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Title:	**Climate Change: The Science and Why You Should Care**

Speaker Biographies

Jose Aguto, Associate Director of the Catholic Climate Covenant, leads the development of the Covenant's advocacy strategy to elevate the voice of the Catholics seeking climate action. Previously, for the Friends Committee on National Legislation, initiating the Call to Conscience on Climate Disruption, an interfaith, grassroots, moral, and non-partisan call to Congress for bipartisan recognition of the reality, science and impacts of climate change. The Call persuaded Rep. Chris Gibson (R-NY) to draft a resolution to that effect. H.Res. 424 was introduced by 10 Republicans in September 2015, as the first positive formal statement by a group of elected Republicans on climate change since the Waxman Markey bill in 2009. The resolution was reintroduced (H.Res.195) in March 2017 by Rep. Stefanik (R-NY).

A crack in the partisan dam on climate change, the resolution played a prominent role in the establishment of the bipartisan House Climate Solutions Caucus, currently 60 members divided evenly by party, among other impacts. Consistent with this approach, Jose seeks to advance the moral dimension of climate action within the Catholic Church and faith community, to contribute to the creation of a national ethos committed to the massive scale of solutions needed to avert climate catastrophe.

Prior to his work at FCNL, Jose worked for the National Congress of American Indians, and with EPA's American Indian Environmental Office, in the service of tribal governments, in the furtherance of tribal sovereignty related to natural resources, energy, environment, and climate change. He is a graduate of Brown University and Villanova Law School.

Christine Brown is a Physicist at Leidos, Inc. She has a B.S. in Aerospace Engineering from Boston University and an M.S. in Aerospace Engineering from Pennsylvania State University. She has worked on projects involving the simulation of strongly perturbed atmospheres, atmospheric data analysis and influenza epidemiology.

Lizanne Carlos had the privilege to live and study in Europe for 12 years and travel to over 20 different countries. She is bilingual and multicultural, which inspired her to help others and pursue a career in engineering. She received a BS in Civil Engineering from Virginia Military Institute and a ME in Environmental Engineering from Carnegie Mellon University. She is an Environmental Engineering consultant with Leidos, Inc. supporting NASA HQ. She has specialized expertise on supply chain risks associated with platinum group metals due to climate change. Ms. Carlos has also developed a prototype tool with GIS to engage NASA’s top supply chain partners and better prepare the Agency for climate related disruptions. She has contributed to a published report on managing the uncertainty of future sea level change and extreme water levels for the Department of Defense coastal sites, worldwide.

Some of her other responsibilities include assisting with GHG emissions accounting and providing associated training, energy management, EPCRA (including TRI), and other reports to ensure that facilities ranging from refineries to NASA sites are in compliance with environmental regulations. She has researched aviation’s contribution to climate change and put together the calculation package to support the human health impacts analysis in an Environmental Impact Assessment for the Naval Weapons Station in South Carolina.

Chizoba Chinweze is a high performance-driven researcher with vast experience in environmental impact/risk assessment and natural resources management. She has her background in ecology and has several professional trainings related to climate change and sustainability.

Chizoba is currently the Director, Research/Development and Chief Consultant, Chemtek Associates, based in Lagos, Nigeria. She is deeply involved in research activities on environmental change and human vulnerability with a focus on developing for implementation, sustainable environmental strategies and climate based policies.

She has twenty-seven (27) scientific peer-reviewed publications and presentations in international meetings. She is a chapter contributor in two book titles; "Demystifying Climate Risk: A Practitioner's Guide" in press (a distillation of the First Annual International Technical Workshop on Climate Risk held in the autumn of 2016 in Wells, Maine in the United States of America (USA), and "Rule of Law for Nature: New Dimensions and Ideas in Environmental law" 2013 (a proceed of the Rule of Law for Nature Conference, convened by the Faculty of Law, University of Oslo, Norway. 9-11 May, 2012).

She is also a contributing author to the United Nations Environment Programme's (UNEP's) Global Environment Outlook Volume 5 (GEO 5) and a participant to the UNEP's CBD Liaison meeting on climate-related Geo-engineering, held in London, June 29 - July 1, 2011, which produced the CBD Technical Series 66, Geoengineering in Relation to the Convention on Biological Diversity: Technical and Regulatory Matters. She is a Member of the Environmental Regulatory Research Group of University of Surrey, U.K and a Fellow of LEAD International (Leadership for Environment and Development), cohort 12. LEAD is an international non-profit organization whose mission is to inspire leadership for a sustainable world.

Ryan Conger entered the University of New England (UNE) an athletic training major; however, changed majors to chemistry before the fall semester of his sophomore year. He is currently a senior at UNE, where he works as a teaching assistant, chemistry tutor, and freshman mentor. He currently conducts research with Stephen Fox, Ph.D. synthetizing novel dicopper(I) model complexes and exploring their catalytic applications. Ryan presented results from this work at the 254th American Chemical Society (ACS) National Meeting in Washington, DC and will be applying for a NSF Graduate Research Fellowship this fall. Under the auspices of Amy Deveau, Ph.D. he developed a "green" lab curriculum for the honors organic chemistry course, utilizing original procedures for reactions at the forefront of synthetic literature, such as A^3 Coupling and "Click Chemistry," along with labs selected from the ACS Journal of Chemical Education. After completion of his undergraduate degree, he plans to pursue a Ph.D. in chemistry with aspirations of researching inorganic catalysts and their direct applications in the chemical industry.

Dr. Shawn Dalton, Principal and Senior Consultant, is a graduate of Sarah Lawrence College (Biology, 1988), the Yale University School of Forestry and Environmental Studies (Masters of Environmental Studies, 1992), and The Johns Hopkins University (Doctorate, Dept. of Geography and Environmental Engineering, 2002). For the past two decades, she has worked in the areas of integrated and community-based urban resource management, watershed management, climate change adaptation and mitigation, and the application of social ecological models to a variety of human ecosystems. She has led collaborative research teams conducting applied research in urban and rural communities, and uses an interest-based approach to the application of social sciences in resource management.

Dr. Dalton has been Director of the Environment and Sustainable Development Research Centre at the University of New Brunswick, in Fredericton, NB, Canada; is a member of the US Department of Interior's Strategic Sciences Working Group, which applies integrated sciences to the restoration of the Gulf of Mexico; and is the Executive Director of the Canaan-Washademoak Watershed Association. In addition, Dr. Dalton serves as the Chair of the Fredericton Area Watersheds Association Steering Committee, and is a Co-Principal Investigator of the Baltimore Ecosystem Study, a National Science Foundation-funded Long-Term Ecological Research site; and an Associate of the Canadian Rivers Institute at UNB.

Joseph Donahue is an Associate at Abt Associates. Mr. Donahue provides policy technical, analytic, and programmatic support for a range of U.S. government, foundation, and nongovernmental programs and agencies, primarily focusing on climate change mitigation and adaptation. His work is currently focused on analyzing and mitigating the impacts of emissions of short-lived climate pollutants (SLCPs), including black carbon, methane, and hydrofluorocarbons (HFCs). Mr. Donahue provides analytic and capacity-building support for the U.S. Environmental Protection Agency (EPA) in its efforts to reduce the impacts of SLCPs through the international Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC) and Global Methane Initiative. He manages Abt's communications, outreach, and data analysis support for EPA's GreenChill program, a voluntary partnership program that works with the supermarket industry to achieve wide-ranging environmental and economic benefits through the adoption of energy-efficient and leak-tight refrigeration systems.

Dr. Thomas Fish is the National Coordinator, Cooperative Ecosystem Studies Units Network, U.S. Department of the Interior, National Park Service. Tom has worked in natural resource management, planning, research, and education for over 25 years. As the national coordinator for the CESU Network, he works across government, academia, and the NGO community to facilitate collaborative research, technical assistance, and capacity building in support of science-informed natural and cultural heritage resource stewardship. Tom's work covers a wide range of topics relating to global change, land use planning, applied social science, marine and forest conservation, and training for protected area managers in the U.S. and abroad. Tom previously held positions with NOAA's Human Dimensions of Coastal Management Program, USDA Forest Service's Social and Economic Dimensions of Ecosystem Management Research Unit, and spent ten years in South Florida with the Florida Department of Environmental Protection, Rookery Bay National Estuarine Research Reserve, Newfound Harbor Marine Institute, and in private consulting. Tom holds a Ph.D. in conservation biology (University of Minnesota), M.S. in science education (Florida Institute of Technology), and B.A. degrees in biology and German (Concordia College).

Kim Gotwals is a senior policy analyst with Leidos, where she has worked for the past 29 years. For the past 10 years, she has focused on climate change and climate adaptation support for NASA and the Department of Defense. With science degrees in geology and environmental science, she enjoys translating climate science information for a range of users. She prepares technical reports and communications documents.

I. Sam Higuchi, Jr. has been a civil servant in the federal government since 1984. His experience spans working at remote Antarctic facilities and a U.S. Navy installation to managing agency-wide programs. He specializes in resolving complex issues encompassing legal, managerial, and technical aspects.

His career includes working for a private consulting firm and a state regulatory agency, as well as working for the federal government. He has worked as research scientist, regulatory engineer, facility's environmental coordinator, civil engineer, environmental engineer, policy & program analyst, and program manager. He has worked for the consulting firm of Schoell & Madson Engineers & Land Surveyors, Inc., University of Minnesota, and Minnesota Pollution Control Agency. His past federal service includes working for the U.S. Antarctic Program, National Science Foundation, National Oceanic & Atmospheric Administration, U.S. Department of Commerce, and the U.S. Navy. He is currently working for the National Aeronautics & Space Administration.

At the National Aeronautics & Space Administration, his areas of leadership expertise and subject matter portfolio include: Managing Climate Risks, Mitigating Greenhouse Gas Emissions, Sustainable Critical Materials Management, and Strategic Risk Management. He has been an invited guest speaker on environmental subjects and risk management issues at several forums at national and international venues. He has co-authored two published professional papers: "U.S. Space Transportation and Climate Change: Potential Impacts of Climate Change on Access to Space;" and "Enhancing Climate Resilience at NASA Centers: A Collaboration Between Science and Stewardship."

Mr. Higuchi actively serves on several environmental committees and participates in various professional organizations. He is co-founder and co-chair of the Interagency Forum on Climate Risks, Impacts & Adaptation. He is chair of Sub-Work Group of Federal Architects & Engineers on Buildings & Infrastructure within the U.S. Global Change Research Program's Adaptation Science Interagency Work Group. He has served on several interagency committees. He serves as an expert professional on the Steering Advisory Group for the Annual International Technical Workshop on Climate Risk. He has initiated and organized several special topic session tracks at professional conferences.

He has received several awards in recognition of his professional and public service. Among his awards are the Bronze Medal Award from the National Oceanic & Atmospheric Administration, Environmental Engineer of the Year Honor Award Winner from the Conference of Federal Environmental Engineers, Partners in Quality Contracting Award from the Council for Excellence in Government, and Antarctic Service Medal from the U.S. Navy.

Mr. Higuchi's academic accomplishments encompass the areas of law, public administration and management, science and engineering. He has earned four university degrees. His law degree is from the University of Iowa. His graduate degrees in public administration and science are respectively from the American University and the University of Minnesota. His undergraduate degree in engineering is from the University of Minnesota. He has been awarded academic grants from the National Science Foundation, National Institutes of Health, and U.S. Environmental Protection Agency. His law college thesis, "The Atikokan Dispute: A case concerning international law and trans-frontier acid precipitation," is accessible as a book. He is a member of Chi Epsilon, an academic honor engineering fraternity.

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At the South Pole
Sam Higuchi, Staff Engineer with "U.S. Antarctic Program"
of the National Science Foundation

Barbara Kanegsberg, President of BFK Solutions, LLC, is a recognized expert in critical/industrial cleaning and contamination control. She develops critical cleaning processes, conducts validations, and resolves product-related regulatory issues. Barbara is a member of the ASTM medical device Cleanliness Testing Task Force and a US Expert to the ISO/TC 209 WG 12. She has a master degree in biological chemistry, and is co-author of the two-volume CRC Handbook for Critical Cleaning.

Dr. Ed Kanegsberg, Vice President of BFK Solutions, is a chemical physicist and engineer who troubleshoots and solves manufacturing production problems in medical device development and in other high-value products. He is a recognized consultant in industrial cleaning process design and process performance with decades of experience helping companies transition from prototype to production. Ed has a Ph.D. in physics and is co-author of the CRC Handbook for Critical Cleaning.

Jack Kiraly is a recent graduate of American University's School of Public Affairs. Having earned a Bachelors in Political Science at AU in May 2015, Jack pursued a combined BA/MA program, allowing him to finish a Masters in Public Policy, with a concentration in Science, Technology, and Environmental Policy, in December 2016. Jack's passion for science, space, and environmental policy manifests itself in the non-profits and research institutions he works with. Jack currently works in policy research and business development for a leading medical device consultancy in downtown DC, but is looking for opportunities in advocacy for space and environmental science policy. On top of all of this, Jack is the host of the DC-based space policy and technology podcast, Ad Astra, on the Elemental FM podcast network.

Mark J. Klingenstein, P.E., is a civil engineer whose 35 year career has focused on wastewater treatment and water pollution control. Mr. Klingenstein has considerable experience with wastewater collection systems, wet weather issues, and wastewater treatment systems (both municipal and industrial). He is also an experienced trainer, who has presented workshops on a variety of water pollution control related topics to government clients. Mr. Klingenstein received a BSCE from Drexel University (1979) and a MECE from Stevens Institute of Technology (1989). Mr. Klingenstein is a licensed Professional Engineer, P.E., in Arizona, New Jersey and Indiana.

Dan Last, Chief Operating Officer for the Catholic Climate Covenant, has nearly a decade of experience working on energy projects and building programs to reduce energy waste in organizations. Beginning in 2009 with an internship with the Renewable and Sustainable Energy Institute (RASEI) at the University of Colorado at Boulder, Dan has been at the forefront of developing innovative strategies to improve the energy efficiency of buildings. After graduating from business school, Dan joined AtSite, a multidisciplinary consulting firm in Washington, DC, where he led the education division for nearly four years. Here, working with some of the most prestigious schools and nonprofits in the region, Dan utilized data, technology and engagement strategies to help these organizations save energy and money, and have a positive impact on their communities.

Dan's work has been published and cited in a number of media outlets, including in The Atlantic. He led the Green Schools Committee for the US Green Building Council – National Capital Region for three years, and has consulted with multiple for-profit and nonprofit organizations, including the Sustainable Endowments Institute and the city of Washington, DC.

Earlier in his career, Dan was a middle school and high school special education and English teacher. In addition to his MBA from the University of Colorado, Dan has a BA, BS and MEd from Boston College. He lives in Virginia with his wife, Shannon and his two sons, Sammy and Charlie.

Dr. Jason Marshall directs the services of the Toxics Use Reduction Institute Cleaning Lab. The lab works with companies, communities and citizens to evaluate the performance of cleaning chemistries and equipment. Recent projects include: promoting the adoption of alternatives to trichloroethylene for businesses in Massachusetts and Rhode Island; promoting safer ingredients in cleaning products resulting in recognition from EPA's Safer Detergent Stewardship Initiative at the Champion Level; participating member of the Toxics Reduction Task Force Massachusetts Executive Order No. 515 establishing an Environmental Purchasing Policy to examine specific areas of environmental procurement and provide targeted technical assistance and guidance to agencies as needed.

Related publications: In Search of the Silver Bullet: Assessment of Alternatives for Trichloroethylene in Cleaning Operations October 2015. "How Green and Does it Clean: Methodologies for Assessing Cleaning Products for Safety and Performance". Chapter in Developments in Surface Contamination and Cleaning (2014); "Road Map for Cleaning Product Selection for Pollution Prevention" Chapter in the Handbook for Critical Cleaning, Second Edition (2011); "Hands-On Assistance Improves Already Successful Pollution Prevention Services of the Toxics Use Reduction Institute's Laboratory" in Journal of Cleaner Production, February 2011.

Dr. Marshall has a Bachelor's of Science in Chemical Engineering, Master's of Science in Environmental Studies and a Doctorate of Science in Occupational and Environmental Hygiene from the University of Massachusetts Lowell.

Dr. Steve Montzka is a research chemist at NOAA responsible for ongoing global atmospheric measurements of 30 different trace gases that influence climate, stratospheric ozone, and air quality. The atmospheric records he has provided over the past 25+ years are integral to NOAA's Annual Greenhouse Gas Index and NOAA's Ozone-Depleting Gas Index, which are indices that track changes in global concentrations of climate-active and ozone-depleting gases. During his career he has authored or co-authored over 160 peer-reviewed papers and also has been lead author of chapters related to atmospheric composition change in a number of national and international assessment reports on ozone depletion and climate.

Dr. Ananthakrishna Sarma is a Senior Scientist at Leidos, Inc. He has a Master's degree in Meteorology from the South Dakota School of Mines and Technology and a Ph.D. in Atmospheric Science from the Colorado State University. His areas of expertise include atmospheric dynamics, physics and chemistry, cloud microphysics, atmospheric transport and diffusion, and numerical weather prediction (NWP). He is a key developer of the Operational Multiscale Environment model with Grid Adaptivity (OMEGA), which was developed by SAIC (predecessor of Leidos) and uses an unstructured solution-adaptive grid – a major advancement in NWP. In his career in NWP, he has simulated atmospheric processes ranging from thunderstorms to hurricanes, smoke dispersion from large fires, and dust generation and transport in Martian atmosphere. He is also a Technical Fellow of Leidos.

Ethan Schechter, Solar Staff, System Design Specialist for ReVision Energy, grew up in Southern New England and has lived and worked in a wide range of places, including Washington, D.C., Boston, Tel Aviv, and Ramallah. He spent the earlier part of his career working on education and international conflict resolution. Ethan worked on an applied research initiative that explored how extractive industry companies in developing countries can better engage local communities to mitigate negative social and environmental impacts. It was through this work that he grew an interest in how businesses can be a force for good, which ultimately led him to ReVision Energy.

After living in the Middle East leading programming for Seeds of Peace, Ethan moved to Maine where he spent three years managing a statewide AmeriCorps program in local schools. During that time, Ethan learned about ReVision Energy and was inspired by its mission to transform the state and region away from a fossil fuel-based economy towards sustainable energy. Ethan loves working at a mission driven company and ReVision Energy's commitment to the triple bottom line (People, Planet, and Profit).

Dr. Sydney Sewall, MD, MPH was educated at Harvard and University of Cincinnati, and has been working as a Pediatrician since graduating from medical school in 1975. After serving in the Indian Health Service in Arizona, he moved to Maine in 1982 and has lived here since, raising two now-adult children with his spouse of 43 years. Medical activities have always included teaching -- either residents or medical students -- and in 2016, he left his pediatric practice to join the faculty at the Maine Dartmouth Family Practice Residency. Dr. Sewall has been involved with Physicians for Social Responsibility Maine Chapter since 1990. Other medical activities have included membership on the board of Maine American Academy of Pediatrics (former president), chairman of Maine General Hospital's Quality Council (and former Chief of Staff), Pediatric Advanced Life Support instructor. Dr. Sewall has a special interest in Epidemiology, and earned an MPH in 1997 while working part time.

Stephen Sweeney recently graduated from American University with a graduate degree in Public Policy concentrating in Environmental Policy and Public Financial Management. His graduate practicum being presented today explores how to utilize geospatial and statistical analysis to inform policy makers on a critical environmental issue. Stephen has worked in non-profits, academia, private consulting, and in numerous state and federal agencies, recently as a Fellow in the Office of Policy at the Environmental Protection Agency. Stephen holds a B.S in Environmental Science from Michigan State University and is currently seeking new opportunities in the climate adaption and mitigation field.

Dr. Terence R. Thompson

Dr. Thompson is Chief Technology Officer at The Climate Service. In this role, he works with private and governmental sectors on the quantification of risks and benefits for climate-change adaptation. He uses large volumes of climate data to develop projections of future regional and local climate, as well as extreme events such as storms, floods, and droughts. The emphasis of Dr. Thompson’s climate analytics work is on bridging the gap between climate data and the decision-oriented information needed by different economic sectors (finance, health, energy, transportation, agriculture, government, etc.) to influence climate-adaptation planning, risk management, and investments. Dr. Thompson received his Ph.D. from the University of Rochester Medical School.

Donald J. Wuebbles is the Harry E. Preble Professor of Atmospheric Science at the University of Illinois where he has been since 1994. He is also a Presidential Fellow at the University of Illinois, with the aim of helping the university system develop new initiatives in urban sustainability. From 2015 to early 2017, Dr. Wuebbles was Assistant Director with the Office of Science and Technology Policy at the Executive Office of the President in Washington DC. He was Head of the Department of Atmospheric Sciences at the University of Illinois for many years. Dr. Wuebbles led the development of the School of Earth, Society, and Environment, and was its first director. While Department Head, he led the development of two highly successful undergraduate programs, one in Atmospheric Sciences, and the other, an interdisciplinary major, in Earth, Society and Environmental Sustainability (ESES).

Dr. Wuebbles is an expert in atmospheric physics and chemistry, with over 500 scientific publications related to the Earth's climate, air quality, and the stratospheric ozone layer. However his work goes well beyond that through providing analyses and development of metrics used in national and international policy and in developing analyses for understanding climate impacts on society and ecosystems, plus potential resilience and societal responses. He has co-authored a number of international and national scientific assessments, including those by the Intergovernmental Panel on Climate Change (IPCC), which was awarded the Nobel Peace Prize in 2007. He helped lead the 2013 IPCC international assessment of climate science and the 2014 U.S. National Climate Assessment. He currently is co-leading a special report assessing the science of climate change as a prelude to the 4th U.S. National Climate Assessment (NCA4), and is leading a chapter in NCA4.

He has received many awards, including the Cleveland Abbe Award from the American Meteorological Society, the Stratospheric Ozone Protection Award from the U.S. Environmental Protection Agency, and is a Fellow of three major professional science societies, the American Association for the Advancement of Science, the American Geophysical Union, and the American Meteorological Society.

Dr. Wuebbles has two degrees in Electrical Engineering from the University of Illinois (1970, 1972) and a Ph.D. in Atmospheric Sciences from the University of California, Davis (1983). Don and his wife, Barbara, have three sons and four grandchildren.

Abstracts

Catholic Action on Climate

Jose Aguto, Associate Director, Catholic Climate Covenant and
Dan Last, Chief Operating Officer, Catholic Covenant Energy Program

Catholic Climate Covenant's works to inspire and equip people and institutions to care for creation and care for the poor. Grounded in the Church's deep history of teaching on creation, ecology, and the poor. The Covenant educates, gives public witness, and offers resources to parishes, schools, and Catholic facilities and helps them respond to the urgent call to take climate action. One of the Covenant's newest programs is the Catholic Energy program which provides a rich opportunity to respond more fully to the challenges of Laudato Si' by working with Catholic dioceses and other entities to dramatically reduce energy use in Catholic-owned buildings.

Statistical Analysis of Precipitation Data for NASA Locations

Christine Brown[1], Ananthakrishna Sarma[2]

Leidos, Center for Atmospheric Physics, Alexandria, VA

Abstract: Changes in climate can have a significant impact on our infrastructure as most infrastructure components are designed to meet specific weather/climate limits. For example, in some cities combined sewer overflow (CSO) events have been attributed to an increase in precipitation. Hence, to understand how long major and critical infrastructure elements will survive, one must understand how these weather/climate limitations may be exceeded in years to come. There are two popular methods of improving our understanding of climate change – 1) modeling, and 2) data analysis. In this paper, we use the latter method to look at changes in precipitation trends that might impact infrastructure relevant to NASA.

For this study, historical weather was analyzed for several NASA facility locations. The focus was on precipitation and how historic trends in precipitation can point to potential future effects. Data from several locations were used for this study to account for any local effects. Four types of statistical analyses were performed on daily precipitation data from each location in order to determine whether the datasets exhibited any stationarity. They are 1) linear regressions of data divided into time segments of several years, 2) linear regressions of data grouped by months, 3) linear and non-linear trend analyses, and 4) cumulative probability distributions were used to examine changes over time in precipitation levels. Popular statistical tests were performed, and the validity of these tests was explored.

Preliminary results show that in general there is a positive trend in precipitation over the last few decades. This upswing in precipitation appears to be the result of both average precipitation event intensity and frequency increases in recent years. Comparisons between early and recent time segments for yearly as well as monthly data groupings will be presented.

[1] Physicist,

[2] Senior Scientist

Platinum Group Metals in Aerospace Technology: Benefits and Risks

Lizanne Carlos EIT | Leidos
Environmental Engineer | Engineering & Technology

Use of platinum group metals (PGM) across a wide variety of industries provides substantial economic, environmental, and social benefits the world over. The National Aeronautics and Space Administration (NASA) and, more broadly, the entire United States (US) aerospace sector, rely heavily on PGMs. Often this includes mission-critical applications where no viable alternatives exist in the marketplace. South Africa and Russia dominate in the production of these metals, holding over 75% of global resources; however, acceleration of climate change could cripple South Africa's and Russia's ready access to current trade routes and mining infrastructure. Purchase of the only PGM mine in the US by a South African company in 2017 exacerbates these supply challenges. It is imperative to understand how climate risks affect the complex PGM supply chain and determine solutions that address potential impacts to NASA and the US.

Traditional Knowledge and Climate Change Challenges: Anambra State, Nigeria Case Study.

Chizoba Chinweze

Abstract

The study area; Anambra State is located in the south-eastern part of Nigeria, West of Africa with a landmass of 44,116sq km and a human population of about 4,182,032 people confined in the area. Soil erosion constitutes the major ecological challenge of the state.

The topography of the area in addition to the soil type and the incidence of increases in precipitation levels and heavy surface water runoffs due to climate variability and change, according to the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report for United Nations Framework Convention on Climate Change (UNFCCC), necessitated soil transport resulting in severe gully formation in 40% of the total land area concentrated in the higher regions and flooding in the lower plane of the state, thus putting pressure on the ecological/earth life support system of the area. Anthropological factors also accelerate the development and expansion of these gullies, with the attendant human vulnerability.

This paper classified the gully erosion/flooding in the area according to their severity and socioeconomic impact; it further analyses their consequence and human vulnerability in the face of climate change challenges and the limited adaptive capacity of the locals through the application of traditional knowledge.

Process Improvement in the Pharmaceutical Industry

Ryan Conger, University of New England

Abstract:

For medicinal chemists to keep pace with the multitude of information derived from biological screenings, there has been an increasing need for reactions meeting the following criteria: efficiency, versatility, and selectivity. Many of these reactions involve the breaking of C-H bonds (C-H activation), often catalyzed by transition metals such as copper(I). Copper(I) catalyzed procedures including heteroatom alkylations/arylations, carbon-carbon bond formations, and heterocycle formations, constitute 42.8% of chemical reactions used in the pursuit of drug candidates. Many of these procedures are inefficient often requiring long reaction times (+12 hours), high catalyst loading (+10%), and hazardous solvents (halogenated and non-halogenated hydrocarbons) contributing to the copious amounts of hazardous waste produced from the pharmaceutical industry (Merck: 254,000 metric tons & Pfizer: 110,000 metric tons in 2016). Taking inspiration from systems found in nature, we have synthesized and characterized over fifty novel dicopper(I) complexes that perform much better than many commonly used copper(I) catalysts (CuCl, CuBr, CuI, CuOTf) in the A3 coupling reaction (Figures 1 & 2). These advances we have made are relevant since many biologically active compounds can be prepared in one step via A3 coupling (Figure 3). Additionally, they demonstrate the underlying potential of dicopper(I) catalysts to activate C-H bonds under benign conditions and improve many other copper(I) catalyzed transformations relevant in medicinal chemistry.

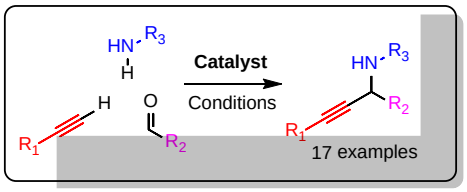

Figure 1: General Scheme for A_3 Coupling

Copper(I)	Dicopper(I)
10 - 30 mol %	0.1 - 0.5 mol %
2 - 4 Days	30 - 90 Minutes
Under Nitrogen or Argon	Atmospheric Conditions
Solvent: Toluene	No Solvent
Yields > 90%	Yields > 90%

Figure 2: Catalyst Comparision in A_3 Coupling

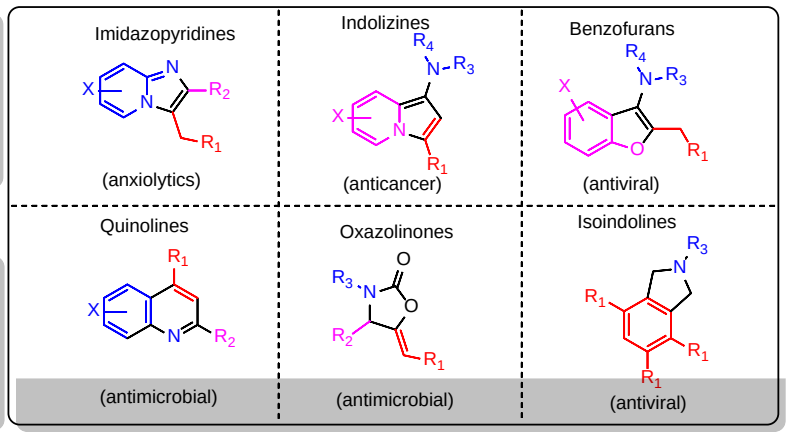

Figure 3: Applications of A_3 coupling in the one step synthesis of bioactive compounds

Measuring and Mapping Community Vulnerability to Climate Change

Dr. Shawn Dalton
Honorary Research Associate
Faculty of Forestry and Environmental Management
University of New Brunswick
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Canada

A community characterization uses maps and statistics to identify, locate, and explain relationships within and between communities and ecosystems at different scales. Based on a series of maps, the relative distribution of goods, benefits, services, and other characteristics can be detected and presented in spatial, tabular, and narrative forms. Users of a community characterization can then determine the potential for economic development, capacity building, infrastructure investment, community vulnerability and resiliency, and other indicators that are important to the residents, planners, and decision-makers of an area.

Here we will present a particular type of community characterization: indicators and measures to determine community vulnerability to climate change. Vulnerability is determined by a combination of exposure to climate-related events such as storms or floods, and the coping ability to respond to exposure. These can be considered at various levels of social structure or geography: individual, family, household, neighborhood, city, etc. or census tract, block group, community, region, watershed, etc. This presentation will demonstrate the use of indicators and maps to identify community vulnerability and resilience to climate change at different scales. This is a critical step in understanding and decision-making regarding options to prepare for and mitigate climate change among different communities and members of society.

Climate Change Communication: From Practice to Theory to Improving Practice

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Climate change communication is necessarily complex and wide-ranging. Originating in the 1980s, initial attempts were largely one-way transmissions of information, intended to communicate scientific predictions about changing average global temperature to lay audiences. Simultaneously, those with a stake in maintaining the carbon-heavy economy funded "think-tanks" of unqualified scientists who knowingly and purposefully delivered misleading messages to the public. Hence, as practitioners and theorists in the field of climate change communication science are well aware, there is considerable political polarization of opinion in the US regarding the fact or causes of our changing climate.

There were and are serious challenges related to societal acceptance of requisite actions to address climate change. These include the fact that the causes of climate change are invisible: greenhouse gases are odourless and colourless, and not of immediate concern to public health. Impacts of climate change are largely distant – this was particularly the case in the 1980s when climate change communication efforts began. There was and little sense of urgency or lived experience of climate change impacts. Couple these challenges with uncertainty and complexity, the inability to detect signals for needed changes in behaviour and policy, and the actions of self-interested parties, and the recipe for unsuccessful climate change communication strategies was complete.

Recent years have seen major advances, as well as additional challenges and opportunities, in climate change communication science. Several factors have contributed to these challenges and opportunities: the climate itself has begun to behave in extreme ways; scientific advances regarding climate change have been released and widely covered by the media; policies and actions around climate change have demanded public attention; consequently, climate communication science itself advanced as opportunities to test different frames on different audiences using different messengers in different contexts arose; climate communication science became an area of academic research, independent of other disciplines; and, contextual changes have created opportunities for climate communication science - that is, other issues create more or less hospitable environments for people to pay attention and respond to climate messaging.

This presentation will briefly describe the evolution of climate change communication, then focus on the rise of boundary organizations and the critical roles they play as they straddle the gap between climate change communication research and researchers, and the community of practitioners who use, or could use, their research findings in their communication and outreach activities to move societal behaviour toward climate change adaptation and mitigation.

Replacing hydrofluorocarbons in the U.S. food retail sector: a review of recent trends and opportunities for supermarkets

Joseph Donahue, Abt Associates,* Bethesda, MD

Focus area: Climate mitigation

Track: Industry-based and governmental policies

Abstract:

The typical commercial refrigeration system in U.S. supermarkets uses approximately 4,000 pounds of refrigerant. In the vast majority of U.S. supermarkets, most of that refrigerant consists of hydrofluorocarbons (HFCs). The HFCs that are most commonly used in commercial refrigeration systems have global warming potentials that dwarf that of carbon dioxide. For example, R-404A – which accounts for the plurality of refrigerant used in commercial refrigeration systems in U.S. supermarkets – has a global warming potential of 3,920. Considering the fact that the typical commercial refrigeration system leaks approximately 25% of its refrigerant each year, the U.S. supermarket sector is an important source of HFC emissions.

Many food retailers in the U.S. and other countries are taking action to reduce HFC installations and emissions from commercial refrigeration systems, with a particular focus on HFCs with higher global warming potentials. For example, in recent years there has been an increase in use of blended refrigerants that include hydrofluoroolefins, chemicals that have low global warming potentials.

Retailers' actions are motivated by multiple factors. First, the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Program has identified some HFCs that have very high global warming potentials as no longer acceptable for certain uses. In addition, many food retailers are motivated to reduce their contributions to climate change in response to internal corporate social responsibility goals and shareholder demands. Lastly, food retailers are realizing that transitioning to lower-global warming potential refrigerants can lead to other cobenefits (in addition to reduced climate impacts), such as increased energy efficiency from newer refrigeration technologies.

There are a number of resources and programs available to U.S. food retailers to help them transition away from HFCs. For example, the EPA's GreenChill program provides food retailers with tools, resources, and support to help them analyze their refrigerant use, identify best practices, and share lessons about refrigerant management.

This presentation will provide an overview of trends in HFC use in U.S. supermarkets, beginning with their initial introduction as a substitute for ozone-depleting substances and concluding with recent data on the rise in use of alternatives to HFCs. It will also present information on programs that are designed to help supermarkets transition away from HFCs, particularly the GreenChill program. The presentation will include a few brief case studies of corporate HFC reduction policies and single-store projects.

**Abt Associates is a contractor for the EPA. The author has worked with the EPA on issues related to HFCs for nearly a decade, in particular the above-mentioned GreenChill program. Among other things, the author manages the GreenChill program's annual data collection and analysis effort, through which the agency has tracked changes in HFC use in this sector. This abstract was prepared by the author alone, and is not submitted on behalf of the EPA.*

COLLABORATIVE PARTNERSHIPS TO ADDRESS CLIMATE RISK TO NATURAL AND CULTURAL RESOURCES

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The U.S. government is charged with science and stewardship for a vast and diverse portfolio of natural and cultural sites and resources – from preserving prehistoric Anasazi structures to documenting traditional lifeways, to restoring urban water resources to maintaining social and natural attributes of remote terrestrial and marine wilderness. Management responsibilities for the majority of these areas (>95%) falls largely to the Departments of the Interior, Agriculture, and Defense, with additional resources and jurisdictions under the National Oceanic and Oceanic Administration, Department of Energy, National Aeronautics and Space Administration, and others. While actions and responsibilities are pursuant to specific enabling legislation, authorities, and agency missions, there are appreciable areas of mission overlap, well suited for coordinated and collaborative approaches that bridge agencies and engage allied partner institutions.

Climate change has become a primary driver of short- and long-term planning for agencies across the federal service, as well as for state and local government and the private sector. For more than the last decade, the Government Accountability Office (GAO) has monitored the vulnerability of key resources within the public domain (e.g., energy, water, infrastructure) to climate change risks and the response by federal agencies to address them. While agencies have initiated actions to address many areas of risk, coordination across agencies and provision of "authoritative" information, guidance, and technical assistance for decision-makers at all levels of government remains a challenge. GAO identified the Cooperative Ecosystem Studies Units (CESU) Network as one logical platform from which to implement coordinated actions. Authorized by Congress in 1998, the CESU Network is a national consortium of federal agencies, tribes, academic institutions, state and local governments, conservation organizations, and other partners working together to provide high quality multi-disciplinary research, technical assistance, and educational services responsive to emerging and long-standing priorities. The network includes 15 federal agencies and more than 400 nonfederal partners in 17 regional CESUs encompassing all 50 states.

The threat and impact of climate change and related response are top priorities for federal and nonfederal partners across the network. This presentation will include an overview of the history and structure of the CESU Network, recent actions by several federal agencies to coordinate their efforts, and example projects from several regions with an emphasis on fostering collaboration and developing strong partnerships to address climate risk issues at different scales and management contexts, and that transcend political, institutional, disciplinary, and ecosystem boundaries.

“Digging Deeper – What to do after you’ve identified climate risks.”

Kim B. Gotwals | Leidos
Senior Policy Analyst | Energy, Environmental Science, and Engineering Division

A methodical process to evaluate adaptation options. Federal agencies are responsible for managing risks to the assets they steward for the public, including risks due to the impacts of climate change. Two consulting firms under contract to the Naval Facilities Engineering Command (NAVFAC), Leidos and Louis Berger, developed a Handbook detailing four Stages to follow to: I) identify/characterize climate risks and determine the scope of the analysis, II) identify and screen action alternatives (options for adaptation measures), III) calculate benefits and costs of action alternatives, and IV) assemble a portfolio of action alternatives. The Handbook contains extensive appendices to assist planners evaluating possible responses to climate impacts, including Worksheets to document findings that will serve as supporting background. The Handbook team delivered a pilot training, sponsored by NASA, to federal representatives in August of this year. This session will provide an overview of the process detailed in the Handbook, a review of important terminology, and example outputs from each Stage of the Handbook.

ABSTRACT

“A ‘4th Environmental Wave‘ Perspective on Climate Risk Management”

Isamu Sam Higuchi, Jr.
Co-Chair, Interagency Forum on Climate Risks, Impacts and Adaptation
Staff Engineer, National Aeronautics and Space Administration – Headquarters

There is an evolving body of literature on the 4th Environmental Wave” which concerns resources and strategic resource positioning. This 4th Wave has been also referred to as sustainable materials management (SMM). Climate risks present a formable challenge to SMM. Businesses and Governmental entities need to manage climate risks related to SMM to remain financial viable. A review of the business-management literature reveals that climate risk management is maturing sufficiently to: 1) identify specific areas of risk, 2) apply an Enterprise Risk Management approach, 3) determine “materiality” of the risk, 4) define a Reporting Framework, and 5) establish a meaningful financial disclosure process. This network of business-management progress results in professional accountant’s leadership in driving and overseeing climate risk management through accounting standards; eventually professional accounting standards will overtake climate risk management attempts of governmental laws and regulations. Governmental entities have a tendency to lag behind the private sector in adapting good business-management practices. Currently, the Presidential Administration and Congress do not consider climate risk to be a National priority issue. However, there are sufficient Federal statutory vestiges that can be networked together for a coherent climate risk management approach within an agency. This network of Federal statutes beckons individual Agencies to use good business-management practices to protect the taxpayer’s investments in a Federal agency assets. In conclusion, consults with expertise in climate risk management have a good prospect for potential clients in the private sector and in bellwether Governmental entities.

ABSTRACT

"Climate Risk Management: Implementation Aspects"

Isamu Sam Higuchi, Jr.
Co-Chair, Interagency Forum on Climate Risks, Impacts and Adaptation
Staff Engineer, National Aeronautics and Space Administration – Headquarters

Over the past few years the technical implementation aspects related to climate risk management have matured from qualitative generalizations to more quantitative efforts. The components for a technical implementation roadmap are highlighted as quantitative advances. These quantitative advances improve technical implementing efforts for managing climate risk; roadmap components include: 1) Dimensional Framework Approach; 2) Methodology aspects of pragmatic considerations and practical hints; and 3) Climate Metrics for facilities activities. One of the more interesting quantitative advances is the Dimensional Framework Approach; there are four dimensions: 1) organizational dimension; 2) spatial dimension related to Asset or Capability or Resource; and 3) spatial dimension related to climate data and climate information; 4) temporal dimension. Finally, the "Annex – Pathway to Sources of Climate Data and Climate Information" is presented that provides "URLs". Practitioners responsible for the implementing technical efforts related to climate risk management will find the presented information and material useful.

Thinking Outside the Box and Outside the Periodic Table

Barbara Kanegsberg and Ed Kanegsberg BFK Solutions LLC

Progress in mitigating climate change risk involves fundamental changes in the way industry and regulatory agencies interact. Currently, industry makes pronouncements about climate change, sustainability, and lessening dependence on chemicals that are currently under regulatory distress. Brave individuals within industry and at trade associations may be tasked with climate change issues. However, there is a huge gap between policy and actual manufacturing. Many in industry wait with dread for the latest pronouncements by regulatory and environmental agencies. The challenge is to decrease the current "us versus them" syndrome. Regulatory approaches that all of accepted during the phaseout of ozone depleting compounds can be modified to adjust to future requirements.

Attempting to regulate on a molecule by molecule basis is not likely to serve us well in the future. Lists of compounds that are forbidden or discouraged continue to grow; this approach is counterproductive. Engaging industry at a fundamental, sustainable level involves understanding by the regulatory community of the physical and chemical attributes of known substances. Based on 30 years of experience and on our recent and ongoing research in developing safer chemical blends for industry. We outline suggestions for a paradigm shift. This shift involves considering or reconsidering the approach to looking at chemistry and process options. Alternative options must be considered for a number of reasons. We must protect the environment and the worker. We must also consider the impact of manufacturing processes on public safety and on personnel safety. We must consider the impact of new technologies such as additive manufacturing.

Additional Investigation of the Current State of Public Entity Adaptation Efforts to Address Changes in Short-Duration IDF Relationships

Mark J. Klingenstein, P.E.

Abstract: Available information, such as that presented in the Third National Climate Assessment, suggests that an increasingly greater portion of annual rainfall is occurring in more intense rainfall events, in much of the continental United States. If this is related to climate change, it is reasonable to expect continued non-stationarity (i.e., further increases) in intense rainfall frequency.

Stormwater/drainage infrastructure is typically designed and constructed to provide specific levels of protection, based upon expected precipitation return frequencies that have been characterized based upon historic precipitation data for a given location. These characterizations take the form of intensity – duration – frequency (IDF) relationships, which are most commonly displayed as IDF curves.

In a previous paper[1], this author examined efforts to date by the climate science and stormwater engineering communities to address this apparent shift in IDF relationships. This paper follows upon that prior paper by examining in greater detail several aspects of the issue of climate change impacts on short-duration IDF relationships.

First, the issue of why very short durations is important is examined in detail, and a discussion is provided of the hydrological methodologies used to design storm sewers and other "minor" drainage system components. In particular, examples from local, state and federal agencies are used to illustrate the significance of sub-one hour IDF relationships.

The paper then provides a review of the degree to which available public agency climate change adaptation plans directly or indirectly tackle the issue of IDF non-stationarity. This review summarizes the degree to which a selection of adaptation plans recognize this issue, describe in detail any specific adaptation measures that target this issue, and to the degree possible, discusses the technical basis for those adaptations.

Finally, the paper provides a review of prior and ongoing research that seeks to better understand the mechanism(s) by which climate change may be directly or indirectly impacting short-duration IDF relationships.

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[1] "Climate Change Adjustment of IDF Curves," presented at the *1st Annual International Technical Workshop on Climate Risk,* Wells, Maine USA, October 20 – 21, 2016

Pollution Prevention Options Analysis System (P2OASys): How to Use It, How to Interpret the Results

Dr. Jason Marshall, Director, Toxics Use Reduction Institute Cleaning Laboratory
The Toxics Use Reduction Institute (TURI), located at the University of Massachusetts Lowell, created the original Pollution Prevention Options Assessment System (P2OASys) in the mid-1990s. P2OASys analyzes chemical and process options designed to help companies reduce their use of toxic chemicals. The P2OASys tool has recently been updated to reflect the guidance and classifications found in globally recognized systems, including the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals and the GreenScreen for Safer Chemicals. P2OASys now functions as a web-based tool. This presentation will provide an overview of the benefits of using the newly improved P2OASys and a primer on its use.

Tracking global changes in greenhouse gas concentrations at NOAA; what have we learned?
Dr. Steve Montzka, Research Chemist, National Oceanic and Atmospheric Administration (NOAA)

Abstract:
The Global Monitoring Division of the National Oceanic and Atmospheric Administration provides measurements of global atmospheric concentrations of persistent chemicals that affect climate, stratospheric ozone, and air quality. The data quantify changes in global atmospheric composition, and from these results we create simple indices that convey overall changes in trace gas environmental impacts. One example is NOAA's Annual Greenhouse Gas Index, which is a measure of the climate-warming influence of long-lived trace gases and how that influence has changed since the onset of the industrial revolution. The index represents the sum of twenty different greenhouse gases, and its value is directly proportional to the change in the direct warming influence supplied from these gases since 1750. Increases in this index are mainly the result of human activity and are largely responsible for the observed increase in global temperature. The value of the AGGI in 2016 was 1.40, which indicates that the direct climate forcing supplied from these gases was 40% higher in 2016 compared to the forcing supplied in the benchmark year of 1990.

The atmospheric data also allow an assessment of the underlying causes for atmospheric changes and, as a result, enhance our ability to predict future climate forcing. This is possible because the data provide insight into emissions and if emission changes are human-caused (e.g., policy decisions) or related to changing natural ecosystems. Hence, the measurements not only can suggest effective emission mitigation policies, but they can also help identify the magnitude of emission reduction needed to achieve climate stabilization on a given timescale. While these budget-type analyses are fairly readily performed on a global scale, much of our effort at NOAA/GMD recently has been focused on supplying this type of information on the U.S. National Scale.

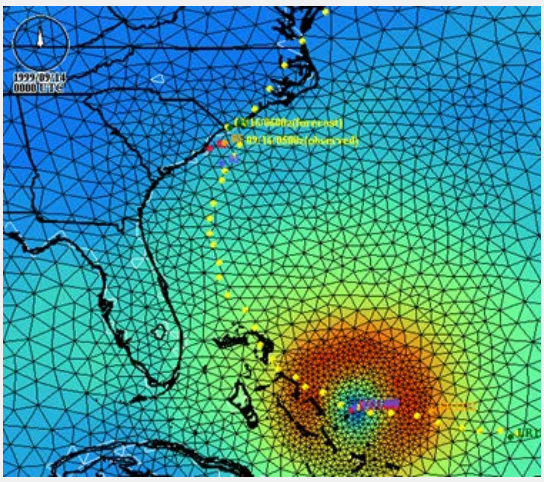
A Glimpse into the Future of Climate Modeling

Ananthakrishna Sarma

Senior Scientist, Center for Atmospheric Physics, Leidos Inc., Alexandria, VA

Abstract: We depend on models to determine what we can expect in the future. The accuracy of the predictions of weather and/or climate depends very much on the accuracy of the algorithms that are used in the models, and the accuracy of the representation of the environment within the model. Hence, models can be divided into roughly three parts: 1) the physical representation of the environment - commonly referred to as a grid, 2) the representation of the fluid dynamics in that grid, and 3) the representation of the physical, chemical, and biological phenomena that are represented on that grid. Over the past few decades, significant advances have been made on the last part. Also, modelers have strived to reach better mathematical accuracy in the second part. However, the first item, the accurate representation of the environment has not kept up. Other disciplines such as computational fluid dynamics, shock propagation, radiation hydrodynamics etc. have benefited from significant advances in grid generation and adaptation to the evolving solution.

In this paper, we present a numerical weather prediction model that was developed for the specific purpose of resolving flows over complex terrain. This model, Operational Multiscale Environment model with Grid Adaptivity (OMEGA), is built on an adaptive unstructured grid, which uses a triangular tessellation of the terrain to form the basis. The triangular cell structure facilitates the accurate rendition of the terrain and coastal features, which the traditional rectangular grids cannot represent accurately. The solution-adaptive numerics facilitates the placement of higher resolution where needed, thus enabling scale-spanning simulations. OMEGA also features a highly parallelized computational infrastructure that can be executed on large parallel machines. Even though currently OMEGA is used for numerical weather prediction, with appropriate changes to the physics, it can be changed into a climate prediction system.



Triangular adaptive grid facilitates simulation of complex phenomena such as hurricanes.

From Fossils to Photons
Ethan Schechter, Solar Staff, System Design Specialist

Join ReVision Energy to learn how you can save money and reduce your carbon footprint by combining solar electricity with hyper-efficient heat pumps, electric vehicle charging, and battery storage. One of ReVision Energy's knowledgeable clean energy experts will help you learn everything you need to know about the process of eliminating fossil fuels with modern technology! The cost of solar technology has dropped more than 75% over the past 10 years, enabling Mainers to receive strong economic and environmental returns.

Death by Degrees: The health crisis of climate change in Maine
Dr. Sydney Sewall, M.D., MPH

Physicians for Social Responsibility Maine Chapter (PSR Maine) released a ground breaking report in 2000 about the looming public health threat of climate change in Maine. PSR Maine updated and rereleased this report in 2015 and created a subsequent public presentation. Its focus on vector borne disease, heat impacts, allergies and asthma, and extreme weather hazards underscore the most likely health risks for human health in Maine. Notwithstanding, the report also importantly features how working together makes a difference in mitigating climate change and highlights work being done in Maine. The presentation has been given in public libraries and other venues in mid-coast and southern Maine as well as at the University of Maine annual Water + Sustainability Conference in the spring of 2016.

Report on the Impact of Sea Level Rise on Superfund Sites

Stephen Sweeney, Jack Kiraly

Abstract:

The research in this report was conducted to determine the location and risk potential of Superfund sites in the United States at risk of inundation by climate change-induced sea level rise. This research draws upon publicly available data, including EPA publications, academic journals, and the U.S. Global Change Research Program's 2014 National Climate Assessment (NCA); synthesized with geospatial analysis conducted by the authors. Maps of Superfund sites were layered with sea levels artificially elevated by 1 and 2 meters to simulate the range of scenarios provided by the NCA. The research shows that under a best-case scenario, up to 50 sites will be directly impacted by sea level rise. Under the 2-meter rise scenario, over 200 Superfund sites could be directly affected. The case study shows how vulnerable Superfund site are to flooding and highlights potential risks to human and ecological health.

“Financial Analysis of Climate Risk: Benefit/Cost Ratios for Adaptation Projects”

Dr. Terry Thompson, The Climate Service, Asheville, NC USA

We discuss how localized climate projections are analyzed to extract probabilities of different threshold events for specific climate variables (temperature, storm surge, etc.). These probability distributions are then coupled with sector-specific impacts and adaptation plans to derive benefit/cost ratios so that adaptation expenditures can be evaluated.