSFC)

September: “Near Real-Time Flood Detection and Socio-economic Impact Assessment in the Lower Mekong River Basin”, J. Bolten (GSFC), **Perry Oddo*** (617/USRA), A. Ahammed (Stanford Univ.) *Presented at Poster Session of YSE.

October: “SnowEx: An Unprecedented Snow Campaign”, E. Kim (GSFC), **Charles Gatebe** (613/USRA), D. Hall (ESSIC), and the SnowEx Team

October: “Rivers and floodplains as key components of global terrestrial water storage variability”, A. Getirana (ESSIC), M. Rodell (GSFC), S. Kumar (GSFC), **Manuela Girotto** (610.1/USRA).

Publications

- Buchard, V.**, C. Randles, A. da Silva, A. Darminen, P. Colarco, R. Govindaraju, R. Ferrare, J. Hair, A. Beyersdorf, L. Ziemba, and H. Yu (2017), The MERRA-2 Aerosol Reanalysis, 1980 -- onward, Part II: Evaluation and Case Studies, *J. Climate*, doi:10.1175/JCLI-D-16-0613.1.
- Chatterjee, A.**, M.M. Gierach, A.J. Sutton, R. A. Feely, D. Crisp, A. Eldering, M. R. Gunson, C. W. O'Dell, B. B. Stephens, and D. S. Schimel (2017), "Influence of El Niño on atmospheric CO₂ over the tropical Pacific Ocean: findings from NASA's OCO-2 mission", *Science*, 358, <http://dx.doi.org/10.1126/science.aam5776>.
Abstract: "Spaceborne observations of carbon dioxide (CO₂) from the Orbiting Carbon Observatory-2 are used to characterize the response of tropical atmospheric CO₂ concentrations to the strong El Niño event of 2015–2016. Although correlations between the growth rate of atmospheric CO₂ concentrations and the El Niño–Southern Oscillation are well known, the magnitude of the correlation and the timing of the responses of oceanic and terrestrial carbon cycle remain poorly constrained in space and time. We used space-based CO₂ observations to confirm that the tropical Pacific Ocean does play an early and important role in modulating the changes in atmospheric CO₂ concentrations during El Niño events—a phenomenon inferred but not previously observed because of insufficient high-density, broad-scale CO₂ observations over the tropics."
- Choi, H., H. Liu, J. H. Crawford, D. B. Considine, D. J. Allen, B. Duncan, L. W. Horowitz, J. M. Rodriguez, S. E. Strahan, L. Zhang, X. Liu, M. R. Damon, and S. D. Steenrod (2017), Global O₃–CO correlations in a chemistry and transport model during July–August: evaluation with TES satellite observations and sensitivity to input meteorological data and emissions, *Atmos. Chem. Phys.*, Vol. 17, 8429–8452, doi:10.5194/acp-17-8429-2017.
- Demirdjian, L., Y. Zhou, and G. Huffman (2017), Statistical Modeling of Extreme Precipitation with TRMM Data, *J. Applied Meteorology and Climatology*, *J. Appl. Meteor. Climatol.*, doi:10.1175/jamc-d-17-0023.1.
- Douglass, A. R., S. E. Strahan, L. D. Oman, and R. S. Stolarski (2017), Multi-decadal records of stratospheric composition and their relationship to stratospheric circulation change, *Atmos. Chem. Phys.*, 17, 12081–12096, <https://doi.org/10.5194/acp-17-12081-2017>.
- Fan, Y., W. Li, C. K. Gatebe, C. Jamet, G. Zibordi, T. Schroeder and K. Stamnes (2017), Atmospheric correction over coastal waters using multilayer neural networks", *Remote Sensing of Environment*, 199, 218–240, <http://dx.doi.org/10.1016/j.rse.2017.07.016>.
- Gelaro, R., W. McCarty, M. J. Suarez, R. Todling, A. Molod, L. Tabacks, C. Randles, A. Darminen, M. G. Bosilovich, R. Reichle, K. Wargan, L. Coy, R. Cullather, C. Draper, S. Ake-lla, V. Buchard, et al. (2017), The Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2), *J. Climate*, doi:10.1175/JCLI-D-16-0758.1.
- Goldberg, D., L. N. Lamsal, C. P. Loughner, W. H. Swartz, Z. Lu, and D. G. Streets (2017), A high-resolution and observationally constrained OMI NO₂ satellite retrieval, *Atmos. Chem. Phys.*, Vol. 17, 11403–11421, doi:10.5194/acp-17-11403-2017.
- Gregg, W., C. S. Rousseaux, and B. A. Franz (2017), Global Trends in Ocean Phytoplankton: A New Assessment from Revised Ocean Color Data, *Remote Sensing Letters*, 8, 1102–1111, doi:10.1080/2150704X.2017.1354263.
- Hsu, N. C., J. Lee, A. M. Sayer, N. Carletta, S. Chen, C. J. Tucker, B. N. Holben, and S. Tsay (2017), Retrieving near-global aerosol loading over land and ocean from AVHRR, *J. Geophys. Res. - Atmospheres*, Vol. 122, doi:10.1002/2017JD026932.
- Knowland, K., R. M. Doherty, K. I. Hodges, and L. E. Ott (2017), The influence of mid-latitude cyclones on European background surface ozone, *Atmos. Chem. Phys.*, Vol. 17, 12421–12447, doi:10.5194/acp-17-12421-2017.
- Krotkov, N., L. N. Lamsal, E. A. Celarier, W. H. Swartz, S. V. Marchenko, E. J. Bucsela, K. L. Chan, M. Wenig, and M. Zara (2017), The version 3 OMI NO₂ standard product, *Atmos. Meas. Tech.*, 10, 3133–3149, <https://doi.org/10.5194/amt-10-3133-2017>.

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(Publications, cont'd)

Lee, J., N. C. Hsu, A. M. Sayer, C. Bettenhausen, and P. Yang (2017), AERONET-based nonspherical dust optical models and effects on the VIIRS Deep Blue/SOAR over-water aerosol product, *J. Geophys. Res. - Atmospheres*, Vol. 122, doi:10.1002/2017JD027258.

Liu, F., S. Beirle, Q. Zhang, R. J. van der A, B. Zheng, D. Tong, and K. He (2017), NO_x emission trends over Chinese cities estimated from OMI observations during 2005 to 2015, *Atmos. Chem. Phys.*, Vol. 17, 9261-9275, doi:10.5194/acp-17-9261-2017.

Mallet, M., F. Solomon, L. Roblou, F. Peers, S. Turquety, F. Waquet, H. Jethva, and O. Torres (2017), Simulation of Optical Properties and Direct and Indirect Radiative Effects of Smoke Aerosols Over Marine Stratocumulus Clouds During Summer 2008 in California With the Regional Climate Model RegCM, *J. Geophys. Res. - Atmospheres*, Vol. 122, doi:10.1002/2017JD026905.

Nag, S., T. Hewagama, G. Georgiev, B. Pasquale, S. Aslam, and C. K. Gatebe (2017), Multispectral Snapshot Imagers Onboard Small Satellite Formations for Multi-Angular Remote Sensing, *IEEE Sensors Journal*, 17(16), doi:10.1109/JSEN.2017.2717384.

Newman, P. A., E. R. Nash, S. E. Strahan, N. A. Kramarova, C. Long, M. C. Pitts, B. Johnson, M. L. Santee, I. Petropavlovskikh, and G. Braathen (2017), 2016 Antarctic Ozone Hole, *Bulletin of AMS*, Vol. 98, No. 8, S169-S172.

Oreopoulos, L., N. Cho, and D. Lee (2017), New insights about cloud vertical structure from CloudSat and CALIPSO observations, *J. Geophys. Res. - Atmospheres*, Vol. 122, No. 17, 8967-9554, doi:10.1002/2017JD026629.

Pereira, F. F., F. Farinosi, M. Arias, and E. Lee (2017), Technical note: A hydrological routing scheme for the Ecosystem Demography model (ED2+R) tested in the Tapajós River basin in the Brazilian Amazon, *Hydrol. Earth Syst. Sci.*, doi:10.5194/hess-21-4629-2017.

Pérez-Ramírez, D., M. Andrade-Flores, T. Eck, A. F. Stein, N. T. O'Neill, H. Lyamani, S. Gassó, D. N. Whiteman, I. Veselovskii, F. Velarde, and L. Alados-Arboledas (2017),

Multiyear aerosol characterization in the tropical Andes and in adjacent Amazonia using AERONET measurements, *Atmos. Env.*, Volume 166, 412-432, <https://doi.org/10.1016/j.atmosenv.2017.07.037>.

Prather, M. J., X. Zhu, C. M. Flynn, S. A. Strode, J. M. Rodriguez, S. D. Steenrod, J. Liu, et al. (2017), Global atmospheric chemistry—which air matters, *Atmos. Chem. Phys.*, Vol. 17, No. 14, doi:10.5194/acp-17-9081-2017.

Randles, C.A., A.M. da Silva, V. Buchard, P.R. Colarco, A. Darmenov, R. Govindaraju, A. Smirnov, B. Holben, R. Ferrare, J. Hair, Y. Shinozuka, and C.J. Flynn (2017), The MERRA-2 Aerosol Reanalysis, 1980 Onward, Part I: System Description and Data Assimilation Evaluation, *J. Climate*, 30, 6823–6850, <https://doi.org/10.1175/JCLI-D-16-0609.1>.

Rousseaux, C. S., and W. W. Gregg (2017), Forecasting Ocean Chlorophyll in the Equatorial Pacific, *Frontiers in Marine Science*, Vol. 4, 236, doi:10.3389/fmars.2017.00236.

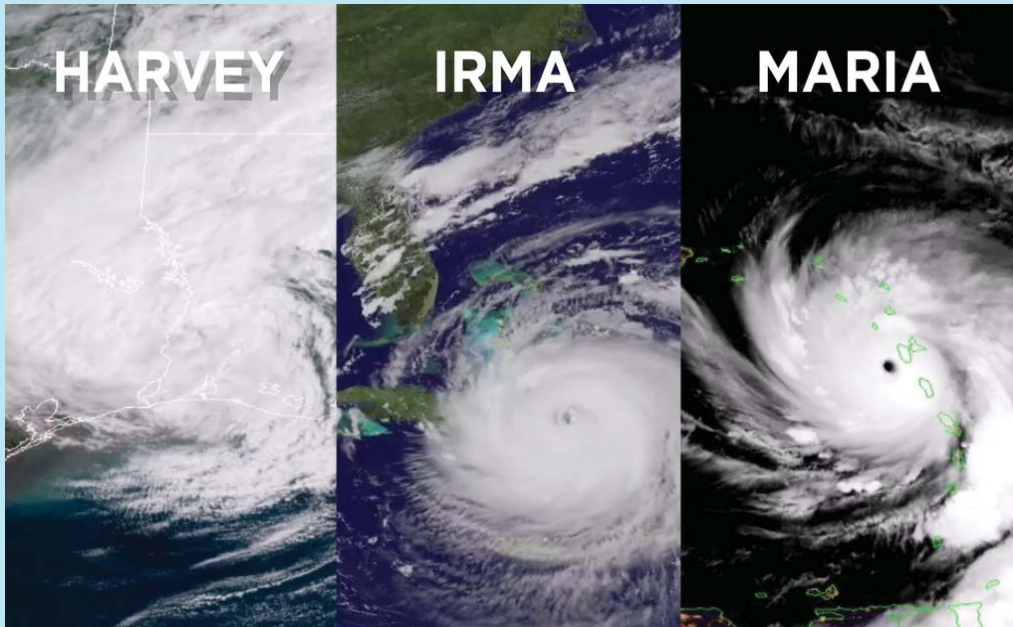
Salmon, O. E., P. B. Shepson, X. Ren, A. B. Collow, M. A. Miller, A. G. Carlton, M. O. Cambaliza, A. Heimbürger, K. L. Morgan, J. D. Fuentes, B. H. Stirm, R. Grundman II, and R. R. Dickerson (2017), Urban Emissions of Water Vapor in Winter, *J. Geophys. Res.- Atmospheres*, 122, 9467–9484, doi:10.1002/2016JD026074.

Sayer, A. M., N. C. Hsu, J. Lee, N. Carletta, S. Chen, and A. Smirnov (2017), Evaluation of NASA Deep Blue/SOAR aerosol retrieval algorithms applied to AVHRR measurements, *J. Geophys. Res. - Atmospheres*, Vol. 122, doi:10.1002/2017JD026934.

Strode, S. A., A. R. Douglass, J. R. Ziemke, M. Manyin, J. E. Nielsen, and L.D. Oman (2017), A Model and Satellite-Based Analysis of the Tropospheric Ozone Distribution in Clear versus Convectively Cloudy Conditions, *J. Geophys. Res. - Atmospheres*, 122, doi:10.1002/2017JD027015.

Várnai, T., A. Marshak, and T. Eck (2017), Observation-based study on aerosol optical depth and particle size in partly cloudy regions, *J. Geophys. Res.-Atmospheres*, 122, 10,013–10,024, doi:10.1002/2017JD027028.

HURRICANE SEASON



“Intense String of Hurricanes Seen From Space”, <https://svs.gsfc.nasa.gov/12738>, produced by Joy Ng (130/USRA), with support from Ryan Fitzgibbons (130/USRA) and others. (Photo: NASA’s Goddard Space Flight Center)

Thoughts continue to be with everyone, including USRA colleagues, affected by the devastating effects from the hurricanes of this past summer. In late August, Hurricane Harvey slammed the Texas coast, bringing widespread large-scale flooding to the Houston metro area. At its peak, Harvey was designated as a Category 4 storm. USRA’s Lunar and Planetary Institute (LPI) in Houston has since reopened, but recovery efforts in the area continue. On September 6, 2017, Hurricane Irma, a Category 5 storm, hit San Juan, Puerto Rico, with 100-mph winds; four people lost their lives. Just two weeks later, on September 20, 2017, Hurricane Maria, designated as a Category 4 tropical cyclone with 155-mph winds, brought destruction to Puerto Rico. Almost 60 people lost their lives. To this day, residents continue to struggle with the catastrophic damage to the island’s infrastructure. USRA is a partner in the operation of the Arecibo Observatory, located in Arecibo, PR. The American Red Cross is one of many organizations that aim to help people affected by Hurricanes Harvey, Irma and Maria: <https://www.redcross.org/donate>. Please keep those affected, struggling, and recovering in your thoughts.

The GESTAR Team: Universities Space Research Association (USRA), Morgan State University (MSU), I.M. Systems Group (IMSG), Johns Hopkins University (JHU), Global Science & Technology, Inc.(GST), and Science and Technology Corporation (STC).

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