

Linking Pacific Storms to North American Heat Waves

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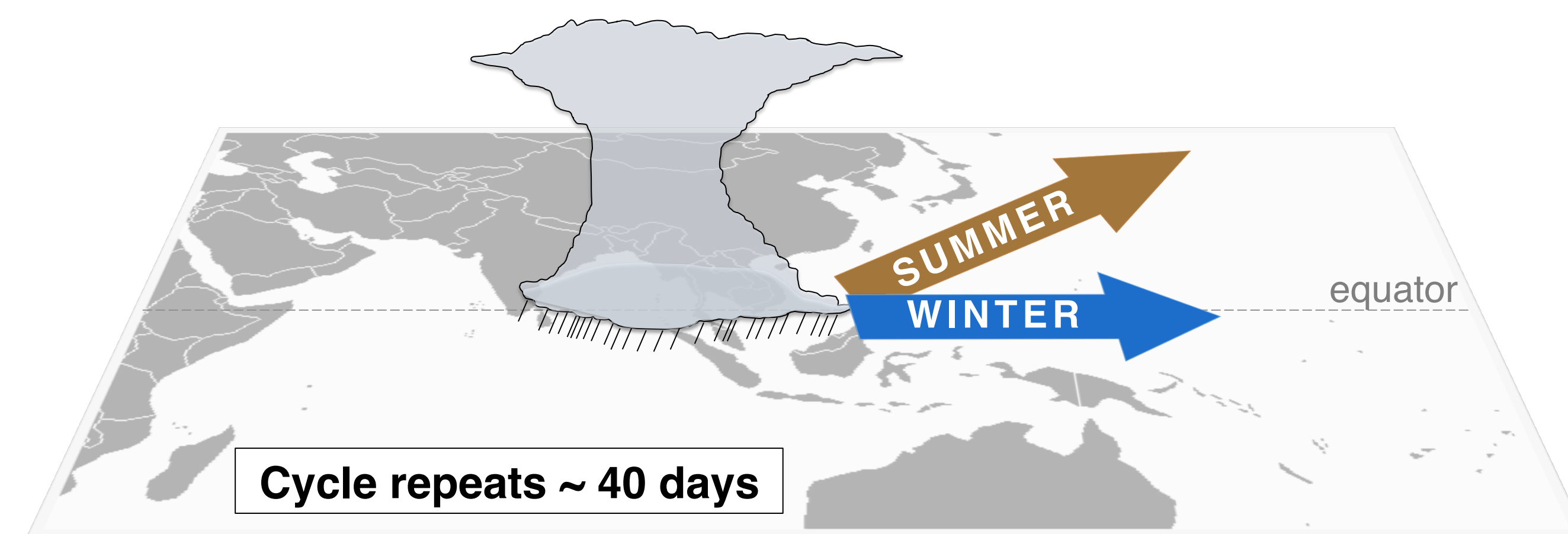


Background

Eastward-propagating tropical Indian Ocean and West Pacific storm system well-understood to influence global weather in the *winter*.

Heat waves are #1 cause of weather-related deaths in the US, but remain poorly-predicted, especially at long lead-times

Question: Is there a link between the *summertime* version of this storm system and US heat waves?

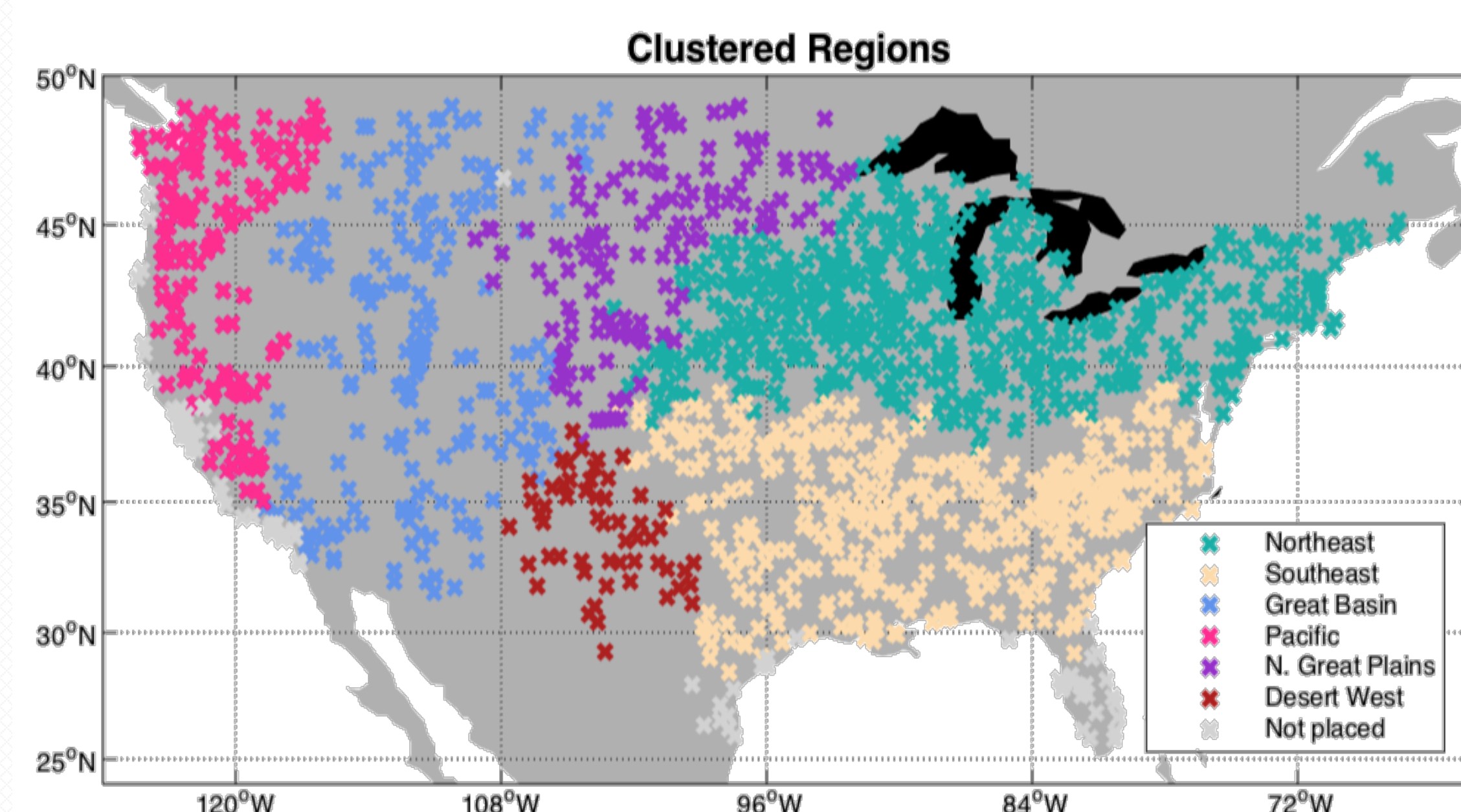


PURPOSE

- Increase predictability of deadly heat waves
- Improve understanding of summer links between tropical and extratropical weather

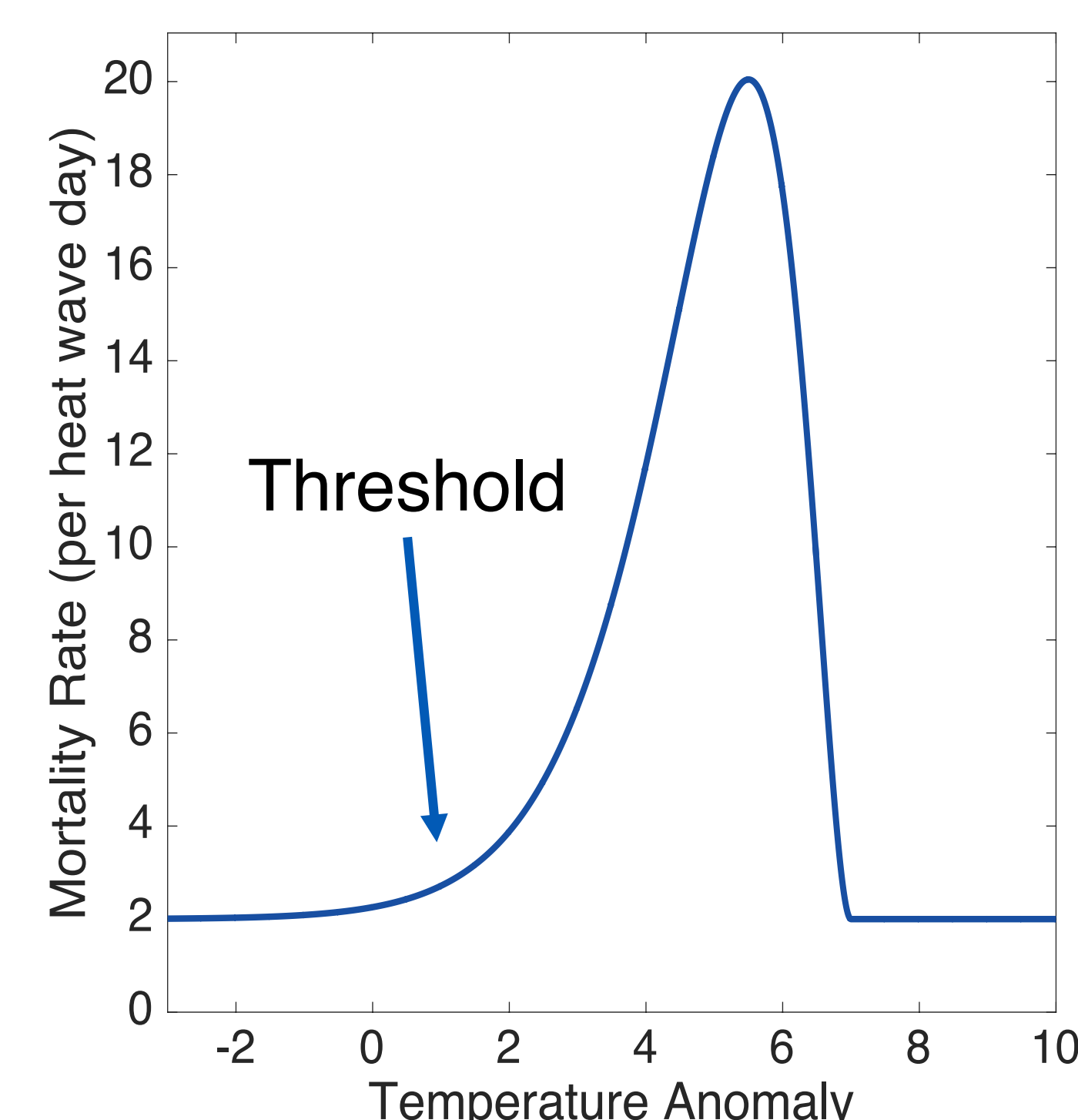
Methods

- 1) Define heat waves in a way significant to public health
- 2) Determine historical anomalous heat wave probability following storm events.



Machine learning algorithm groups US weather station into regions based on extreme temperature similarity

Heat wave—daily maximum temperature anomaly exceeds threshold



Results

Heat wave activity after Indian Ocean/W. Pacific storms

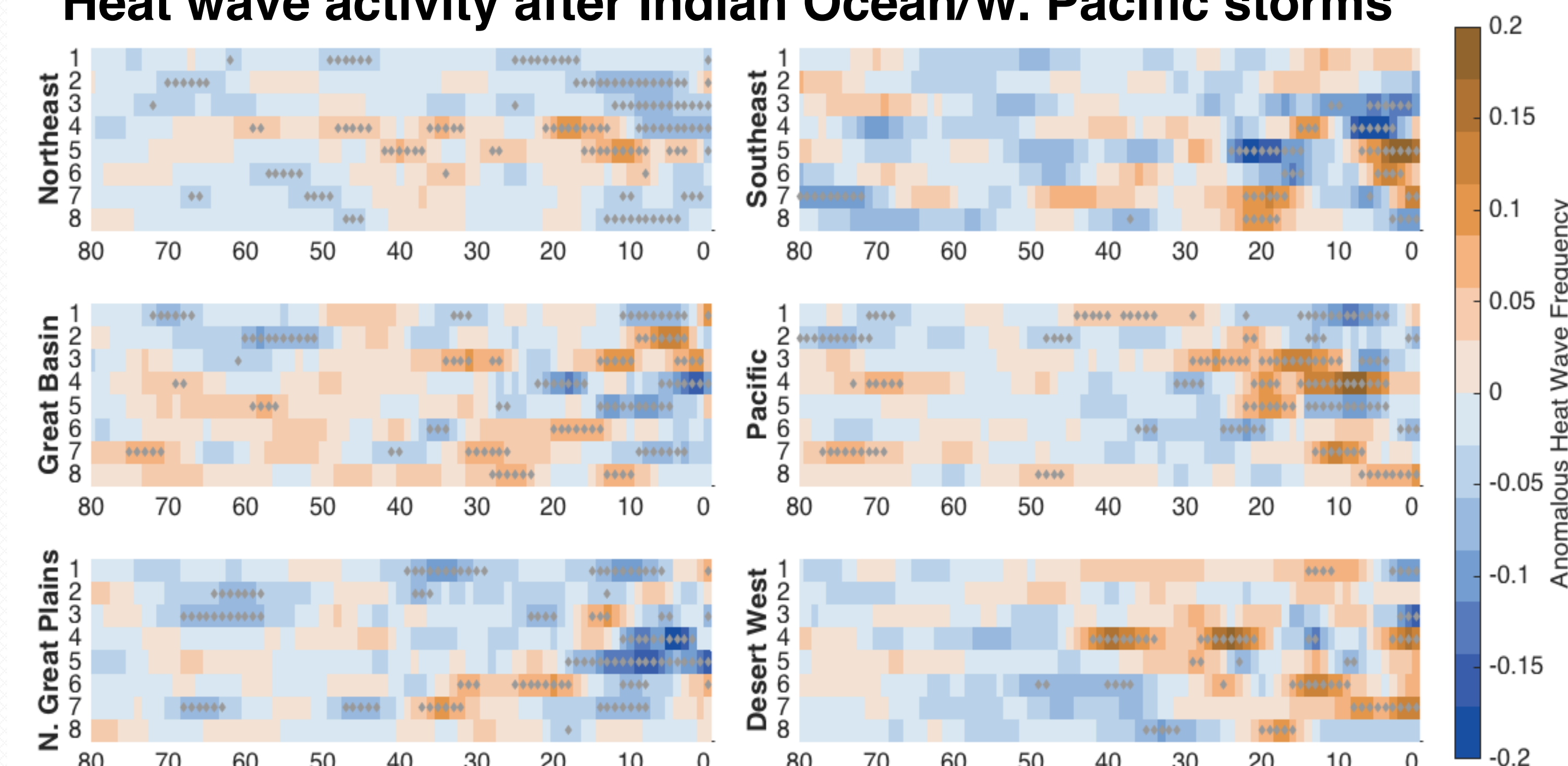


FIGURE KEY

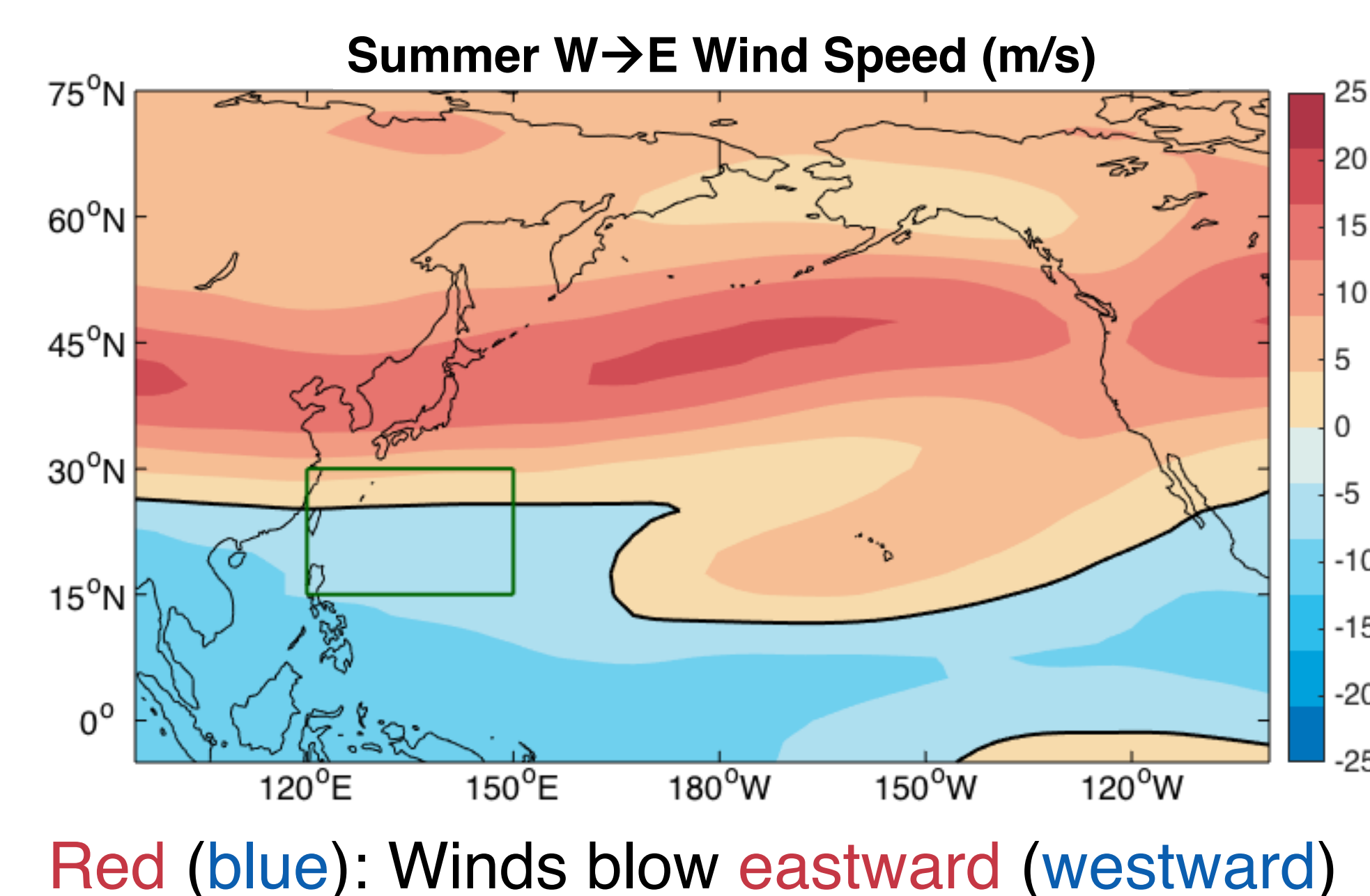
- Vertical axis (#1-8) represents storm position in cycle
→ 1 = over Indian Ocean; 8 = over West Pacific
- Horizontal axis numbers describe how many days into the future heat wave activity is being composited over
- Colors indicate increased (orange) or decreased (blue) frequency of heat waves
- Gray diamonds indicate significance at 95% confidence using block bootstrap test

SIGNIFICANCE

There is significant anomalous heat wave activity occurring following a storm propagation event (stripes of the same color from upper left to lower right) for some US regions (e.g., Pacific cluster of weather stations between days 40 to 0).

HOW IT WORKS

- Jet stream acts as 'waveguide'; planetary waves can not propagate through westward winds
- Composites (figure above) for storms only when average wind speed in green box > 7 m/s



Conclusion

- For some regions of the US, the persistent storm system in the Indian Ocean and West Pacific seems to influence heat wave activity.
- This signal is stronger for certain conditions of the jet stream (jet "entrance" shifted further south)

Impact

- Findings suggest strong potential for use in seasonal to subseasonal heat wave forecasting
- Save human lives and protect property
- Test climate models

Future Work

- Use simplified global atmospheric circulation model to verify dynamical mechanism
- Develop statistical model using combination of storm system and jet stream information and test heat wave forecast skill