

Projecting exposure to extreme climate impact events across six event categories and three spatial scales

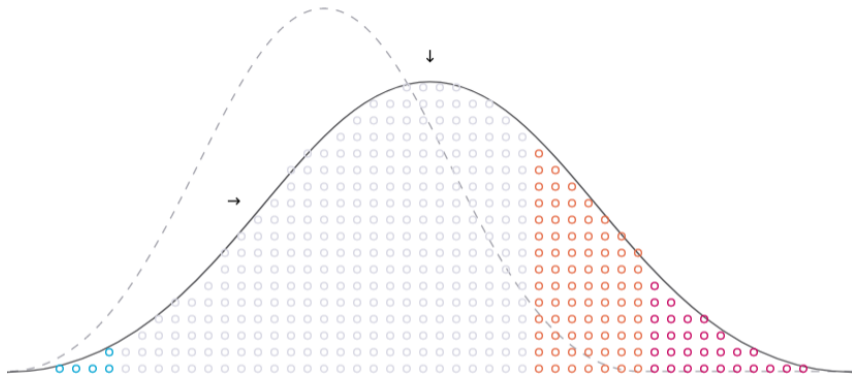
Stefan Lange

CRESCENDO General Assembly, 16 March 2021

43 authors

Stefan Lange, Jan Volkholz, Tobias Geiger, Fang Zhao, Iliusi Vega, Ted Veldkamp, Christopher P. O. Reyer, Lila Warszawski, Veronika Huber, Jonas Jägermeyr, Jacob Schewe, David N. Bresch, Matthias Büchner, Jinfeng Chang, Philippe Ciais, Marie Dury, Kerry Emanuel, Christian Folberth, Dieter Gerten, Simon N. Gosling, Manolis Grillakis, Naota Hanasaki, Alexandra-Jane Henrot, Thomas Hickler, Yasushi Honda, Akihiko Ito, Nikolay Khabarov, Aristeidis Koutroulis, Wenfeng Liu, Christoph Müller, Kazuya Nishina, Sebastian Ostberg, Hannes Müller Schmied, Sonia I. Seneviratne, Tobias Stacke, Jörg Steinkamp, Wim Thiery, Yoshihide Wada, Sven Willner, Hong Yang, Minoru Yoshikawa, Chao Yue, and Katja Frieler

Research question



How will the exposure to extreme climate impact events change in response to global warming?

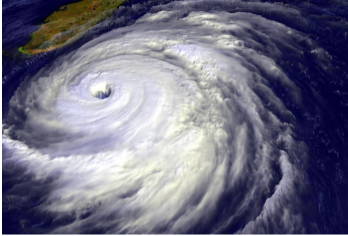
ISIMIP2b input and output data analysis

Extreme event categories

River flood



Tropical cyclone



Drought



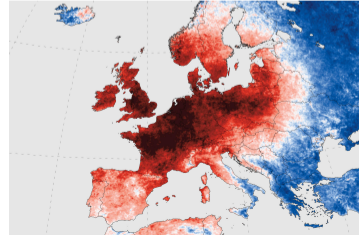
Crop failure



Wildfire



Heatwave

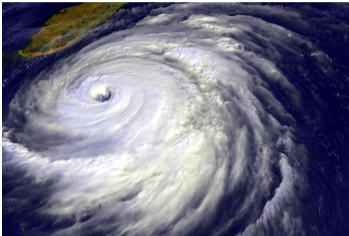


Models

Hydrological models



Tropical cyclone model



Hydrological models



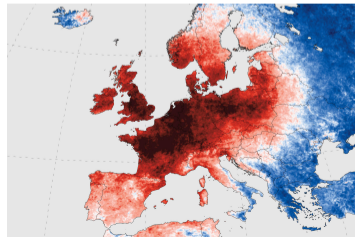
Crop models



Vegetation models



Climate models

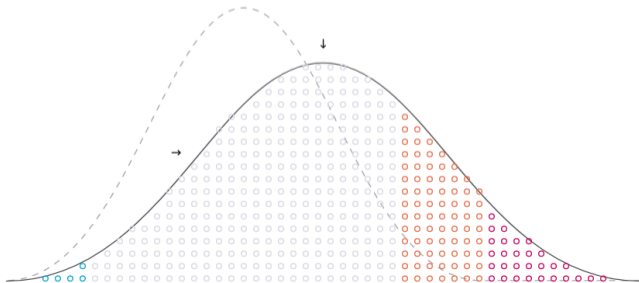


Analysis framework

- needed a metric for extreme events that works for all event categories:
 - different quantities and units
 - different time scales of occurrence
 - different ways of affecting us

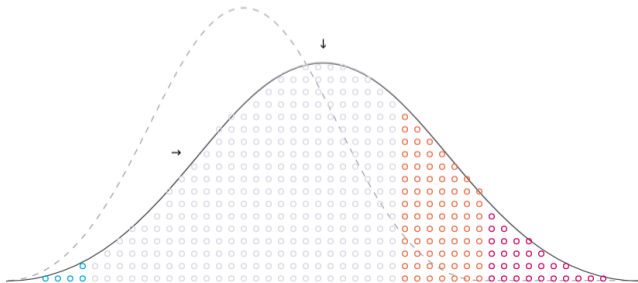
Analysis framework

- needed a metric for extreme events that works for all event categories:
different quantities and units → **threshold**
different time scales of occurrence
different ways of affecting us



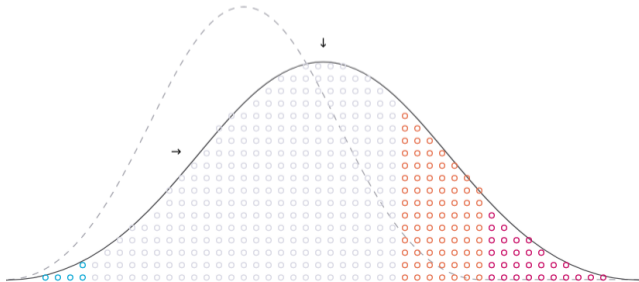
Analysis framework

- needed a metric for extreme events that works for all event categories:
different quantities and units → **threshold**
different time scales of occurrence → **year**
different ways of affecting us



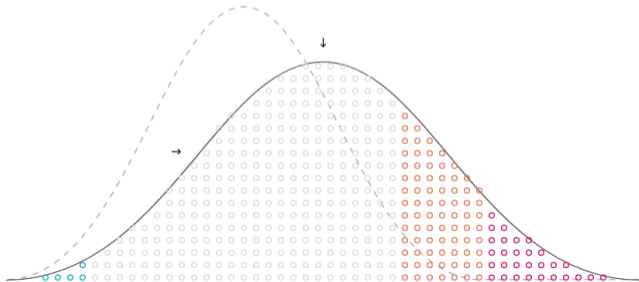
Analysis framework

- needed a metric for extreme events that works for all event categories:
different quantities and units → **threshold**
different time scales of occurrence → **year**
different ways of affecting us → **spatial extent**



Analysis framework

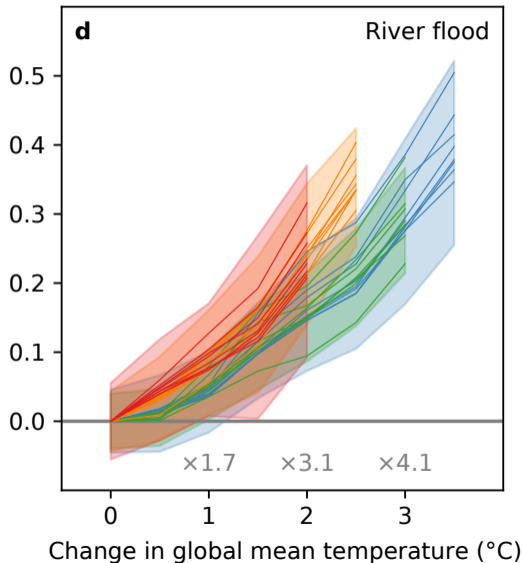
- needed a metric for extreme events that works for all event categories:
different quantities and units → **threshold**
different time scales of occurrence → **year**
different ways of affecting us → **spatial extent**
- our metric: **land area** flooded/burned/... **at least once in a given year** due to a river flood/wildfire/... event of a **magnitude greater than** a threshold value that represents what was extreme under pre-industrial climate conditions



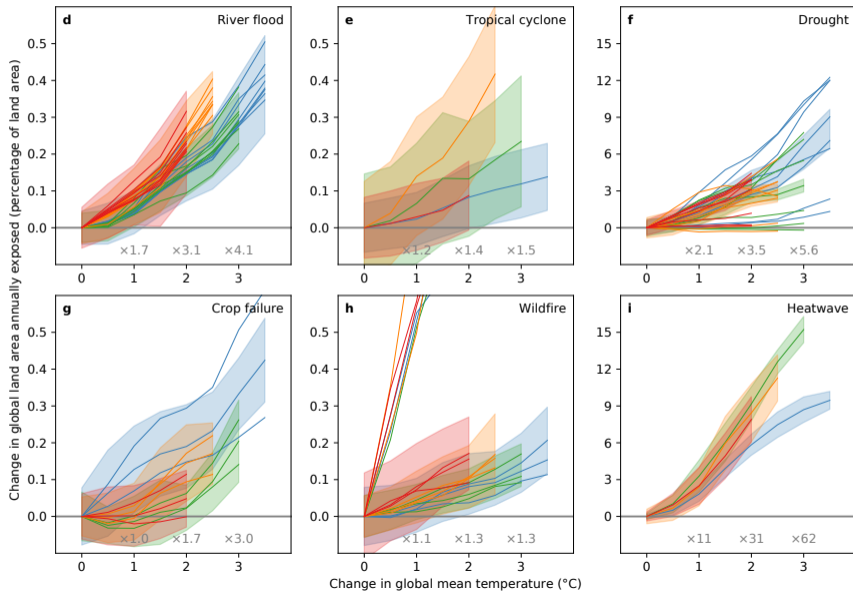
Results for river floods

- flood magnitudes that occur only once in 100 years under pre-industrial climate conditions
- simulations with 4 climate models \times 8 hydrological models
- only climate varies in future projections
- results pooled per global warming level relative to pre-industrial

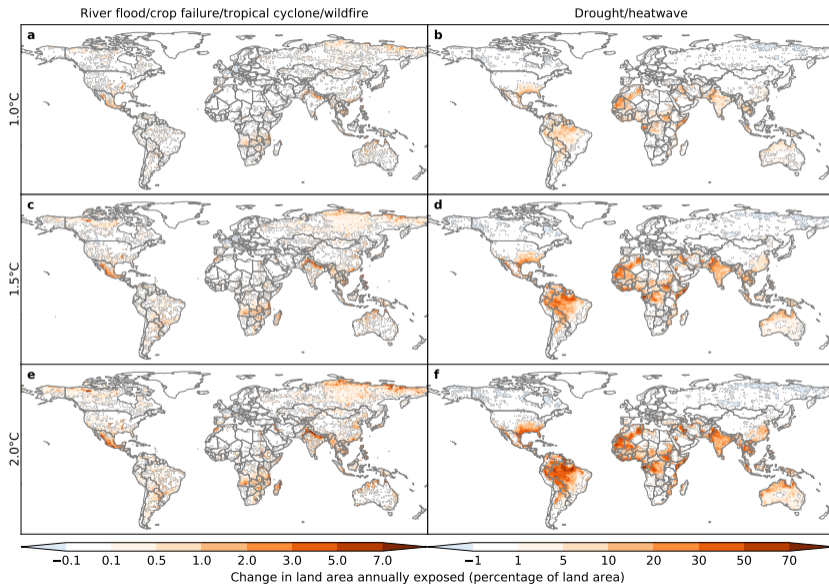
Change in global land area annually exposed (percentage of land area)



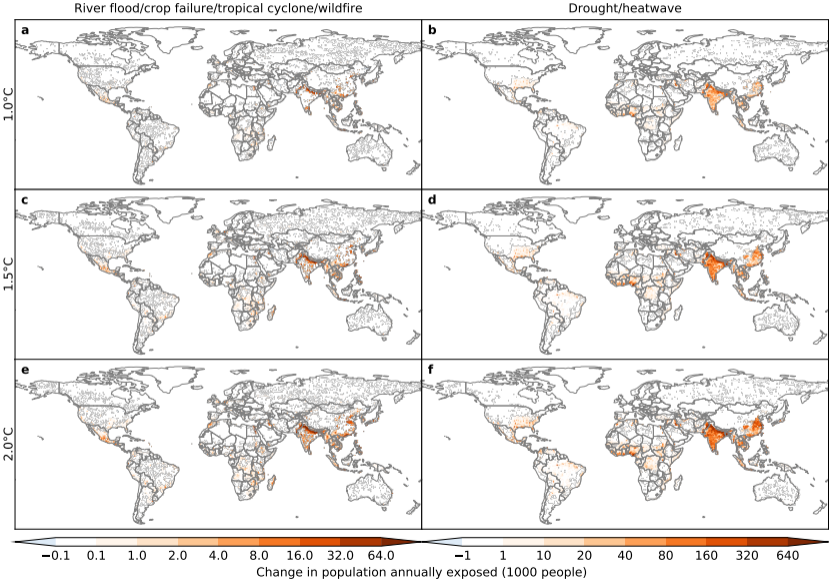
All event categories



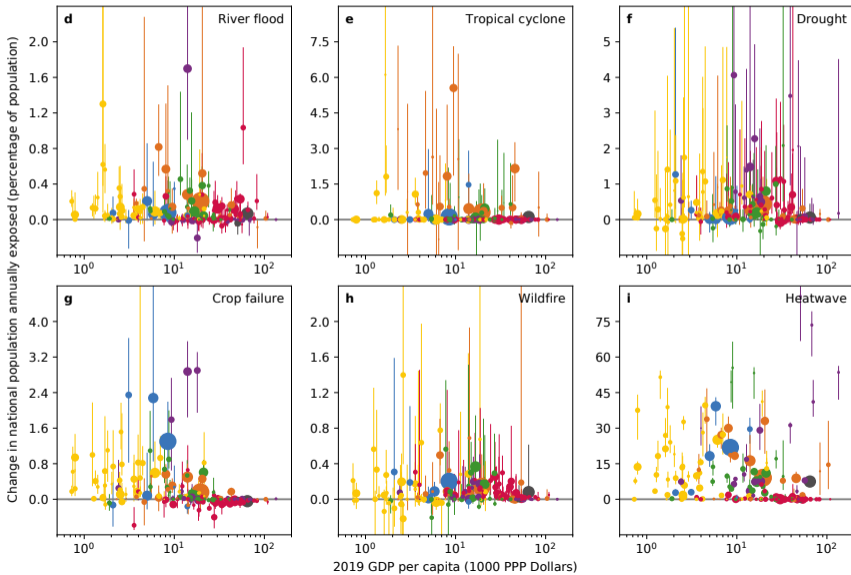
At 0.5° grid scale



Population exposure change



At country level



Want to learn more?

- paper in Earth's Future 8(12)
- simple-language article on ISIpedia
- visualisation by SENSES
- follow-up study on inter-generational justice

