

Global Disease Outbreaks & the 2015-2016 El Niño Event

In February, an important paper based on years of research titled “Global Disease Outbreaks Associated with the 2015-2016 El Niño Event” was published in *Nature*. The lead author is Assaf Anyamba (618/USRA) and co-authors include Radina Soebiyanto (618/USRA) and Compton Tucker (610/GSFC). El Niño Southern Oscillation (ENSO) is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean. The changes in sea surface temperatures affects atmospheric circulation impacting rainfall and temperature patterns across the tropics (South America, Africa and Asia) and further into the northern hemisphere including North America. Dr. Anyamba’s research shows that “In some regions, ENSO events are associated with the amplification of endemic diseases such as dengue, malaria, chikungunya,” and in other regions, “an ENSO warm event precedes Rift Valley fever, Cholera, Plague and Hantavirus outbreaks.” Several illnesses in fact are associated with ENSO events; dengue, chikungunya and Zika outbreaks were seen in Brazil, and St. Louis Encephalitis and Tularemia in the U.S.

Why study the 2015-2016 ENSO event in particular? This event is ranked in the top three since 1950, and early signs of its impacts were apparent in certain regions. What gradually followed was extreme rainfall, which resulted in flooding and droughts, based on whether a region was experiencing above-normal rainfall or below-normal rainfall. Based on their findings, early warning alerts were issued across the globe: East Africa, South America, India, parts of the U.S., and Asia.

Throughout their paper, Anyamba and co-authors refer to the vector-borne diseases, especially those transmitted via mosquitoes, as well as to the possible transmittal via trade and travel from different regions. Some good news comes in the form of early vaccinations of livestock for Rift Valley fever, which reduced the number of losses. Yet, Anyamba explains, their exploration of a select group of diseases in certain regions resulted in this conclusion: “These disease events are often proximate outcomes of ecologically enhanced disease-vector population dynamics. They are indirectly facilitated by ENSO-driven ecological processes and with proximate changes in land-use or agricultural practices.”

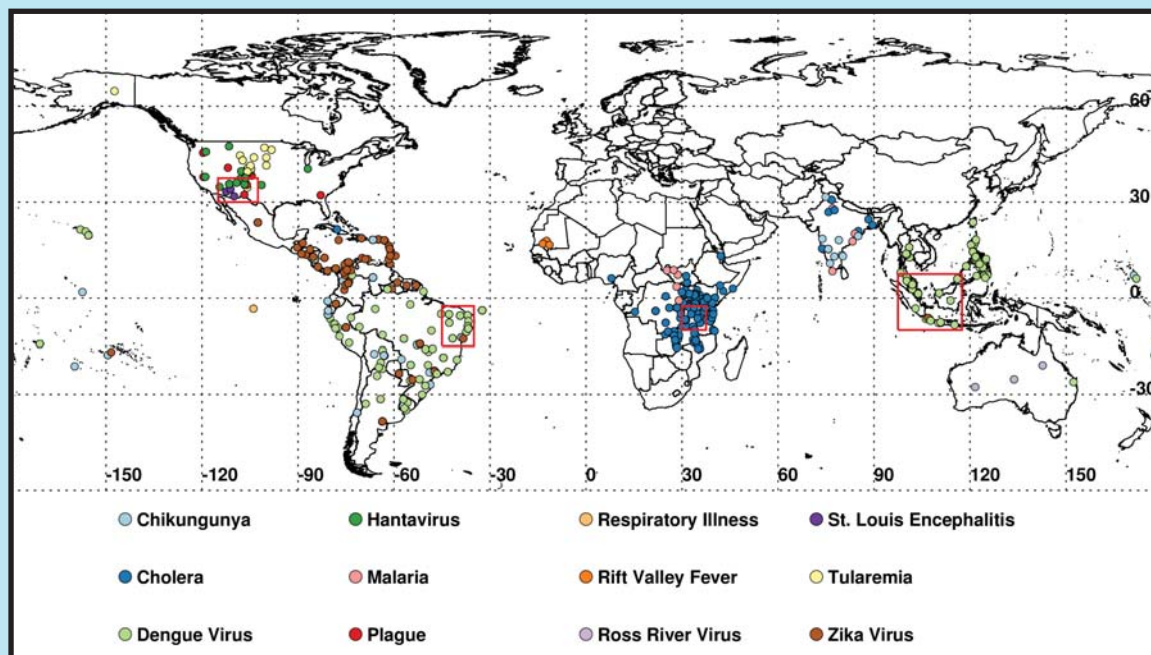


Figure above shows the emergence of vectors and outbreaks of various diseases worldwide related to the 2015-2016 El Niño event. (Image Credit: A. Anyamba, et al.)

(ENSO 2015-2016, cont'd)

Their work shows that routine and ongoing global satellite monitoring of climate anomalies can be used identify regions at risk for emergence and propagation of disease vectors. Such information can provide sufficient lead-time for outbreak prevention and potentially reduce the burden and spread of ecologically coupled diseases globally. In fact, Dr. Soebiyanto tells us, “[With this information], we send monthly updates to our interagency collaborators on areas at risk for disease outbreaks including Rift Valley fever, Dengue, Chikungunya, Cholera, etc. In these monthly updates, we include the global sea surface temperature anomaly patterns, rainfall anomalies and report any signs of developing ENSO that can potentially result in disease outbreaks.” This information is also shared with other concerned federal government agencies and international collaborators, including WHO, FAO and OIE.

Lead Visualizer **Helen-Nicole Kostis** (606.4/USRA) worked with the scientists to produce accompanying visualizations, which are available on NASA’s Scientific Visualization Studio site: first, “2015-2016 El Niño Triggered Disease Outbreaks Across the Globe” (<https://svs.gsfc.nasa.gov/13152>), and second “Precipitation Anomaly and Dengue Outbreaks in South East Asia: 2015-2016” (<https://svs.gsfc.nasa.gov/4693>).

This article is available at <https://doi.org/10.1038/s41598-018-38034-z> (Anyamba, Assaf, Jean-Paul Chretien, Seth C. Britch, Radina P. Soebiyanto, Jennifer L. Small, Rikke Jepsen, Brett M. Forshey, Jose L. Sanchez, Ryan D. Smith, Ryan Harris, Compton J. Tucker, William B. Karesh & Kenneth J. Linthicum (2019), Global Disease Outbreaks Associated with the 2015–2016 El Niño Event, *Nature*, Scientific Reports, 9 (1930)).

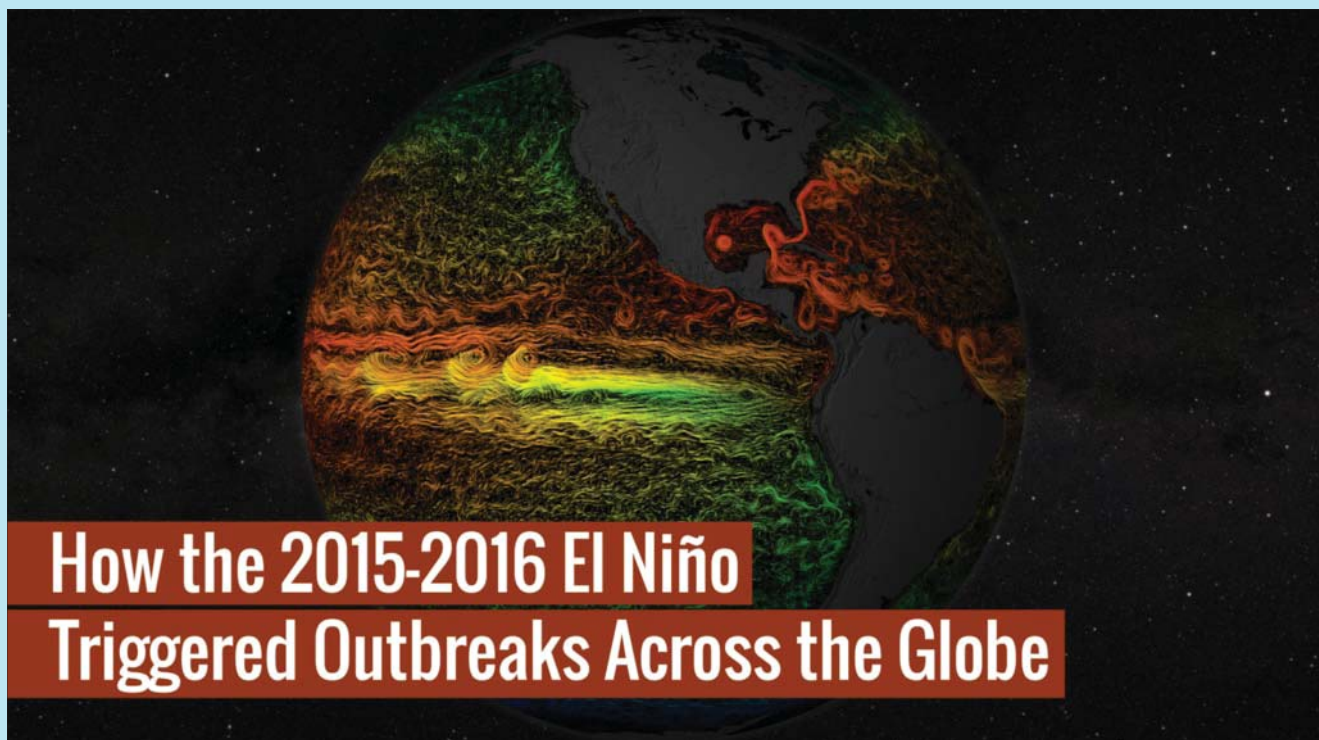


Image from "2015-2016 El Niño Triggered Disease Outbreaks Across the Globe", H.-N. Kostis, Lead Visualizer plus L.K. Ward, Lead Producer and Matt Radcliff, Producer (both 130/USRA), and others, along with Drs. Anyamba and Soebiyanto. (Credit: NASA's Goddard Space Flight Center)

Early Career Scientist Forum

On November 1, 2018, the Early Career Scientist Forum (formerly known as the Young Scientist Forum) was held in Building 34 in Rooms W120 and W150. The forum is open to scientists who have obtained their degree in the last 10 years. **Manuela Girotto** (610.1) co-chaired the Data and Tools Session, **Edward Nowottnick** (614) co-chaired the Clouds and Aerosols Session, and **Manuela Girotto** and **Ed Nowottnick** chaired the Air Quality Session; **Manisha Ganeshan** (613) co-chaired both the Understanding Earth and Analogs Session and The Water Cycle Session.

GESTAR participation included the following oral presentations:

K. Emma Knowland (610.1): “Using NASA’s new composition forecast to investigate ozone exceedance events linked with stratospheric intrusions” and

Yingxi Shi (613): “Understanding airborne fertilization of oceanic ecosystems using Satellite and Model data”.

As usual, a Poster Session was held after the presentations, and GESTAR scientists were lead authors on the following:

David Carvalho (610.1): “Evaluation and validation of NASA’s GMAO MERRA2 reanalysis surface winds”;

Manuela Girotto (610.1): “Data Assimilation of Terrestrial Water Storage to Adjust Precipitation Fluxes”;

Manisha Ganeshan (613): “A regional analysis of factors affecting the Antarctic boundary layer during the Condoriassi campaign”;

Manisha Ganeshan (613): “Impact of assimilating AIRS cloud-cleared radiances on the representation of Polar Lows”;

Perry Oddo (617): “The Value of near real-time flood impact information in a disaster response scenario”;

Thomas Fauchez (699): “Impact of clouds and hazes in the JWST simulated transmission spectra of TRAPPIST-1 planets in the habitable zone”;

Yuni Lee (699): Effects of a Solar Flare on the Martian Hot O Corona and Photochemical Escape”.



Manuela Girotto (610.1) and Ed Nowottnick (614), two of the committee members and session chairs of the ECSF. (Photo: A. Houghton)



Yingxi Shi (613) and Ludovic Brucker (615) during a break at the ECSF. (Photo: A. Houghton)

Science Highlights

2018 & 2019 – Atmospheric Sciences

November: “MAIAC (Multi-Angle Implementation of Atmospheric Correction) MODIS C6: A New Interdisciplinary Suite of Atmospheric and Surface Products”, A. Lyapustin, Y. Wang, **Sergey Korkin** (613/USRA), D. Huang.

*None for December.

January: “A New Global Anthropogenic SO₂ Emission Inventory for the Last Decade: A Mosaic of Satellite-Derived and Bottom-Up Emission”, **Fei Liu** (614/USRA), S. Choi, C. Li, and others.

February: “An Advanced Bin Microphysics Scheme Explains Improvements in Simulated Radar and Radiometer Signals and Sensitivities to ice Nucleation”, **Mei Han** (612/MSU), S. Braun, T. Matsui, and T. Iguchi.

“Volcano-induced global anisotropy anomaly in scattered radiances”, D. Wu, T. Wang, T. Varnai, J. Limbacher, R. Kahn, **Ghassan Taha** (614/USRA), J. Lee, **Jie Gong** (613/USRA), and T. Yuan.

2018 & 2019 – Hydrosphere, Biosphere, & Geophysics
For Nov 2018–Feb 2019, there were none for GESTAR members.

New Hires

GESTAR welcomes the following members:

Jonathan North, Visiting Multimedia Specialist, Animator
Violeta Sanjuan Calzado, Senior Scientist, Earth Sciences
Christopher Smith, Multimedia Specialist, Producer
Natalie Thomas, Visiting Postdoctoral Researcher, Science
Elizabeth Wilk, Visiting Multimedia Specialist, Producer

maniac talks

GESTAR thanks the following scientists who presented talks this past winter: Robert Corell (Chair, Arctic Climate Impact Assessment and Principal, Global Environment and Technology Foundation) – Nov 2018; Christa Peters-Lidard (Deputy Director for Hydrosphere, Biosphere, and Geophysics, ESD, GSFC) – Nov 2018. Note, no talks were scheduled for December or January. In February, Nick White’s talk was cancelled due to weather and has been rescheduled for April 17. Previous 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.

USRA IRAD Proposals

The proposal entitled “Surface Polarized Reflectance Analysis Using Space Lidar: Proof of Concept”, PI: **Sergey Korkin** (613/USRA), was selected under a USRA Internal Research and Development (IRAD) proposal.

Bridget Seegers’ (616/USRA) research proposal titled “Cyanobacteria Assessment Network Validation” was funded by the USRA IRAD program. The grant will support a summer research field campaign to gather in situ data for the validation of satellite algorithms for cyanobacteria blooms.

Moving On

Tobias Bollian
Javier Concha (CNR – ISMAR, Italy)
Jianjun Jin (SSAI)
Mike Kurylo (Congratulations on your retirement!)
Yury Vikhliaev (SSAI)
James Wang (Institute for Advanced Sustainability Studies, Germany)
Weidong Yang

GESTAR Holiday Party

The GESTAR Holiday party was held Thursday, December 20, 2018 from 11:00am-1:00pm at the GSFC Recreation Center. The brunch-style event included made-to-order omelettes and Belgian waffles. Several people were recognized with USRA Service Awards; Dr. Nick White, Senior V.P., Science, USRA, presented each recipient with a certificate and gift. Those who received a 5-year service award included Nayeong Cho, Paolo De Matthaeis, Manisha Ganeshan, Daeho Jin, David Ladd, Junhua Liu, Thomas Stanley, Andrew Swanson, and Brad Weir. Dagmar Morgan received a 10-year service award. Congratulations to all!



Nick White and Daeho Jin.



Nick White and Manisha Ganeshan.



Nick White and Brad Weir.



Jackson Tan and Adrian Southard.

(All photos by A. Houghton.)

(cont'd on page 6)

(Party, cont'd)



Photos from Anniversary Party:

(top) Members of the GESTAR IPT: Angie Espiritu, Elamae Samuel, Carol Kuehn, Amy Houghton, and Carine Nourieh. (Credit: C. Rousseaux)

(center) Henry Selkirk and Mike Kurylo. (Credit: A. Houghton)

(bottom) Richard Damoah, Bhaskar Bishnoi, and Assaf Anyamba. (Credit: A. Houghton)



In The Press

On November 2, 2018, a newly published paper by **Manisha Ganeshan** (613/USRA) and **Yuekui Yang** (613/GSFC), entitled “A Regional Analysis of Factors Affecting the Antarctic Boundary Layer During the Concordiasi Campaign” (J. Geophys. Res., 123), was featured as the editor’s highlight in EOS Earth & Space Science News. See <https://eos.org/editor-highlights/dropsondes-reveal-atmospheric-boundary-layers-over-antarctic>.

On November 13, 2018, NASA People featured two Climate & Radiation Laboratory members, **Nayeong Cho** (613/USRA) and **Jaehwa Lee** (613/UMD) in “Two Loves, Atmospheric Science and Each Other”. See <https://www.nasa.gov/feature/goddard/2018/cho-and-lee-two-loves-atmospheric-science-and-each-other>.

Richard Damoah (618/MSU) was in Ghana in November as a guest speaker for an international satellite conference as All Nations University demonstrated the concept for its Ghana-2 mission. Details on the mission and conference were published in Space in Africa: <https://africanews.space/all-nations-university-unveils-and-demonstrates-ghanasat-2-mission-concept/>.

In December, **Ludovic Brucker** (615/USRA) and a colleague contributed an item to Earth Observatory’s Notes from the Field as part of their work with the SWESARR (Snow Water Equivalent Synthetic Aperture Radar and Radiometer) expedition. Visit <https://earthobservatory.nasa.gov/blogs/fromthefield/category/swesarr/>.



Photo taken on Grand Mesa. (Credit: L. Brucker, C. Hiemstra, on the Earth Observatory’s Notes from the Field website.)

At the 2018 AGU Fall Meeting held in December in Washington, DC, **Abhishek Chatterjee** (610.1/USRA) participated in a Carbon Cycle Press Conference: see <https://www.youtube.com/watch?v=x1pEkORYzSk&feature=youtu.be>.

On November 15, 2018, NASA issued a Press Release titled “International team, NASA make unexpected discovery under Greenland ice” (<https://climate.nasa.gov/news/2828/international-team-nasa-make-unexpected-discovery-under-greenland-ice/>), which garnered national and international coverage. The discovery of the 18-mile-wide Hiawatha impact crater was supported with the visualization titled “Massive Crater Discovered under Greenland Ice”, released November 14, 2018 (see <https://svs.gsfc.nasa.gov/12941>). Credits included **Cindy Starr** (606.4/GST) plus **Brian Monroe**, **Jefferson Beck** and **Michael Lentz** (all with 130/USRA at the time) and others.

Then, on February 11, 2019, the visualization “A Possible Second Large Subglacial Impact Crater in Northwest Greenland” was released (see <https://svs.gsfc.nasa.gov/4691>). This visualization highlighted a second impact crater, which was 114 miles away from the Hiawatha crater and measured 22 miles wide. Credits included **Cindy Starr**, **Leann Johnson**, and **Eric Sokolowsky** (all 606.4/GST) as well as others. This was in support of a 2018 paper led by Dr. Joseph MacGregor (615/GSFC) of the same title: “A possible second large subglacial impact crater in northwest Greenland”, <https://doi.org/10.1029/2018GL078126>.

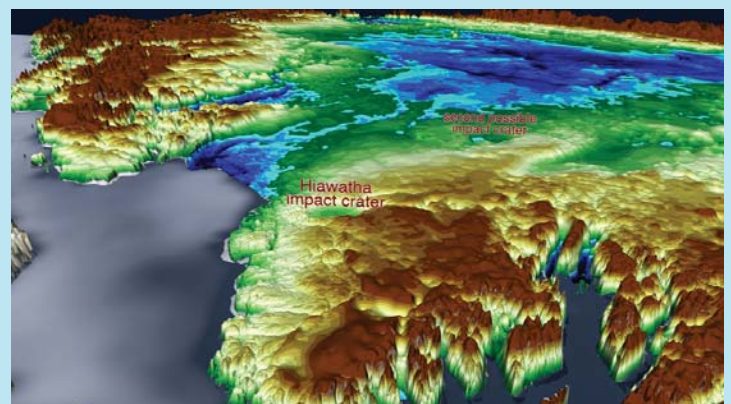
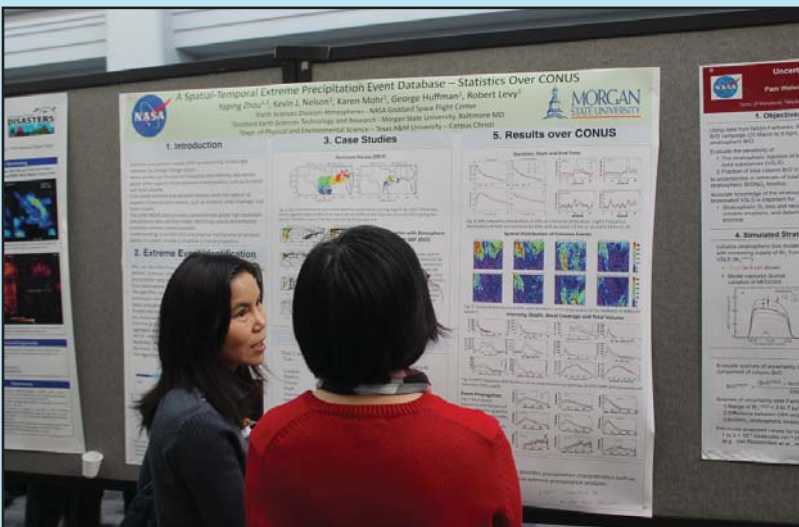


Image of the two impact crater sites, from <https://svs.gsfc.nasa.gov/4691>, lead visualizer C. Starr. (Credit: NASA’s Scientific Visualization Studio.)

SED Poster Party

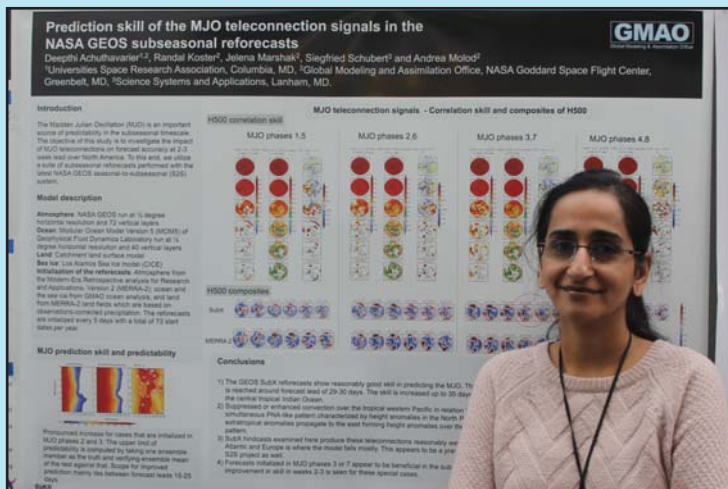
This year, the 12th annual Sciences and Exploration Directorate (SED) Poster Party was pushed back by a month and held on Tuesday, February 26, 2019, in the Atrium of Building 28. Of the 151 posters on display, 15 were led by these GESTAR scientists: Deepthi Achuthavarier (610.1), two from Amanda Armstrong (618), Allison Collow (610.1), Thomas Fauchez (699), two from Manisha Ganeshan (613), MinJeong Jo (618), Rhae Sung Kim (617), Emma Knowland (610.1), Young-Kwon Lim (610.1), Perry Oddo (617), Bridget Seegers (616), Sarah Strode (614), and Yaping Zhou (613).



Yaping Zhou (613/USRA), at left, discusses her poster: "A Spatial-Temporal Extreme Precipitation Event Database & Statistics Over CONUS".



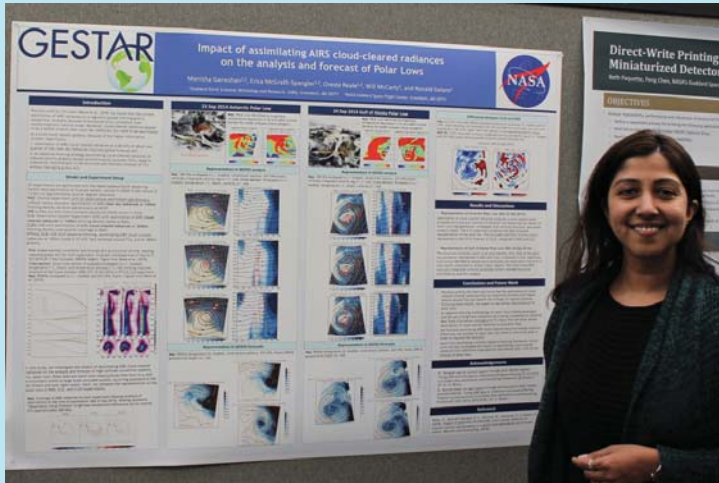
Perry Oddo (617/USRA) with poster and demonstration of Near Real-Time Routing Explorer: "The Value of Near Real-Time Flood Impact Information in a Disaster Response Scenario".



Deepthi Achuthavarier (610.1/USRA) with her poster: "Prediction skill of the MJO teleconnection signals in the NASA GEOS subseasonal reforecasts".

*All photos taken by A. Houghton.

(SED Poster Party, cont'd)



Manisha Ganeshan (613/USRA) with her poster "Impact of assimilating AIRS cloud-cleared radiances on the analysis and forecast of Polar Lows".



Bridget Seegers (616/USRA) discusses her poster "Sippin' On Science & Outreach, Small Towns, and Data Product Apps".

Follow-Up:

As profiled in our GESTAR Spring 2018 issue, with IRAD funding, Bridget Seegers conducted a two-week outreach effort, "Sippin' On Science", holding events in Minnesota and her home state of Wisconsin in summer 2018. In coffeehouses, breweries and bars, she highlighted NASA earth science, such as using satellites for water quality of lakes, particularly cyanobacteria monitoring. On November 13th, Dr. Seegers shared her outreach experiences in an informative and engaging presentation at the NASA Goddard Rec Center.

Recent Publications

Anyamba, A., J.P. Chretien, S. Britch, R. Soebiyanto, J. Small, R. Jepsen, B. Forshey, J. Sanchez, R. Smith, R. Harris, C. J. Tucker, W. Karesh, and K. Linthicum (2019), Global Disease Outbreaks Associated with the 2015-2016 El Nino Event, *Nature*, Volume 9 (1930), <https://doi.org/10.1038/s41598-018-38034-z>.

Carr, J. L., D. L. Wu, M.A. Kelly, and J. Gong (2018), "MISR-GOES 3D Winds: Implications for Future LEO-GEO and LEO-LEO Winds", *Remote Sensing, Special Issue on Multi-angle Imaging SpectroRadiometer (MISR)*.

Castellanos, P., A. M. da Silva, A. S. Darmenov, V. Buchard, R. C. Govindaraju, P. Ciren, and S. Kondragunta (2019), "A Geostationary Instrument Simulator for Aerosol Observing System Simulation Experiments", *Atmosphere*, 10 (1), 2; doi:10.3390/atmos10010002.

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Concha, J., A. Mannino, B. Franz and W. Kim, (2019), Uncertainties in the Geostationary Ocean Color Imager (GOCI) Remote Sensing Reflectance for Assessing Diurnal Variability of Biogeochemical Processes, *Remote Sensing*, 11, 295, doi:10.3390/rs11030295.

Concha, J., A. Mannino, B. Franz, S. Bailey (616) and W. Kim, (2019): Vicarious calibration of GOCI for the SeaDAS ocean color retrieval, *International Journal of Remote Sensing*, doi:10.1080/01431161.2018.1557793.

Giles, D., A. Sinyuk, M. Sorokin, J. Schafer, A. Smirnov, I. Slutsker, T. Eck, B. Holben, J. Lewis, J. Campbell, E. Welton, S. Korokin, and A. Lyapustin (2018), Advancements in the Aerosol Robotic Network (AERONET) Version 3 database – automated near-real-time quality control algorithm with improved cloud screening for Sun photometer aerosol optical depth (AOD) measurements, *Atmos. Meas. Tech.*, Vol. 12, 169-209, doi:10.5194/amt-12-169-2019.

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(Publications, cont'd)

Hall, S., K. Ullmann, C. Flynn, M. Prather, L. Murray, A. Fiore, G. Correa, **S. Strode**, **S. Steenrod**, et al. (2018), Cloud impacts on photochemistry: building a climatology of photolysis rates from the Atmospheric Tomography mission, *Atmos. Chem. Phys.*, Vol. 18, 16809-16828, doi:0.5194/acp-18-16809-2018.

Hegarty, J. D., J. R. Lewis, **E. L. McGrath-Spangler**, J. M. Henderson, A. Scarino, R. A. Ferrare, P. DeCola, M. M. Hicks, R. Adams-Selin, and E. J. Welton (2018), Analysis of the Planetary Boundary Layer Height during DISCOVER-AQ Baltimore - Washington, DC with Lidar and High-resolution WRF Modeling, *J. Applied Meteorology Climatol.*, Vol. 57, No. 11, 2679-2696, doi:10.1175/JAMC-D-18-0014.1.

Korkin, S., and A. Lyapustin (2019), Matrix exponential in C/C++ version of vector radiative transfer code IPOL, *JQSRT*, Vol. 227, 106-110, <https://doi.org/10.1016/j.jqsrt.2019.02.009>.

Liao, L., and R. Meneghini (2019), A modified dual-wavelength technique for Ku- and Ka-band radar rain retrieval, *J. Appl. Meteor. Climatol.*, 58, 3-18.

Lim, Y.-K., S. D. Schubert, R. M. Kovach, A. M. Molod, and S. Pawson (2018), The Roles of Climate Change and Climate Variability in the 2017 Atlantic Hurricane Season, *Scientific Reports*, 8, 16172, doi:10.1038/s41598-018-34343-5.

Liu, F., S. Choi, C. Li, V. Fioletov, C. McLinden, J. Joiner, N. Krotkov, H. Bian, G. Janssens-Maenhout, A. S. Darmenov, and A. M. da Silva (2018), A new global anthropogenic SO₂ emission inventory for the last decade: a mosaic of satellite-derived and bottom-up emissions, *Atmos. Chem. Phys.*, 18, 16571-16586, doi:10.5194/acp-18-16571-2018.

McKelvey, C., C. Ball, C. Chen, A. O'Brien, G. Smith, M. Andrews, J. Garry, J. Johnson, S. Misra, S. Brown, R. Jarnot, R. Bendig, C. Felten, J. Kocz, K. Horgan, J. Lucey, C. Duran-Aviles, M. Solly, **J. Peng**, et al. (2018), Testing and Operation Planning of the Cubesat Radiometer Radio Frequency Interference Technology Validation (Cuberrt) System, *IEEE IGRSS*, doi:10.1109/IGARSS.2018.8519417.

Misra, S., S. Brown, R. Jarnot, C. Felten, R. Bendig, J. Kocz,

C. McKelvey, C. Ball, C. Chen, A. O'Brien, G. Smith, M. Andrews, J. Garry, J. Johnson, **P. Mohammed**, J. Lucey, K. Horgan, Q. Bonds, C. Duran-Aviles, M. Solly, **J. Peng**, et al. (2018), CubeSat Radiometer Radio Frequency Interference Technology (CubeRRT) Validation Mission: Enabling Future Resource-Constrained Science Missions, *IEEE IGRSS*, doi:10.1109/IGARSS.2018.8517477.

Neukermans, G., T. Harmel, M. Galí, N. Rudorff, J. Chowdhary, O. Dubovik, C. Hostetler, Y. Hu, C. Jamet, K. Knobelspiesse, Y. Lehahn, P. Litvinov, **A. M. Sayer**, B. Ward, E. Boss, I. Koren, and L. A. Miller (2018), Harnessing remote sensing to address critical science questions on ocean-atmosphere interactions, in the journal *Elementa*, *Elem. Sci. Anth.*, 6(1), 1-71, doi:10.1525/elementa.331.

Piepmeyer, J., **J. Peng**, S. Misra, E. Dinnat, S. Yueh, T. Meissner, D. Le Vine, K. Shelton, A. Freedman, R. S. Dunbar, S. Chan, J. Chaubell, R. Bindlish, G. De Amici, **P. Mohammed**, and L. Hong (2018), SMAP Microwave Radiometer: Instrument Status and Calibration for the First Three Years of Operation, *IEEE IGRSS*, doi:10.1109/IGARSS.2018.8518012.

Sayer, A. M., N. C. Hsu, J. Lee, W. V. Kim, O. Dubovik, S. T. Dutcher, D. Huang, P. Litvinov, A. Lyapustin, J. L. Tackett, and D. M. Winker (2018), Validation of SOAR VIIRS Over-Water Aerosol Retrievals and Context Within the Global Satellite Aerosol Data Record, *J. Geophys. Res. Atmos.*, 123, 13,496-13,526, doi:10.1029/2018JD029465.

Strode, S. A., **J. R. Ziemke**, L. Oman, **L. Lamsal**, **M. Olsen**, and J. Liu (2019), Global changes in the diurnal cycle of surface ozone, *Atmos. Environ.*, Vol. 199, 323-333, doi:10.1016/j.atmosenv.2018.11.028.

Tan, J. and L. Oreopoulos (2019), Subgrid Precipitation Properties of Mesoscale Atmospheric Systems Represented by MODIS Cloud Regimes, *J. Climate*, doi:10.1175/JCLI-D-18-0570.1.

Wang, C., S. Platnick, **T. Fauchez**, K. Meyer, Z. Zhang, H. Iwabuchi, and B.H. Kahn (2019), An assessment of the impacts of cloud vertical heterogeneity on global ice cloud data records from passive satellite retrievals, *J. Geophys. Res. Atmos.*, 123, <https://doi.org/10.1029/2018JD029681>.

Reale Named New GESTAR Director

As of February 16, 2019, **Dr. Oreste Reale** was appointed Director, Goddard Earth Science Technology and Research (GESTAR).

Dr. Reale joined USRA in 2011, and served as a Senior Scientist, Group Lead, and most recently, Associate Director on GESTAR. He has been a member of the NASA Sounder Science Team since 2011, and is currently Principal Investigator of a 3-year NASA grant focused on the assimilation of cloud-cleared radiances to improve forecast skill and tropical cyclone representation in the Goddard Earth Observing System Model.

Prior to joining USRA, Dr. Reale supported Earth Sciences research at NASA Goddard for roughly ten years through a NASA cooperative agreement with the University of Maryland, Baltimore County. He received his “Laurea” in geophysical engineering from the University of Trieste, Italy, and obtained his M.S. and Ph.D. in meteorology from the University of Maryland, College Park.

To paraphrase Dr. Reale, he hopes to continue to guide and grow the legacy of GESTAR in the steps of former director Dr. Bill Corso (1956-2018).

Along with USRA leadership, we welcome Dr. Reale to his new leadership position.



Dr. Oreste Reale
(Photo Credit: A. Houghton)

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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The GESTAR Newsletter is published by GESTAR/USRA. Any comments/suggestions/ideas can be forwarded to Amy Houghton, Editor at ahoughton@usra.edu.