

# Assessing regional sensitivities to scenario uncertainty through climate emulation

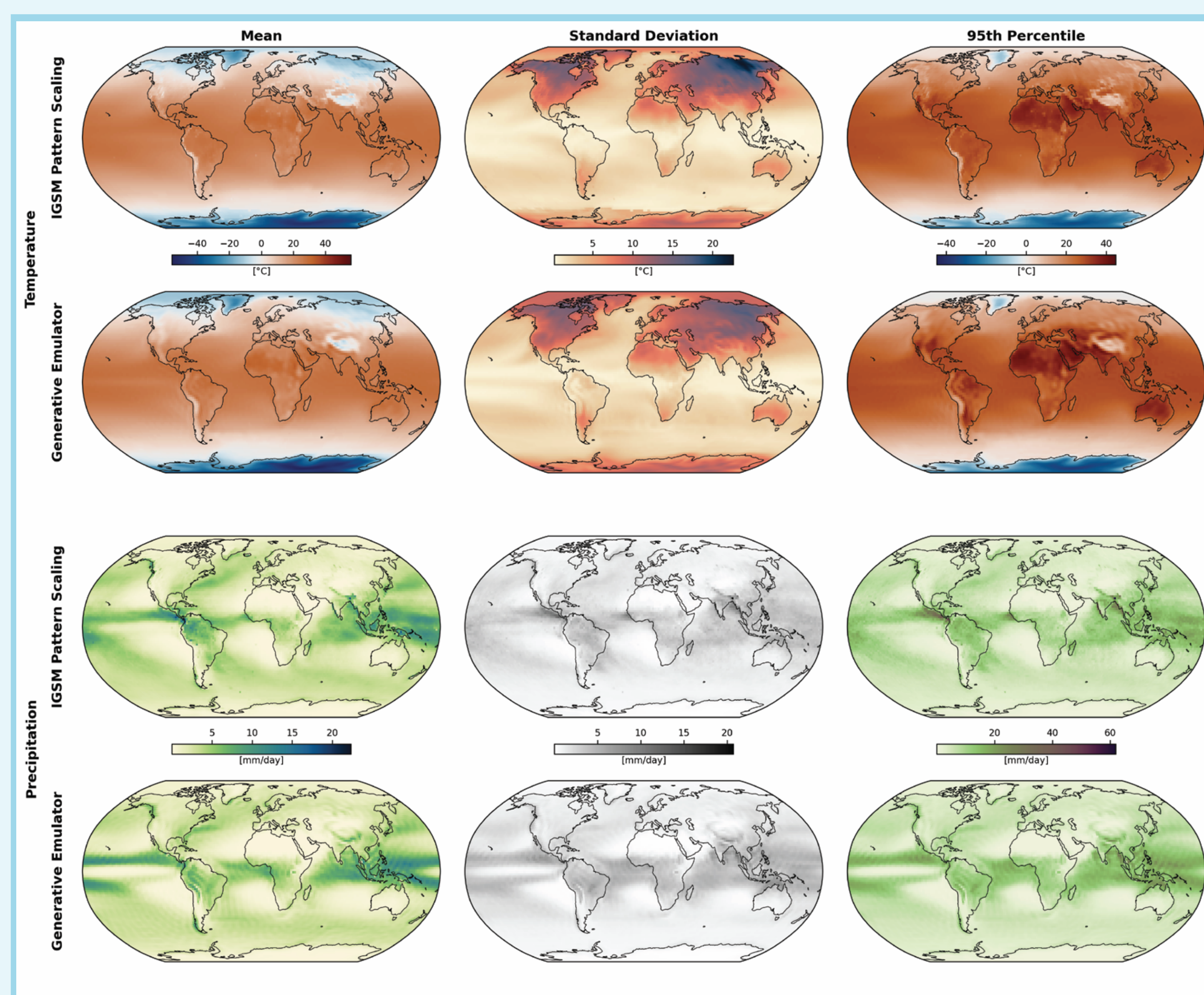
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## I. Emulating future heat stress

- There is **high uncertainty** in climate change-induced **regional temperature changes**.
- Earth System Models are **too computationally expensive** to assess this uncertainty.
- To resolve this, we use a **novel generative AI climate emulator** to project future heat stress.

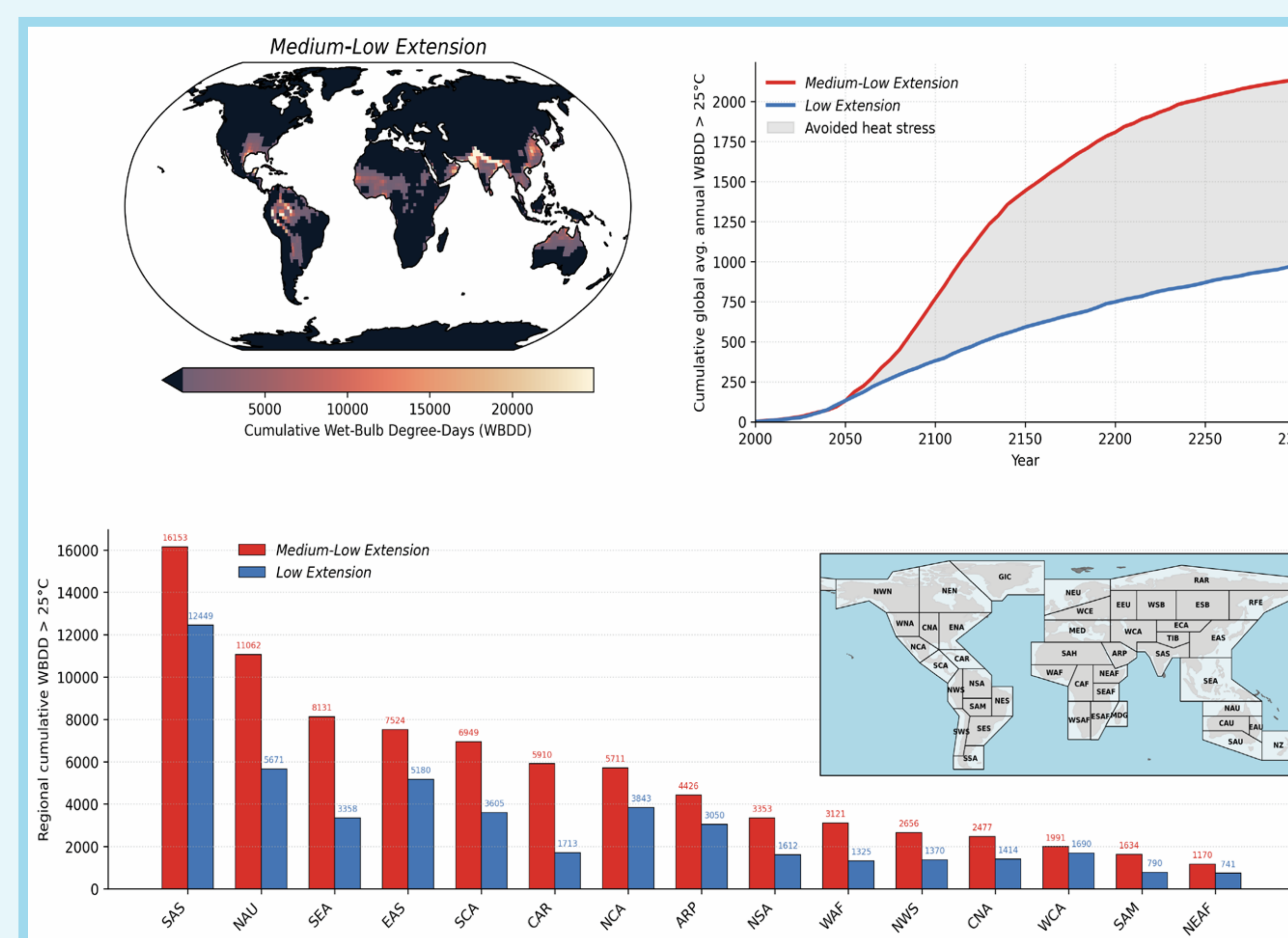
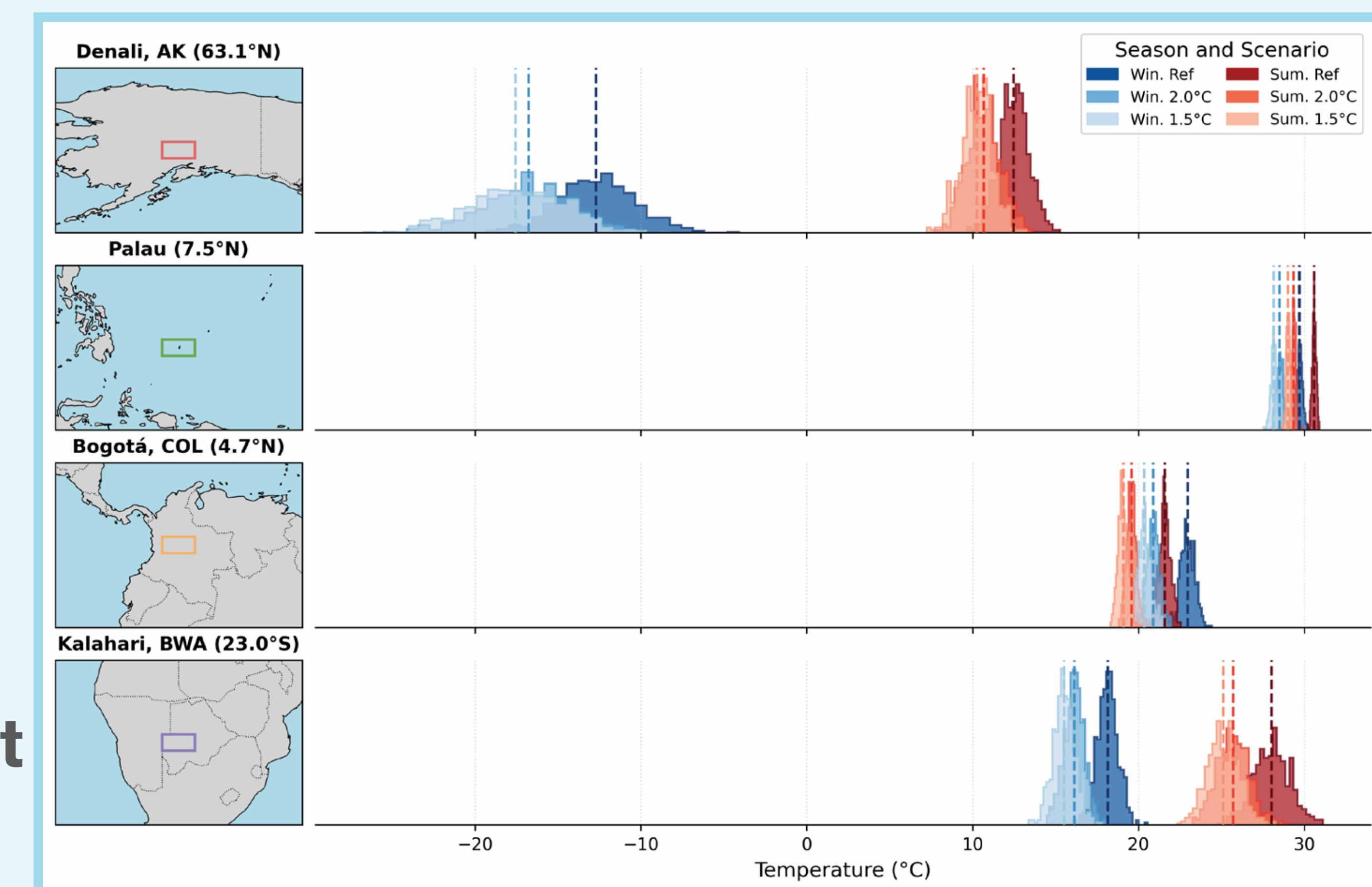
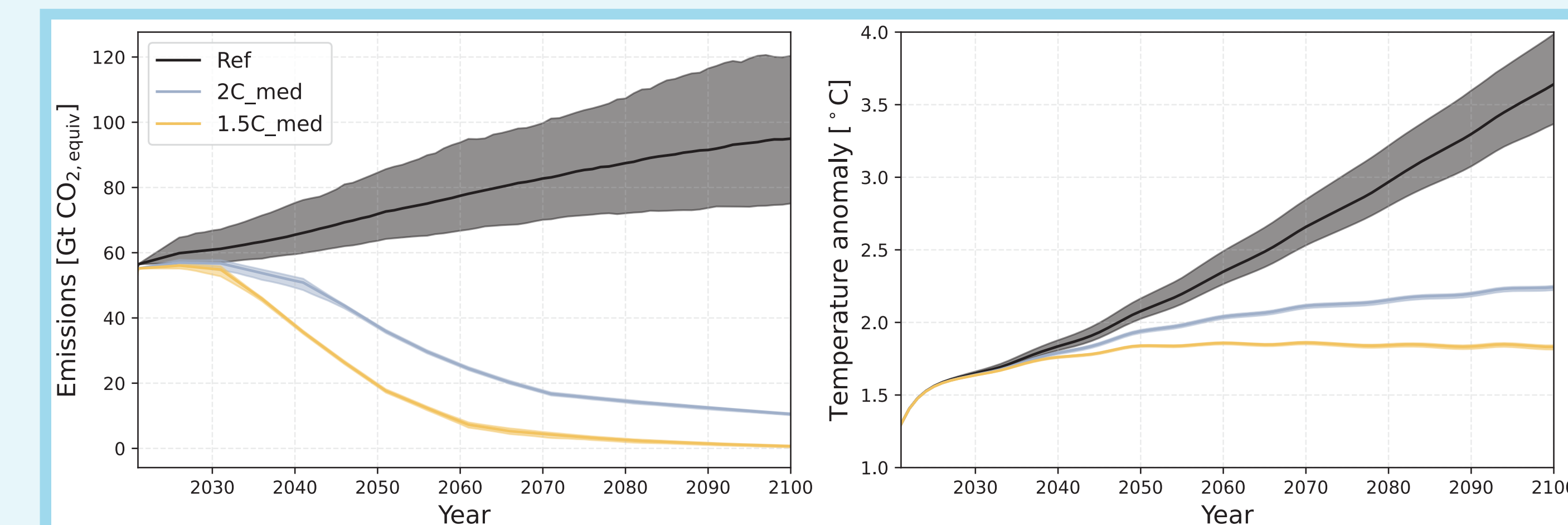
## II. Emulator benchmarking

- We benchmark our emulator against an existing technique (pattern scaling; *Gao et al. 2023*).
- Our emulator **reliably reproduces temperature and precipitation patterns** (below), along with relative humidity and wind fields.
- This is essential to **build trust** in our new tool.



## III. Climatological changes

- We analyze projected **changes in local temperature distributions** across three scenarios (upper right) and four regions (lower right).
- **High-latitude regions** experience significantly **larger temperature shifts** compared to equatorial zones.
- **Differences in local temperature outcomes** between the 1.5°C and 2.0°C policies are **often statistically insignificant**.
- While mitigation is highly effective on a global scale, **the benefits of stricter policy targets can be difficult to detect locally**, complicating messaging.



## IV. Overshoot heat stress

- We compare **heat stress** in a low emissions pathway versus an overshoot scenario (both reaching the same long-term temperature target).
- **South Asia** and **Northern Australia** face the largest projected increases in heat stress under both scenarios.
- Despite sharing identical long-term targets, the low emissions scenario yields **less than half the magnitude of heat stress** of the overshoot scenario.