BAMS
Meeting Summary

Summary of an Interdisciplinary Workshop on Risk-Relevant Gaps and Needs in Freezing Rain Science

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What: Freezing rain scientists and stakeholders generated a road map of risk-relevant knowledge gaps in freezing rain science and critical avenues to fill those gaps.
When: 11–12 October 2021
Where: Online

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On 11–12 October 2021, Purdue University hosted the Purdue Ice Storm Risk Workshop, a 2-day interdisciplinary workshop bringing together over 20 experts from across weather and climate science and a wide range of sectors, including meteorology, climate, forestry, energy, aviation, agriculture, and economics. Freezing rain, even in small amounts, can cause acute, devastating impacts across multiple sectors each year. Yet this topic has received little research attention compared to other major meteorological hazards, and the community that studies it is relatively small. The workshop's primary goal was to bring this community of scientists and stakeholders together to generate a road map of risk-relevant knowledge gaps in freezing rain science and critical avenues to fill those gaps.

The workshop was held virtually through Zoom and was facilitated professionally by Divergent Science and Lean-To Collaborations. Initial planning for the workshop began in 2019 with a target date of May 2020, but was postponed twice due to the COVID-19 pandemic and eventually held virtually to ensure that it would not be postponed again. The workshop was funded jointly by an NSF grant and a seed grant from the Purdue Climate Change Research Center. The organizing team comprised faculty members at Purdue University across Earth, Atmospheric, and Planetary Sciences, Forestry and Natural Resources, and Ecological and Environmental Engineering.

Participants used the interactive web platform Mural to facilitate collaboration. On day 1, workshop facilitators led the group through open brainstorming sessions and small-group breakout discussions to get participants out of their intellectual boxes and stimulate novel cross-disciplinary discussion and ideation regarding what we know, do not know, and need to know regarding freezing rain science and impacts. On day 2, the group came together to collectively map out common, critical knowledge gaps and potential solutions that emerged from the prior day.

The workshop had four key outcomes. First, the workshop fostered a new, collaborative network of researchers and stakeholders from academia and the public/private sector interested in freezing rain science and impacts. Second, stakeholders seeking to mitigate risk across sectors shared a common need for impact-relevant measures of freezing rain, particularly ice accretion amount/rate, ice duration, and joint occurrence with wind or cold, that are not currently captured by traditional meteorological forecast variables focused solely on the occurrence of freezing rain. Moreover, estimating these quantities requires the diagnosis of freezing rain and freezing drizzle in real time, which remains a significant challenge for our current observational system. Third, the extent to which current forecast models can skillfully forecast impact-relevant measures of freezing rain,

as well as the underlying causes of forecast biases, is currently poorly understood, which limits our ability to mitigate risks in any sector. Finally, stakeholders expressed the need for midterm (30-yr) projections of freezing rain changes, which is a time scale that is more actionable than longer-term (end-of-century) projections though also challenging given the large natural variability of freezing rain. Overall, the challenges limiting our understanding of present-day risk and forecast model skill hinder our ability to confidently assess how freezing rain risks will change with future climate change.

The group generated a road map with four key directions to help fill these knowledge gaps and increase resilience to freezing rain impacts. First and foremost, there is an urgent need for a coherent, public, and easy-to-use climatological geographic database over North America of key freezing rain quantities relevant to risk, including freezing rain and drizzle frequency, duration, and ice accretion amount/rate, at high spatial and temporal (subdaily) resolution. Such an effort would ideally integrate both public and private data sources given the current challenges of diagnosing freezing rain in real time. Second, a synthesis and dataset of climatological freezing rain risks across sectors, including forestry, energy, and transportation, would be of great value to quantify relationships between weather, climate, and impact risk. Third, a detailed evaluation is needed of the skill of forecast models, including short-term weather forecast models, historical "reanalysis" datasets, and climate models, to represent and predict freezing rain amounts and key causes of biases. Finally, given the acute nature of freezing rain impacts, continued dialogue between on-the-ground stakeholders and weather/climate scientists is critical to ensure the science is addressing decision-relevant needs. Progress in these directions can rapidly advance our limited understanding of freezing rain meteorology and impacts and provide the foundation for determining how these impacts will change in the future.