Session 2: Mechanisms and Pathways for Modeling the Impacts of Chronic and slow-onset Events on Human Migration

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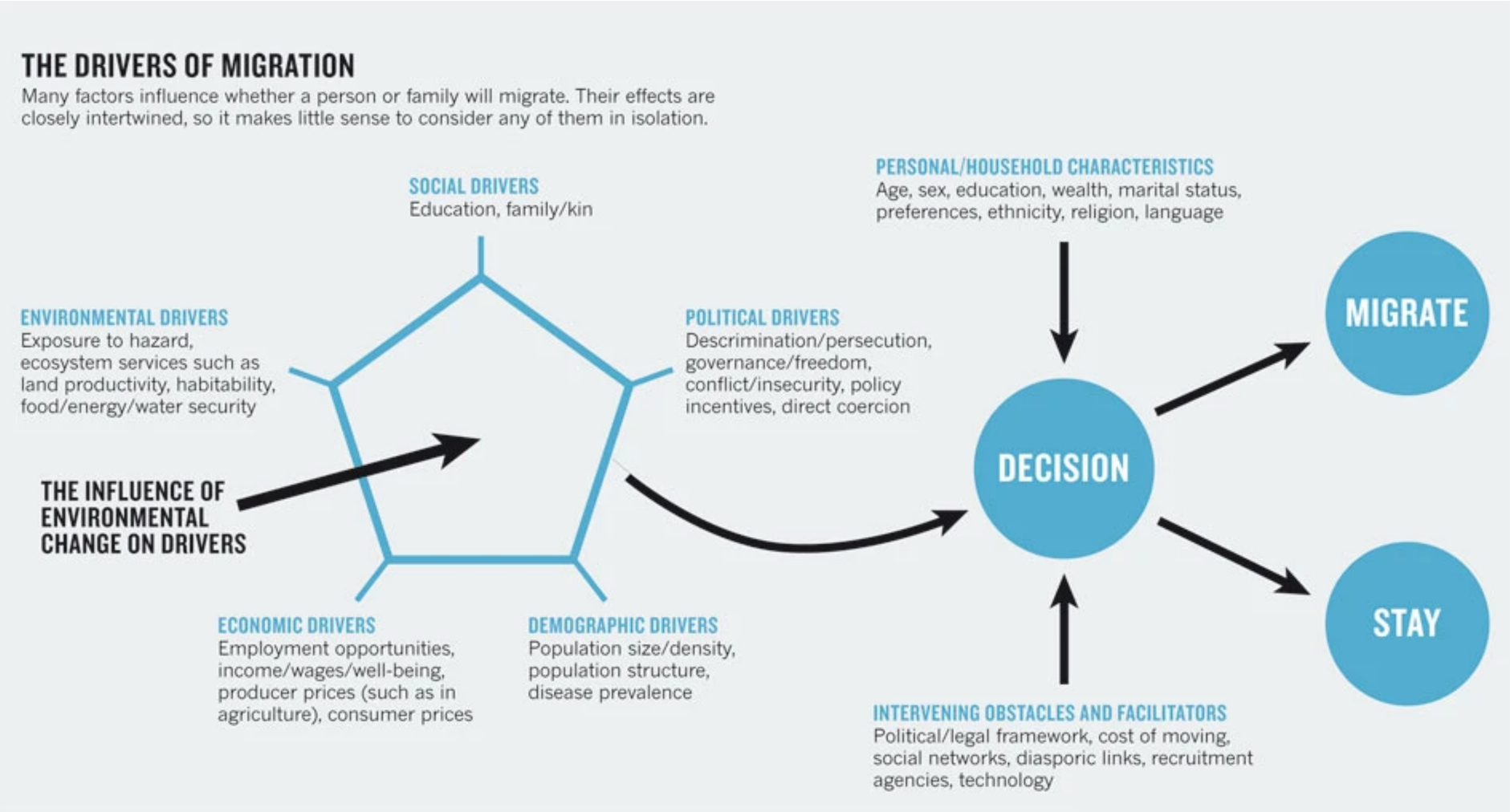
Migration As Adaption



Black *et al.* 2011

Top-Down vs. Bottom Up

"There is a risk that such climate determinism minimizes the potential for human agency to find creative, locally appropriate solutions.

Although top-down modeling can serve a useful purpose in identifying potential future "hot spots" for habitability decline and potential outmigration, **only by integrating "bottom-up" insights related to place-based physical systems and social contexts**, including potential adaptive responses, will we arrive at a more nuanced understanding."

Horton *et al.* 2021

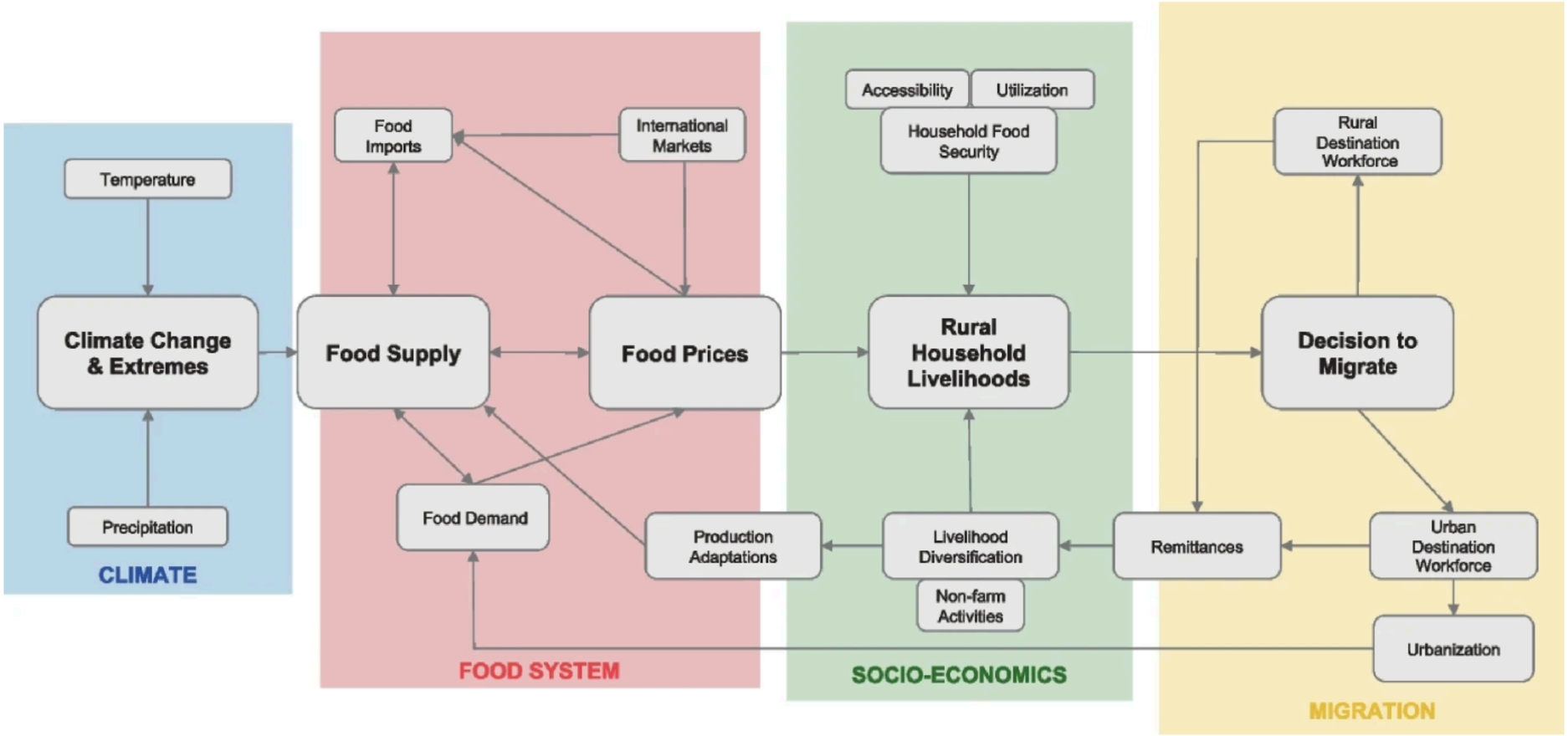
Context is Key

- Top-down approaches do not per say capture **qualitative** economic, social, cultural, and political contexts.
- Risk of ecological fallacy.
- Fear that climate change will be overly attributed as a primary driver of mobility, rather than a confounding factor.

Fig. 2

From: A framework to link climate change, food security, and migration: unpacking the agricultural pathway

The "Agricultural Pathway"



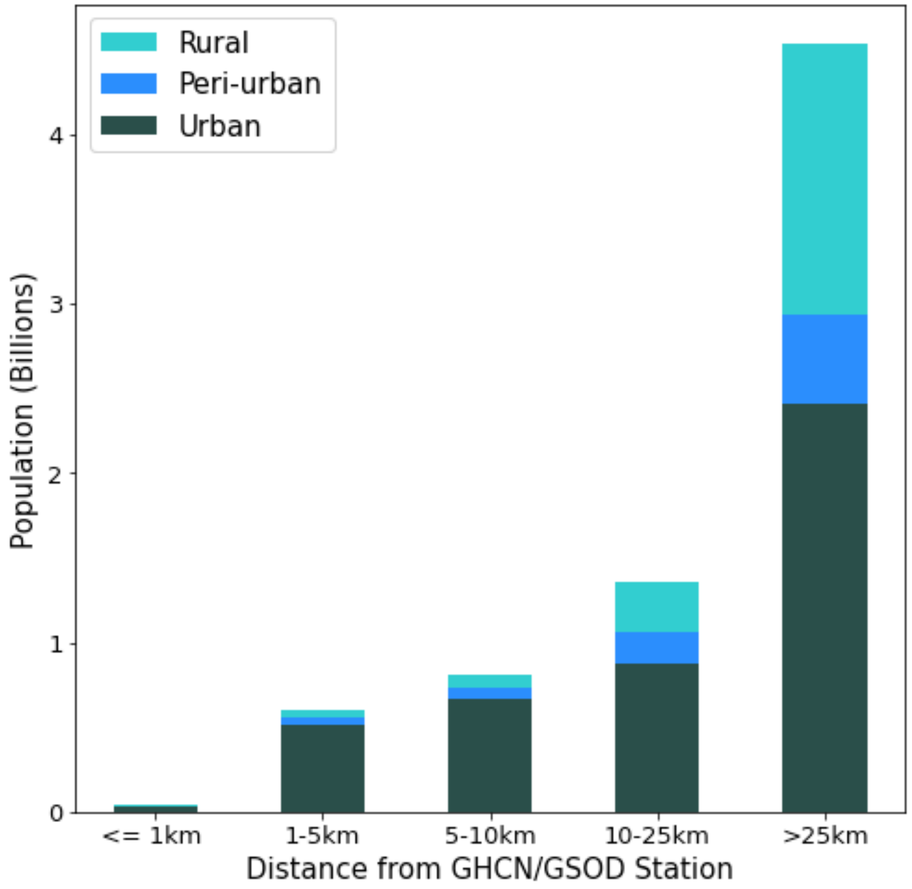
Conceptual diagram of the components and linkages underpinning the agricultural pathway as a hypothesis to study the climate–food–migration nexus. The diagram is focused on local climate impacts on agriculture and rural households or individuals' decision to migrate. Note that many of these linkages are bidirectional and can be negatively and positively reinforcing

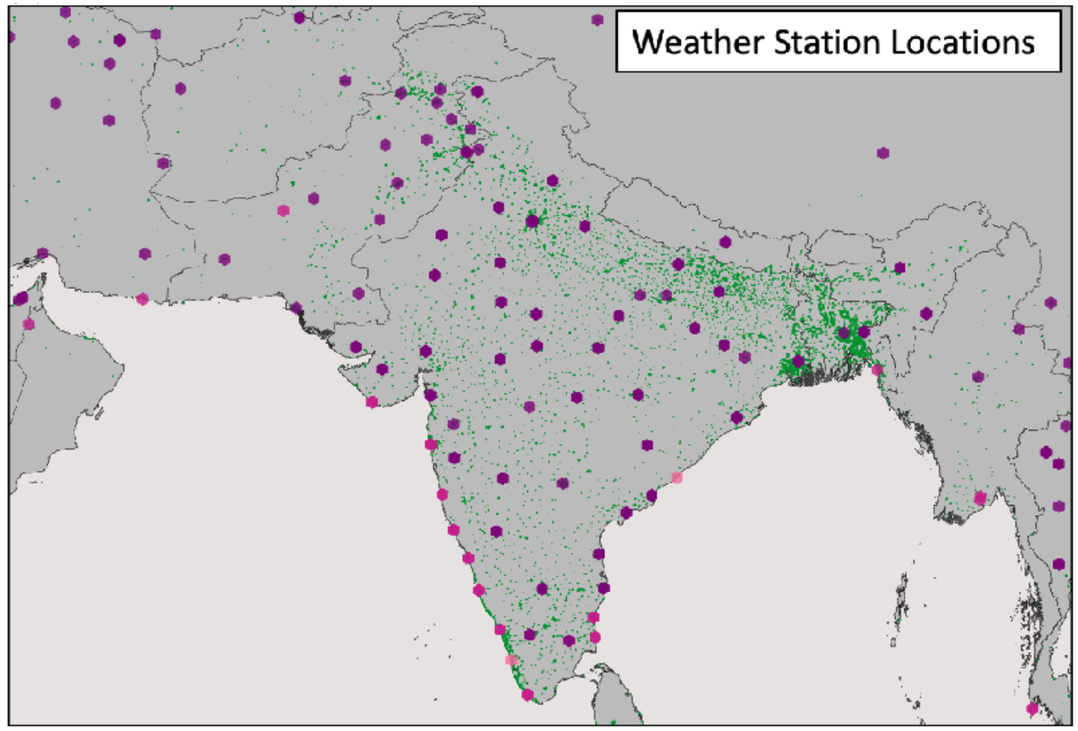
Tuholske *et al.* 2024

Climate Data Example

- Challenge defining “slow-onset” climate events in data-sparse locations, much less impacts.
- How do we define slow-onset or chronic events?
- Once defined, how do we attribute slow-onset or chronic events to climate change?
- Once attributed to climate change, how do we measure impacts from such events as sufficient to drive migration?

Climate Data Example

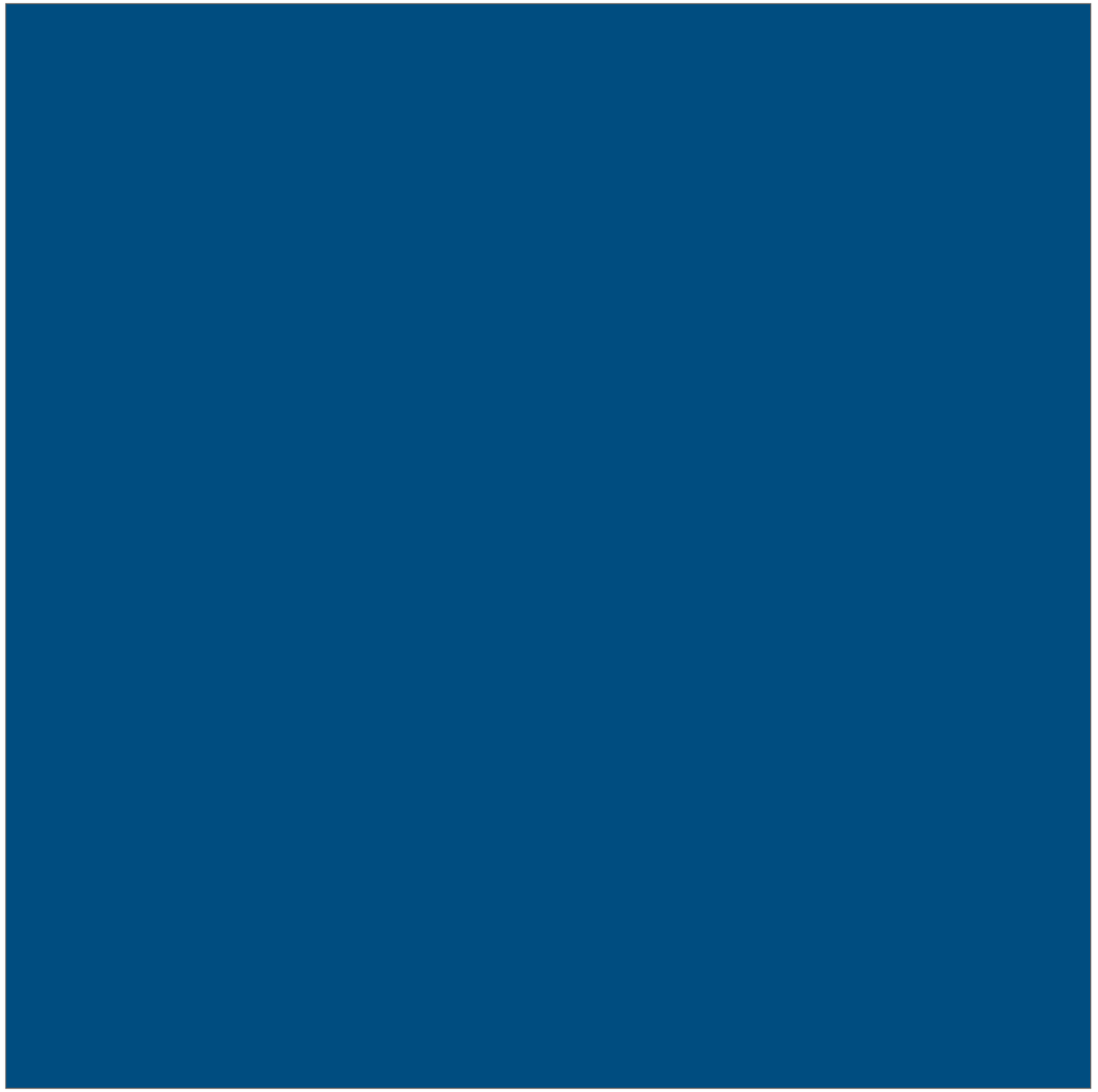




Tuholske *et al.* 2021; Zaitchik & Tuholske 2021;
Verdin *et al.* 2020; Funk *et al.* 2019

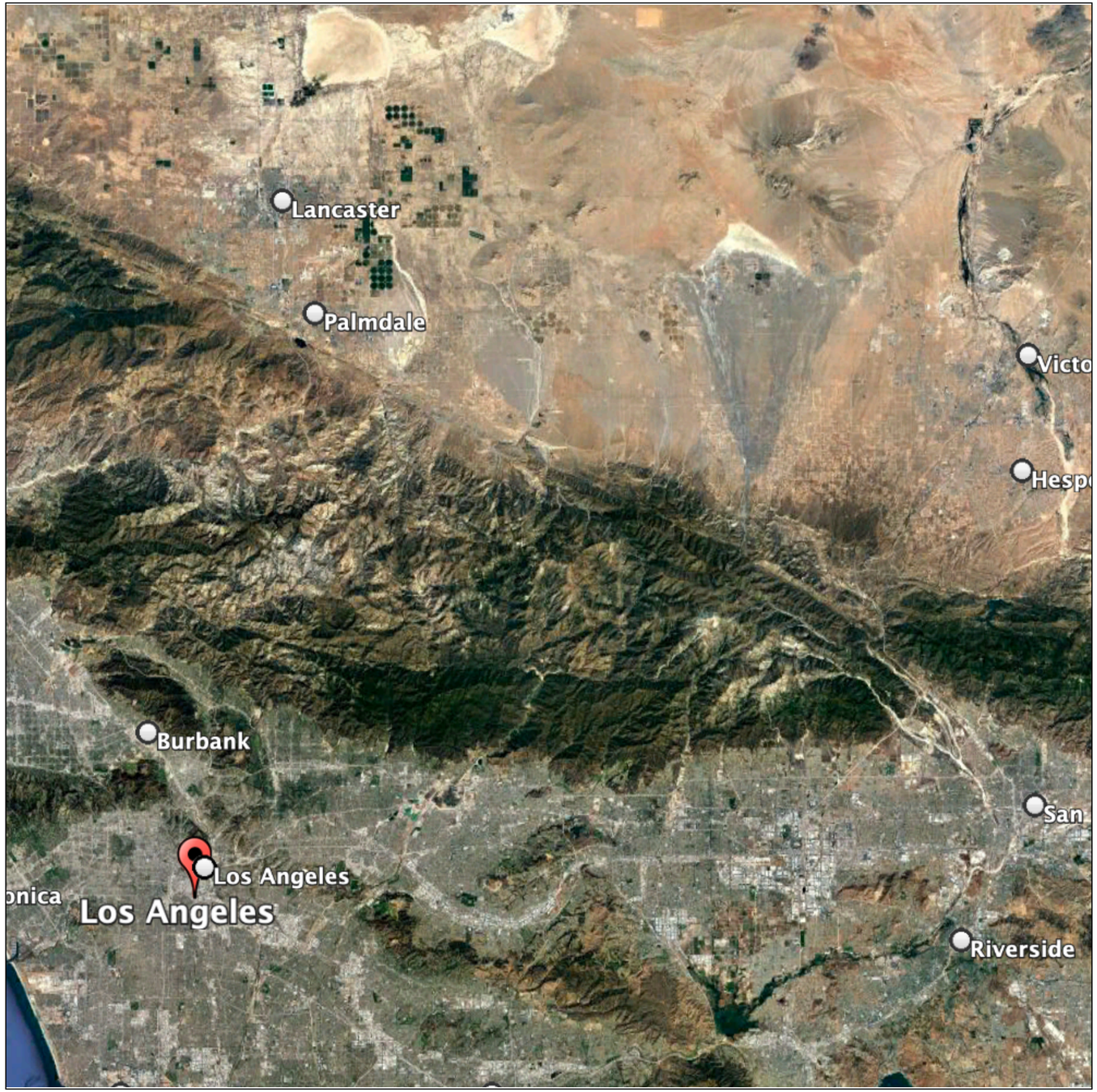
Due to declining number of weather stations, we have lacked accurate, high-resolution weather/climate data across the most populated regions worldwide.

Climate Data Example



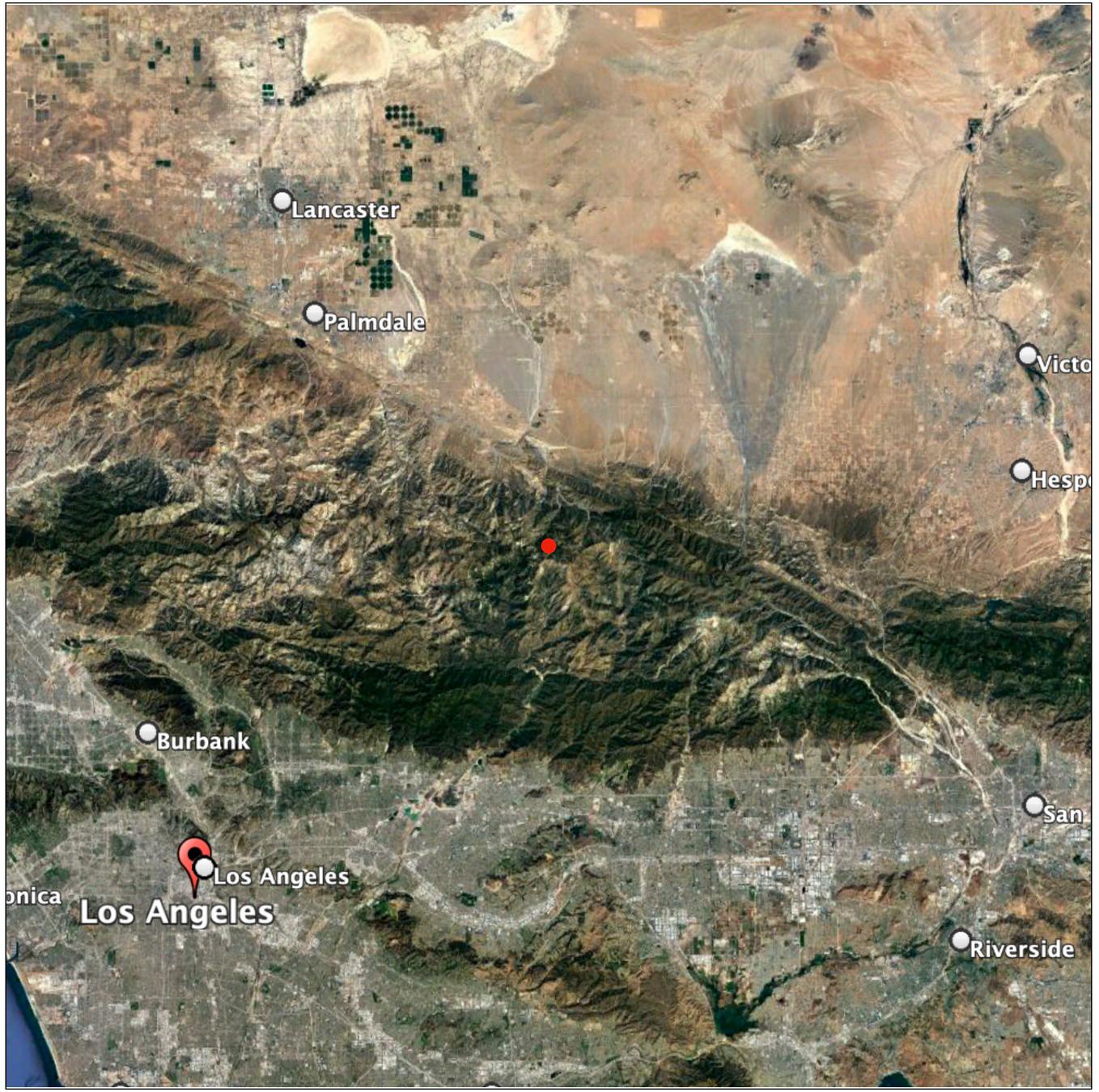
CMIP-6
Climate Projection
100 x 100 km

Climate Data Example



CMIP-6
Climate Projection
100 x 100 km

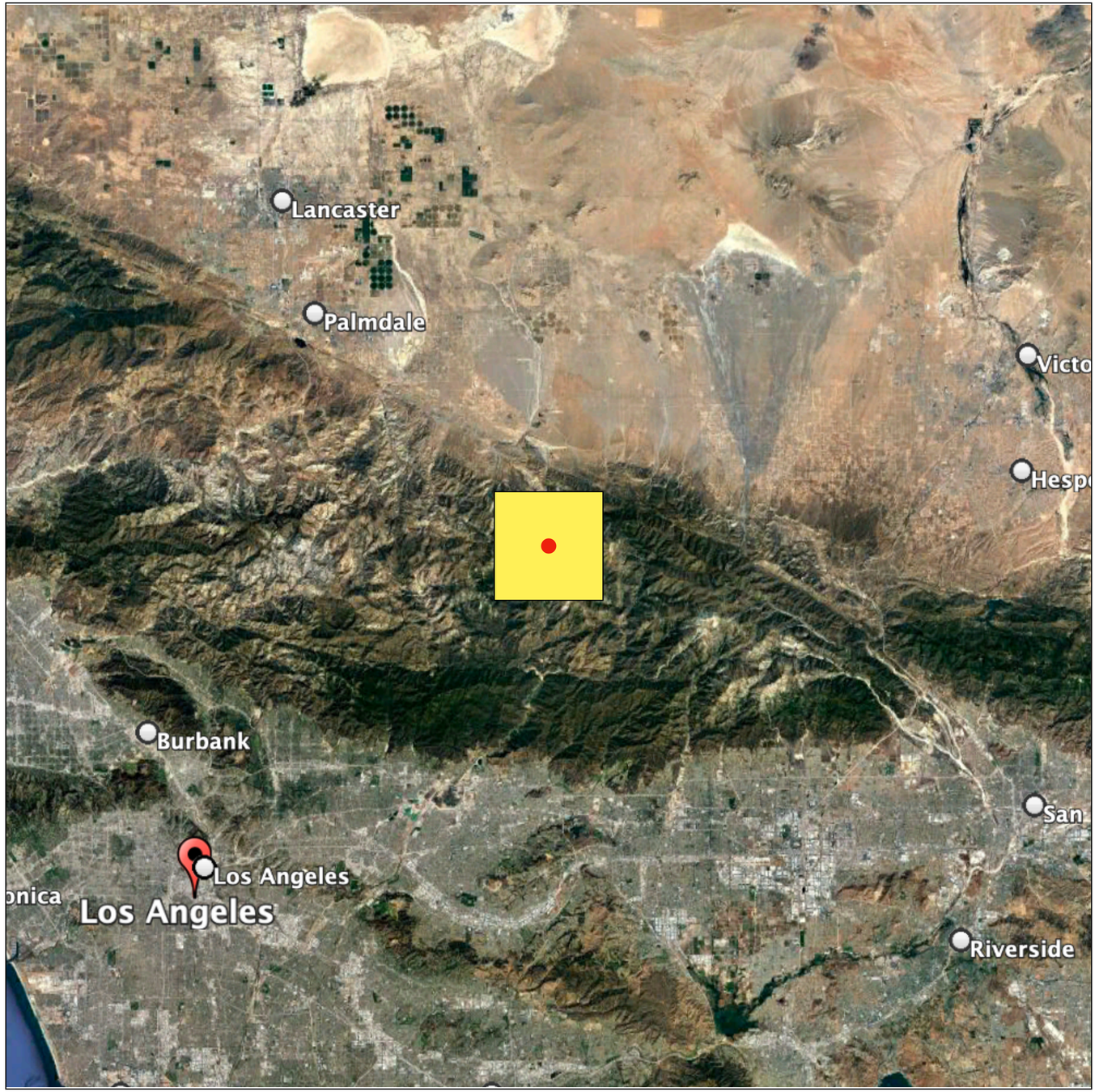
Climate Data Example



CMIP-6
Climate Projection
100 x 100 km

Person location
(if you're lucky)
Point data

Climate Data Example

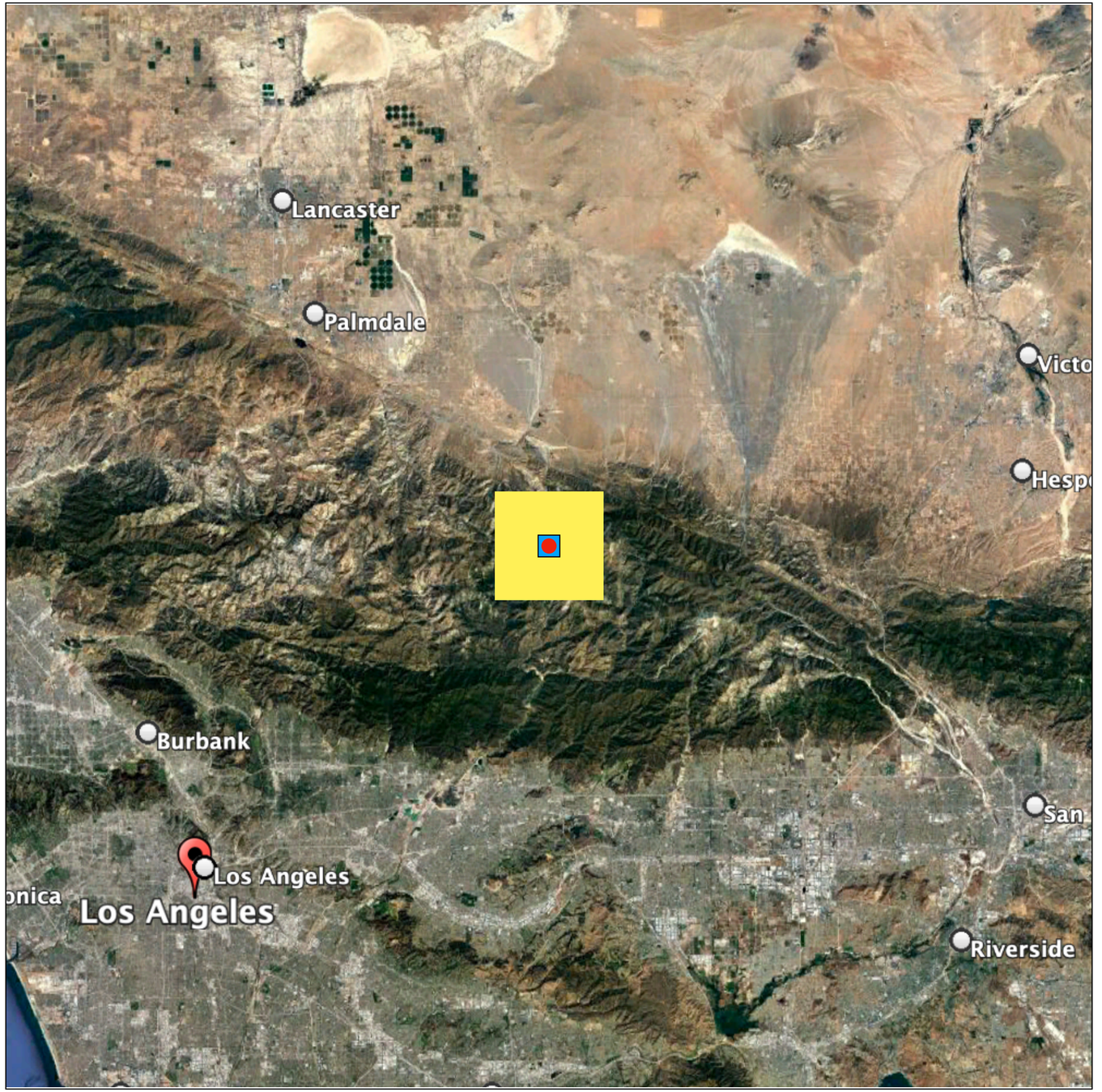


CMIP-6
Climate Projection
100 x 100 km

Person location
(if you're lucky)
Point data

ERA-5
Temperature
Record
25 x 25 km

Climate Data Example



CMIP-6
Climate Projection
100 x 100 km

Person location
(if you're lucky)
Point data

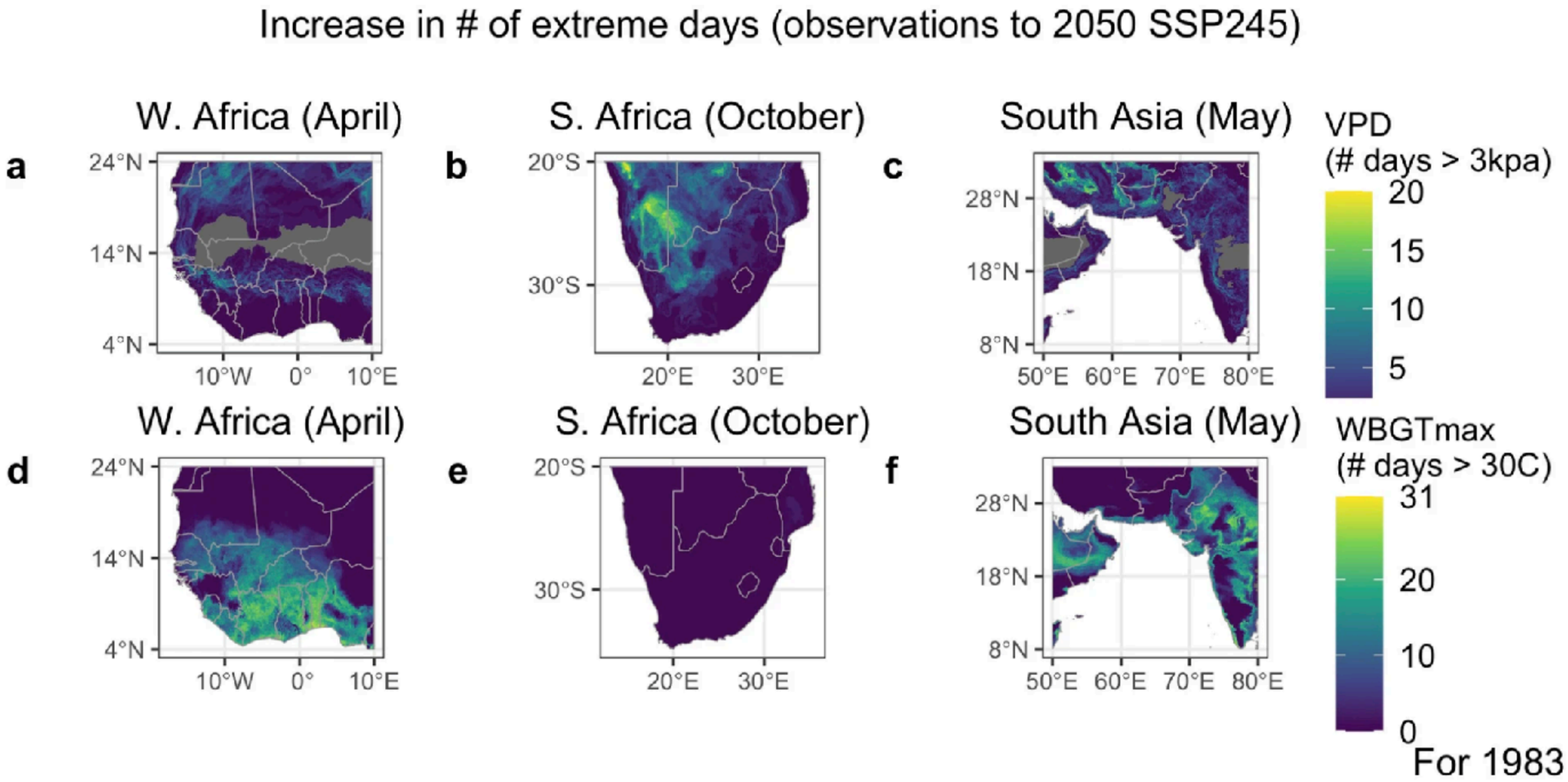
ERA-5
Temperature
Record
25 x 25 km

New
CHC-CMIP6
Projections
5 x 5 km

Williams *et al.* 2024

Fig. 6

From: High resolution climate change observations and projections for the evaluation of heat-related extremes

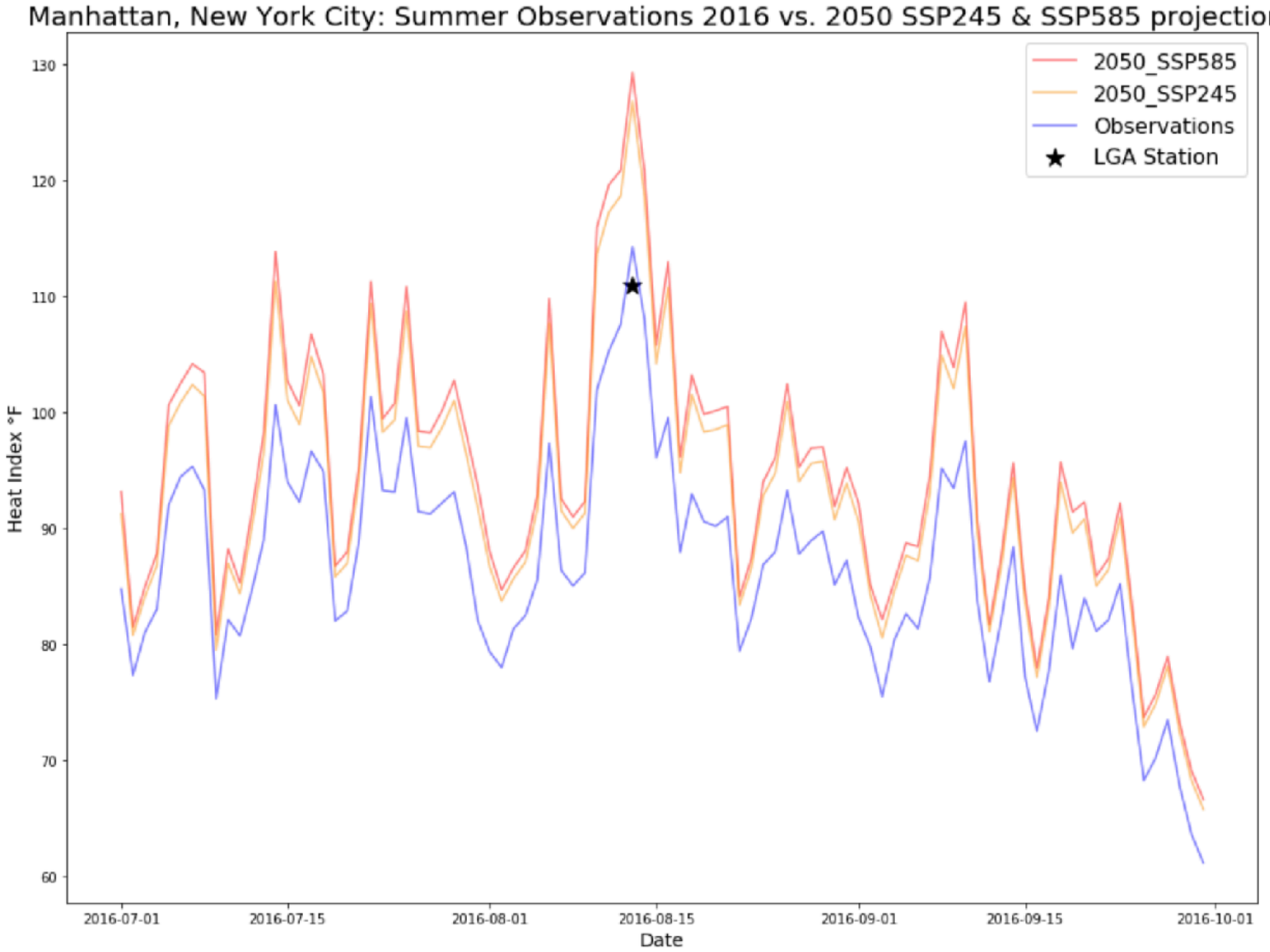


Change in the number of 'extreme' days between the first year (1983) of the observational and 2050 SSP245 scenarios. The extremes are defined as surpassing the 3 kPa threshold for VPD and the 30 °C threshold for $WBGT_{max}$. The increase in the number of extreme days is depicted for the local hottest month for the Sahel in April (right column), southern Africa in October (middle column), and southern Asia in May (right column). Note, locations that already experience extremes for all days of the month are grayed out (e.g. across the Sahara for VPD).

CHC-CMIP6

Williams *et al.* 2024

CHC-CMIP6



Note figure made with preliminary data from Williams *et al.* 2024.

Concluding Points

- Trend-preserving, higher resolution climate projections can help define **“slow onset”** events.
- Slow onset events need to be linked to actual (1) impacts to humans and (2) decisions to migrate.
- On-the-ground impacts and mobility of people need to be substantiated by the experience of the people who have decided to move.
- Impacts from slow onset events need to be contextualized within economic, social, cultural, and political influences.