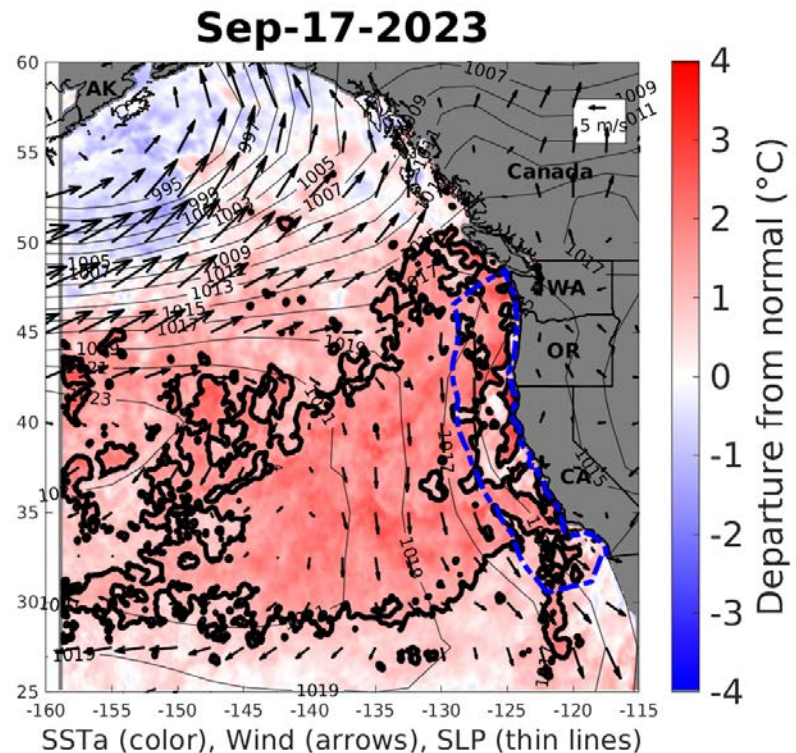
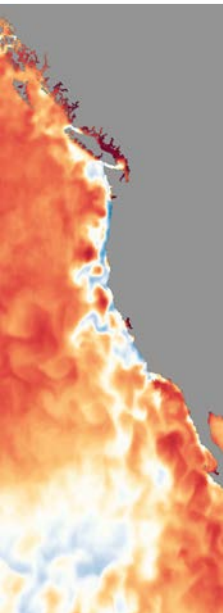


Current Status of Marine Heatwaves in the Northeast Pacific

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NOAA California Current IEA Team

PSC meeting, Sept 20, 2023

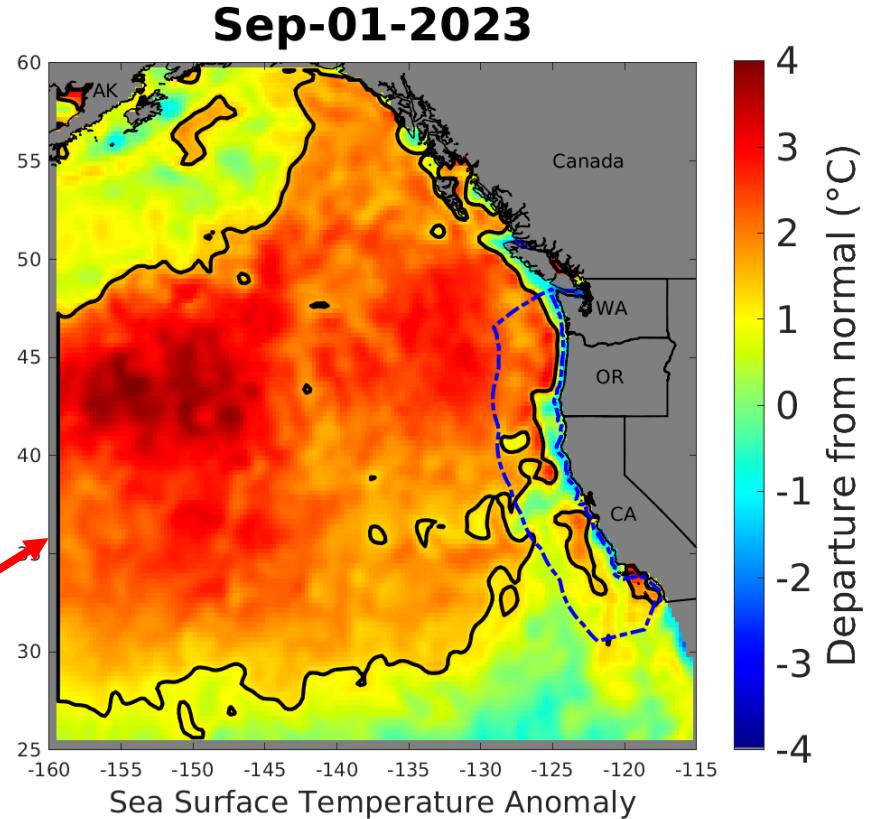


What is a marine heatwave?

Marine Heatwave = Temperature warmer than 90% of all measurements for a specific location for the specific day of year, and lasting at least 5 days.

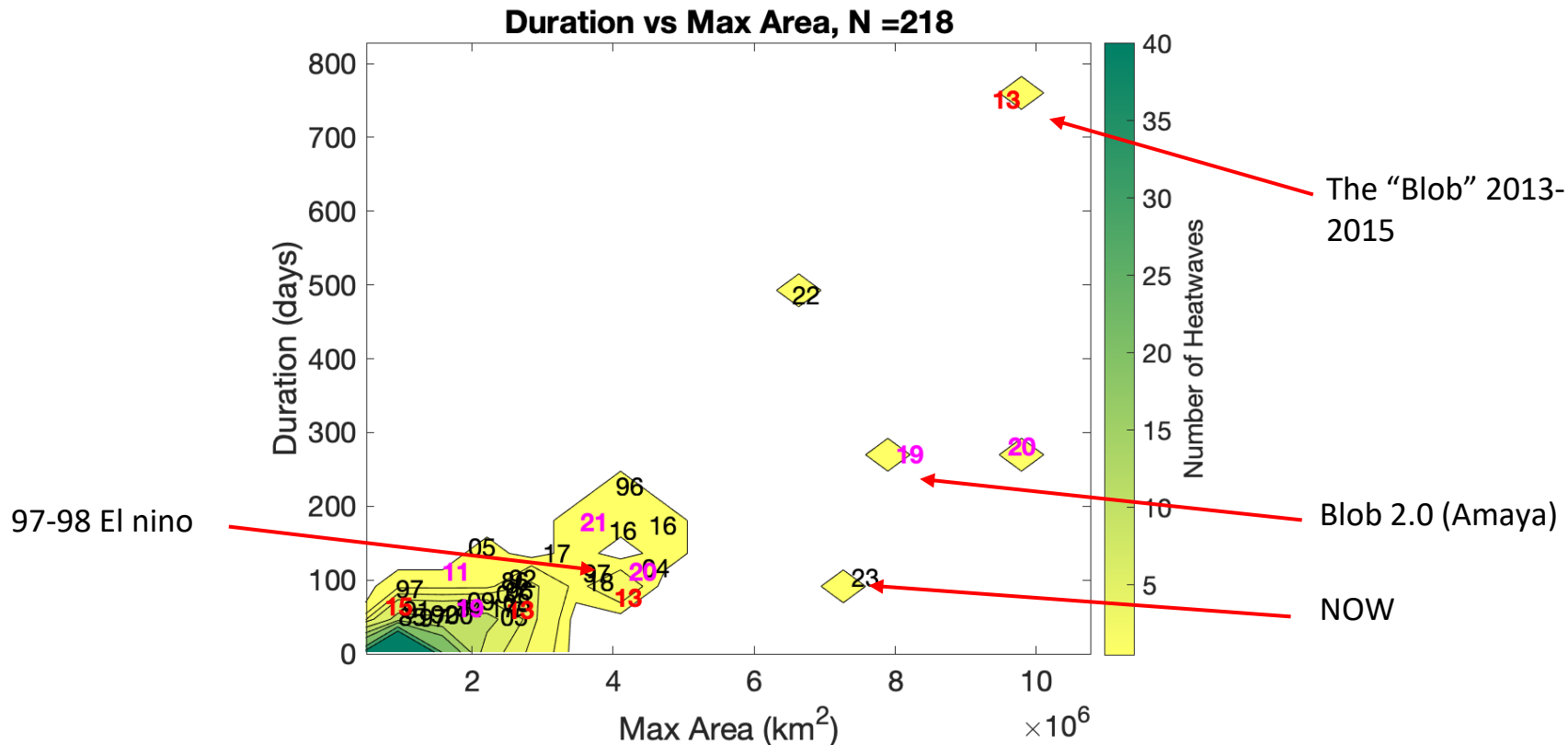
Definition from Hobday et al., 2016.; Based off of atmospheric literature definitions.

Science quality SST anomaly data from NOAA's OISST dataset. Dark line indicates region that is in "heatwave status". Blue dashed line is the US EEZ

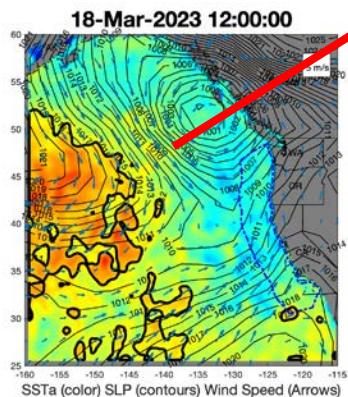
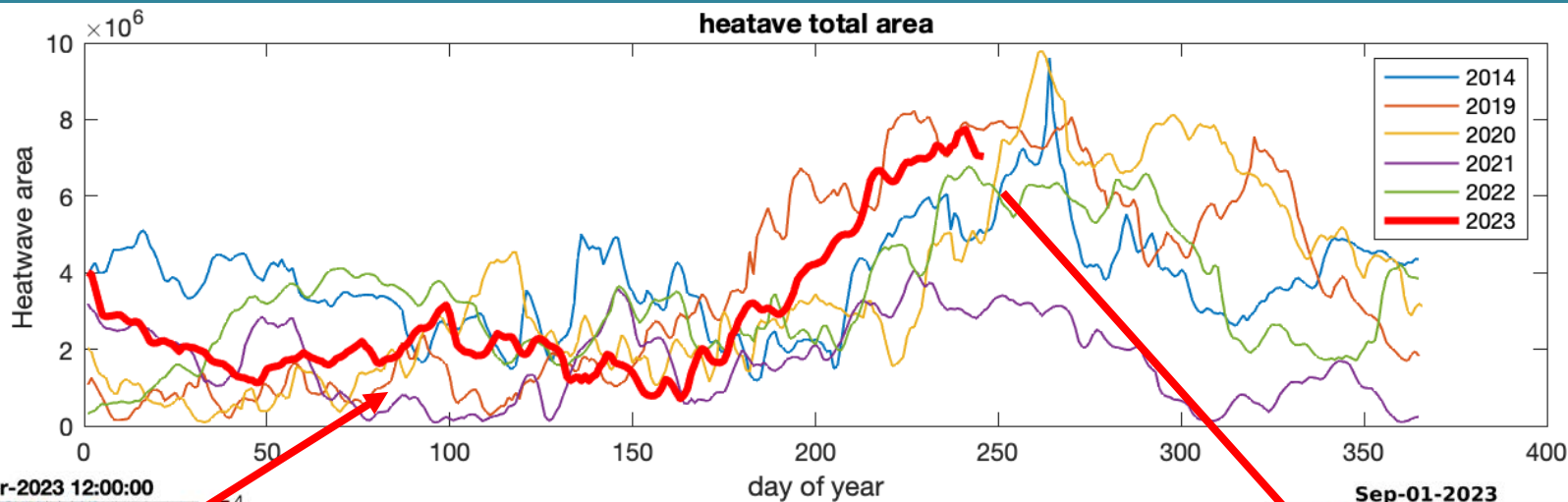


How many, how big, how long for NEP?

Original definition does not include a minimum size threshold; here I apply a threshold of top 20% by area = yields 218 “large” marine heatwaves since 1982 (time when we first have good satellite data)

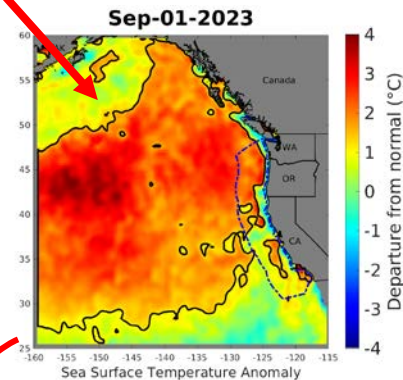


Last ~ 10 years: Lots of heatwaves!

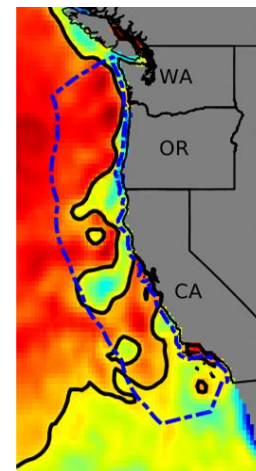
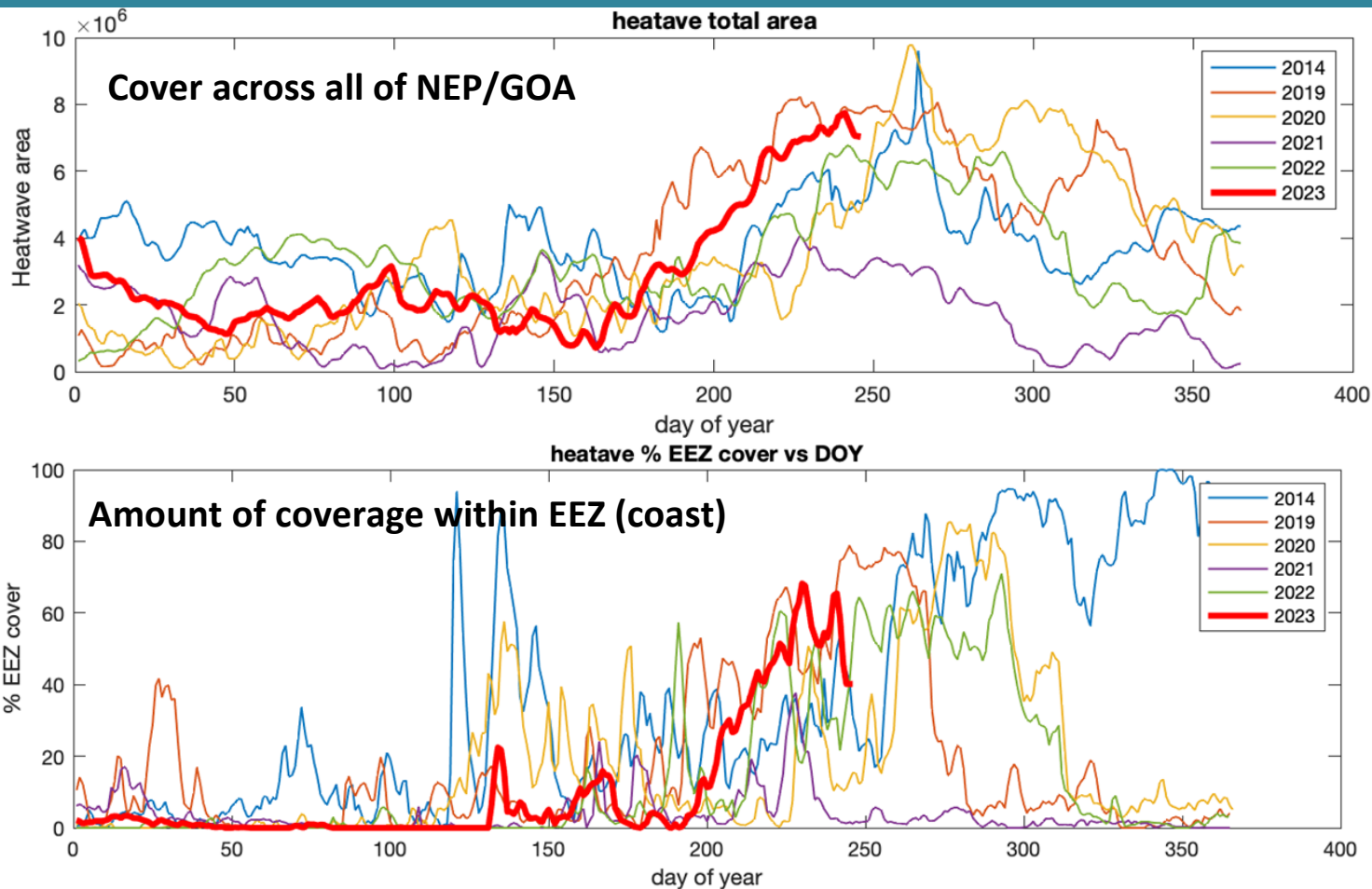


These 6 years all had very similar heatwave phenology:

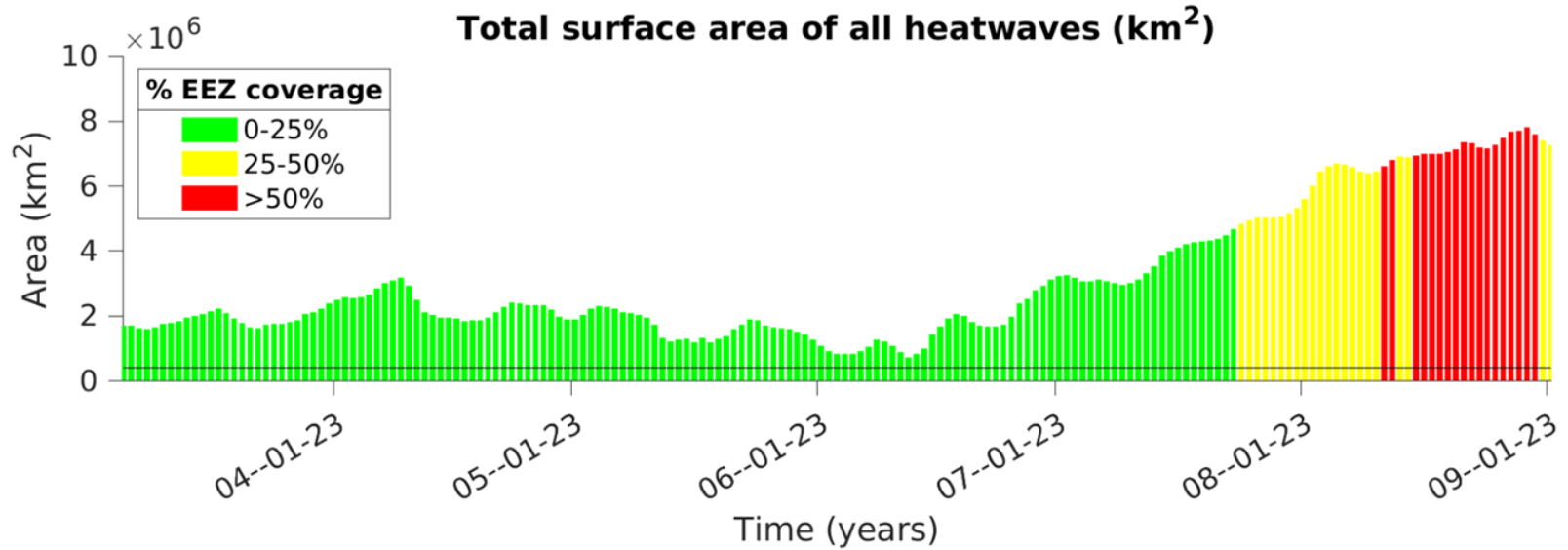
- Develop in late winter/early spring far offshore in GOA
- Reach maximum size sometime in Late Aug-Sep
- Decline in area during the fall/winter



Last ~ 10 years: difference in coastal impacts

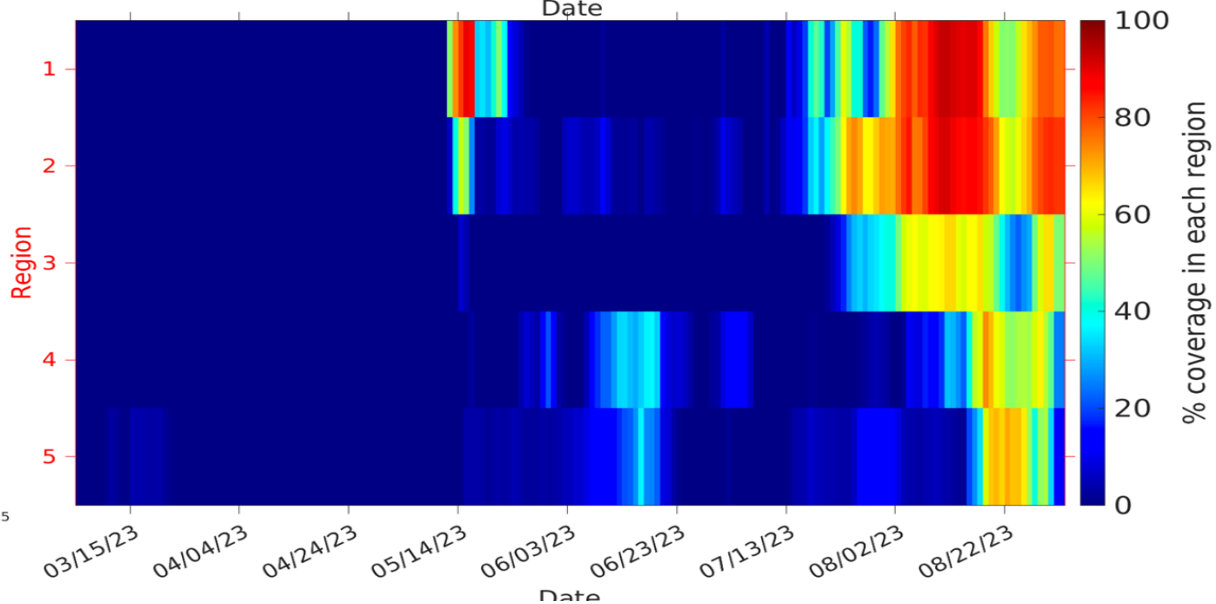
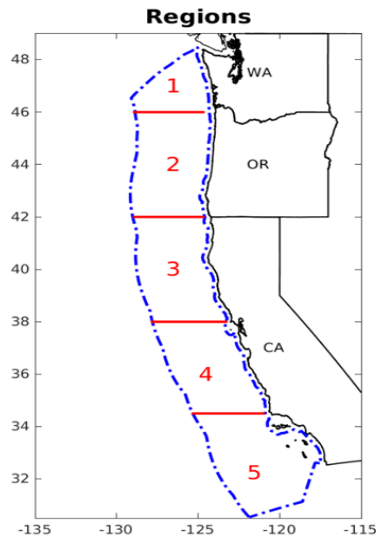
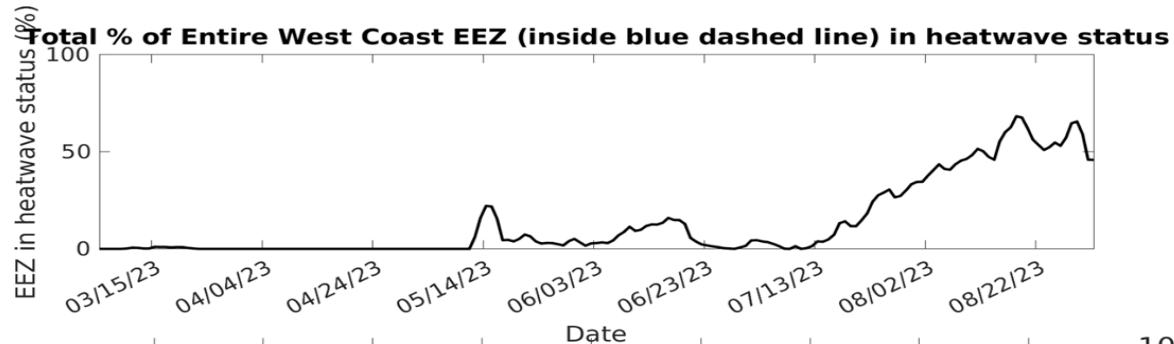


More detail about this year:

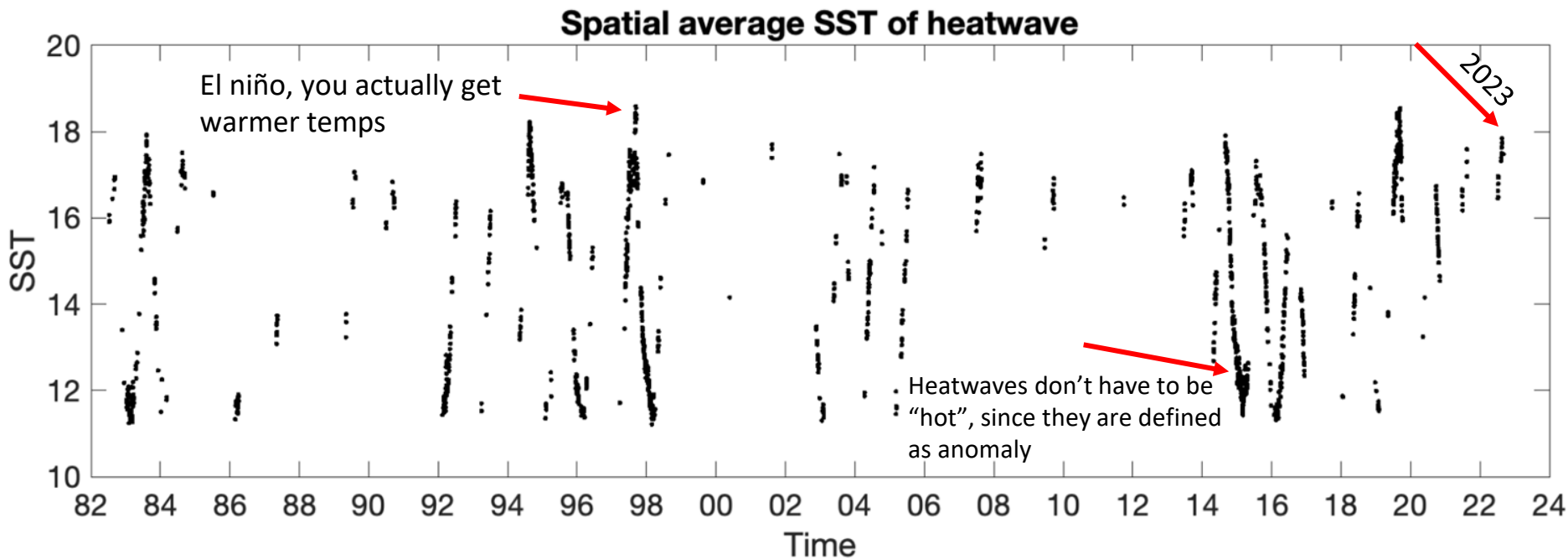


Color denotes levels of Coverage of the US west Coast EEZ (WA/OR/CA)

More detail about this year:

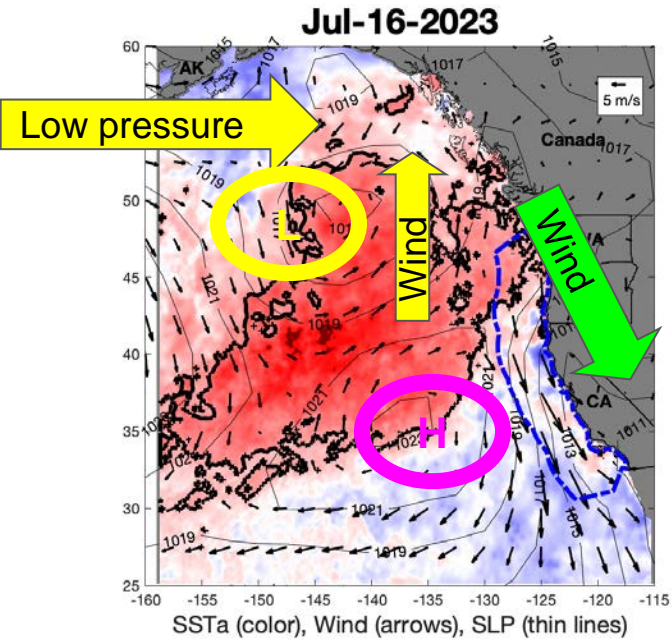


What kind of temperatures are we talking about here?

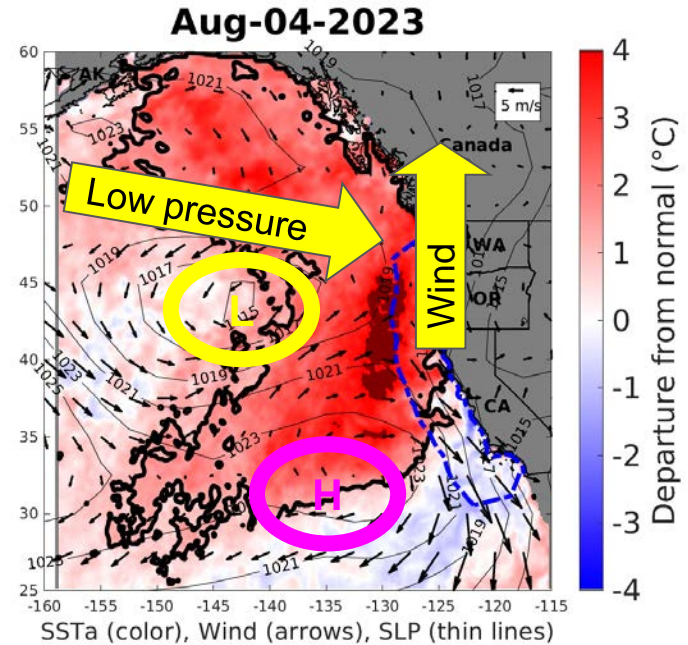


This is just for the OR/WA shelf. Absolute average SST for ONLY the area that is in "heatwave status" and only when at least 33% of the shelf is covered by heatwave.

What causes these heatwaves to reach the coast?

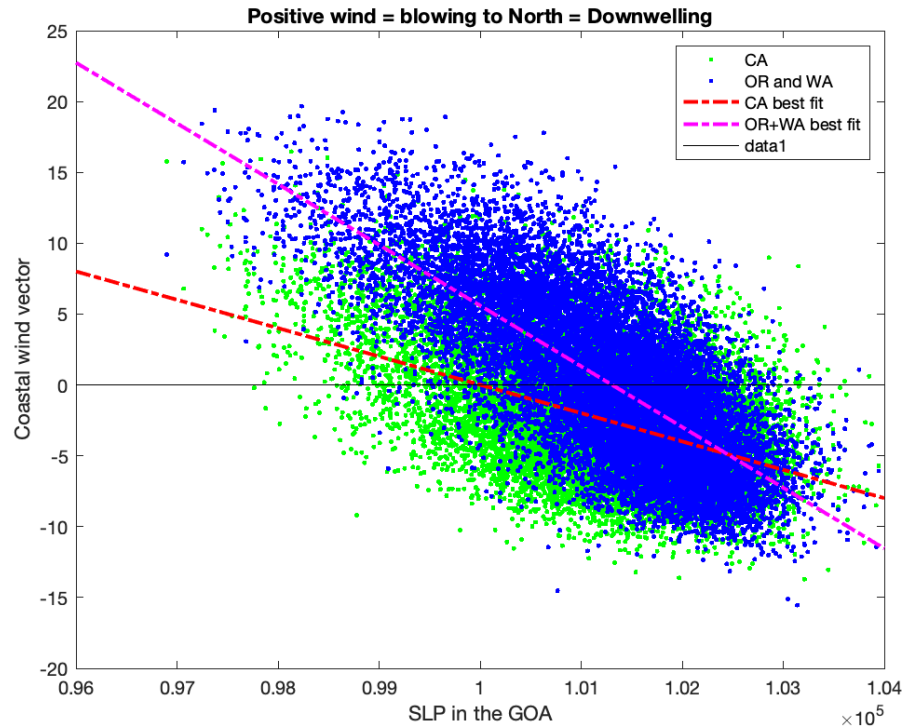


Low pressure cells track from west to east, and change coastal wind direction upwelling -> downwelling!!!



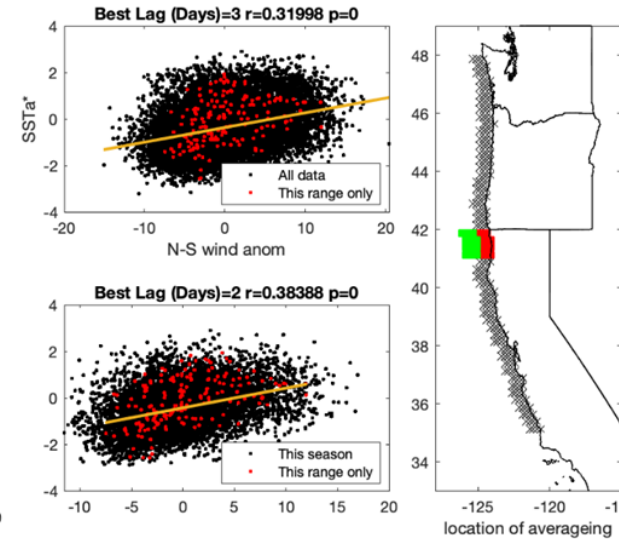
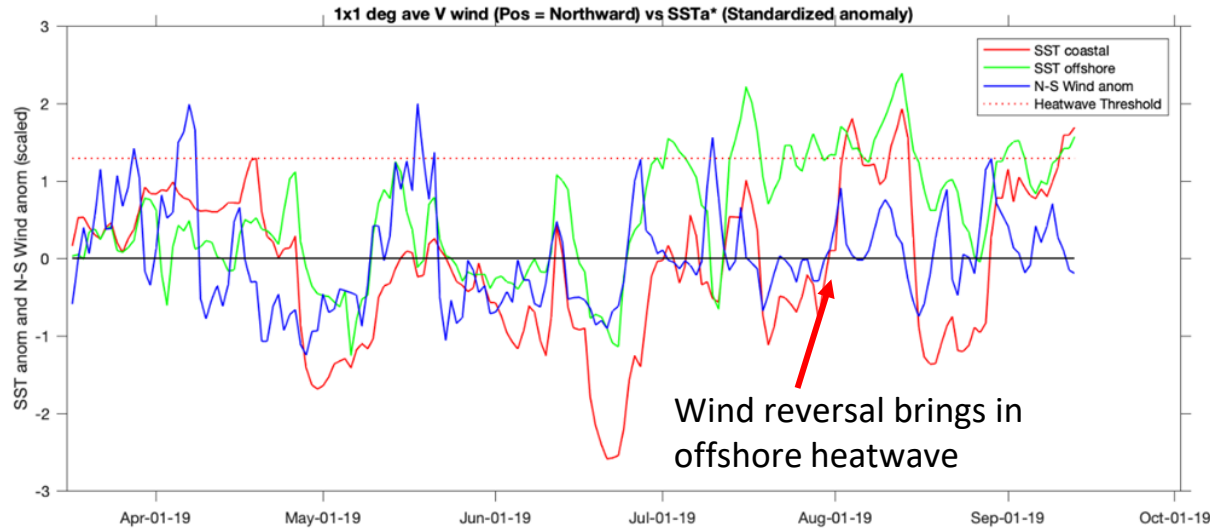
What causes these heatwaves to reach the coast?

**N-S wind vector very well correlated with SLP over the GOA region:
with different slope OR/WA vs CA**



What causes these heatwaves to reach the coast?

Coastal temperature well correlated with N-S wind speed vector, lagged 2-3 days



Wind reversals generally raise the coastal temperature, but even more so if there is an already extant offshore heatwave (the green line)

Summary:

- **Offshore “Large” Marine heatwaves fairly consistent since 2014 (especially last 5 years)**
- **Differential coastal impacts depending on low pressure cells disturbing wind pattern**
- **2023 synopsis:**
 - **4th largest (by area) heatwave since 1982**
 - **Similar phenology to past 4 years**
 - **Less coastal intrusion in mid summer but more intrusion later summer (vs past)**
 - **Most intrusions in WA/OR, but more CA intrusion later in summer (vs past)**
 - **Short term forecast suggests more warming for WA/OR in next week**
- **BIG question: what will happen this fall????**
 - **Heatwave recedes to far offshore during fall (like last 5 years) -> Spring El Niño?**
 - **Heatwave remains (persistence related to El Niño?) -> add to spring El Niño?**
 - **Other?**

Shameless plug: Our IEA website on Heatwave tracking (where most of the previous graphs come from): **Google “CCIEA Blobtracker”**, or <https://www.integratedecosystemassessment.noaa.gov/regions/california-current/california-current-marine-heatwave-tracker-blobtracker>