

Calculating and Communicating Daily Climate Change Attribution

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apershing@climatecentral.org

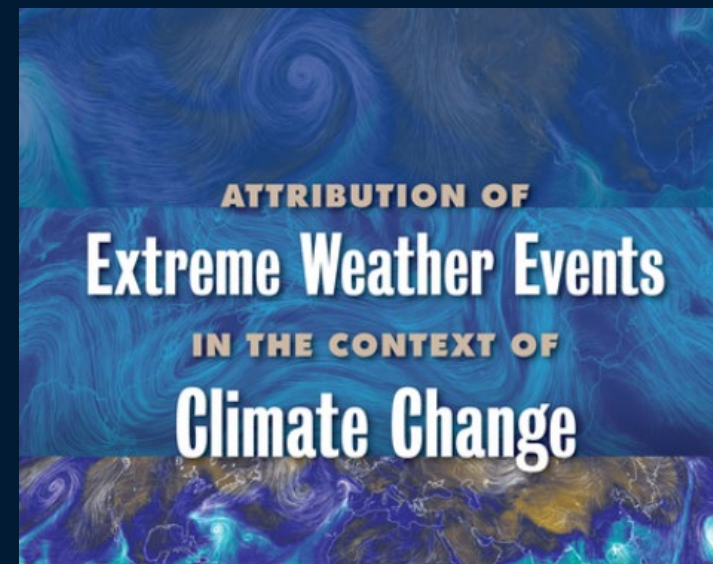
Co-authors:

Daniel Gilford, Bernadette Woods Placky,
Dan Dodson, Benjamin Strauss



Event Attribution

- Doesn't answer "cause" question
 - Change in likelihood
 - Change in magnitude



World Weather Attribution website header and latest analyses section. The header includes the logo and navigation menu: Home, About, Analyses, News, Projects, Resources. The latest analyses section features three articles:

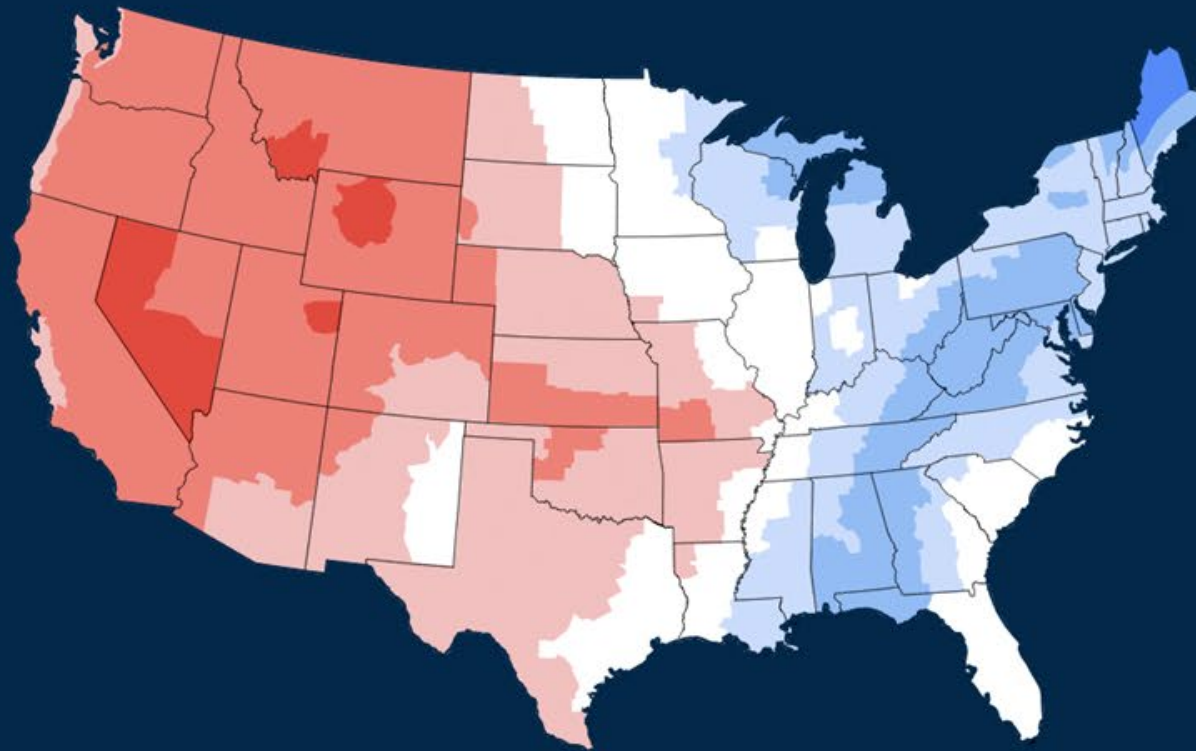
- Climate change likely increased extreme monsoon rainfall, flooding highly vulnerable communities in Pakistan**
- Without human-caused climate change temperatures of 40°C in the UK would have been extremely unlikely**
- Climate change increased heavy rainfall, hitting vulnerable communities in Eastern Northeast Brazil**

The Washington Post article header and title. The header includes the navigation menu: Politics, Opinions, War in Ukraine, Investigations, Well-Being, Tech, Lifestyle, World, D.C., Md. & Va., Sports. The article title is: "Study finds that climate change added 10% to Ian's rainfall". The author is Seth Borenstein | AP, and the date is September 29, 2022 at 10:16 p.m. EDT.

Climate Shift Index

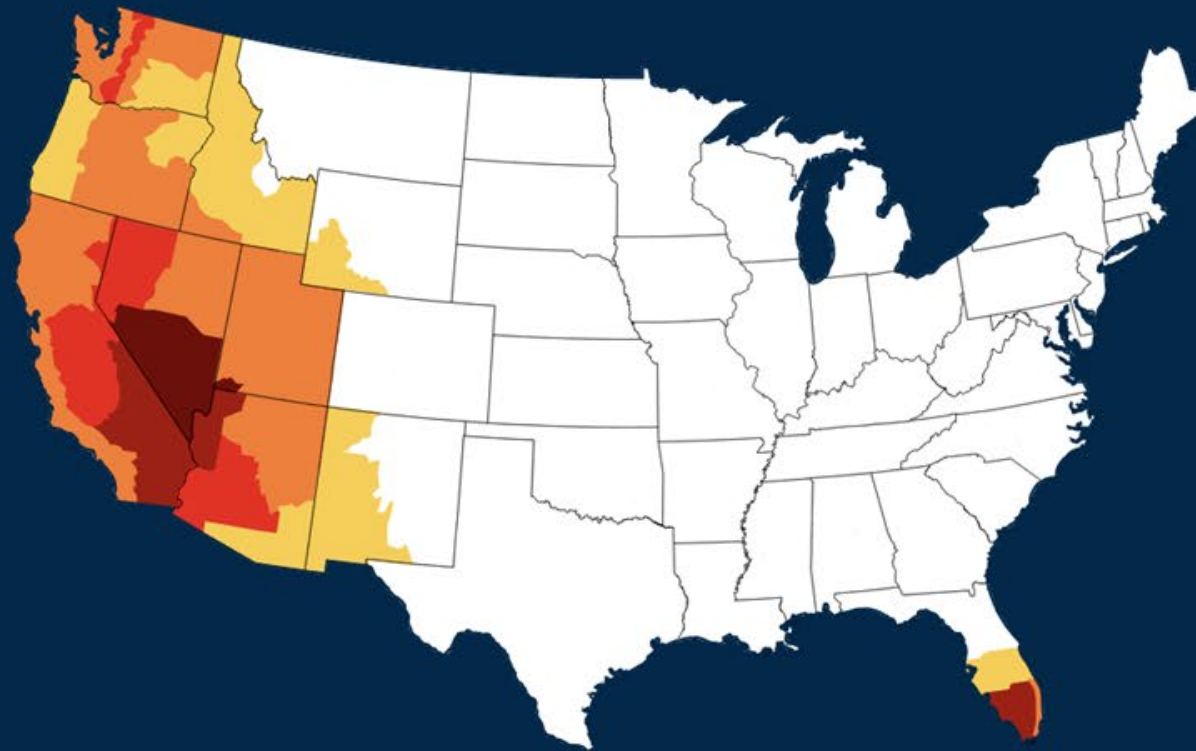
Temperature Anomaly

For Low Temperature on October 10, 2022

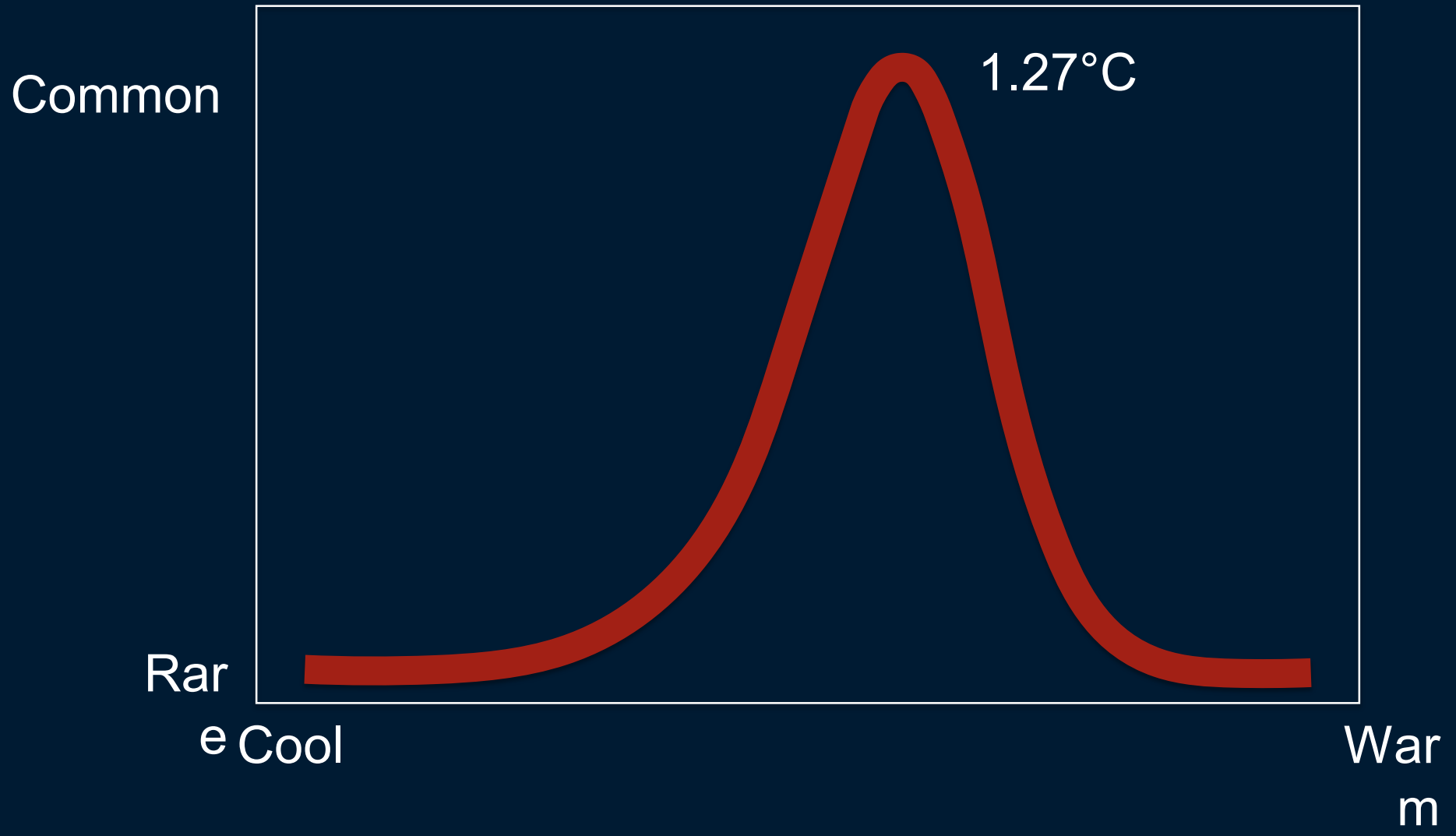


Source: Climate Central analysis based on NOAA data. Produced on 10/9/2022. **CLIMATE CENTRAL**

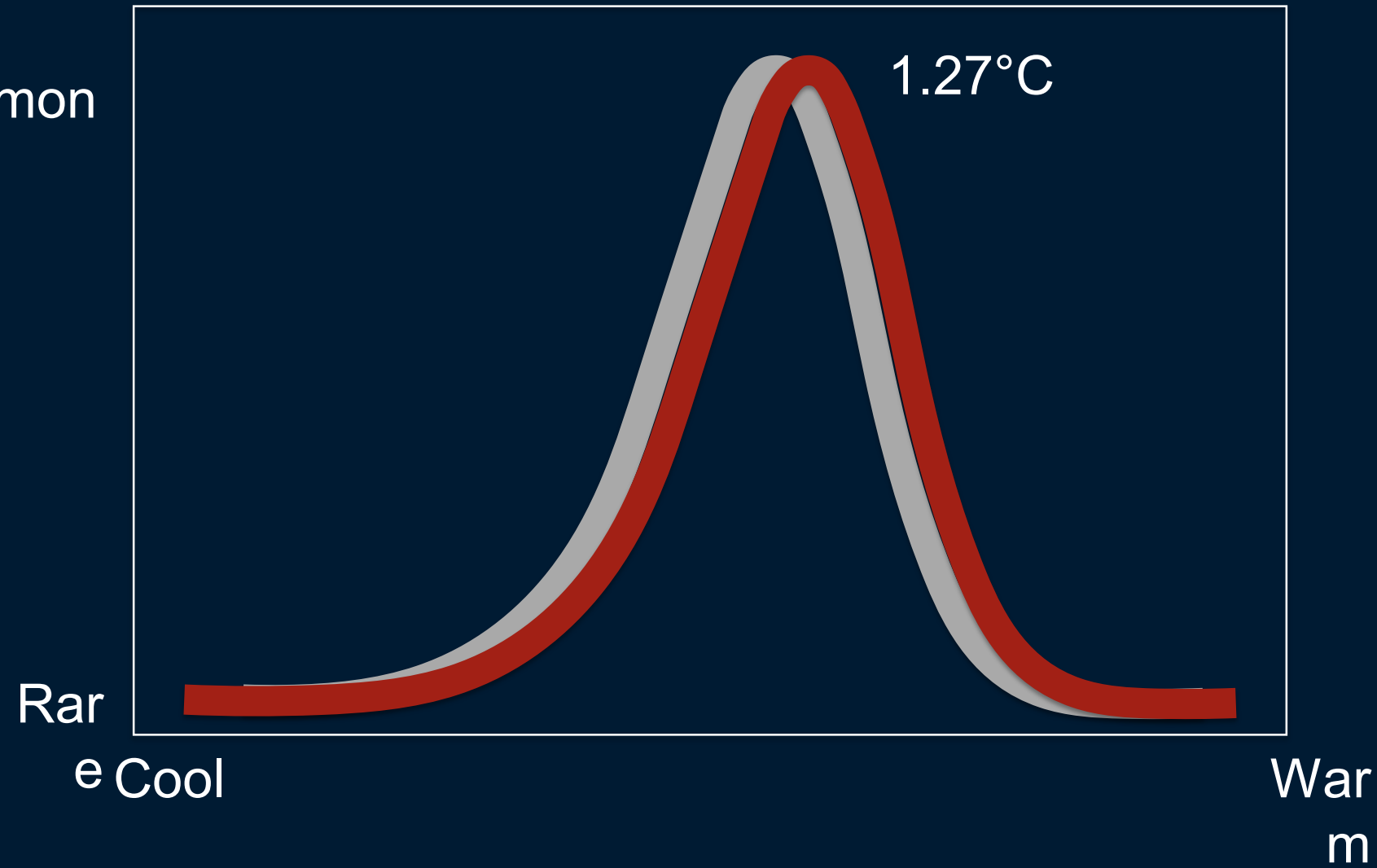
Climate Shift Index™ For Low Temperature on October 10, 2022



Source: Climate Central analysis based on NOAA data. Produced on 10/9/2022. CLIMATE CENTRAL



Common



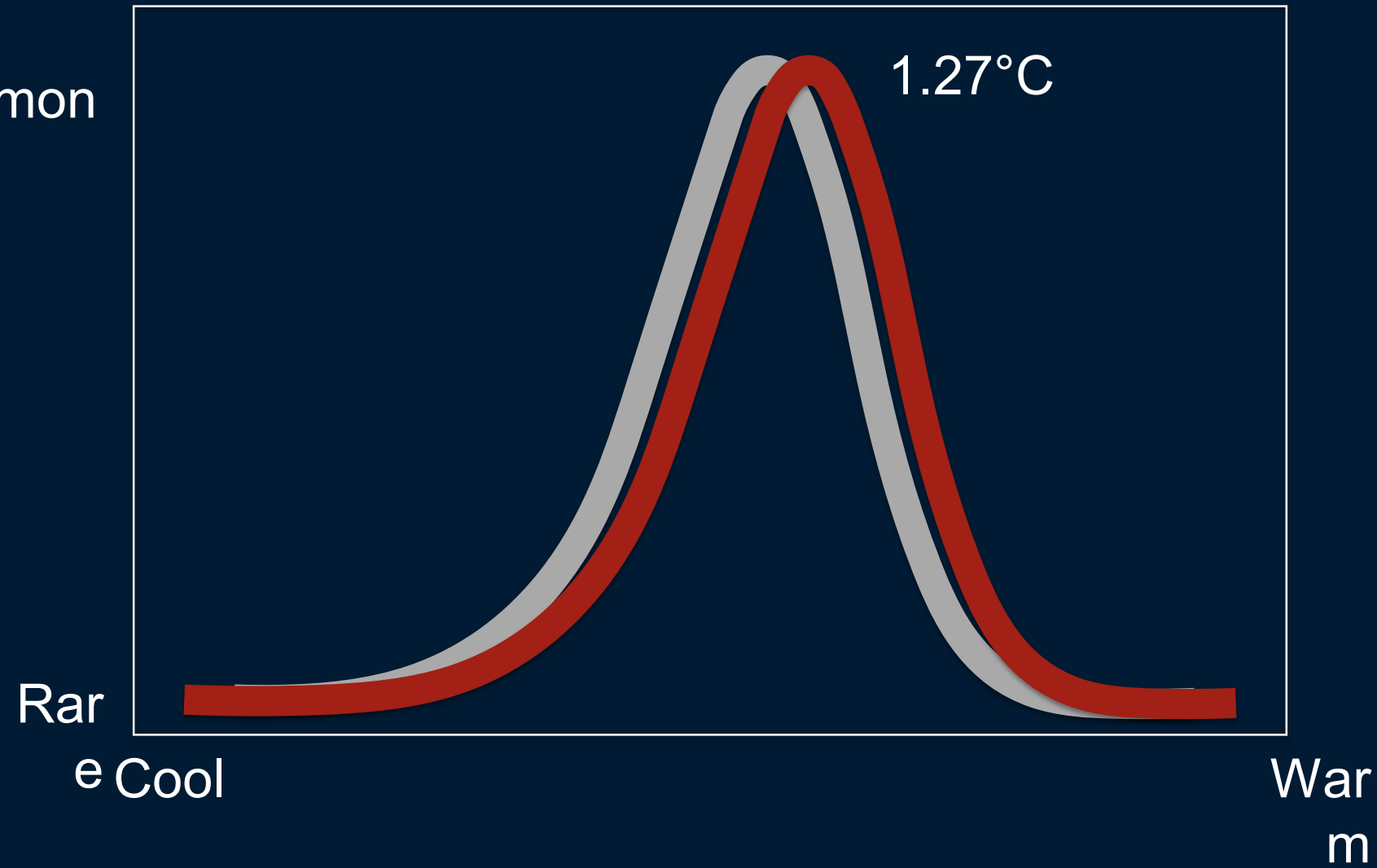
1.27°C

Rare

Cool

Warm

Common



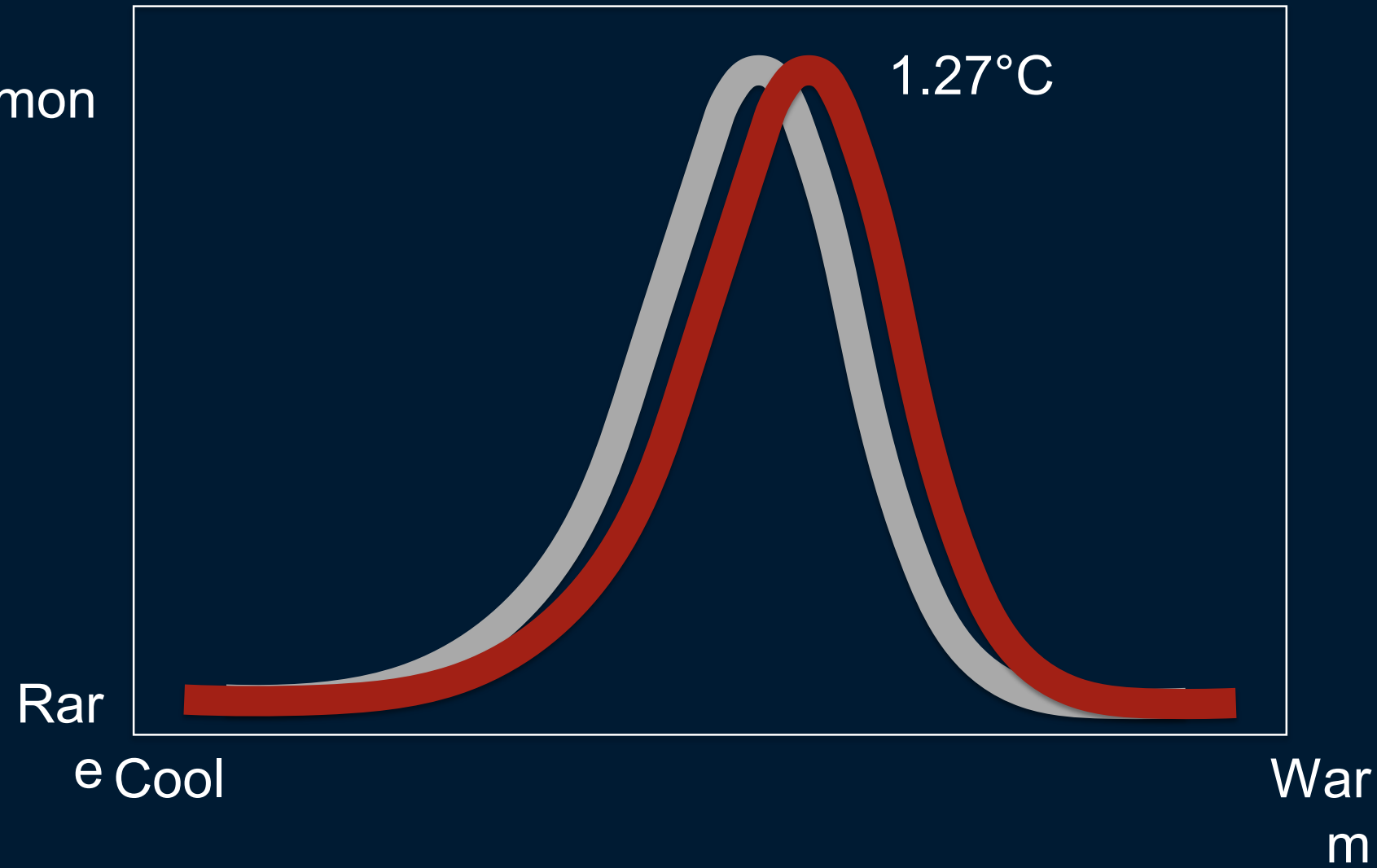
1.27°C

Rare

Cool

Warm

Common



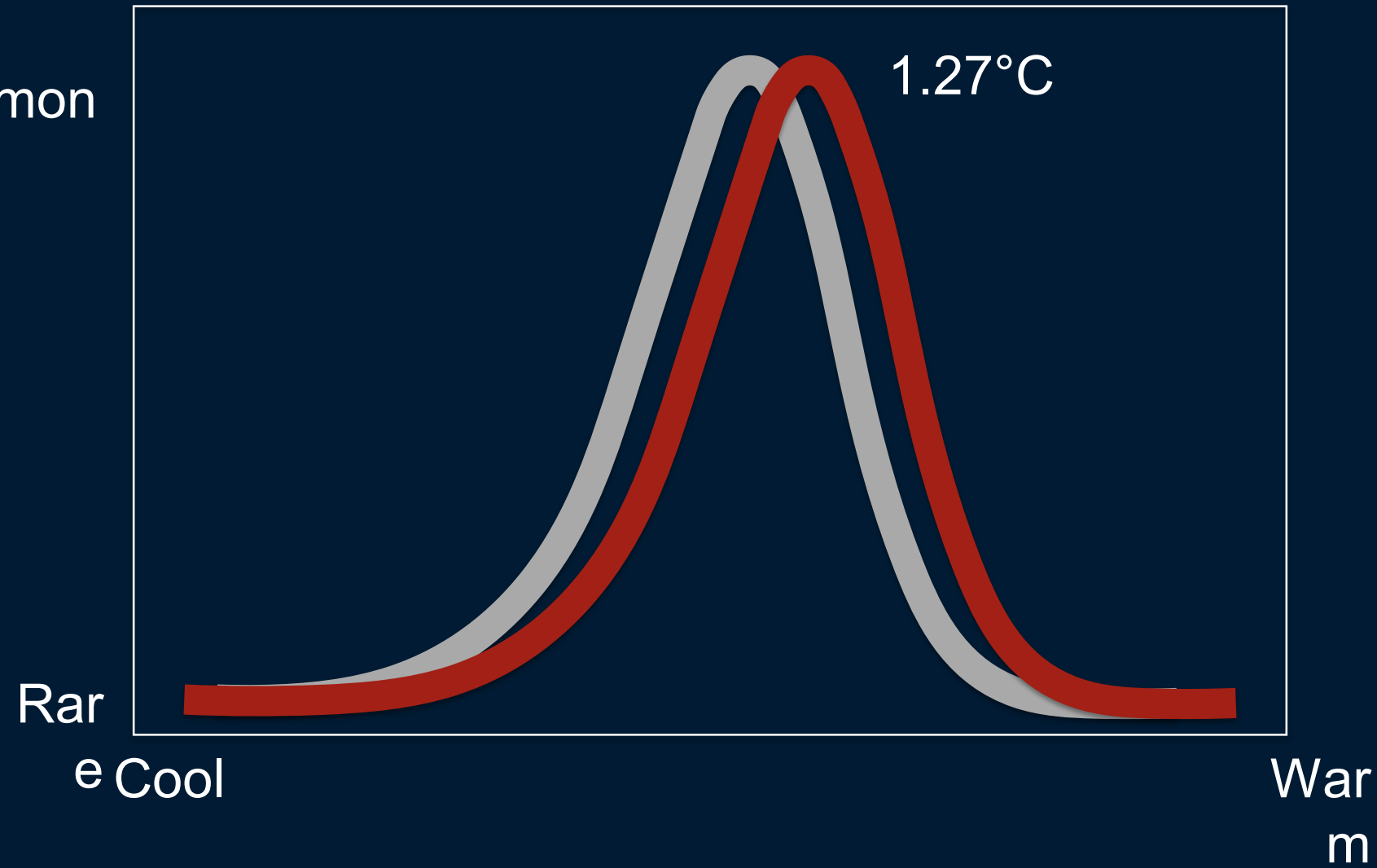
1.27°C

Rare

Cool

Warm

Common

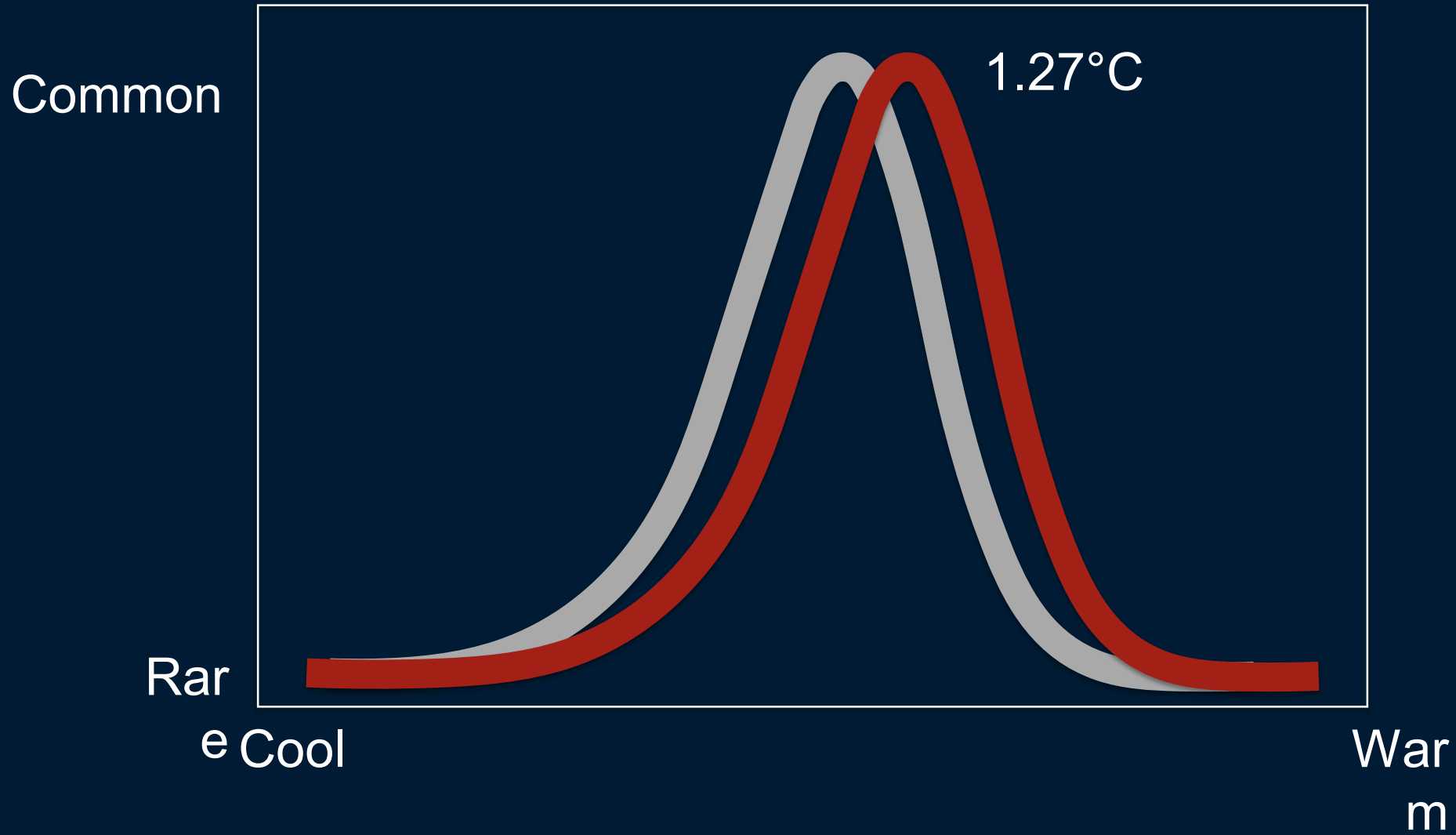


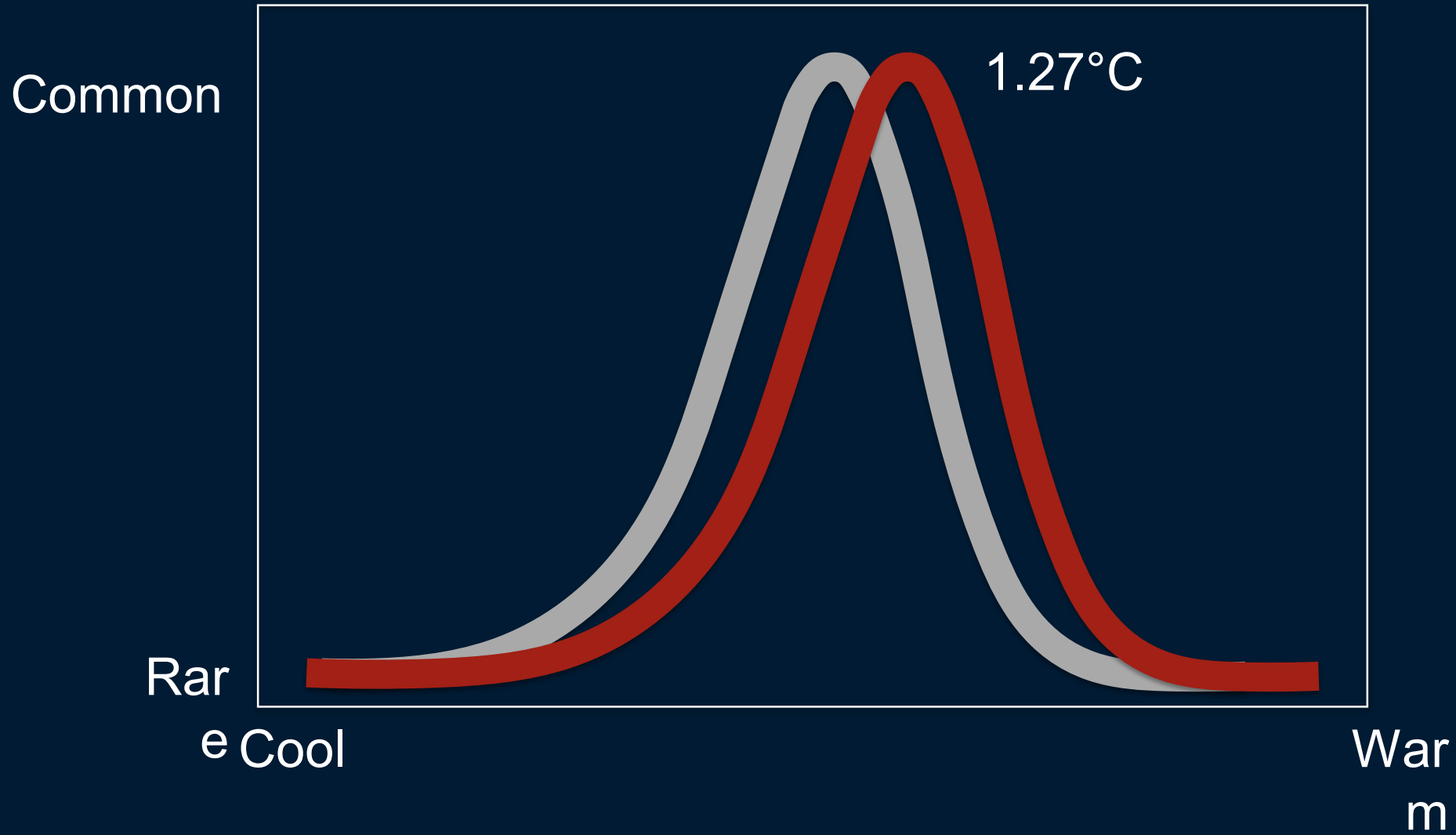
1.27°C

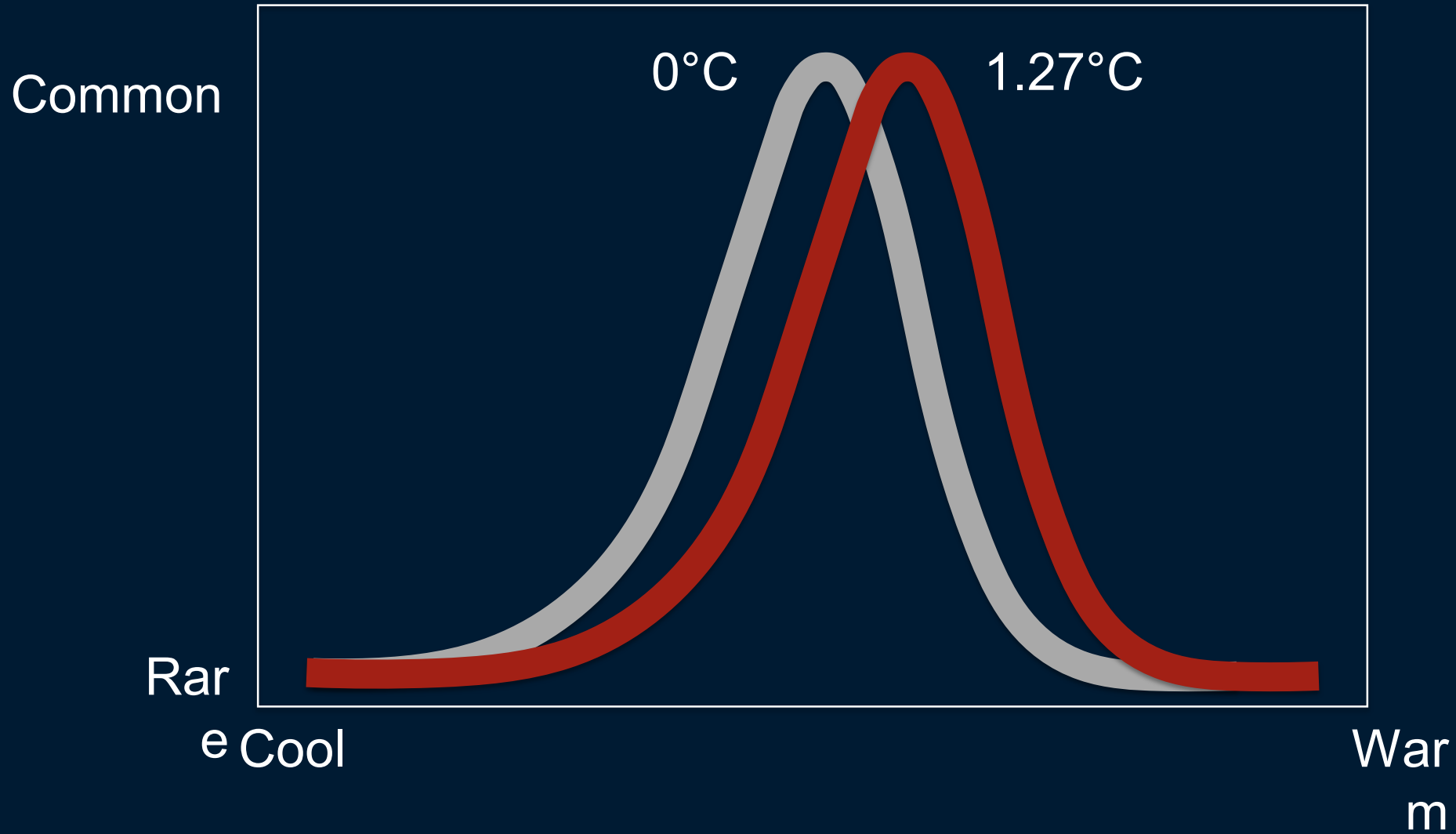
Rare

Cool

Warm

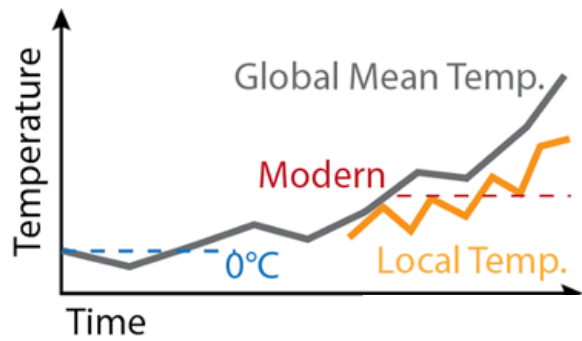






ERA5 reanalysis:
Tmin, Tmax,
Tavg

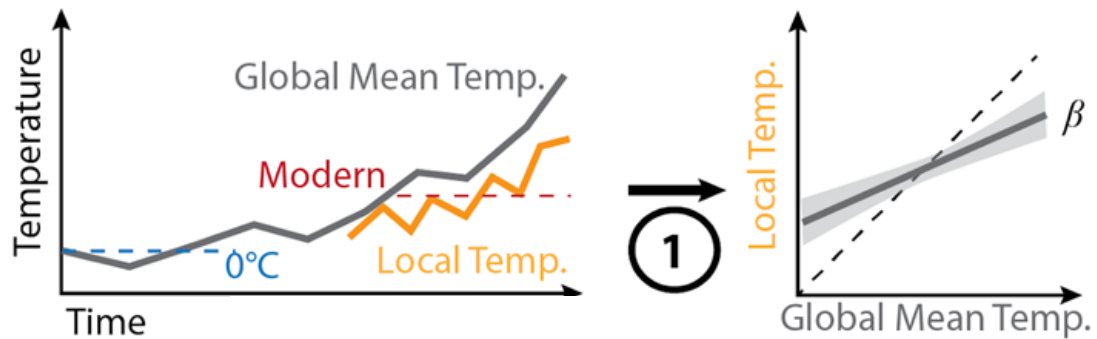
Observation-based Methods



Gilford et al. (2022) A multi-method framework for global real-time climate attribution.
Adv. Stat. Clim. Meteorol. Oceanogr., 8, 135–154

ERA5 reanalysis:
Tmin, Tmax,
Tavg

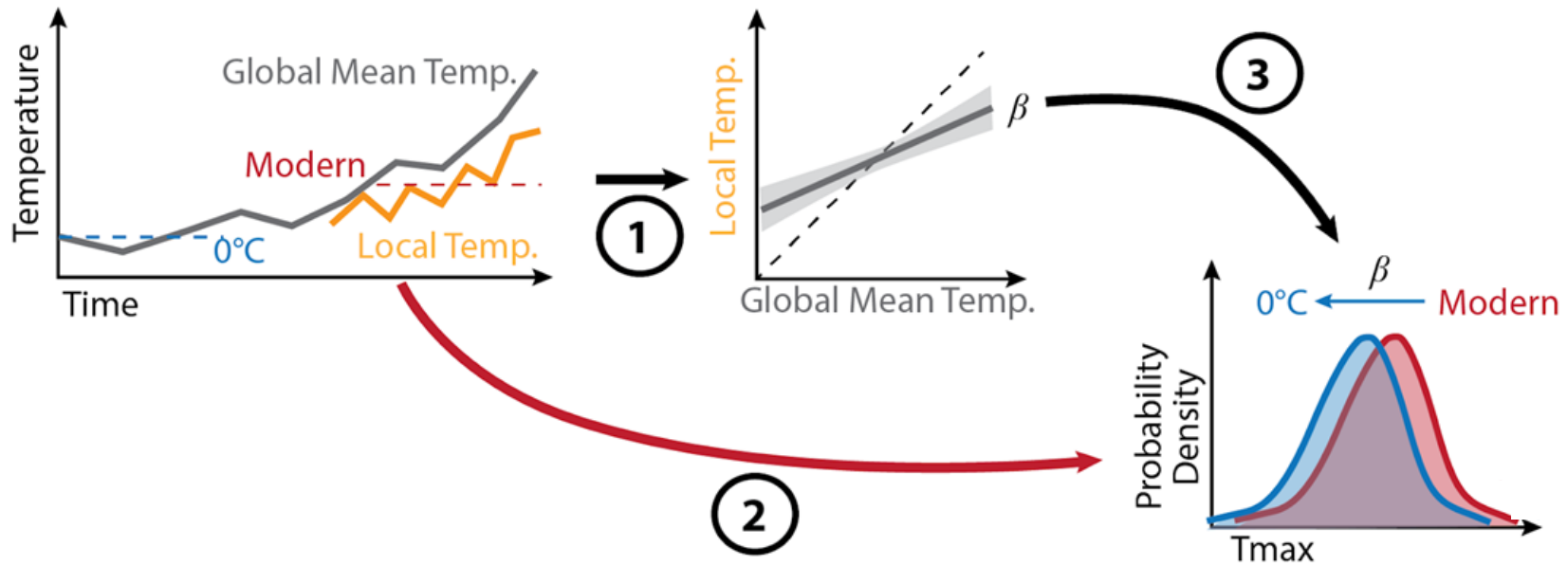
Observation-based Methods



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ERA5 reanalysis:
Tmin, Tmax,
Tavg

Observation-based Methods

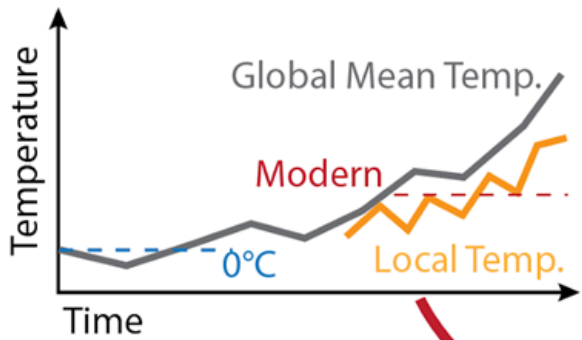


Gilford et al. (2022) A multi-method framework for global real-time climate attribution. *Adv. Stat. Clim. Meteorol. Oceanogr.*, 8, 135–154

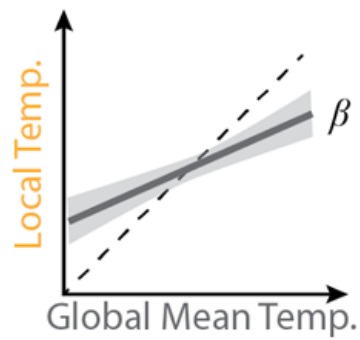
ERA5 reanalysis:
Tmin, Tmax,
Tavg

24 CMIP6
models w/ forced
& control runs

Observation-based Methods

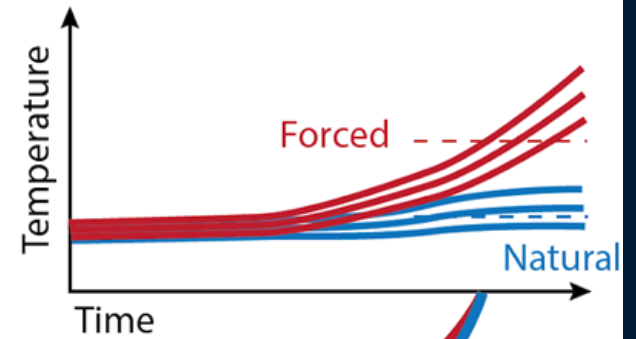


1

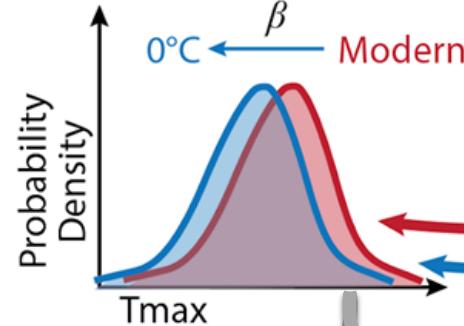


3

Model-based Method



4



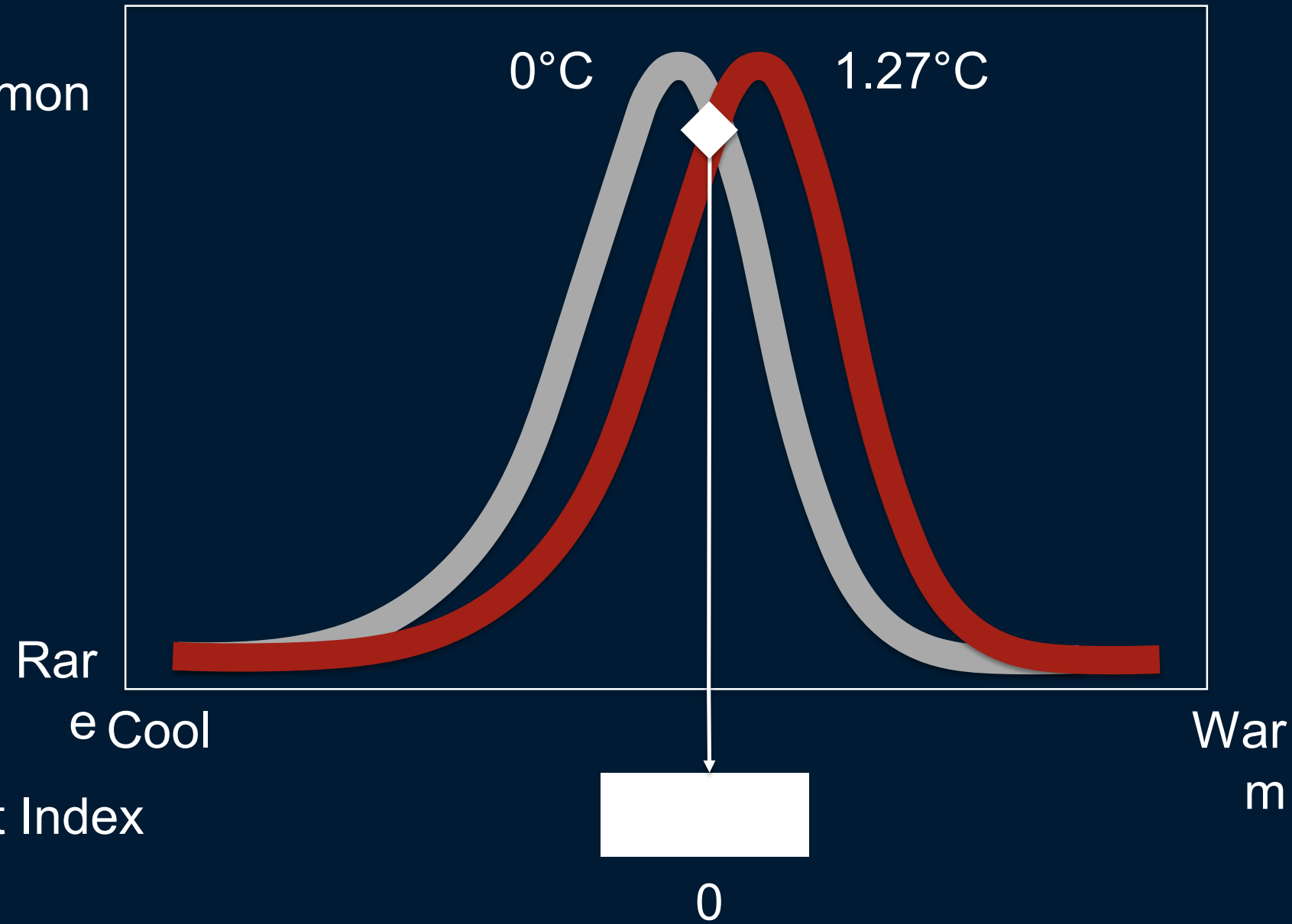
2

ERA5

NOAA GFS

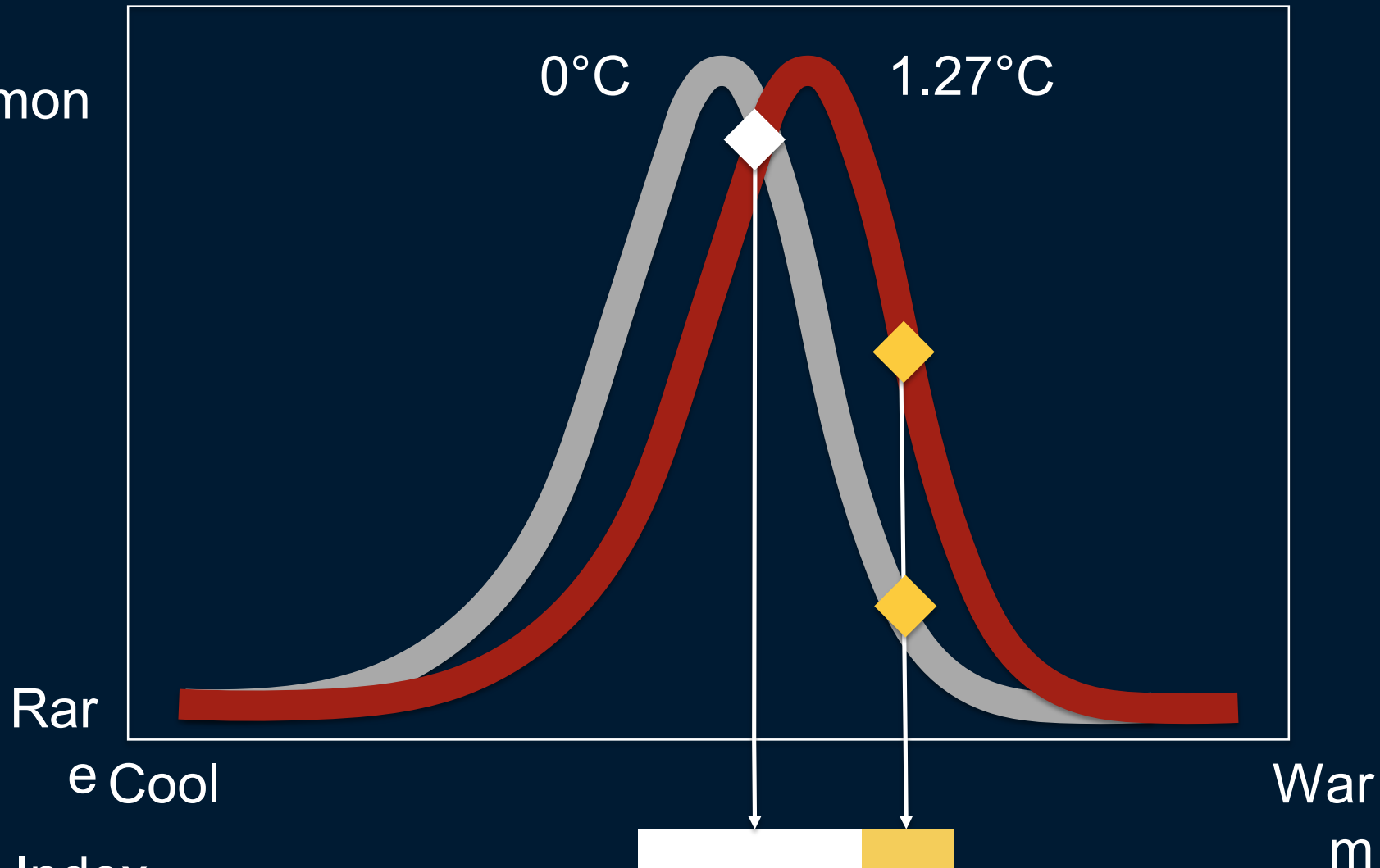
Gilford et al. (2022) A multi-model approach for global real-time climate attribution. *Adv. Stat. Clim. Meteorol. Oceanogr.*, 8, 135–154

Common



Climate Shift Index

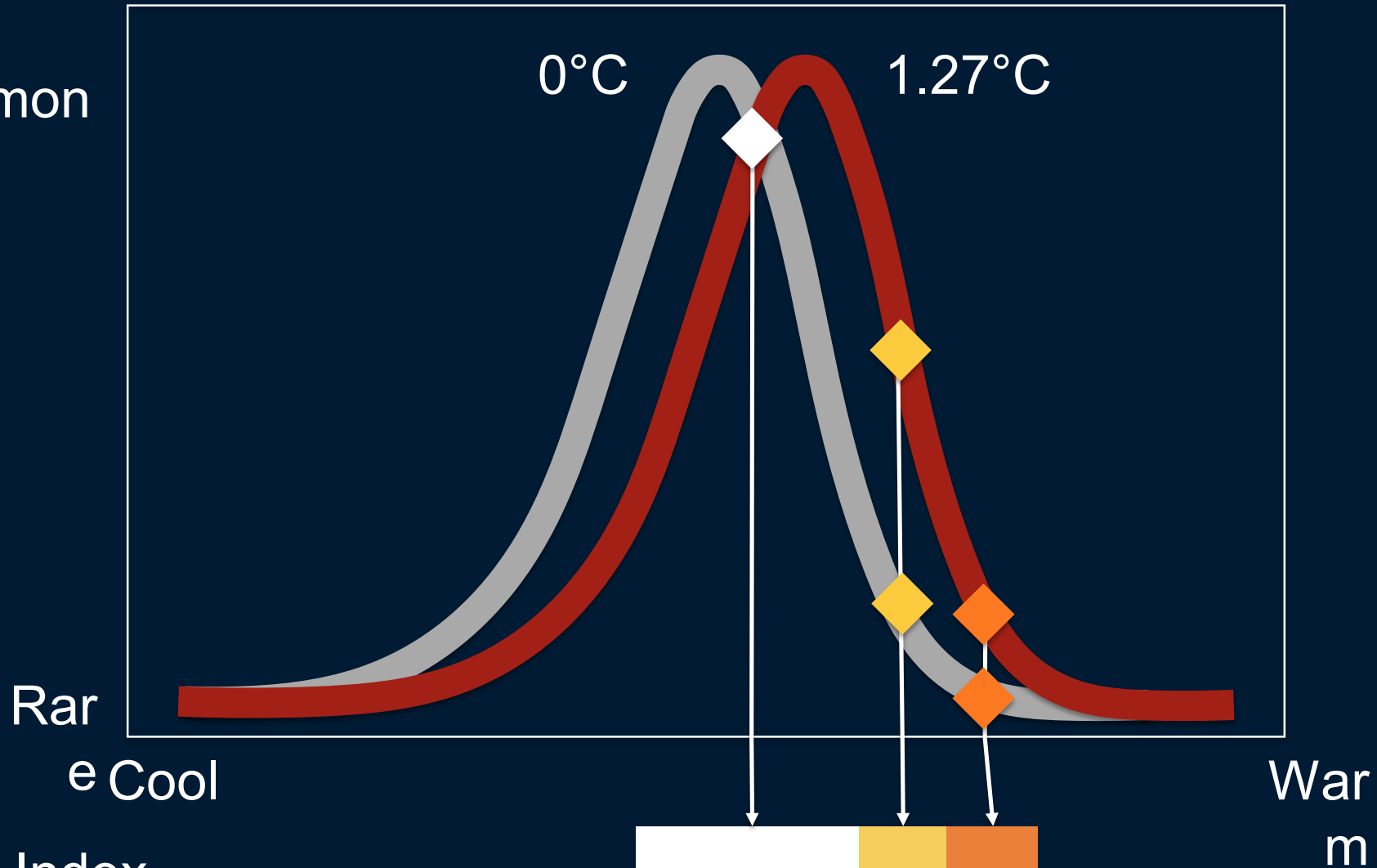
Common



More frequent

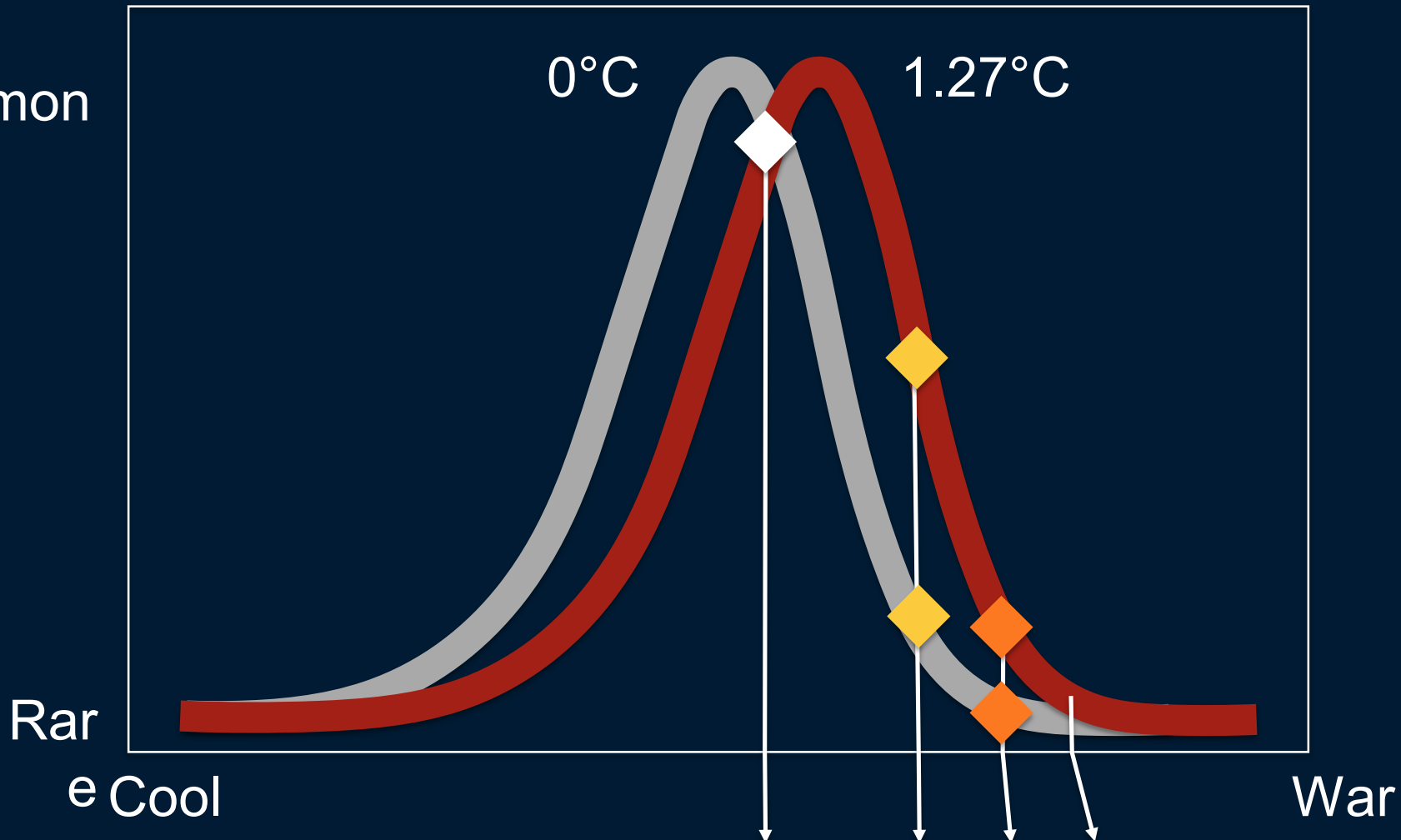


Common



More frequent

Common



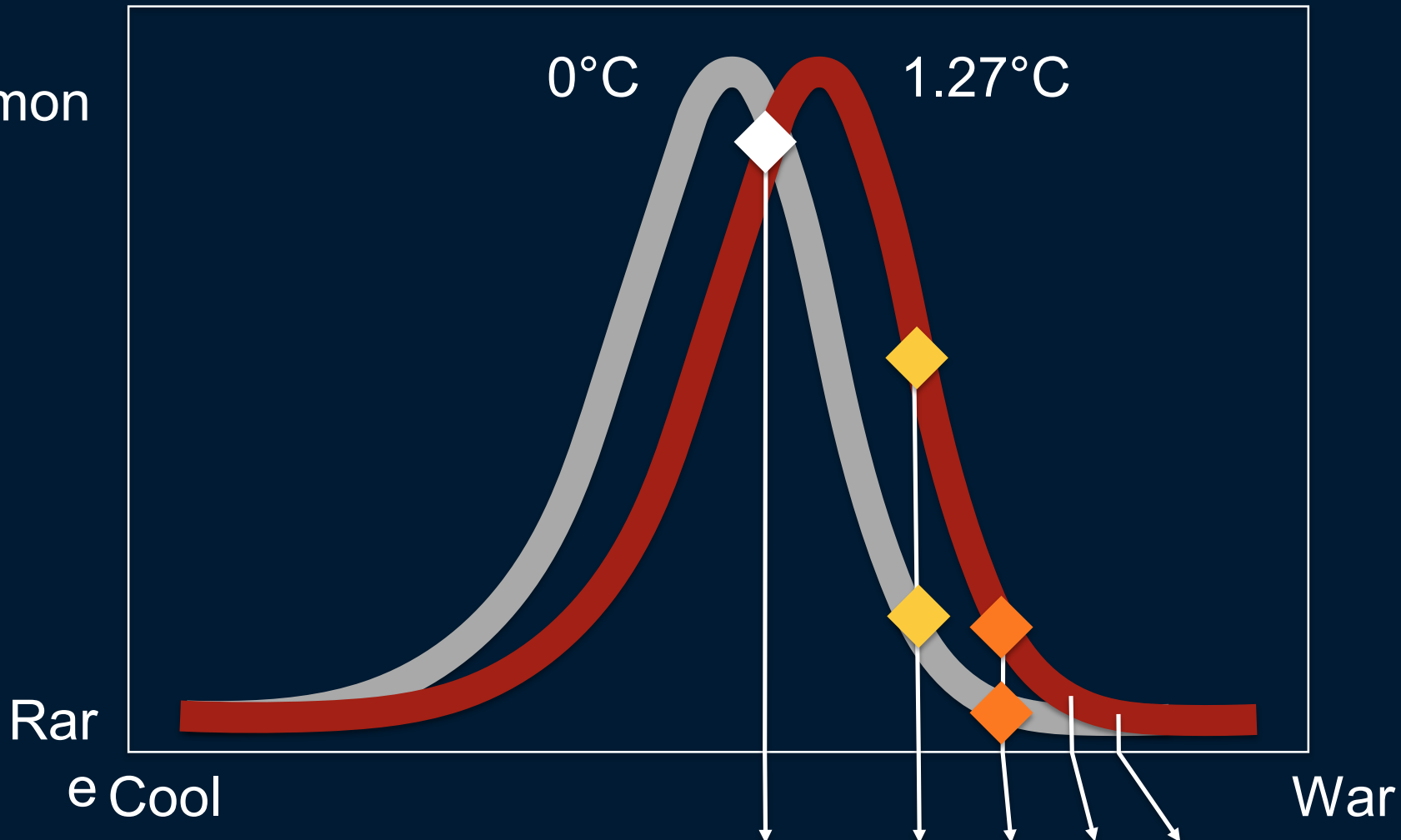
Climate Shift Index



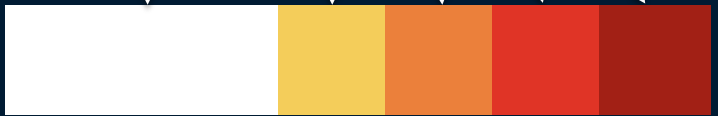
0 1 2 3

More frequent

Common



Climate Shift Index

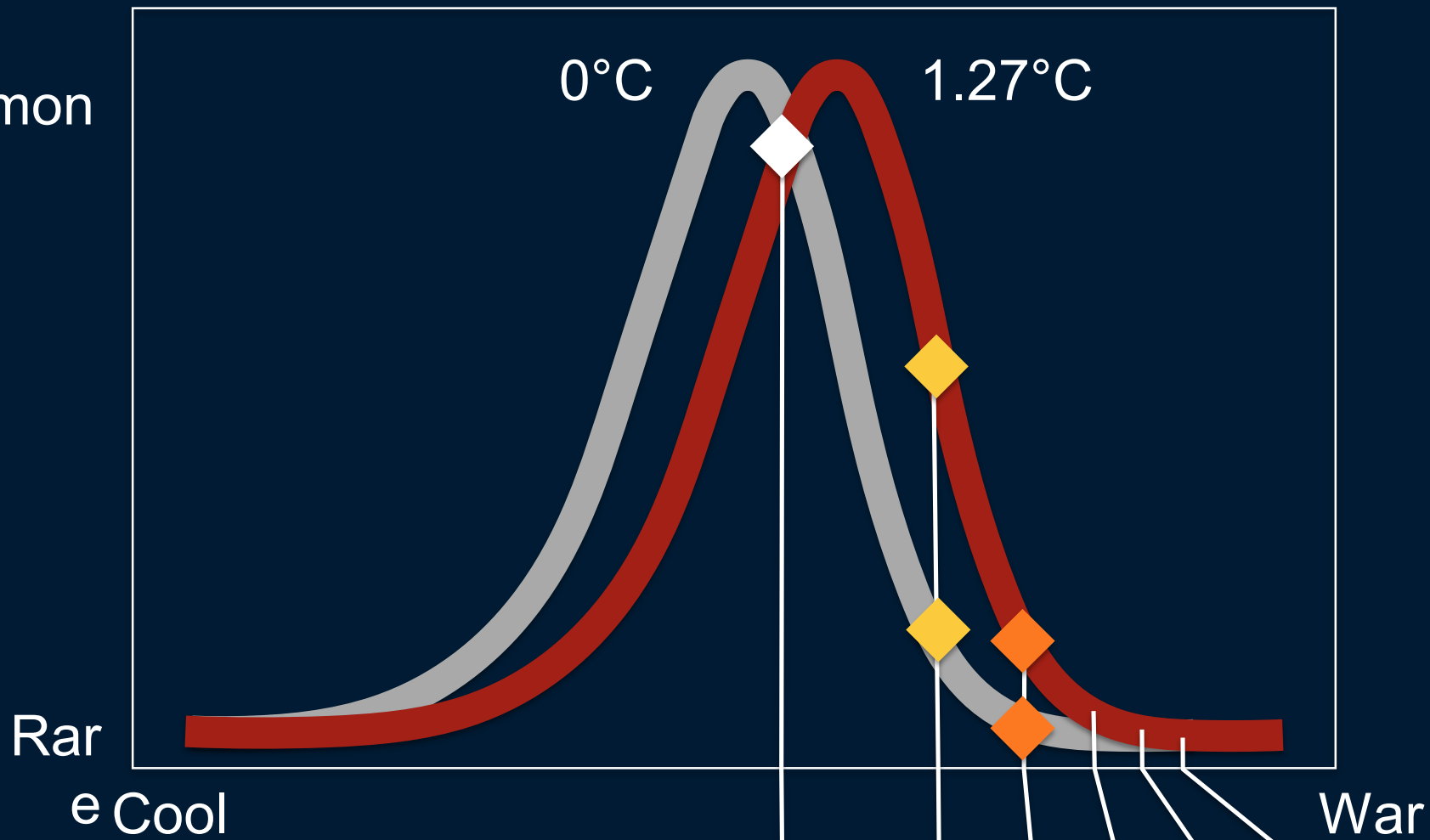


0 1 2 3 4

More frequent



Common



0°C

1.27°C

Rare

Cool

Warm

Climate Shift Index

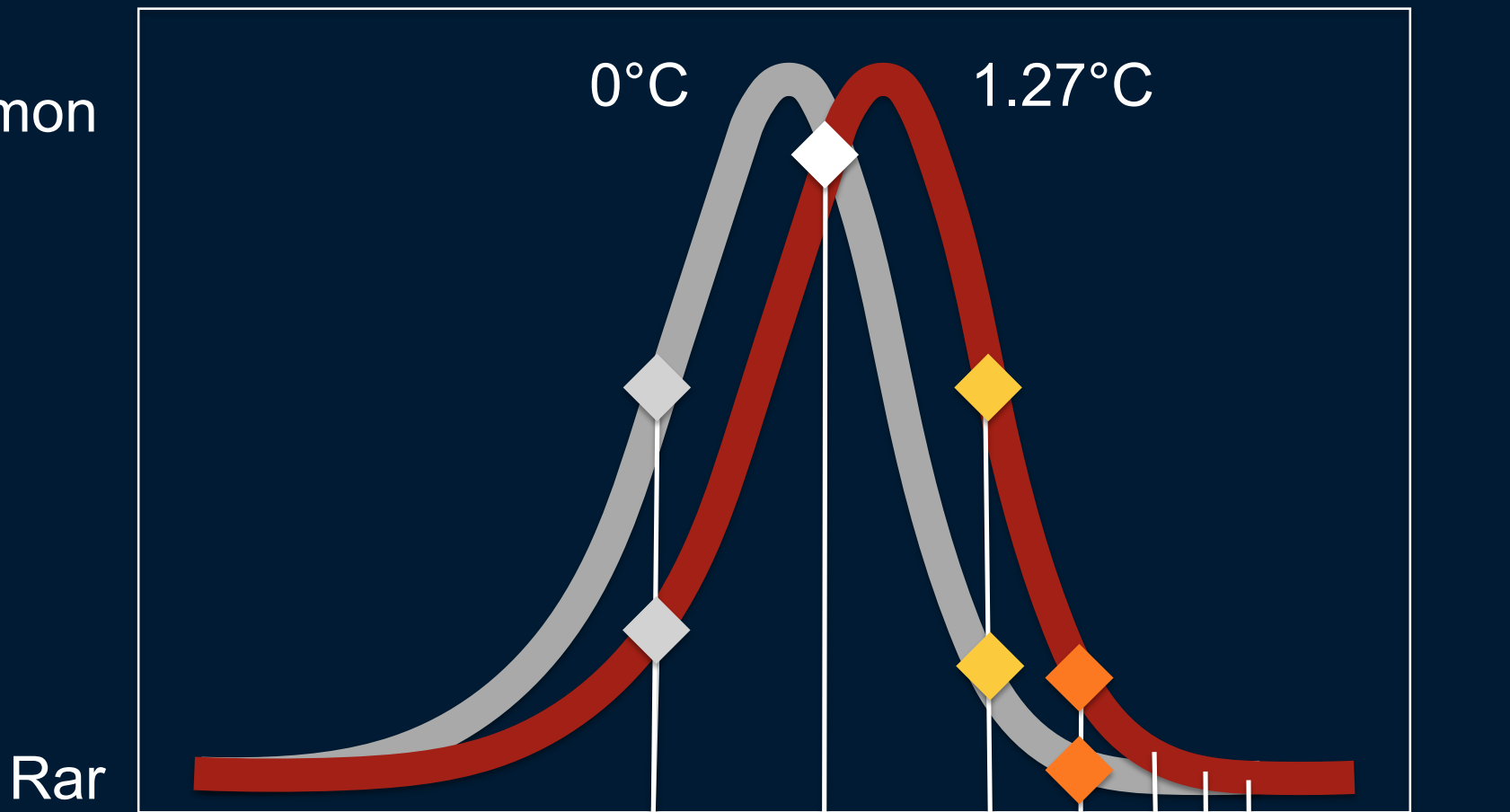


0 1 2 3 4 5

More frequent



Common



0°C

1.27°C

Rare

Cool

Warm

Climate Shift Index



-1

0

1

2

3

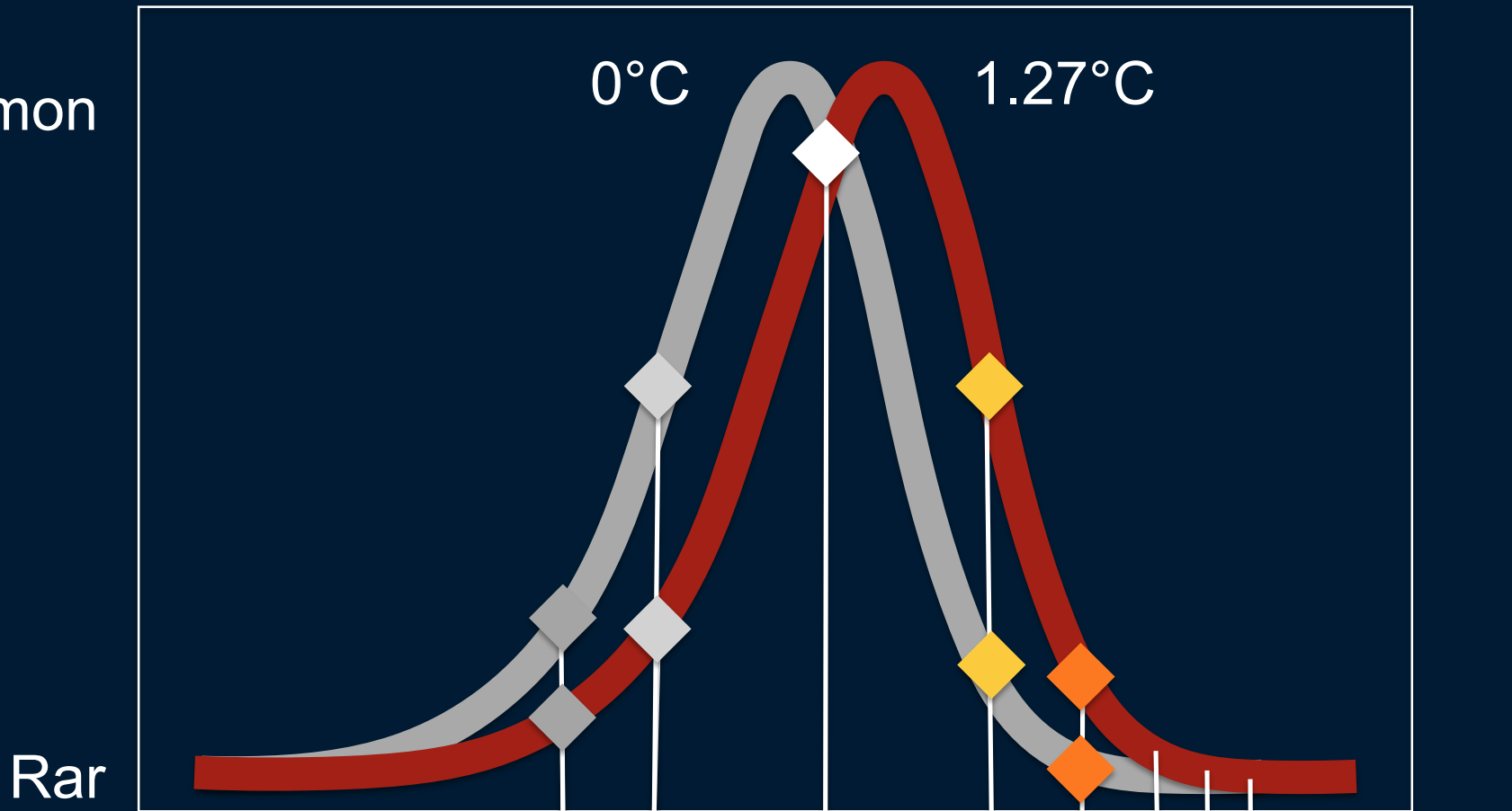
4

5

Less frequent

More frequent

Common



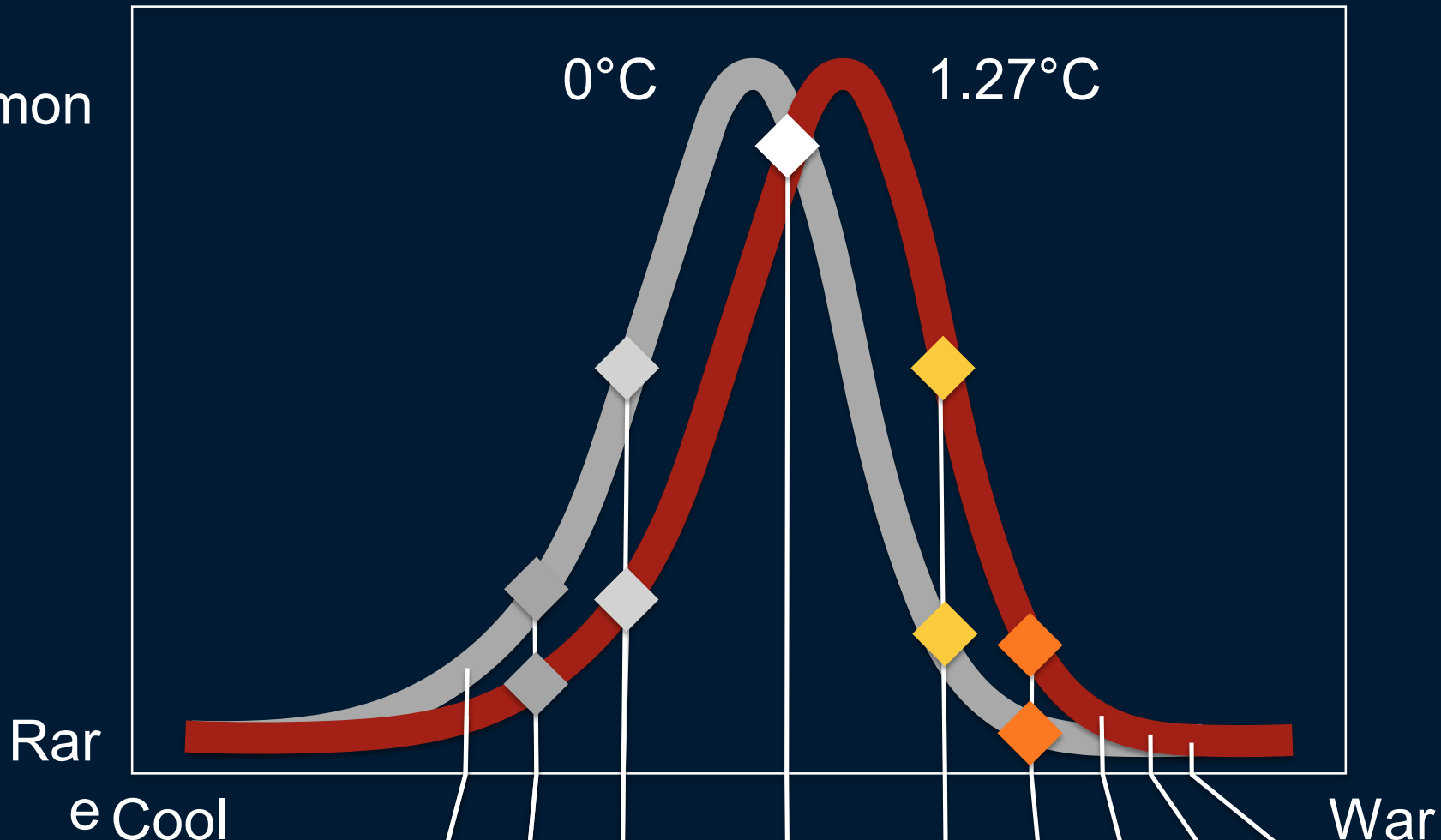
Climate Shift Index



Less frequent

More frequent

Common



Climate Shift Index



-3 -2 -1 0 1 2 3 4 5

Less frequent

More frequent

Common

0°C

1.27°C

Rare

Cool

Warm

Climate Shift Index



-4 -3 -2 -1 0 1 2 3 4 5

Less frequent

More frequent



Common

0°C

1.27°C

Rare

$$CSI(T) \cong 2 \cdot \log_2(P_{\text{modern}}(T)/P_{\text{counter}}(T))$$

Cool

Warm

Climate Shift Index



-5 -4 -3 -2 -1 0 1 2 3 4 5

Less frequent

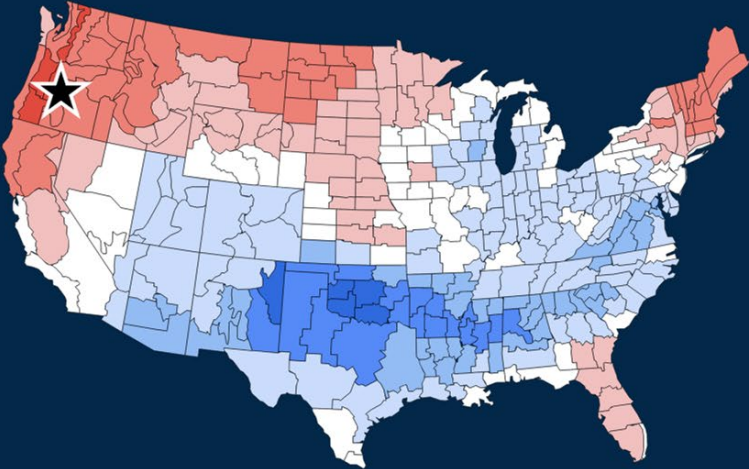
More frequent



Climate Shift Index, August 21, 2022

Temperature Anomaly

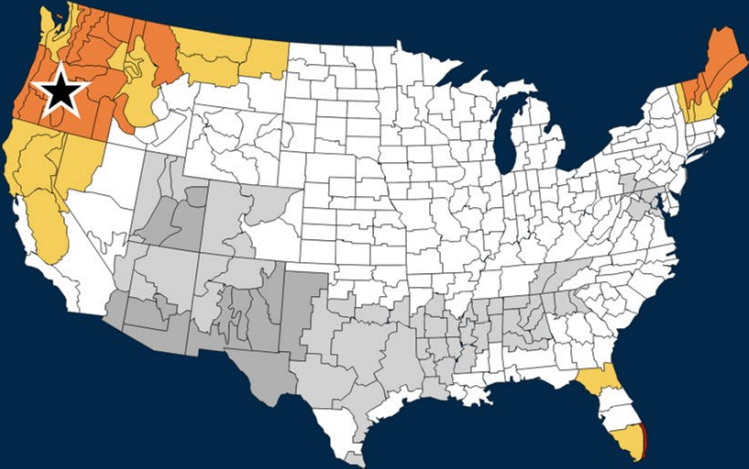
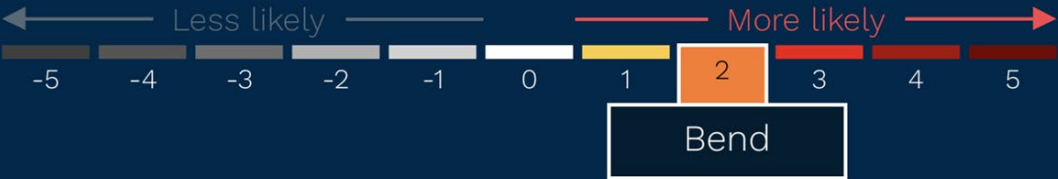
For High Temperature on August 21, 2022



Source: Climate Central analysis based on NOAA data. Produced on 8/21/2022. CLIMATE CENTRAL

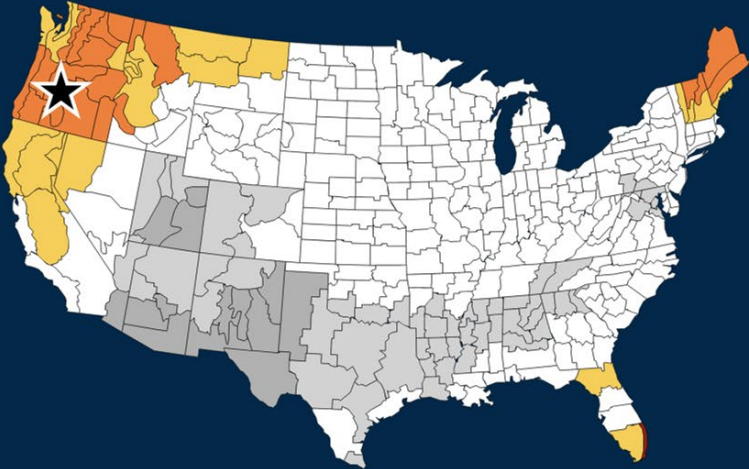
Climate Shift Index, August 21, 2022

Climate Shift Index For High Temperature on August 21, 2022



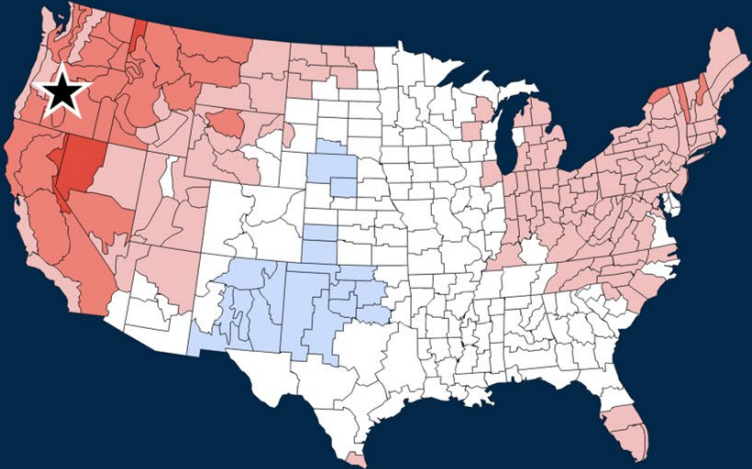
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Climate Shift Index, August 21, 2022



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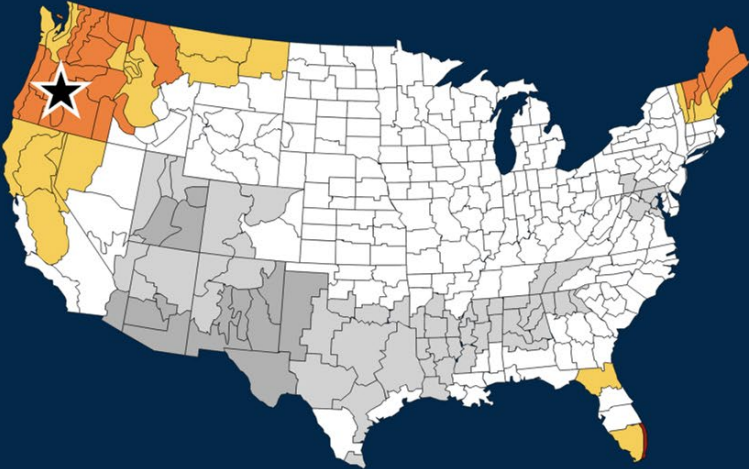
Temperature Anomaly



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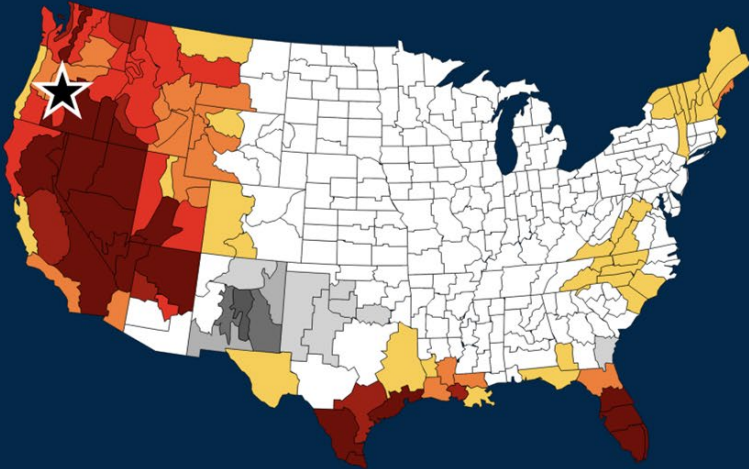
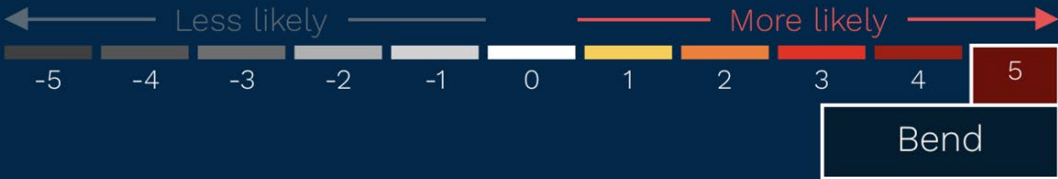
Climate Shift Index, August 21, 2022

Climate Shift Index For High Temperature on August 21, 2022



Source: Climate Central analysis based on NOAA data. Produced on 8/21/2022. CLIMATE CENTRAL

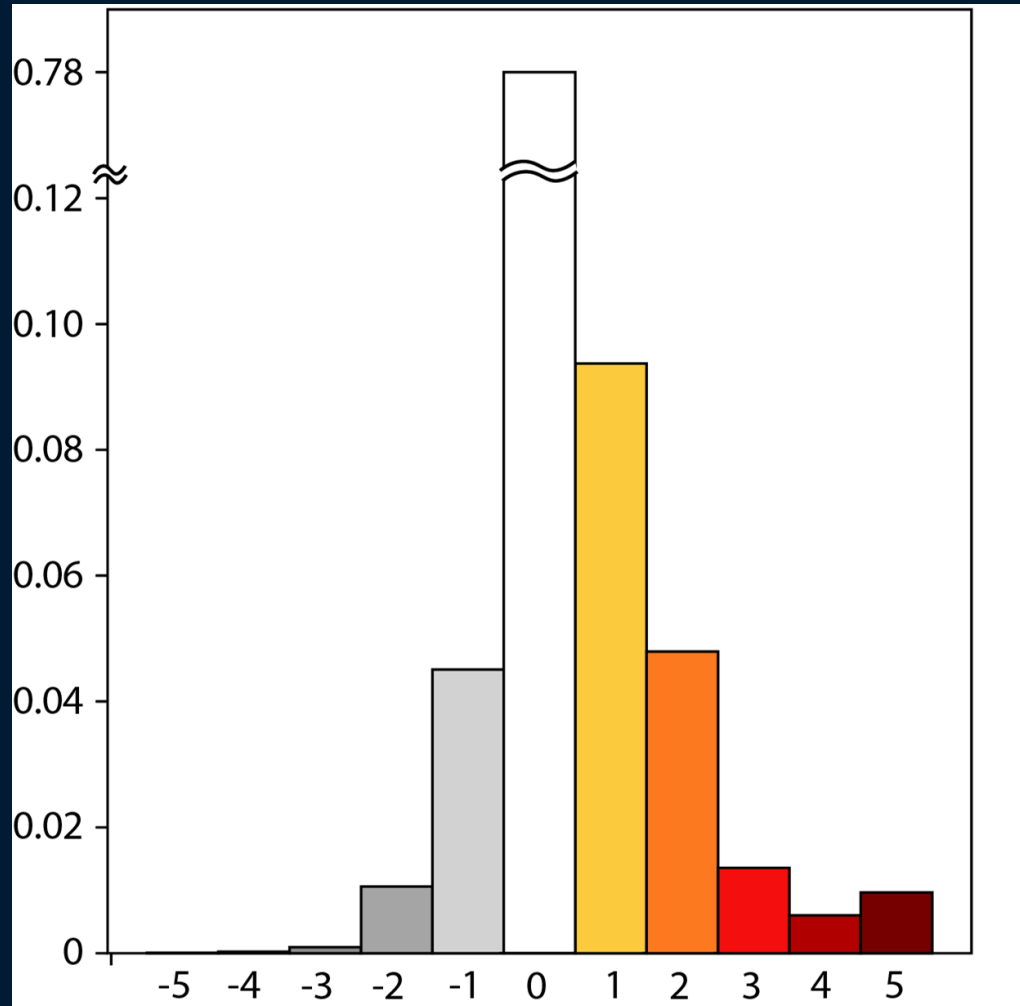
Climate Shift Index For Low Temperature on August 21, 2022



Source: Climate Central analysis based on NOAA data. Produced on 8/21/2022. CLIMATE CENTRAL

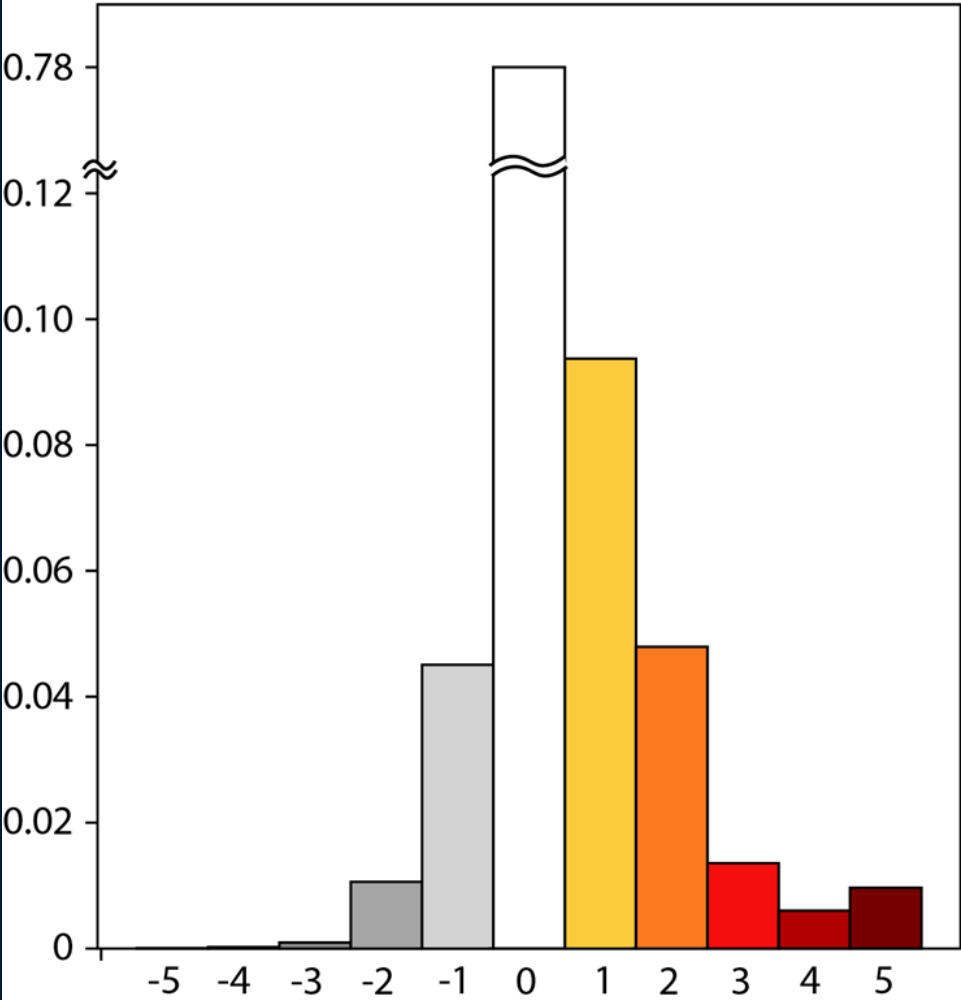
2022

Tmax

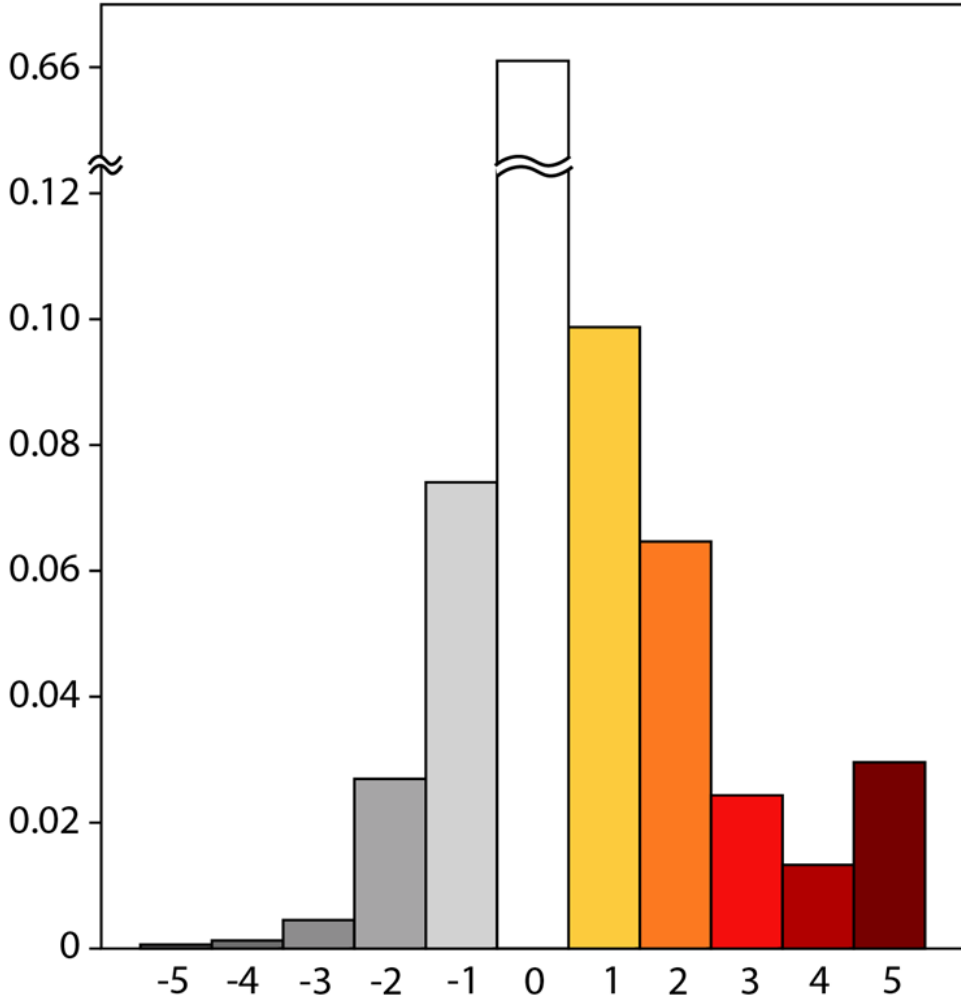


2022

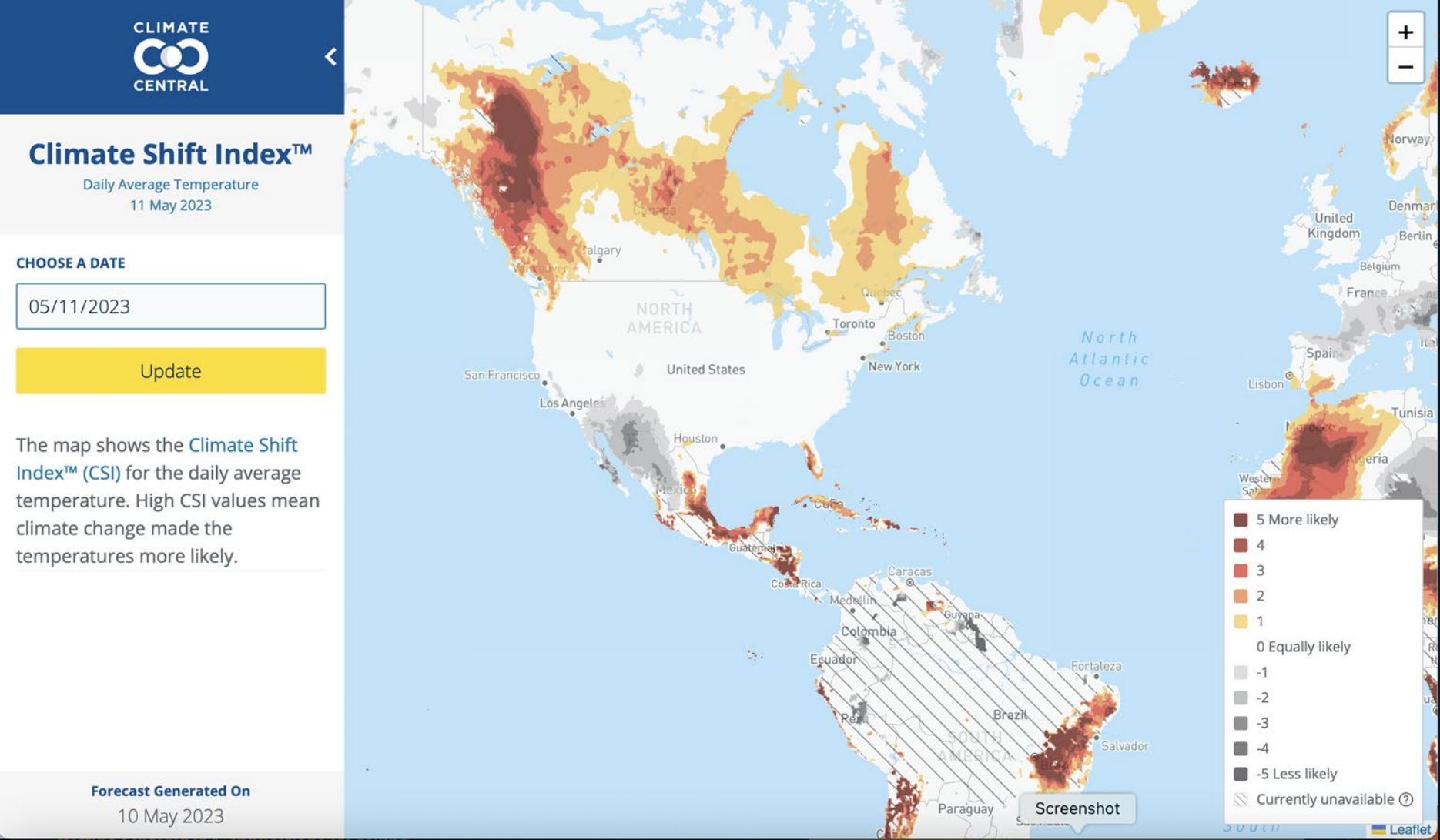
Tmax



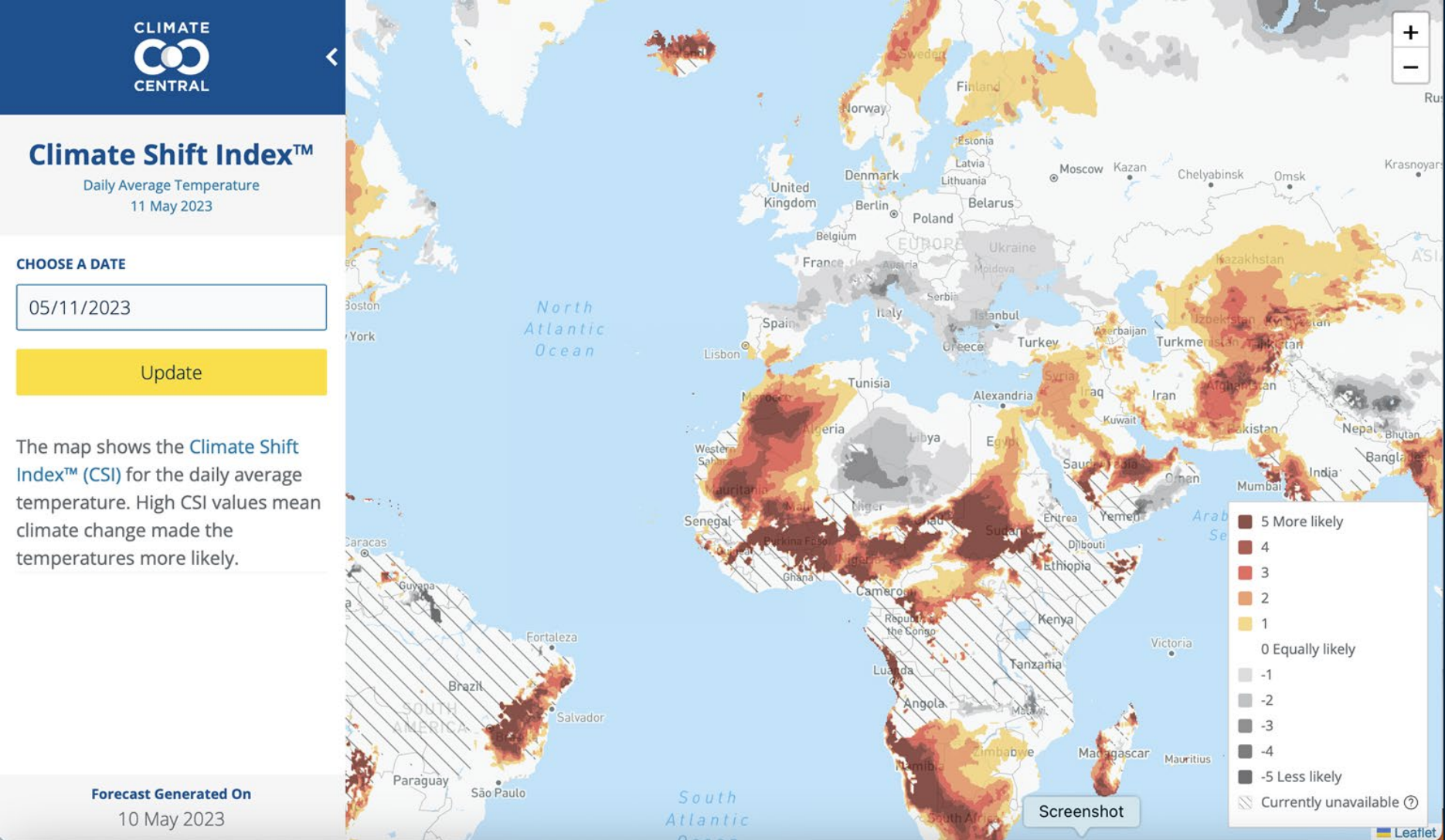
Tmin



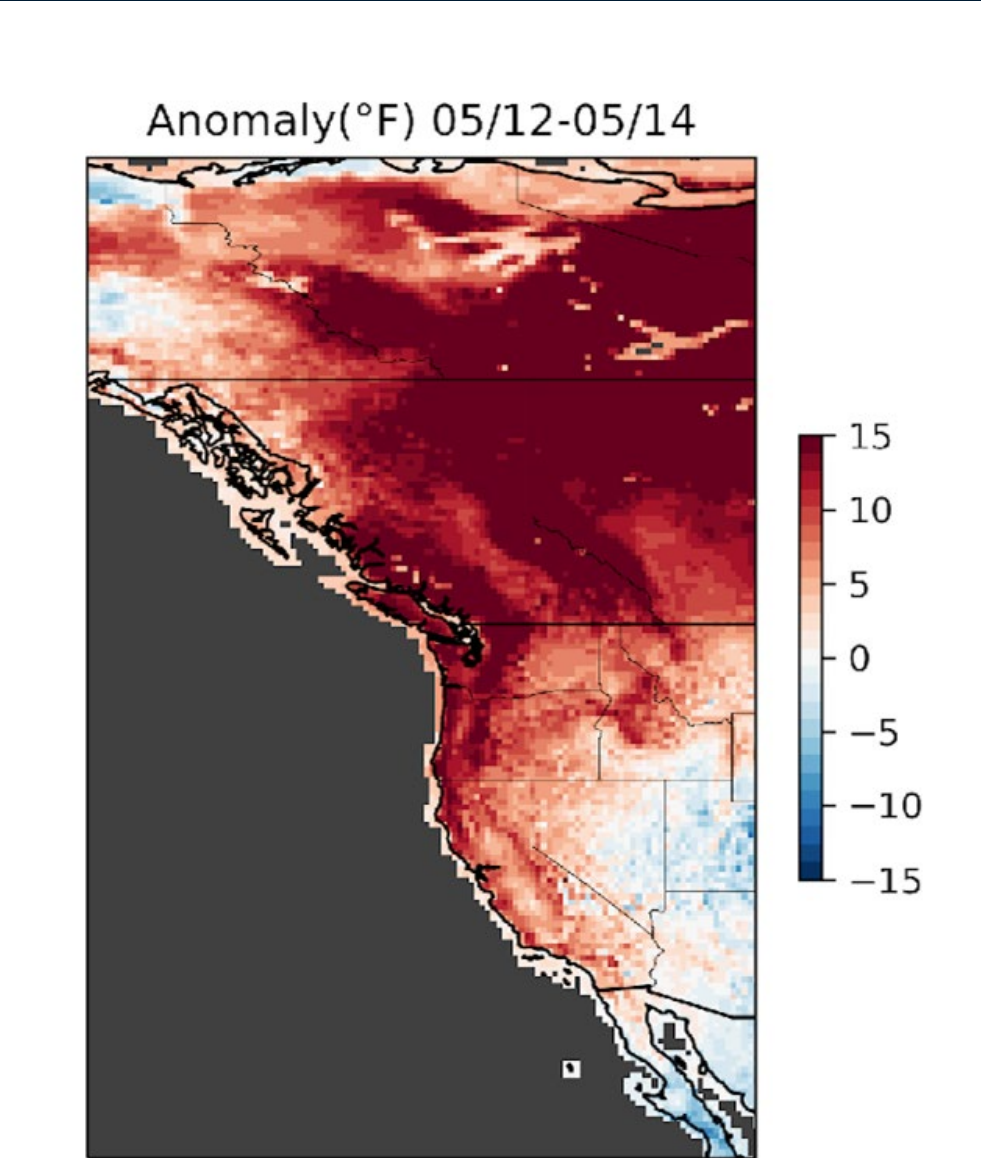
May 11, 2023



May 11, 2023

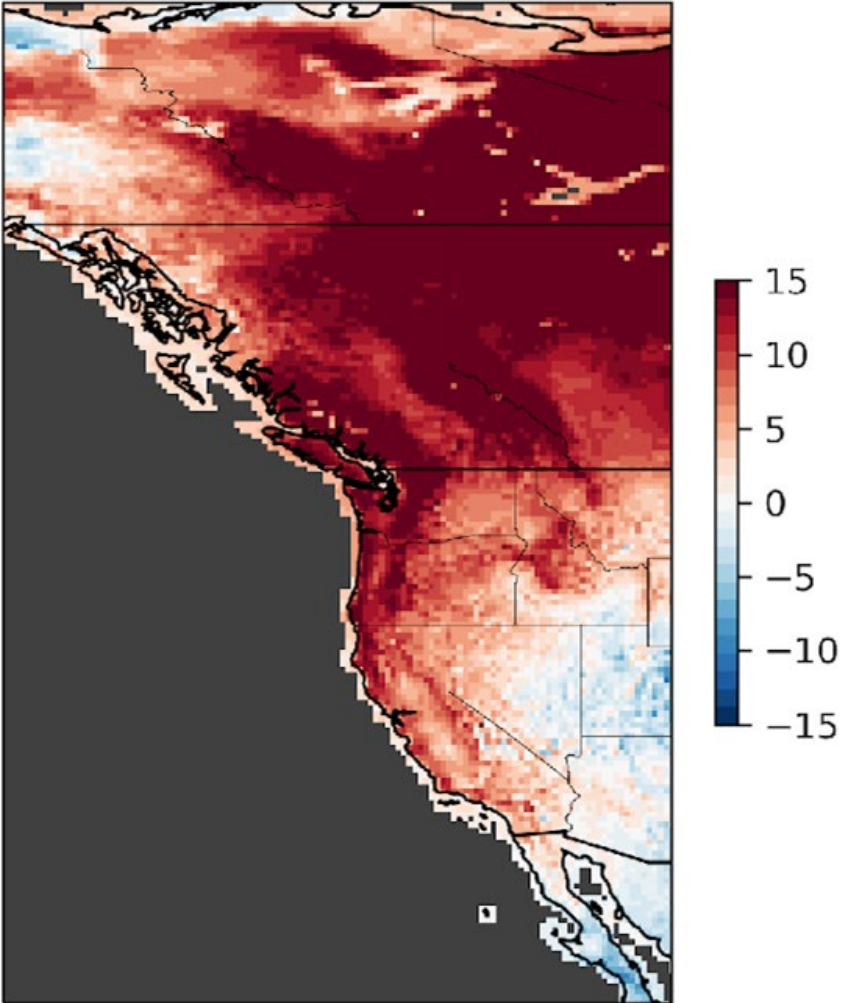


May 12-15, 2023

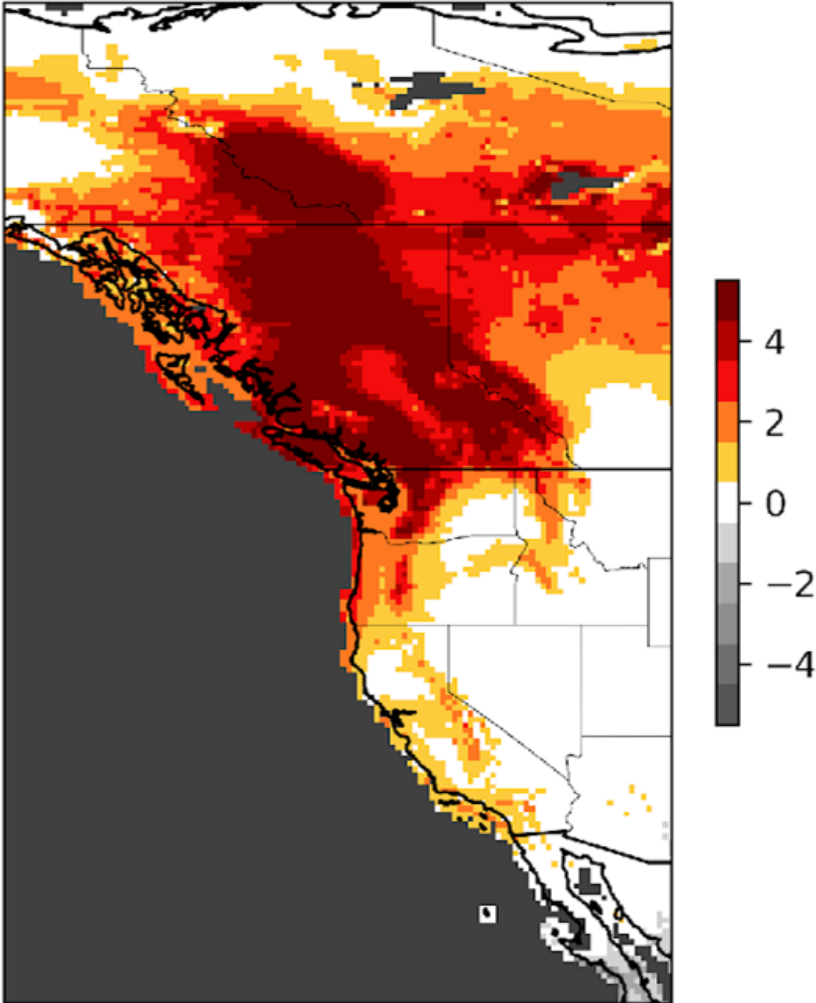


May 12-15, 2023

Anomaly(°F) 05/12-05/14



Climate Shift Index 05/12-05/14



Summary & Future Directions

- Climate Shift Index
 - Multi-method approach to daily attribution
 - Novel index for ordinary and extreme temperatures
- Upcoming
 - 1970-present hindcast
 - Comparison with World Weather Attribution events
 - Ocean temperatures

Climate Shift Index

- US tool: www.climatecentral.org/tools/climate-shift-index
- Global tool: csi.climatecentral.org
- Realtime Climate Alerts: www.climatecentral.org/realtime-climate
- Climate Matters: www.climatecentral.org/climate-matters

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