

ENSO update and outlook (it's a busy one!)

Presented by: Ben Noll, NIWA with
thanks to BoM, Météo-France, NOAA,
University of Hawaii, APCC, SPREP & SPC

20 April 2023

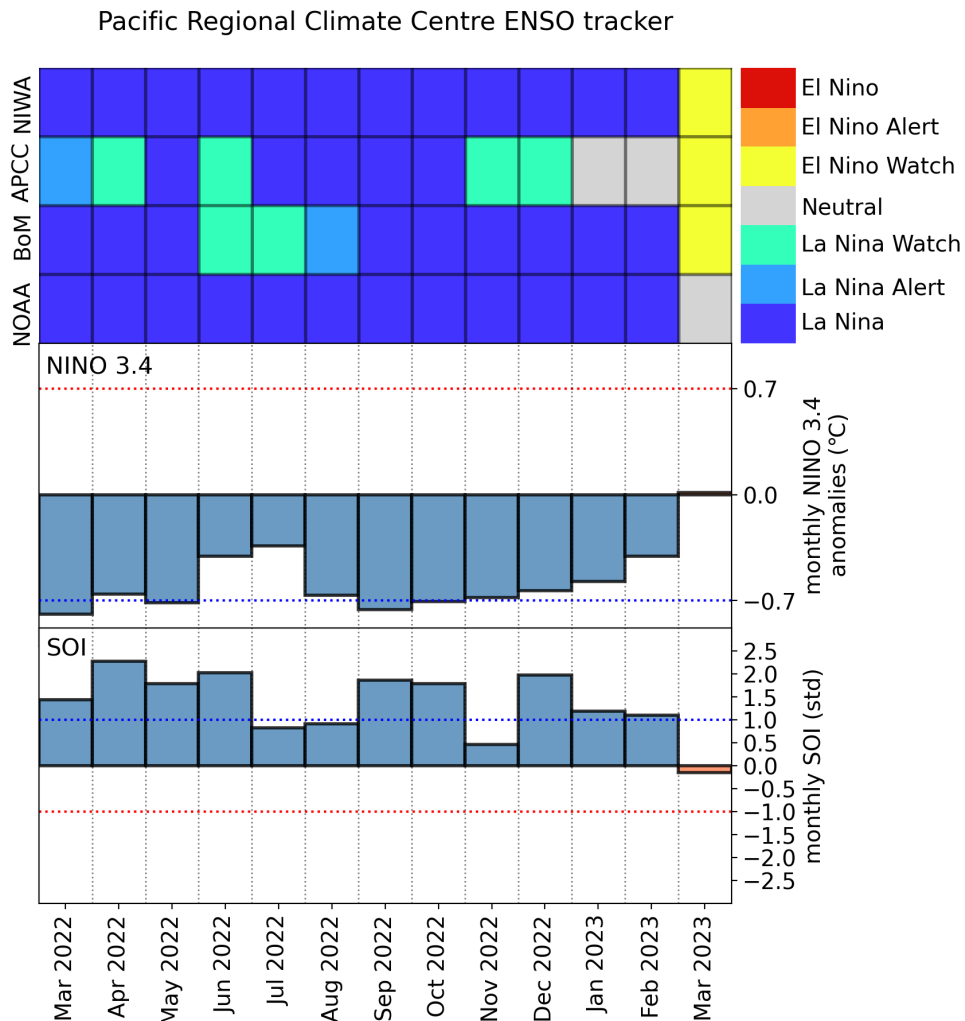
Outline of Presentation

- **Introduction & overview of El Niño-Southern Oscillation (ENSO) tracker:** *BoM, APCC, NIWA & NOAA on “El Niño Watch”*
- **Current state of play in the equatorial Pacific**
 - At the surface: *dramatic warming, particularly in the east*
 - In the sub-surface: *much warmer than average waters lurk below*
- **Trends in zonal winds:** *reduction in trade winds / westerly wind burst*
- **ENSO probabilities and predictions from global producing centres:** *strong agreement – BUT! Need to be mindful of the “Spring Predictability Barrier”*
- **It’s been a while! Reminder of what El Niño tends to bring to the region...**
- **Possible atmospheric response to changing ocean conditions:** *the ocean & atmosphere must “couple” for climatic changes to be realised*
- **Global Seasonal Climate Update:** *brief update from WMO*

Pacific Regional Climate Centre ENSO tracker

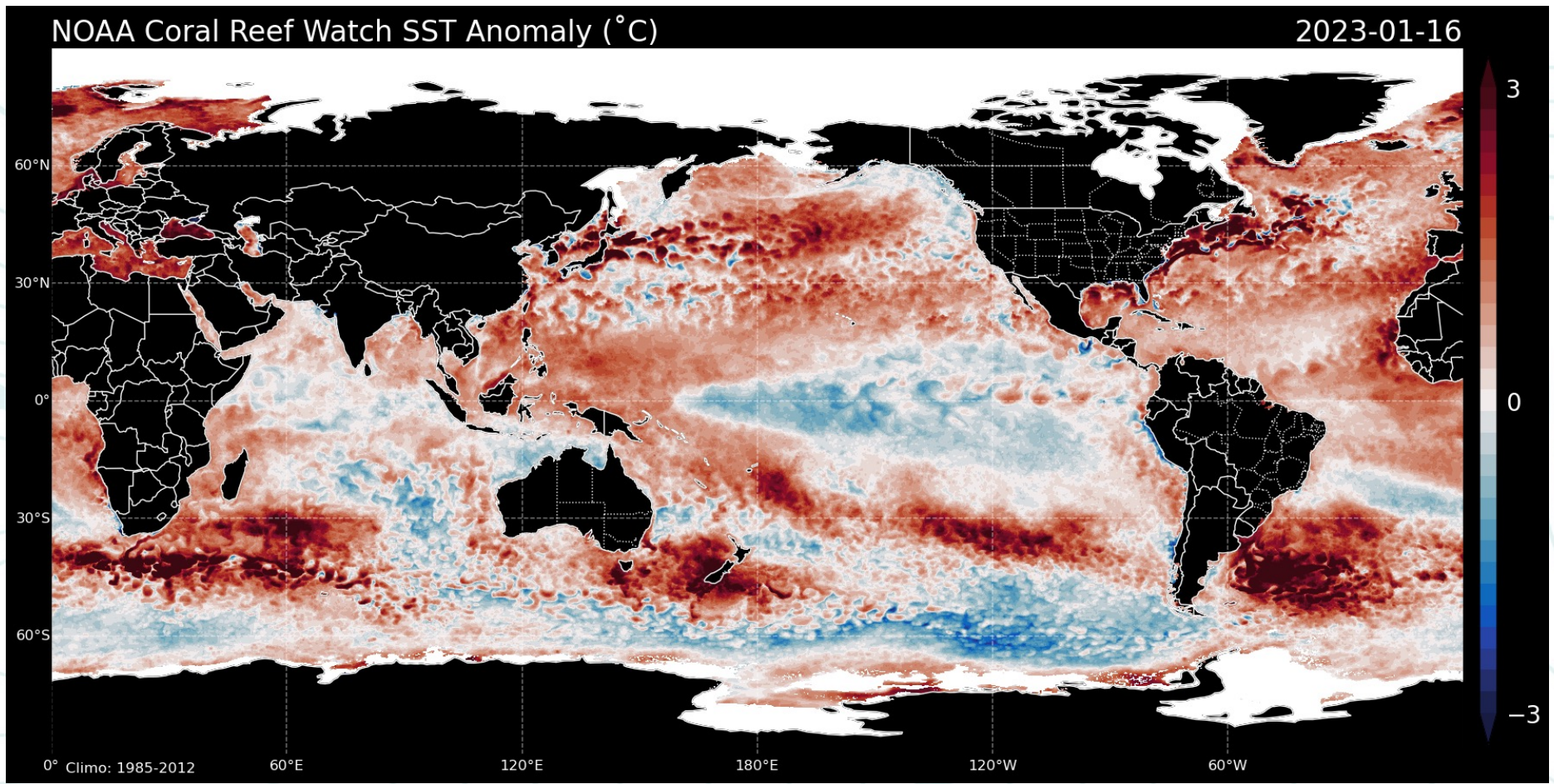
<https://www.pacificmet.net/enso-tracker>

- **What is it?** A near real-time, monthly updated monitor of ENSO conditions from Pacific RCC consortium members
 - Shows past, present, and future conditions all-in-one
- **Why?** Different organisations have different ENSO criteria – think of the ENSO tracker like a “multi-model ensemble” of predictions that leverages the “wisdom of the crowd”
 - Follow the link above for the criteria
- **What does it show?** 3 out of 4 organisations (BoM, APCC & NIWA) indicate El Niño Watch; **NOAA moved to El Niño Watch 13 April**



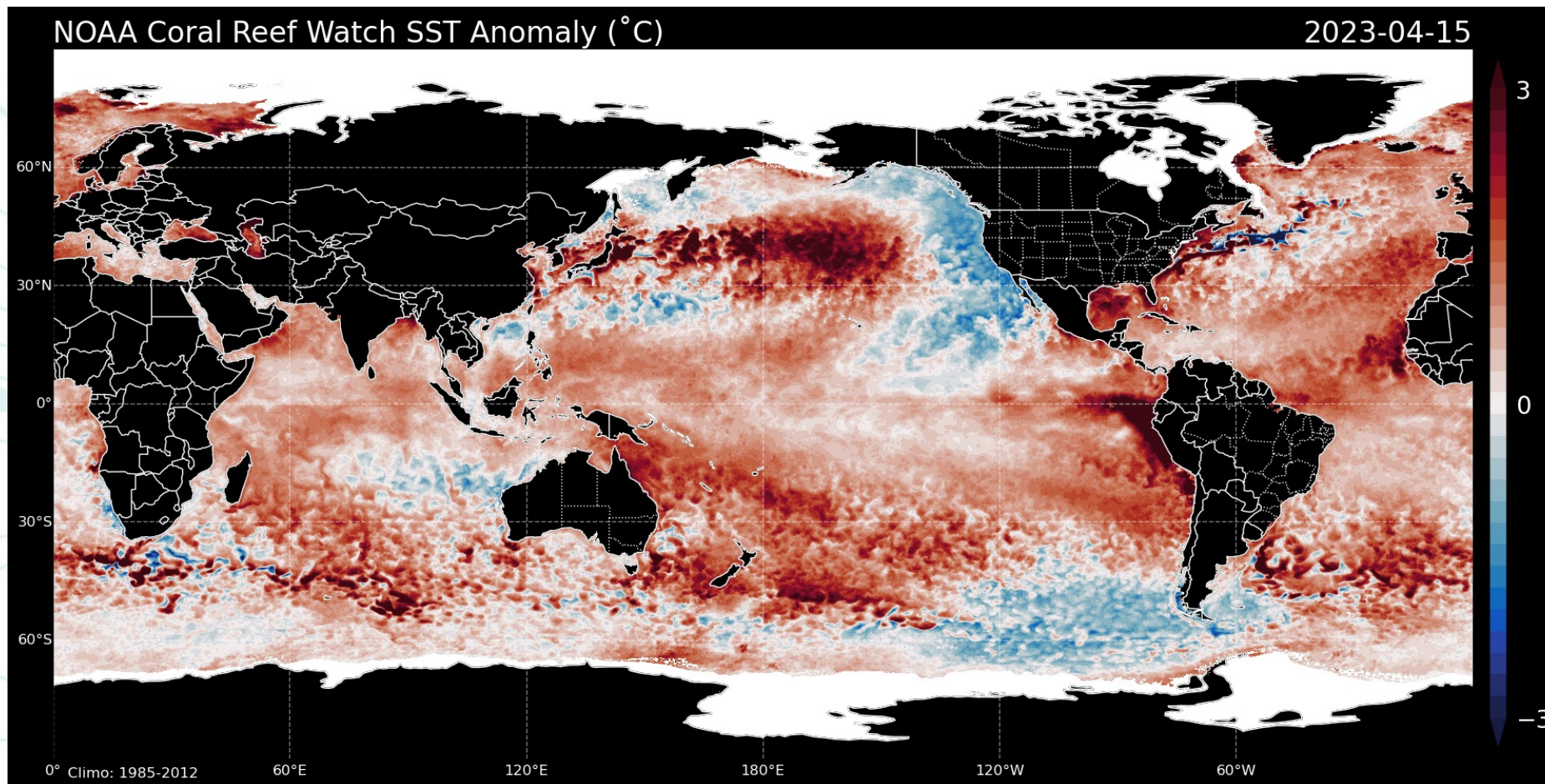
BOOKMARK IT

Wow, what a change! 2023-01-16...



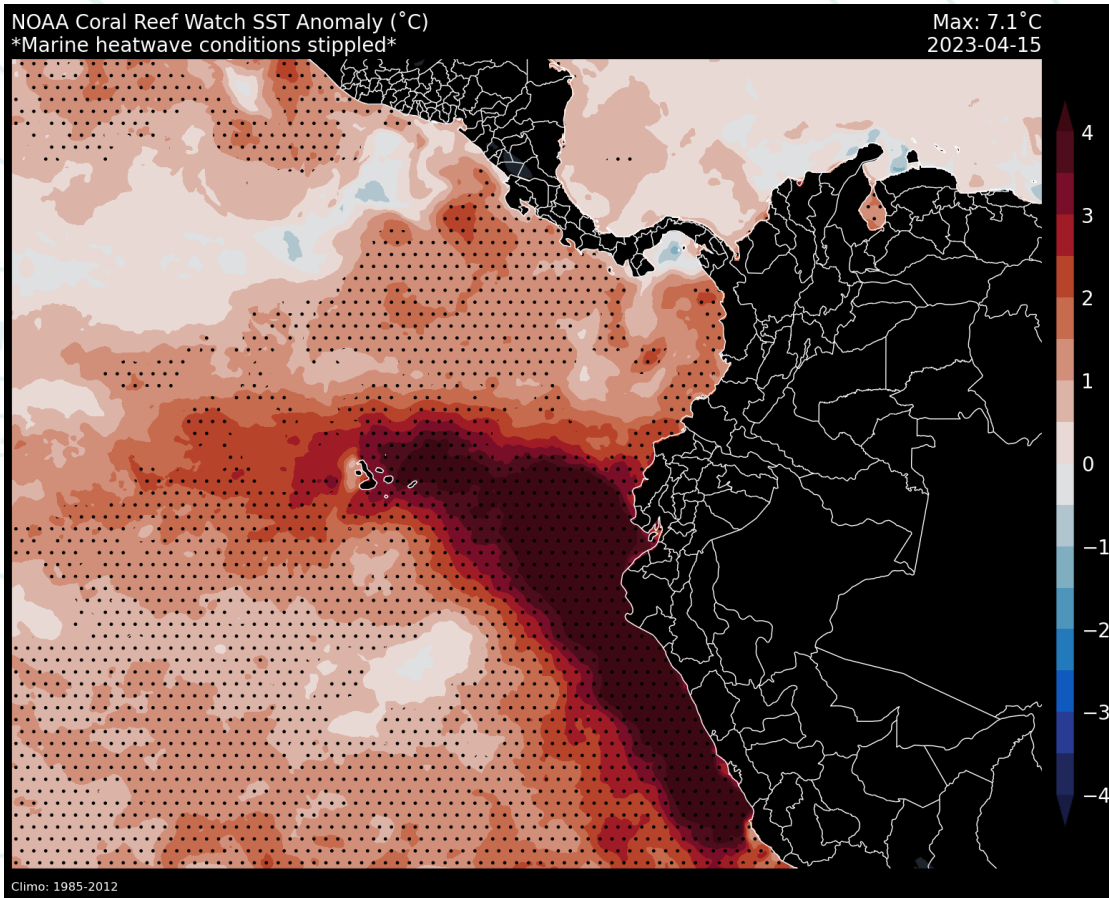
Data: NOAA Coral Reef Watch
Climatology: 1985-2012

Wow, what a change! 2023-04-15...

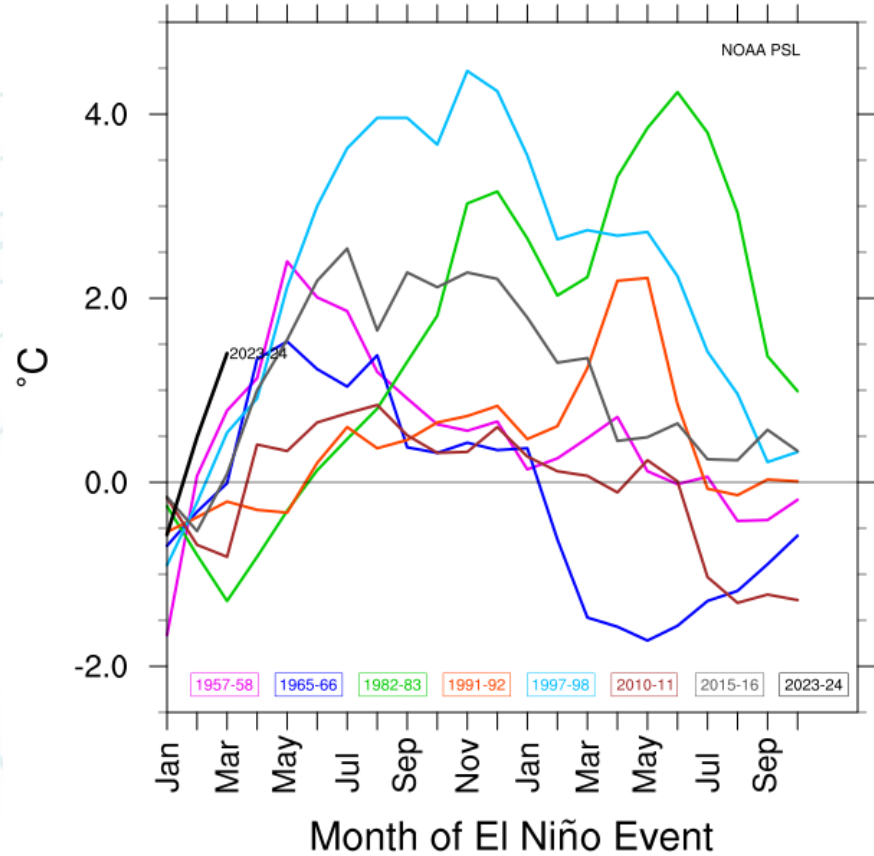


Data: NOAA Coral Reef Watch
Climatology: 1985-2012

Seas in the eastern equatorial Pacific are extremely warm (El Niño Costero)



Nino 1+2 for the top 8 El Niño events (since 1950)

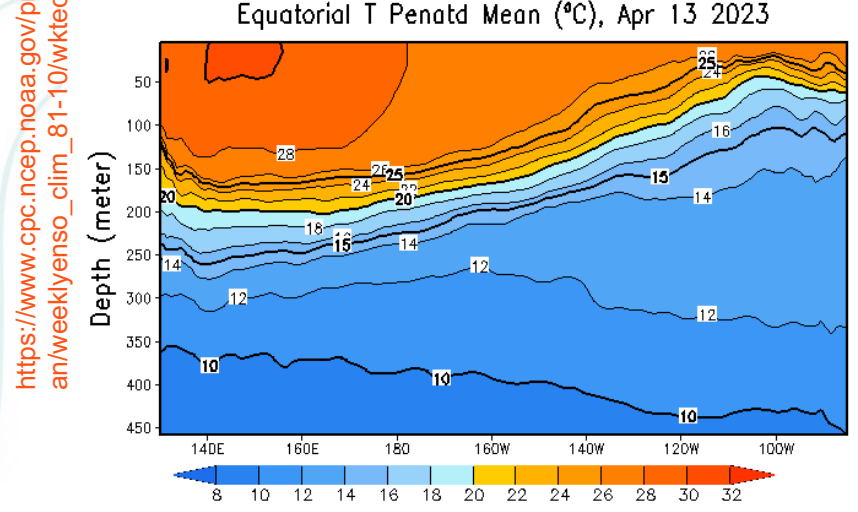
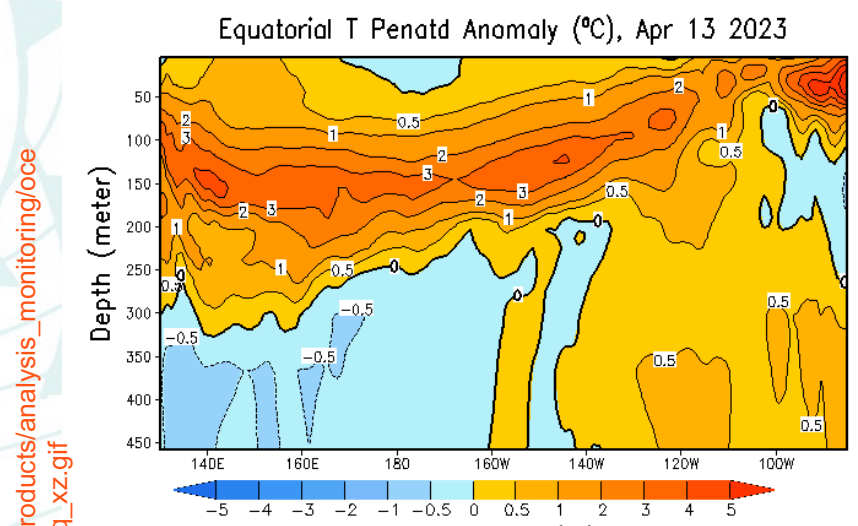
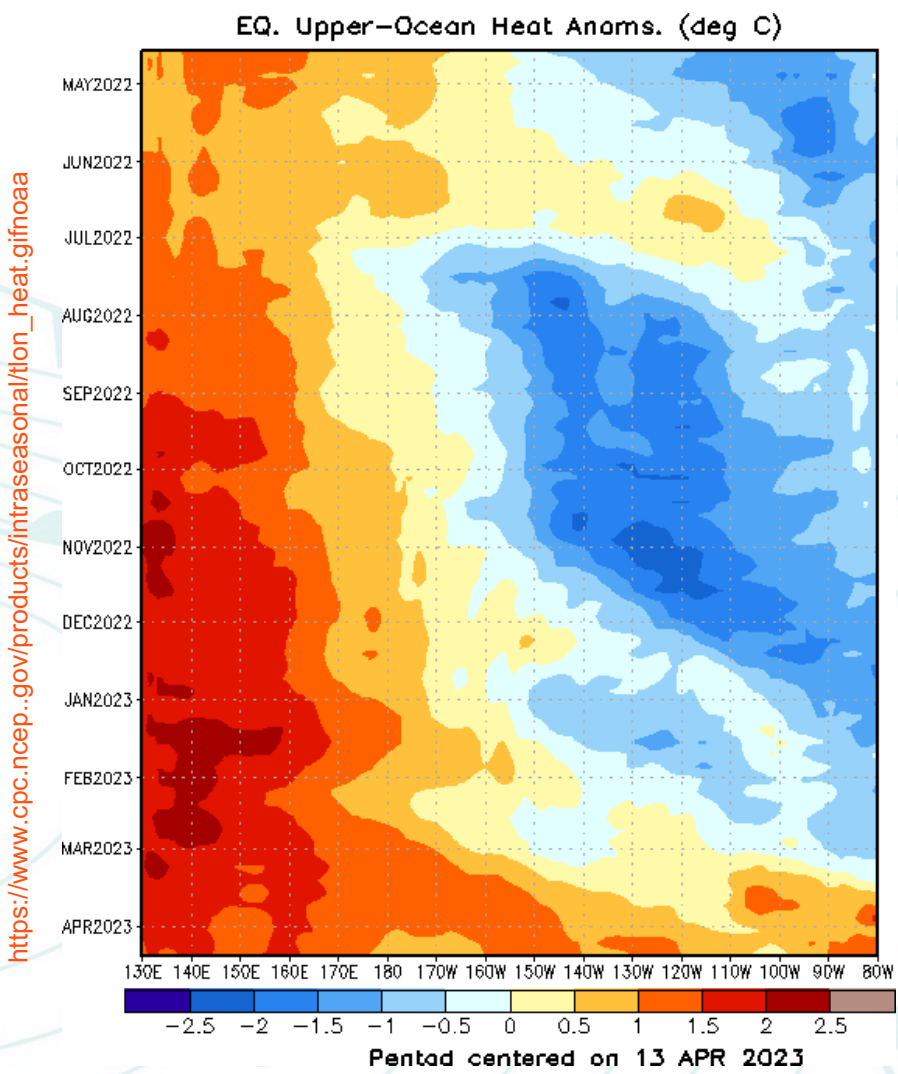


Data: NOAA Coral Reef Watch
 Climatology: 1985-2012

<https://psl.noaa.gov/enso/dashboard.html>

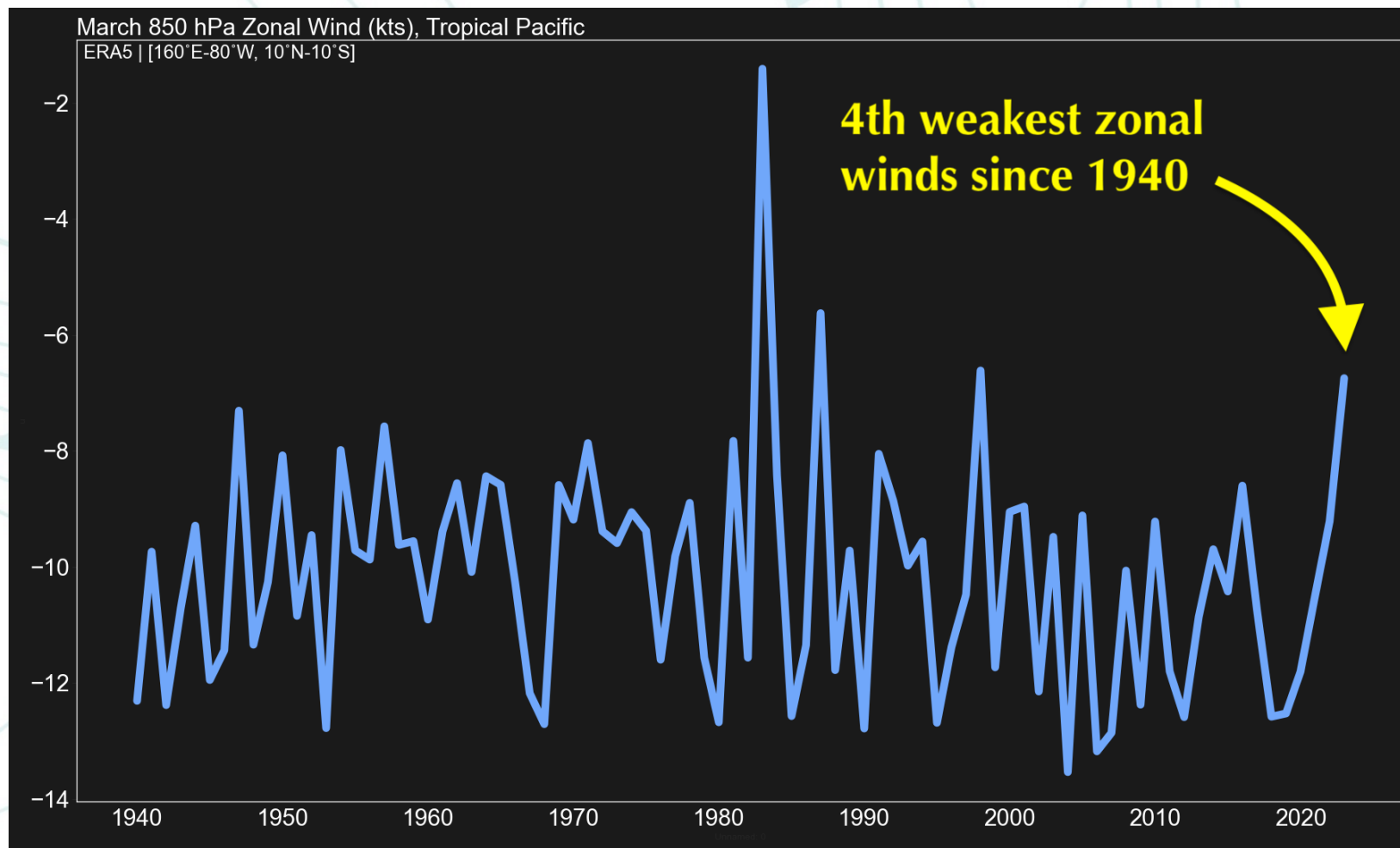
Under the sea – not the little mermaid, but a big shark!

- Ocean temperatures as much as 3-5°C warmer than average beneath the surface
- Warm water from the West Pacific Warm Pool discharging eastward by way of changes in trade winds



March Westerly Wind Burst: *got the train in motion*

- **Westerly Wind Burst:** reversal of trade winds; critical mechanism toward developing El Niño events
- March event was **4th strongest in the last 84 years**, per ECMWF/ERA5 reanalysis

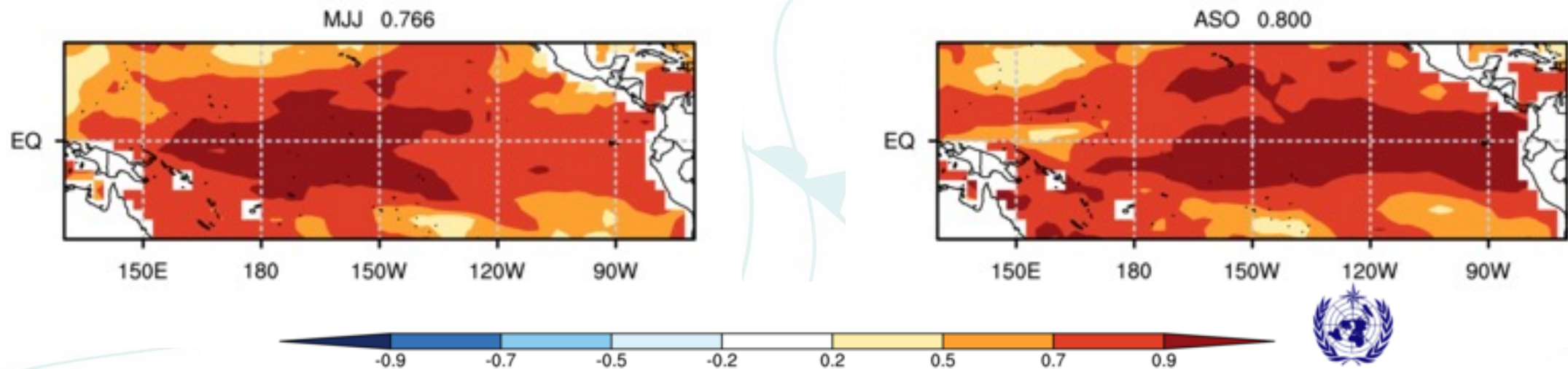


Graphic: NIWA
Data: ECMWF/ERA5

Be aware of the *spring predictability barrier*!

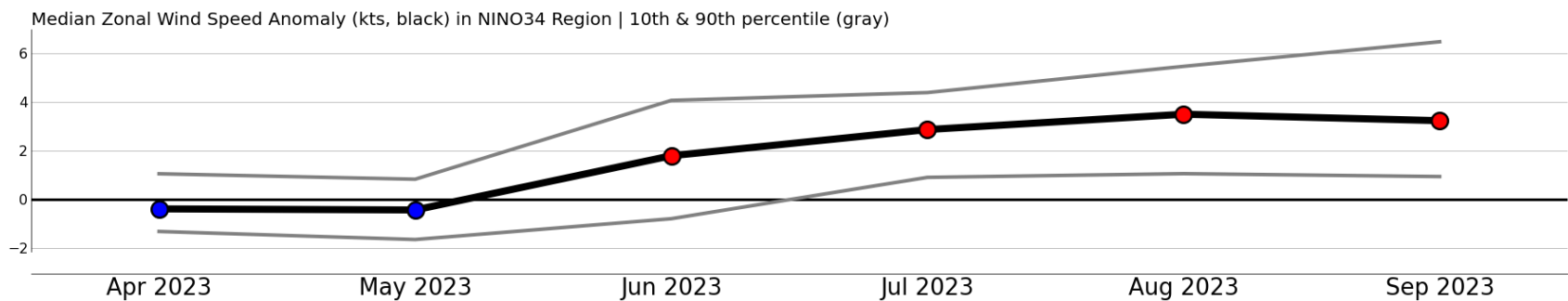
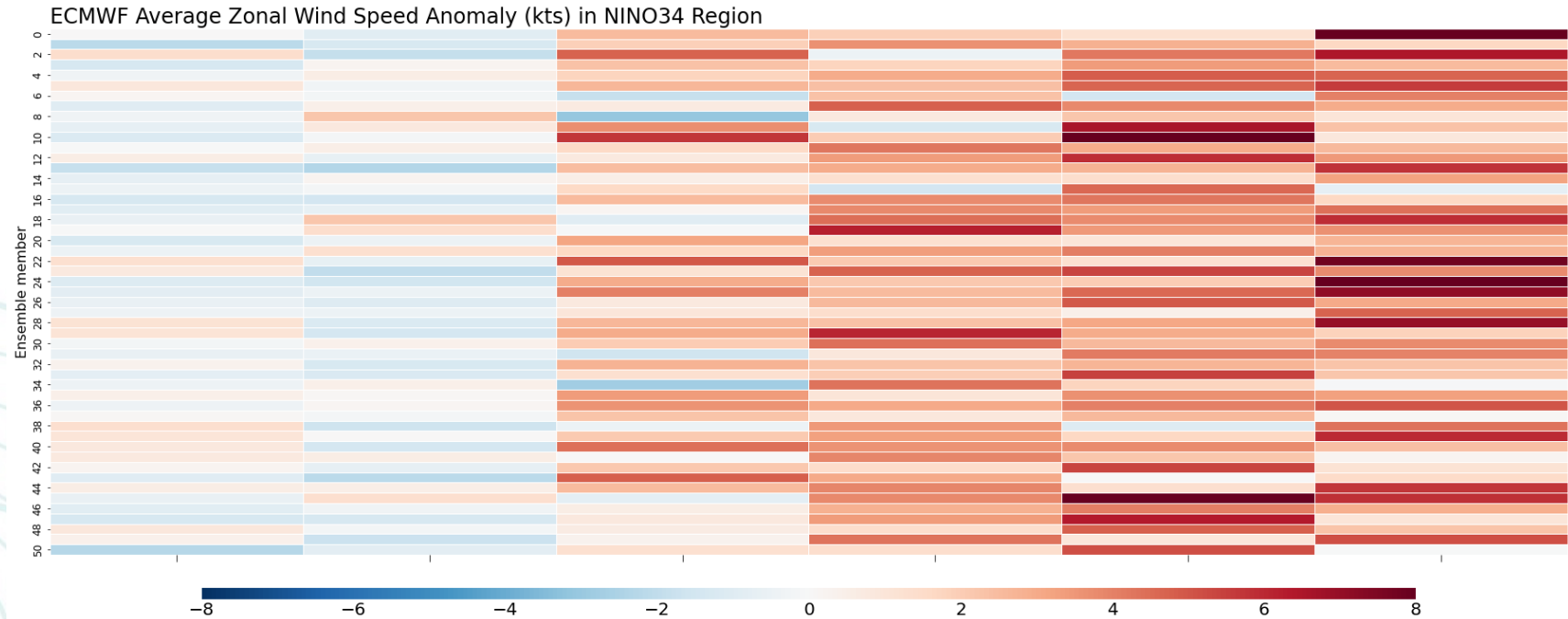
<https://www.climate.gov/news-features/blogs/enso/spring-predictability-barrier-we%E2%80%99d-rather-be-spring-break>

- ENSO predictions made during Northern Hemisphere spring have lower skill
- Why? ENSO is typically in-flux this time of the year, decaying from one phase and potentially moving toward another. This transition is influenced by things like the Madden-Julian Oscillation, which is only predictable at most a few weeks in advance.



Will the warming translate toward the surface?

- Red boxes indicate weaker trade winds (or possible westerlies)
- There is a strong trend toward weaker trades from June
- This may come with additional **westerly wind burst** events, helping to warm the sea surface and aid with the eastward progression of sub-surface warmth



Graphic: NIWA
Data: ECMWF

What are the models saying? *Strong agreement*

- The top performing climate models for our region (ECMWF, UKMO, ACCESS) indicating a strong El Niño (>1.5°C)
- Most models show **at least** a moderate event (>1.0°C)
- Spring predictability barrier encourages caution, but in the context of the observed changes, these outlooks seem reasonable!

Niño 3.4 Index anomalies (°C) over the next 6 months

	2023-04	2023-05	2023-06	2023-07	2023-08	2023-09
ECCC	0.15	0.43	0.81	1.24	1.62	1.68
ECMWF	0.17	0.55	0.90	1.20	1.47	1.68
Météo-France	0.13	0.33	0.64	0.91	1.11	1.24
JMA	0.29	0.59	0.88	1.17	1.47	1.56
DWD	-0.23	-0.09	0.17	0.42	0.60	0.71
CMCC	0.02	0.46	0.91	1.28	1.55	1.62
UKMET	0.14	0.50	0.82	1.18	1.47	1.64
NCEP	0.11	0.45	0.75	1.16	1.42	1.61
ACCESS		0.92	1.31	1.76	2.21	2.43

Graphic: NIWA
Data: Copernicus Climate Change Service

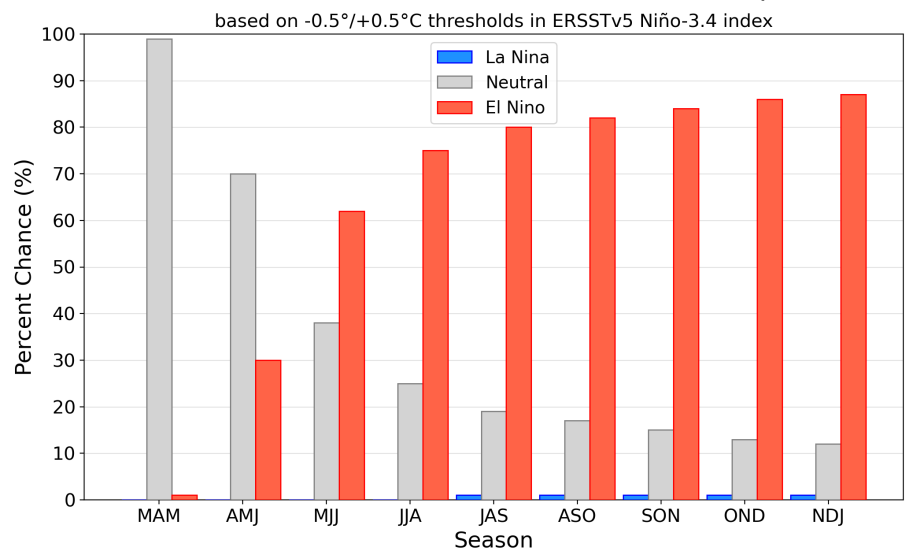
El Niño odds from IRI & APCC

Graphic: NIWA (top), IRI (bottom left), APCC (bottom right)
Data: IRI, APCC

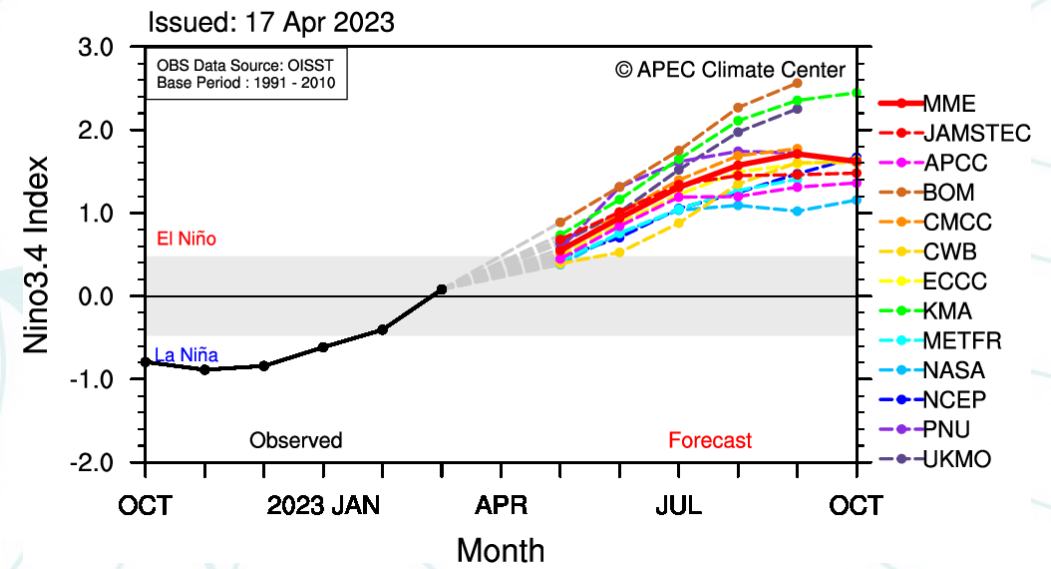


Season	La Niña	Neutral	El Niño
MAM	0%	99%	1%
AMJ	0%	70%	30%
MJJ	0%	38%	62%
JJA	0%	25%	75%
JAS	1%	19%	80%
ASO	1%	17%	82%
SON	1%	15%	84%
OND	1%	13%	86%
NDJ	1%	12%	87%

Official NOAA CPC ENSO Probabilities (issued Apr. 2023)



Niño3.4 Index for 2023 MJJASO



WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

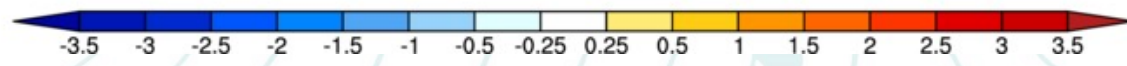
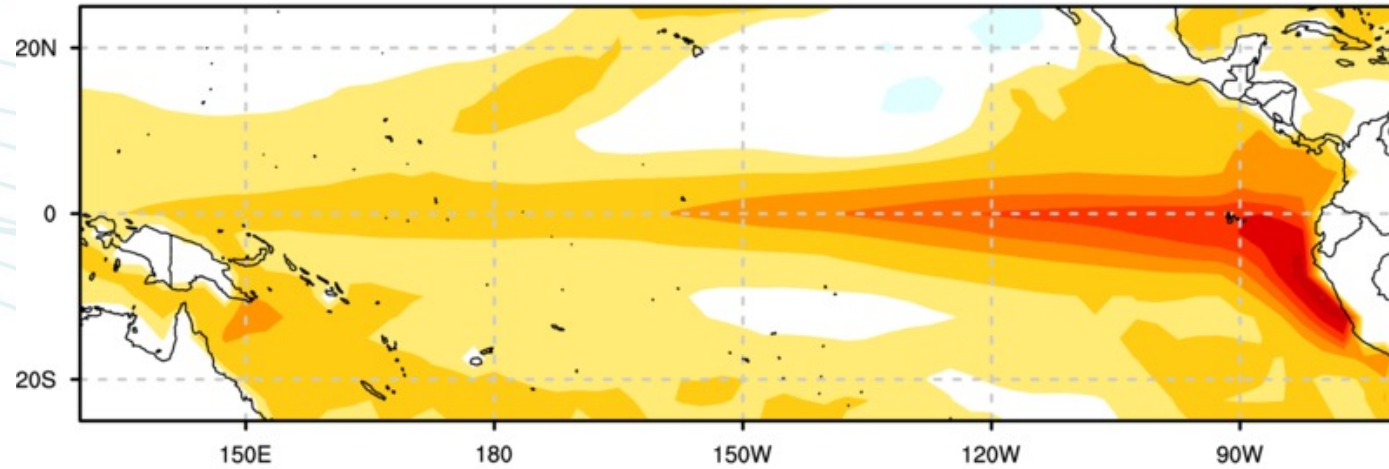
Simple Composite Map

Beijing, CMCC, ECMWF, Exeter, Melbourne, Montreal, Offenbach, Seoul, Tokyo, Toulouse, Washington

Sea Surface Temperature : MJJ2023

[Unit : K]
 (issued on Apr2023)

MAY-JULY



Graphic: WMO Lead Centre

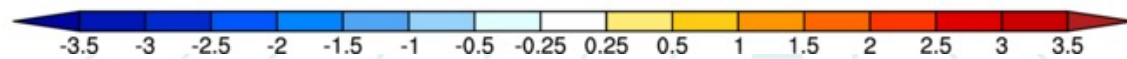
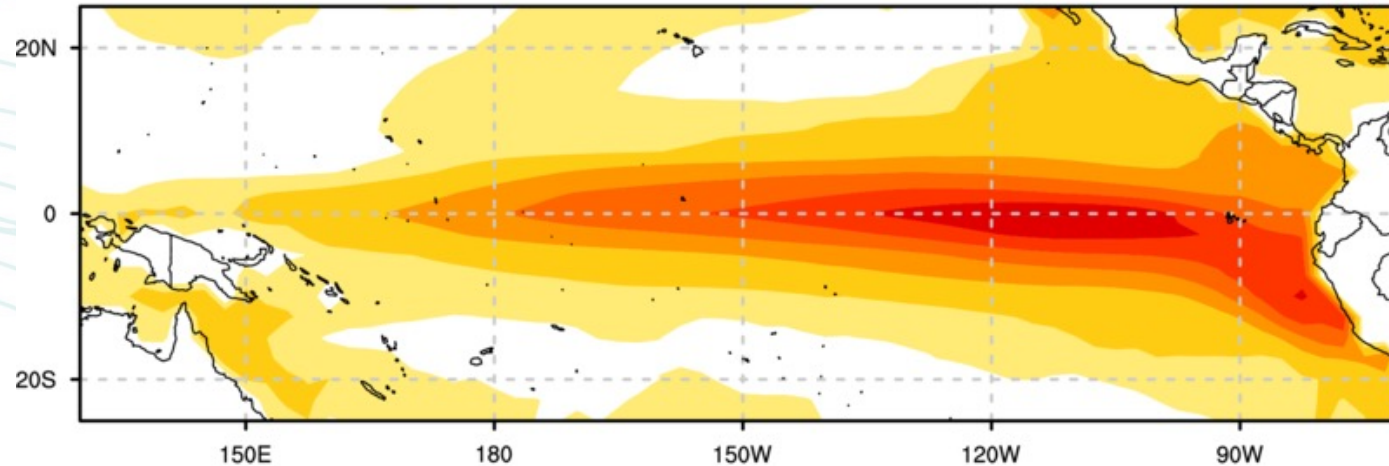
https://www.wmolc.org/seasonVrfyHindDmmeUI/plot_VrfyHIND_DMME#

WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble

Simple Composite Map
Beijing, Montreal, Seoul, Tokyo, Washington
Sea Surface Temperature : ASO2023

[Unit : K]
(issued on Apr2023)

AUGUST-OCTOBER



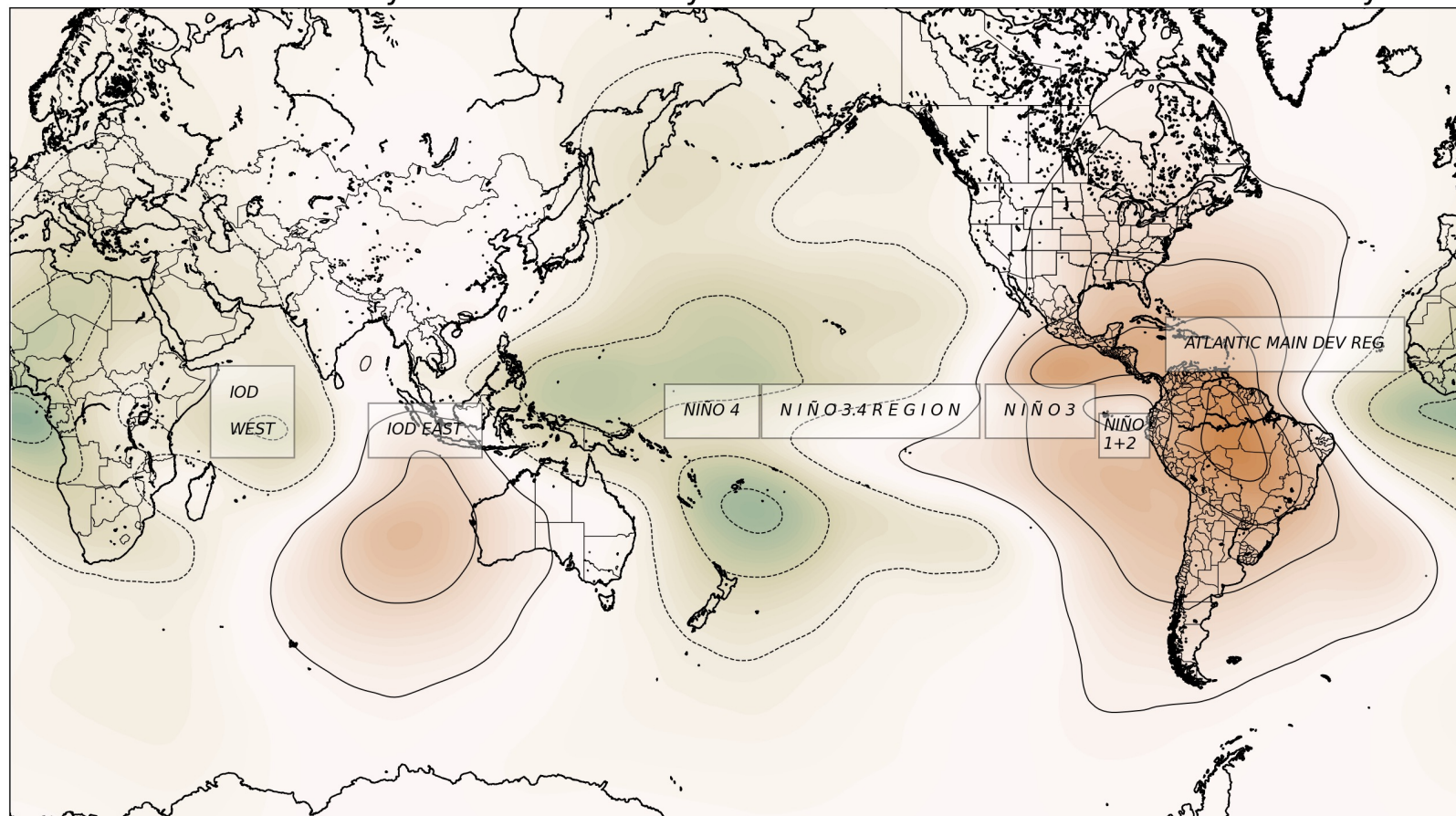
Graphic: WMO Lead Centre

https://www.wmolc.org/seasonVrfyHindDmmeUI/plot_VrfyHIND_DMME#

Will the ocean-atmosphere communicate (couple)?

ECMWF 200 hPa Velocity Potential Anomaly

May 2023



More convection

Less convection

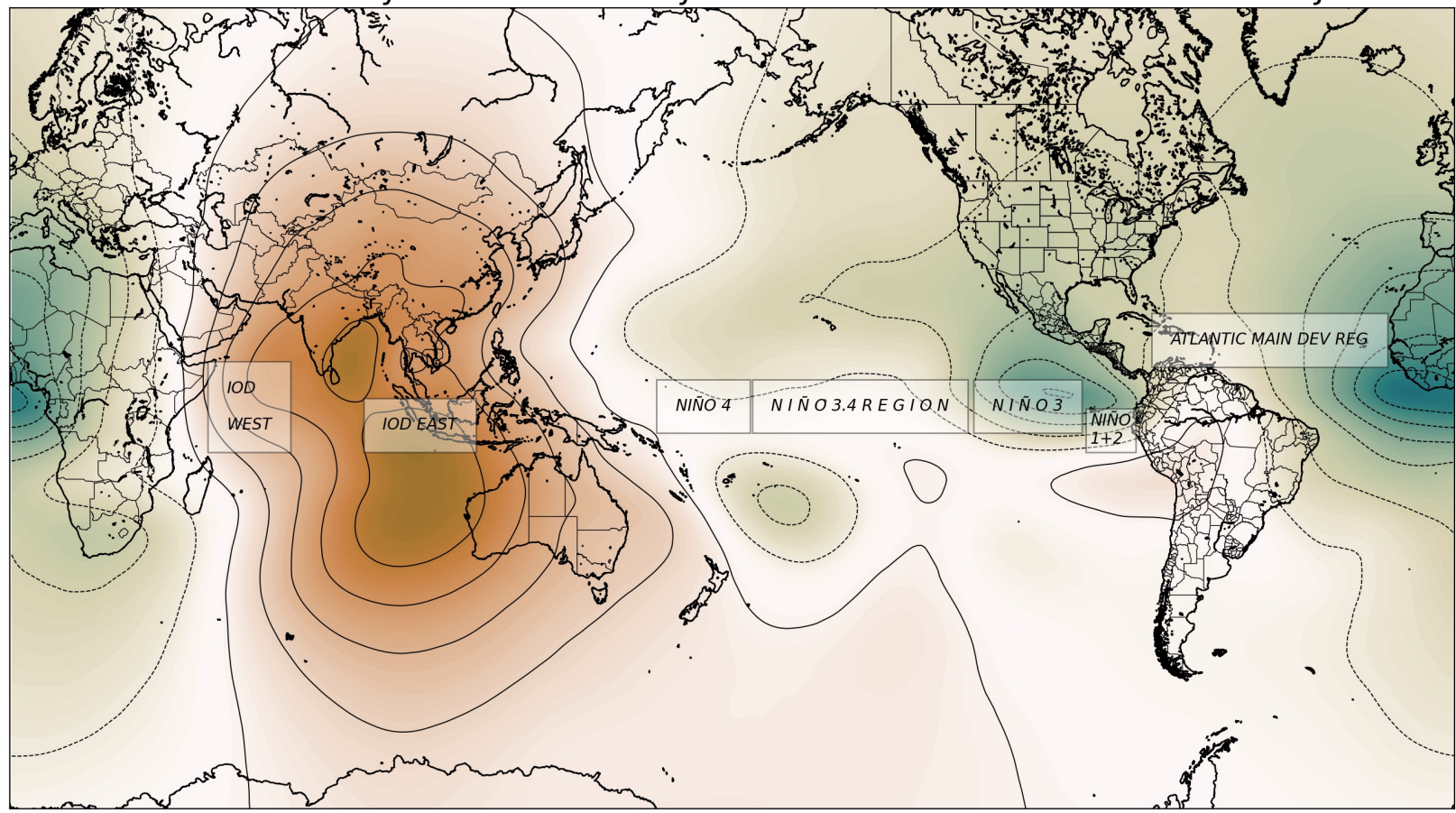
Graphic: NIWA
Data: ECMWF

- May:** La Niña-like “lag” effect?
 Rising air (green) over the western Pacific

Will the ocean-atmosphere communicate (couple)?

- **June:** Important change toward El Niño-like forcing with sinking motion (brown) over the Maritime Continent and rising air over the eastern Pacific

ECMWF 200 hPa Velocity Potential Anomaly Jun 2023



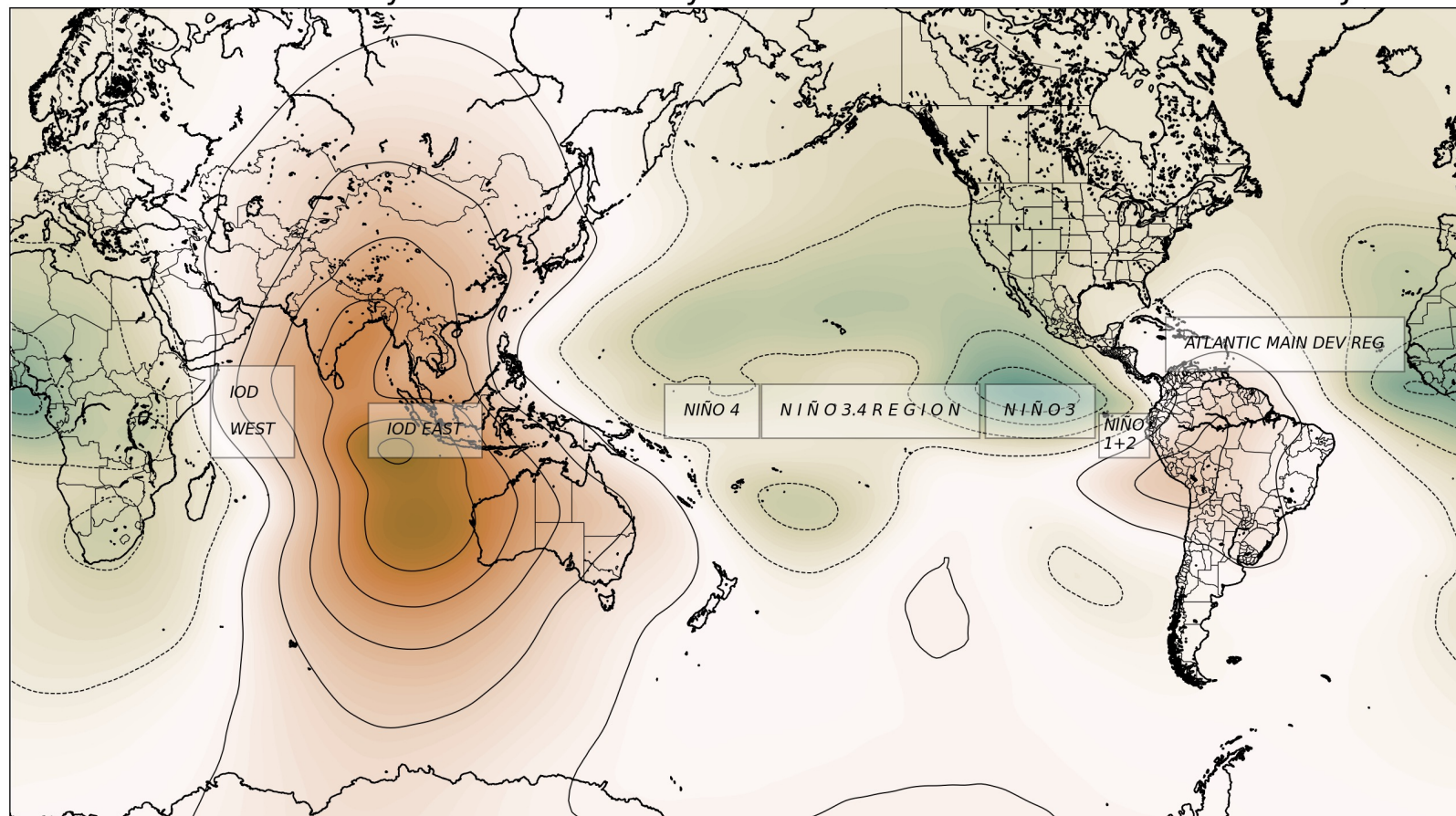
More convection ← → Less convection

Graphic: NIWA
 Data: ECMWF

Will the ocean-atmosphere communicate (couple)?

ECMWF 200 hPa Velocity Potential Anomaly

Jul 2023



More convection

Less convection

Graphic: NIWA
 Data: ECMWF

- **July:** a continuation of the June pattern; El Niño-like, modified Walker Circulation

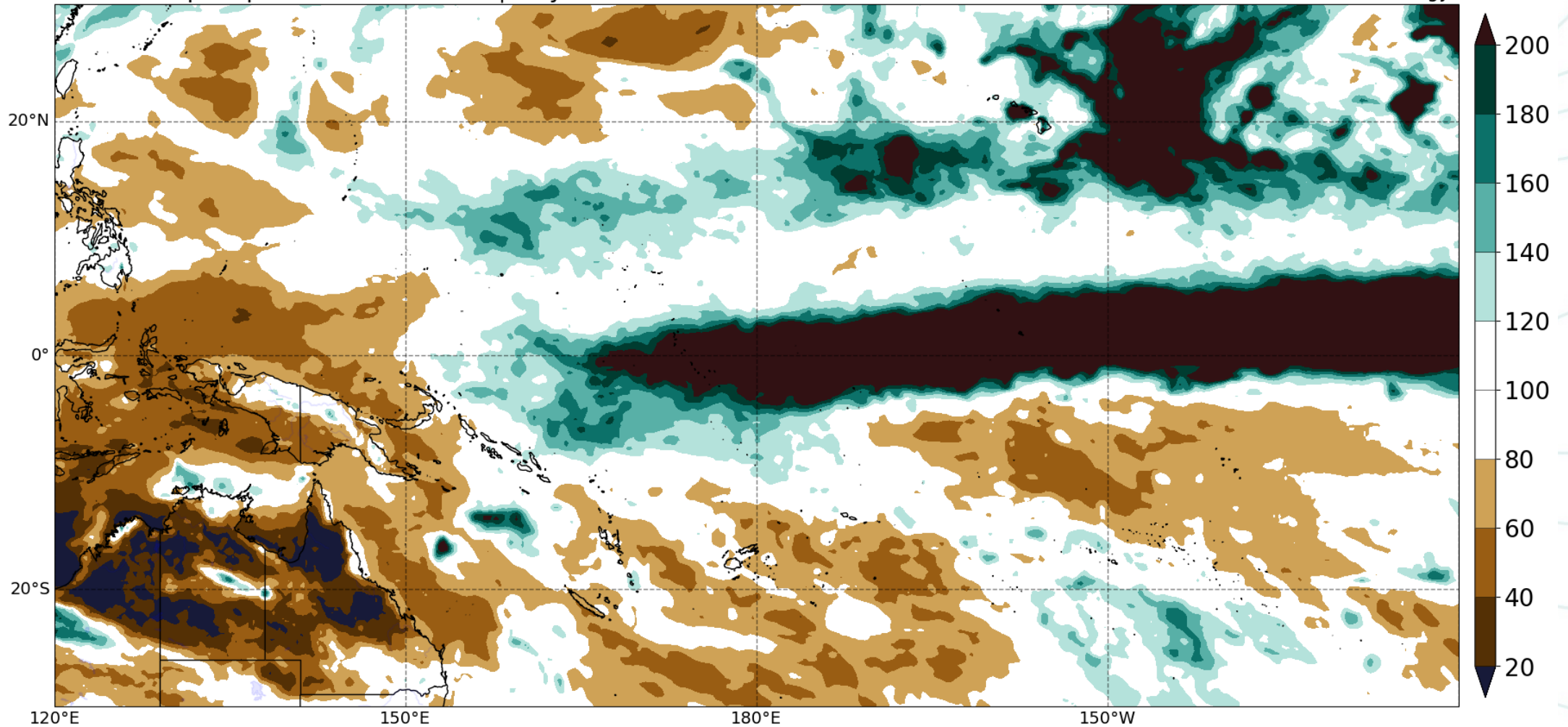
While we may know the “average outcome” associated with El Niño, no event is “average”.

Every event comes with a unique set of climate characteristics!

Rainfall during May-October 2015, 1997, and 1982

ERA5 total precipitation % of normal | May - October 2015

[1991-2020 climatology]



WMO Global Seasonal Climate Update

The WMO Global Seasonal Climate Update (GSCU), issued quarterly, summarizes the current status (monitoring) and the expected future behaviour (prediction) of the global seasonal climate focusing on the major general circulation features and large-scale oceanic anomalies around the globe (e.g., El Niño/Southern Oscillation, North Atlantic Oscillation, Indian Ocean Dipole, etc.) and their potential impacts on the worldwide surface temperature and precipitation patterns.

Latest Update

GSCU for April-May-June 2023

During December-February 2022/2023, Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific, except in the far east near the South American coast, were below-normal. The observed SST conditions in the equatorial Pacific were characterized by a weak La Niña. The Indian Ocean Dipole (IOD) over the observed period was weakly positive. The North Tropical Atlantic (NTA) index was near-zero while the South Tropical Atlantic (STA) SST index was positive.

For the April-June 2023 season, near-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted and indicate a tendency for weak La Niña conditions to transition towards neutral ENSO conditions with SST anomalies favouring positive values.

<https://public.wmo.int/en/our-mandate/climate/global-seasonal-climate-update>

Key messages / summary

- ENSO neutral currently, but Pacific RCC node members for LRF all now indicating El Niño Watch; IRI odds show over 62% chance of El Niño from May-July and 82% for August-October
- Surface & sub-surface water in the equatorial Pacific is well above average
- Westerly wind burst in March; more likely to come – can help to push warm water eastward and toward the surface
- Strong agreement from global models on a moderate to strong El Niño; *could* have similarities with 2015, 1997, and 1982, but need to be mindful of spring predictability barrier
- Major change in climate patterns compared to last several years with ocean-atmosphere coupling due to El Niño, possibly from June onward

Thank you!

Questions?