GLOBAL CHANGES

MIT JOINT PROGRAM ON THE SCIENCE & POLICY OF GLOBAL CHANGE

FALL 2018 NEWSLETTER

OUR RESEARCH MISSION

At the Joint Program, our integrated team of natural and social scientists studies the interactions among human and Earth systems to provide a sound foundation of scientific knowledge. Such a foundation will aid decision-makers in confronting the interwoven challenges of future food, energy, water, climate and air pollution issues, among others.

Our mission is accomplished through:

- *Quantitative analyses of global changes and their social and environmental implications, achieved by employing and constantly improving an Integrated Global System Modeling (IGSM) framework;*
- *Independent assessments of potential responses to global risks through mitigation and adaptation measures;*
- *Outreach efforts to analysis groups, policymaking communities, and the public; and*
- *Cultivating a new generation of researchers with the skills to tackle complex global challenges in the future.*

In This Issue:

SAVE THE DATE:
XLII (42nd) GLOBAL CHANGE FORUM

March 27–29, 2019 • MIT Campus • Cambridge, MA

Theme: Global Change - Risks and Opportunities

JOINT PROGRAM SPONSORS' MEETING

March 27, 2019 • 2:00–5:00 pm EST

Forum attendance is by invitation only.

For additional information, please

- Log into the sponsors' section of our website
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MIT JOINT PROGRAM ON THE SCIENCE AND POLICY OF GLOBAL CHANGE

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FALL 2018 GLOBAL CHANGES

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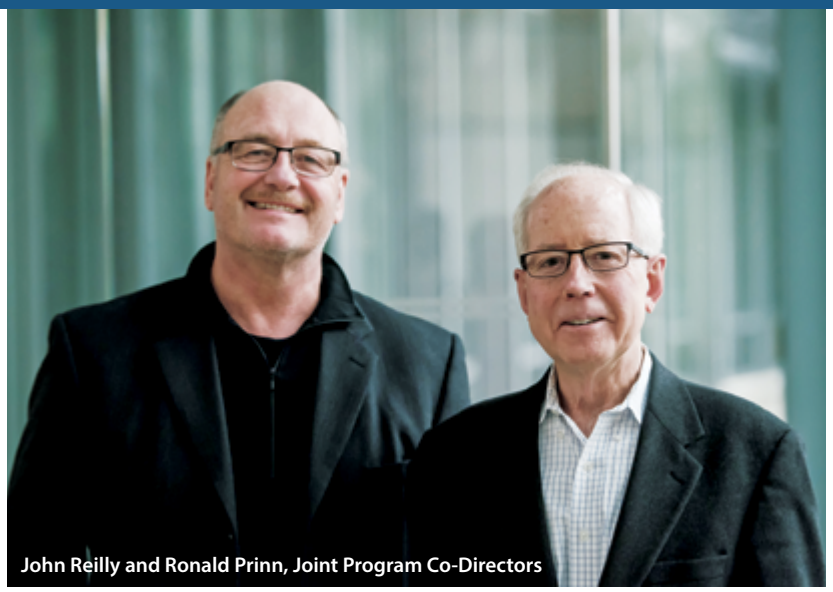
Our take on the *IPCC Special Report on Global Warming of 1.5°C*


John Reilly and Ronald Prinn, Joint Program Co-Directors

Adopted by 195 nations at the 21st Conference of the Parties (COP21) to the UNFCCC in December 2015, the Paris Agreement sought to intensify the global response to the threat of climate change by "holding the increase in the global average temperature to well below 2°C (3.6°F) above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5°C (2.7°F) above pre-industrial levels." On October 8, the IPCC Special Report on Global Warming of 1.5ºC highlighted the impacts that could be avoided by limiting global warming to 1.5°C compared to 2°C, and the steps needed to put the globe on an emissions path consistent with achieving the 1.5°C goal.

According to the IPCC report, avoided impacts with 1.5°C versus 2°C include 10 centimeters (~4 inches) less global sea-level rise by 2100, a reduced likelihood of an ice-free Arctic Ocean in summertime (once per century rather than at least once per decade), and a less severe decline in coral reefs (70–90 percent instead of nearly 100 percent). Keeping global warming below 1.5°C rather than 2°C should also lower climate-related risks to food security, water supplies, biodiversity and ecosystems, human health, livelihoods and security, and economic growth.

A disappointing aspect of the latter set of conclusions is that there is little quantification; the justification seems largely, if 2°C is bad, then 1.5°C must be not quite as bad. This is a reasonable conclusion, but the inability of the IPCC to better quantify the reduction in risks reflects the state of development of climate impact research across all sectors of the economy and relevant human activities. Estimating "climate response functions" for specific economic sectors and human activities is a very challenging task with competing methods, each with strengths and weaknesses. Factoring in the adaptation possibilities in a noisy, chaotic, multivariate and highly uncertain description of future weather adds to the challenge.

There is no questioning the report's broad conclusion that capping global warming at 1.5°C will amount to a "Herculean task" that requires "rapid and far-reaching" transitions in the planet's use of natural resources, from land use to energy production to industrial practices to urban infrastructure. According to the IPCC, achieving the 1.5°C goal entails reducing global net anthropogenic emissions of carbon dioxide (CO_2) by approximately 45 percent from 2010 levels by 2030, and reaching "net-zero" emissions (anthropogenic emissions minus anthropogenic sinks) by around 2050.

While the analysis in our recently released 2018 Food, Water, Energy and Climate Outlook suggests that it is not necessary to get to net-zero GHG emissions this century to remain consistent with achieving the 1.5°C target, we do agree that emissions would need to be reduced very rapidly and very soon. A challenge for the IPCC is that it continues to use separate analyses using atmosphere-ocean global circulation models for CO_2, with side calculations of other greenhouse gases (GHGs), to come up with a CO_2 equivalent GHG budget consistent with a stabilization level. The budget is then used in economic models as a constraint on emissions. This approach does not fully capture the Earth-system response to rapidly declining emissions, the role of a short-lived gas such as methane that with substantial emissions reductions can lead to quick declines in methane concentrations and reduced radiative forcing from that source, and the slow uptake of CO_2 by the ocean that will persist for centuries.

The net-zero-by-2050 target is a somewhat arbitrary cutoff even in the IPCC summary. The report concludes that CO_2 emissions remaining after about 2050 would have to be cancelled out by technologies capable of extracting CO_2 from the air, such as bio-electric power with carbon capture and storage (BECCS). Such technologies have not yet been demonstrated on a large scale. We agree that CO_2 removal technologies may eventually be needed to cancel out emissions from nitrous oxide from fertilizer use and methane from livestock and rice production—unless we dramatically change our diets as well as our energy consumption patterns. At present, the options to eliminate greenhouse

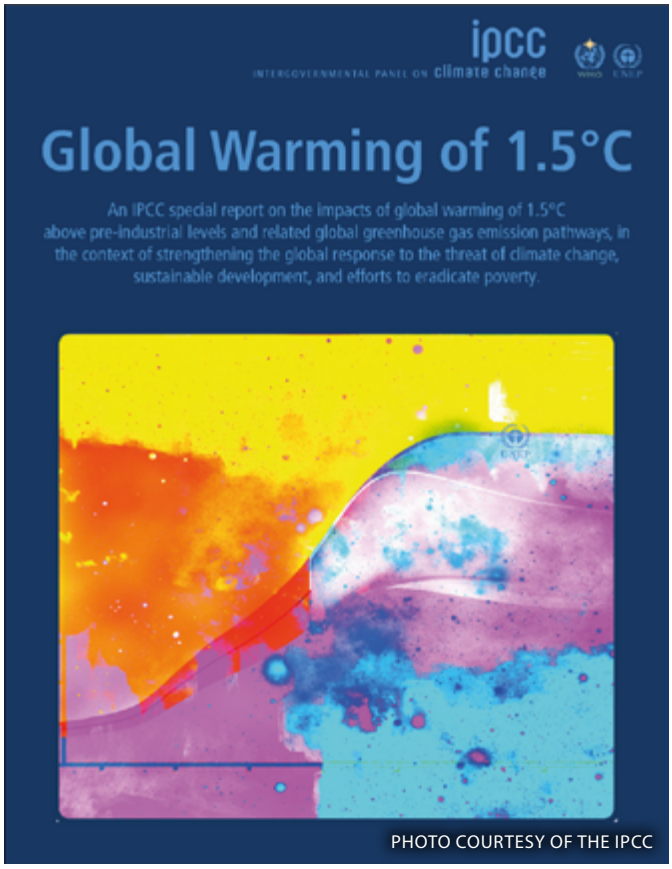
gas emissions from agriculture, energy production and energy-intensive sectors such as chemicals, iron and steel, or cement, are not obvious. A significant contribution from negative CO_2 emissions sources such as BECCS, reforestation or improved soil management later this century would provide more headroom in the near-term, resulting in less drastic immediate reductions. However, that would amount to kicking the can down the road, leaving more of the problem to the next generation and betting that these options could be developed, improved and implemented.

Our 2018 Outlook, published just days before the release of the IPCC report, presented the MIT Joint Program perspective on the viability of and necessary steps for meeting the 1.5°C and 2°C goals. The 2018 Outlook finds that these Paris Agreement targets remain technically achievable but require much deeper, and more near-term reductions than those embodied in the Nationally Determined Contributions (NDCs) agreed upon in Paris.

Because the Earth-system response to increased GHGs is uncertain, we compared emissions paths that stay below 2°C with a 50-50 (i.e. 50%) chance to those that had a 2-in-3 (i.e. 67%), the minimum defined by the IPCC as "likely") chance of staying below that level, and interpreted the 1.5°C aspiration with a 50-50 chance, with or without a temporary overshoot of that target. For these long-term targets, we applied globally uniform carbon-equivalent pricing that increased over time, starting in either 2020 or 2030 to determine whether a 10-year delay in going beyond the Paris NDCs rendered the long-term goal unattainable.

Not surprisingly, we found that making deeper cuts immediately (i.e. 2020) rather than as a next step in the Paris process (waiting until 2030) would lower the carbon prices needed to achieve long-term goals, and reduce the need for unproven options to achieve zero or negative emissions after 2050. We estimate that achieving 2°C with a 50-50 chance would require an $85/ton carbon dioxide-equivalent (CO_2-e) carbon price if applied globally and started in 2020, or $122/ton if delayed until 2030 (in 2015 dollars). Achieving 2°C with a 2-in-3 chance would require CO_2-e carbon prices of $109/ton if started in 2020 or $139/ton if started in 2030. We estimate that achieving the 1.5°C aspiration with a 50-50 chance would require a CO_2-e carbon price of $130/ton starting in 2020 and applied globally. In the end, it is fair to say that our analysis puts a dollar sign on the aforementioned "Herculean task," with the above $130/ton price in 2020 needing to rise at 4% per year through 2100.

One possible reaction to the IPCC report is that it appears so difficult to achieve this 1.5°C target, or for that matter even the 2°C goal, that we may as well give up and just adapt to climate impacts. However, that would be foolhardy. Even if



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we miss these targets but still end of up stabilizing at 2.5°C or even 3°C, we will be far better off than if we give up completely and end up at 4 or 5°C by 2100, and continue rising after that. Such temperatures would almost certainly destabilize the Greenland and Antarctic ice sheets and eventually result in tens of meters of sea-level rise, flooding every major coastal city, and dramatically reshaping the coastlines of the world's continents.

One more politically viable strategy to help reverse climate change, now emerging in places like China, is to bundle GHG emissions reduction with a broader set of more immediate problems such as conventional air pollution, water pollution and ecosystem degradation due to land-use change. Solving these bundled issues locally leads to local benefits, making this strategy more politically compelling to local, regional and national governments. Also, the solutions to these other problems often also reduce greenhouse gas emissions, or with a little more effort and thought can do so, and hence do not depend as much on international enforcement. We are certainly not recommending that we abandon the UNFCCC and COP process, but real progress will also require more "boots on the ground" working with people to map out how they can benefit from a more sustainable path forward.

—Ronald Prinn and John Reilly, Co-Directors

MIT Joint Program News Releases:
Latest research developments and their implications

MIT Joint Program in the Media:
Latest coverage of our research

The following summaries are listed by primary research focus area, but may span multiple research focus areas.

Food, Water & Forestry

What will we eat in the year 2050?

Combining art and science to envision the global food system under climate change

How might climate change alter the global food system by 2050? Will diets change to reflect a revamped agriculture designed to adapt to a warming world? MIT Joint Program Principal Research Scientist Erwan Monier and New York University artist Allie Wist grappled with these questions as they developed a dinner menu for the MIT Climate Changed Symposium, a two-day gathering of experts in the sciences, humanities and design focused on the role and impact of models in a changed climate.

Workshop explores intertwined future of food production, water and climate

Choices by consumers and farmers can help limit global warming, but climate change may also curtail those choices in the future

Joint Program researchers, including Co-Director John Reilly, delivered presentations at a two-day workshop organized by the Abdul Latif Jameel Water & Food Systems Lab (J-WAFS). Reilly noted how changes in the agriculture sector, which produces nearly a quarter of all anthropogenic greenhouse gas emissions, can have a significant impact on the global environment.

Day Zero: Water Crisis South Africa

Joint Program Research Scientist Kenneth Strzepek highlights need for collaborative solutions on Tufts Water: Systems, Science and Society Symposium panel

Strzepek discussed economic developments surrounding the water crisis and rising concerns about how water is used in agriculture, which withdraws 62% of South Africa's water while only producing 4.32% of the nation's GDP. He also emphasized the need for collaboration by representatives from government, development and society.

Gauging the effects of water scarcity on an irrigated planet

Study projects likely impacts on food prices, bioenergy production and deforestation

Joint Program researchers found that changes in water availability for agriculture of plus or minus 20% had little impact on global food prices, bioenergy production, land-use change and the global economy. Appearing in the *Australian Journal of Agriculture and Resource Economics*, their study is the first to estimate how irrigation management and systems may respond to changes in water availability in a global economy-wide model that represents agriculture, energy and land-use change.

Apple farmers in Wisconsin worry about changing climate (*CBS MoneyWatch*)

News story cites global temperature projections from MIT Joint Program's 2016 Outlook

A spate of hot, wet weather this summer and over the past few growing seasons has left Wisconsin apple farmers concerned about their futures.

Air Quality & Health

COMMENTARY **Another problem with China's coal: Mercury in rice (*The Conversation*)**

Study highlights need for mercury emissions-control policy

Assoc. Prof. Noelle Selin and former postdoc Sae Yun Kwon, both Joint Program affiliates, find that mercury emissions-control policy can significantly reduce concentrations of methylmercury in rice.

A proposed global metric to aid mercury pollution policy (*Science*)

Noelle Selin authors a Policy Forum paper in the journal Science

Selin identifies criteria for a global-scale metric to assess the impact of mercury emissions-reduction policies and overall progress toward the goal of the Minamata Convention on Mercury.

Australian climate policy ignoring billions in potential health savings, experts say (*Australian Broadcasting Corporation*)

Health co-benefits could be an added incentive for individual countries to take action on climate

Noelle Selin: "I would not be surprised if there were co-benefits in Australia, given we found them in the United States which is an industrialized country with advanced air pollution regulations."

Study: Health benefits could offset cost of China's climate policy

A 4% reduction per year in CO_2 emissions should net $339 billion in health savings in 2030, researchers estimate

A Joint Program study in *Nature Climate Change* estimates that by meeting its greenhouse gas-reduction goals, China would simultaneously improve its air quality, thereby avoiding a significant number of air pollution-related deaths in every province. Fewer deaths from air pollution translates to a $339 billion savings in 2030 that the researchers estimate could be about four times what it would cost China to meet its climate goals.

Tracking air quality changes across space and time

Modeling advance enables more efficient & precise estimates

A team of researchers from the Joint Program and collaborating institutions has developed a method to optimize air quality signal detection capability over much of the continental U.S. by applying a strategic combination of spatial and temporal averaging scales. Presented in the journal *Atmospheric Chemistry and Physics*, the method could improve researchers' and policymakers' understanding of air quality trends and their ability to evaluate the efficacy of emissions-reduction policies.


International Journalism Festival panel


International Journalism Festival panel


Chien Wang

Earth System Science

Connecting science and journalism though climate change and digital innovation

On International Journalism Festival panel, MIT Joint Program Co-Director John Reilly highlights challenges and strategies for impactful climate change reporting

"Changing people's minds on climate change is like waging a military campaign," said Reilly on the panel. "You won't win the war if you rely solely on an aerial attack—i.e., through placing a story or two in the international press that covers the issue in broad terms. You also need a 'ground game'—boots on the ground, if you will. Reporters must work in all parts of the world, get the trust of people in local communities, and connect the complex issues that they experience to global issues."

Targeting one of climate modeling's biggest uncertainties

New method enables faster, more accurate simulation of aerosol-cloud interaction

In a study in the journal *Atmospheric Chemistry & Physics*, former Joint Program research assistant/postdoc Daniel Rothenberg—in collaboration with Senior Research Scientist Chien Wang and an Emory University co-author—advanced a method and software that represents a key aspect of aerosol-cloud interaction with far greater accuracy and computational efficiency than existing approaches. The research could help reduce a significant source of uncertainty in climate models.

MIT Joint Program senior research scientist selected for "Make our Planet Great Again" program

Chien Wang one of six new U.S. scientists to join French climate research initiative

Wang's project aims to advance knowledge about the critical yet still poorly understood issue of how aerosol-cloud interactions impact the climate, and to develop new methods to more precisely represent key physical processes involved in these interactions in Earth-system models. Produced by power plant emissions, vehicle exhaust, biomass burning and other human activities, as well by natural processes such as volcanic eruptions, aerosols have far-reaching effects on the Earth system.

Macron's call to 'Make our Planet Great Again' attracts six more US-based scientists (*CNN*)

Joint Program researcher awarded grant focused on the role of aerosols in the climate

Chien Wang was among the second round of scientists selected to pursue climate-change research as part of the French President's initiative.

Climate Policy

Carbon taxes could make significant dent in climate change, study finds

Several different carbon-pricing approaches would help reduce emissions, and some would be fair as well, researchers report

Putting a price on carbon, in the form of a fee or tax on the use of fossil fuels, coupled with returning the generated revenue to the public in one form or another, can be an effective way to curb emissions of greenhouse gases. That's the key finding in a *Climate Change Economics* paper co-authored by MIT Joint Program Co-Director John Reilly and former postdoc Justin Caron, and two researchers at NREL. The paper provides an overview of 11 different studies.

What is the likely outcome of a trade war between the U.S. and the rest of the world?

Study highlights economic losses for participating countries

A study in *The World Economy* by Joint Program Principal Research Scientist Niven Winchester estimates the impact of a trade war between the U.S. and the rest of world when the U.S. alone does not comply with the Paris Agreement. Winchester concludes that strategic tariffs could be used to enforce Paris Agreement commitments as long as compliant countries are willing to absorb substantial economic losses on the home front.

Meeting the goals of the Paris Agreement (*EnergyCollective*)

IGSM used to assess Shell's "Sky" rapid energy transition scenario

A Joint Program Report's analysis of the Sky scenario shows how massive reforestation could make it possible to cap global warming at 1.5°C.

Are greenhouse emissions down under Donald Trump, as EPA says? (*PolitiFact*)

Joint Program Co-Director John Reilly helps correct the record

Reilly highlights external factors, including a long-term shift from coal to natural gas which accounts for emissions reductions, and Trump policies that promote increased emissions.

COMMENTARY Beat protectionism and emissions at a stroke (*Nature*)

Applying carbon charges, not trade tariffs, to imports would bolster the Paris Agreement

Two huge multilateral issues—free trade and climate change—top policymakers' agendas in 2018. This offers a chance to couple them, argue CEEPR Deputy Director Michael Mehling and colleagues.

Carbon pricing lets us follow our money and our moral compass (*Huffington Post*)

Joint Program study cited in Canada blog post

Study showed that several different carbon-pricing approaches would help reduce U.S. emissions, and some would be fair as well.

French President Emmanuel Macron addresses US Congress, Jun 2017.

Regional Analysis

Clearing the air over Southeast Asia

Why reducing biomass burning is not enough

A study led by Joint Program Senior Research Scientist Chien Wang's research group that appears in the journal *Atmospheric Chemistry and Physics* shows that the main driver of observed low-visibility days in 50 ASEAN cities is more likely aerosols from non-fire anthropogenic sources. The study indicates that while biomass burning should be minimized, emissions control of non-fire sources such as fossil fuel combustion must be a key component of Southeast Asia air pollution mitigation policy.

Checking China's pollution by satellite

Study finds reduction in sulfur emissions from power plants

A study in PNAS led by Asst. Prof. Valerie Karplus, a Joint Program faculty affiliate, examines a Chinese law that has required coal-fired power plants to significantly reduce emissions of sulfur dioxide, a pollutant associated with respiratory illnesses, starting in July 2014. Overall, the study finds that with the policy in place, the concentration of these emissions at coal power plants fell by 13.9%, but satellite data has pinpointed insufficient compliance with the law in key regions.

The price of the pledge

MIT Joint Program researchers assess impact of Paris climate commitments on a national economy

Meeting Turkey's Paris Agreement pledge will require a dramatic shift to low-carbon energy sources. To assess how much of a toll such a transition might take on the nation's economy, Joint Program researchers developed a computational general equilibrium (CGE) model of the Turkish economy, TR-EDGE. Unlike similar CGE models, TR-EDGE includes a detailed representation of the energy-intensive electricity sector. The team's analysis appears in the journal *Energy Policy*.

COMMENTARY **China's emissions trading takes steps towards big ambitions (*Nature Climate Change*)**

If successful, China could lead the next generation of global carbon markets in developing and industrializing countries

Asst. Prof. Valerie Karplus, a faculty affiliate of the Joint Program, and co-authors identify five aspects of change needed to boost the long-term effectiveness and efficiency of China's emissions trading scheme.

Curbing Emissions: Can satellites help keep China on track? (*Wharton*)

Valerie Karplus and experts at Duke and Wharton discuss her new study on environmental regulation compliance in China

Remote sensing data could be used to inform policy-making and to enhance the understanding of how firms respond to pollution-control regulations, says Karplus.

Study: Climate action can limit Asia's growing water shortages

Following the Paris accord could reduce risk of severe water-access problems, researchers find

In a study in *Environmental Research Letters*, a team of Joint Program researchers found that with no constraints on economic growth and climate change, an additional 200 million people across Asia would be vulnerable to severe water shortages by 2050. However, fighting climate change along the lines of the 2015 Paris Agreement would reduce by around 60 million the number of people facing severe water problems.

Energy

ES-MIT ENERGY-AT-SCALE
A PROJECT OF THE MIT JOINT PROGRAM

Energy-at-Scale: Charting the future of decarbonization

MIT Joint Program workshop explores economic and environmental impacts of scaling up low-carbon energy

Drawing upon many years of leading-edge work identifying challenges, hazards and potential barriers to low-carbon options deployed at continental to global scales—including knowledge generated in MIT's ongoing Energy-at-Scale project—researchers focused on challenges and opportunities in large-scale, low-carbon energy technology deployment. Discussions underscored the potential of unique Joint Program assessment strategies and tools to quantify the economic and environmental impacts of large-scale decarbonization and support investment and policy decisions in this space.

COMMENTARY **Handicapping the high-stakes race to net-zero (*Milken Institute Review*)**

A roadmap for decarbonization and climate stabilization

MIT Joint Program faculty affiliate Richard Schmalensee explores three key challenges that must be surmounted to get to net-zero emissions relatively soon and at politically tolerable costs.

Modeling Tools

Description and Evaluation of the MIT Earth System Model (MESM)

Results from the latest version of MESM compare favorably with those produced by more computationally intensive models

Comparing the performance of the MESM with that of more computationally intensive Earth-system models, Joint Program researchers and collaborators show that the MESM effectively simulates changes in the observed climate system since the mid-19th century as well as the main features of the present-day climate system. The researchers describe the new MESM's capabilities in a paper appearing in the *AGU Journal of Advances in Modeling Earth Systems*.

Milestones

Noelle Selin, an associate professor in the Department of Earth and Planetary Sciences (EAPS) and Institute for Data, Systems and Society (IDSS), was named director of the MIT Technology and Policy Program, a two-year master's program. Selin, whose research focuses on using atmospheric chemistry modeling to inform decision-making strategies on air pollution, climate change and toxic substances, was also awarded a Hans Fischer Senior Fellowship at the Technical University of Munich Institute for Advanced Study.

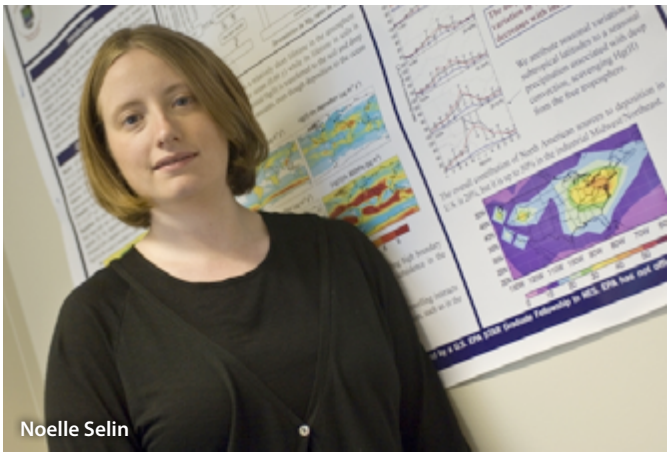
Former Joint Program-affiliated researcher **Sarah Fletcher** (PhD '18, IDSS) was awarded a fellowship to the Global Future Council on Food Systems and Innovation.

EAPS Professor of Atmospheric Science **Kerry Emanuel** was named a 2018 American Geophysical Union (AGU) Fellow. Emanuel was also chosen by the **National Center for Science Education** to receive its 2018 Friend of the Planet award in recognition of his substantial contribution to climate-change education.

EAPS Professor **Daniel Cziczo** was awarded tenure. Cziczo studies the interrelationship of atmospheric aerosol particles and cloud formation and its impact on the Earth's climate system.

Atmospheric scientist **Jimmy Gasore** (PhD '18, EAPS) won the Rossby Award for best doctoral thesis done the preceding academic year within the EAPS Program in Atmospheres, Oceans and Climate (PAOC). Gasore provided significantly more accurate estimations of carbon dioxide and methane sources and sinks in Central and Eastern Africa through a new high-frequency, long-term greenhouse gas monitoring station and model.

– EAPS; IDSS; MIT News


Noelle Selin

Joint Program Reports

329. Next Steps in Tax Reform

330. Meeting the Goals of the Paris Agreement: Temperature Implications of the Shell Sky Scenario

331. The economic and emissions benefits of engineered wood products in a low-carbon future

332. Turkish Energy Sector Development and the Paris Agreement Goals: A CGE Model Assessment

333. Statistical Emulators of Irrigated Crop Yields and Irrigation Water Requirements

Joint Program Reprints

2017-20. Historical greenhouse gas concentrations for climate modelling (CMIP6) (*Geosci Model Dev*)

2017-21. Aggregation of gridded emulated rainfed crop yield projections at the national or regional level (*JGEA*)

2017-22. "Climate response functions" for the Arctic Ocean: a proposed coordinated modelling experiment (*Geosci Model Dev*)

2017-23. Carbon Pricing under Political Constraints: Insights for Accelerating Clean Energy Transitions (*The Political Economy of Clean Energy Transitions, Ch. 3*)

2017-24. Towards a Political Economy Framework for Wind Power: Does China Break the Mould? (*The Political Economy of Clean Energy Transitions, Ch. 13*)

2018-2. Modelling Ocean Colour Derived Chlorophyll-a (*Biogeosciences*)

2018-3. The Impact of Water Scarcity on Food, Bioenergy and Deforestation (*AJARE*)

2018-4. Tight Oil Market Dynamics: Benchmarks, Breakeven Points, and Inelasticities (*Energy Economics*)

2018-5. Toward a consistent modeling framework to assess multi-sectoral climate impacts (*Nature Communications*)

2018-6. Potential Impacts of Climate Warming and Changing Hot Days on the Electric Grid: A Case Study for a Large Power Transformer (LPT) in the Northeast United States (*Climatic Change*)

2018-7. Sectoral aggregation error in the accounting of energy and emissions embodied in trade and consumption (*J Industrial Ecol*)

2018-8. New data for representing irrigated agriculture in economy-wide models (*JGEA*)

2018-9. Maximizing Ozone Signals Among Chemical, Meteorological, and Climatological Variability (*Atmos Chem Phys*)

Peer-Reviewed Studies & Pending Reprints

A review of global environmental mercury processes in response to human and natural perturbations: changes in emissions, climate, and land use (*Ambio*)

Air Quality Co-benefits of Carbon Pricing in China (*Nature Climate Change*)

Baseline evaluation of the impact of updates to the MIT Earth System Model on its model parameter estimates (*Geosci Model Dev*)

Can Tariffs be Used to Enforce Paris Climate Commitments? (*The World Economy*)

Description and Evaluation of the MIT Earth System Model (MESM) (*J Adv Model Earth Sys*)

Ecological control of nitrite in the upper ocean (*Nature Communications*)

Exploring the Impacts of a National U.S. CO_2 Tax and Revenue Recycling Options with a Coupled Electricity-Economy Model (*Climate Change Economics*)

Impacts of air pollutants from fire and non-fire emissions on the regional air quality in Southeast Asia (*Atmos Chem Phys*)

Linking Science and Policy to Support the Implementation of the Minamata Convention on Mercury (*Ambio*)

Mid-Western U.S. Heavy Summer-Precipitation in Regional and Global Climate Models: The Impact on Model Skill and Consensus Through an Analogue Lens (*Climate Dynamics*)

Modeling Uncertainty in Integrated Assessment of Climate Change: A Multi-Model Comparison (*J Assoc Environ Res Econ*)

Modeling Unit Commitment in Political Context: Case of China's Partially Restructured Electricity Sector (*IEEE Transactions on Power Systems*)

On the representation of aerosol activation and its influence on model-derived estimates of the aerosol indirect effect (*Atmos Chem Phys*)

Overview of the EMF 32 Study on Carbon Tax Scenarios (*Climate Change Economics*)

Present and future mercury concentrations in Chinese rice: Insights from modeling (*Global Biogeochemical Cycles*)

Seasonal resource conditions favor a summertime increase in North Pacific diatom–diazotroph associations (*ISME Journal*)

Synthesis of the Southeast Atmosphere Studies: Investigating fundamental atmospheric chemistry questions (*BAMS*)

The greening of Northwest Indian subcontinent and reduction of dust abundance resulting from Indian summer monsoon revival (*Scientific Reports*)

The Impact of Climate Change Policy on the Risk of Water Stress in Southern and Eastern Asia (*Environ Res Lett*)

Turkish Energy Sector Development and the Paris Agreement Goals: A CGE Model Assessment (*Energy Policy*)

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p 7: MIT China Energy & Climate Project

p 8: Courtesy of Noelle Selin

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(1): See p 3
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