I N T R O D U C T I O N

Low-risk, high-consequence (LRHC) extreme climate change (ECC) represents a severe threat to human society.

Existing literature tends to focus on average climate responses projected by climate models and emphasises the most likely scenarios based on a probabilistic approach.

The impact of LRHC extreme and worst case scenarios, particularly on urban infrastructure, has not received as much attention (e.g. Kemp et al., 2022).

While the likelihood of worst-case ECC effects by current assessment is low (IPCC, 2021), there remains significant uncertainty regarding, for example, climate tipping points that may cascade, trigger feedbacks and lead to runaway climate change (Lenton et al., 2019), even if global temperature increase is restricted to 1.5°C - 2°C (Armstrong McKay et al., 2022) which is growing more unlikely (Liu and Raftery, 2021).

The potentially existential impacts of such scenarios necessitates that we exercise the precautionary principle (Sutton, 2019) and "explore the boundaries of plausibility" (Shepherd et al, 2018).

In this poster, we present synthesised evidence utilising the upper range of the SSP5-8.5 scenario output of the CMIP6 models. We use SSP5-8.5 as a proxy for specific extreme climate scenarios that include tipping points and other 'worst case' scenarios that do not currently exist.

Here we present an assessment of heterogeneous ECC impacts to highlight regions that may need significant pre-emptive adaptation efforts. IPCC WGII defined regions are ranked according to their potential vulnerability.

We aim to identify regions to be assessed in greater regional detail to identify potentially vulnerable cities and assess the resilience of their urban infrastructure systems to ECC risks.

Given that 85% of the approximately 10bn people projected to be to be alive in 2100 will be living in cities, and the importance of urban environments to the global economy and human flourishing, it is vital that the full range of potential climate impacts on urban areas is understood.

T H E   M E T H O D

MODEL SET: CMIP6 *(re-gridded to common 1° x 1°)*

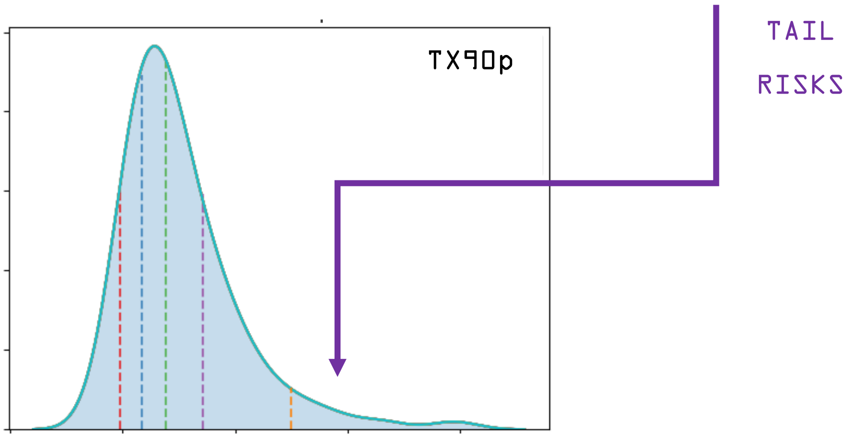
SCENARIO: SSP5-8.5

CLIMATE METRICS: 6/40+ metrics based on temperature and precipitation are presented here

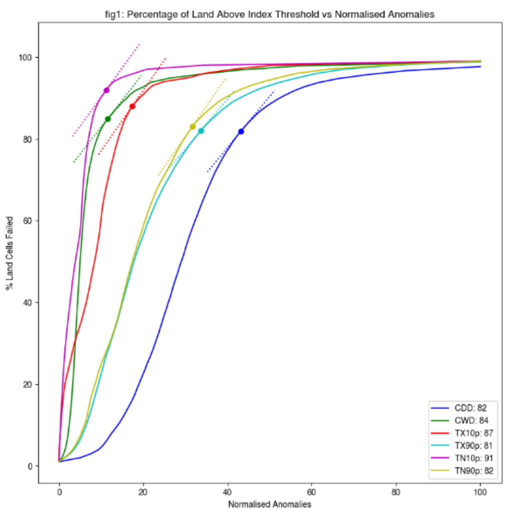
ANOMALIES: End-of-century (2070 - 2100)
- vs -
Present Day (2015 - 2025)

(relative anomalies)

EXTREMES: Defined as 75th percentile of model spread



ASSESSMENT SCENARIO: Thresholds for grid cell failure based on 'elbows' - where CCDF gradient is 45°



Climate Index	Percentile (i.e. % of land cell 'failed')	Anomaly (% change)
CDD	82	42%
CWD	84	9%
TX10p	87	20%
TX90p	81	33%
TN10p	91	11%
TN90p	82	30%

F U T U R E   W O R K

- Expand analysis to include more climate change metrics (40+)

- Assess clustering of percentile threshold scenario permutations
    Which threshold combination scenarios are most important?

- Finalise inter-region and intra-region ranking system
    - For combined climate metrics i.e. compound risks

- Include extreme end of more SSP scenarios

- Apply population weighting
    - Rank regions by per capita impact
    - Implications for migration / ‘climate refugees’

- Analyse time emergence of impacts
    - i.e. *when* are regions / cities likely to become vulnerable (short, medium, long term)
    - How long have we got to act?

- Repeat analysis at regional scale
    - Use regional climate models (RCMs)
    - Identify the most vulnerable cities within regions through ranking system

- Build case studies of identified vulnerable cities
    - Resilience of existing and planned urban infrastructure to the identified risks

- Cross border impacts e.g:
    - Supply chains
    - Food systems
    - Migration