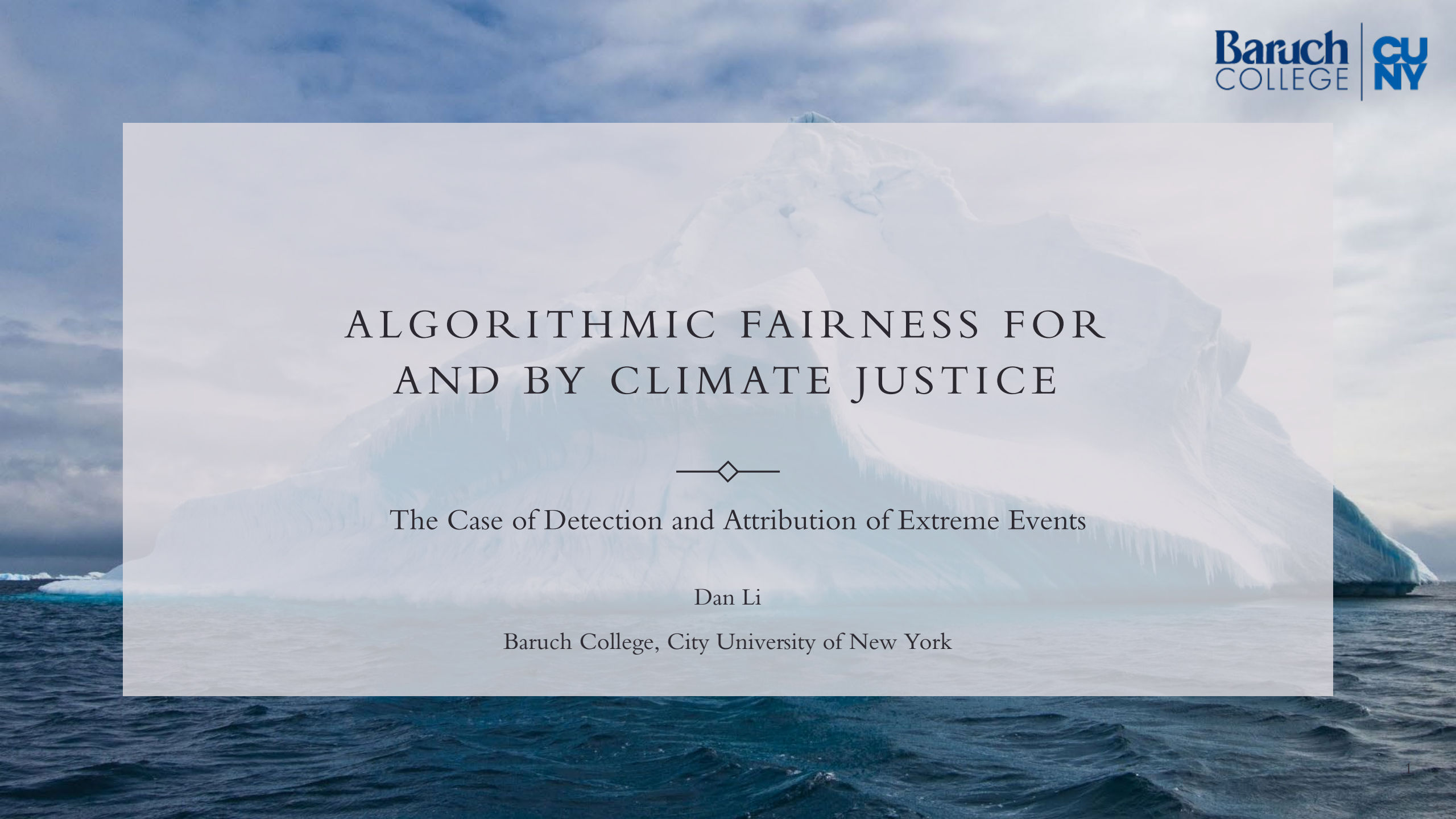

ALGORITHMIC FAIRNESS FOR AND BY CLIMATE JUSTICE

The Case of Detection and Attribution of Extreme Events

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Baruch College, City University of New York

Fair or not fair

Who gets selected in a job interview?

Should communities with different infrastructure get the same kind of flood warning?

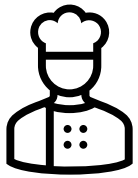
Where is “fairness”

For example, AGU’s community report “Ethical and Responsible Use of AI/ML in the Earth, Space, and Environmental Sciences” (Stall et al. 2023)

- Transparency

- replicability

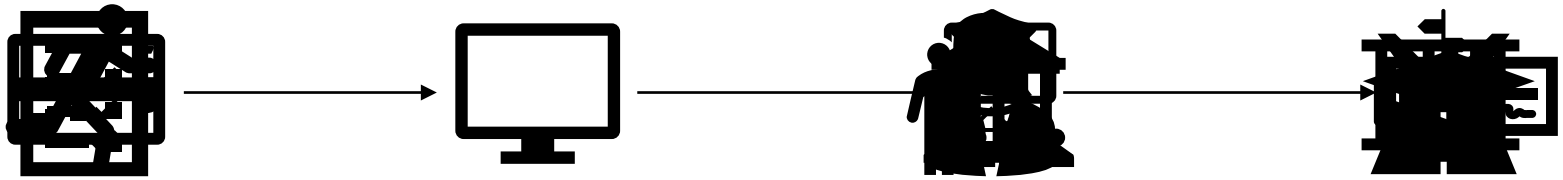
- interpretability



Chef-in-the-kitchen mentality
(deontological, in philosophers’ jargon)

What do customers say?
(consequentialist, in philosophers’ jargon)

Fairness of Process



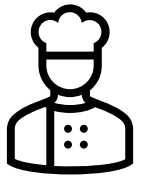
Screening software

Machine learning

Algorithmic Fairness

- Separation: Same false positive and false negative rates of predictions across groups
- Sufficiency: Same actual outcome given the same predictions across groups

Limitations of "Algorithmic Fairness"



1. Impossibility Theorem

- separation and sufficiency cannot be satisfied simultaneously unless the data are already perfectly fair (Angwin and Larson 2016; Kleinberg et al. 2016; Chouldechova 2017; Barocas et al. 2019)

2. Fairness as an attribute of the algorithm

- "Likes alike, unlikes unalike" (reproducing inequality)

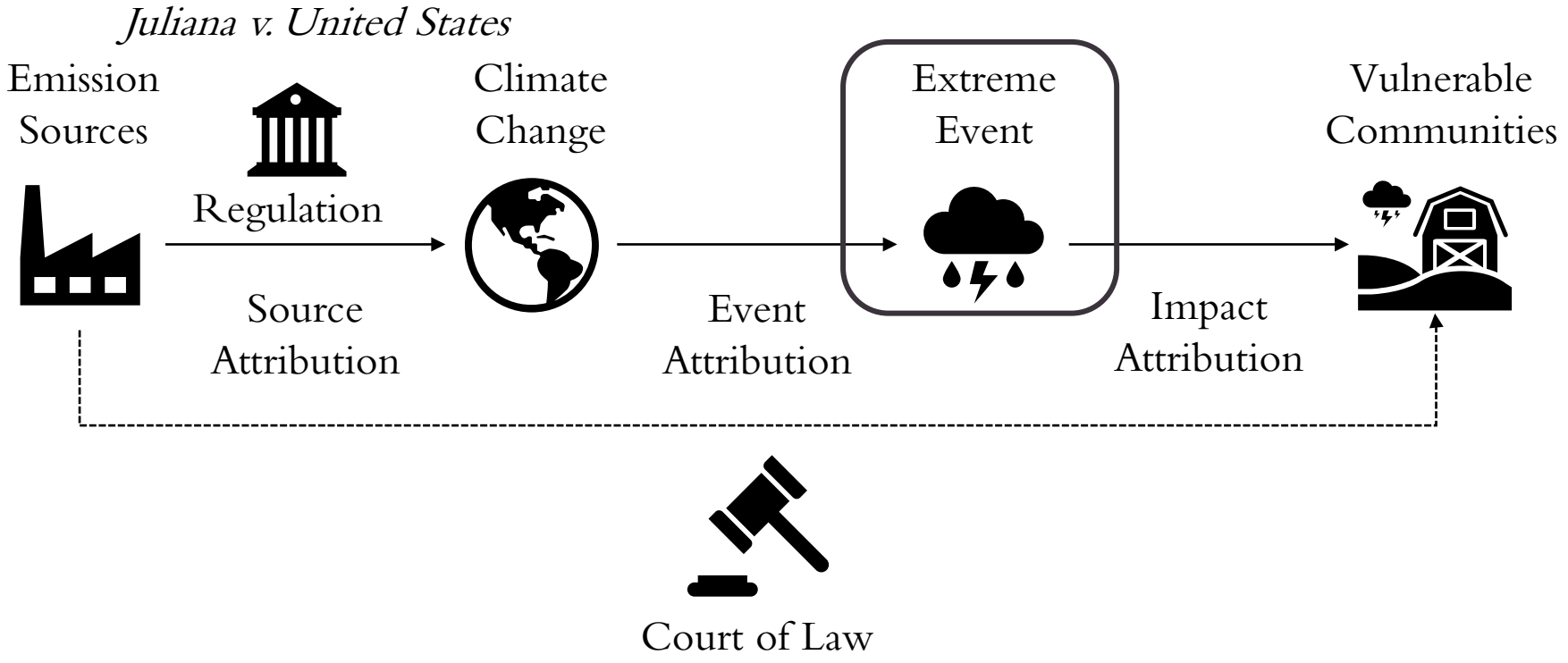
- Restricts analysis to specific decision points; cannot account for inequalities that often surround those decision points (Green 2022) → consequentialist approach

3. Fairness only in the context of social justice

- having to do with task (data ontology, or the way we make categories for data)

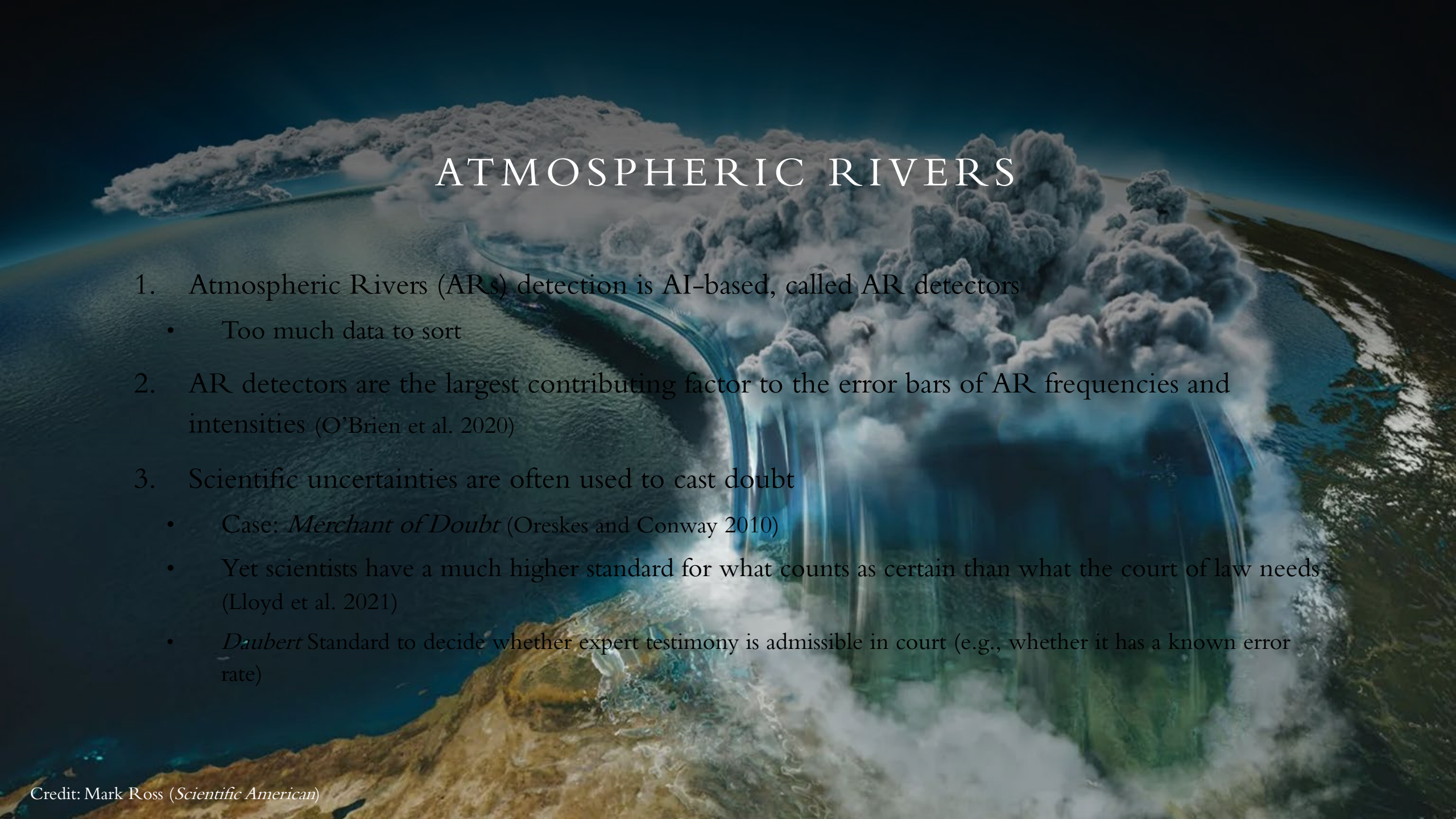
Algorithmic Fairness informed by Climate Justice

Detection and Attribution of Extreme Events (and its science and law, Burger et al. 2020)

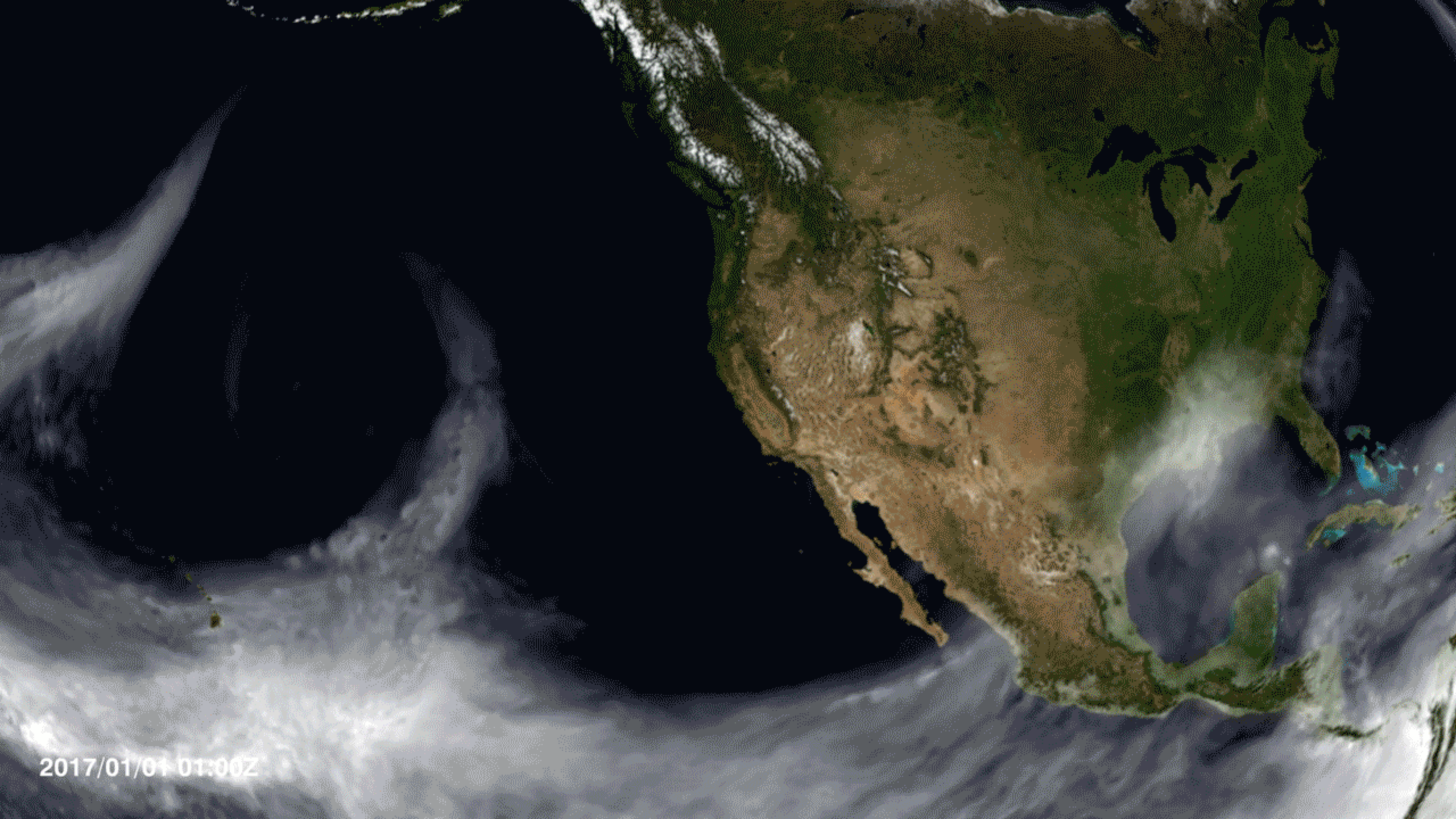


ATMOSPHERIC RIVERS

1. Atmospheric Rivers (ARs) detection is AI-based, called AR detectors
   - Too much data to sort
2. AR detectors are the largest contributing factor to the error bars of AR frequencies and intensities (O'Brien et al. 2020)
3. Scientific uncertainties are often used to cast doubt
   - Case: *Merchant of Doubt* (Oreskes and Conway 2010)
   - Yet scientists have a much higher standard for what counts as certain than what the court of law needs (Lloyd et al. 2021)
   - *Daubert* Standard to decide whether expert testimony is admissible in court (e.g., whether it has a known error rate)



Credit: Mark Ross (*Scientific American*)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Difference between Scientific Reasoning vs. Legal Reasoning

SCIENTIFIC

experiment
- Randomized control trials
- Cohort studies (natural experiment)

results
- Aggregate data
- Statistical significance

analysis
- "Smoking increases risk of cancer"
- "Warmer atm. → ext. more frequent

Induction: from finite # → generalizations
To establish causation, in general

LEGAL(TORT LAW)

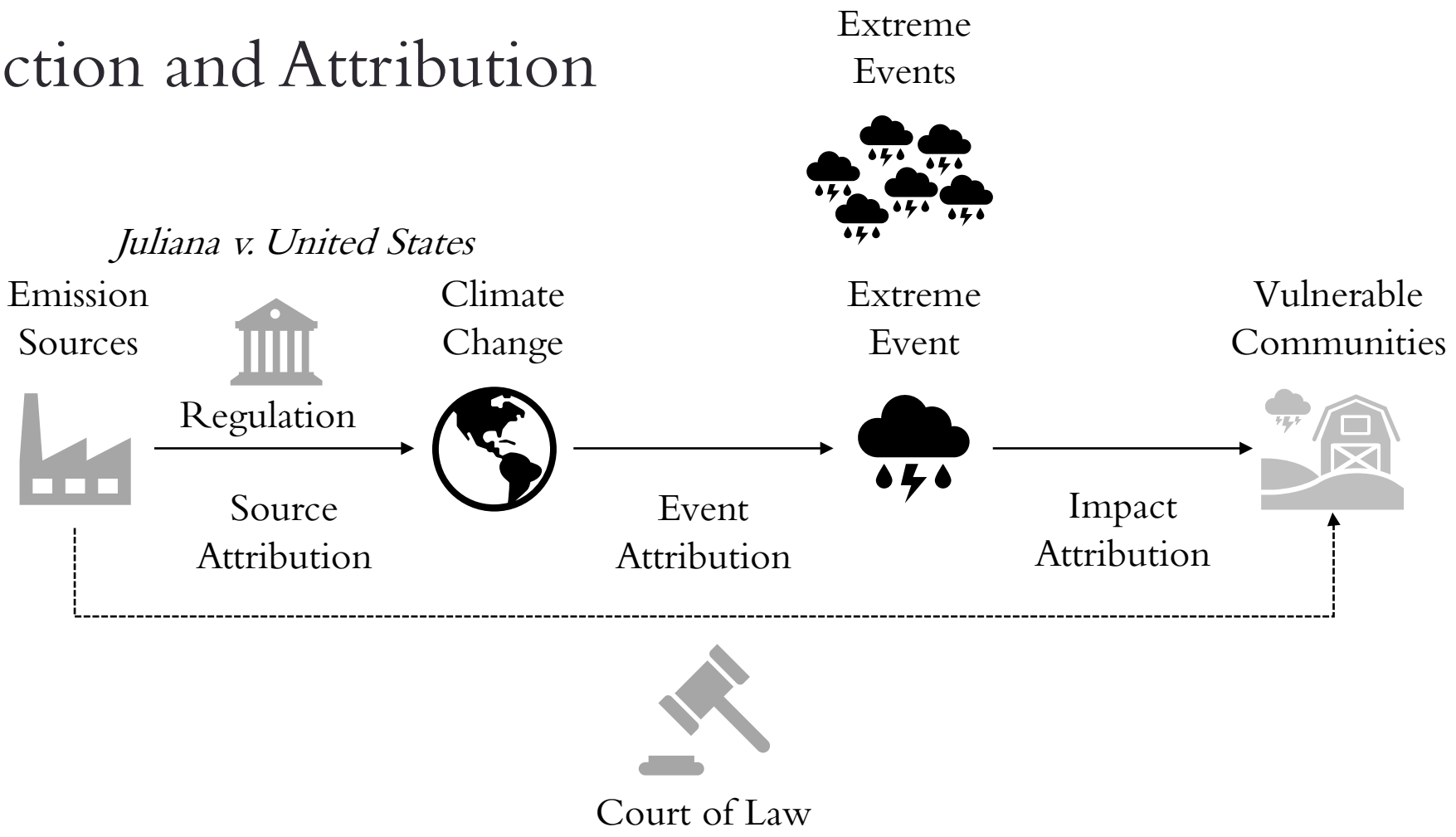
evidence
- Evidence of *individualized* harm
- Responsible party

explanation
- Causal chain (from action to harm)
- Competing causal chains

Best explanation
- Eliminate competing explanations
- Establish the best explanation

Abduction: inference to the best explanation
To establish causation, in particular

Detection and Attribution

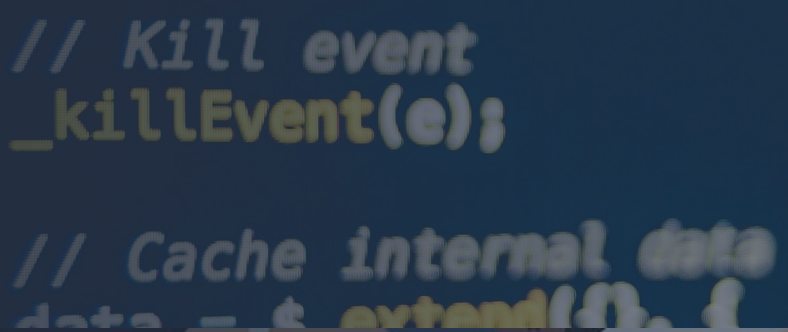


Conclusion

Conclusion

1. Sole focus on algorithms, missing greater contexts
   - Source of data
   - Downstream consequences

Conclusion

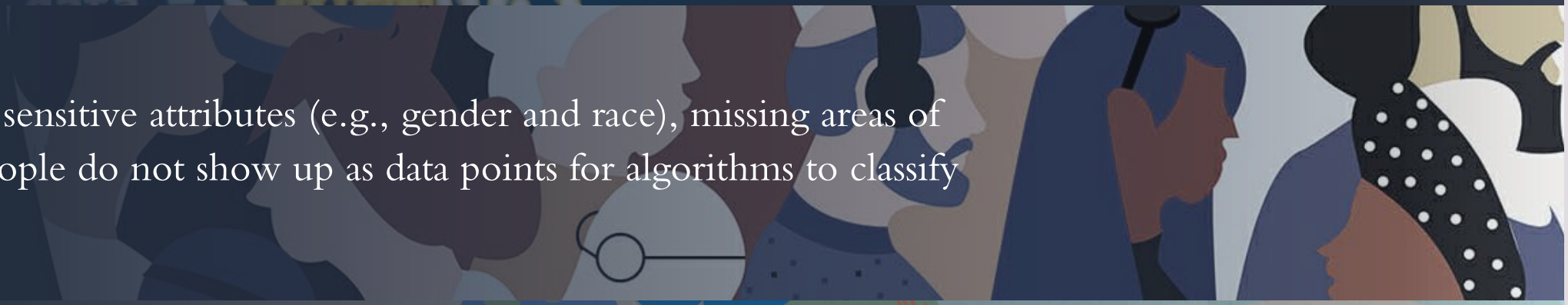


1. Sole focus on algorithms, missing greater contexts
   - Source of data
   - Downstream consequences

2. Sole focus on sensitive attributes (e.g., gender and race), missing areas of justice where people do not show up as data points for algorithms to classify

Conclusion

1. Sole focus on algorithms, missing greater contexts
   - Source of data
   - Downstream consequences



2. Sole focus on sensitive attributes (e.g., gender and race), missing areas of justice where people do not show up as data points for algorithms to classify

3. Algorithmic fairness needs be informed by all areas of justice, including climate justice
   - Extreme event detection and attribution (potentially source and impact attribution as well)

Thank you!

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