NATIONAL ACADEMIES Sciences Engineering Medicine

Advancing Risk Communication with Decision-Makers for Tropical Cyclones: Learning from Extreme and Unprecedented Weather Events--A Workshop

February 5-6, 2024

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NATIONAL ACADEMIES Sciences Engineering Medicine

BOARD ON ATMOSPHERIC SCIENCES AND CLIMATE
BOARD ON ENVIRONMENTAL CHANGE AND SOCIETY

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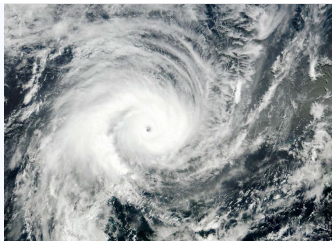
Learning from Extreme and Unprecedented Weather Events



February 5-6, 2024

VIRTUAL | **NAS Building** (2101 Constitution Ave. NW, Washington, DC 20418

Additional information and webcast available on the event page

This workshop will explore opportunities and challenges for communicating with decision-makers about extreme tropical cyclones (TCs) and identify lessons that can be drawn from engagement and communication concerning other hazards and applied to the tropical cyclone (TC) context. Workshop discussions will also consider challenges related to communicating about rare events and compounding hazards and cascading impacts.

MONDAY, FEBRUARY 5, 2024 | All times ET

10:30–10:40 **Welcome and Opening Remarks**

Ann Bostrom, University of Washington, Committee Chair

10:40–12:00 **Session 1: Communicating Risks of Atypical Tropical Cyclones: Lessons from Henri and Hilary**

Moderators: Andrea Schumacher, NSF-NCAR, & Ann Bostrom, University of Washington, Planning Committee Members

Panel 1: Forecaster Perspectives

2 minute intros + 30 minutes Q&A

- **Alex Lamers**, National Weather Service Weather Prediction Center
- **Rose Schoenfeld**, National Weather Service
- **Robbie Berg,** National Hurricane Center

Panel 2: Research Perspectives

5-8 minute talks + 15 minutes Q&A

- **Roxane Cohen Silver**, University of California, Irvine
- **Julie Demuth**, NSF National Center for Atmospheric Research
- **Emma Spiro**, University of Washington

12:00–12:45 **Lunch**

12:45–1:50 **Session 2: Risk Communication in Multi-Hazard Environments: Challenges and Learning Opportunities from Compounding Hazards and Cascading Impacts**

Moderator: Marshall Shepherd, University of Georgia, Planning Committee Member

Keynote Speaker:

15 minute talk

- **Jen Henderson**, Texas Tech University

Panel:

5-8 minute talks, 15 minutes Q and A

- **Jason Senkbeil**, University of Alabama
- **Rebecca Moulton**, FEMA
- **Jeff Lindner**, Harris County Flood Control District
- **Jessica Schauer**, National Weather Service Tropical Cyclone Weather Services Program

1:50–2:05 **Break**

2:05–2:15 **High Level Summary of Sessions 1 and 2**

2:15–2:20 **Transition to Breakout Rooms**

2:20–2:55 **Session 3: Breakout Discussions: Applying Risk Communication Lessons from Other Hazards to the Tropical Cyclone Context**

Moderator: Jeannette Sutton, SUNY Albany, Planning Committee Member

5-minute talks + 20 mins discussion

Room 1: Earthquakes

- **Richard Allen,** University of California, Berkeley
- **Michele Wood**, California State University, Fullerton
- **Sara McBride**, USGS

Room 2: Extreme Heat

- **Micki Olson,** SUNY, Albany
- **Olga Wilhelmi,** National Center for Atmospheric Research
- **Peter Howe,** Utah State University

Room 3: Flooding

- **Amanda Schroeder**, National Weather Service
- **Rachel Hogan Carr**, Nurture Nature Center

Sample Discussion Questions:

- What recent advances in communicating risk and uncertainty for this hazard are relevant for TCs?

- What are the technological communications challenges in forecasting and alerting for this hazard that might inform TC risk communication?
- Who are the important intermediaries communicating about this hazard? How could they advance risk communication about the hazard, and how might this inform TC communication?
- How does a hazard's speed of onset affect the warning process? What have local authorities done to speed warning dissemination in rapid onset incidents? What information have they disseminated in advance to speed warning reception and protective response by those in the risk area?
- Which communication channels do local authorities use for warnings? What do they think are the limitations of those channels, if any? How might this inform TC communication?
- How do local authorities address population segments with special needs for warning reception and/or assistance in protective action?
- What do local authorities believe about peer warning networks (especially unintentional or deliberate misinformation) and how accurate are those beliefs?

2:55–3:15 **Report Back to Plenary**

5-minute transition back to plenary

Moderator: Jeannette Sutton, SUNY Albany, Planning Committee Member

Breakout moderators report back on key takeaways from their discussions

3:15–3:30 **Break**

3:30–4:45 **Session 4: Risk Communication and Decision Making in Communities**

Moderators: Craig Fugate, Craig Fugate Consulting LLC, & Brad Colman, American Meteorological Society, Planning Committee Members

Panel: Risk Communication Across Scales: Risk Communicators in Communities

5 minute talks + 15 minute Q and A

- **Drew Pearson,** Dare County Emergency Management
- **Russel Strickland,** Maryland Department of Emergency Management
- **Daphne Ladue,** University of Oklahoma
- **Tom Cova,** University of Utah
- **Jim Elliott,** Rice University

Roundtable: Community Leaders and Community Action

30-minute discussion

- **Jeff Lindner**, Harris County Flood Control District
- **Peyton Siler-Jones,** National League of Cities (NLC)

- **Archie Chaisson**, Lafourche Parish Government
- **Randy Reid**, International City/County Management Association (ICMA)

4:45–4:55 **High Level Summary of Sessions 3 and 4**

4:55–5:00 **Wrap Up and Plans for Day 2**
Ann Bostrom, University of Washington, Committee Chair

5:00 **END OF DAY 1**

TUESDAY, FEBRUARY 6, 2024 | All times ET

10:30–10:35 **Welcome and Opening Remarks**
Ann Bostrom, University of Washington, Committee Chair

10:35–10:50 **Recap from Day 1**
Rebecca Morss, U.S. National Science Foundation

10:50–12:30 **Session 5: Practical Translation of Risk in the Public Arena**
Moderators: Andrea Schumacher, NCAR, & Jeannette Sutton, SUNY Albany, Planning Committee Members & Gabrielle Wong-Parodi, Stanford University

Panel 1: Risk Communication Innovations and New Frontiers in TC Communication: Public Sector

5-8 minute talks + 10 minutes Q&A

- **Mike Brennan,** National Hurricane Center
- **Castle Williamsberg,** FedWriters Supporting NOAA's Weather Program Office
- **Gina Eosco,** NOAA Weather Program Office

Messaging Technology Walkthrough:

5-8 minute demos of messaging technologies + 10 minutes Q and A

- **Mike Gerber**, National Weather Service
- **Brock Aun**, HAAS Alert
- **Anatoliy Gruzd** & **Philip Mai**, Toronto Metropolitan University

Panel 2: Risk Communication Innovations and New Frontiers in TC Communication: Private Sector

5-8 minute talks + 10 minutes Q&A

- **Mike Chesterfield,** The Weather Channel
- **Micah Berman,** Google
- **John Lawson,** AWARN

12:30–1:15 **Lunch**

1:15–2:50 **Session 6: New Approaches to Unmet Needs: Communication for the Whole Community**

Moderators: Ann Bostrom, University of Washington & Jeannette Sutton, SUNY Albany, Planning Committee Members

Keynote Speaker: Jargon, Technical Language, and Plain Language

10 minute talk, 5 minutes Q and A

- **Wändi Bruine de Bruin,** University of Southern California

Panel 1: Communicating Uncertainty and Probabilistic Information about TC Tracks, Timing and Severity

10 minute talks, 10 minutes Q and A, 10 minute discussion of a prototype wind-speed product

- **Lace Padilla,** Northeastern University
- **Jessica Hullman,** Northwestern University

Panel 2: Access and functional needs:

- **L. Vance Taylor,** California Governor's Office of Emergency Services
- **Sherman Gillums, Jr.,** FEMA
- **Joseph Trujillo-Falcon,** University of Oklahoma

2:50–3:05 **Break**

3:05–3:15 **High Level Summary of Sessions 5 and 6**

3:15–4:15 **Session 7: Workshop Retrospective and Implications for the Future**

Moderators: Marshall Shepherd, University of Georgia & Brad Colman, American Meteorological Society, Planning Committee Members

60 minute roundtable discussion

- **Julie Demuth**, NSF National Center for Atmospheric Research
- **Brock Aun**, HAAS Alert
- **Sherman Gillums, Jr.**, FEMA
- **Gina Eosco**, NOAA Weather Program Office
- **Rebecca Morss**, U.S. National Science Foundation

4:15–4:30 **Wrap Up and Closing Remarks**

Ann Bostrom, University of Washington, Committee Chair

4:30 **Adjourn**

Guidance for Asking Questions Via Slido

How to join the conversation

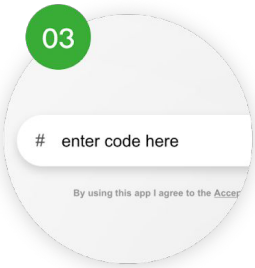
Access the link directly: https://app.sli.do/event/r86ZJJ6GU82AnqYpNoqh9F

OR

Go to slido.com and enter the event code: **#** 2867388

Open browser

Go to slido.com



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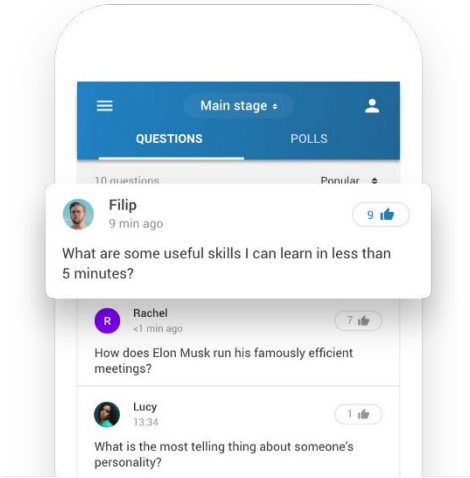
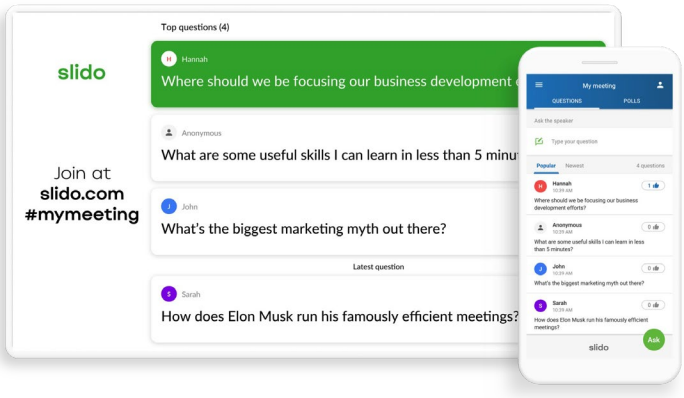
Upvote questions you like



Questions and votes will appear in real-time on an interactive wall



For more information: https://community.sli.do/

Speaker Bios

Richard Allen is a professor of earth and planetary science and the Director of the Berkeley Seismological Laboratory. He is an expert in earthquake alerting systems and deep earth imaging. He has developed and implemented earthquake early warning methodologies that use traditional seismic and GPS sensing networks, and has pioneered the use of smartphones to detect earthquakes globally and issue warnings. His research has been featured in Science, Nature, Scientific American, The New York Times and dozens of other media outlets around the world, and his technology has been incorporated into Google's Android Earthquake Alerts system. He has a B.A. from the University of Cambridge and a Ph.D. from Princeton University.

Brock Aun is Vice President of Communications and Public Policy at HAAS Alert, where he works closely with policymakers, automakers, fleet operators, and other partners to drive awareness and adoption of digital alerting and other V2X applications in communities nationwide. He is also the Chair of the Beyond 5.9 V2X Committee at ITS America, where stakeholders are developing a national deployment plan for connected vehicle technologies. Brock brings more than a decade of experience in communications, organizing, public affairs, and business planning in both the private and public sectors.

Robbie Berg is a senior hurricane specialist at NOAA's National Hurricane Center in Miami, Florida. Berg is the NHC focal point for the infusion of social science into hurricane forecasting, communication, products, and outreach. Berg helps coordinate NHC's social media activities, and in that role, he administers and writes posts for NHC's blog, Inside the Eye. He also interacts and conducts research with the NHC Storm Surge Unit to improve the operational forecasting of hurricane-induced storm surge. Berg received his Bachelor of Science in Meteorology and a Bachelor of Science in Marine Science from North Carolina State University. He received a Master of Arts in Communication from Johns Hopkins University and also completed some graduate work at the University of Miami Rosenstiel School of Marine and Atmospheric Science.

Micah Berman is Product Manager for Android Platform Safety at Google. His teams look after services that help keep billions of Android users safe - including empowering 911/112 response via the Emergency Location Service and providing early warnings of potentially-damaging shaking via Earthquake Early Warning. Before Android, Micah led a $150M+ portfolio of product, technical and international development-focused grants for Google.org. He started his career at Google as an engineering analyst working on anti-abuse strategies for Search. His career is driven by his belief that technology, in service of humans, can make our world better. Micah is a graduate of Pomona College, and lives in Oakland, CA.

Michael Brennan is the Director of NOAA's National Hurricane Center (NHC) in Miami, Florida, where he oversees NHC's tropical cyclone and marine forecast and warning missions and the provision of Impact Based Decision Support Services (IDSS) related to marine and tropical cyclone hazards. He also serves as the chair of the WMO RA-IV Hurricane Committee. Dr. Brennan previously served as the Branch Chief of NHC's Hurricane Specialist Unit from 2018-2023, where he directly supervised the issuance of tropical cyclone forecasts and warnings for the Atlantic and eastern North Pacific hurricane basins for the United States and more than 20 other nations. From 2008 to 2018, Dr. Brennan served as a senior hurricane specialist at NHC, a position where operational duties included the issuance of track, intensity, and wind radii forecasts and associated watches and warnings for tropical cyclones in the Atlantic and eastern North Pacific oceans. Dr. Brennan has presented at numerous scientific meetings, including conferences of the American Meteorological

Society, the American Geophysical Union, and the National Weather Association. Dr. Brennan serves as a reviewer for several scientific journals and is currently an associate editor for the AMS journals Weather and Forecasting and Monthly Weather Review.

Wändi Bruine de Bruin is Provost Professor of Public Policy, Psychology, and Behavioral Science at the Sol Price School of Public Policy at the University of Southern California (USC), and director of the USC Behavioral Science and Well-Being Policy initiative. She holds a PhD in Behavioral Decision Research and Psychology from Carnegie Mellon University. Her research aims to understand and inform how people make decisions about climate change, health, and household finances. She has published more than 150peer-reviewed publications on these topics. She is a Fellow of the Society for Risk Analysis and the UK's Academy of Social Sciences. She is an editorial board member for Perspectives on Psychological Science, the Journal of Behavioral Decision Making, Decision, Medical Decision Making, the Journal of Risk Research, and Psychology and Aging. She has served on the National Academy of Sciences on Communicating Science Effectively, the National Academy of Sciences committee on Respiratory Protection for the Public and Workers without Respiratory Protection Programs at their Workplaces, and on the Council of the Canadian Academies committee on Health Product Risk Communication.

Rachel Hogan Carr has served on Nurture Nature Center's board of directors and been Executive Director of the organization since its inception. At NNC, Carr is the person with first line leadership responsibility for managing staff and strategic planning. She has been, as well, the principal person in charge of carrying out some of NNC's most important grant work. Carr has spoken widely about how to engage the community in understanding and addressing the risks they face, including engagements for: American Meteorological Society; the Pennsylvania Floodplain Managers Association; the New Jersey Emergency Preparedness Association; NOAA Science Days; FEMA Region III; FEMA TMAC; and others. Carr has an M.A. in Environmental Policy Design from Lehigh University, where she wrote her thesis on Community Identity and Actionable Risk Communication: A Theoretical Framework for Motivating Flood Preparedness. Before that she studied at Pennsylvania State University, where she was Editor-in-Chief of The Daily Collegian, and graduated from Moravian College. She is a certified floodplain manager.

Archie Chaisson is the Parish president of Lafourche parish in Louisiana. Prior to his election, Archie served as the Public Works Director for the City of Thibodaux from January of 2016. There he was responsible for the management of the City's infrastructure including water and gas production and distribution, streets and drainage, planning and zoning as well as the City's municipal airport. Prior to his start with the City of Thibodaux, Archie was appointed Parish Administrator for Lafourche Parish, responsible for overseeing the day to day operations, including its 100-million-dollar budget and its 350 employees. Prior to being appointed Parish Administrator, Archie was hired as the Administrator for the Lafourche Parish Government Office of Coastal Zone Management on March 28, 2011. His primary responsibilities include administrating the Local Coastal Program for Lafourche Parish, issuing Local Coastal Use Permits, commenting on and inspecting State Coastal Use Permits, and the management of the sixteen Environmental Management Units (EMU's) of the parish. Archie was also the lead on the restoration efforts inside Lafourche Parish following the Deep Water Horizon Incident of 2009, working on all Natural Resource Damage Assessment (NRDA) related activities as well as coordinating other parish restoration efforts. Archie began his career after college as the Permits and Grants Coordinator for Picciola and Associates, Inc., a consulting engineering firm in the South Lafourche Area. Archie also served a member of the Lafourche Chamber of Commerce Board of Directors, having served as Chairman of the Board in 2014 and the Nicholls State University Alumni Federation Board of Directors

serving as their President in 2015 and 2019. Archie also served his community by serving as Chairman Central Lafourche Ambulance Service District Board from 2016 to 2019, which provides ambulance services to the northern third of Lafourche Parish. He holds a BS in science management from Nicholls State University.

Mike Chesterfield is a seasoned media executive and Emmy award-winning leader with nearly three decades of experience in weather presentation and data visualization. Currently serving as the Vice President of Weather Presentation at The Weather Channel, he has demonstrated expertise in conceptualizing and producing innovative weather content and experiences. Mike is recognized for his multidimensional approach, leveraging emerging technologies to enhance legacy weather messaging techniques. A trailblazer in the field, Mike has led a team of designers and meteorologists in pioneering immersive mixed reality (IIMR) content. His team's work, including the development of Surge-FX and Flood-FX products, has garnered acclaim for providing hyper-realistic simulations of storm surge forecasts. By showing audiences realistic depictions of forecasted storm surge events in advance, Mike has significantly improved public understanding of potential dangers. With a commitment to clear and concise messaging, Mike brings a wealth of experience to the National Academies workshop on Risk Communication for Tropical Cyclones. Mike's innovative contributions to weather communication is driven by his passion to leverage his subject matter expertise and his unique position as a way to warn audiences everywhere, hopefully saving life and property along the way.

Tom Cova is Professor of Geography at the University of Utah in Salt Lake City. His research and teaching interests are environmental hazards, emergency management, transportation, and geographic information science (GISci). His primary focus is wildfire evacuation analysis and planning, and he has published on a variety of topics in many leading hazards, transportation and GIScience journals. He served as Chair of the GIS Specialty Group and Hazards, Disasters & Risks Specialty Group of the Association of American Geographers (AAG). In 2008, he served as Program Chair for the International Conference of Geographic Information Science (GIScience '08) held in Park City, Utah. Recently, he led an NSF-funded program to mentor junior faculty in the field of Hazards and Disaster research. He teaches courses on environmental hazards, human geography, emergency management, and GIS.

Julie Demuth is a Project Scientist III at the National Center for Atmospheric Research (NCAR) in the Mesoscale and Microscale Meteorology (MMM) Lab. She has an interdisciplinary background in both physical and social science, with a BS and MS in atmospheric science and a PhD in communication with a focus on risk. She conducts research on hazardous weather risk communication, risk perception, and decision-making, including how these intersect with predictability and prediction capabilities. Her recent work centers on (1) collecting event-based, perishable, longitudinal social science observations from the public during real-world hurricane threats and analyzing the data to examine whether, when, and how people's risk perceptions and behaviors are evolving as the hurricane risks evolve; (2) developing and refining numerical weather prediction (NWP) and AI/ML guidance for weather forecasters that is trustworthy, trusted, useful, and usable; and (3) understanding how forecasters, their core partners, and the public interpret, perceive, and use forecast uncertainty information. In addition to her research role, Julie also is the Lead of the Convergence Science Program in the NCAR Directorate.

Jim Elliott is Professor and Chair of Sociology at Rice University in Houston, TX. His research focuses on social inequality, environmental hazards, and climate adaptation. He has served as a program advisor for the US National Science Foundation and as co-editor of Sociological Perspectives, the official journal of the Pacific Sociological Association. His co-authored book Sites Unseen: Uncovering Hidden Hazards in American Cities recently won the Robert E. Park Award for best book in community and urban sociology from the

American Sociological Association. Current research includes a focus on urban flooding and residential adaptation, including policies and programs of managed retreat. He has also recently served as an invited speaker to FEMA's 2023 annual Civil Rights Summit as well as a scientific advisor to Harris County, TX and Houston's Advanced Research Center on matters of situational awareness and communication before, during and after local extreme events.

Gina Eosco is the Weather Program Office's Division Chief for Science, Technology, and Society overseeing an interdisciplinary set of WPO programs including the Testbed Program, Joint Technology Transfer Initiative, and the Social Science Program. Together, this Division ensures that research and development projects are useful, usable, and used through co-development and transitioning research into applications. Gina earned her M.S. and Ph.D. in weather risk communication from Cornell University, and a B.S. in Environmental Science and Policy from the University of Maryland.

Sherman Gillums Jr., a native of Buffalo, New York, serves as FEMA's disability coordinator and the director of its Office of Disability Integration and Coordination (ODIC), located in the agency's Washington D.C. headquarters. In his role, Sherman advises FEMA Administrator Criswell on meeting the agency's commitment to equity in emergency management for people with disabilities, including older adults and others with access and functional needs. Within seven months of joining FEMA in August 2022, Sherman deployed to response operations for hurricanes Ian and Fiona, deadly tornados in Alabama and Mississippi, and served as the Agency's lead advisor on disability integration after a train derailment in East Palestine, Ohio. In March 2023, Sherman released to the FEMA workforce his Director's Intent, "A Guide to Meeting the Disability Integration Mission". The vision focuses on 14 potential points of inequity that can substantially extend the disaster lifecycle for people with disabilities and older adults. Before joining FEMA, Sherman led strategy, operations, and impact for the National Alliance on Mental Illness. There he focused the organization's efforts to universalize timely access to mental healthcare and destigmatize mental illness. A United States veteran, Sherman joined the U.S. Marine Corps at age 17 and served for 12 years before medically retiring at the rank of Chief Warrant Officer 2. He holds a graduate degree from the University of San Diego School of Business and completed his executive education at Harvard Business School. He will complete his doctoral studies at the University of Dayton in 2024. Sherman and his wife Tammie, herself a U.S. Army veteran of Operation Enduring Freedom, have two sons, four daughters—including one who is presently a Midshipman at the U.S. Naval Academy—and two granddaughters.

Anatoliy Gruzd is a Canada Research Chair, Professor, and Director of Research at the Social Media Lab at Toronto Metropolitan University. His research explores how social media and the growing availability of user data are changing the ways in which people and organizations communicate, collaborate, and disseminate information and how these changes impact the social, economic, and political norms and structures of modern society. He holds a Ph.D from the University of Illinois at Urbana-Champaign.

Jen Henderson examines the sociocultural, technical, and ethical aspects of weather and climate extremes. She is especially interested in the environmental governance of disasters like compound hazards and the decision-making challenges they create both for people who are in harms' way and for those experts who must predict and communicate risk. To help address these issues, Jen works alongside various prediction and public safety experts to co-produce usable science that can help mitigate local vulnerabilities and communication obstacles. Her collaborators primarily come from operational and broadcast meteorology, atmospheric sciences, and wind engineering, with whom she is exploring the integration of physical and social

data. Within the social sciences community, she is helping conceptualize infrastructures that facilitate storage and sharing of qualitative materials (e.g. DesignSafe-CI and the Disaster STS Network). Jen is an assistant professor of Geography at Texas Tech University and the founder of the Risk and Equity in Disasters Lab, an experimental qualitative space that supports local methods and approaches to hazards research, such as longitudinal ethnography, social mapping, and the use of AI in analysis of qualitative data. She is a founding member of the Editorial Collective for the Journal of Disaster Studies and the incoming Planning Commissioner for the American Meteorological Society.

Peter Howe is an Associate Professor of Geography in the Department of Environment & Society in the S.J. and Jessie E. Quinney College of Natural Resources at Utah State University, where he directs the Human-Environment Spatial Analysis Lab. Howe specializes in the human dimensions of climate change and environmental hazards. His lab's research focuses on the intersection of human perception and decision-making with societal vulnerability and adaptation to climate change and environmental hazards. He investigates how spatial relationships and environmental context influence risk perceptions, communication, and behavior. He is also an an affiliate researcher with the Yale Program on Climate Change Communication, an associate of the USU Ecology Center, and serves on the leadership team for the Climate Adaptation Science graduate program. He holds and MS and PhD in Geography from Penn State University.

Jessica Hullman is Ginni Rometty Associate Professor of Computer Science at Northwestern University. Her research addresses challenges and limitations that arise when people draw inductive inferences from data. Her work has contributed multiple visualization and interaction techniques for improving reasoning under uncertainty from data-driven interfaces, as well as theoretical frameworks for understanding the role of visualization in statistical workflow. Jessica's work has been awarded with multiple best paper and honorable mention awards at top visualization and HCI venues, a Microsoft Faculty award, a Google Faculty award, and NSF CAREER, Medium, and Small awards as PI, among others. She frequently speaks and blogs on topics related to visualization and reasoning about and representing uncertainty in data analysis and data-driven science.

Daphne S. LaDue is a Senior Research Scientist at the University of Oklahoma's Center for Analysis and Prediction of Storms. She focuses much of her research on how emergency managers (EMs) make and adapt their severe weather preparation decisions based upon forecast briefings and uncertainty, past experiences, and the unique characteristics and vulnerabilities in their jurisdiction. She is also collaborating with wind and structural engineers to explore how tornado survivor's observations might enhance, support, or challenge engineering conclusions regarding the order and mechanisms of tornado damage. Their data include information on forecast and warning messages received, when and how survivors decided what to do about the threat of a tornado, and how effective any sheltering decisions were. She primarily employs qualitative methods including unstructured and semi-structured interviews and participant observation for much of her work. She has also employed talk-aloud and other cognitive task analysis/decision protocols.

Alex Lamers is the Warning Coordination Meteorologist at the National Weather Service's Weather Prediction Center in College Park, Maryland. This is a new position at WPC since 2019 -- Alex is the first WCM at WPC, the national forecast center focused on the prediction of precipitation, including extreme rainfall and winter weather, and the overall national weather picture. Alex regularly engages with government and public safety partners, media outlets, and other interested users about WPC forecasts and their interpretation. He arrived at WPC in 2017 as a forecaster and primarily specialized in the prediction of extreme rainfall events from days to

hours in advance. Alex has also previously worked as a liaison at NOAA Headquarters for NOAA's Satellite and Information Service (NESDIS), and as a meteorologist and forecaster in four local NWS forecast offices, including Milwaukee, Wisconsin; Norman, Oklahoma; Duluth, Minnesota; and Tallahassee, Florida.

John Lawson serves as Executive Director of the Advanced Warning and Response Network (AWARN) Alliance, an international coalition of broadcasting, consumer electronics, and professional tech companies. The Alliance is leveraging Next Generation Television (ATSC 3.0) to develop an advanced system for emergency alerting, news, and information. He's also President of Convergence Services, Inc, a consulting firm focused on spectrum, resilience, Next Gen TV business models, and the Intelligent Transportation Industry. John was one of four signatories to the original Joint Petition that led to FCC approval of ATSC 3.0 transmission in 2017. John served on FEMA's National Advisory Council IPAWS Subcommittee (2017-2018) and graduated from FEMA's Emergency Management Executive Academy (2018). He was an expert panelist at the White House Earthquake Resilience Summit in 2016 and has served on three FCC emergency communications advisory committees. John began his work on advanced alerting while CEO of the Association of Public Television Stations during the 9/11 attacks. He was Executive VP of ION Media Networks and Executive Director of the Mobile500 Alliance. Board service includes the National Association of Broadcasters, the Open Mobile Video Coalition, and Senior Warden of Historic Christ Church in Alexandria, Virginia. John earned BA and MA degrees in International Studies at the University of South Carolina.

Jeff Lindner: Joining the Harris County Flood Control District in 2003 as the District's first meteorologist is one of many precedents set by Jeff Lindner. In his primary role as Director of the Hydrologic Operations Division and Harris County meteorologist, Jeff implements regular communication with multiple agencies, elected officials, and media partners during episodes of severe weather. Jeff oversees the operation of the District's flood operations, the flood warning system, and flood forecasting efforts. Jeff holds a Bachelor of Science degree in meteorology from Texas A&M University. He is a prominent figure on the topic of weather forecasting, weather impacts, and emergency management activations for county government during adverse weather conditions. Lindner, who became widely known for his constant reporting and calm demeanor during Hurricane Harvey, served as a memorable personality for millions of residents in the City of Houston, Harris County, and the southeast Texas region. He has been recognized by numerous organizations including the American Meteorological Society, the City of Houston, several local, state, and federal organizations for his efforts in weather communication and public safety.

Philip Mai is a Co-director and a Senior Researcher of the Social Media Lab at Toronto Metropolitan University in Canada. His research interest is mainly in the areas of dis/misinformation campaigns, online toxicity, hate, conspiracy theories, and extremism. He holds an MA and PhD from Syracuse University.

Sara McBride is a social scientist and Crisis Communication Response Leader with 20 years progressive experience in risk, hazard, science communication, public education, disaster risk reduction, community resilience, and international humanitarian response. McBride is a social scientist with methodology expertise in mixed methods and a specialty in content and critical analysis. Her professional communications accomplishments include serving as Public Information Manager for GeoNet/GNS Science during the Kaikoura Earthquake and Second-in-Command for Christchurch Earthquake Response. Her extensive international and domestic on-site crisis communication and emergency management experience includes work in New Zealand, Solomon Islands, Samoa, Fiji, Namibia, Hawai'i, and Washington. She is proficient in French and Solomon Islands Pidgin.

Rebecca Morss is currently serving as Interdisciplinary Program Director in the Office of Integrative Activities at the National Science Foundation. She previously served as a Senior Scientist and Deputy Director of the Mesoscale and Microscale Meteorology (MMM) Laboratory at NSF's National Center for Atmospheric Research (NCAR) in Boulder, Colorado. She also lead NCAR's Weather Risks and Decisions in Society program. She is an expert in weather forecasting systems and risk communication, with an emphasis on high-impact weather including hurricanes, floods, fires, and tornadoes. She brings more than twenty years of experience in developing and implementing research programs, conceptualizing and leading projects, and building collaborative teams. Her work focuses in particular on integrating knowledge, methods, and data across fields to address problems that cross disciplinary boundaries in order to bridge science and technology with societal needs. Her recent research foci include the communication and interpretation of weather and climate risks, the use of weather- and climate-related information in decision making, and weather hazard prediction and predictability. She received a B.A. from the University of Chicago and a Ph.D. from the Massachusetts Institute of Technology

Rebecca Moulton is a regional meteorologist for FEMA Region 4, serving as a senior member of the National Hurricane Program and FEMA Hurricane Liaison Team. Since 2007, she has supported outreach and training, modernization and development of new tools and resources for tropical cyclone evacuation planning and response, to support partners across the emergency management community. Additionally, she provides ongoing situational awareness and planning support for all weather hazards with the Operational Planning Branch within FEMA Response. In 2022, she served on a detail in Resilience and Climate Adaptation at FEMA HQ, to the White House Intergovernmental Working Group on Extreme Heat, and FEMA Extreme Heat Working Group. She has also served as a member of the FEMA Climate Literacy Strategic Working Group, and initiatives at the regional level including the 2023 FEMA Region 4 Southeast Climate Workshop, bringing together stakeholders and participants across the Gulf and Southeast states to focus on challenges of translating climate science to emergency management. Rebecca received her Bachelor of Science in Communication from Ohio University in Athens, Ohio and her Master's degree in Earth and Atmospheric Science from Georgia Tech.

Michele (Micki) Olson is a senior risk communication researcher in the Emergency and Risk Communication Testing Laboratory at the University at Albany. Her research focuses on risk and weather communication, alerts and warnings, and persuasive message design. As a communication scholar, she uses theories and methods from the communication discipline to better understand and design imminent threat messaging. Previously, she was a social science contractor in the National Oceanic and Atmospheric Administration's Weather Program Office, focusing on issues of social science integration and weather risk communication in the agency.

Lace Padilla joined Northeastern University in 2023 as an Assistant Professor of Computer Science and Psychology where she is a member of the Data Visualization Lab @Khoury. Her interests lie in the intersection between Information Visualization, Behavioral Decision Making, and Data Science. Her research on uncertainty communication explores how to align data visualizations of future events with human decision-making capabilities. She has received the best paper award at IEEE VIS, honorable mentions, an APA Early Career Award, and a NSF CAREER Award. She is the PI and Co-PI on several other grants funded by NSF (#2122174, #2028374, #1810498) and DOE. In her spare time, she is a strong advocate for minoritized groups in STEM, previously serving on the IEEE VIS Inclusivity Committee and the Governing Board of Spark Society.

She has also received several grants and awards for her diversity work. She holds an MS and PhD in Psychology from the University of Utah.

Drew Pearson joined the Dare County staff on August 4, 2014 and was appointed Director on March 1, 2015. Prior to joining Dare County, he served as United States Coast Guardsmen for thirty years retiring as a Captain on August 1, 2014. As a Coast Guard Aviator he had numerous aviation and staff assignments prior to retiring as Commander, Sector San Juan, Puerto Rico. As Director, he led the response and recovery to numerous weather events that have included five federal disaster declarations for Matthew in 2016, Florence and Michael in 2018, Dorian in 2019, and Isaias in 2020. He supported the Public Health response to the COVID-19 pandemic while continuing to lead community recovery and mitigation efforts while building partnerships and resilience through collaboration. Pearson's collaborative efforts led to establishing a countywide mass notification capability called OBXAlerts, the installation of twenty-seven storm surge awareness interpretive displays to improve public understanding of flood risk and a public engagement campaign called Love The Beach, Respect The Ocean that has reduced the number of lives lost to ocean hazards. While all efforts have been well received, the Love The Beach, Respect The Ocean campaign was awarded the International Association of Emergency Managers USA Council's 2023 Preparedness Award. Pearson holds advanced degrees in Public Administration and Emergency Management. Since 2006, he has maintained designation as a Certified Emergency Manager (CEM) from the International Association of Emergency Managers.

Randy Reid is employed at ICMA as the Southeast Regional Director. He is a former member of the Alliance For Innovation Board of Directors and a full member of I.C.M.A. and F.C.C.M.A. He has served state associations as President of FCCMA and GOSCMA. He has served the profession as chair of the FCCMA Ethics Committee and more recently the ICMA Sustainable Communities Advisory Committee. He is currently Practitioner In Residence at the Bob Graham Center For Public Service at the University of Florida and a member of the National Eagle Scout Association. He holds an masters degree in public administration from the University of Dayton.

Jessica Schauer is the Tropical Weather Services Program Manager for the National Weather Service (NWS). Jessica manages policy for tropical cyclone products and services from the National Hurricane Center, the Central Pacific Hurricane Center, and NWS Weather Forecast Offices (WFOs). She works closely with physical and social scientists and developers on tropical product and service innovations. Jessica manages the solicitation and incorporation of comments from NWS partners, stakeholders, and the public on proposed tropical cyclone product/service changes and experimental products. She is also responsible for the formal announcement of NWS tropical cyclone service changes. Jessica served as an NWS forecaster for 17 years before moving into this position in 2016. She has a bachelor's degree in physical oceanography from the Florida Institute of Technology and a master's degree in meteorology from the University of Hawaii at Manoa.

Rose Schoenfeld is a meteorologist at the National Weather Service - Los Angeles/Oxnard CA. Since joining the team in late 2022, she has focused on hazard communication, partner relations, and social media. She has worked several high profile events including Hurricane Hilary, the Montebello tornado in downtown Los Angeles, and extreme high surf and coastal flooding. Rose started her National Weather Service career as an intern at NWS San Diego in 2020 and volunteered for NWS Seattle from 2021-2022. She also interned with the NASA Student Airborne Science Program, where she researched the impacts of atmospheric river events on coastal waters, and participated in flight missions on the DC-8 flying laboratory. Rose received her B.S. in Atmospheric Sciences concentrating in Meteorology and Climate from the University

of Washington in 2022.

Amanda J. Schroeder is the Senior Service Hydrologist (SSH) with the National Weather Service (NWS) Weather Forecast Office in Fort Worth, Texas (FWD) where she leads the NWS hydrology program for North and Central Texas. Dr. Schroeder obtained her B.S. and M.S. in Meteorology from the University of Oklahoma and earned her doctorate from the University of Georgia with a research focus on urban flash flooding. Dr. Schroeder began her NWS career as a meteorologist at FWD in 2013 and gained valuable experience as a hydrologist at the NWS West Gulf River Forecast Center from 2016 through 2021 before becoming the SSH at FWD in Spring 2021. Over the past decade, Dr. Schroeder has been a forecaster for numerous high-impact weather events across Texas, including Hurricane Harvey. She has also led several local, regional, and national hydro-focused initiatives within the NWS, has published multiple peer-reviewed journal articles and conference preprints, and remains an active leader in the hydrometeorological community.

Jason Senkbeil is a Professor and the Director of Undergraduate Studies for the Department of Geography at The University of Alabama. He is a Meteorologist and Climatologist with interests in social science research applications. His primary research areas are focused upon how the public perceives and if they accurately comprehend scientific information in extreme event weather forecasts, specifically tropical cyclones and tornado outbreaks. His career objectives are to continue working to bridge the gap between meteorologists and the public by explicating the messages, graphics, and products with enhancements that lead to accurate decision making or protective action decision making. He eagerly looks forward to all opportunities for implementing advancements in operational, research, educational, or curricular development for the greater good as the perception of meteorological and climatological topics becomes increasingly important in the coming decades.

Roxane Cohen Silver is Vice Provost for Academic Planning and Institutional Research and Distinguished Professor in the Department of Psychological Science, the Department of Medicine, and the Program in Public Health at the University of California, Irvine, where she has been actively involved in research, teaching, and administration since 1989. An international expert in the field of stress and coping, Silver has spent over four decades studying acute and long-term psychological and physical reactions to stressful life experiences, including personal losses and larger collective traumas such as terror attacks, infectious disease outbreaks, and natural disasters across the world. Her research has been funded by the National Science Foundation, the National Institute of Mental Health, the U.S. Department of Homeland Security, and the U.S. Public Health Service. She has guided governments in the U.S. and abroad in the aftermath of natural disasters and terrorist attacks and served for a decade on numerous senior advisory committees and task forces for the U.S. Department of Homeland Security, providing advice to the Department and its component agencies on the psychological impact of disasters and terrorism. Silver has twice testified to the U.S. House of Representatives' Committee on Science, Space and Technology. Silver is Past-President of the *Federation of Associations in Behavioral & Brain Sciences* (FABBS) (serving on their board for 6 years) and 2016 President of the *Society of Experimental Social Psychology*. She was also a founding Director and Chair of the Board of Directors of *Psychology Beyond Borders*.

Emma S. Spiro is an Associate Professor at the University of Washington Information School. She is also an Adjunct Associate Professor in the Department of Sociology and the Department of Human Centered Design & Engineering, and an affiliate of the UW Center for Statistics and the Social Sciences. Dr. Spiro is a Data Science Fellow at the eScience Institute. At the iSchool, Dr. Spiro previously held the position of Interim

Associate Dean for Research. She is also a co-director of the Data Science and Analytics Lab (DataLab). Dr. Spiro is a PI and Co-Founder of the UW Center for an Informed Public. Dr. Spiro's research involves the collection and analysis of large-scale social and behavioral data to answer key questions within the areas of sociology, information science, and social computing. Since early 2012, her work has focused on understanding social and information-related behaviors in the context of crisis events, including rumors, misinformation and collective sensemaking in online environments. Her work also explores the structure and dynamics of interpersonal and organizational networks in both online and offline environments. Her research has been published in leading journals such as PNAS, Science Advances, Social Networks, Field Methods, Demography, and Information, Communication & Society. She also participates in premier conferences such as ACM CHI, ACM CSCW, and AAAI ICWSM. Dr. Spiro earned her Ph.D. in Sociology from the University of California, Irvine. She also holds a B.A. in Applied Mathematics and a B.A. in Science, Technology, and Society from Pomona College, as well as an M.A. from the Institute for Mathematical Behavioral Sciences at University of California, Irvine.

Russell J. Strickland has been leading the Maryland Department of Emergency Management (formerly Maryland Emergency Management Agency, MEMA) since July 2015 and was reappointed Secretary of Emergency Management by Governor Wes Moore in January 2023. In this role, Mr. Strickland directs a department that has the primary responsibility and authority for emergency preparedness policy, and for coordinating hazard mitigation, incident response, disaster recovery, the Maryland 9-1-1 Board, and the Office of Resilience for the State of Maryland. This includes serving as a direct advisor to the Governor during disasters and coordinating support for local governments as requested. Mr. Strickland is an experienced emergency management professional who has more than 40 years of experience in the field of emergency services and first responder activities at the state and local levels of government, academia, and the private sector. This includes expertise in fire and rescue services, emergency medical services, fire inspection and investigation, communications, and emergency management leadership. Mr. Strickland also has experience leading a cabinet-level emergency services department at the local level as the Director of Emergency Services in Harford County, Md. This position oversees emergency operations and communications, public safety answering points (the 9-1-1 center), training, and special operations among other responsibilities. His executive responsibilities have also included previously serving the State of Maryland as Deputy Director of the Maryland Emergency Management Agency and the Assistant Director of the Field Programs Division at the Maryland Fire and Rescue Institute, University of Maryland College Park. Mr. Strickland has a Master of Science degree in Management from Frostburg State College. He earned his Bachelor of Arts degree in Criminology from the University of Maryland, College Park.

Joseph Trujillo-Falcon is a bilingual meteorologist and a Ph.D. student in Communication at the University of Oklahoma, where he combines his passion for meteorology and communication to improve bilingual risk messaging in weather and climate. As a research assistant for CIWRO, NSSL, and SPC, he contributes to the Probabilistic Hazard Information project and several bilingual weather and climate communication projects, collaborating with academic institutions, broadcast networks, and public/private sectors. He has published articles in prestigious journals, such as the Bulletin of the American Meteorological Society, on the translation issues and frameworks in Spanish weather communication. He is also the chairperson of the AMS Committee for Hispanic and Latinx Advancement, where he works with scientific professionals from various domains to establish a Latinx joint network, provide improved resources for bilingual meteorologists, and create opportunities for mentorship and professional development for the AMS Latinx community. Beyond the research landscape, he is a bilingual meteorologist for MyRadar, a popular weather application downloaded by

50 million users.

Luis "Vance" Taylor is the Chief of the Office of Access and Functional Needs at the California Governor's Office of Emergency Services. Vance leads the team responsible for ensuring the needs of individuals with disabilities and persons with access or functional considerations are identified and integrated into the State's emergency management systems before, during, and after disasters. Vance was appointed by President Biden to serve as a member of the President's National Infrastructure Advisory Council (NIAC) in 2022. As a member of the NIAC, Vance advises the White House on how to reduce physical and cyber risks and how to improve the security and resilience of the nation's critical infrastructure sectors. Born and raised in the San Francisco Bay Area, Vance was diagnosed with muscular dystrophy as a child and uses a power wheelchair. He has worked in Washington, D.C. as an advisor for two different members of Congress, directed security policy at a national water association, and been a principal at a ranked homeland security and emergency management consulting firm. Vance is a nationally recognized public speaker and advocate for individuals with disabilities. Vance has a Master's degree in homeland security from the University of Connecticut and an undergraduate degree from Brigham Young University in communications. He is married to his sweetheart, Casey, and they have two wonderful daughters. Vance and his family live in Rancho Cordova, CA.

Olga "Olya" Wilhelmi is a geographer whose research interests focus on interactions among weather, climate and society across scales, with the main emphasis on understanding societal risk, vulnerability and adaptive capacity to extreme weather events and climate change. She is a project scientist in the Research Application Laboratory and is the head of NCAR's Geographic Information Science Program. Olga is a graduate of Lomonosov Moscow State University where she majored in physical geography. She completed her Ph.D. in the School of Natural Resources at the University of Nebraska-Lincoln in 1999. Olga has been leading and participating in numerous research activities and has written peer-reviewed articles, chapters, and reports addressing societal aspects of weather extremes and climate change; urban extreme heat and human health; drought vulnerability and water management; extreme precipitation events and flash floods; and the methodologies for integration of physical and social sciences in a GIS.

Castle Williamsberg supports the Social Science Program in NOAA's Weather Program Office (WPO) as a contractor. Within WPO, Castle coordinates and leads Research-to-Applications (R2X) initiatives for social, behavioral, and economic science research. Castle assists in identifying, translating, and transferring research and development outputs to operations, applications, commercialization, and other practical uses. Castle enjoys being at the center of both research and practice, and most importantly, finding ways to help bridge the research-to-practice divide to ensure voices on both sides are heard, understood, and acted upon.

Gabrielle Wong-Parodi is an Assistant Professor in the Department of Earth System Science, Social Sciences Division, and Center Fellow at the Stanford Woods Institute for the Environment at Stanford University. Her research focuses on applying behavioral decision research methods to address challenges associated with global environmental change. Dr. Wong-Parodi seeks to understand the psychosocial and contextual factors that influence people's responses to environmental change – especially extremes – over time, with a particular focus on those communities that have been historically marginalized or disproportionately impacted by climate change. She also uses behavioral decision science approaches to create and evaluate evidence-based strategies for informed decision making, with a particular focus on building resilience and promoting sustainability in the face of a changing climate. Dr. Wong-Parodi has a background in climate change adaptation and mitigation, energy technologies and resources, extreme weather

events, and low-carbon technologies. She recently served on the National Academy of Sciences committee titled "Long-term Coastal Zone Dynamics: Interactions and Feedbacks between Natural and Human Processes and their Implications for the U.S. Coastline." Dr. Wong-Parodi is an adjunct assistant professor in the Department of Engineering and Public Policy at Carnegie Mellon University. Dr. Wong-Parodi received her B.S. in Psychology at the University of California Berkeley, and her M.A. and Ph.D. in Risk Perceptions and Communication from the University of California, Berkeley.

Michele M. Wood holds a doctorate in Community Health Sciences from the School of Public Health at the University of California, Los Angeles, with a minor degree in Sociology. She also holds a bachelor's degree in Psychology and a master's degree in Community Psychology. She is Professor and Chair of the Department of Public Health and the California State University, Fullerton and teaches graduate and undergraduate courses in Research Methods, Statistics, and Program Design and Evaluation. Dr. Wood's research interests include risk communication for disasters with an emphasis on mobile alerts and earthquake early warning, HIV/AIDS among high-risk populations, and program design and evaluation. Dr. Wood has served as a subject matter expert for USGS, FEMA, the National Academies of Sciences, the Southern CA Earthquake Center, the U.S. Fire Administration, and the National Institute on Drug Abuse. She helped lead early research on the nation's wireless emergency alert (WEA) system and is currently serving as Principal Investigator on a collaborative research project funded by USGS focused on earthquake early warning, IPAWs, and over-alerting.

Breakout Discussion Questions (Session 3.1)

One of the sessions in the afternoon on Monday, February 5th will be a series of breakout discussions discussing lessons learned from communication in other hazard contexts. Because multiple breakout rooms will be going on simultaneously, these will not be included in the webcast and the webcast will be paused while the discussions are ongoing. Following the discussions, the webcast will resume and the moderators of each breakout group will provide a summary of the discussions to the larger group to capture those discussions for the webcast audience. The breakout discussions will be organized around a subset of the following questions:

- What recent advances in communicating risk and uncertainty for this hazard are relevant for TCs?
- What are the technological communications challenges in forecasting and alerting for this hazard that might inform TC risk communication?
- Who are the important intermediaries communicating about this hazard? How could they advance risk communication about the hazard, and how might this inform TC communication?
- How does a hazard's speed of onset affect the warning process? What have local authorities done to speed warning dissemination in rapid onset incidents? What information have they disseminated in advance to speed warning reception and protective response by those in the risk area?
- Which communication channels do local authorities use for warnings? What do they think are the limitations of those channels, if any? How might this inform TC communication?
- How do local authorities address population segments with special needs for warning reception and/or assistance in protective action?
- What do local authorities believe about peer warning networks (especially unintentional or deliberate misinformation) and how accurate are those beliefs?

Workshop Statement of Task

An ad hoc committee will plan a workshop to bring together experts to explore challenges and learning opportunities around actionable and understandable risk communication with decision-makers for extreme weather events. In particular, the workshop may consider the information needs, capabilities, and motivations of different decision-making audiences for risk communication (government, industrial, public) in the service of protecting lives, property and livelihoods. Discussions will include issues of justice, equity and inclusion in risk communication and community engagement both with and for vulnerable and underserved communities.

Workshop discussion will consider the following topics:

• Explore the current understanding of effective communication practices and features to convey to decision-makers uncertainty/probabilistic information about risks associated with discrete, extant extreme weather events. Discussions may include barriers faced by decision-makers in implementing uncertainty/probabilistic information, benefits and challenges with existing Impact-Based Decision Support Services (IDSS), and lessons learned in the light of recent events.

• Examine risk communication and decision-making challenges posed by extreme weather events that are unprecedented in nature or scale for the affected locations. Discuss what communication practices and features are most effective for addressing these challenges, which may include accounting for historical precedence, diverse populations, and the impacts of climate change on the nature, behavior and frequency of extreme weather events as well as the potential for compounding or cascading events.

• Explore opportunities for learning from synergies, successes and challenges across multiple hazards and decision-making contexts and applying them to the hurricane context. Discussions may include hazard or event types with different lead times, different motivations (or success criteria) among decision-makers, vulnerable communities or livelihood sectors with different characteristics, outcomes of communication that are considered both “successful” and “unsuccessful”, and factors and strategies that contribute to successful community engagement and co-production of risk-reduction strategies.

Planning Committee Bios

Ann Bostrom (*Chair*) is the Weyerhaeuser endowed Professor in Environmental Policy at the Evans School of Public Policy and Governance, University of Washington. Until 2007 she was Professor of Public Policy and Associate Dean for Research of the Ivan Allen College of Liberal Arts at Georgia Institute of Technology, and co-directed the Decision, Risk and Management Science Program at the National Science Foundation (NSF) from 1999 to 2001. She studies risk perceptions, risk communication, and mental models of hazards: how people understand and make decisions under uncertainty about, for example, climate change, extreme weather, and earthquakes. Bostrom currently co-directs the NSF-funded Cascadia Coastlines and Peoples Hazards Research Hub and co-leads risk communication in the NSF Artificial Intelligence (AI) Institute for research on Trustworthy AI in Weather, Climate and Coastal Oceanography. Bostrom previously served as the task team co-lead for the National Oceanic and Atmospheric Administration's Science Advisory Board "Priorities for weather research" report. She is also a Fellow and former President of the Society for Risk Analysis, and recipient of its Chauncey Starr and Distinguished Educator Award. She is also a Fellow of the American Association for the Advancement of Science and an elected member of the Board of Directors of the Washington State Academy of Sciences. Bostrom received a Ph.D. in policy analysis from Carnegie Mellon University. She also received an M.B.A. from Western Washington University and a B.A. in English from the University of Washington. She co-chaired the National Academies of Sciences, Engineering, and Medicine consensus report on Integrating Social and Behavioral Sciences Within the Weather Enterprise and contributed to Communicating Science Effectively: A Research Agenda.

Dereka Carroll-Smith is a Postdoctoral Research Associate for the National Institute of Standards and Technology-Professional Research Experience Program at the University of Maryland College Park and a research meteorologist for the National Wind Impacts Reduction Program. Carroll-Smith also holds a joint appointment as a Program Coordinator and Adjunct Professor in the Department of Chemistry, Physics, and Atmospheric Sciences at Jackson State University, and as a Scientific Visitor at the National Center of Atmospheric Research (NCAR), where she conducts interdisciplinary research focusing on secondary tropical cyclone hazards, climate change, and associated societal impacts. While in graduate school, she received the David M. Knox endowment fellowship and the National Science Foundation Graduate Research Fellowship which allowed her the freedom to explore her interdisciplinary interests. Carroll- Smith is a member of the American Meteorological Society and serves on the steering committee for the Significant Opportunities in Atmospheric Research and Science program at NCAR and served as co-rapporteur of the tropical cyclone tornado section for the World Meteorological Organization's 10th workshop on Tropical Cyclones. Carroll-Smith received a B.S. in meteorology from Jackson State University, an M.S. in atmospheric science from Purdue University, and a Ph.D. in atmospheric science from the University of Illinois Urbana-Champaign.

Brad R. Colman is currently serving as President of the American Meteorological Society (AMS). Prior to this role he served as Director of Weather Strategy for Bayer/The Climate Corporation where he oversaw and guided the design and execution of the Bayer Enterprise weather programs. Before joining Bayer/Climate, Colman worked on a new Microsoft consumer weather service team to serve weather information across the entire Microsoft ecosystem. Previously, Colman had a diverse career

with the National Oceanic and Atmospheric Administration (NOAA) where he worked at The National Weather Service's forecast office in Seattle, Washington; NOAA's Environmental Research Laboratory; and was the Acting Director of NOAA's Meteorological Development Laboratory. Colman is a member and Fellow of the AMS, a member of the Washington State Academy of Sciences, and is currently co-chair of NOAA's Science Advisory Board's Environmental Information Services Working Group. Colman received a B.S. in Earth sciences and mathematics from Montana State University and an Sc.D. in atmospheric sciences from the Massachusetts Institute of Technology. He currently serves on the National Academy of Sciences, Engineering, and Medicine's Roundtable on Macroeconomics and Climate Change and the Board on Atmospheric Sciences and Climate.

W. Craig Fugate provides senior level advice and consultation in disaster management and resiliency policy through Craig Fugate Consulting LLC. Previously, he served as the Administrator of the Federal Emergency Management Agency (FEMA) and the Florida Emergency Management Director from 2001 to 2009. Fugate led FEMA through multiple record-breaking disaster years and oversaw the federal government's response to major events such as the Joplin and Moore Tornadoes, Hurricane Sandy, Hurricane Matthew, and the 2016 Louisiana flooding. He successfully managed the devastating effects of the 2004 and 2005 Florida hurricane seasons (Charley, Frances, Ivan, Jeanne, Dennis, Katrina, and Wilma). Fugate holds a certificate as a paramedic from Santa Fe College in Gainesville Florida. He also serves as a member of the National Academies of Sciences, Engineering, and Medicine's Gulf Research Program Division Committee.

Michael Lindell is an Emeritus Professor, Texas A&M University; Affiliate Professor, University of Washington Department of Urban Design and Planning; Affiliate Professor, Boise State University Department of Geosciences; and Affiliate Professor, Oregon State University School of Civil and Construction Engineering, and currently serves as a consultant on two hurricane warning and evacuation research projects funded by the National Science Foundation and U.S. Army Corps of Engineers. He has conducted emergency management research and provided technical services to 40 different organizations in the public and private sectors and conducted research on topics ranging from surveys of disaster warning response to the development of an evacuation management decision support system. He also conducted a series of hurricane evacuation planning studies for the Texas Division of Emergency Management during his term as the Director of the Texas A&M University Hazard Reduction & Recovery Center. He has received awards from the International Sociological Association and the Human Factors and Ergonomics Society for his development of the Protective Action Decision Model, which summarizes research on human response to disaster warnings. Lindell received a Ph.D. in social psychology at the University of Colorado, Boulder, while working on the first NSF-funded Assessment of Research on Natural Hazards.

Andrea Schumacher is a Project Scientist in the Weather Risks and Decisions in Society research group at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. She works in the interdisciplinary space between atmospheric and social science, and her most recent research focuses on how information use, risk perceptions, and behavioral responses evolve in the days prior to a landfalling hurricane. Previously she was a Research Associate at the Cooperative Institute for Research in the Atmosphere at Colorado State University, where she was the Lead of the Societal Impacts of Weather and Climate Team, tropical cyclone (TC) forecast product developer and satellite liaison. She has collaborated extensively with operational TC forecasters in the National Weather Service, especially on the topic of communicating TC wind hazards and probabilities to a variety of

decision makers. Her work on the National Hurricane Center TC wind speed probability product earned her an Outstanding Achievement Award in Meteorology from the National Hurricane Conference and a Leadership Award from the Louisiana Emergency Preparedness Association. Schumacher received an M.S. in atmospheric science from Colorado State University.

Marshall Shepherd is the Georgia Athletic Association Distinguished Professor of Geography and Atmospheric Sciences at the University of Georgia and Director of its Atmospheric Sciences Program. Prior to academia, he spent 12 years as a scientist at the National Aeronautics and Space Administration Goddard Space Flight Center and was Deputy Project Scientist of the Global Precipitation Measurement Mission. Shepherd is the host of The Weather Channel's Weather Geeks Podcast, a senior contributor to Forbes Magazine, and has three TEDx talks on climate science and communication. Shepherd is a recipient of a Presidential Early Career Award for Scientists and Engineers, the Captain Planet Foundation Protector of the Earth Award, the 2019 AGU Climate Communication Prize, the 2020 Mani L. Bhaumik Award for Public Engagement with Science, and the 2018 American Meteorological Society (AMS) Helmut Landsberg Award. He is an elected member of the National Academy of Sciences, National Academy of Engineering, and the American Academy of Arts and Sciences and was the 2013 President of AMS. Shepherd received a B.S., M.S. and Ph.D. from Florida State University. He currently serves as a member of the National Academies of Sciences, Engineering, and Medicine's Board on Atmospheric Sciences and Climate.

Jeannette Sutton is currently an Associate Professor in the Department of Emergency Preparedness and Homeland Security at the University at Albany where she directs the Emergency and Risk Communication Message Testing Lab. Sutton has led research associated with natural, technological, and human induced phenomena, with a focus on alerts and warnings over short messaging channels. She served for six years as the primary social scientist on the National Institute of Standards and Technology National Construction Safety Team Advisory Committee. Sutton received a Ph.D. from the University of Colorado Boulder and completed her postdoctoral training at the Natural Hazards Center. She previously served as co-chair of the National Academies of Sciences, Engineering, and Medicine's workshop on Public Response to Alerts and Warnings on Mobile Devices.

NATIONAL ACADEMIES Sciences Engineering Medicine

PREVENTING DISCRIMINATION, HARASSMENT, AND BULLYING:
POLICY FOR PARTICIPANTS IN NASEM ACTIVITIES

The National Academies of Sciences, Engineering, and Medicine (NASEM) are committed to the principles of diversity, inclusion, integrity, civility, and respect in all of our activities. We look to you to be a partner in this commitment by helping us to maintain a professional and cordial environment. **All forms of discrimination, harassment, and bullying are prohibited in any NASEM activity.** This policy applies to all participants in all settings and locations in which NASEM work and activities are conducted, including committee meetings, workshops, conferences, and other work and social functions where employees, volunteers, sponsors, vendors, or guests are present.

Discrimination is prejudicial treatment of individuals or groups of people based on their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws.

Sexual harassment is unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature that creates an intimidating, hostile, or offensive environment.

Other types of harassment include any verbal or physical conduct directed at individuals or groups of people because of their race, ethnicity, color, national origin, sex, sexual orientation, gender identity, age, religion, disability, veteran status, or any other characteristic protected by applicable laws, that creates an intimidating, hostile, or offensive environment.

Bullying is unwelcome, aggressive behavior involving the use of influence, threat, intimidation, or coercion to dominate others in the professional environment.

REPORTING AND RESOLUTION

Any violation of this policy should be reported. If you experience or witness discrimination, harassment, or bullying, you are encouraged to make your unease or disapproval known to the individual at the time the incident occurs, if you are comfortable doing so. You are also urged to report any incident by:

- Filing a complaint with the Office of Human Resources at 202-334-3400 or hrservicecenter@nas.edu, or
- Reporting the incident to an employee involved in the activity in which the member or volunteer is participating, who will then file a complaint with the Office of Human Resources.

Complaints should be filed as soon as possible after an incident. To ensure the prompt and thorough investigation of the complaint, the complainant should provide as much information as is possible, such as names, dates, locations, and steps taken. The Office of Human Resources will investigate the alleged violation in consultation with the Office of the General Counsel.

If an investigation results in a finding that an individual has committed a violation, NASEM will take the actions necessary to protect those involved in its activities from any future discrimination, harassment, or bullying, including in appropriate circumstances **the removal of an individual from current NASEM activities and a ban on participation in future activities**.

CONFIDENTIALITY

Information contained in a complaint is kept confidential, and information is revealed only on a need-to-know basis. NASEM will not retaliate or tolerate retaliation against anyone who makes a good faith report of discrimination, harassment, or bullying.

Updated December 2, 2021

NATIONAL ACADEMIES Sciences Engineering Medicine

A GUIDE TO THE

Harassment Complaint Process for Participants

AT THE NATIONAL ACADEMIES

Review the Policy here.

Complaints regarding violations of the National Academies anti-harassment policies should be reported by:

- Filing a complaint with the Office of Human Resources at 202-334-3400 or hrservicecenter@nas.edu or
- Reporting the incident to an employee involved in the activity in which you are participating.

Complaints of harassment, discrimination, or bullying should be filed as soon as possible after an incident. The Office of Human Resources will investigate the alleged violation in consultation with the Office of the General Counsel.

When reporting an incident, please provide as much of the following information as is possible and applicable:

- Name and role of the person or persons allegedly causing the harassment;
- Description of the incident(s), including the dates, locations and the presence of any witnesses;
- Steps taken to try to stop the harassment; and
- Any other information that may be relevant.

If the National Academies determines that a participant in a National Academies activity has violated this policy, the National Academies will take action as it deems appropriate to address the situation and to prevent the participant from engaging in future discrimination, harassment, or bullying in National Academies activities, up to and including banning that individual from current or future participation in National Academies activities.

All inquiries, complaints, and investigations are confidential, and information is revealed only on a need-to-know basis. Information contained in a complaint is kept confidential. The National Academies will not retaliate or tolerate retaliation against anyone who makes a good faith report of discrimination, harassment, or bullying. or participates in a complaint investigation.

For more information, please watch the following videos from our Expert Volunteer Orientation:

- Making a Commitment to Diversity, Equity, and Inclusion
- Preventing Discrimination, Harassment, and Bullying