AOS & CIMES Newsletter

Program in Atmospheric and Oceanic Sciences (AOS) &
The Cooperative Institute for Modeling the Earth System (CIMES)

Winter 2020 **Volume 14 Number 1**

Geeta Persad

AOS alumna Geeta Persad recently accepted a faculty position at the Jackson School of Geosciences, UT Austin. She graduated in 2016 with a thesis titled "Climate Implications of the Heterogeneity of Anthropogenic Aerosol Forcing." She was co-advised by GFDL Director V. Ramaswamy and AOS Faculty Member Yi Ming. She reflects on her experiences in a conversation with AOS Director Stephan Fueglistaler.

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Nick Lutsko

AOS alumnus Nick Lutsko recently accepted a faculty position at Scripps Institution of Oceanography. He graduated in 2017 with a thesis titled "Aspects of Eddy Momentum Fluxes in the General Circulation of the Troposphere." His adviser was AOS Senior Meteorologist Isaac Held. In a conversation with Fueglistaler, he shares his experiences.

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CIMES Awards $715,000 in Earth System Sciences

The Cooperative Institute for Modeling the Earth System (CIMES) has announced awards totaling $715,000 to support nine innovative, cross-disciplinary projects aimed at modeling and understanding the Earth system, projects that align closely with the strategic goals of NOAA's Geophysical Fluid Dynamics Laboratory (GFDL). The newly awarded endeavors explore an array of topics in various disciplines, from constraining the role of equatorial dynamics and the variability of the biological pump in GFDL models to validating and improving the nitrification representation in COBALT, and a novel approach to explicitly incorporate wave and wave breaking effects into the parameterization of ocean-atmosphere momentum and mass fluxes, the latter of which will be highlighted in this issue. The projects run from 2020 to 2021 and foster research, teaching, and mentorship in Earth system science.

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Welcome!

The situation due to COVID-19 is unprecedented, and most of AOS and CIMES have switched to teleworking; we appreciate your patience during this challenging time.

In this issue, we feature a graduate student interview with AOS/CIMES Alums Nicholas Lutsko and Geeta Persad, who have been recently named to faculty positions. We highlight the work of Luc Deike, one of nine awarded projects recently funded by CIMES. We turn your attention to a couple of CIMES/AOS-sponsored workshops originally scheduled for June 2020, which are currently under re-evaluation. Lastly, we are pleased to extend a warm welcome to all those that are new to the AOS/CIMES Community.

Gabe Vecchi, Director, CIMES
Stephan Fueglistaler, Director, AOS

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Looking Forward and Back: A Conversation with Geeta Persad, Nick Lutsko and AOS Director Stephan Fueglistaler

Congratulations on your recent appointments! Looking back - what factors do you consider were important for your decision to pursue an academic career, and what was useful to achieve this objective?

Lutsko: A researcher or faculty position was of interest to me already when I started my Ph.D.

Persad: Same for me. I've spent an internship at GFDL before joining AOS, and already knew the place quite well. I have also been very interested in the policy side of climate research, and the WW-S/STEP fellowship was a cornerstone for my development/progress. I also found the breadth of expertise available at GFDL and Princeton highly beneficial and stimulating.

Lutsko: I agree, the many opportunities to interact with researchers, faculty, postdocs and other students were important for me, and helped me shape my research ideas - specifically applying fundamental theory to real-world problems.

Persad: I already had clear ideas - a strong interest on impact of climate on society - when I started the Ph.D., but I enjoyed the many opportunities to take advantage of the freedom to explore and interact, which broadened my horizon.

What was your experience what Universities are looking for?

Lutsko: They were definitely looking for a solid background in theory, but it was also important to demonstrate the ability to apply to real world problems.

Persad: Working more from the impact side, it was beneficial to have a solid background in aerosol, and interest in theory and fundamental questions - such as how accurately will we be able to determine the impact of aerosol on local scale given the strong signal from CO2 forcing, and internal variability.

Lutsko: In addition to research, teaching is an important aspect. Often there are no teaching opportunities for post-docs (as in my case), and I don't regret the TA course taken at Princeton. While short, it was focused and useful in bringing to mind "obvious" aspects, such as making sure that also more quiet students get their share of interaction and attention.

Persad: I had the opportunity to teach a class while postdoc in Stanford - that was useful. I got the impression that requirements of Departments regarding teaching experience of applicants may vary quite a bit.

Traditional disciplines versus interdisciplinarity, and new developments such as machine learning?

Persad: These aspects are widely recognized and discussed, but the structures are generally still fairly "traditional" - but certainly it is widely recognized that climate research is intrinsically interdisciplinary. Also, with climate change widely recognized as a major issue, we are more confronted with people from outside our field asking specific questions - "can climate models informs us about changes on the local scale that are close to people's everyday experience." My work with the Union of concerned scientists also explored the problem that climate model output may not be directly what's needed for specific tasks - say hydroclimate and water management, where a change in the mean rainfall may be secondary to the question how the amplitude and frequency distribution of rainfall events may change. The wide recognition of the societal impact of the climate problem has drawn new players to the field - stakeholders asking very specific questions", foundations, and also fundamental research on how to bridge scales and what can be said about fidelity of predictions.

Lutsko: I see things very similarly - we have a solid theoretical framework for zonal means, but the impacts of climate change are local, and may not be well described by the zonal mean. Extending theory such that we can also tackle such problems is of interest to me. For example, with Jane Baldwin (who was in my cohort at Princeton), we worked to extend ideas about what controls zonal-mean temperature variance to regional scales, then used this framework to investigate how the major Northern Hemispheric mountain ranges cause the variance of near-surface temperatures to be much higher over North America than over Eurasia.

The same challenges arise in the context of geo-engineering, where proposed solutions operate on global scale, but stakeholders are local, and what may be good for the average temperature of the planet may not be good for local rainfall.

Persad: The question of "local" is also particularly relevant for aerosol. Emissions are very localized, and may have both local and global impacts. However, unambiguous attribution of local changes and global changes to changes in aerosol emission have proved challenging - a challenge I take as guiding question for my research in the coming years: How reliable can attribution be when properly accounting for uncertainties in emissions, and given the concurrent strong forcing by CO2, and the large internal variability that poses a challenge to statistically detect aerosol impacts that tend to be clustered in space and time.

Lutsko: Proper attribution is also a major driver for my research - how well do we really understand the observed climate, and changes therein, over the past few decades; and can this observational record strongly constrain model's climate sensitivity? The possibility that clouds may have evolved very unexpectedly over the past few decades (the "pattern effect"), unexpectedly in the sense that no coupled model predicts a strong negative feedback from clouds whereas "AMIP" simulations do, needs to be better understood.

AOS & GFDL Scientists among World's Most Influential Scholars

Contributed by Maria Setzer, GFDL Communications Director

Three AOS and six GFDL scientists were recognized on the Web of Science Group's 2019 list of "Highly Cited Researchers." This index identifies the most influential scientists, who are authors of papers that were most frequently cited by their peers over the last decade. This determination is based on papers published and cited during 2008-2018 and ranked in the top 1% by citations. According to the Web of Science, this small fraction of researchers "contributes disproportionately to extending the frontiers of knowledge and gaining for society innovations that make the world healthier, richer, more sustainable, and more secure."

Scientific papers are categorized into 21 fields of science. AOS Senior Meteorologist Isaac Held, CIMES Director Gabriel Vecchi, professor of geosciences and the Princeton Environmental Institute, and GFDL scientists Tom Delworth, Larry Horowitz, Vaishali Naik, and Andrew Wittenberg are listed for Geosciences; Jorge Sarmiento, the George J. Magee Professor of Geoscience and Geological Engineering, Emeritus, and GFDL Scientists John Dunne and Elena Shevliakova are named for "cross-field" impact, reflecting their highly cited publications that span across multiple scientific fields.

The 2019 list of "Highly Cited Researchers" includes 12 NOAA scientists, half of whom are scientists at GFDL. No other NOAA lab has as many influential scientists. Princeton University was also well represented, with 42 University researchers listed among the world's most influential scholars. The full list of approximately 6,000 scientists are affiliated with more than 1,000 different institutions worldwide.

POSTPONED!

Physics-Dynamics Coupling in Weather and Climate Models Workshop

CIMES and GFDL will co-sponsor a workshop on Physics-Dynamics Coupling in Weather and Climate Models (PDC 2020), the fourth in a series of biennial workshops aimed at bringing together the growing community of scientists who have an interest in discussing and improving process coupling in geophysical modeling. The workshop, originally scheduled from June 23-26, 2020 on Main Campus in Frick Chemistry Lab's Taylor Auditorium, has been postponed until 2021 in light of the COVID-19 situation.

The PDC2020 (now 2021) workshop will provide a forum for an exchange of ideas and experiences on the following topics: conceptual issues in model or process formulation, including conservation and consistency; discretization of individual processes and process interactions; solution sensitivity to static or dynamic adaptation in spacial and temporal resolutions; test strategies, results, and intercomparisons; and optimization, algorithmic efficiency and high-performance computing.

The scope of the workshop extends beyond the coupling between an atmospheric dynamical core and its physical parametrizations, according to the 2020 PDC organizing committee. It also includes a discussion about optimal strategies for coupling processes in and/or between the different component models of the Earth system. Of particular interest are contributions with a focus on the interactions of physical modules across Earth system components and the numerics of the coupling. The workshop may also include new approaches to Earth system modeling, including emulators and machine-learning approaches, said GFDL Research Scientist Lucas Harris, a former AOS postdoc and member of the 2020 organizing committee.

"We are excited to be hosting this year's workshop," Harris said. "GFDL's scientists and engineers have been at the forefront of the scientific and computational aspects of coupling between component models and between dynamics and the subgrid-scale physical processes, and this workshop is a great venue to discuss issues and solutions with other model developers from around the world."

The workshop will feature keynote lectures, oral presentations, and a poster session.

Further information about the workshop and registration details can be found at: http://splash.princeton.edu/pdc2020/index.html. "This website will remain up and the abstract submission website will be re-opened," Harris said. "All submitted abstracts will remain in the system. We will update this website with more information about the rescheduled PDC workshop when details become available. We greatly regret the change of plans and any inconvenience it may cause. We hope to see you all in 2021."

CIMES Awards continued from Page 1

CIMES Award Highlight

Understanding and Modeling Gas Flux Associated to Breaking Waves

Physical processes at the ocean-atmosphere interface have a large effect on climate and weather by controlling the transfer of momentum and mass. Without wave breaking, transport between the ocean and the atmosphere is through slow conduction and molecular diffusion, while wave breaking is a transitional process from laminar to turbulent flow. When waves are breaking, the surface experiences dramatic changes, with sea spray ejection in the atmosphere and air entrainment into the ocean water. The complex dynamics and statistics of wave breaking in a particular ocean location depends mainly on the local wave state not the wind velocity, while current parameterizations for ocean-atmosphere interactions are based almost exclusively on the wind speed.

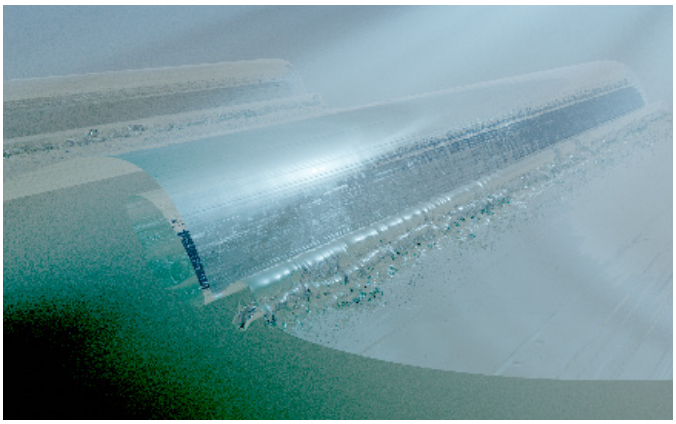


Image credit: Wouter Mostert and Luc Deike. High fidelity direct numerical simulation of breaking waves

With funding from CIMES, Luc Deike, assistant professor of Mechanical and Aerospace Engineering and the Princeton Environmental Institute, is furthering his research aimed at improving parameterizations of gas transfer to be implemented in large scale ocean and Earth system models. The researchers have developed a general theoretical framework to account for the complex nature of wave breaking and air entrainment, and the very large range of scales involved in the process, from the atmospheric and wave scales (scales of tens to hundreds of km), to wave breaking, (scales of tens of meters), to air bubble entrainment and bubble dynamics and dissolution (scales of microns to mm).

Small scale processes related to wave breaking and bubbles in turbulence are described by sophisticated numerical methods using adaptive mesh refinement, combined with laboratory experiments. This leads to fundamental understanding of the wave breaking energetics, as well as the bubble size population and fate, which are necessary to develop parameterization of the resulting bubble, mediated gas transfer. The parameterization is then implemented and applied to larger ocean scale by modeling the wave statistics using the state-of-the art wave model WavewatchIII.

Image credit: Wouter Mostert and Luc Deike. High fidelity direct numerical simulation of breaking waves.

This framework is currently being applied to regional and global scales. The researchers compute the gas transfer velocity globally and show that bubble mediated gas transfer accounts for about 40% of the total CO2 flux, with significant seasonal and regional variability. The role of such sea-state dependent variability in global geochemical cycles remains to be tested, which will be done by implementing their formulation in ocean and Earth system models.

This work is done in close collaboration with Brandon Reichl from GFDL.

Recent publications supported by CIMES:

Mostert and Deike, Journal of Fluid Mechanics, 2020, in press.
Reichl and Deike, Geophysical Research Letters, in review (2020).

CIMES

From Spectroscopy to Climate: Radiative Constraints on the General Circulation Workshop

ON HOLD!

A 3-day workshop, "From Spectroscopy to Climate: Radiative Constraints on the General Circulation Workshop," will be held from June 8-10, 2020 at The Princeton Center for Theoretical Sciences, Princeton University. The workshop will focus on radiative constraints on the general circulation and climate.

"Part of the motivation for this workshop is to clarify and provide a good intuitive understanding of the role of spectroscopic properties of gases in the atmosphere for climate as we know it," said AOS Director and workshop organizer Stephan Fueglistaler.

Confirmed speakers, including Dennis Hartmann (University of Washington), Nadir Jeevanjee (Princeton University), Keith Shine (University of Reading), Jacob Seeley (Harvard University), Daniel Koll (MIT), and Joao Teixeira (Caltech), will offer differing perspectives on the topic.

The workshop program includes invited talks, a poster session, and daily student-led summary discussions, followed by Q&A sessions.

The workshop is open and registration is free. Attendance is limited to 50 registrants.

AOS Graduate Student Yi Zhang Recipient of Outstanding Student Presentation Award at AGU's 2019 Fall Meeting

AOS Graduate Student Yi Zhang was awarded an Outstanding Student Presentation Award (OSPA) at AGU's 2019 Fall Meeting for her presentation entitled "Extreme wet-bulb temperature constrained by mean surface warming in the tropics." Zhang is a co-author, along with AOS Director Stephan Fueglistaler and AOS Senior Meteorologist Isaac Held, on this study.

The Outstanding Student Presentation Awards (OSPAs) recognize and support undergraduate, Master's and Ph.D. students for distinctive research reflective of the Earth and space sciences. The prestigious award is only granted to the top 5% of student participants.

Learn more about the Program

GFDL 2020 Poster Expo Planned for May

The 2020 GFDL Poster Expo will be held on May 8, 2020 from 1-4 pm at GFDL in the Smagorinsky Seminar Room. The Poster Expo is an opportunity to showcase the breadth of research conducted by the broader GFDL community and to foster dialogue and interactions among community members.

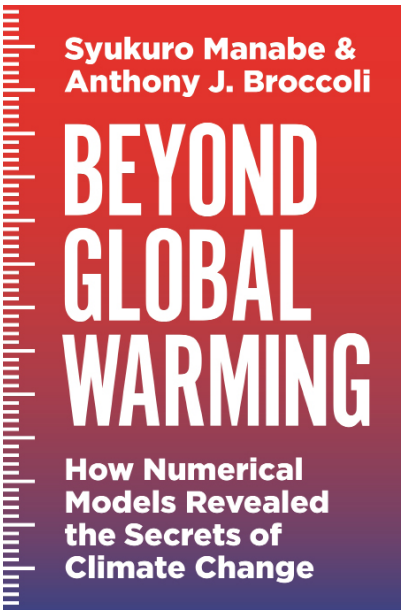
The Expo gives early-career researchers, in particular, the opportunity to practice and hone their presentation skills in the format used by many academic conferences, and it provides an informal forum for more seasoned GFDL scientists, AOS/CIMES postdocs and research scholars, and AOS students to highlight the progress and results of their research and scholarly work. The event also promotes transdisciplinary collaboration among colleagues and community partners.

Poster presentations on research topics relevant to the broader GFDL community, as well as topics related to diversity, equity, and inclusion are welcome. Registration is required for poster presenters and closed on Wednesday March 18, 2020 at 5pm. Only poster submissions with either first author or at least one co-author affiliated with GFDL/UCAR/SAIC/USGS/AOS/CIMES who is actively collaborating on the project were accepted.

Logistics and registration information can be found on the 2020 Poster Expo webpage. Please note that due to space limitations, posters are limited to 28. The committee is proceeding as planned, but will reassess after April 5.

Q&A with Suki Manabe: Beyond Global Warming

In his new book *Beyond Global Warming: How Numerical Models Revealed the Secrets of Climate Change*, AOS Senior Research Meteorologist Suki Manabe gives *u*s a firsthand account of how the scientific community came to understand the human causes of climate change, and how numerical models using the world's most powerful computers have been instrumental to these vital discoveries.



Q: What led you (with Anthony Broccoli) to write this book?

Manabe: This book has evolved from the lecture notes of a graduate course that I taught in the AOS Program at Princeton University. The primary title of this book, *Beyond Global Warming*, reflects our shared belief that the greatest value of climate models is not just their utility for making predictions, but also their ability to provide a deeper understanding of how the climate system works. The book may be useful as a reference text for graduate and advanced undergraduate courses in climate dynamics and climate change, but also in other disciplines that involve the environment, ecology, energy, water resources, and agriculture. We hope that this book will be useful for those who are curious about how and why the climate has changed in the past and how it will change in the future.

Q: Why is it important to walk readers through the history of climate modeling?

Manabe: Climate models are the most powerful tools for predicting human-induced global warming. They are based upon the laws of physics and have evolved from the models used for numerical weather prediction. Exploiting the vast computational resources of some of the world's most powerful supercomputers, climate models have been used to make predictions of future climate change and its impact, providing valuable information for policymakers. Climate models have been useful not only for predicting climate change but also for understanding it. Serving as "virtual laboratories" of the coupled atmosphere-ocean-land system, they can be used for performing controlled experiments that have proven very effective for systematically elucidating the physical mechanisms involved in climate change.

Starting from the pioneering study conducted by Arrhenius more than 100 years ago, this book presents a history of the use of models in the study of climate change. Based upon the analysis of numerical experiments performed with a hierarchy of climate models of increasing complexity, we seek to elucidate the basic physical processes that control not only global warming but also the changes in climate of the geological past. It is not our intention, however, to present a comprehensive survey of the literature on climate dynamics and climate change. Instead, we would like to focus on studies in which we are participants and those that influenced our thinking. We hope to describe the scientific journey that allowed us to develop a better understanding of the processes that underlie climate change. [Manabe was accompanied for parts of his journey by Broccoli, who was likewise influenced and informed by the studies described in this volume.]

Q: Are you optimistic about the future of our warming planet?

Manabe: There is no doubt that the composition of the atmosphere and the Earth's climate have changed since the industrial revolution, with human activities as the predominant cause. The atmospheric concentration of carbon dioxide has increased by more than 40% since the preindustrial era, primarily from the combustion of fossil fuels for the production of energy. The global mean surface temperature, which has been relatively stable over 1,000 years, has already increased by about 1°C, since the preindustrial era. If these energy production activities do not shift markedly, these changes will continue. The global mean temperature is projected to increase by an additional ~2°C during the 21st century, with land areas warming significantly more than ocean and the Arctic warming significantly more than the tropics.

The availability of water is also likely to change over continents. Water will be more plentiful in already water-rich regions, increasing the rate of river discharge and frequency of floods. In contrast, water stress will increase in the subtropics and other water-poor regions that are already relatively dry, increasing the frequency of drought. Observations suggest that the frequencies of both floods and droughts have been increasing.

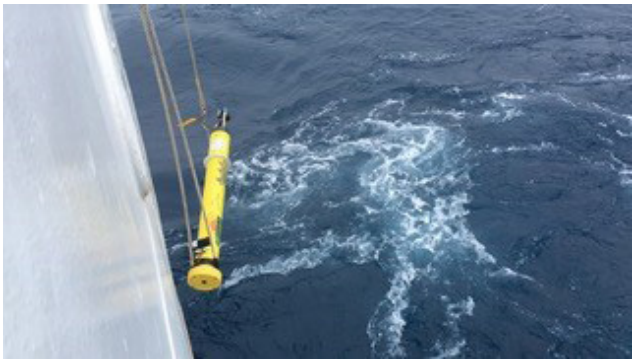
Unless dramatic reductions of greenhouse gas emissions are achieved, global warming is likely to exert far-reaching impacts upon human society and the ecosystem of our planet during the remainder of 21st century and for many centuries to come.

Oakham Students Welcome AOS Research Oceanographer Bob Key

This past fall, AOS Research Oceanographer Bob Key, SOCCOM's shipboard data manager, visited Oakham Primary School in Sandwell, England as part of the SOCCOM "Adopt-A-Float" initiative. The initiative creates a unique opportunity for elementary- and secondary-aged students to learn about oceanographic research and processes by engaging directly with leading scientists from across the globe, and by naming and tracking SOCCOM autonomous profiling floats.

The SOCCOM floats measure ocean temperature and salinity, as well as dissolved oxygen, nitrogen and pH. They drift with the current and can control their buoyancy to collect observations in the upper water column. The instruments dive down to one kilometer and float with the currents for nine days. Next, they drop even farther, to two kilometers, and then rise back to the surface while measuring water properties. After surfacing, they beam their observations back to shore via satellite.

While the floats are launched in some of the most remote waters and underexplored waters across the globe, students interact with the scientists deploying them by following the scientists' blogs for each deployment cruise. Students can track the trajectories of their adopted float through SOCCOM's interactive map, which also shows the float tracks of all the other SOCCOM floats. Locating their float in the water and watching the data coming back is often the best part of the experience for the students, many of whom would not otherwise be exposed to large-scale scientific research.



Deployment of Lautan (Oakham Primary School, England)

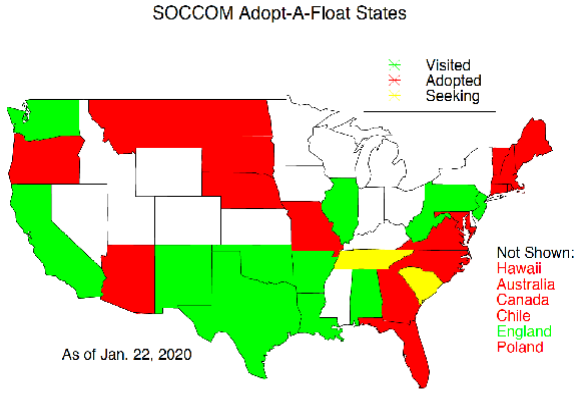
Oakham's float, Lautan (which in Indonesian means "ocean"), was launched on January 12 from the Japanese Research Vessel Mirai as part of the first ever occupation of the I07S line in the southwestern Indian Ocean, according to Key. "The float had reported five profiles by February 28th and is functioning properly," Key said. Over the float's five-year lifetime, vast amounts of data will be reported from places where little or no data previously existed.

In addition to his float presentation, Key spent time talking with students and sharing his experiences at sea and in academia during the course of his four-decade career.

"These outreach visits are incredibly satisfying and fun for Tonalee and me," Key said. "The reception we have received at every school has been incredible! While I will retire this year, we hope to have a SOCCOM visit to each of the remaining 50 states over the next year or so."

The Adopt-A-Float program has enjoyed tremendous success. From just one classroom in just one school in 2015, the pilot now encompasses 50 schools in 30 U.S. states as well as Chile, Canada, Australia, Poland, and now England. In total, 104 floats have been adopted and named.

CIMES and SOCCOM help support the outreach tours. Key and his wife, Tonalee, make the outreach visits together. They plan to make an outreach trip through the southeastern United States prior to the annual SOCCOM meeting in June.



Alumni News

Former AOS Postdoctoral Research Associate **Ángel Muñoz**, a climate scientist at Columbia University's International Research Institute for Climate and Society, has been given an Early Career Scientist Leadership Award by the U.S. Climate Variability and Predictability Program (US CLIVAR). The award recognizes his outstanding contributions to national and international work to advance research and applications of subseasonal-to-seasonal predictions.

Former AOS Visiting Research Scholar **Laure Zanna** has been awarded the Nicholas P. Fofonoff Award of the American Meteorological Society for exceptional creativity in the development and application of new concepts in ocean and climate dynamics.

Former AOS Postdoc **Thomas Frölicher** won the 2019 Theodor Kocher Prize in recognition of his fundamental contributions to the study of extreme events in the ocean, which show that global warming makes marine heat waves even more frequent, intense, and extensive and has potentially large and harmful effects on ecosystems. The prize is conferred annually upon young researchers at the University of Bern for outstanding and innovative scientific achievement in any faculty or field.

PEI Graduate Research Awards — Call for Applications

Princeton Energy and Climate Scholars (PECS): Application Deadline April 10

Princeton Energy and Climate Scholars (PECS), a two-year faculty-guided and student-governed fellowship program, allows Princeton graduate students from the humanities, natural and social sciences and engineering to engage in a common intellectual exploration within the broad area of climate and energy. Scholars participate in informal student discussions, fellow-faculty dinners and group projects; a $1,000 research stipend is provided to support fellows' research and professional development. Interested students can apply through the PEI website.

PEI-STEP Graduate Fellowship: Application Deadline April 15

The two-year PEI-STEP Graduate Fellowship program enables participating graduate students to explore the environmental policy dimensions of their doctoral research. Students who complete the requirements of the PEI-STEP fellowship are awarded a Graduate Certificate in Science, Technology, and Environmental Policy from the Woodrow Wilson School of Public and International Affairs, in addition to receiving a degree from the department in which the student is enrolled. PEI offers half financial support for two years (stipend and tuition). Support is generally awarded in the second and third years of the student's Ph.D. tenure. PEI-STEP Fellows also receive a $3,500 award to support their graduate research. Interested students can apply through the PEI website.

Walbridge Fund Graduate Award for Environmental Research: Application Deadline April 15

The Walbridge Fund Graduate Award for Environmental Research provides up to $10,000 in research funding to graduate students pursuing innovative research on climate change science, energy solutions, environmental policy or, more broadly, on other environmental topics. Funds may be used for a range of purposes, including fieldwork support, travel, conference participation, the purchase of equipment, and costs associated with data analysis and facilities use. Applications are available through the Student Activities Funding Engine (SAFE).

Mary and Randall Hack '69 Graduate Award for Water and the Environment: Application Deadline April 20

The Mary and Randall Hack '69 Graduate Award for Water and the Environment provides up to $10,000 in research funding to graduate students pursuing innovative research on water and water-related topics with implications for the environment, including projects related to climate science, engineering and environmental policy. Applications are available through the Student Activities Funding Engine (SAFE).

AOS & CIMES News

AOS Research Meteorologist **Morris Bender** is the recipient of the 2020 Richard H. Hagemeyer Award in tropical meteorology for his leadership role that has contributed to significant advances in the numerical modeling of tropical systems.

Maurizia (Maura) De Palma, a 2019 CIMES Summer Intern from Kean University, was awarded a student presentation award at AGU's Fall Meeting for her presentation entitled, "Anthropogenic Carbon Uptake and Ocean Acidification in GFDL's CM4 and ESM4 Models." Maura worked with John Krasting during her summer internship.

Arrivals

Alexander Huth arrived in early January, from the University of Washington, to work with Alistair Adcroft and Olga Sergienko as a postdoc.

Zhihong Tan arrived in early January, from the University of Chicago, to work with Ming Zhao as a postdoc.

Ruth Moorman arrived in early January, from Australian National University, to work with Steve Griffies and Jorge Sarmiento as a research specialist (SOCCOM).

Justin Perket arrived in mid-January, from NASA (Greenbelt, MD), to work with Elena Shevliakova as a software engineer.

Maike Sonnewald arrived in early February, from MIT, to work with V. Balaji as an associate research scholar.

Yi-Hsuan Chen arrived in mid-February, from the University of Michigan, to work with Leo Donner and Ming Zhao as a postdoc.

Xiaowei Zhu arrived in late March, from Johns Hopkins University, to work with Ming Zhao as a postdoc.

Joseph Mouallem will arrive in mid-April, from ASML, Eindhoven, the Netherlands, to work with Lucas Harris and Tim Marchok as a research software engineer.

Departures

Xiao Liu accepted a support scientist position at IMSG and NOAA NWS NCEP/EMC in College Park, MD. She left the Program in early February.

COVID-19: Coronavirus Update!

AOS faculty, staff, and students should continue to check the University's COVID-19 website for updates on the continuing effort to ensure the health and well-being of the community.