

AGENDA

Welcome to the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research (NRC/RES) 5th Annual NRC Probabilistic Flood Hazard Assessment (PFHA) Research Workshop. Participants include staff and contractors from NRC, Electric Power Research Institute (EPRI), federal agencies, industry, and other organizations involved in flood hazard assessment, flood risk assessment, and flood protection and mitigation research who will provide information on recent results, current activities, and perspectives on future research directions. This 3-day workshop is open to the public at no charge, but registration is required.

WEDNESDAY, FEBRUARY 19, 2020

09:00 – 09:10 **Welcome & Logistics**

Session 1A: Introduction

Session Chair: *Joseph Kanney, NRC/RES/DRA*

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| 09:00 – 09:10 | Logistics
Kenneth Hamburger, NRC/RES/DRA/FXHAB | 1A-0 |
| 09:10 – 09:20 | Introduction
Raymond Furstenau* , Director, NRC Office of Nuclear Regulatory Research | 1A-1 |
| 09:20 – 09:35 | NRC Flooding Research Program Overview
<i>Joseph Kanney, Meredith Carr*</i> , Tom Aird, Elena Yegorova, Mark Fuhrmann and Jacob Philip, NRC/RES | 1A-2 |
| 09:35 -09:50 | Overview of recent activities at USACE-RMC
Haden Smith* , Risk Management Center, U.S. Army Corps of Engineers (USACE) | 1A-3 |
| 09:50 – 10:05 | IRSN External Flooding Research Program Overview
Vincent Rebour* , Institut de radioprotection et de sûreté nucléaire (IRSN) Radioprotection and Nuclear Safety Institute | 1A-4 |
| 10:05 – 10:20 | Nuclear Energy Agency: Committee on the Safety of Nuclear Installations (CSNI): Working Group on External Events (WGEV) Flooding Overview
John Nakoski* , NRC/RES | 1A-5 |
| 10:20 – 10:40 | BREAK | |

* denotes presenter, ^ denotes remote presenter

Session 1B: Climate

Session Chair: *Elena Yegorova, NRC/RES/DRA*

- 10:40 – 11:10 Regional Climate Change Projections: Potential Impacts to Nuclear Facilities 1B-1
*L. Ruby Leung** and *Rajiv Prasad, Pacific Northwest National Laboratory (PNNL)*
- 11:10 – 11:35 Modeling of climate change induced flood risk in the Conasauga River Basin 1B-2
Tigstu T. Dullo, Tennessee Technical University (TTU), Sudershan Gangrade, Oak Ridge National Laboratory (ORNL), Md Bulbul Sharif, TTU, Mario Morales-Hernandez, ORNL, Alfred J. Kalyanapu, Sheikh K. Ghafoor, TTU, Shih-Chieh Kao and Katherine J. Evans, ORNL*
- 11:35 – 12:00 KEYNOTE - Causality and extreme event attribution. Or was my house flooded because of climate change? 1B-3
Michael F. Wehner[^], Lawrence Berkeley National Laboratory
- 12:00 – 12:25 Attribution of Flood Nonstationarity across the United States—Climate-Related Analyses 1B-4
Karen Ryberg, Stacey A. Archfield, William H. Asquith, Nancy A. Barth, Katherine J. Chase, Jesse E. Dickinson, Robert W. Dudley, Angela E. Gregory, Tessa M. Harden, Glenn A. Hodgkins, David Holtschlag, Delbert Humberson, Christopher P. Konrad, Sara B. Levin, Daniel E. Restivo, Roy Sando, Steven K. Sando, Eric D. Swain, Anne C. Tillery, Benjamin C. York, Julie E. Kiang; U.S. Geological Survey (USGS)*

12:25 – 13:30 **LUNCH**

Session 1C: Precipitation

Session Chair: *Elena Yegorova, NRC/RES/DRA*

- 13:30 – 14:00 KEYNOTE: Planned Improvements for NOAA Atlas 14 Process and Products 1C-1
Sanja Perica, Hydrometeorological Design Studies Center, Office of Water Prediction, National Weather Service, National Oceanic and Atmospheric Administration (NOAA/NWS/OWP/HDSC), Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, NOAA/NWS/OWP/HDSC and University Corporation for Atmospheric Research*
- 14:00 – 14:25 Application of Point Precipitation Frequency Estimates to Watersheds 1C-2
Shih-Chieh Kao, Scott T. DeNeale, ORNL*
- 14:25 – 14:50 How well can Kilometer-Scale Models Capture Recent Intense Precipitation Events? 1C-3
Andreas F. Prein, David Ahijevych, Jordan Powers, Ryan Sobash, Craig Schwartz, National Center for Atmospheric Research (NCAR)*

14:50 – 15:05 **BREAK**

continued... WEDNESDAY, FEBRUARY 19, 2020

Session 1C: Precipitation, continued...

Session Chair: *Elena Yegorova, NRC/RES/DRA*

- 15:05 – 15:30 Probabilistic Flood Hazard Assessment of NPP Site considering Extreme Precipitation in Korea (**Tentative due to emergent travel issue**) 1C-4
*Kun-Yeun Han**, *Beom-Jin Kim, Kyungpook National University, Korea; Minkyu Kim, Korea Atomic Energy Research Institute, Korea*
- 15:30 – 15:55 Analysis of Heavy Multi-day Precipitation Events in CMIP6 Model Simulations in Support of the Fifth National Climate Assessment 1C-5
*Kenneth Kunkel**, *North Carolina Institute for Climate Studies, North Carolina State University and David Easterling, NOAA National Centers for Environmental Information*
- 15:55 – 16:10 **Daily Wrap-up**

THURSDAY, FEBRUARY 20, 2020

08:55 – 09:00 **Day 2 Welcome**

Session 2A: Riverine Flooding

Session Chairs: *Meredith Carr and Mark Fuhrmann, NRC/RES/DRA*

- 09:00 – 9:30 KEYNOTE: An Overview NOAA's National Water Model 2A-1
*Brian Cosgrove**, *NOAA/NWS/OWP, David Gochis, Research Applications Laboratory, NCAR, Thomas Graziano, Ed Clark, and Trey Flowers, NOAA/NWS/OWP*
- 09:30 – 09:55 Moving Beyond Streamflow: Quantifying Flood Risk and Impacts through Detailed Physical Process and Geospatial Representation using the WRF-Hydro Modeling System 2A-2
*David Gochis**, *Aubrey Dugger Laura Read, NCAR*
- 09:55 – 10:20 Extreme Flood Hazard Assessment – Overview of a probabilistic methodology and its implementation for a Swiss river system 2A-3
V.N. Dang, C.A. Whealton, Paul Scherrer Institute
- 10:20 – 10:45 Practical Approaches to Probabilistic Flood Estimates: an Australian perspective 2A-4
*Rory Nathan**, *University of Melbourne*
- 10:45 – 11:05 **BREAK**

continued... THURSDAY, FEBRUARY 20, 2020

Session 2A: Riverine Flooding, continued...

Session Chairs: *Meredith Carr and Mark Fuhrmann, NRC/RES/DRA*

- 11:05 – 11:30 Columbia River Basin Regional Hydrology Studies: Regional Statistical Analyses for Flood Risk Assessment 2A-5
Angela M. Duren*, *Northwest Division, USACE Portland*
- 11:30 – 11:55 Reducing uncertainty in estimating rare flood events using paleoflood analyses: Insights from an investigation near Stillhouse Hollow Dam, TX 2A-6
Justin Pearce[^], *USACE, Risk Management Center; Brian Hall, USACE, Alessandro Parola, USACE Fort Worth; Brendan Comport, USACE Seattle; Christina Leonard, Utah State University*
- 11:55 – 12:20 Improving Flood Frequency Analysis with a Multi-Millennial Record of Extreme Floods on the Tennessee River near Chattanooga, TN 2A-7
Tess Harden*, *Jim O'Connor, USGS*
- 12:20 – 13:30 **LUNCH**
- 13:30 – 13:55 Estimating Design Floods with Specified Annual Exceedance Probabilities Using the Bayesian Estimation and Fitting Software (RMC-BestFit) 2A-8
Haden Smith*, *Risk Management Center, U.S. Army Corps of Engineers (USACE/RMC)*

Session 2B: Coastal Flooding

Session Chair: *Joseph Kanney, NRC/RES/DRA*

- 13:55 – 14:20 Coastal KEYNOTE: South Atlantic Coast Study: Coastal Hazards System 2B-1
Norberto C. Nadal-Caraballo*, *Chris Massey, Victor M. Gonzalez, USACE Engineer R&D Center, Coastal and Hydraulics Laboratory (USACE/ERDC/CHL), Kelly Legault, USACE Jacksonville District*
- 14:20– 14:45 Data, Models, Methods, and Uncertainty Quantification in Probabilistic Storm Surge Models 2B-2
Norberto C. Nadal-Caraballo*, *Victor M. Gonzalez, Efrain Ramos-Santiago, Madison O. Campbell, USACE/ERDC/CHL*
- 14:45 – 15:10 Using Physical Insights in Spatial Decomposition Approaches to Surge Hazard Assessment 2B-3
Jennifer Irish*, *Virginia Tech, Donald T. Resio, University of North Florida, Michelle Bensi, University of Maryland, Taylor G. Asher, University of North Carolina, Yi Liu, Virginia Tech, Environmental Science Associates, Jun-Whan Lee, Virginia Tech*
- 15:10 – 15:35 Investigation of Surrogate Modeling Application in Storm Surge Assessment 2B-4
Azin Al Kajbat*, *Michelle (Shelby) Bensi, University of Maryland*

continued... THURSDAY, FEBRUARY 20, 2020

15:35 – 15:45 **Daily Wrap-up**

15:45 – 17:00

Session 2C: Poster Session

Session Chair: *Thomas Aird, NRC/RES/DRA*

18:00 – 20:00

Group Dinner: TBD

FRIDAY, FEBRUARY 21, 2019

08:55 – 09:00 **Day 3 Welcome**

Session 3A: Modeling Frameworks

Session Chair: *Thomas Nicholson, NRC/RES/DRA*

- 09:00 – 09:25 Structured Hazard Assessment Committee Process for Flooding (SHAC-F) for Probabilistic Flood Hazard Assessment (PFHA) 3A-1
*Rajiv Prasad** and *Phillip Meyer, PNNL; Kevin Coppersmith, Coppersmith Consulting, Norberto C. Nadal-Caraballo, Victor M. Gonzalez, USACE/ERDC/CHL*
- 09:25 – 09:50 Using HEC-WAT to Conduct a PFHA on a Medium Watershed 3A-2
*Will Lehman**, *Brennan Beam, Matthew Fleming, and Leila Ostadrahimi, USACE, Institute for Water Resources, Hydrologic Engineering Center (IWR/HEC), Joseph Kanney, Meredith Carr, NRC*
- 09:50 – 10:15 Paleoflood Analyses for Probabilistic Flood Hazard Assessments— Approaches and Review Guidelines 3A-3
Tessa Harden, Karen Ryberg*, Jim E. O'Connor, Jonathan M. Friedman, and Julie E. Kiang, USGS*
- 10:15 – 10:40 Probabilistic Assessment of Flood Hazards Due to Combinations of Flooding Mechanisms: Study Progress and Next Steps 3A-4
*Michelle (Shelby) Bensi** and *Somayeh Mohammadi, University of Maryland, Shih-Chieh Kao and Scott DeNeale, ORNL*
- 10:40 – 10:55 **BREAK**

* indicates speaker, ^ indicates remote speaker

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Session 3B: External Flooding Operating Experience

Session Chair: *Thomas Aird, NRC/RES/DRA*

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| 10:55 – 11:20 | Risk and Operational Insights of the St. Lucie Flooding Event
John David Hanna* , <i>NRC Region III, Chicago, IL</i> | 3B-1 |
| 11:20 – 11:45 | Reflections on Fort Calhoun Flooding Yellow Finding and 2011 Flooding Event Response
Gerond George* , <i>NRC Region IV, Arlington, TX</i> | 3B-2 |
| 11:45 – 12:10 | 2019 Cooper and Fort Calhoun Flooding Event Response
Patricia Vossmar* and Mike Stafford* , <i>NRC Region IV, Arlington, TX</i> | 3B-3 |
| 12:10 – 12:25 | Panel Discussion | 3B-4 |
| 12:25 – 13:30 | LUNCH | |

Session 3C: Overview of NRC PFHA Pilot Studies

Session Chair: **TBD**

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| 13:30 – 13:40 | Local Intense Precipitation Flooding PFHA Pilot
Joseph Kanney* , <i>NRC/RES, Rajiv Prasad, PNNL</i> | 3C-1 |
| 13:40 – 13:50 | Riverine Flooding PFHA Pilot
Meredith Carr* , <i>NRC/RES, William Lehman, USACE/HEC</i> | 3C-2 |
| 13:50 – 14:00 | Coastal Flooding PFHA Pilot
Joseph Kanney* , <i>NRC/RES, Norberto Nadal-Caraballo and Victor Gonzalez, USACE/ERDC/CHL</i> | 3C-3 |
| 14:00 – 14:10 | Panel Discussion | 3C-3 |

Session 3D: Towards External Flooding PRA

Session Chair: *Mehdi Reisi-Fard, NRC/NRR/DRA*

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| 14:10 – 14:35 | EPRI External Flooding PRA Activities
Marko Randelovic* , <i>Electric Power Research Institute</i> | 3D-1 |
| 14:35 – 15:05 | KEYNOTE: Computational Methods for External Flooding PRA
Curtis L. Smith* , <i>Idaho National Laboratory</i> | 3D-2 |
| 15:05 – 15:30 | External Flooding PSA in IRSN – developments and insights
Maud Kervalla* , <i>Gabriel Georgescu, Claire-Marie Duluc
Institute for Radiological Protection and Nuclear Safety
(France)</i> | 3D-3 |
| 15:30 – 16:00 | Final Wrap-up Discussion | |