Local Experience and Scientific Uncertainty: Implications for Communicating Extreme Event Attribution Findings

Joe Ripberger
Associate Professor, Public Policy
Deputy Director for Research, Institute for Public Policy Research and Analysis
University of Oklahoma

Guiding Questions

My Research Focus:

- Public opinion on climate change and extreme weather risk communication

Today's Focus:

1. What does current research tell us about the impact of personal experience with extreme events on climate change opinions and behaviors?
2. What does current research tell us about the inclusion of uncertainty information in risk communication?

Implications for effectively communicating the results of extreme event attribution studies

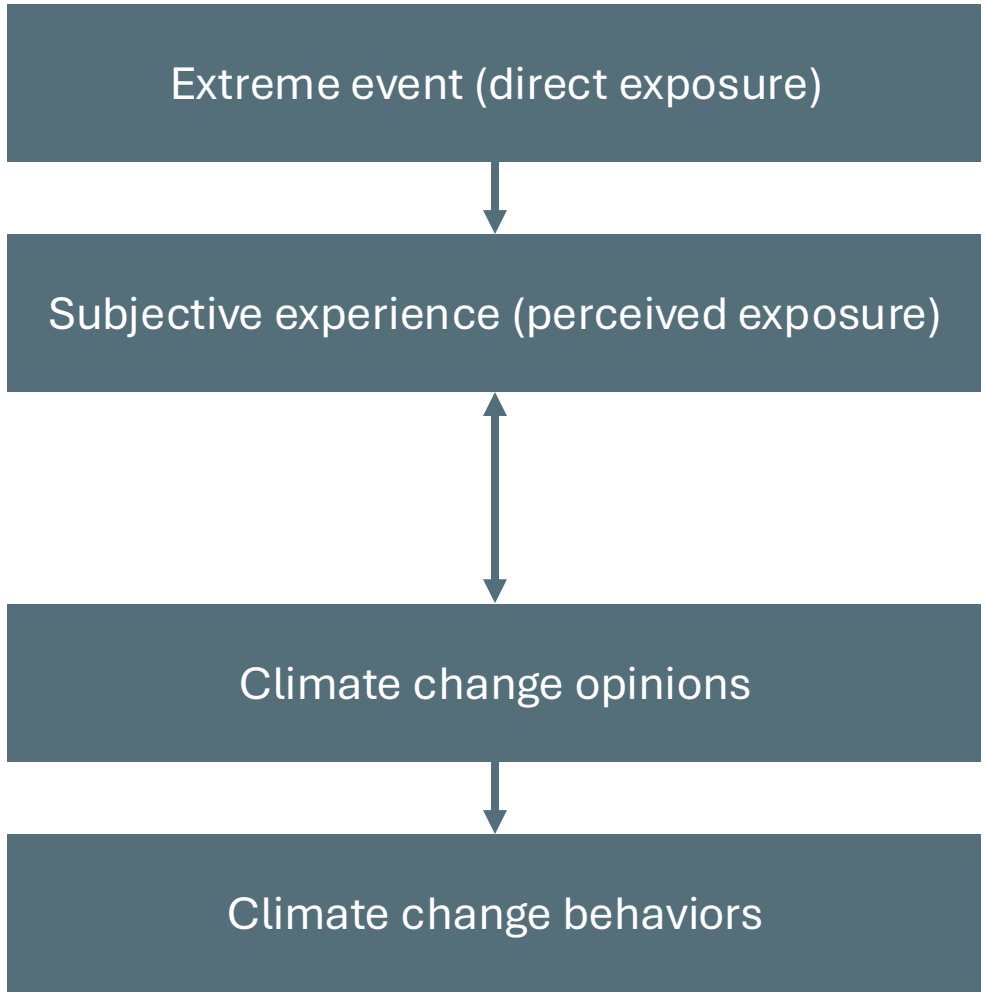
Personal Experience and Climate Change Opinions

- A large body of evidence indicates that personal experience with weather and climate extremes ***can*** influence climate change opinions and behaviors.[1, 2]

- Evidence further indicates that these relationships are complex and often heavily dependent on **pre-existing beliefs (priors)**.

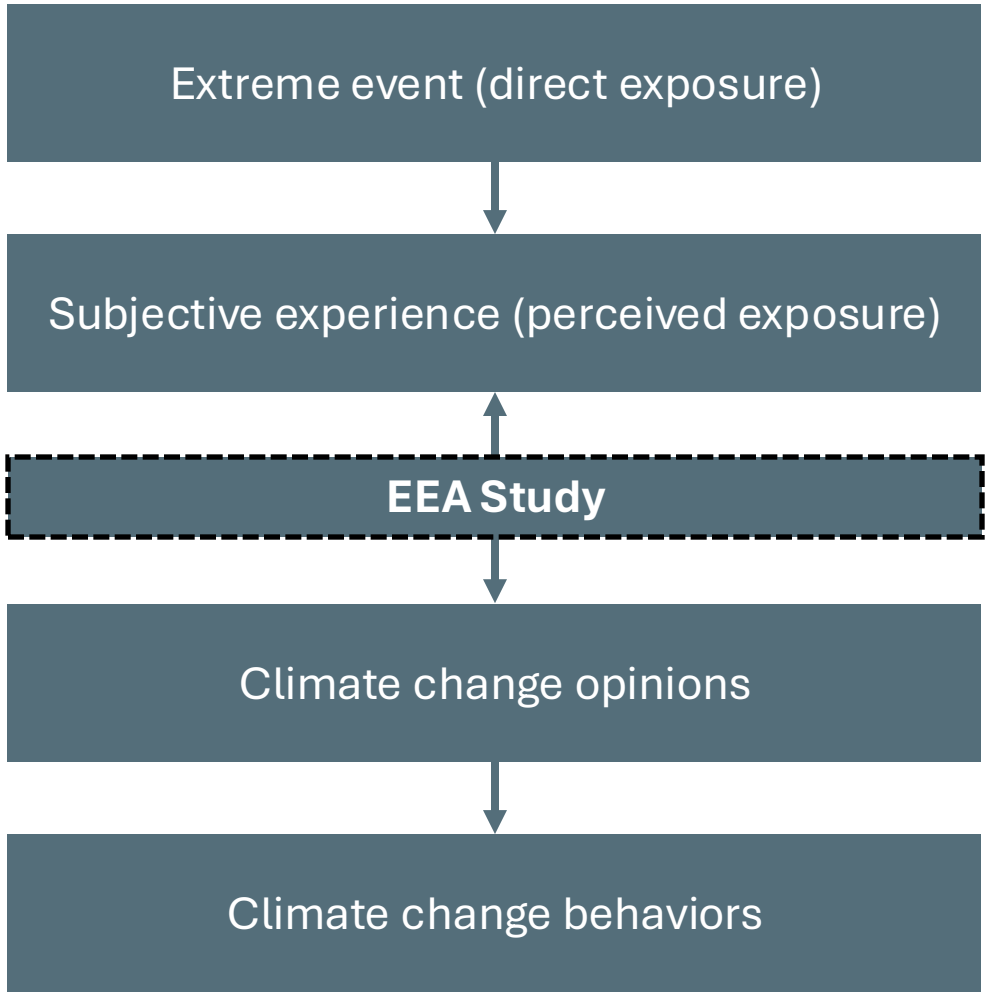
    - Individuals who **accept** the reality of climate change are more likely to notice extreme events and attribute them to climate change than those who do not.[3, 4]

    - Individuals who **do not accept** the reality of climate change are more likely to update their opinions in response to extreme events than those who do.[5-7]



Implications for Communicating the Results of EEA Studies

- Personal experience and climate change opinions as a “self-directed” exercise in extreme event attribution (EEA)—individuals assess the events they live through, decide if climate change is a cause, and adjust their opinions or behaviors accordingly.
- What happens when we attempt to inform this self-directed process using findings from EEA studies?
- **Pre-existing beliefs (priors)** are likely to shape how individuals receive and respond to EEA findings, and we may need to adjust our communication and measurement strategies to acknowledge this possibility.
    - For individuals who **accept** the reality of climate change, EEA findings are likely to reinforce existing opinions, so communication and measurement strategies may be more effective if they focus on **behaviors**.
    - For individuals who **do not accept** the reality of climate change, EEA findings have the potential to change **opinions**, but only if communicated in ways that **build trust** and connect to personally relevant experiences and values.



Risk and Uncertainty Communication

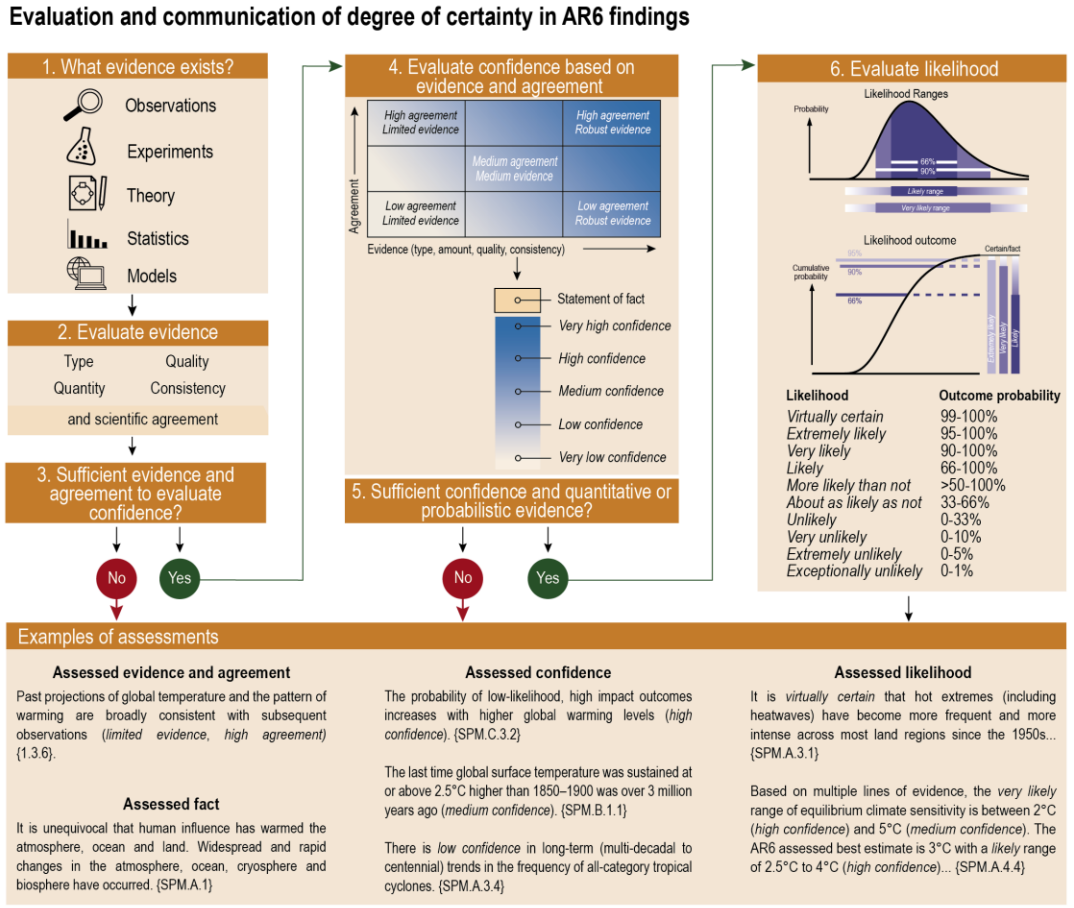
- Uncertainty is inherent in all scientific enterprises, and it can be tempting to minimize it when communicating results to policymakers or the public—whether out of concern that it will undermine trust in the findings, or that the nuance will be too confusing for people to follow.

- A large body of evidence suggests that this instinct is often misguided: when communicated clearly and transparently, information about uncertainty can build **trust** and support **informed decision-making**.[8, 9]

    - Research provides many recommendations on how to do this in situations where there is robust evidence and relatively strong agreement about the likelihood of an event, outcome, or relationship.[10-12]

    - Less research and fewer recommendations exist for situations where evidence is limited, rapidly evolving, or where expert consensus has not yet emerged—cases of "epistemic uncertainty."[13]

        - Research on COVID-19 risk communication provides a few examples.[14, 15]



Source: Chen, D. et al. Framing, context, and methods. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (eds Masson-Delmotte, V. et al.) 147–286 (Cambridge Univ. Press, 2021).

Risk and Uncertainty Communication

- Uncertainty is inherent in all scientific enterprises, and it can be tempting to minimize it when communicating results to policymakers or the public—whether out of concern that it will undermine trust in the findings, or that the nuance will be too confusing for people to follow.

- A large body of evidence suggests that this instinct is often misguided: when communicated clearly and transparently, information about uncertainty can build **trust** and support **informed decision-making**.[8, 9]

    - Research provides many recommendations on how to do this in situations where there is robust evidence and relatively strong agreement about the likelihood of an event, outcome, or relationship.[10-12]

    - Less research and fewer recommendations exist for situations where evidence is limited, rapidly evolving, or where expert consensus has not yet emerged—cases of "epistemic uncertainty."[13]

        - Research on COVID-19 risk communication provides a few examples.[14, 15]

Lessons emerging from this research…

1. Simply acknowledging that uncertainty exists—without context about its **magnitude** or **source**—can erode trust.

    - Avoid vague statements like "there is some uncertainty around this estimate or statement."

2. When possible, provide information about the **magnitude** of uncertainty around an estimate or statement, ideally using numbers (e.g., ranges or intervals) rather than—or in addition to—words.

3. If the medium allows, also include information about the **source (cause)** of uncertainty around an estimate or statement—what's driving it?

Implications for Communicating the Results of EEA Studies

- Uncertainty is inherent in extreme event attribution.
- Most EEA studies—particularly those from World Weather Attribution—appear to align well with evidence-based practices for communicating uncertainty.
- However, there is still a clear need for additional research and testing to identify the most ***effective*** way to incorporate uncertainty information when discussing the results of EEA studies. This is especially true when there is uncertainty about uncertainty.
- There is often room for more explicit discussion of what we mean by ***effective***?
    - Is the objective to inform, build trust, prompt action, change opinions?
    - Clarifying the objective is essential for guiding both communication strategies and how we evaluate their impact.

Lessons emerging from this research…

1. Simply acknowledging that uncertainty exists—without context about its **magnitude** or **source**—can erode trust.
    - Avoid vague statements like “there is some uncertainty around this estimate or statement.”
2. When possible, provide information about the **magnitude** of uncertainty around an estimate or statement, ideally using numbers (e.g., ranges or intervals) rather than—or in addition to—words.
3. If the medium allows, also include information about the **source (cause)** of uncertainty around an estimate or statement—what’s driving it?

References*

1. Howe, P. D., Marlon, J. R., Mildenberger, M. & Shield, B. S. How will climate change shape climate opinion? Environ. Res. Lett. 14, 113001 (2019).
2. Howe, P. D. Extreme weather experience and climate change opinion. Current Opinion in Behavioral Sciences 42, 127–131 (2021).
3. Howe, P. D. & Leiserowitz, A. Who remembers a hot summer or a cold winter? The asymmetric effect of beliefs about global warming on perceptions of local climate conditions in the U.S. Global Environmental Change 23, 1488–1500 (2013).
4. Shao, W. Are actual weather and perceived weather the same? Understanding perceptions of local weather and their effects on risk perceptions of global warming. Journal of Risk Research 19, 722–742 (2016).
5. Deryugina, T. How do people update? The effects of local weather fluctuations on beliefs about global warming. Climatic Change 118, 397–416 (2013).
6. Jenkins-Smith, H. C. et al. Partisan asymmetry in temporal stability of climate change beliefs. Nat. Clim. Chang. 10, 322–328 (2020).
7. Carlson, D. et al. The causal impact of local weather anomalies on beliefs about the occurrence of climate change. Environ. Res. Commun. 5, 115006 (2023).
8. Gustafson, A. & Rice, R. E. A review of the effects of uncertainty in public science communication. Public Underst Sci 29, 614–633 (2020).
9. Kerr, J. R., Schneider, C. R., Freeman, A. L. J., Marteau, T. & van der Linden, S. Transparent communication of evidence does not undermine public trust in evidence. PNAS Nexus 1, pgac280 (2022).
10. Spiegelhalter, D. Risk and Uncertainty Communication. Annual Review of Statistics and Its Application 4, 31–60 (2017).
11. Bonner, C. et al. Current Best Practice for Presenting Probabilities in Patient Decision Aids: Fundamental Principles. Med Decis Making 41, 821–833 (2021).
12. Ripberger, J. et al. Communicating Probability Information in Weather Forecasts: Findings and Recommendations from a Living Systematic Review of the Research Literature. Weather, Climate, and Society 14, 481–498 (2022).
13. van der Bles, A. M. et al. Communicating uncertainty about facts, numbers and science. Royal Society Open Science 6, 181870 (2019).
14. Kerr, J. et al. The effects of communicating uncertainty around statistics, on public trust. Royal Society Open Science 10, 230604 (2023).
15. Dries, C., McDowell, M., Rebitschek, F. G. & Leuker, C. When evidence changes: Communicating uncertainty protects against a loss of trust. Public Underst Sci 33, 777–794 (2024).

***Note that all references are intended as examples (e.g.), not an exhaustive list.**