COLUMBIA LAW SCHOOL

SABIN CENTER FOR CLIMATE CHANGE LAW

Legal Applications of Extreme Event and Impact Attribution

Jessica Wentz

Senior Fellow, Sabin Center for Climate Change Law

April 1, 2025

Legal Applications

- **Statutory, regulatory, and administrative actions**
  - E.g., GHG regulations, “climate superfund bills”, adaptation programs, emergency response
- **Climate litigation**
  - Government obligations related to GHG emissions, adaptation, risk assessments, etc.
  - Private sector liability for climate damages
  - Government defense of climate action
- **UNFCCC loss and damage negotiations**

Legal Applications

- **Evidence of harm:** Climate change is causing “actual and imminent” harm to people, communities, ecosystems, etc.
  - Legal decisions and documents often cite findings re: extreme event attribution, but focus tends to be on changing trends in event classes over time
- **Liability and quantification of damages:** What are the damages attributable to a particular activity or defendant? (“end-to-end attribution”)
- **Climate impact assessment and adaptation:** What are the foreseeable consequences of climate change that should be assessed and disclosed in the context of specific government decisions?
  - E.g., natural resource management plans, emergency preparedness programs, project approvals

Verein KlimaSeniorinnen v. Switzerland (European Court of Human Rights, 2024)

Submission from European Network of Human Rights Institutions:

"According to the IPCC, climate change induced by greenhouse gas (GHG) emissions has already caused a significant increase in heatwave frequency, intensity and duration in Europe, and this is projected to worsen if warming exceeds 1.5°C, particularly in Central European cities.[9] In addition, event attribution studies have found that several heatwaves in Europe over the past 20 years would have been extremely unlikely to occur without human-induced climate change.[10] Climate change made the 2003 heatwave, which resulted in 70,000 excess deaths in Europe, at least hundreds of times more likely to occur.[11] The temperatures reached during the heatwave would have occurred once every several thousand years without human-induced climate change, but are now projected to be "commonplace" by the 2040s.[12] At a global level, the probability of an extreme heat event that occurs once every 20 years in the current climate will increase by 130% with 1.5°C of warming and by 340% with 2.0°C of warming.[13]"

[9] IPCC, Sixth Assessment Report (AR6) Working Group I (WGI) *The Physical Science Basis*, 2021, 2021, p. 1548-1557, Fig. SPM.3, Table 11.16; Guerreiro et al., "Future heatwaves, droughts and floods in 571 European cities," *Environ. Res. Lett.* 13, no. 3 (2018); Junk et al., "Future Heat Waves in Different European Capitals Based on Climate Change Indicators," *Int. J. Environ. Res. Public Health* 16, no. 20 (2019).
[10] IPCC, *AR6 WGI* (2021), p. 1553; Vautard et al., "Human Contribution to the record-breaking June and July 2019 heatwaves in Western Europe," *Environ. Res. Lett.* 15, no. 9 (2020); Christidis et al., "Dramatically increasing chance of extremely hot summers since the 2003 European heatwave," *Nat. Clim. Change* 5, no.1 (2015).
[11] Christidis et al. (2015) updating original estimate in Peter Stott et al., "Human contribution to the European heatwave of 2003," *Nature* 432 (2004); Robine et al., "Death toll exceeded 70,000 in Europe during the summer of 2003," *Comptes Rendus Biologies.* 331, no. 2 (2008).
[12] Christidis et al. (2015), abstract, p. 48.
[13] Kharin et al., "Risks from Climate Extremes Change Differently from 1.5°C to 2.0°C Depending on Rarity," *Earth's Future* 6, no. 5 (2018); Li et al., "Changes in Annual Extremes of Daily Temperature and Precipitation in CMIP6 Models," *Journal of Climate* 34, no. 9 (2021).

Verein KlimaSeniorinnen v. Switzerland (European Court of Human Rights, 2024)

Submission from European Network of Human Rights Institutions:

"The negative impacts of heatwaves on mortality and morbidity are well-documented and are projected to worsen with every incremental increase in warming.[14] There is an "exponential increase in mortality with increasing temperatures".[15] Climate-attributed heat mortality is thus "one of the clearest and impactful fingerprints of a changing climate".[16] Exposure to extreme heat increases the risk of acute kidney injury, heatstroke, asthma attacks, disrupted sleep, poor mental health, as well as respiratory, cardiovascular, immune and nervous-system diseases and disorders, which in some cases can be fatal.[17] In Switzerland, between 1991 and 2018, 31.3% of heat-related deaths were attributable to human-induced climate change, with elderly women and infants being particularly affected.[18]"

[14] *IPCC, AR6 WGII Impacts, Adaptation and Vulnerability,* 2022, pp. 1045, 1046, 1071, 1072 and 1092.
[15] Mitchell, *Climate attribution of heat mortality*. Nat. Clim. Chang. 11, 467–468 (2021).
[16] Mitchell (2021).
[17] Romanello et al., "The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels," *The Lancet* 400, no. 10363 (2022); Howard et al., "How hot weather kills: the rising public health dangers of extreme heat," *Br. Med. J.* 2022;378:o1741.
[18] Vicedo-Cabrera et al., "The burden of heat-related mortality attributable to recent human-induced climate change," *Nat. Clim. Change* 11, no. 6 (2021), Supplementary Table 4.

Multnomah County v. ExxonMobil Corp. (2023)

- 2021 Pacific Northwest Heat dome caused record high temperatures in Multnomah County (peaking at 116°F)
- Sixty-nine people died of heat stroke
- Attribution studies cited in complaint:
  - K.J. Heeter et al., *Unprecedented 21st century heat across the Pacific Northwest of North America*, 6 npj Clim Atmos Sci 5 (2023) - tree ring data suggests this was hottest event since 950AD
  - S.Y. Philip et al., *Rapid attribution analysis of the extraordinary heat wave on the Pacific coast of the US and Canada in June 2021*, 13 Earth Syst. Dynam. 1689 (2022)

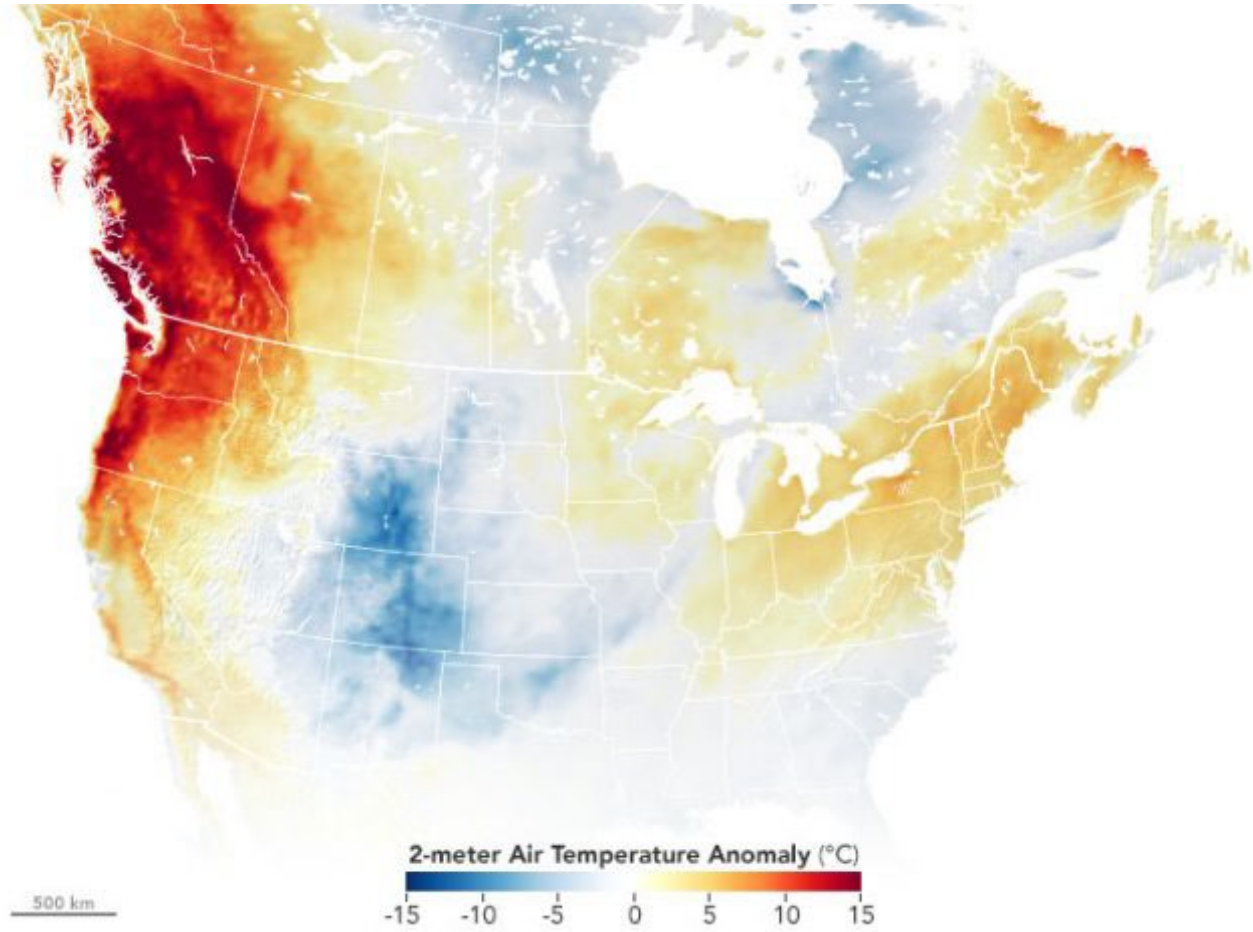

Image: Air temperature anomalies across the continental United States and Canada during a record-breaking heatwave on June 27, 2021. NASA Earth Observatory, Joshua Stevens (2021).

Municipalities of Puerto Rico v. ExxonMobil Corp. (2021)

- Puerto Rico experienced extensive damages during 2017 hurricane season
  - Three key storms – Hurricane Harvey, Hurricane Irma, Hurricane Maria
  - "At least $294.92 billion in damages" and 3,000+ deaths

- Attribution research cited in complaint:
  - Keelings & Hernández Ayala, *Extreme Rainfall Associated with Hurricane Maria Over Puerto Rico and its Connections to Climate Variability and Change,* 46 Geophysical Research Letters 2964 (2019)
  - Mark D. Risser & Michael F. Wehner, *Attributable Human-Induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation during Hurricane Harvey*, 44 Geophysical Research Letters 12457 (2017)

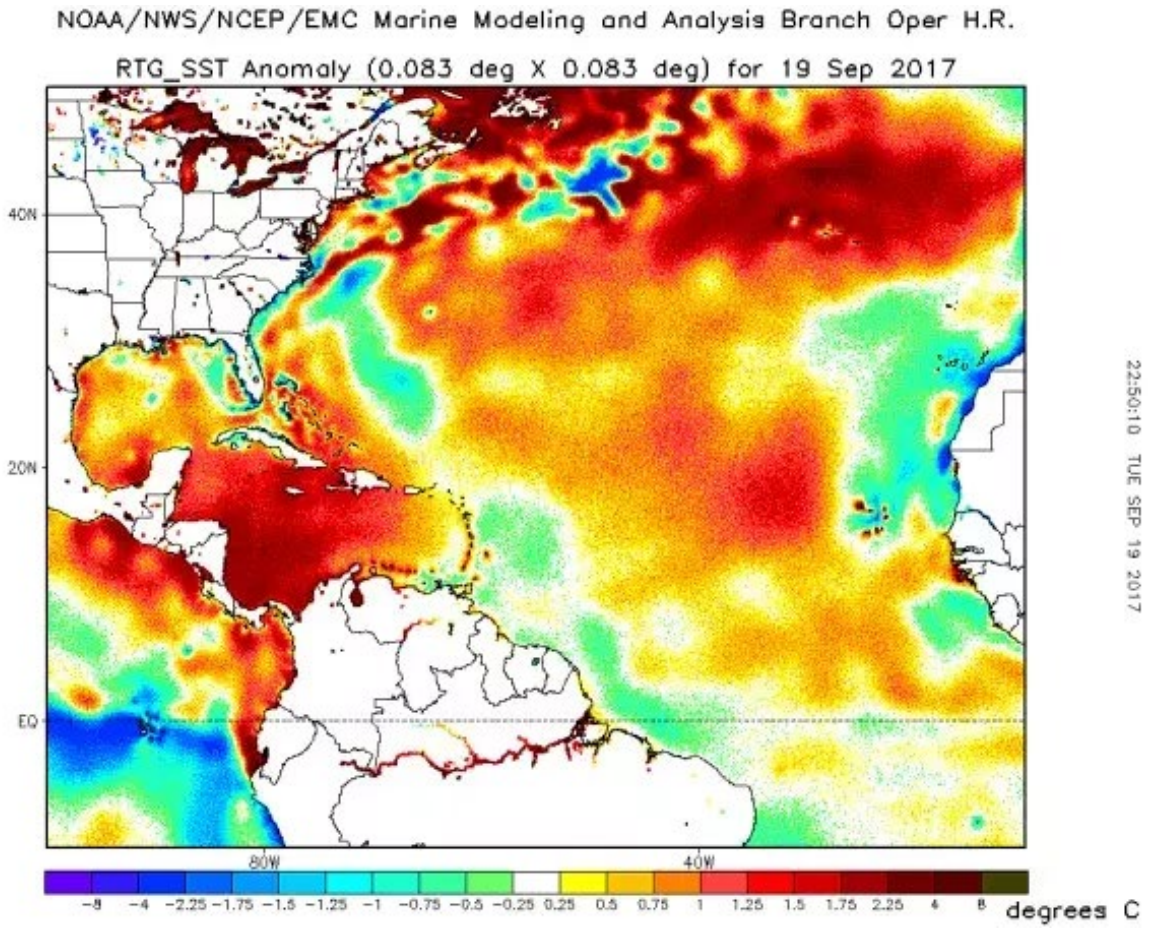

Image: As it approached Puerto Rico, Maria was aided by SSTs 0.9-1.8°F (0.5-1°C) above average relative to a 1961-1990 baseline.

Climate Impact Assessment and Adaptation – Forest Management Cases

- **Bark v. U.S. Forest Service (9th Cir. 2020):** US Forest Service did not adequately "engage with the considerable contrary and scientific expert opinion" regarding the effectiveness of forest thinning in suppressing wildfires, remanded for preparation of a full environmental impact statement (EIS)

- **Klamath Siskiyou Wildlands Center v. U.S. Fish & Wildlife Service (D. Or. 2021):** In BiOp for logging plan, U.S. Fish and Wildlife Service (FWS) adequately considered climate change and fires' impacts on spotted owl critical habitat, including in the LSRs, and that the FWS's use of historical wildfire data was entitled to significant deference.

Image: Bull Complex Fire burning in Mt. Hood National Forest in 2021 (credit: Inciweb)

Concluding thoughts

- Most legal decisions focus on long term trends, changes in event classes over time
  - Higher level of scientific confidence
  - Individual event does not capture full scope of harm
- Studies on individual events are still useful and important, can complement other data sources
  - May be a key focus in some lawsuits (e.g., liability and compensation claims)
- Utility of extreme event attribution research:
  - Evidence that harm is concrete, real, and immediate – not hypothetical or speculative
  - Distinguish true “anomalies” from trends caused by climate change
- Useful to have information about past *and future* impacts attributable to emissions
- Both probabilistic and storyline approaches are relevant and complementary

Columbia **Law School** | COLUMBIA CLIMATE SCHOOL

SABIN CENTER FOR CLIMATE CHANGE LAW

Thank you!

Sabin Center for Climate Change Law useful links:

- https://climate.law.columbia.edu/
- X https://twitter.com/SabinCenter
- https://www.instagram.com/sabincenter/
- https://www.linkedin.com/company/sabin-center-for-climate-change-law

Amicus Brief Submitted by the Sabin Center to the IACtHR on Climate Science and Human Rights Obligations (Nov. 2, 2023), https://corteidh.or.cr/sitios/observaciones/OC-32/4_sabin_center_columbia.pdf

The Law and Science of Climate Change Attribution, 5 COLUM. J. ENVTL. L. 57 (2020)