Current Climate: Worldwide Trends in Flood Hazard and How Cat Models Capture These Trends

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Flood hazard trends in the United States

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What types of flooding?

IPCC AR6 WGI — *Climate Change 2021: The Physical Science Basis*

Rainfall

- More positive than negative trends
- Vast majority are statistically insignificant
- Consistent with laws of thermodynamics
What types of flooding?

IPCC AR6 WGI — *Climate Change 2021: The Physical Science Basis*

**Rainfall**
- More positive than negative trends
- Vast majority are statistically insignificant
- Consistent with laws of thermodynamics

**Coastal**
- Pretty consistent increase
- Generally dominated by sea-level rise
River floods are trickier

- Archfield et al. (GRL, 2016)
  Change in frequency and magnitude of 0.5-year streamflow (1940-2013)

- Slater et al. (GRL, 2021)
  Change in magnitude of 20-year flood (today vs 1970s)

- Gudmundsson et al. (GRL, 2019)
  Change in magnitude of AMAX (1971-2010)
General thoughts on river flood hazard trends

• Changes vary in size and sign
• Many studies do not focus on relevant quantiles
• For those that do, trends in extremes are difficult to detect from limited observations
• Non-stationary statistical models are useful: but is it a real trend or parameter noise?
• History represents only one sample of the background flood hazard
• Flood-generating processes are important
• Only possible with observations: cat models are dominated by ungauged predictions
IS UK FLOOD RISK CHANGING?

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Thanks to Joshua Charge, Duncan Faulkner, Becky Hayman, Steve Hutchings, Dave Leedal, Alison Poulston, Jane Toothill
CHANGING RIVER FLOWS?
CHANGING FLOOD HAZARD?

Increase in flooded area (whole Dee catchment)

- RP20: 0.67%
- RP100: 0.84%
- RP1000: 1.24%
Average annual loss
Just at-risk properties, assuming £200k TSI

Stationary: £217.85
Non-stationary: £218.04

Overall, difference akin to updating DTM, location data changes etc.
- Flooding is non-stationary
- It’s not just climate change
- Data, methods, science: an ongoing journey
- Material impact small in UK compared to “standard” baseline…for now
CAN WE RELIABLY IDENTIFY TRENDS?
GLOBAL LEADERS IN FLOOD RISK MANAGEMENT.
Europe
Dr Caroline McMullan
April 2024, Oasis Conference
PRECIPITATION INTENSITY RESPONSES ARE LIKELY TO VARY REGIONALLY IN A WARMER WORLD
VERISK FOUND VERY FEW STATISTICALLY SIGNIFICANT TRENDS IN REGIONAL SHORT-DURATION PRECIPITATION INTENSITY

SIGNIFICANT TRENDS IN REGIONAL SHORT-DURATION PRECIPITATION INTENSITY

Trends in Annual Max. Regional 168 hour Precipitation

MK Test Trend/Decade: 6.00%
TRENDS IN SHORT-DURATION PRECIPITATION INTENSITY IN ITALY: SUMMARY

Signal

• Both positive and negative trends in short-duration precipitation intensity can be detected across Italy in grid-based analyses covering 1979-2018.

Statistical significance

• Very few of the detected grid-based trends are statistically significant.

Scale

• Verisk’s analyses show there are very few statistically significant trends within watershed sized regions. This result makes it hard to confidently say what is driving the grid-based trends and any role from climate change.
Climate Change and Climate Variability in Asia-Pacific Flood Hazard
Moody’s slides have been omitted at request of the speaker
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