Global Ocean Monitoring: Recent Evolution, Current Status, and Predictions

Prepared by

Climate Prediction Center, NCEP/NOAA

June 10, 2025

http://www.cpc.ncep.noaa.gov/products/GODAS/

This project, to deliver real-time ocean monitoring products, is implemented by CPC in cooperation with NOAA's Global Ocean Monitoring and Observing Program (GOMO)

Outline

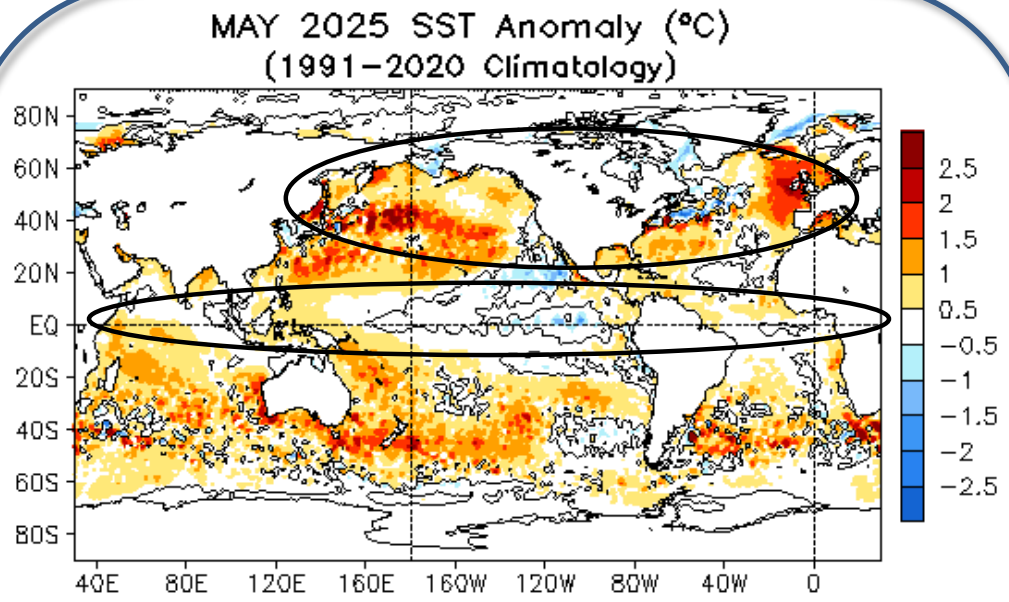
- **Overview**
- **Recent highlights**
  - Pacific Ocean
  - Arctic & Antarctic Oceans
  - Indian Ocean
  - Atlantic Ocean (2025 NOAA Hurricane Outlook)
- **Global SSTA Predictions**

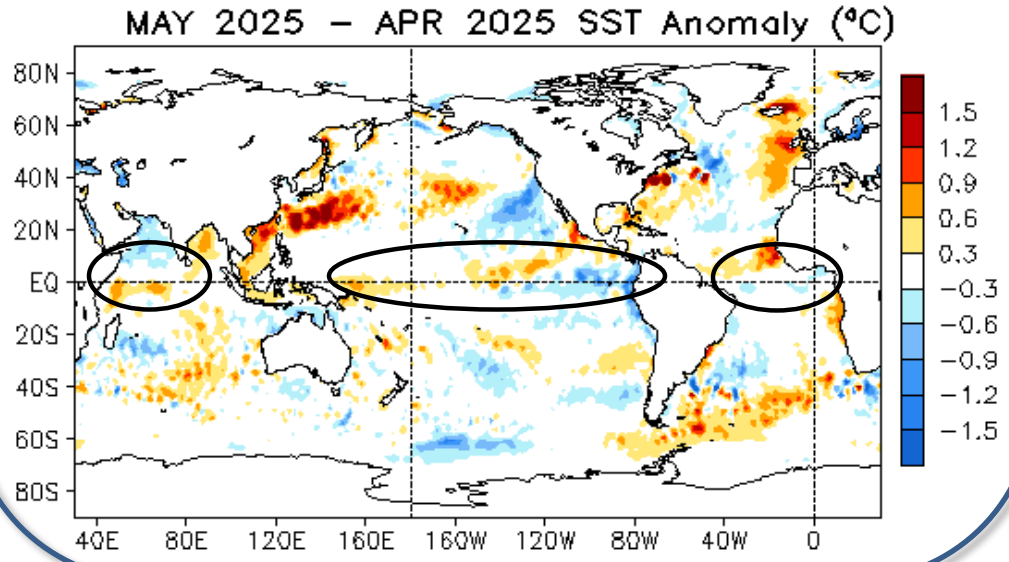
Overview

- **Pacific Ocean**
  - SSTs along the equatorial Pacific were near average with Niño3.4 = 0.0^{o}C in May 2025.
  - Coastal El Niño-like warming along the South America ended with Niño1+2 = 0.2^{o}C in May 2025.
  - NOAA "ENSO Diagnostic Discussion" issued *Not Active* on May 8, 2025.
  - The PDO has been in a negative phase since March 2020 with PDOI = -1.1 in May 2025.
- **Arctic & Antarctic Oceans**
  - Arctic Sea ice extent was 12.6 million km^2 in May 2025, tying with 2004 for the 7th lowest on the 47-year satellite record.
  - Antarctic sea ice extent was 9.2 million km^2 in May 2025, close to May 2024 extent.
  - CPC model-based forecasts indicate a below-average Arctic sea ice extent in 2025.
- **Indian Ocean**
  - SSTs were near-to-above average in the tropical Indian Ocean in May 2025.
- **Atlantic Ocean**
  - SSTs were slightly above average in the tropical North Atlantic Ocean in May 2025.
  - NAO was in a positive phase with NAOI = 0.5 in May 2025.
  - On May 22, 2025, NOAA predicted an active Atlantic hurricane season in 2025.

Global Oceans

Global SST Anomaly (°C) and Anomaly Tendency



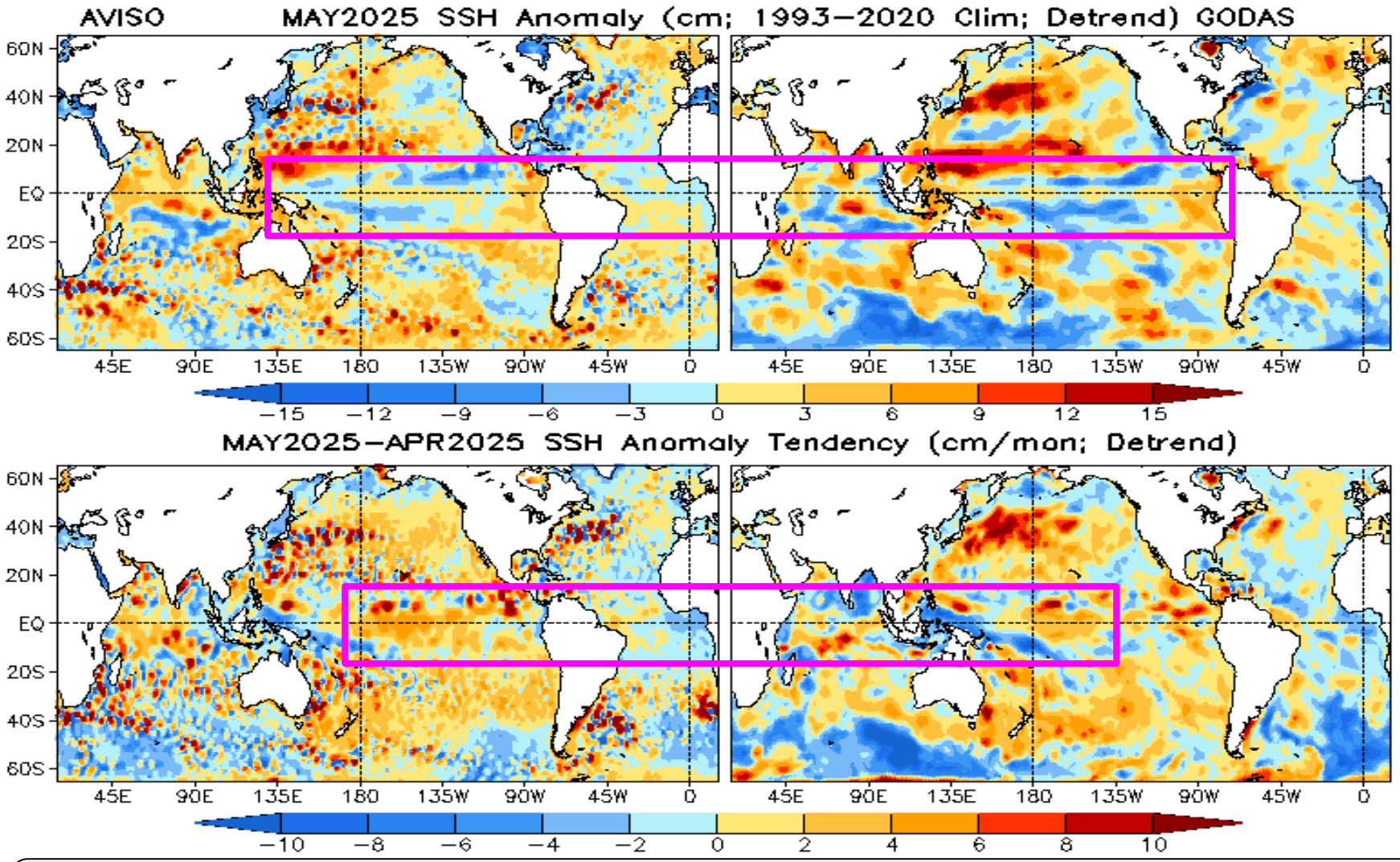


- Equatorial Pacific SSTs were slightly above average in the far-west and slightly below average in the east.
- Positive SSTAs persisted in the mid-latitudes of both the Pacific and Atlantic Oceans.
- SSTs were near-to-above average in the equatorial Indian and Atlantic Oceans.

- Tropical SSTA tendencies were positive in west-central and central Pacific and negative in the eastern Pacific.
- SSTA tendencies were small in the equatorial Indian and Atlantic Oceans.

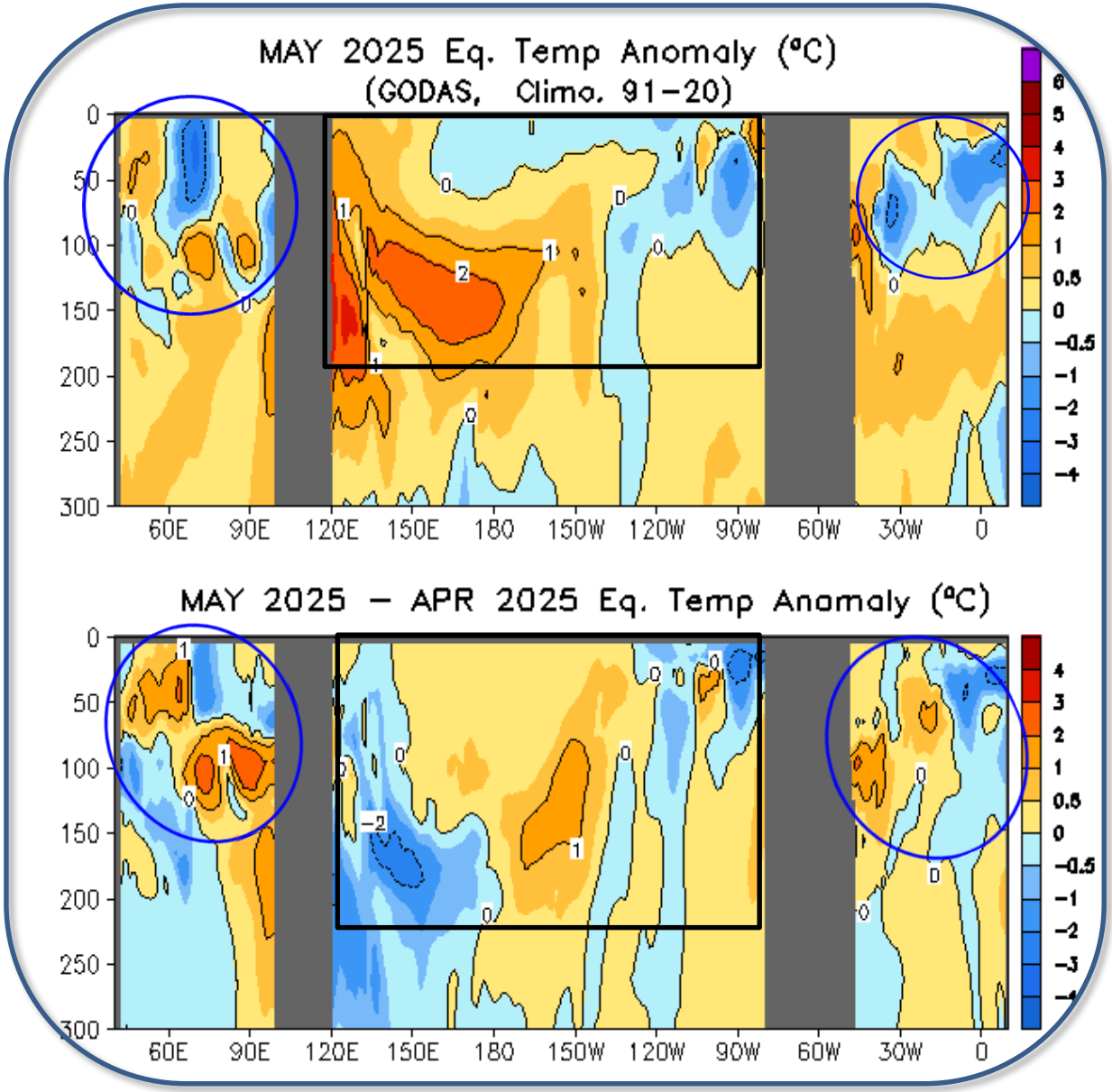
SSTA (top) and SSTA tendency (bottom). Data are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

AVISO & GODAS SSH Anomaly (cm) and Anomaly Tendency



- SSH was near average in the equatorial Pacific Ocean.
- Positive SSH anomalous tendencies were observed in the central and east-central equatorial Pacific.

Longitude-Depth Temperature Anomaly and Anomaly Tendency in 2°S-2°N



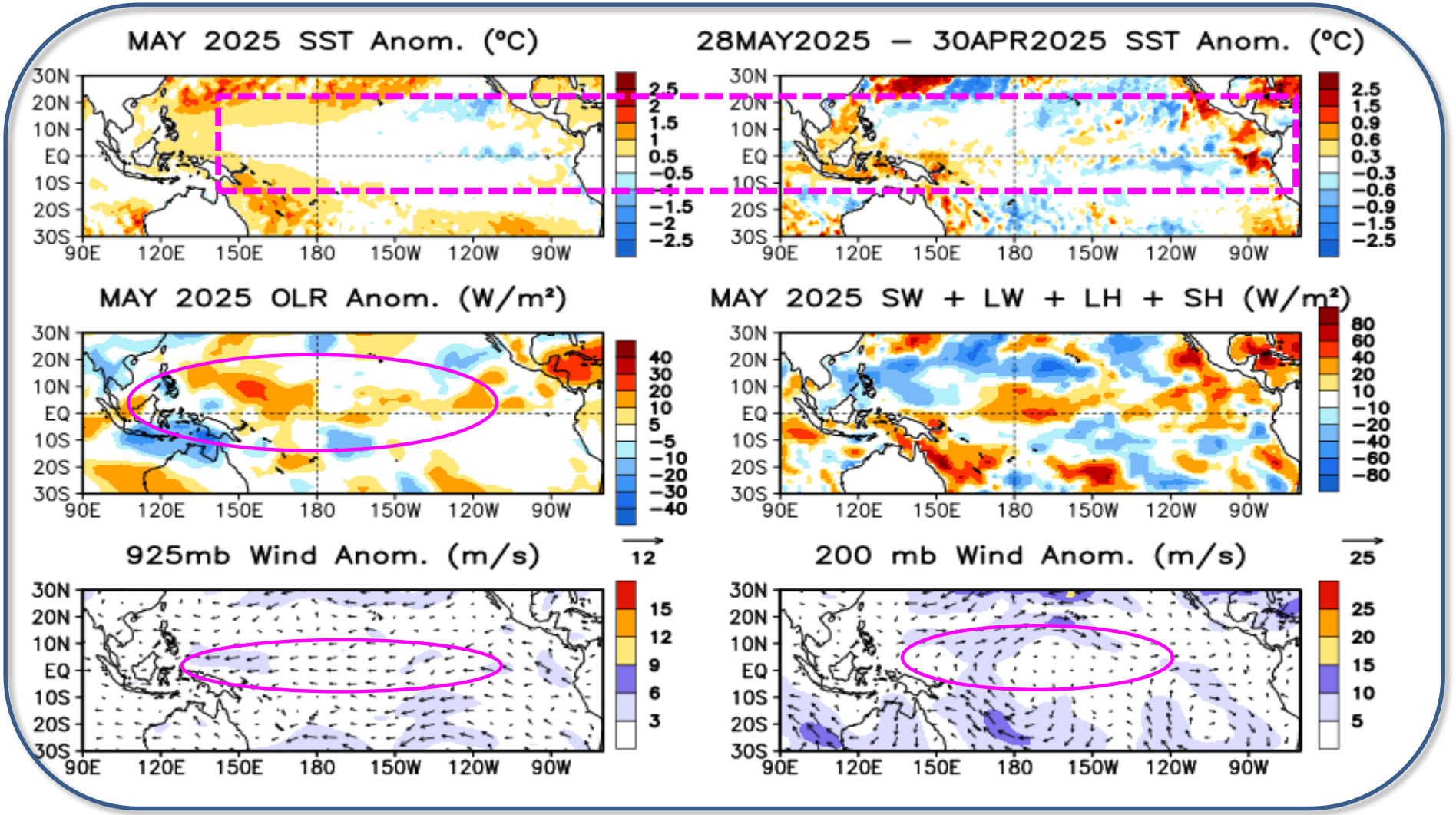
- Positive ocean temperature anomalies dominated the western and central equatorial Pacific Ocean along the thermocline with some negative anomalies in the east.
- Both positive and negative temperature anomalies were observed in the Indian Ocean.
- Negative anomalies were present along the thermocline in the central and eastern Atlantic Ocean.

- Positive (negative) temperature anomaly tendencies were observed in the central (western and eastern) Pacific Ocean.
- Positive anomaly tendencies were dominated in the Indian and Atlantic Oceans.

Equatorial depth-longitude section of ocean temperature anomalies (top) and anomaly tendency (bottom). Data is from the NCEP's GODAS. Anomalies are departures from the 1991-2020 base period means.

Tropical Pacific Ocean and ENSO Conditions

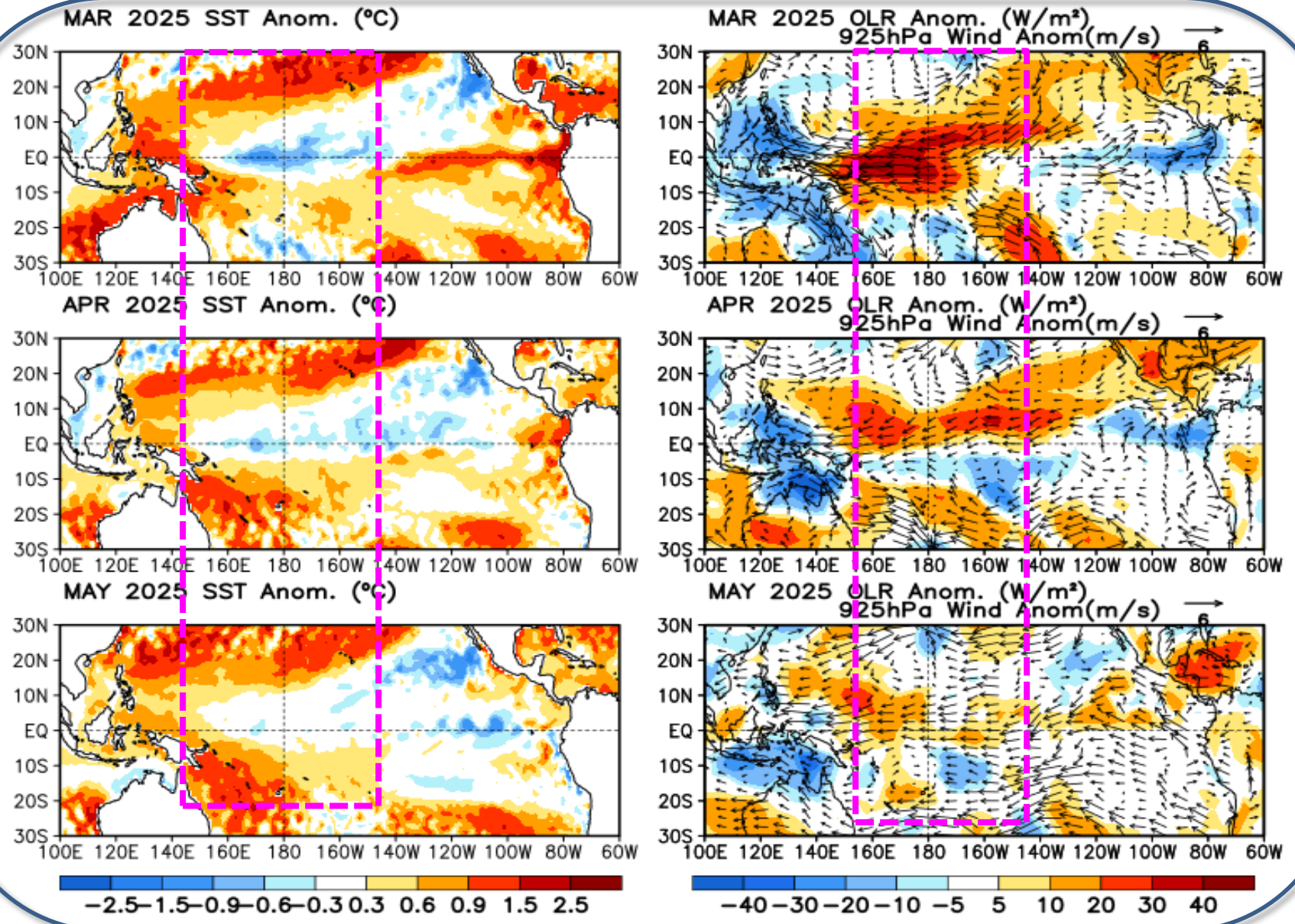
Tropical Pacific: SSTA, SSTA Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Winds:
Neutral conditions in the tropical Pacific



SSTA (top-left), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right; positive means heat into the ocean), 925-mb wind anomaly vector and its amplitude (bottom-left), 200-mb wind anomaly vector and its amplitude (bottom-right). SST are derived from the OIv2.1 SST analysis, OLR from the NOAA 18 AVHRR IR window channel measurements by NESDIS, winds and surface radiation and heat fluxes from the NCEP CDAS. Anomalies are departures from the 1991-2020 base period means.

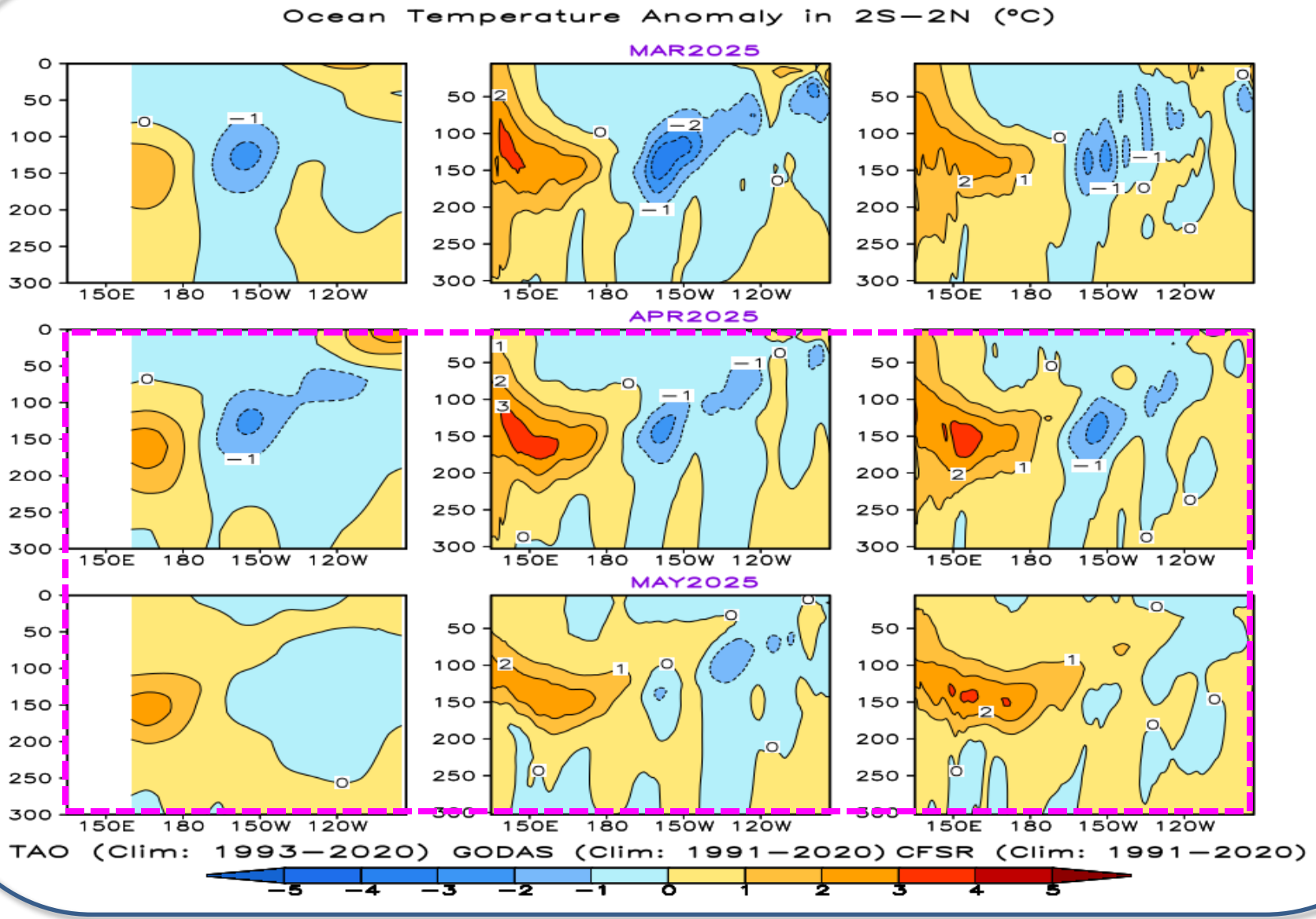
Last 3-month Tropical Pacific Ocean SST, OLR, and uv925 Anomalies:

Negative SSTA weakened & easterly wind anomalies were persistent in the central tropical Pacific

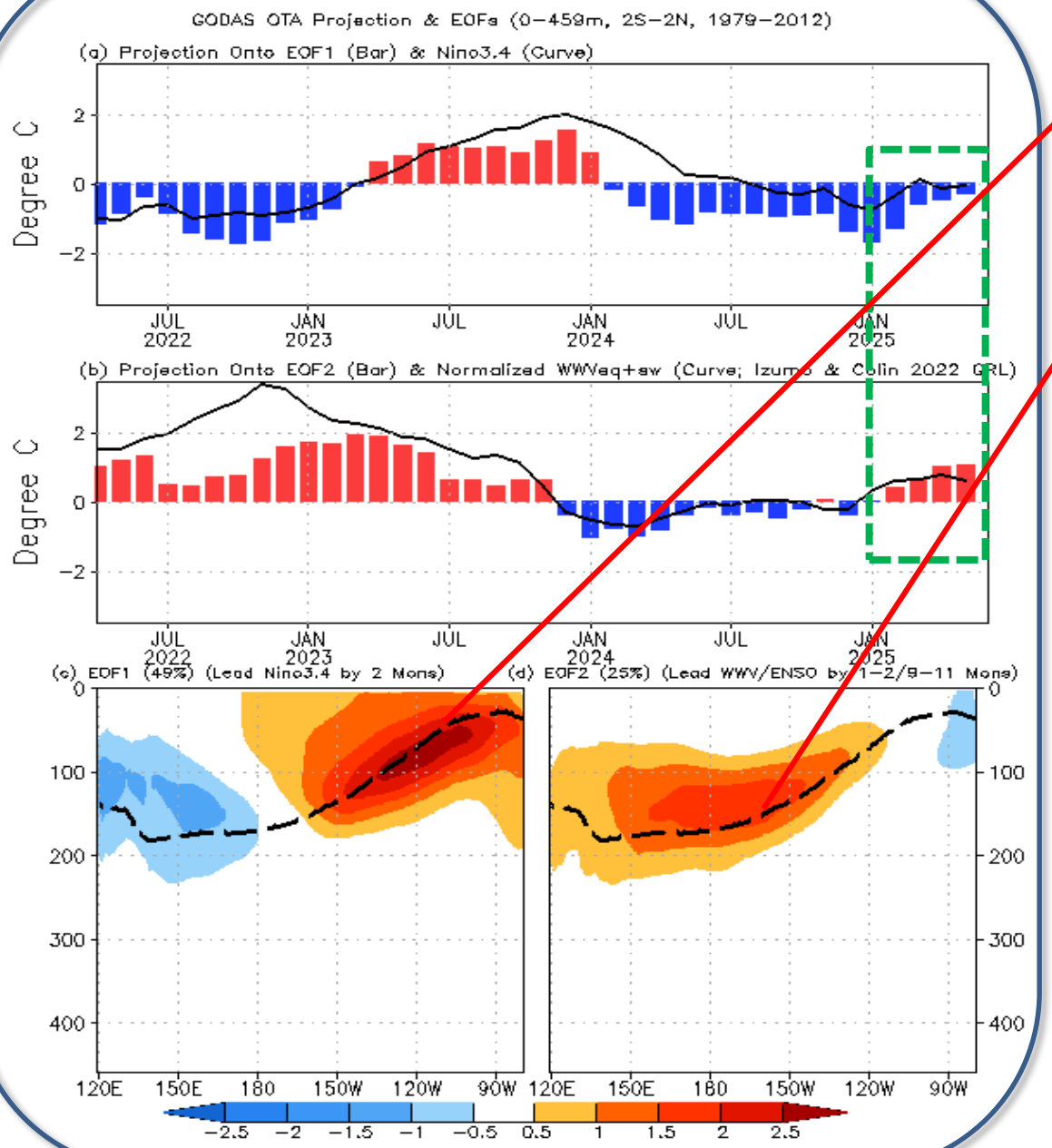


Monthly mean subsurface temperature anomaly along the Equator:

Positive anomalies in the western Pacific & negative anomalies in the eastern Pacific weakened in May 2025



Equatorial Sub-surface Ocean Temperature Monitoring



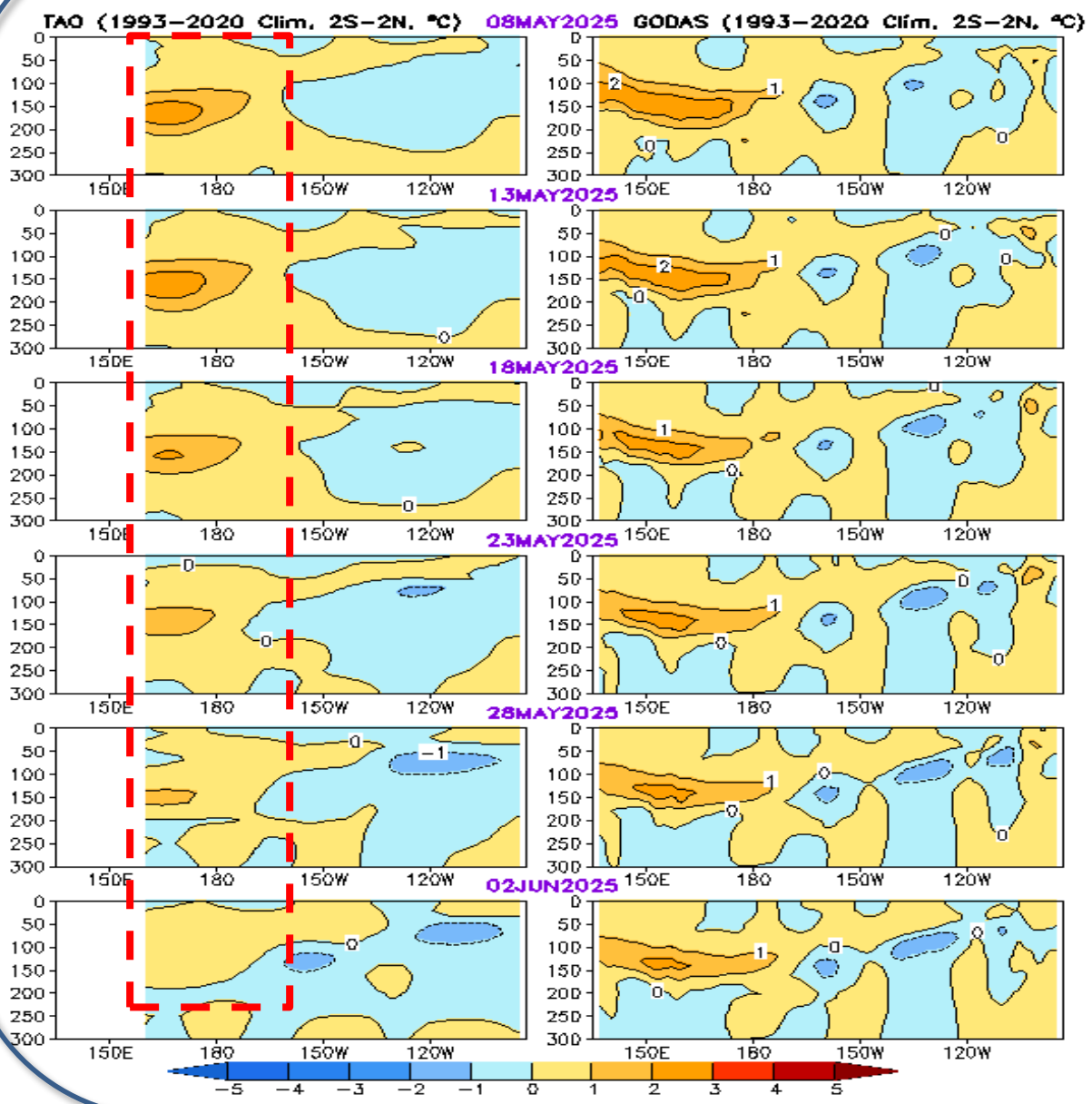
- The negative phase of the dipole mode has weakened since Feb 2025.
- WWV switched to a recharge phase in Feb 2025 and strengthened in Apr and May 2025.

- Projection of ocean temperature anomalies onto EOF1 and EOF2; EOF1: Tilt/dipole mode (ENSO peak phase); EOF2: WWV mode.

- Recharge/discharge oscillation (ENSO transition phase); Recharge process: heat transport from outside of equator to equator; Negative -> positive phase of ENSO

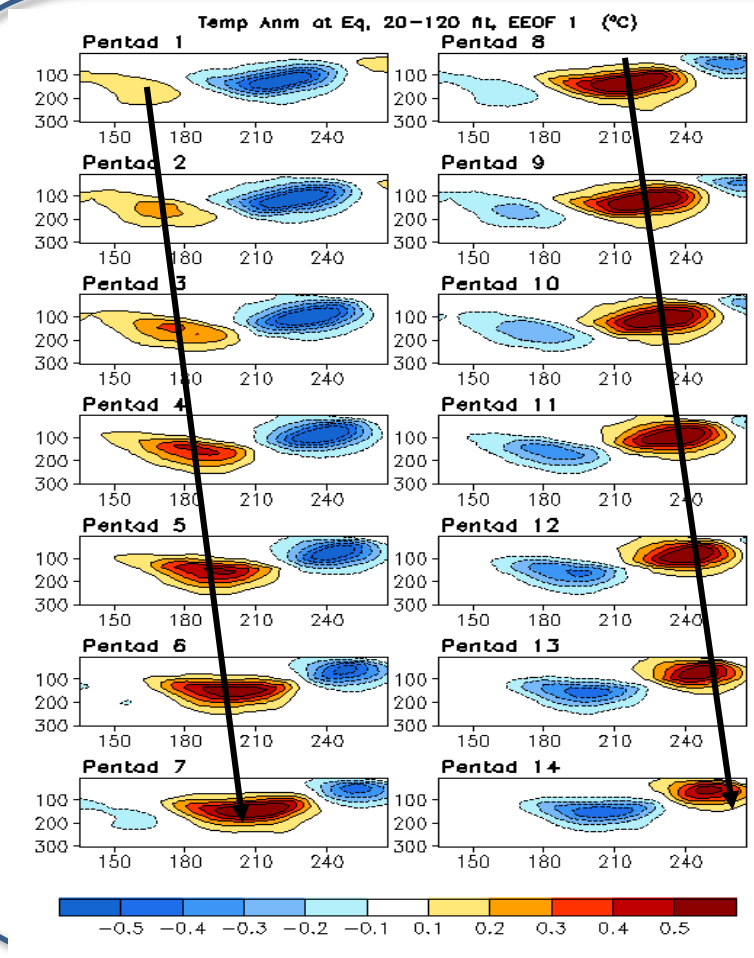
- For details, see: Kumar and Hu (2014) DOI: 10.1007/s00382-013-1721-0; Izumo & Colin (2022) DOI: 10.1029/2022GL101003.

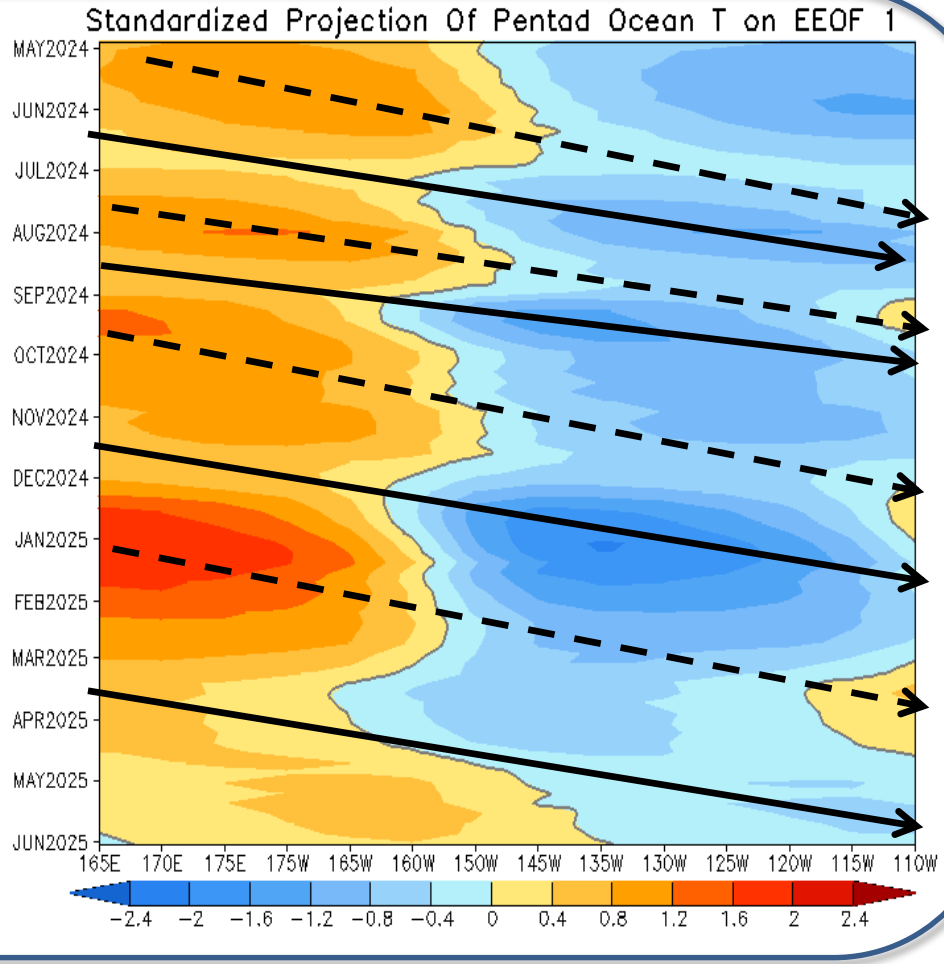
Equatorial Pacific Ocean Temperature Pentad Mean Anomaly



- Positive ocean temperature anomalies along the equatorial thermocline in the western Pacific weakened during the last month.
- The features of the ocean temperature anomalies were similar between GODAS and TAO analysis.

Oceanic Kelvin Wave (OKW) Index





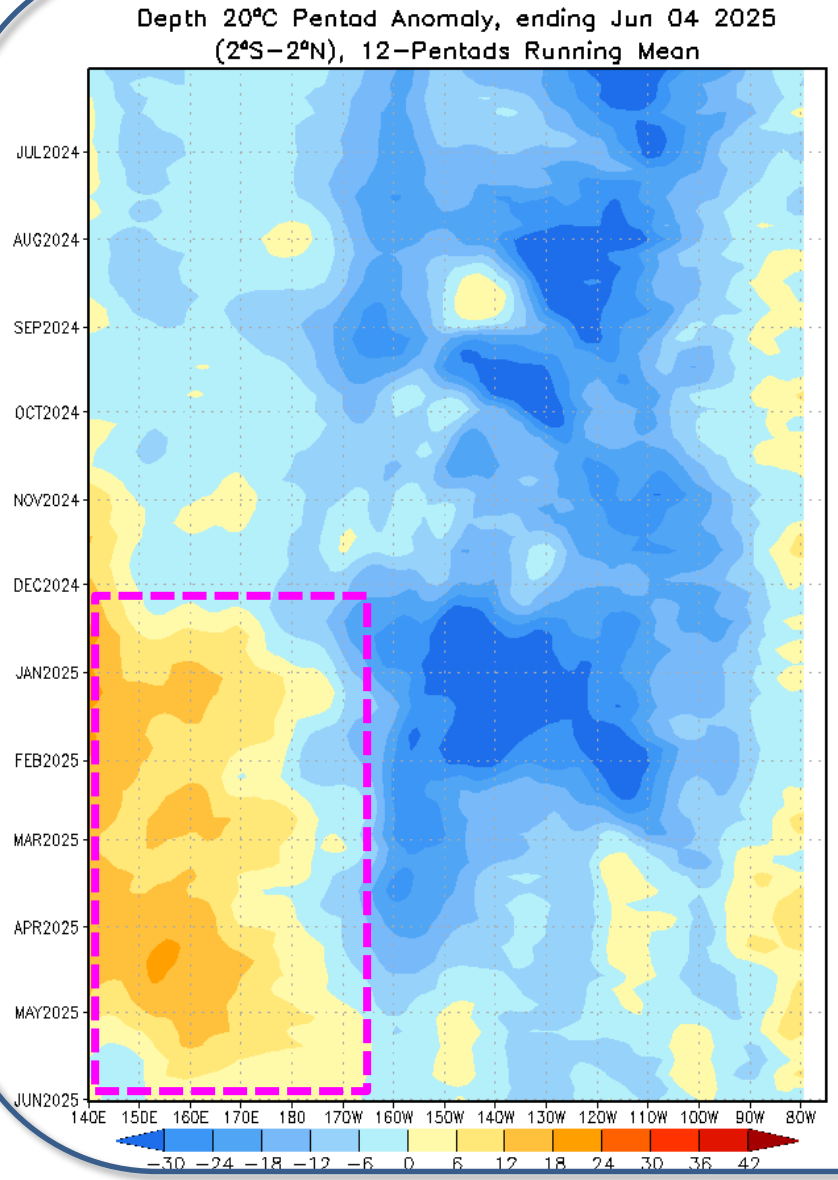
- **Multiple downwelling and upwelling Kelvin waves were observed in 2024-25, leading to fluctuations in SSTA in the central and eastern equatorial Pacific and ENSO evolution.**

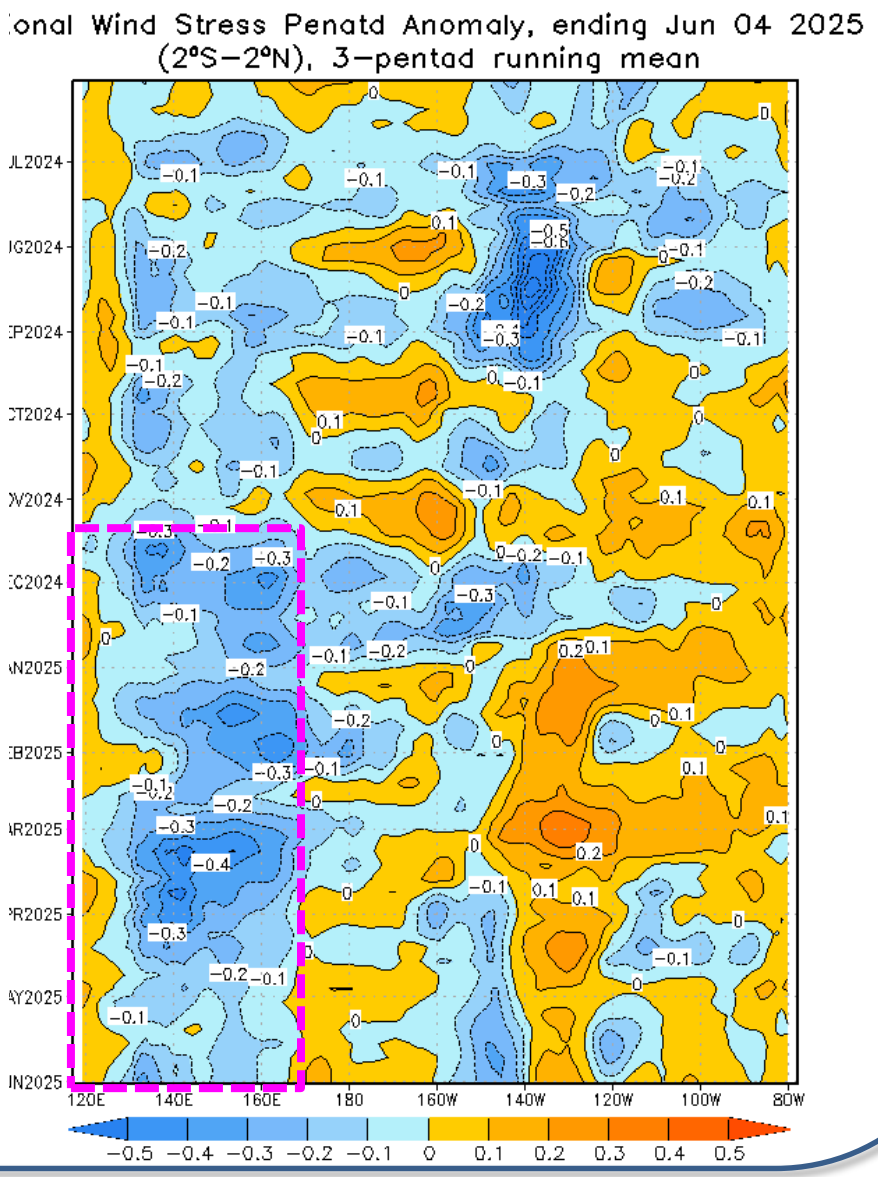
- **Although there were some Kelvin wave-like fluctuations, the variations were mostly stationary since Feb 2024.**

(OKW index is defined as standardized projections of total anomalies onto the 14 patterns of Extended EOF1 of equatorial temperature anomalies (Seo and Xue , GRL, 2005).)

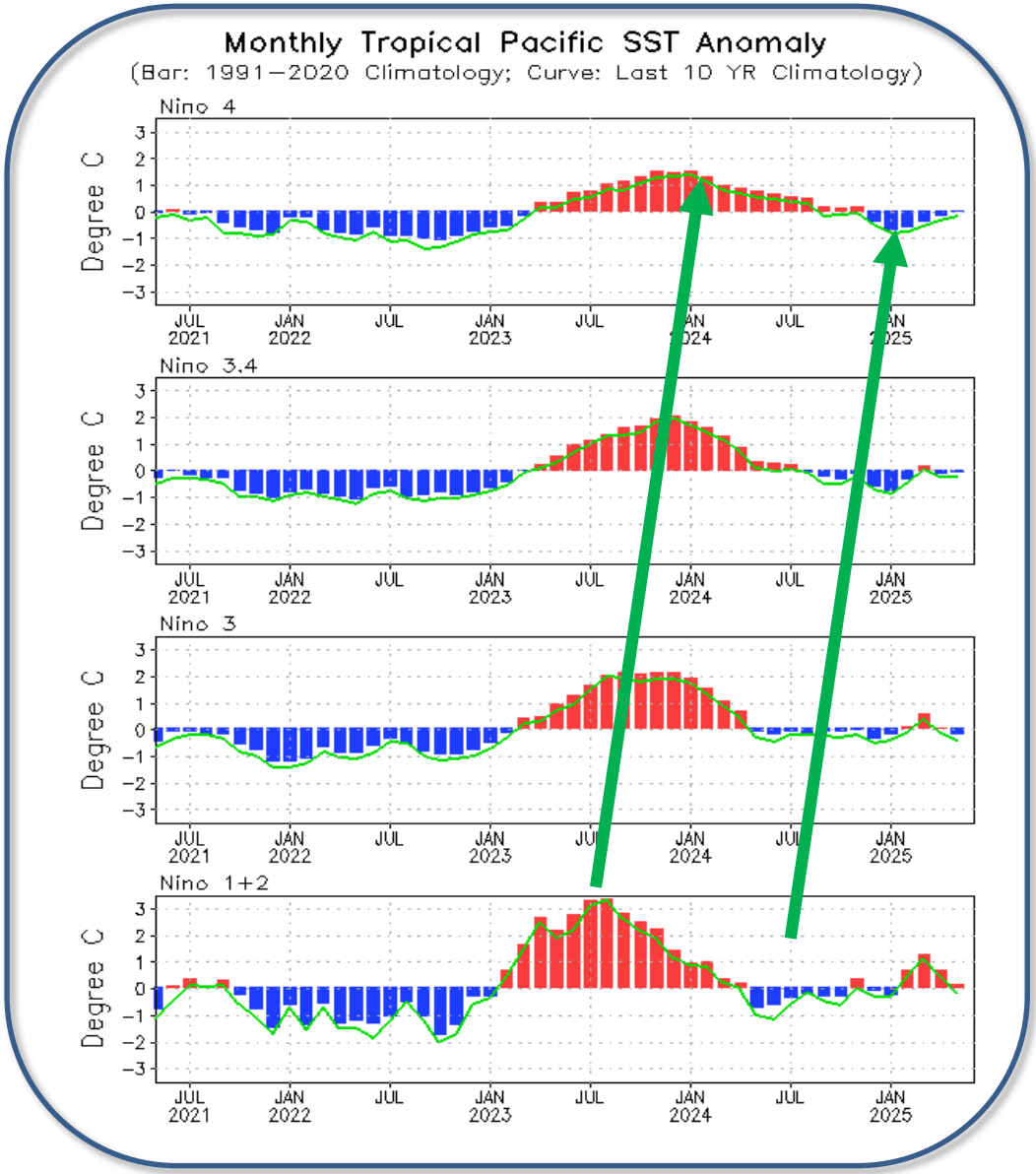
Evolution of Pentad D20 and Taux anomalies along the equator

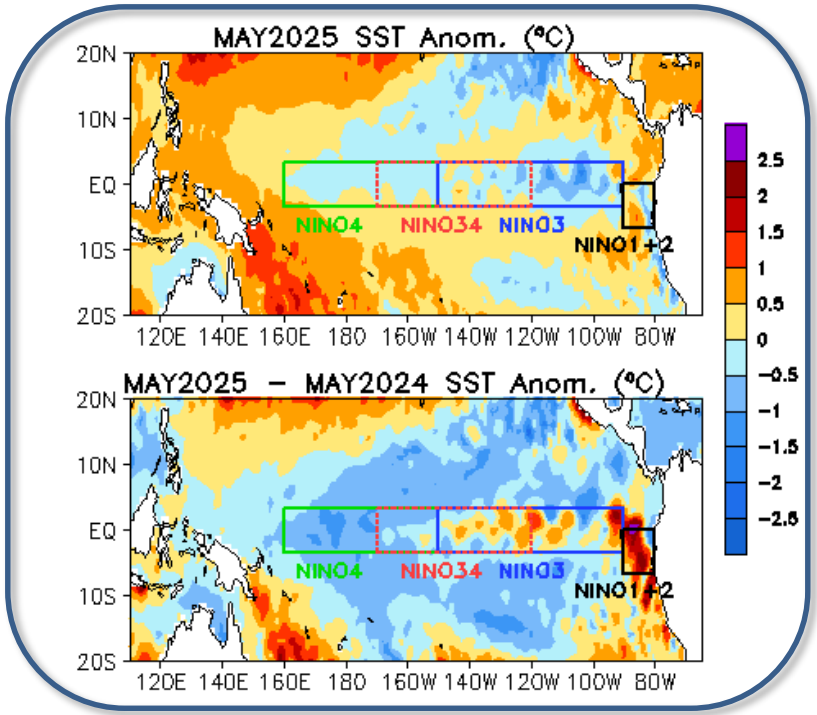
Positive D20 anomalies & easterly wind anomalies persisted in the western Pacific in 2025





Evolution of Pacific Niño SST Indices





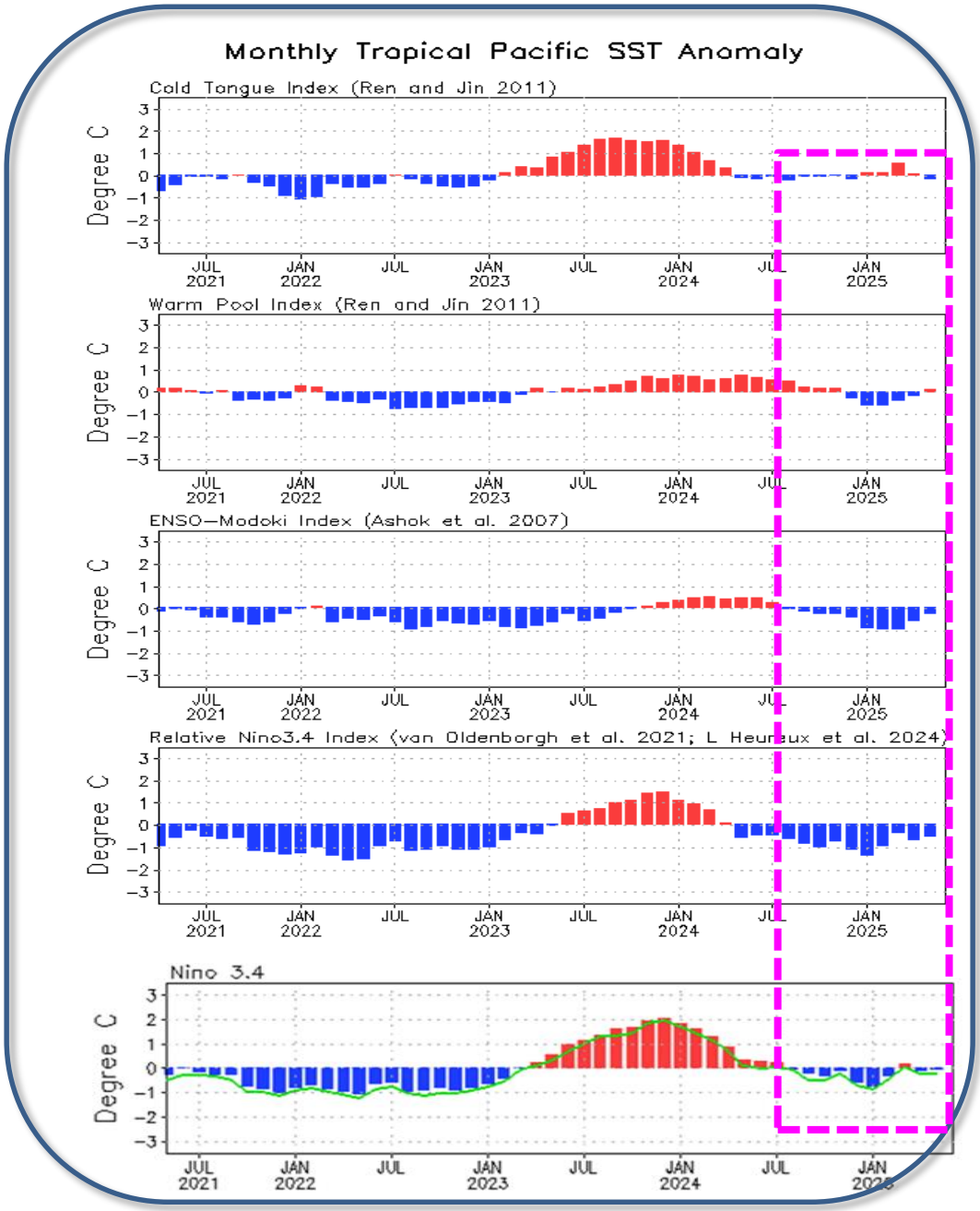
- In May 2025, all Niño indices were small with Niño3.4 = 0.0°C (-0.2°C in ERSSTv5).

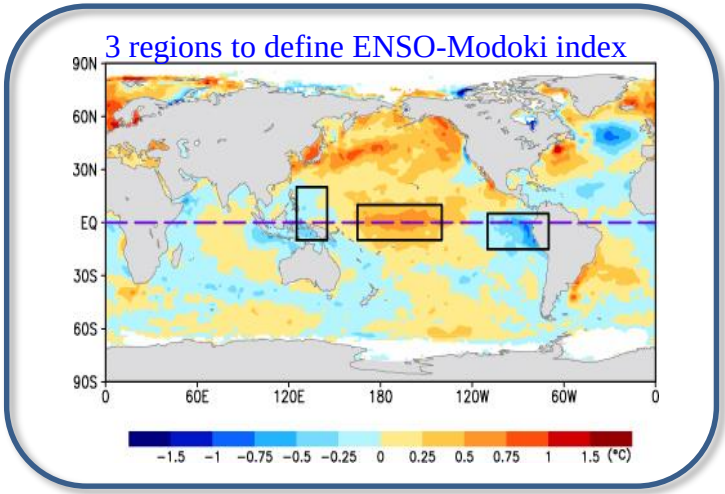
- Compared with May 2024, the tropical eastern (central) Pacific was warmer (cooler) in May 2025.

- The values of the indices may have differences if based on different SST products.

Niño region indices, calculated as the area-averaged monthly mean SSTA (°C) for the specified region. Data are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

- The cooling center is in the central equatorial Pacific, meaning a CP-like La Niña conditions
- rNiño3.4 has been cooler than Niño3.4 since May 2024



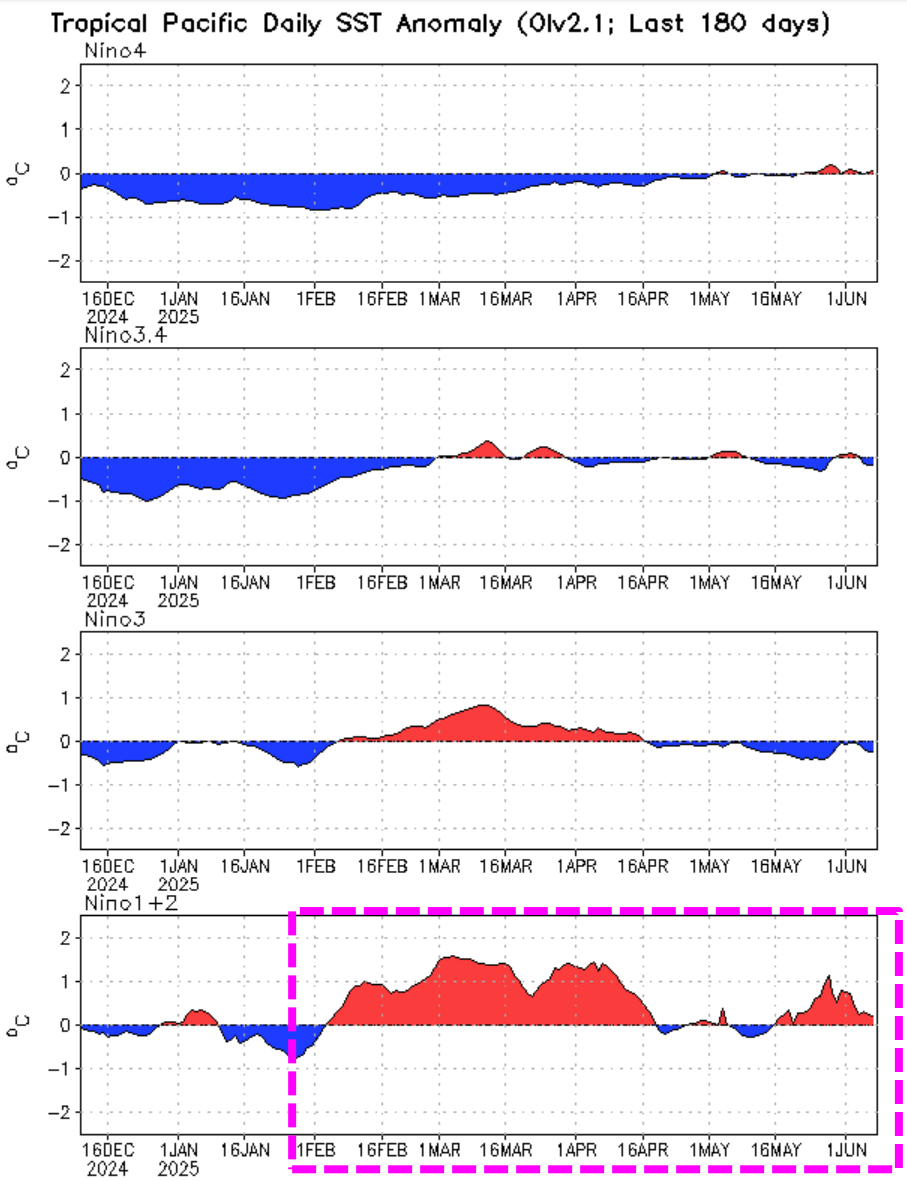


- Relative Niño3.4 index is now included in ENSO monitoring, which is defined as the conventional Niño3.4 index minus the SSTA averaged in the whole tropics (0°-360°, 20°S-20°N), in order to remove the global warming signal. Also, to have the same variability as the conventional Niño3.4 index, the relative Niño3.4 index is renormalized (Izumo et al. 2020: GRL, 10.1029/2019GL086182; van Oldenborgh et al. 2021: ERL, 10.1088/1748-9326/abe9ed; L'Heureux, et al. 2024: J. Climate, 10.1175/JCLI-D-23-0406.1).

Relative Niño3.4 data updated monthly at:

https://www.cpc.ncep.noaa.gov/data/indices/RONI.ascii.txt

Daily El Niño SST Indices: coastal warming up again since mid-May 2025



Three mechanisms for a coastal El Niño occurrence (Hu et al. 2019; Clim. Dyn. DOI: 10.1007/s00382-018-4290-4):

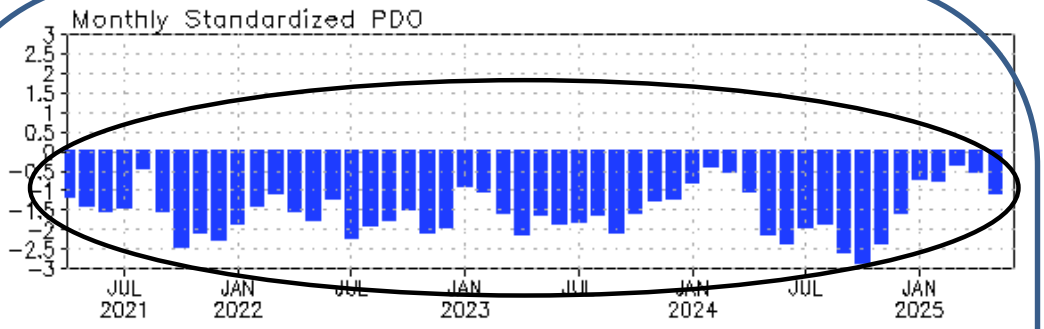
- Southward shift of ITCZ after an extreme basin-scale El Niño (1983, 1987, & 1998);

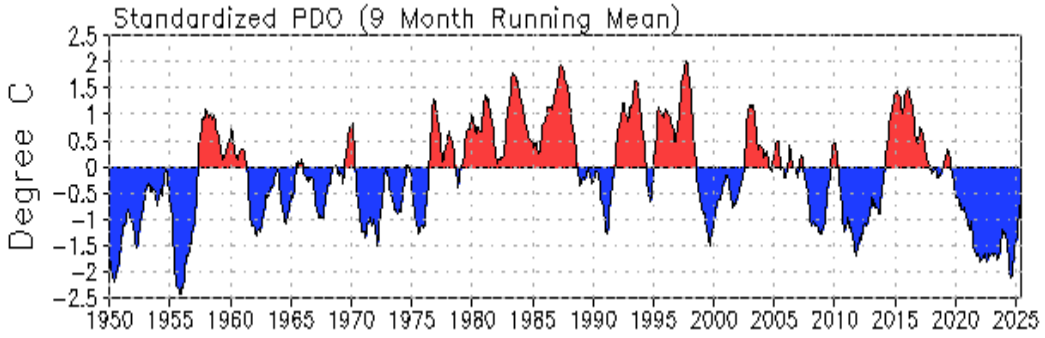
- Westerly wind burst, downwelling Kelvin waves, similar to basin-scale El Niño (2014; 2015);

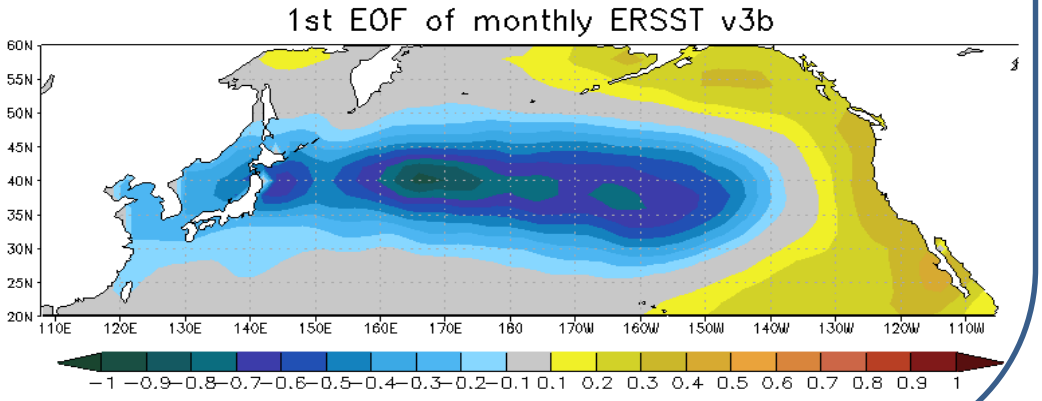
- Westerly wind anomalies and enhancement of the seasonal cycle extend the warm phase of the seasonal cycle (2008 & 2017).

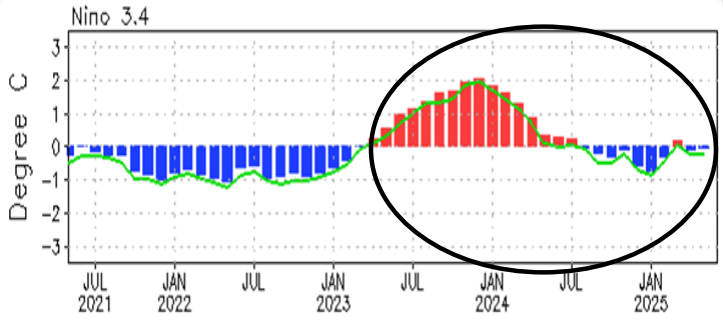
North Pacific, Arctic, & Antarctic Oceans

Pacific Decadal Oscillation (PDO) Index





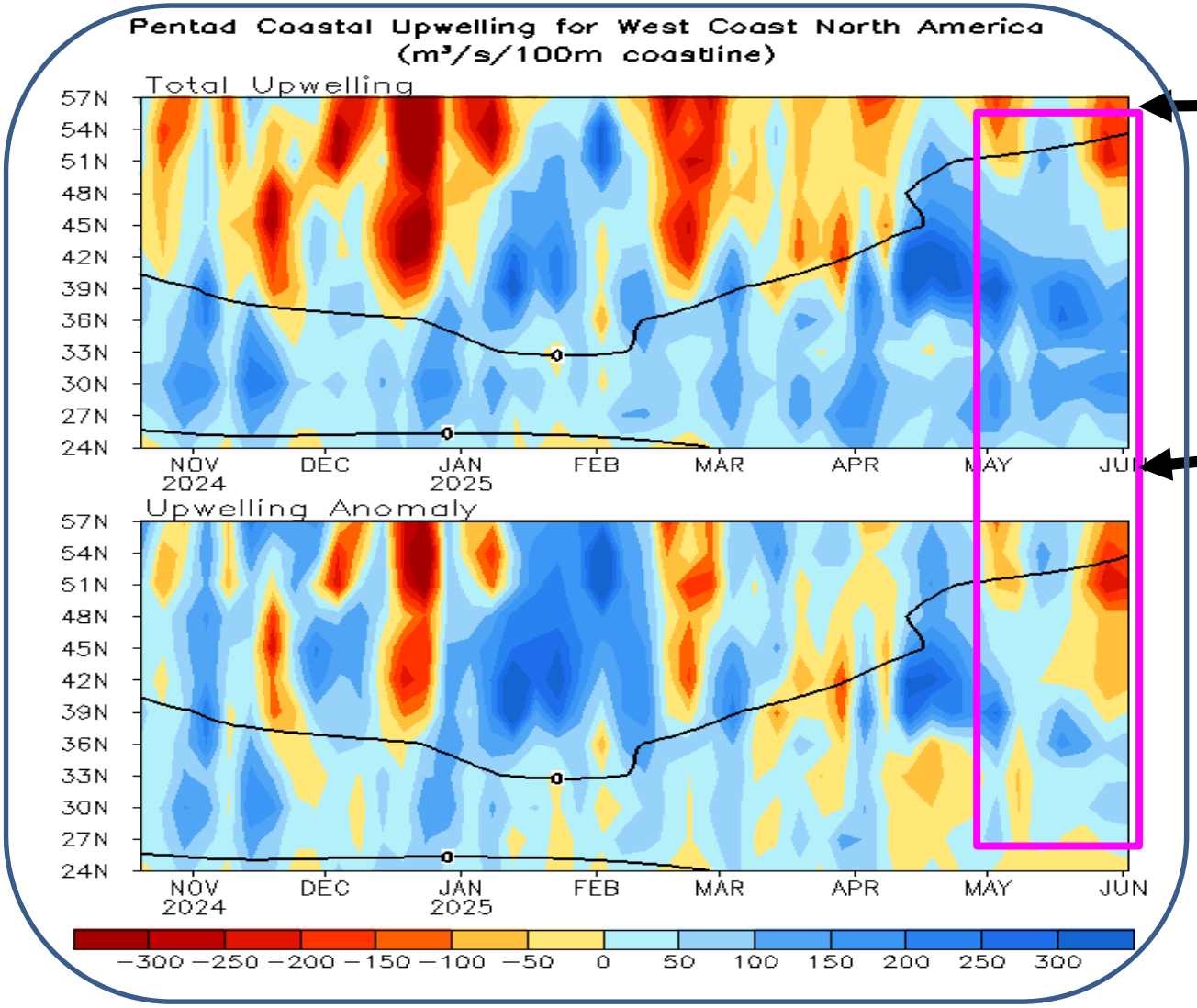


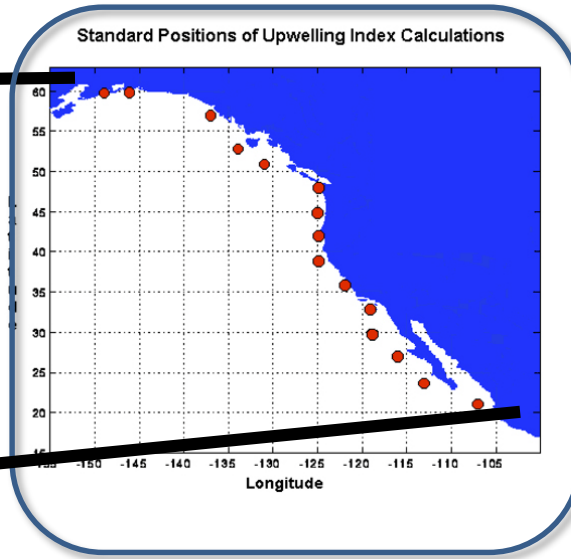


- The PDO has been in a negative phase since Mar 2020 and strengthened in May 2025 with PDOI = -1.1.
- Simultaneous correlation of PDO & Niño3.4 indices is 0.43 in 1961-1990 and 0.50 in 1991-2020.
- Statistically, ENSO leads PDO by 3-4 months, through teleconnection via atmospheric bridge, with El Niño (La Niña) associated with positive (negative) PDO Index.

• PDO is defined as the 1st EOF of monthly ERSST v3b in the North Pacific for the period 1900-1993. PDO index is the standardized projection of the monthly SST anomalies onto the 1st EOF pattern.

North America Western Coastal Upwelling

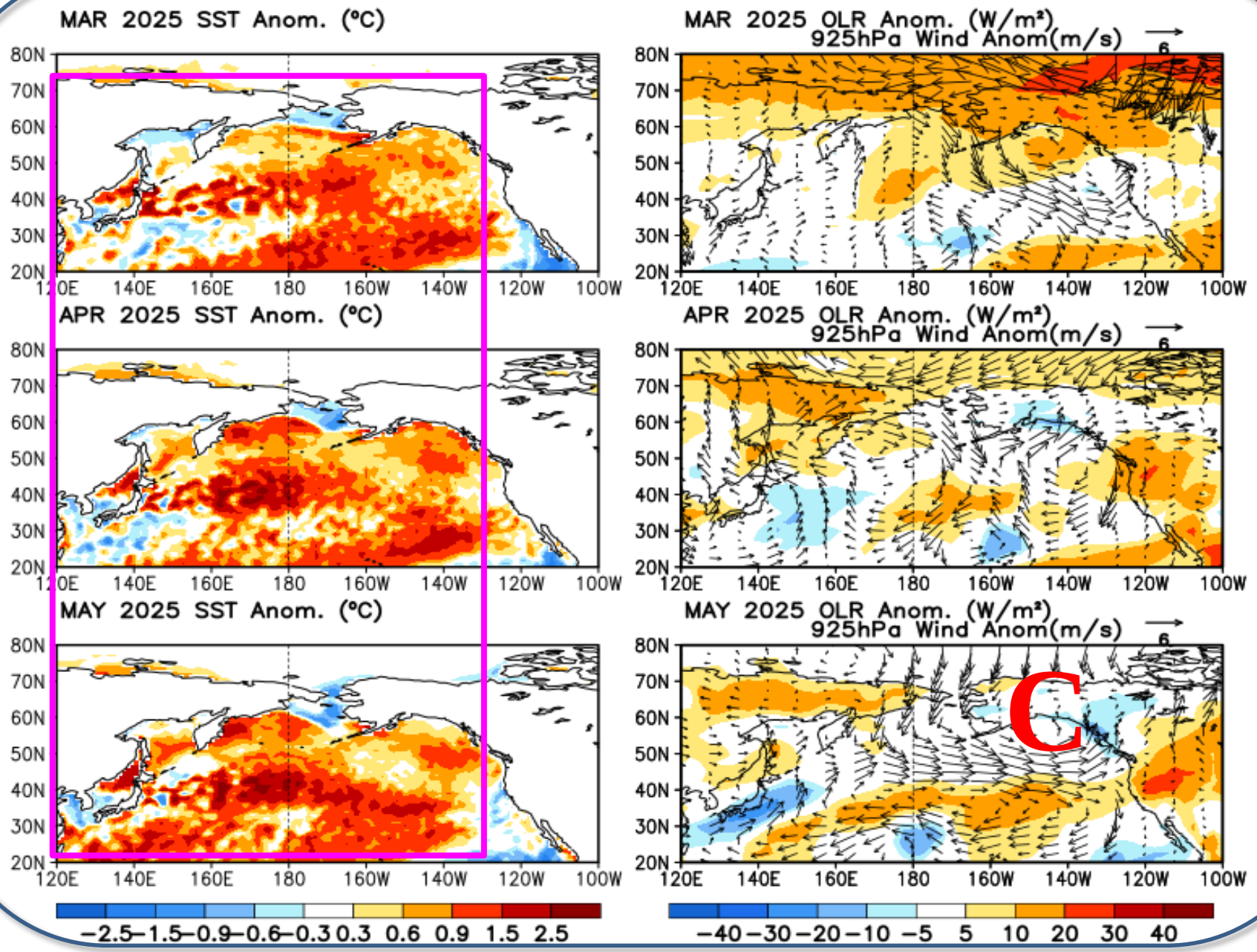




- Anomalous upwelling and downwelling activity was observed in May 2025.

(top) Total and (bottom) anomalous upwelling indices at the 15 standard locations for the western coast of North America. Derived from the vertical velocity of the NCEP's GODAS and are calculated as integrated vertical volume transport at 50-meter depth from each location to its nearest coast point ($m^3/s/100m$ coastline). Anomalies are departures from the 1991-2020 base period pentad means.
- Area below (above) black line indicates climatological upwelling (downwelling) season.
- Climatologically upwelling season progresses from March to July along the west coast of North America from 36ºN to 57ºN.

Last 3-month North Pacific SST, OLR, and uv925 anomalies



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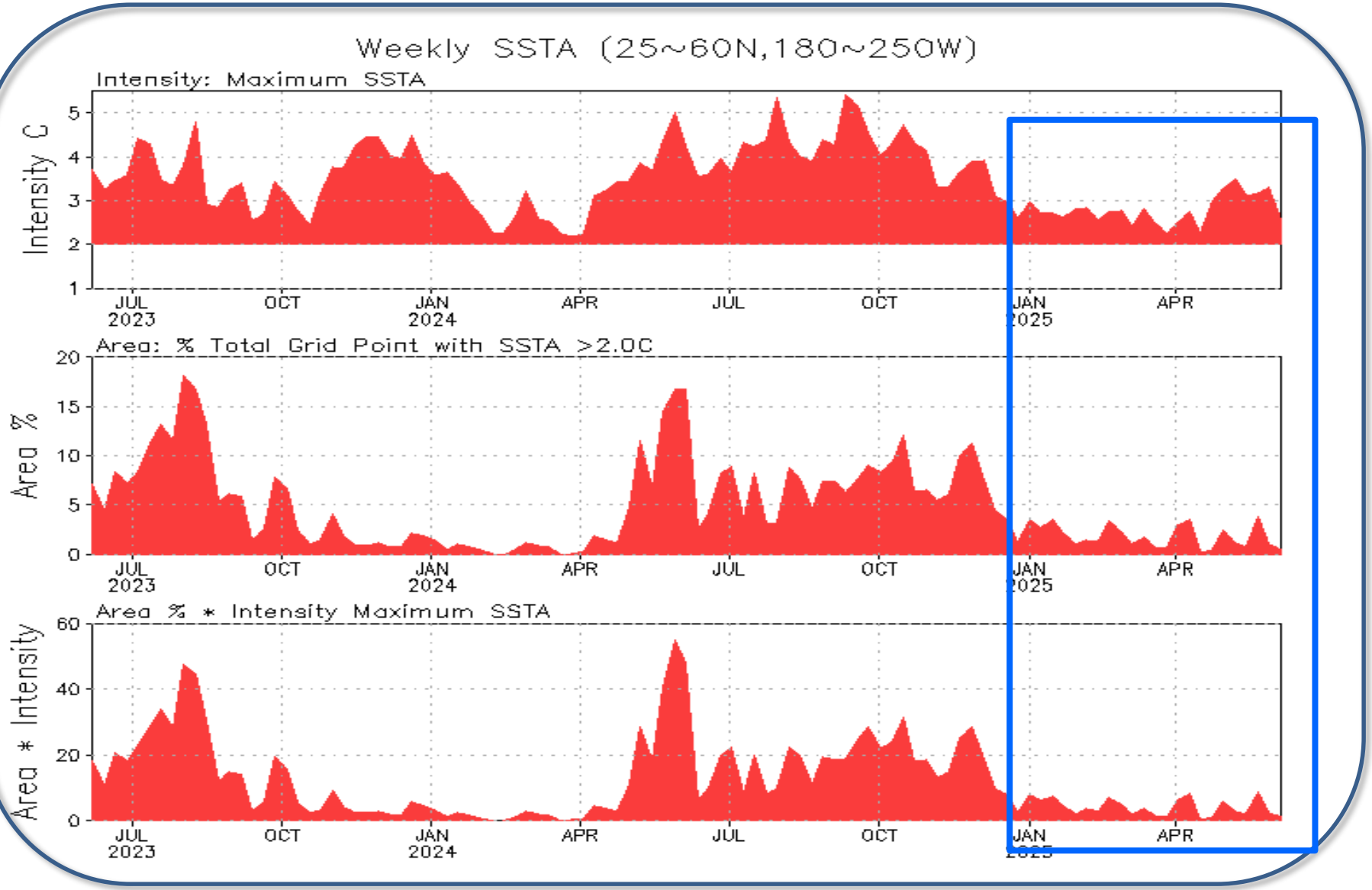
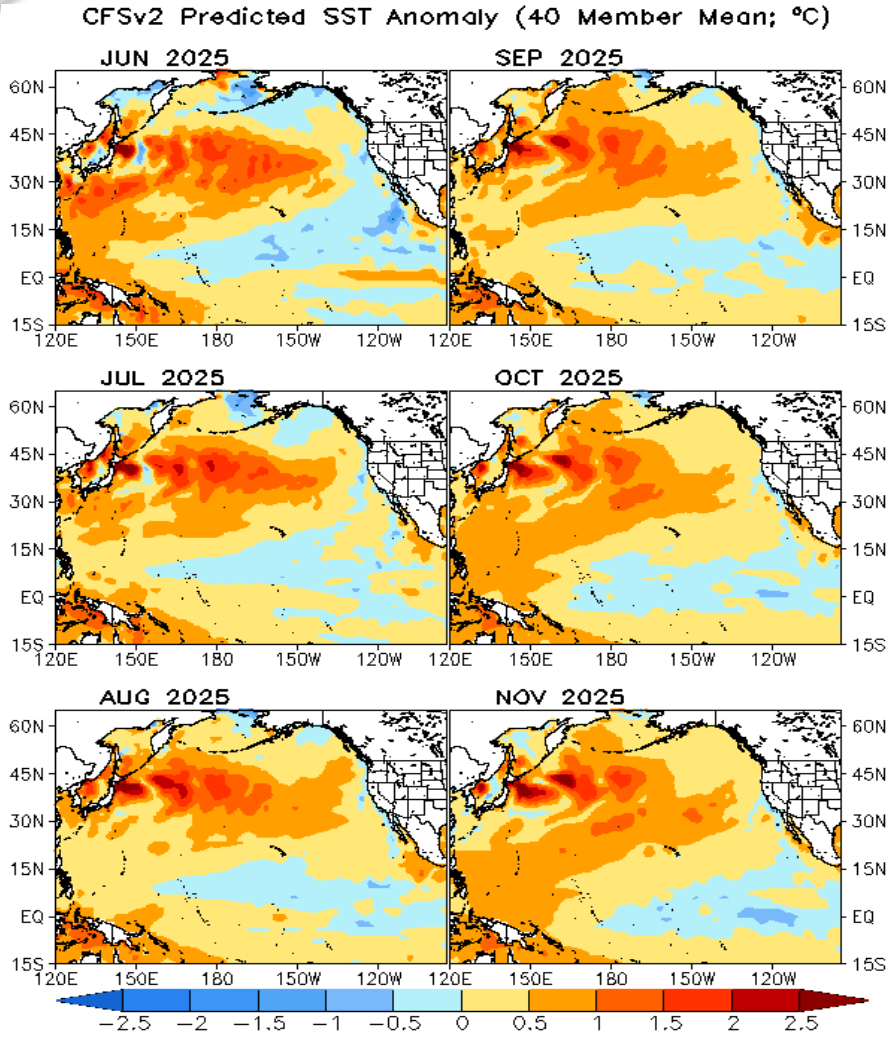
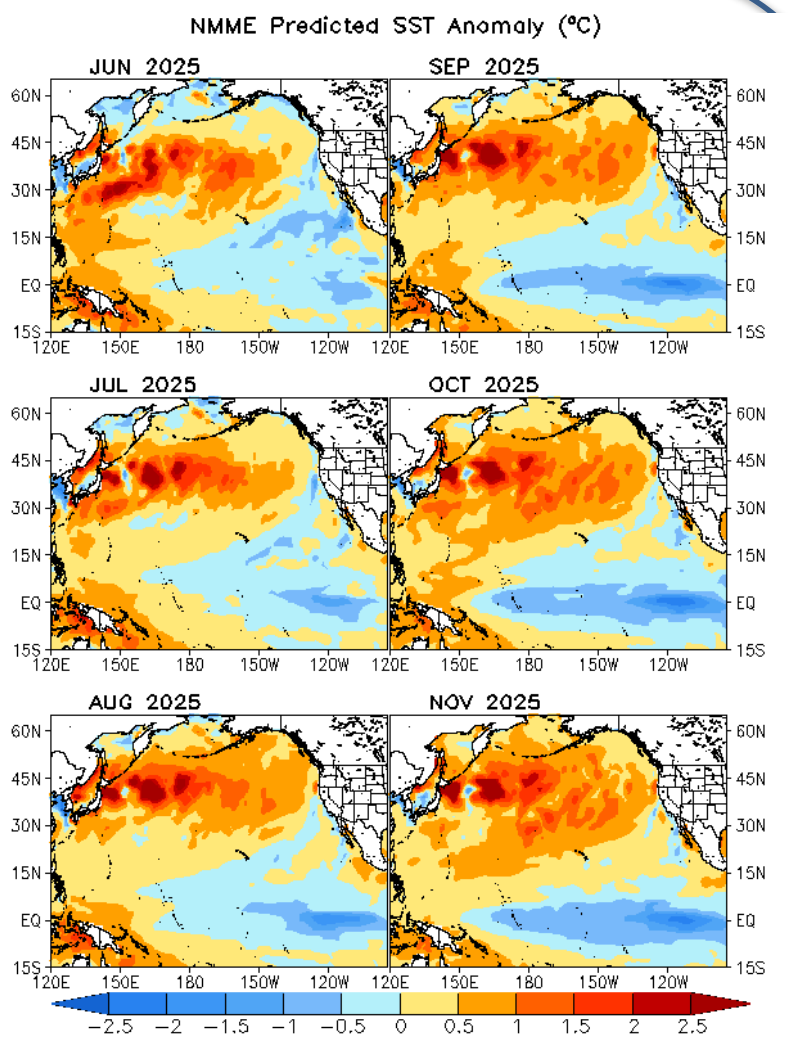
N. Pacific Marine Heat Wave: Weakened since Jan 2025



https://origin.cpc.ncep.noaa.gov/products/GODAS/MarineHeatWave.html

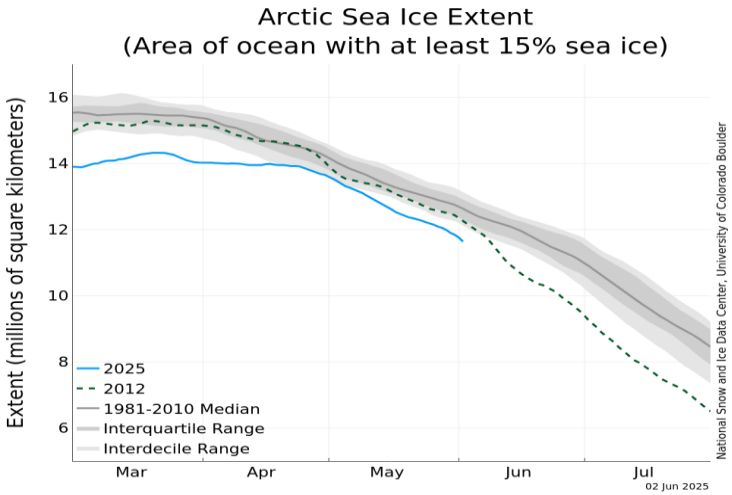
CFSv2 & NMME N. Pacific SST Anomaly Predictions

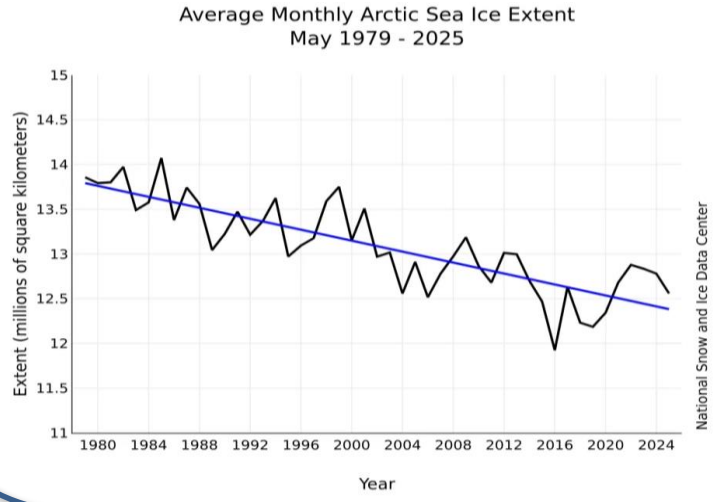


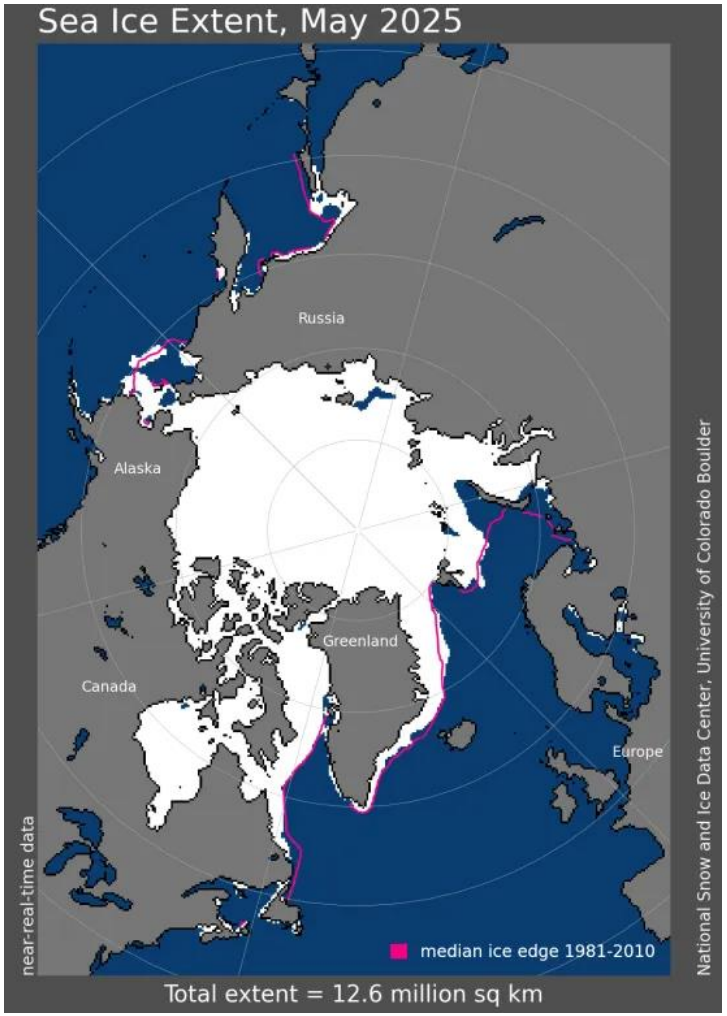


- CFSv2 & NMME predict that the current warm condition in the North Pacific will persist through fall 2025.

Arctic Sea Ice; NSIDC (https://nsidc.org/arcticseaicenews/)

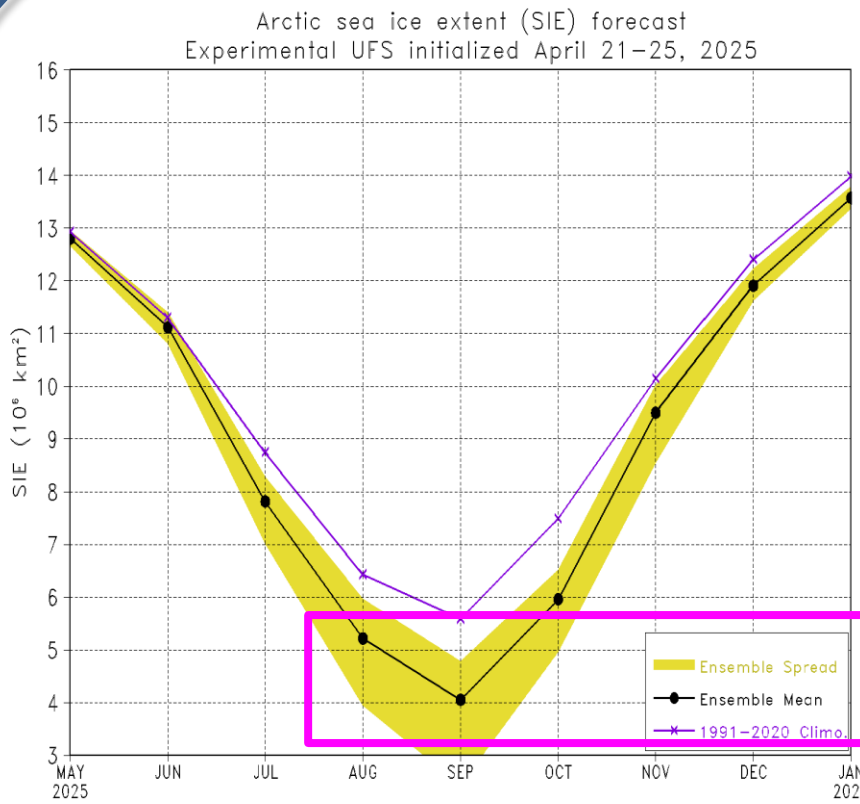


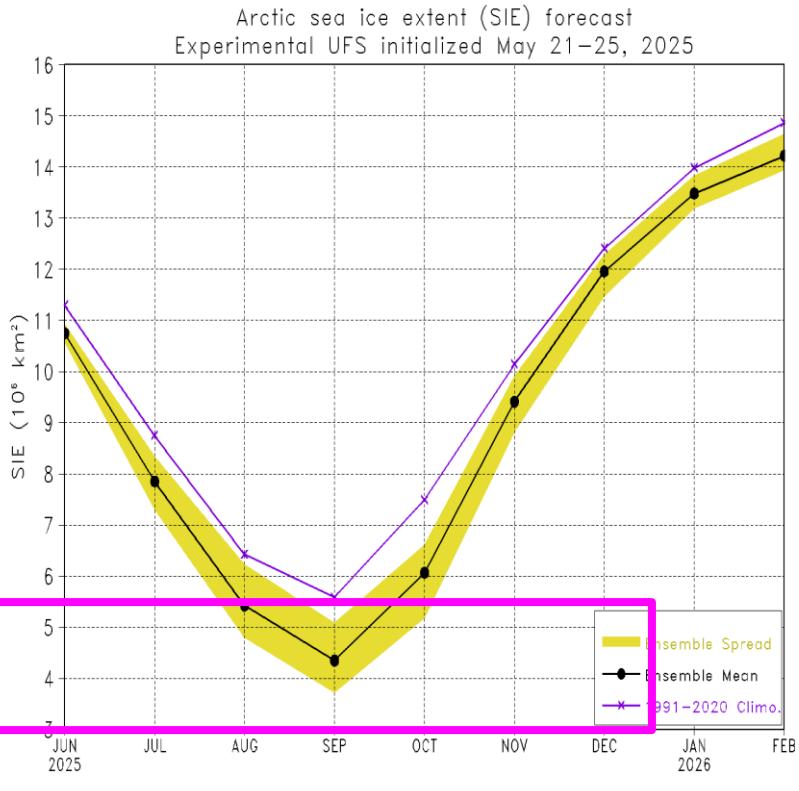




- Arctic sea ice extent was 12.6 million km^2 in May 2025, tying with 2004 for 7th lowest on the 47-year satellite record.
- The downward linear trend through 2025 for May is 2.3% per decade relative to the 1981-2010 average.
- Since 1979, May has lost 1.4 million km^2 of sea ice, roughly equivalent to twice the size of Texas.

NCEP/CPC Arctic Sea Ice Extent (SIE) Forecast

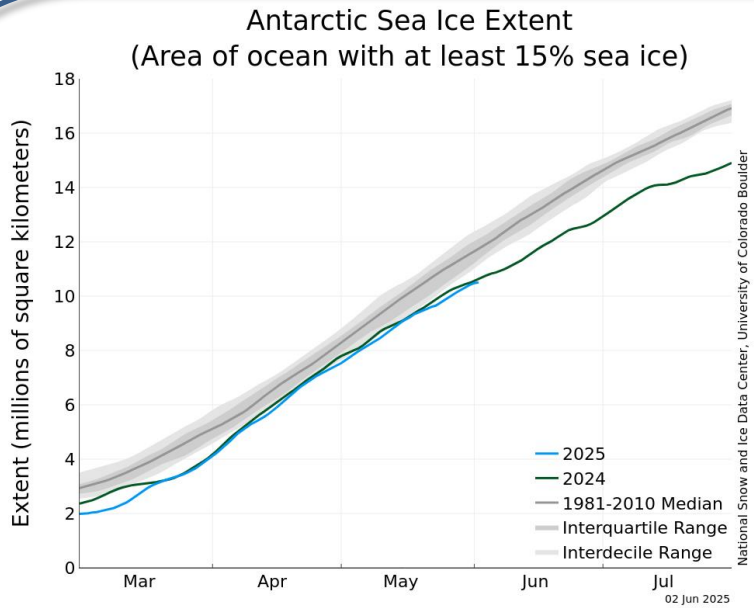


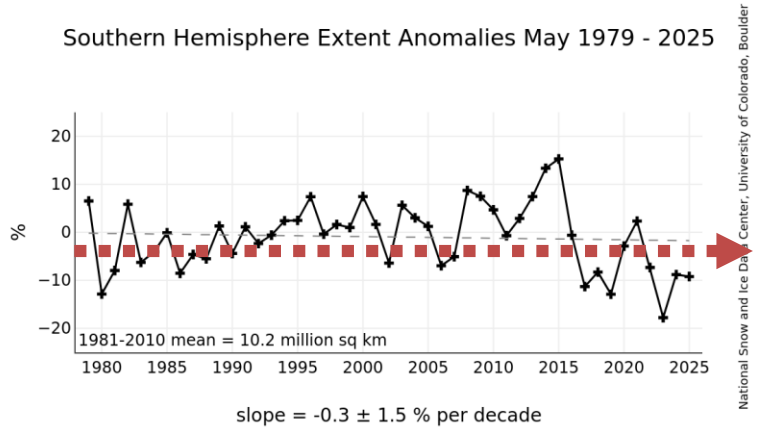


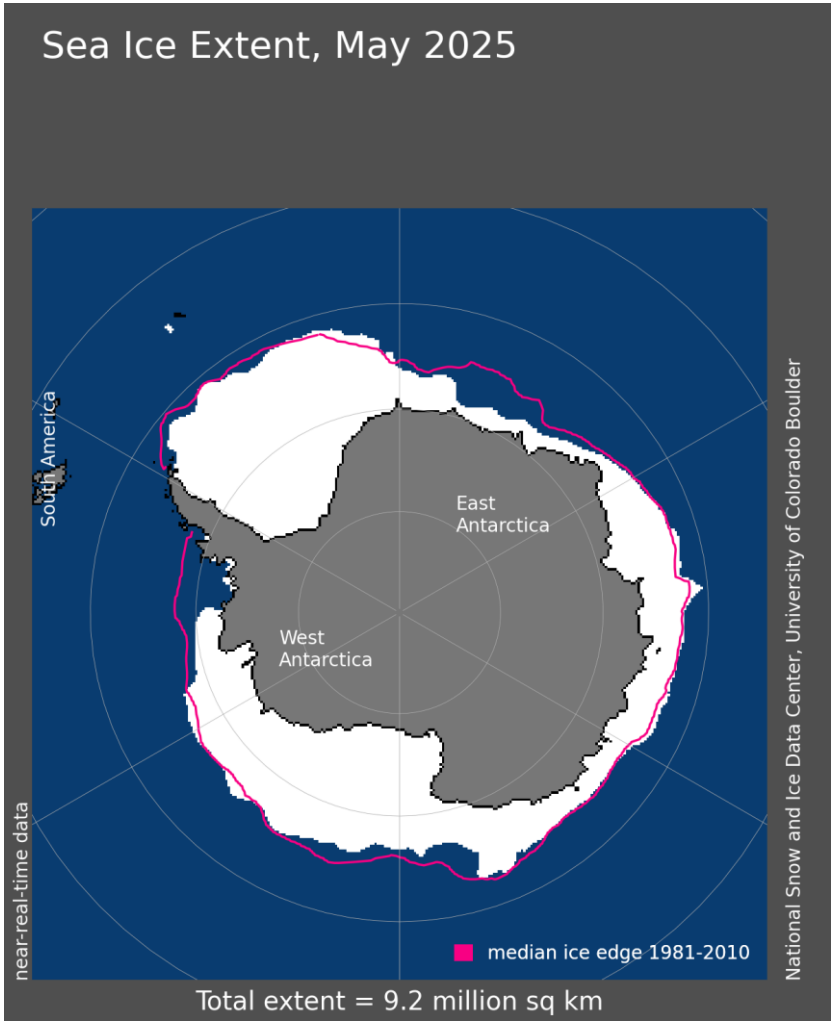
https://www.cpc.ncep.noaa.gov/products/people/jszhu/seaice_seasonal/index.html

- CPC model-based forecasts indicate a below-normal Arctic sea ice extent in Sep 2025 and through end of 2025.

Antarctic Sea Ice; NSIDC (https://nsidc.org/arcticseaicenews/)

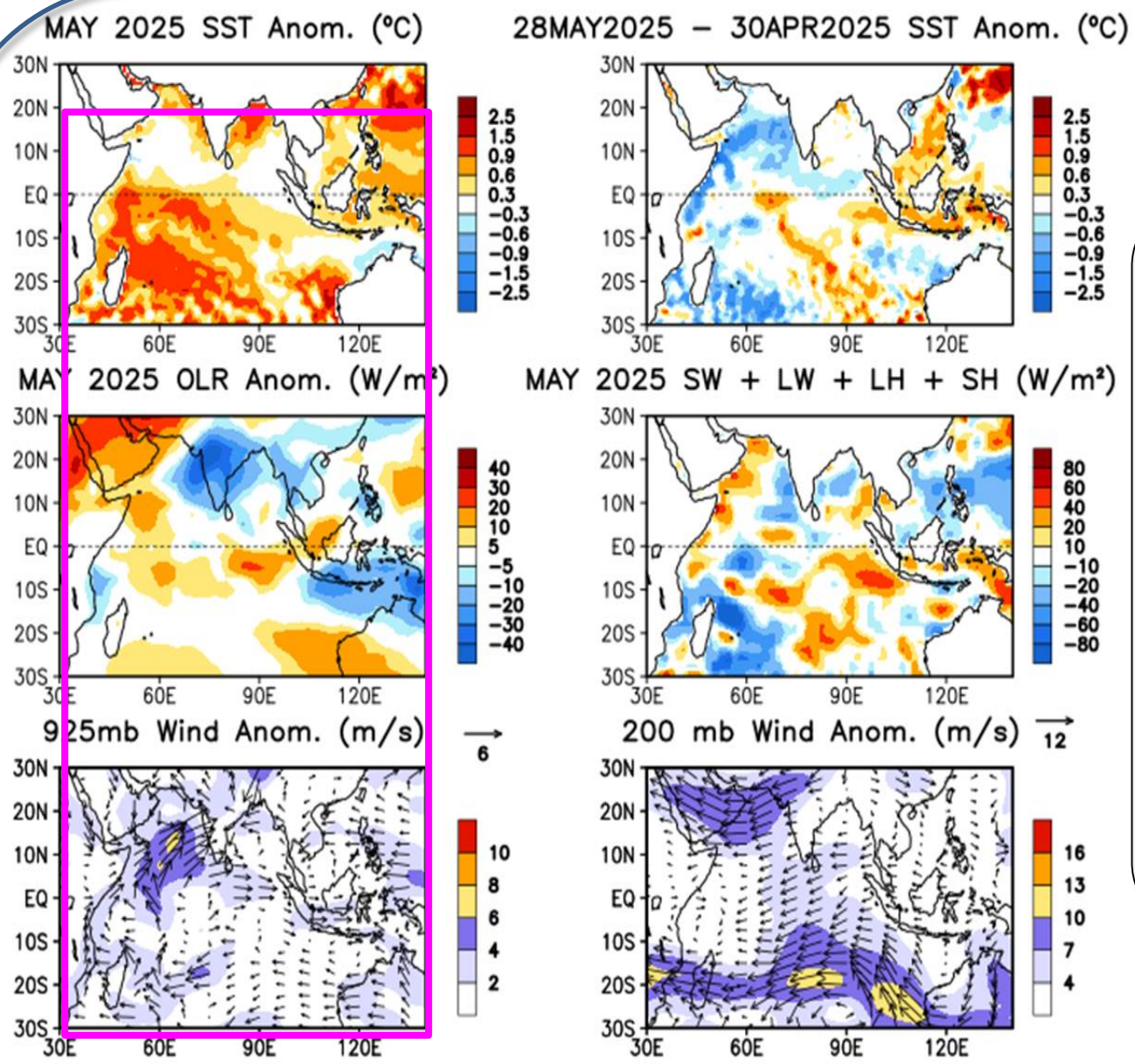






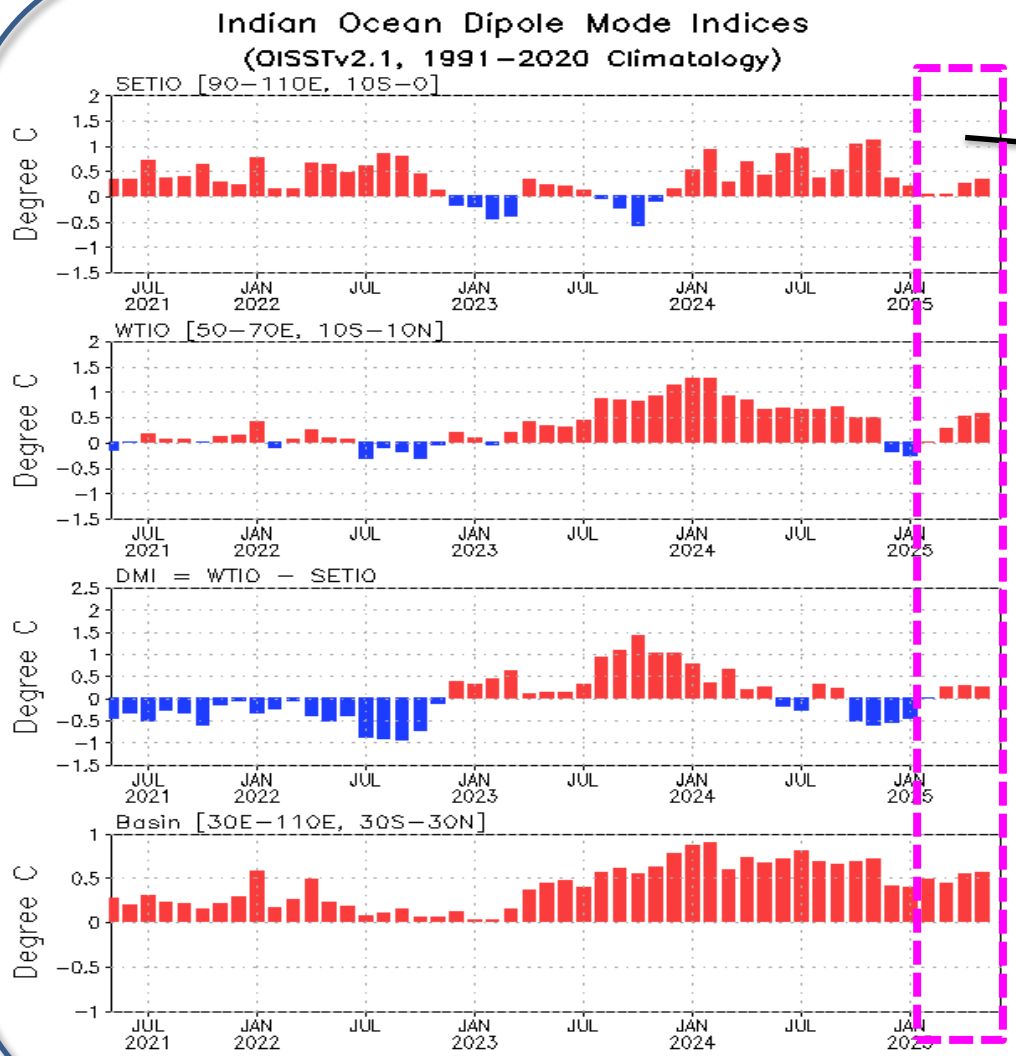
- Antarctic sea ice extent was 9.2 million km^2 in May 2025, close to the May 2024 extent.

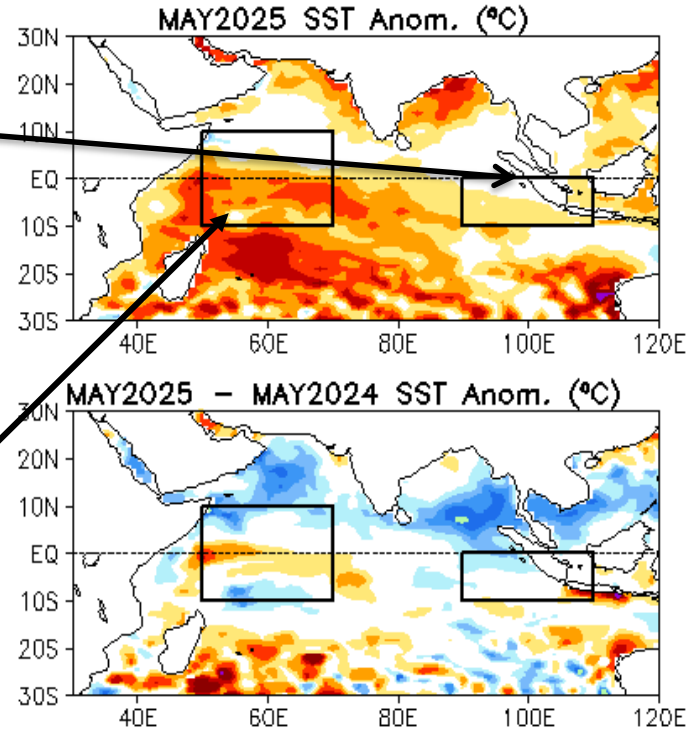
Indian Ocean



-SSTs were near average along the equatorial Indian Ocean in May 2025.
-The strong Somali jet is associated with the enhanced convection over the Indian Peninsula.

Evolution of Indian Ocean SST Indices



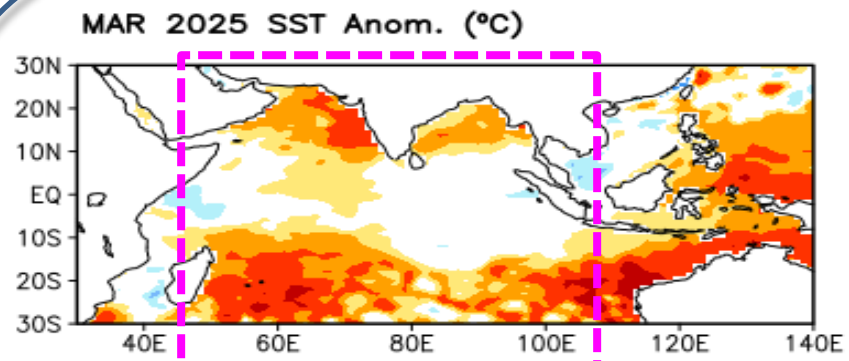


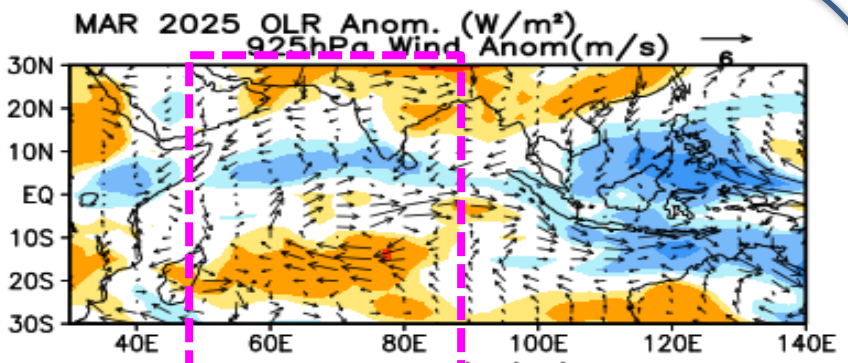
- All the indices were positive in May 2025.
- Basin-wide warming featured a positive phase of the IOBM.

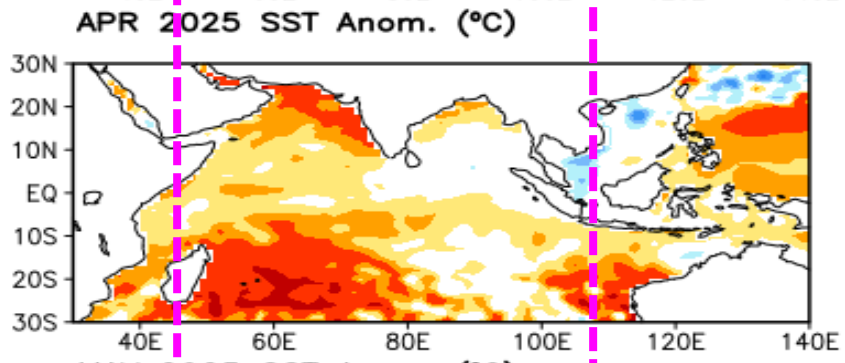
Indian Ocean region indices, calculated as the area-averaged monthly mean SSTA (OC) for the SETIO [90ºE-110ºE, 10ºS-0] and WTIO [50ºE-70ºE, 10ºS-10ºN] regions, and Dipole Mode Index, defined as differences between WTIO and SETIO. Data are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

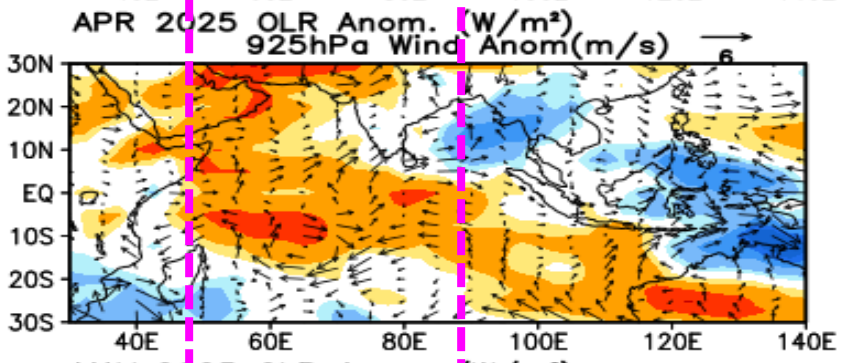
Last 3-month Tropical Indian Ocean SST, OLR, and uv925 Anomalies:

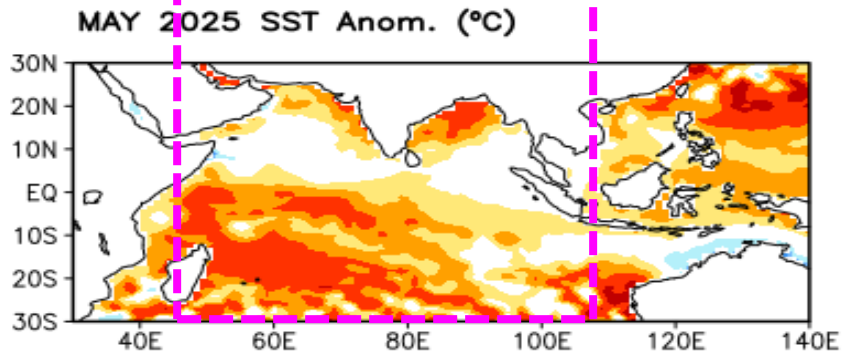
Above average SST, weak wind anomalies, & strong Somali jet in May 2025

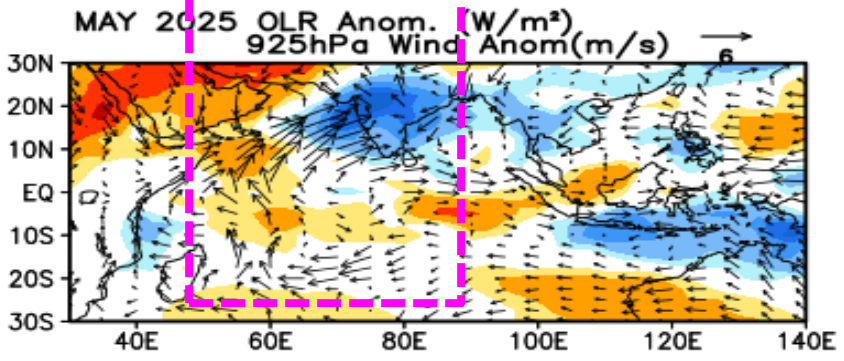


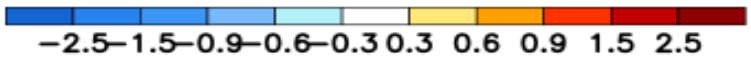


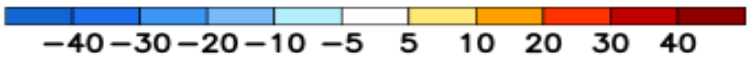






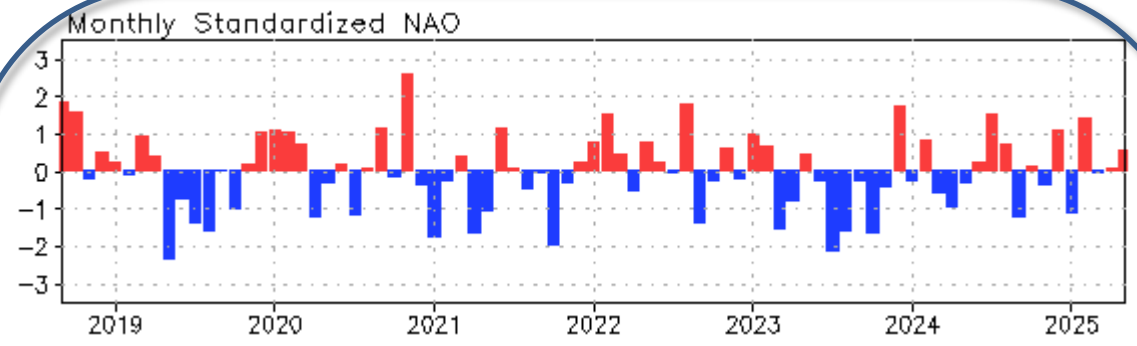


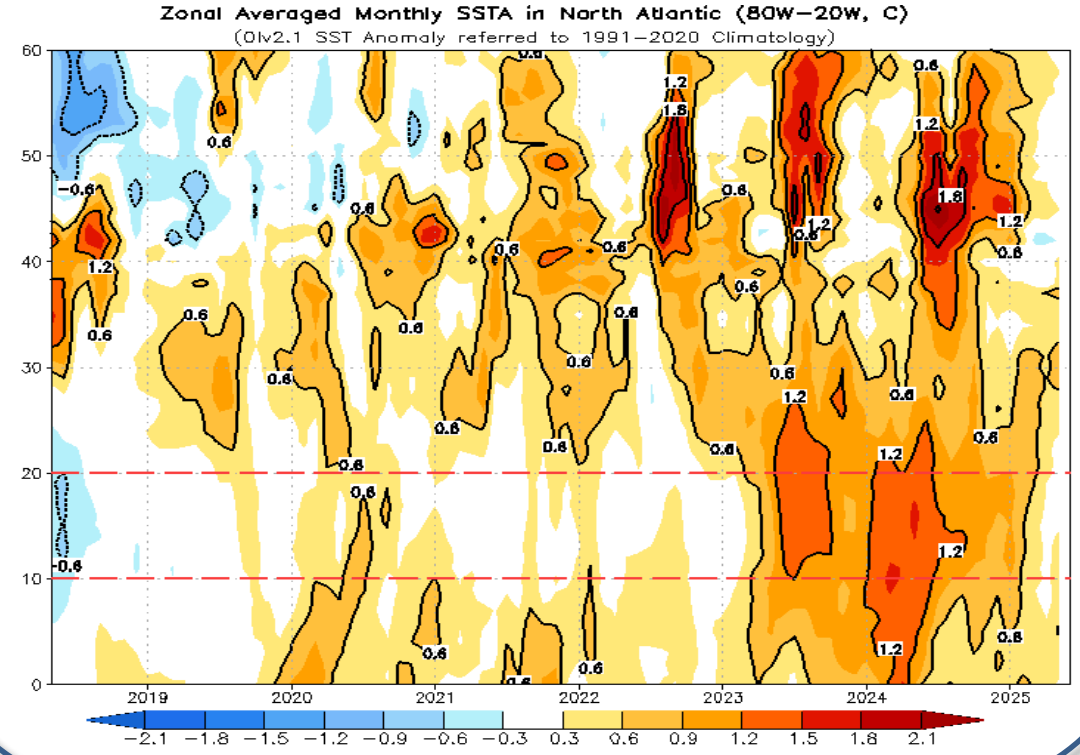


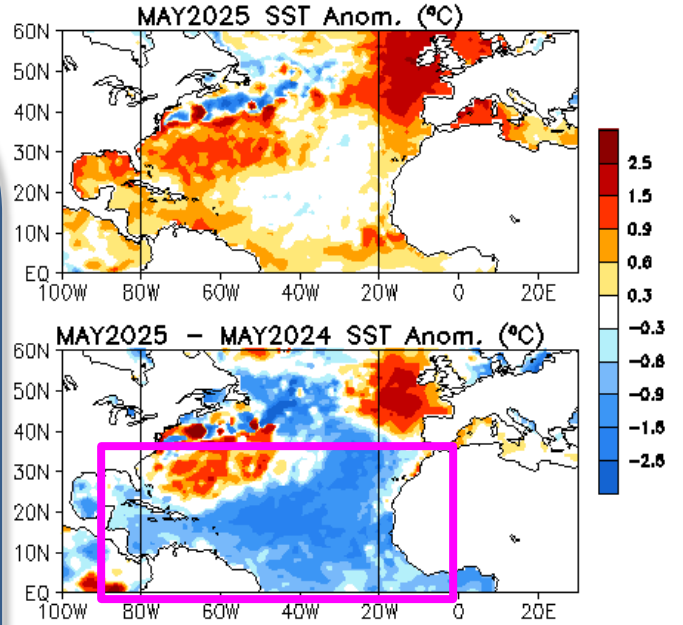


Tropical and North Atlantic Ocean

NAO and SST Anomaly in North Atlantic



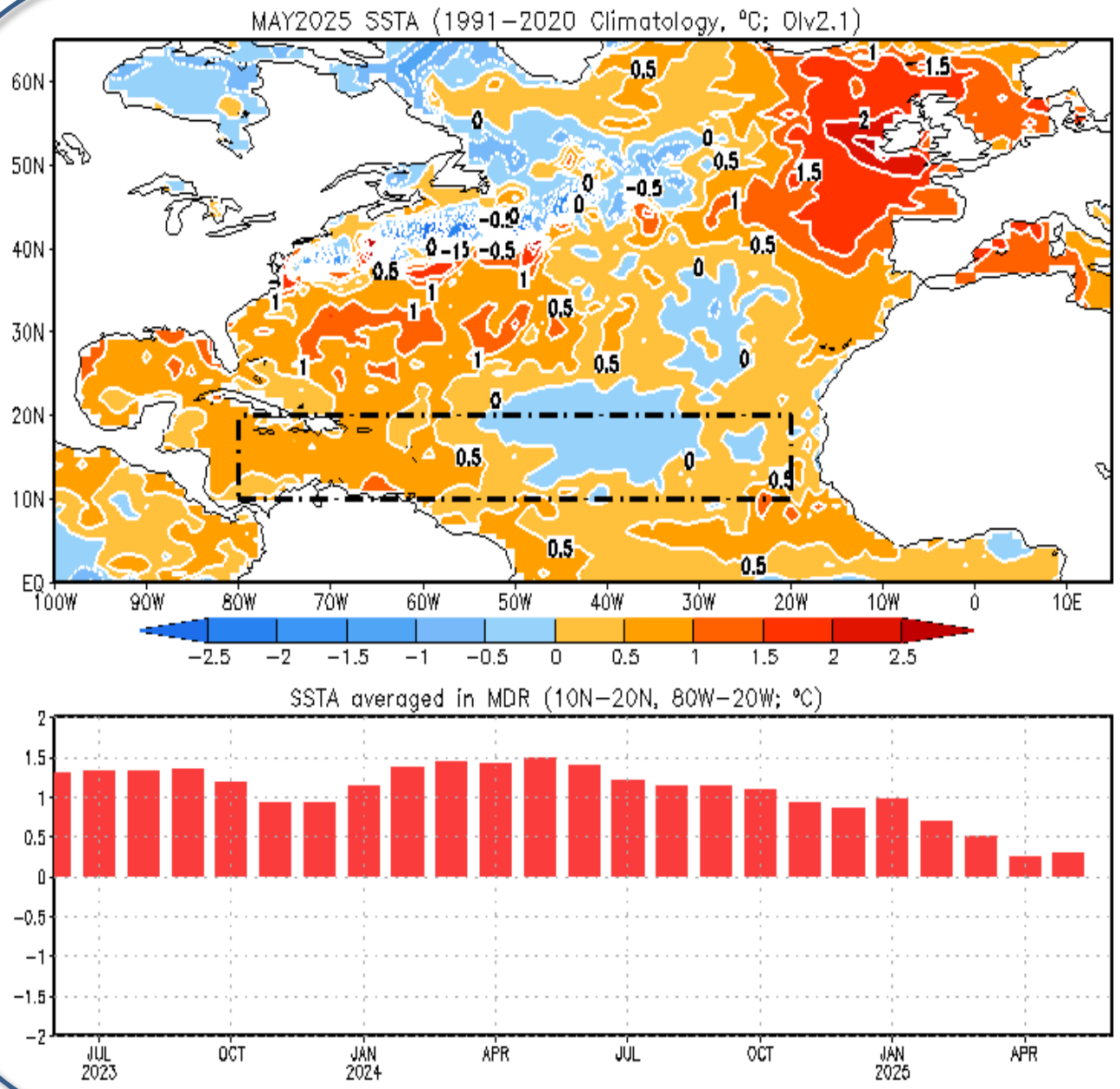




- NAOI =0.5 in May 2025.
- The tropical North Atlantic Ocean was much cooler in May 2025 than in May 2024.
- The prolonged positive SSTA in the middle and high latitudes were evident during the last 5-6 years.

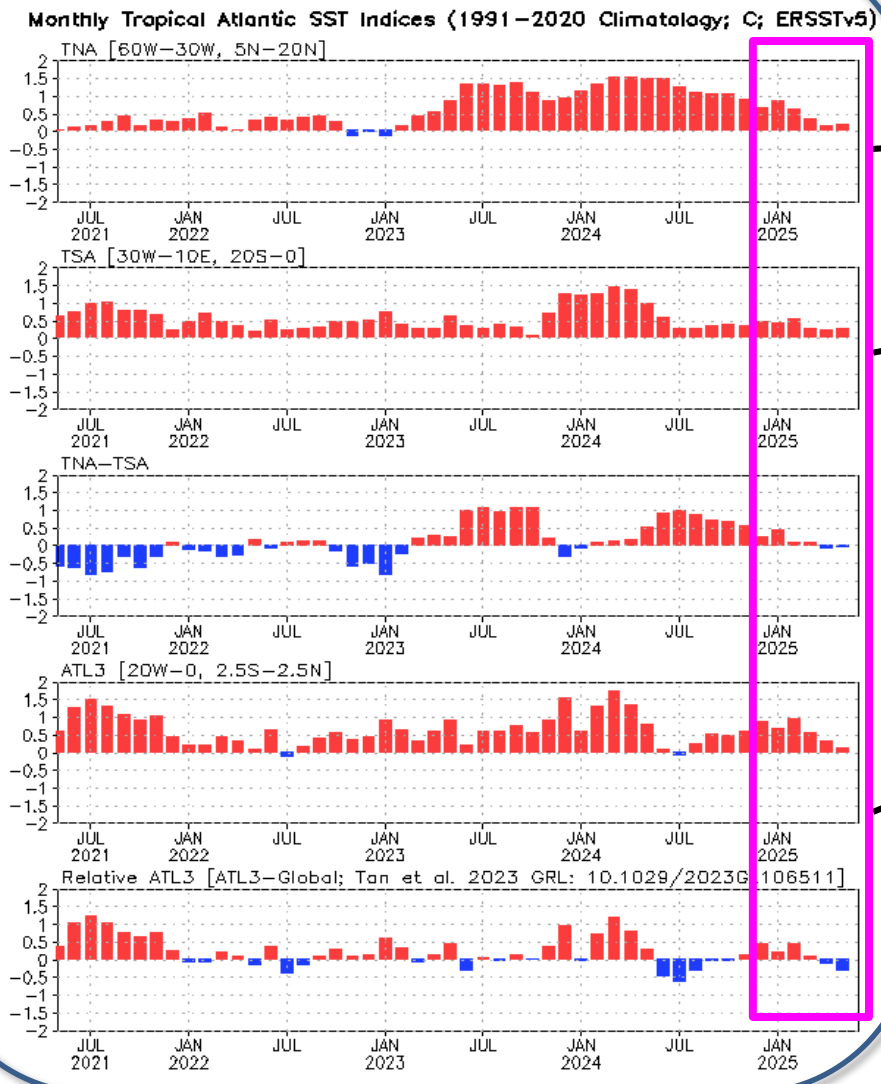
Monthly standardized NAO index (top) derived from monthly standardized 500-mb height anomalies obtained from the NCEP CDAS in 20^{O}N-90^{O}N. Time-latitude section of SSTA averaged between 80ºW and 20ºW (bottom). SST are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

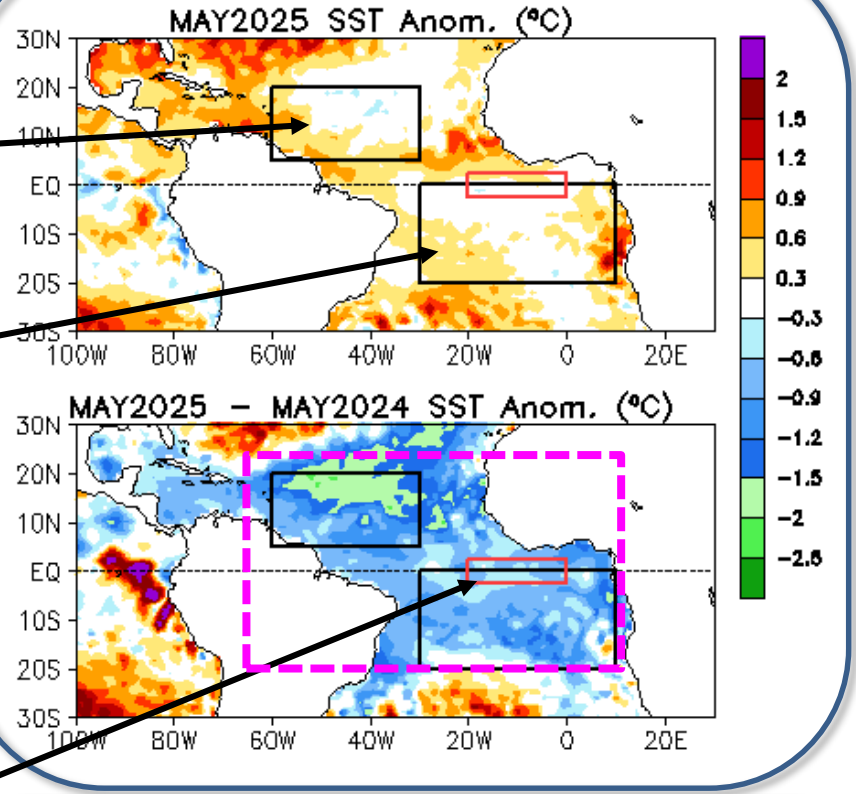
SSTA in the North Atlantic & MDR



- Above-average SSTs dominated in the tropical and North Atlantic in May 2025.
- Positive SSTAs persisted in the hurricane main development region (MDR) in may 2025.

Evolution of Tropical Atlantic SST Indices

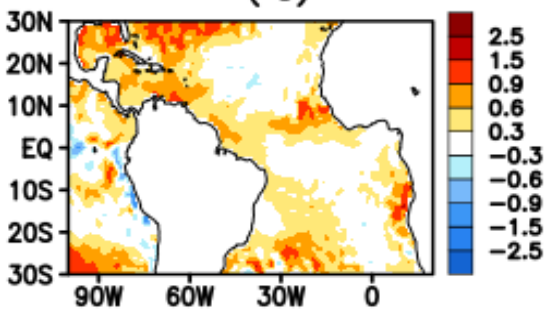


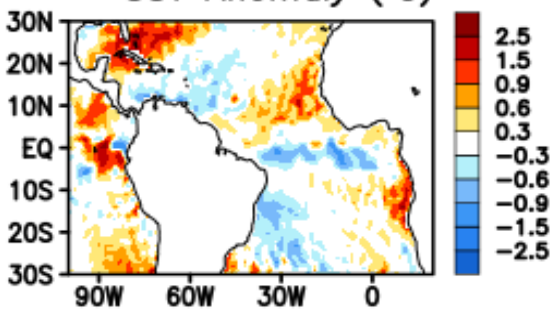


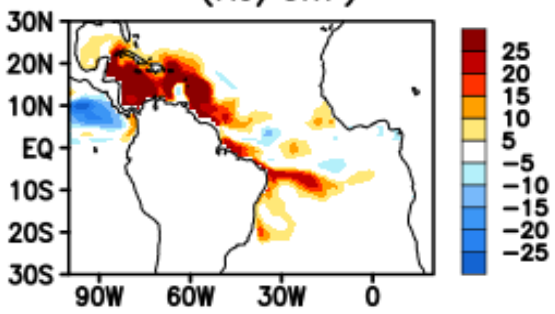
- SSTA was mostly positive in the tropical N. & S. Atlantic Ocean in May 2025.
- The relative ATL3 index (ATL3-Global; Tan et al. 2023, GRL DOI: 10.1029/2023GL106511) has been negative since Apr 2025 and strengthened in May 2025.
- The tropical Atlantic Ocean was much cooler in May 2025 than in May 2024.

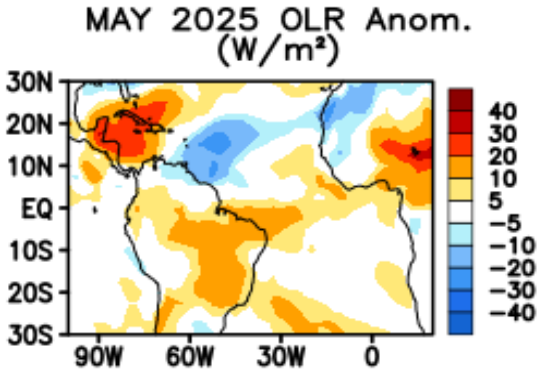
Tropical Atlantic Variability region indices, calculated as the area-averaged monthly mean SSTA (^{O}C) for the TNA [60^{O}W-30^{O}W, 5ºN-20^{O}N], TSA [30^{O}W-10^{O}E, 20^{O}S-0] and ATL3 [20^{O}W-0, 2.5^{O}S-2.5^{O}N] regions, and Meridional Gradient Index, defined as differences between TNA and TSA. Data are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

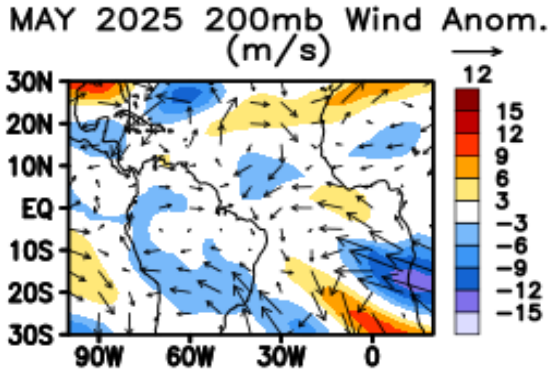
Tropical Atlantic: SST, SST tend., TCHP, OLR, 200 hPa wind, wind share, heat flex, & RH anom.

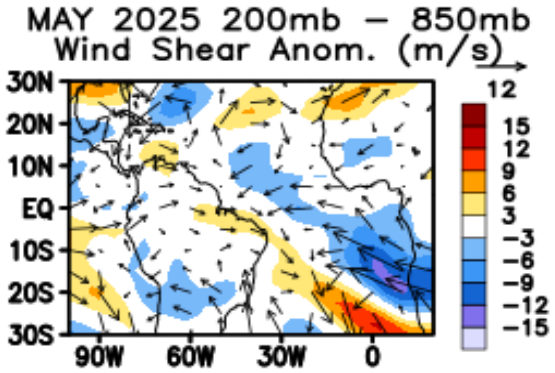


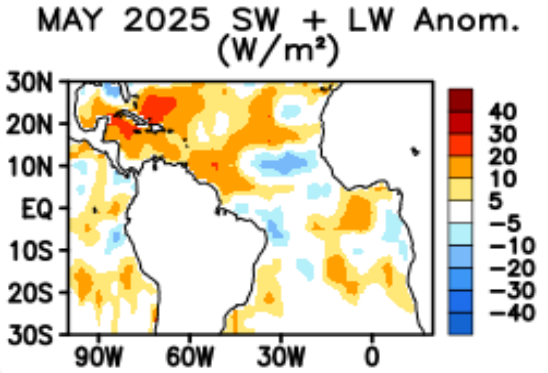


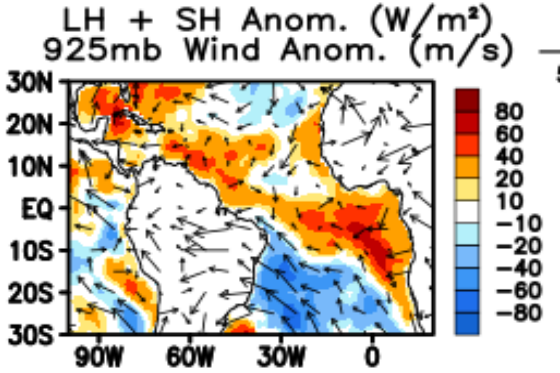


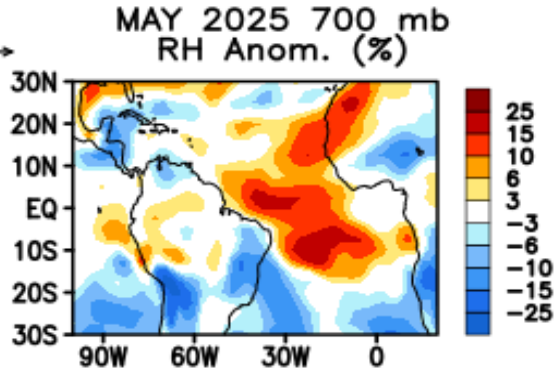




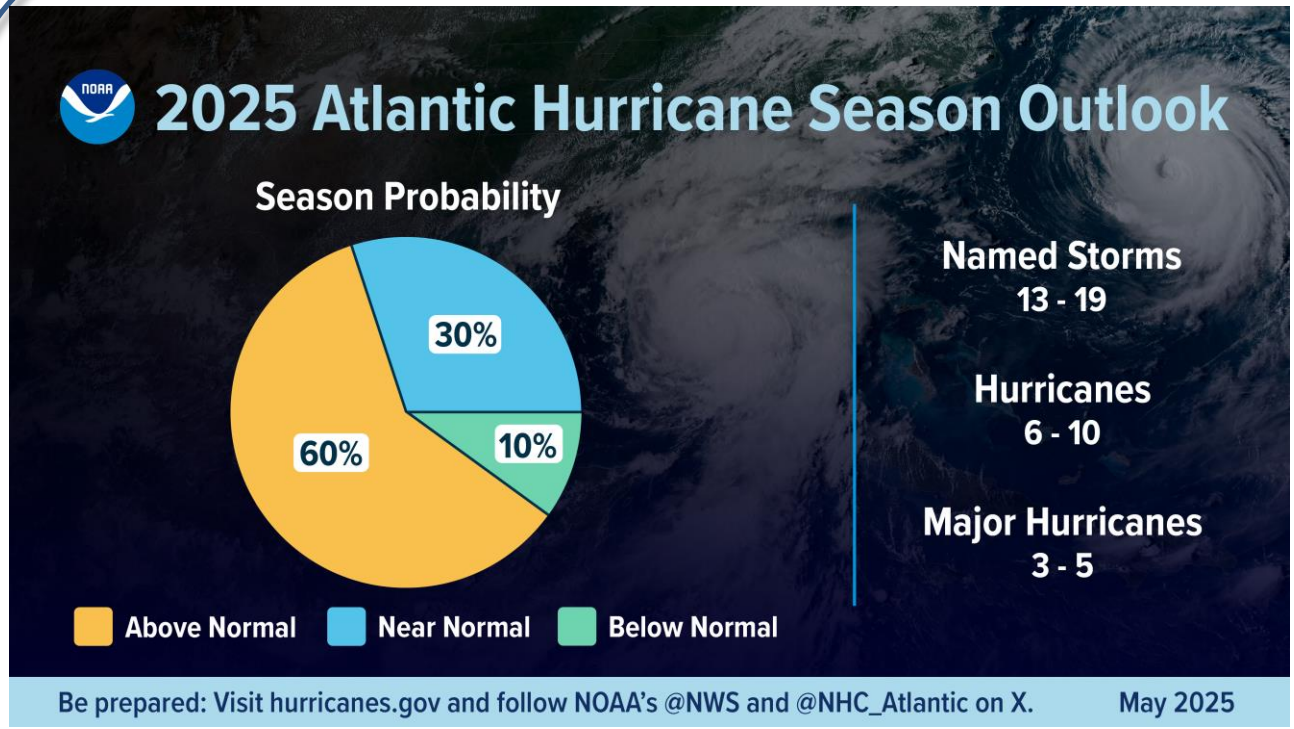








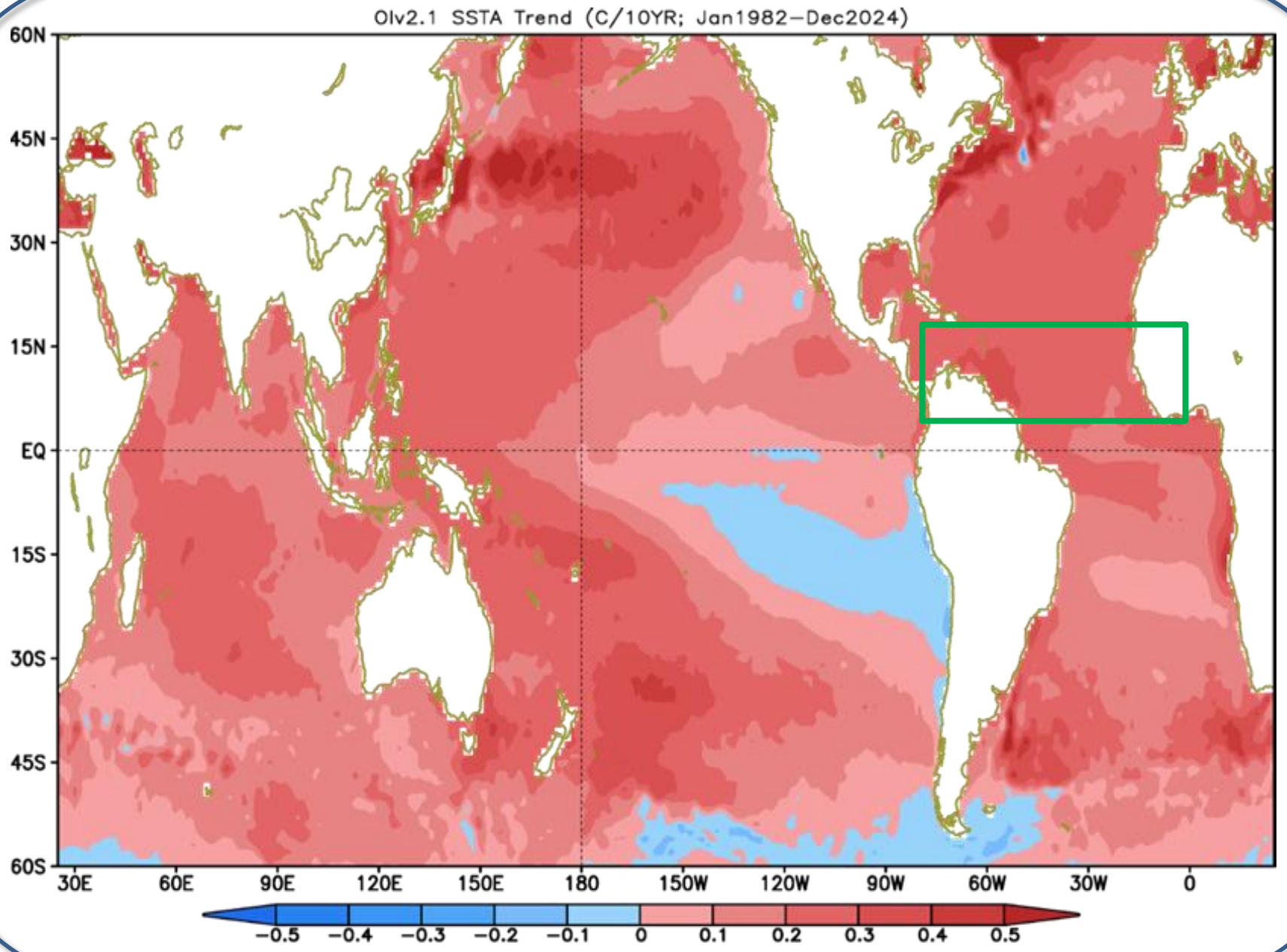
2025 Atlantic Hurricane Season Outlook



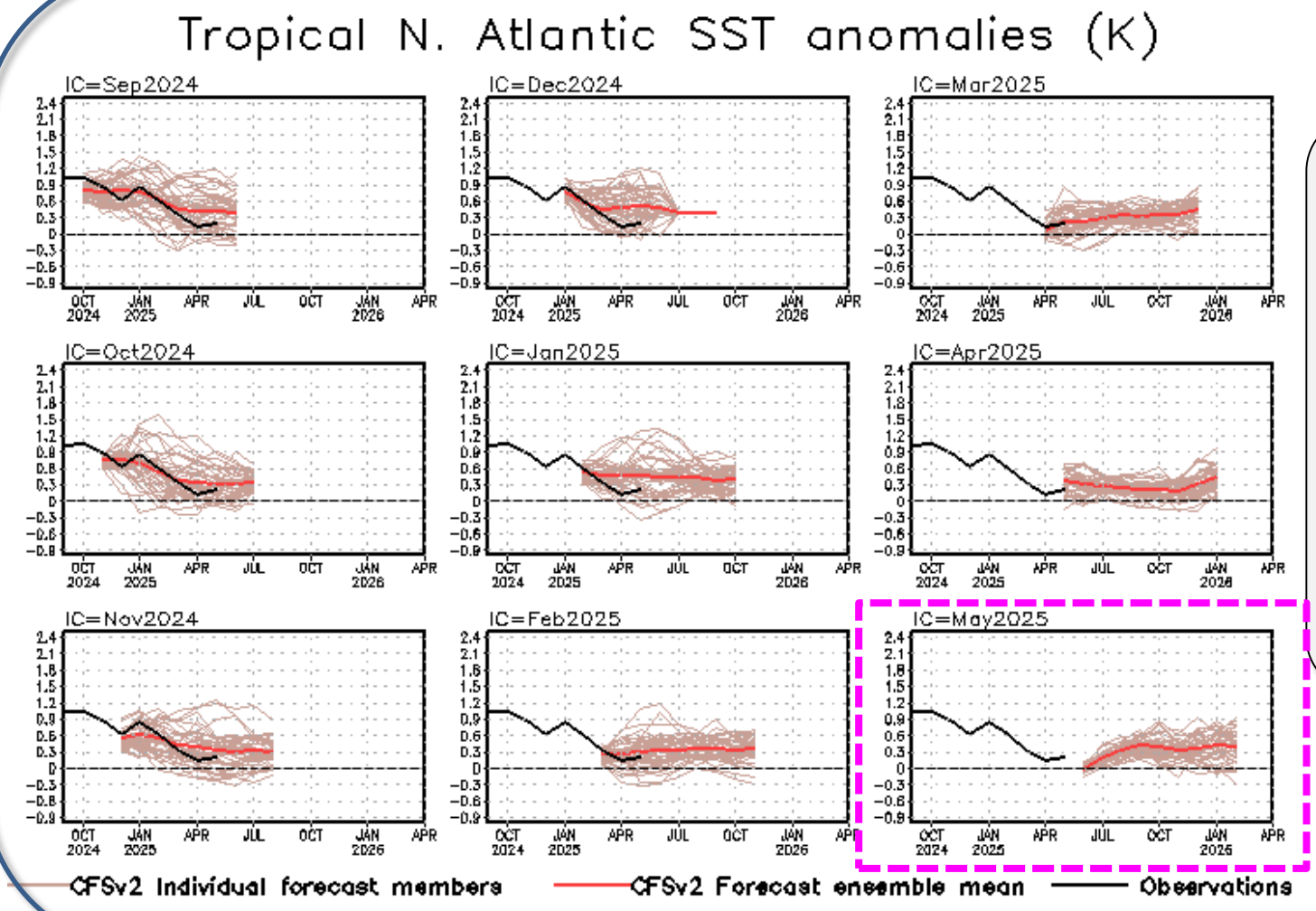
- May 22, 2025: "…an above-normal season is most likely, with a moderate probability that the season could be near-normal and lower odds for a below-normal season."

"… – due to a confluence of factors, including continued ENSO-neutral conditions, warmer than average ocean temperatures, forecasts for weak wind shear, and the potential for higher activity from the West African Monsoon, …. All of these elements tend to favor tropical storm formation …."
(https://www.noaa.gov/news-release/noaa-predicts-above-normal-2025-atlantic-hurricane-season)

SST warming trends are favorable for hurricane activity



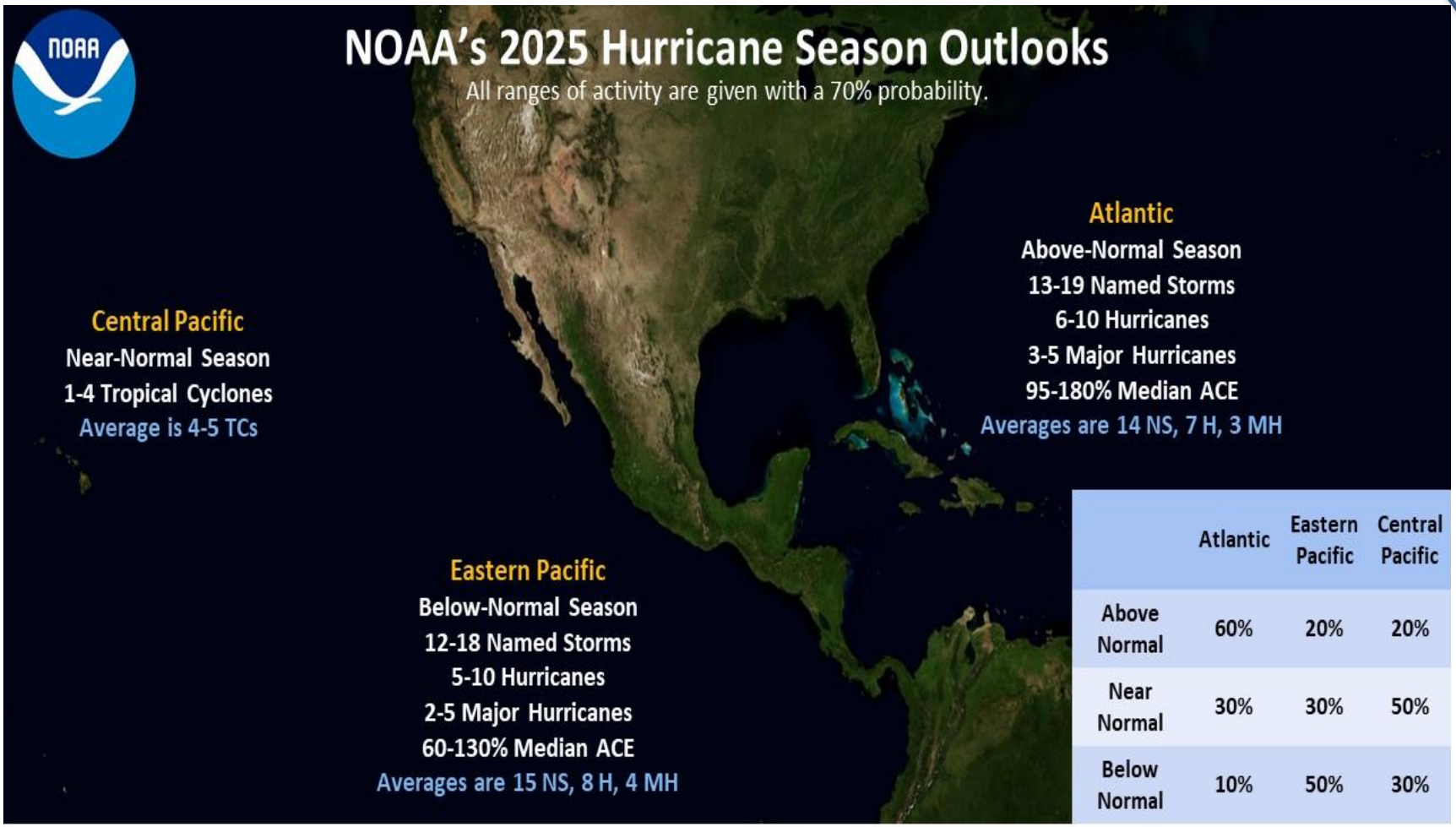
NCEP CFSv2 Tropical North Atlantic (TNA) SST Predictions from Different Initial Months



- Latest CFSv2 predicts above-normal SSTA in the tropical North Atlantic.

CFS Tropical North Atlantic (TNA) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). Anomalies were computed with respect to the 1991-2020 base period means. TNA is the SST anomaly averaged in the region of [60oW-30oW, 5oN-20oN].

2025 Hurricane Season Outlook



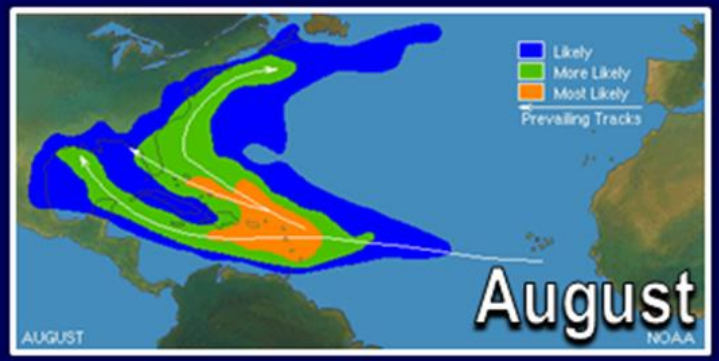
	Atlantic	Eastern Pacific	Central Pacific
Above Normal	60%	20%	20%
Near Normal	30%	30%	50%
Below Normal	10%	50%	30%

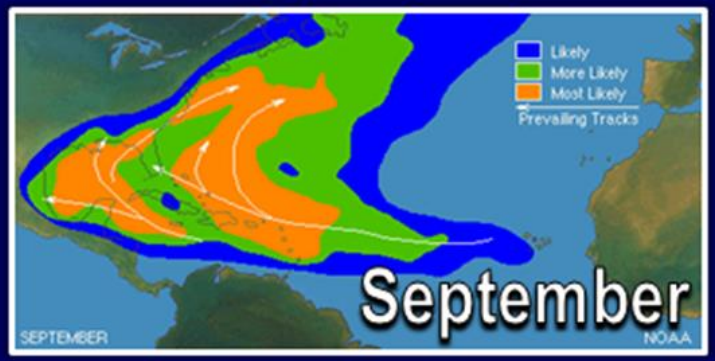
For the Atlantic hurricane region, the outlooks indicate a 60% chance of an above-normal season, a 30% chance of a near-normal season, and a 10% chance of a below-normal season. For the East Pacific Hurricane season, the outlooks indicate a 50% chance of below-normal activity, with a 30% chance for near-normal levels, and a 20% chance for above-normal levels.

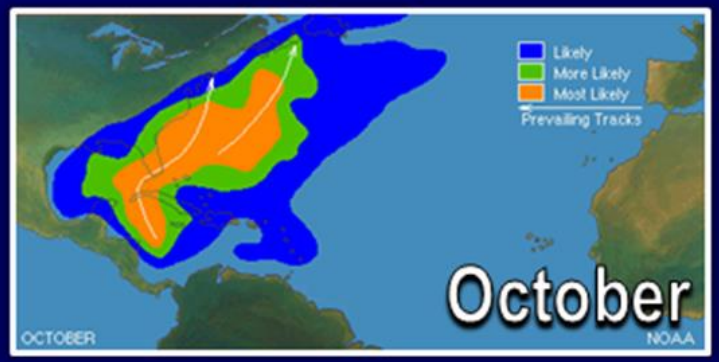
These outlooks are for the overall seasonal activity. They are not a hurricane landfall forecast.

Climatological Areas of Origin

And Typical Hurricane Tracks by Month

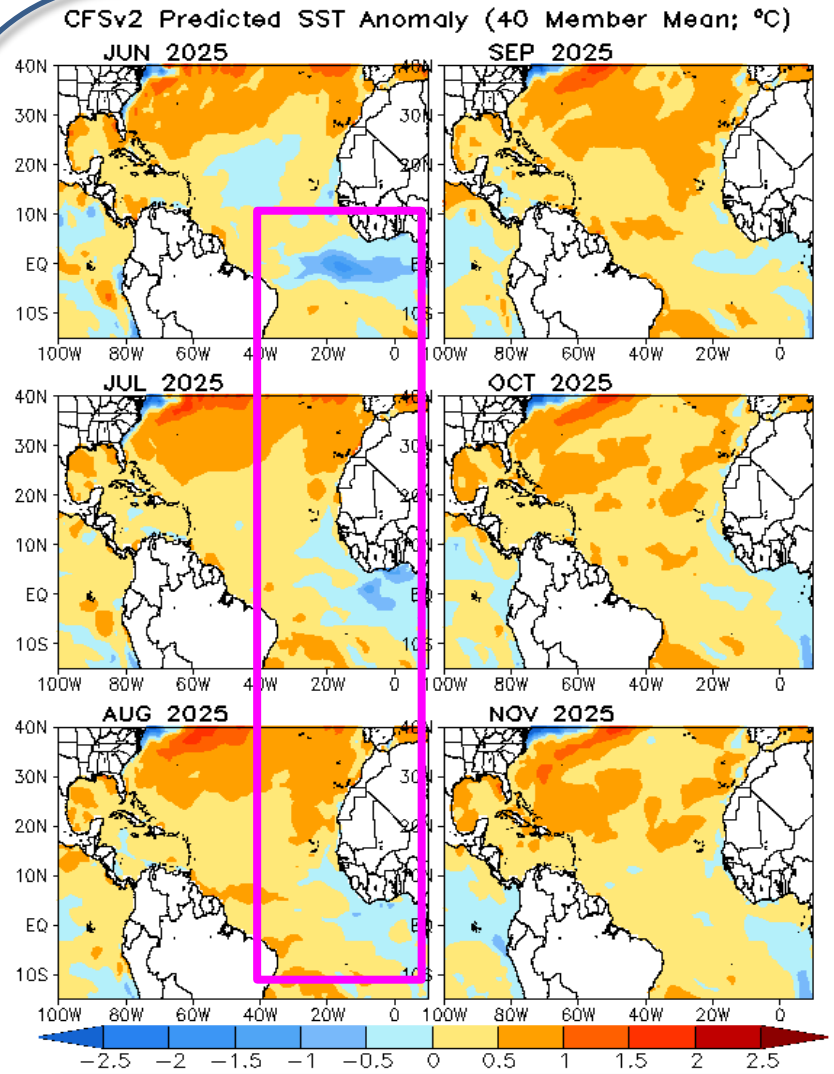


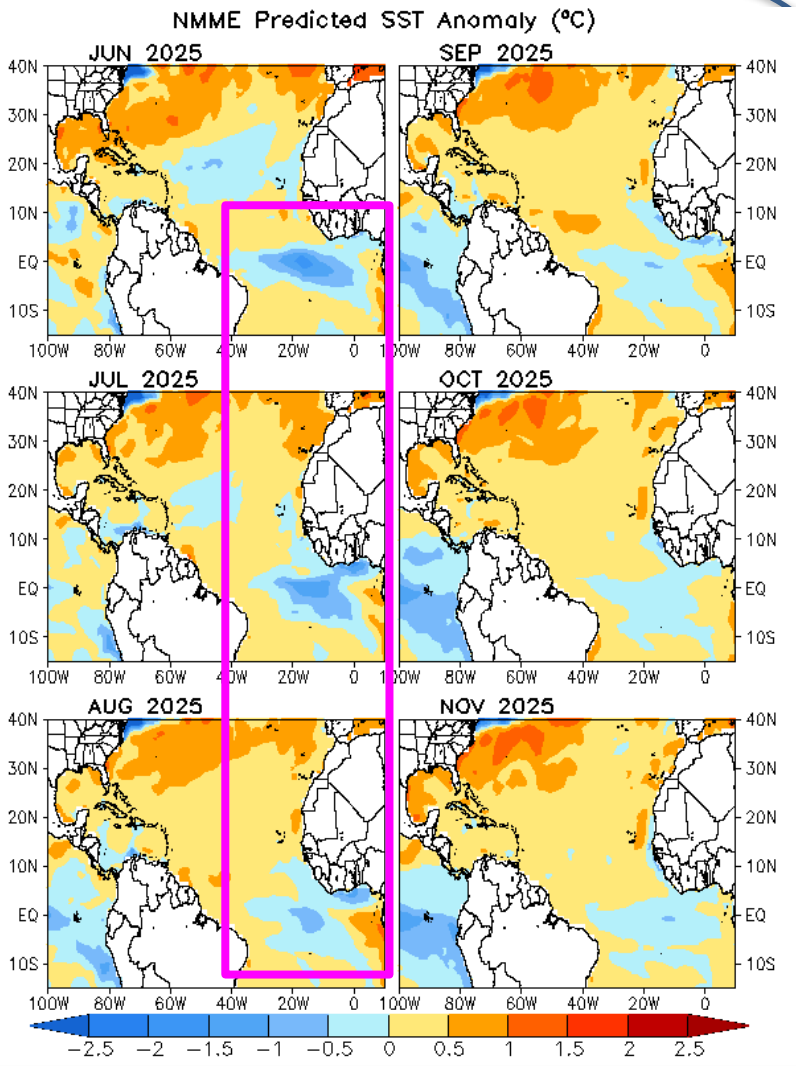




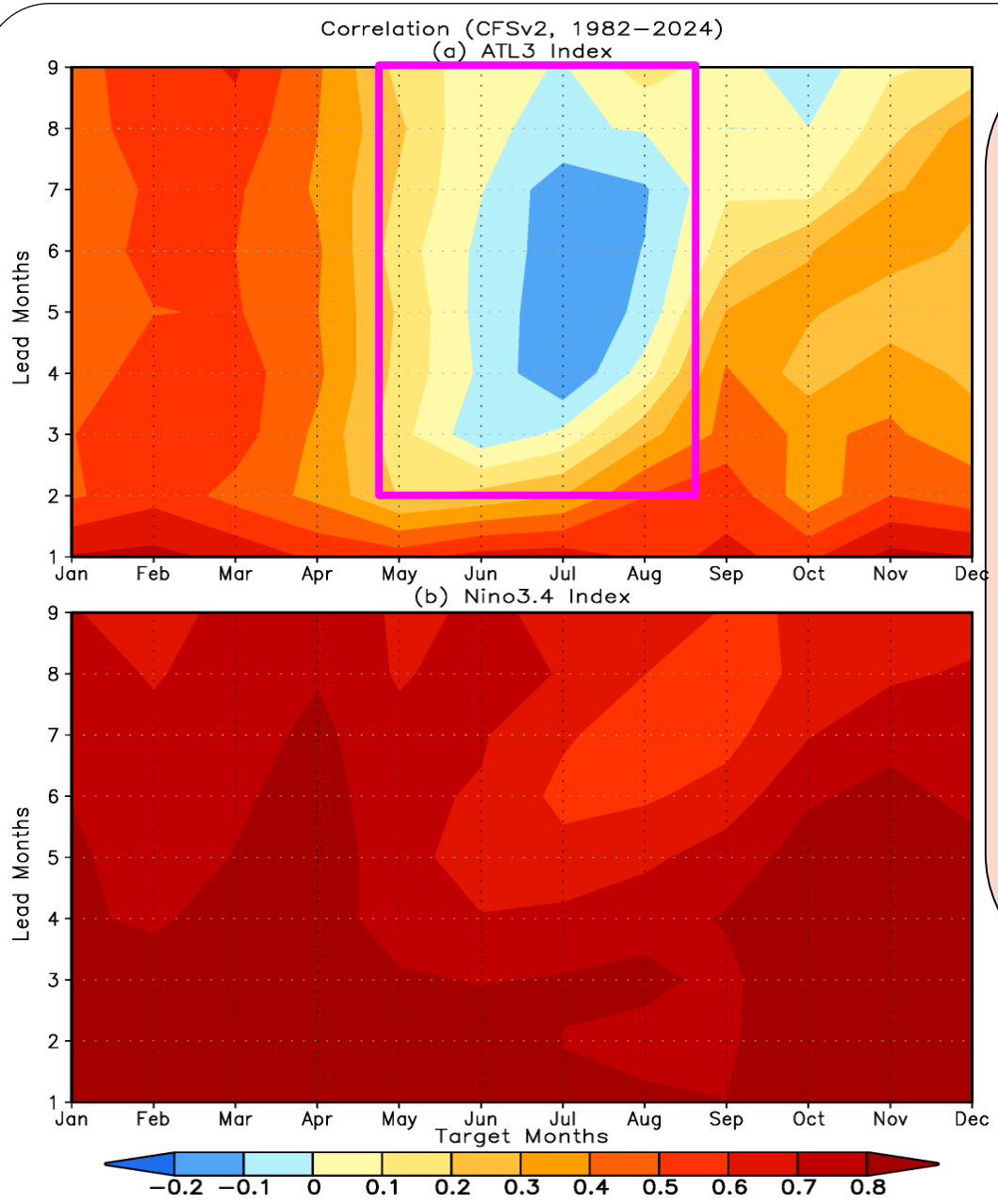
https://www.weather.gov/images/mob/climate/May2018Climate/TC_AreasofOrigin.PNG

CFSv2 & NMME Atlantic SST Anomaly Predictions





- Atlantic Niña-like cooling was present in both the CFSv2 & NMME predictions in June & July 2025.

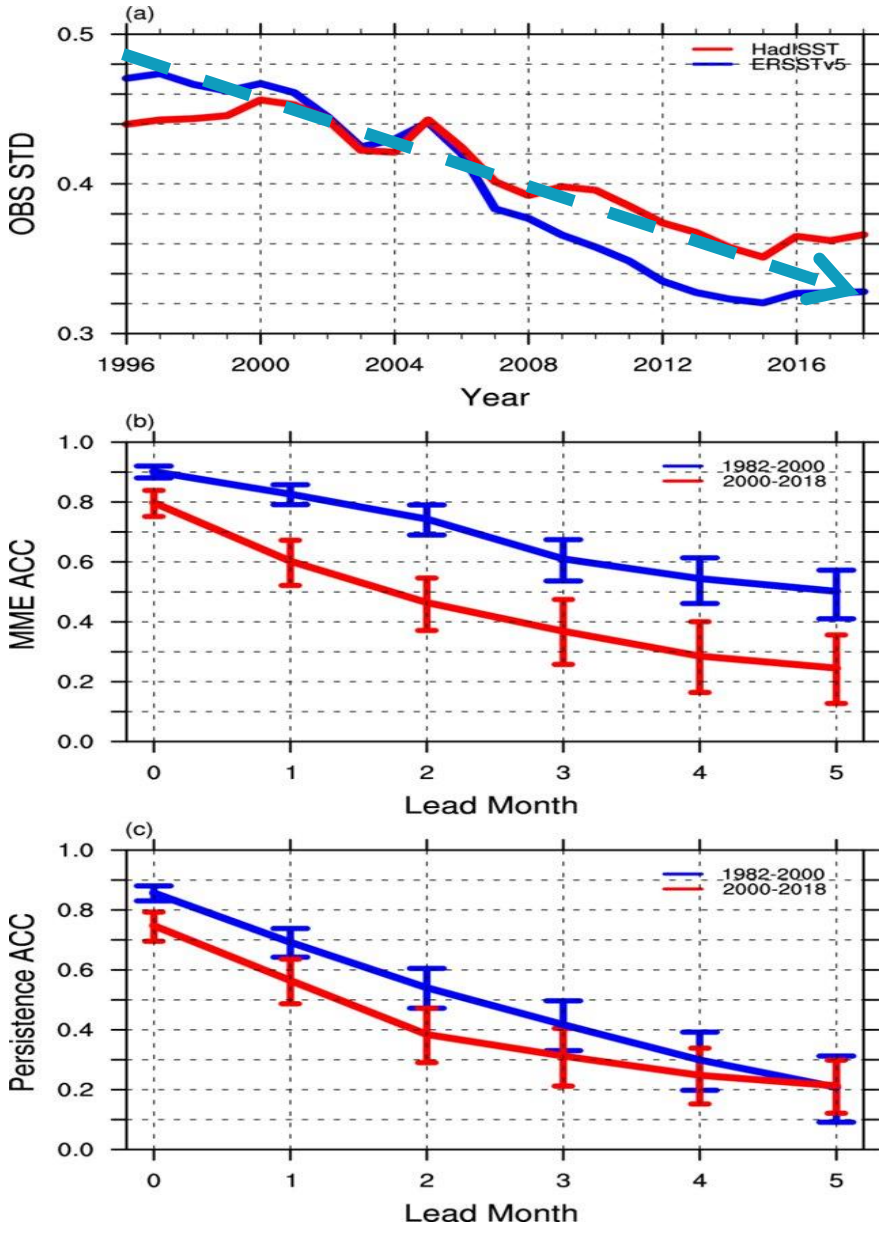


Overall, the prediction skill is much lower for ATL3 than for Niño3.4.

- There are also different seasonal variations in the prediction skills between ENSO & ATL3.

Lead time (y-axis) and target month (x-axis) dependent correlations between CFSv2 predicted and observed monthly mean (a) ATL3 and (b) Niño3.4 indices during Jan 1982-Dec 2024.

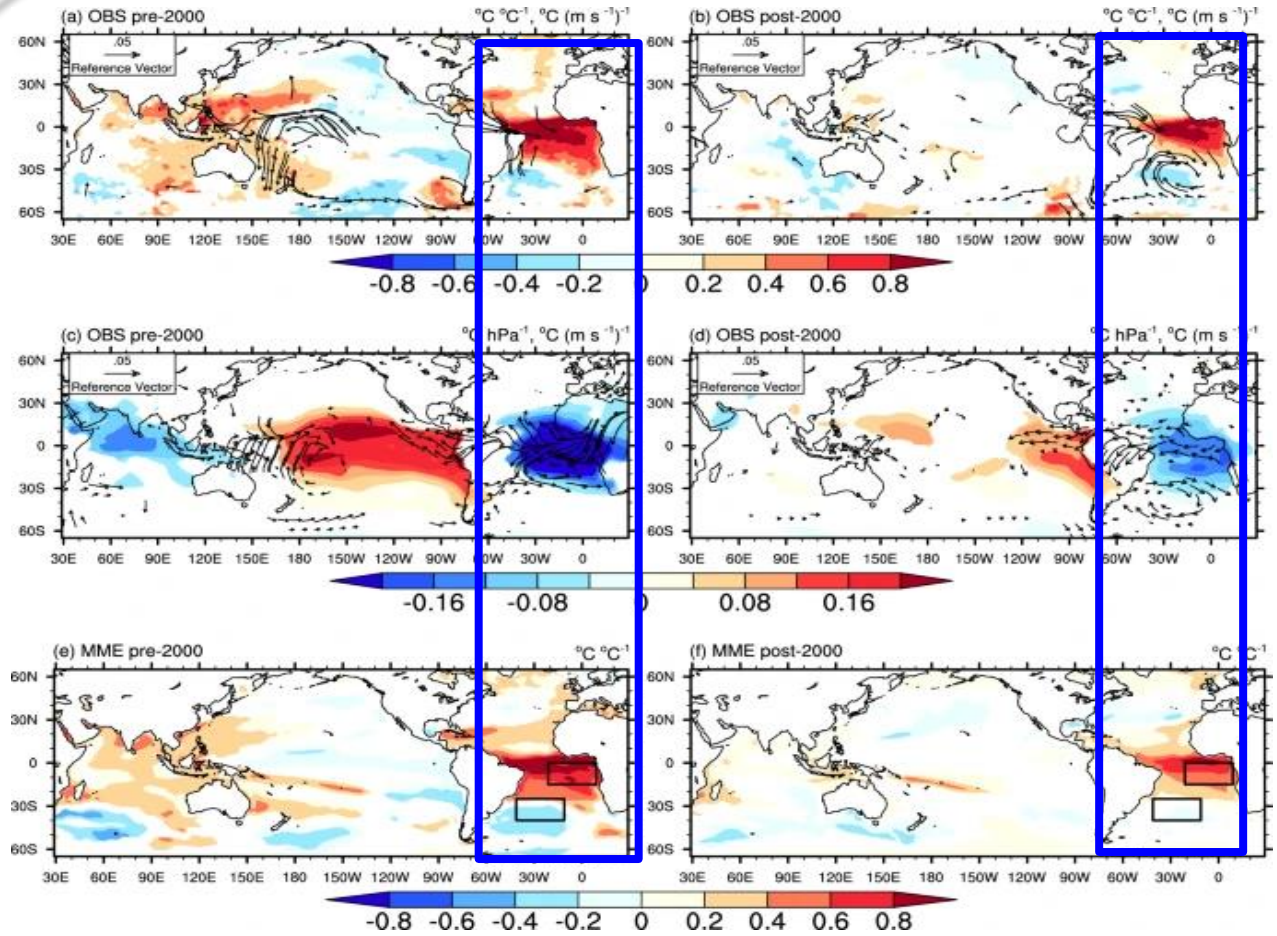
Tan, et al., 2024: Multi-Time Scale Variations in Atlantic Niño and a Relative Atlantic Niño Index. GRL. DOI: 10.1029/2023GL106511.



➢ "… a dramatic decline in Atlantic Niño prediction skill since 2000 by evaluating the predictions of NMME."

The Atlantic Niño variability and prediction skill a 15-year sliding standard deviations (STD) of ATL3 index calculated separately with the HadISST and ERSSTv5 datasets. b ACCs of MME over the two subperiods. c Persistence prediction skills over the two subperiods. The x-axis of (a) indicates the last year of each 15-year sliding window. Error bars in (b) and (c) indicate the 95% confidence interval determined by a bootstrap test with resampling times of 10000.

(Chen, et al., 2024: Decline in Atlantic Niño prediction skill in the North American multi-model ensemble. Commun Earth Environ 5, 524, DOI: 10.1038/s43247-024-01693-0)



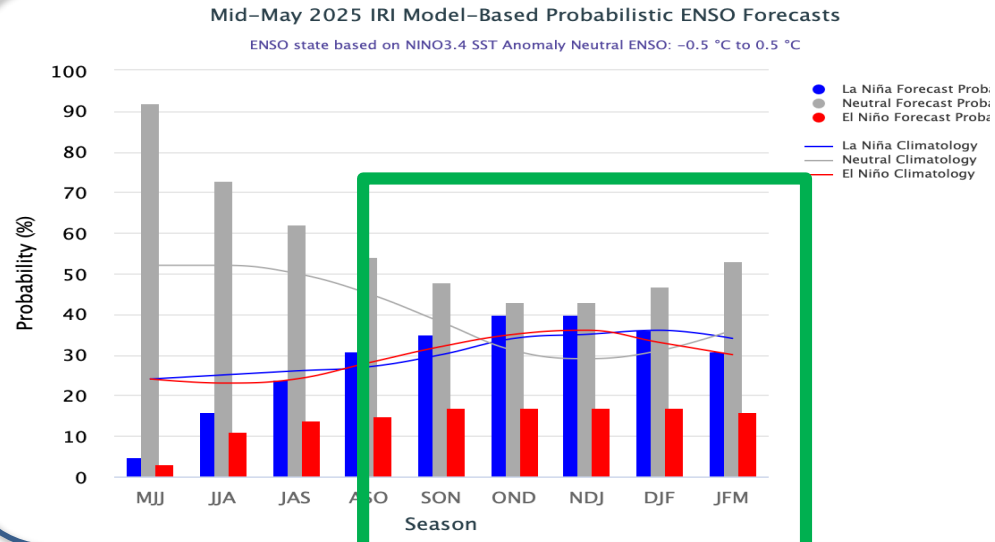
➢ "The prediction skill decline is mainly associated with a climatic regime shift, which leads to a weakened ENSO teleconnection to the SSTA dipole mode over the South Atlantic."

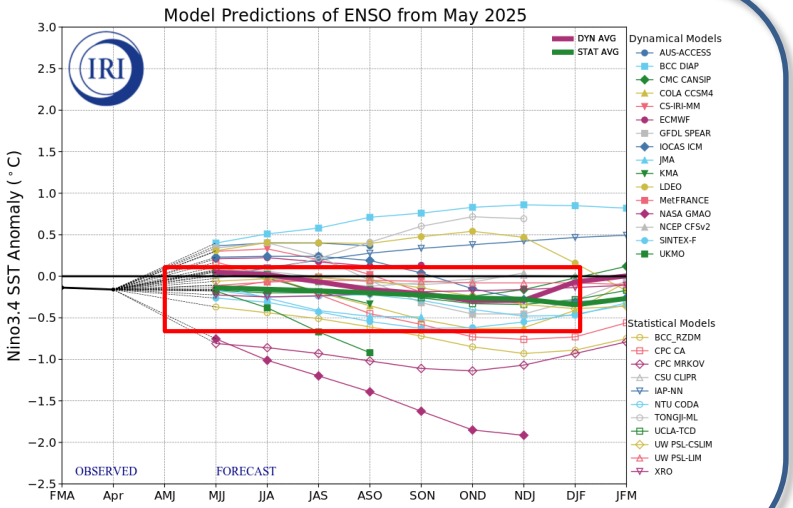
a, b regressions of ATL3 index onto the global SSTA (shading) and 850 hPa wind anomalies (vectors) in observations; c, d regressions of ATL3 index onto the global SLP (shading) and 200 hPa wind anomalies (vectors) in observations (OBS); e, f regressions of ATL3 index onto the global SSTA at the 2-month lead in the multi-model ensemble mean (MME) predictions. a, c, e show results pre-2000; b, d, f show results post-2000. Only regressions with significance level of $p < 0.05$ are plotted. Black boxes in (e, f) indicate the northeastern pole (NEP) and southwestern pole (SWP) of the South Atlantic Ocean Dipole (SAOD). Wind anomalies are missing in (e, f) since wind data are not available from the NMME..

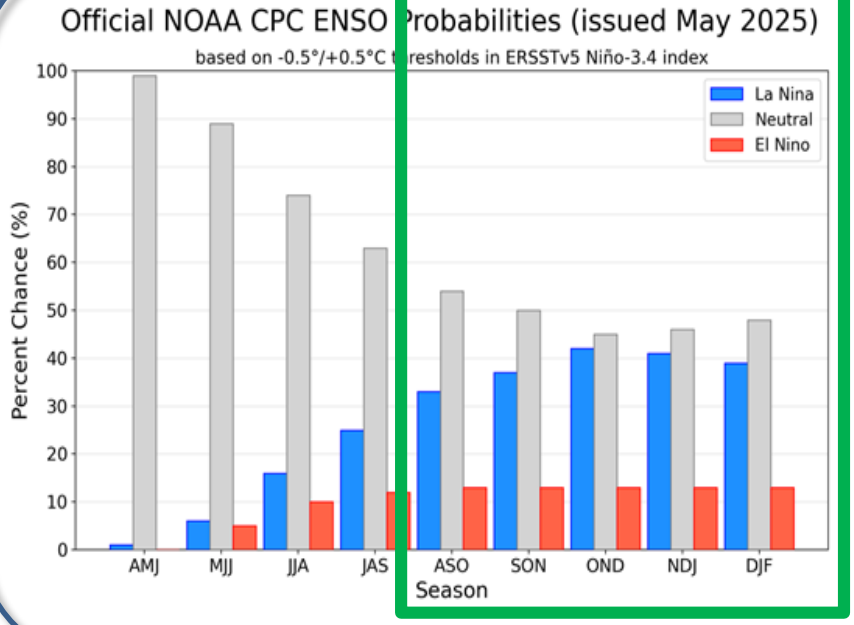
(Chen, et al., 2024: Decline in Atlantic Niño prediction skill in the North American multi-model ensemble. Commun Earth Environ 5, 524, DOI: 10.1038/s43247-024-01693-0)

ENSO and Global SST Predictions

CPC & IRI Niño3.4 Forecast



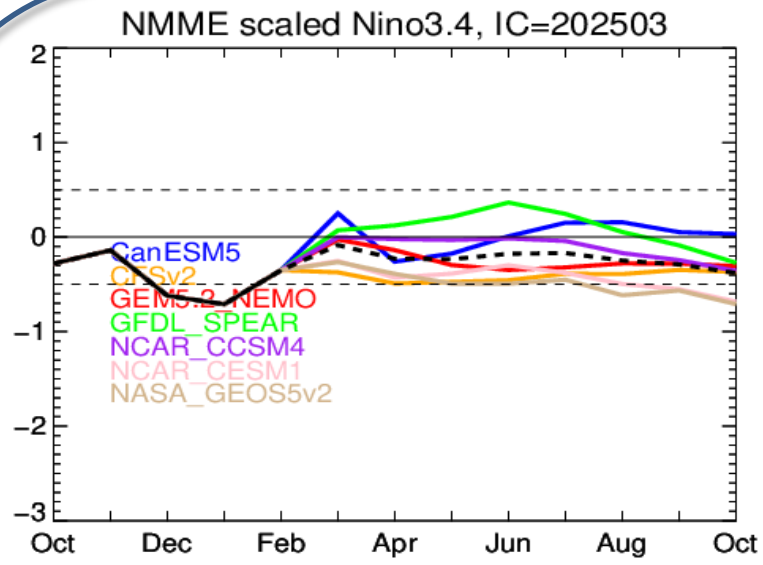


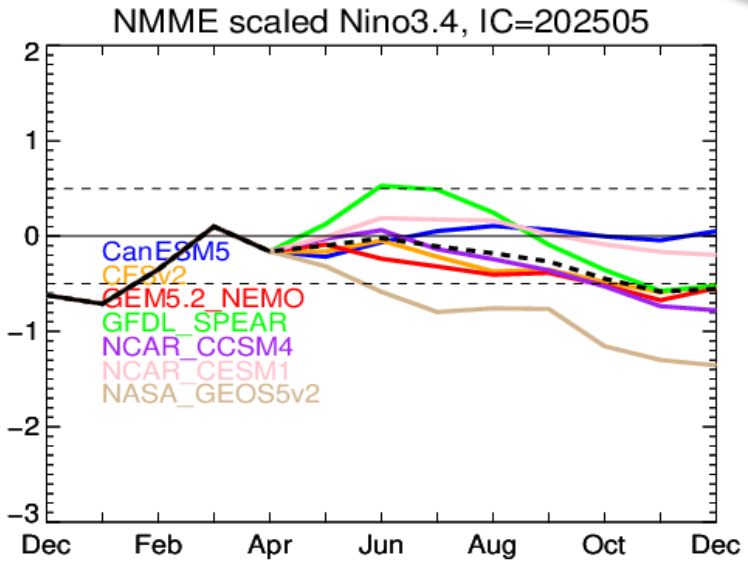


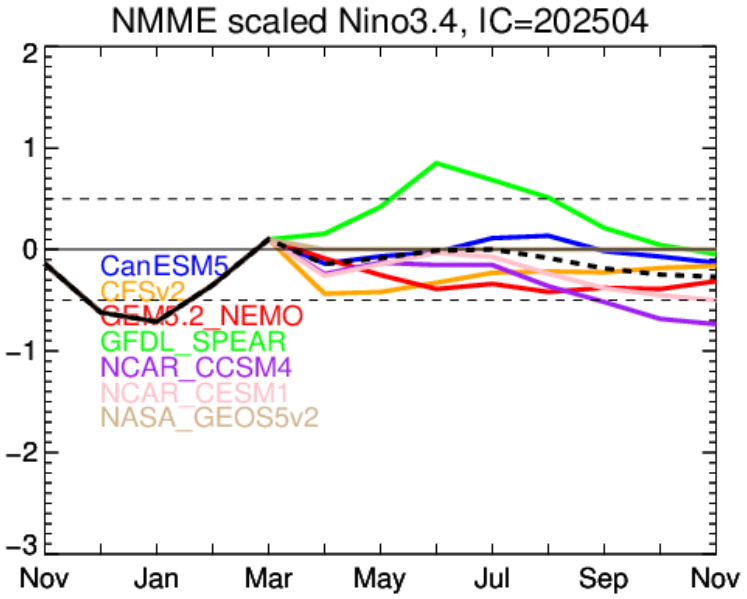
- Niño3.4 index is near or slightly below normal in the both dynamical and statistical model averages in 2025.

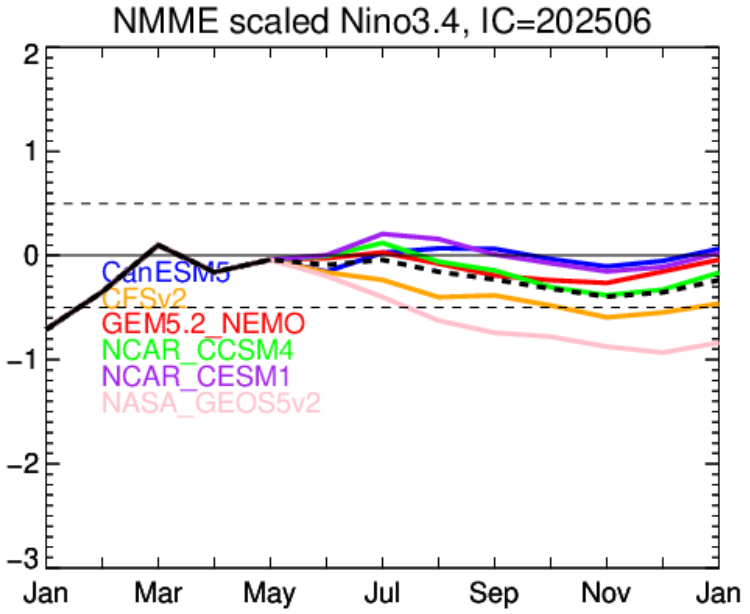
- **On May 8, 2025, CPC issued: Not Active.**
- Synopsis: *"ENSO-neutral is favored through the Northern Hemisphere summer 2025 (74% chance during June-August), with chances exceeding 50% through August-October 2025."*

NMME forecasts from different initial conditions



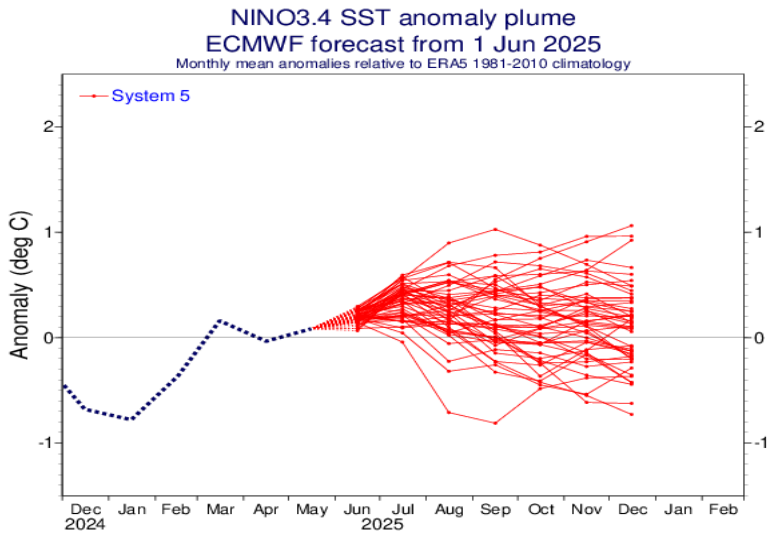




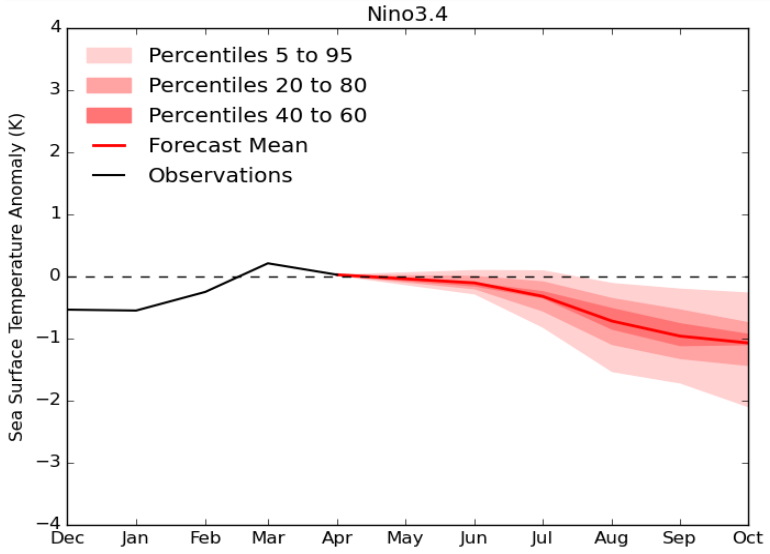


Individual Model Forecasts: Small positive or negative Nino3.4 in summer & fall 2025

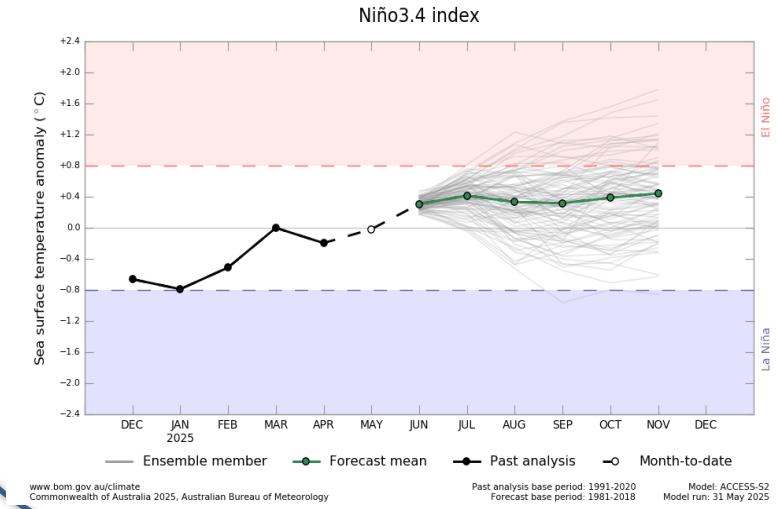
EC: Niño3.4, IC= 1 June 2025



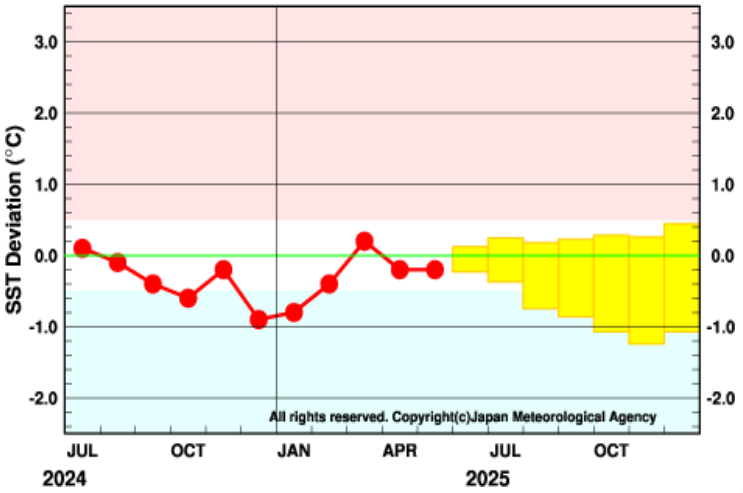
UKMO: Niño3.4, Updated 11 May 2025



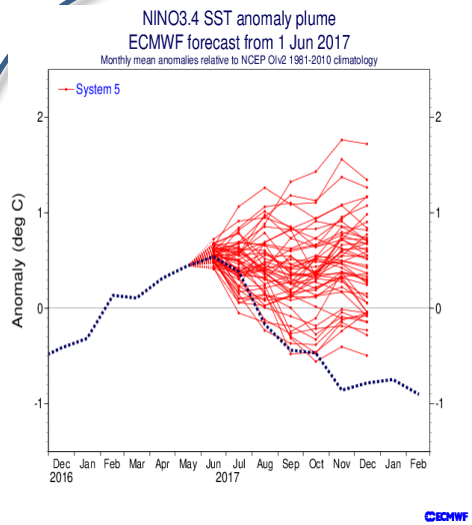
BOM: Niño3.4, Updated 31 May 2025

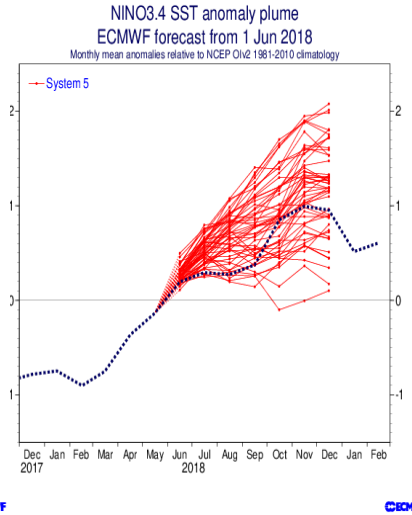


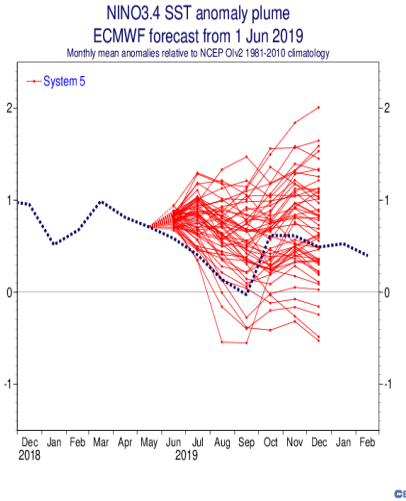
JMA: Niño3.4, Updated 10 June 2025

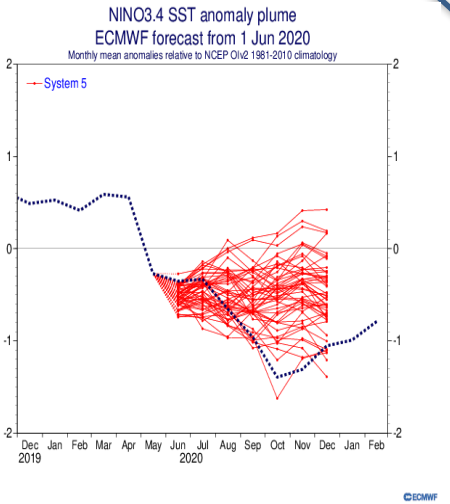


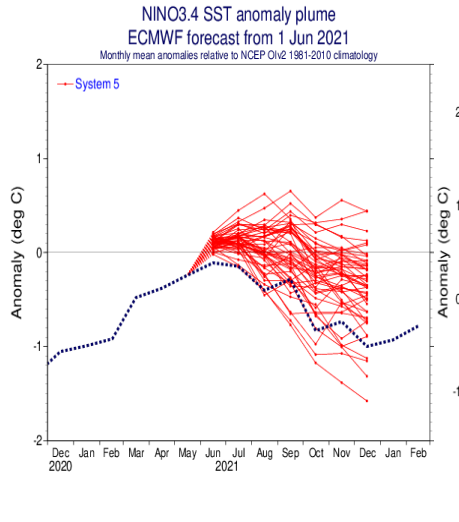
ECMWF Forecasts with IC in Jun since 2017: Warm biases

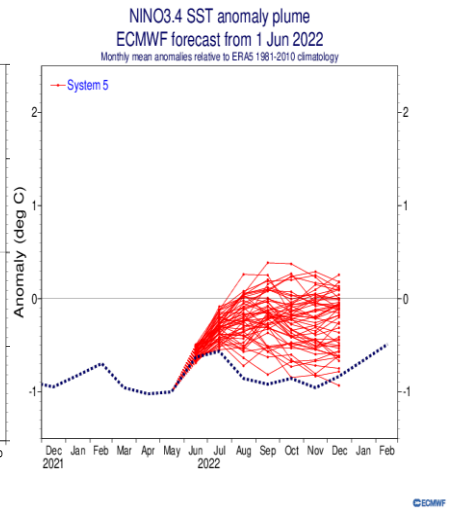


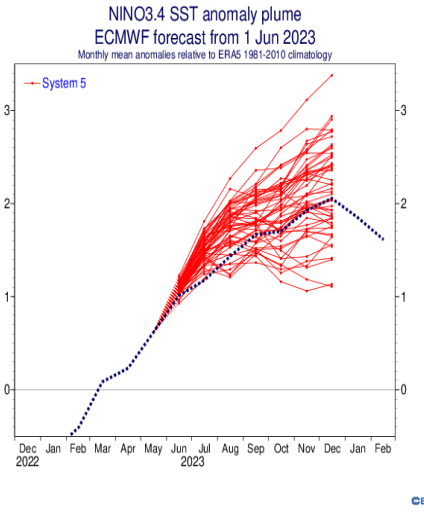


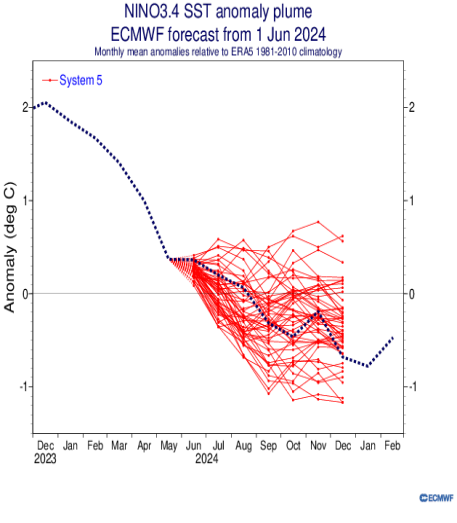




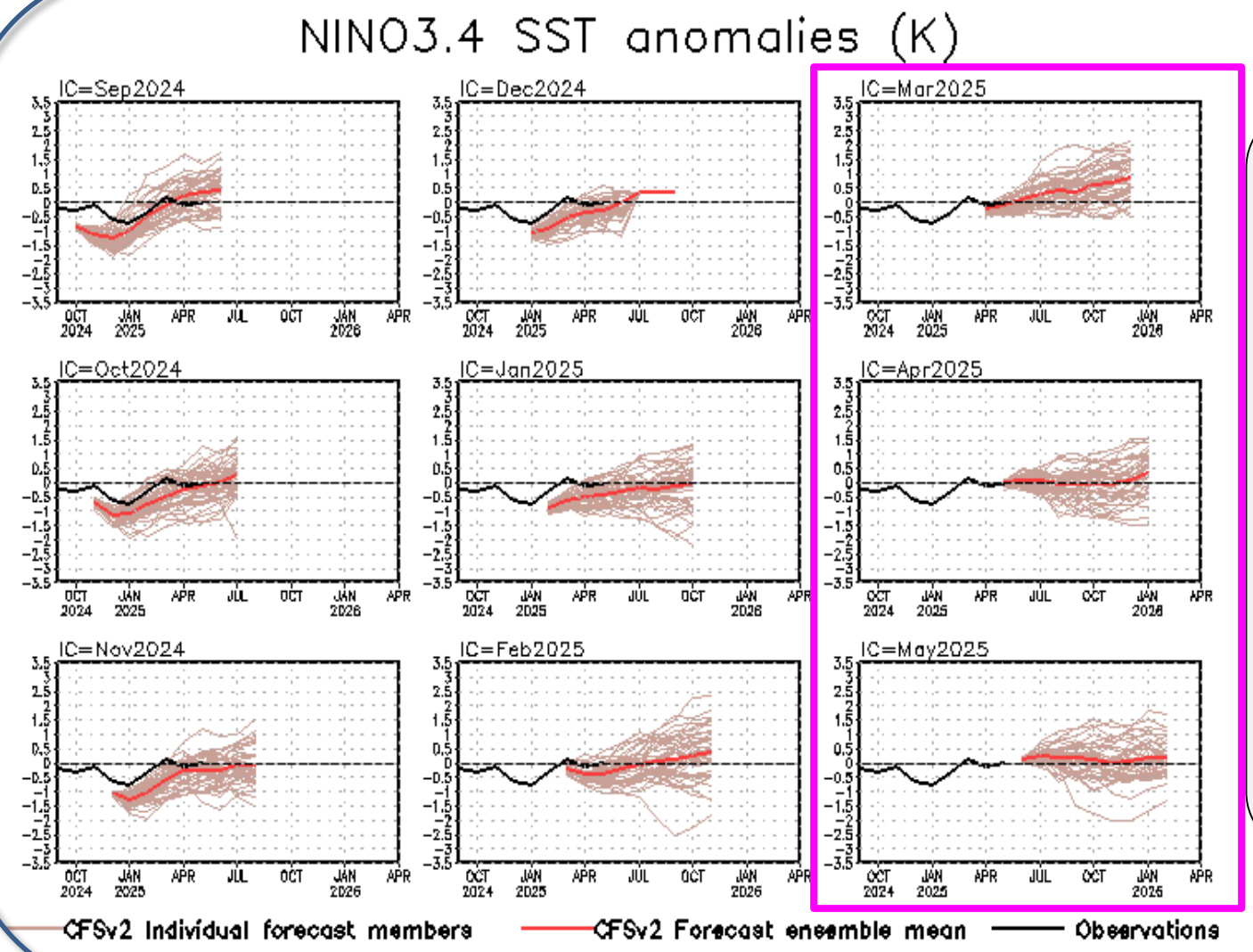








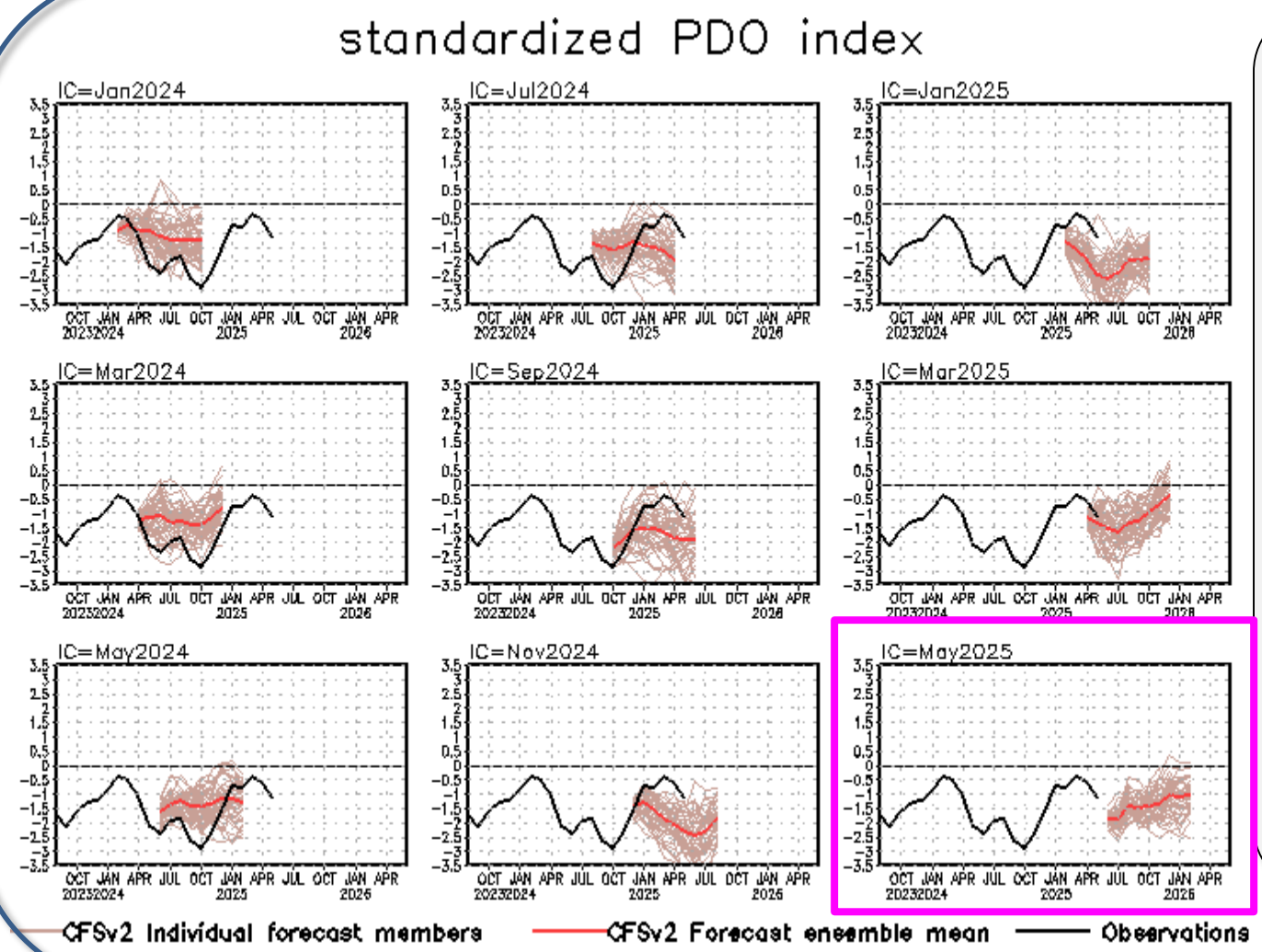
CFS Niño3.4 SST Predictions from Different Initial Months



- The latest CFSv2 forecasts neutral condition in 2025.
- Cold biases are seen in the forecasts with ICs in Jun 2024-Feb 2025.

CFS Niño3.4 SST prediction from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). Anomalies were computed with respect to the 1991-2020 base period means.

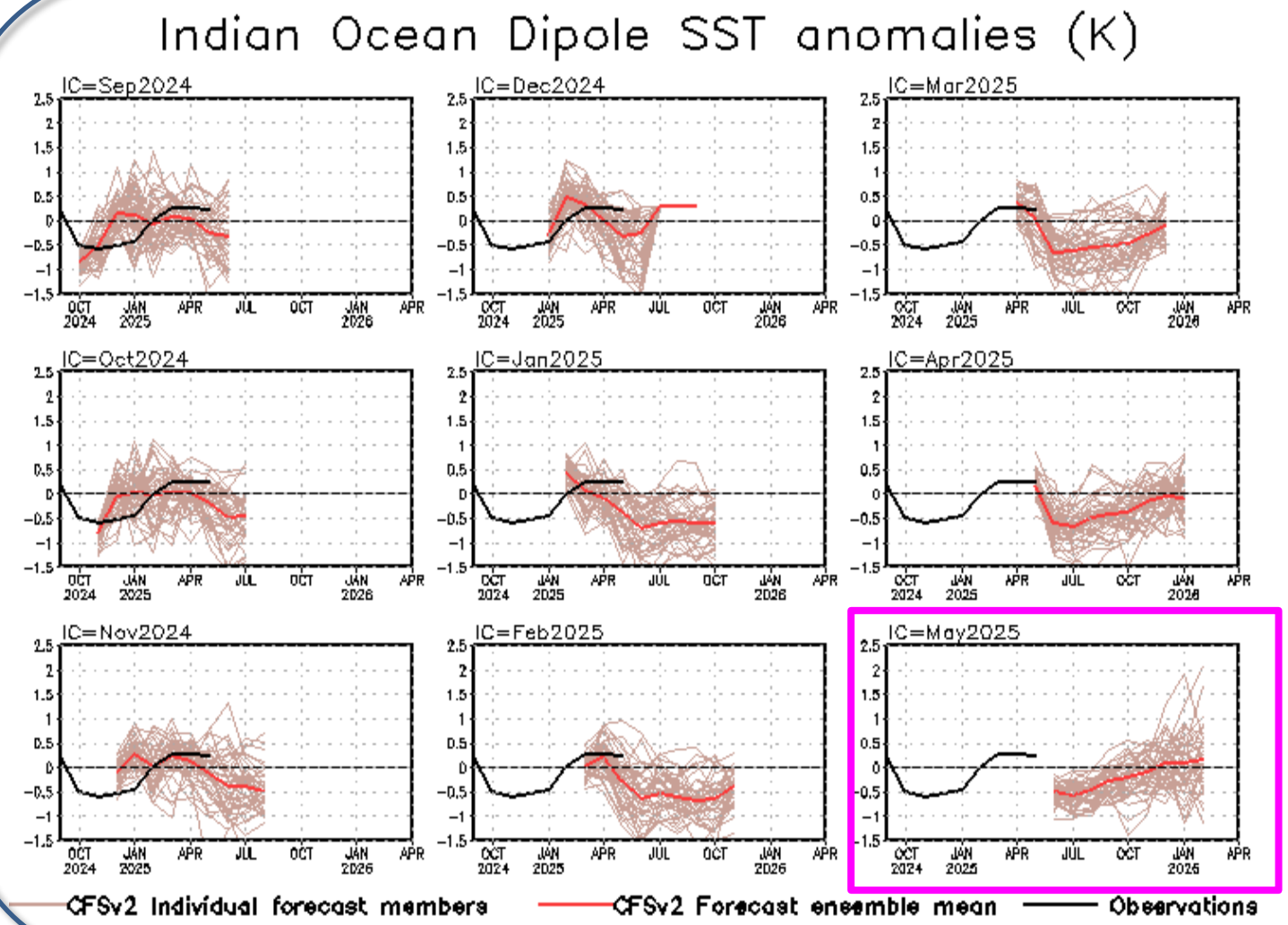
NCEP CFSv2 PDO Index Predictions from Different Initial Months



- CFSv2 predicts a persistent negative phase of PDO in 2025.
- Most forecasts had large warm (cold) biases with ICs in early 2024 (since mid-2024).

CFS Pacific Decadal Oscillation (PDO) index predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). Anomalies were computed with respect to the 1991-2020 base period means. PDO is the first EOF of monthly ERSSTv3b anomaly in the region of [110°E-100°W, 20°N-60°N]. CFS PDO index is the standardized projection of CFS SST forecast anomalies onto the PDO EOF pattern.

NCEP CFSv2 DMI SST Predictions from Different Initial Months



- CFSv2 predicts a switch to a negative phase of IOD in the next month.

CFS Dipole Model Index (DMI) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). The hindcast climatology for 1981-2006 was removed, and replaced by corresponding observation climatology for the same period. Anomalies were computed with respect to the 1991-2020 base period means.

Acknowledgement

- Drs. Jieshun Zhu and Caihong Wen: reviewed PPT, and provided insightful suggestions and comments
- Drs. Yanjuan Guo and Pingping Xie maintained the BASS/CMORPH/CFSR EVAP package
- Drs. Jieshun Zhu & Wanqiu Wang conducted the sea ice forecasts

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Zeng-Zhen.Hu@noaa.gov

Data Sources (climatology is for 1991-2020)

- **NCEP/CPC Ocean Monitoring & Briefing Operation (Hu et al., 2022, BAMS)**
- **Weekly Optimal Interpolation SST (OIv2.1 SST; Huang et al. 2021)**
- **Extended Reconstructed SST (ERSST) v5 (Huang et al. 2017)**
- **Blended Analysis of Surface Salinity (BASS) (Xie et al. 2014)**
- **CMORPH precipitation (Xie et al. 2017)**
- **CFSR evaporation adjusted to OAFlux (Xie and Ren 2018)**
- **NCEP CDAS winds, surface radiation and heat fluxes (Kalnay et al. 1996)**
- **NESDIS Outgoing Long-wave Radiation (Liebmann and Smith 1996)**
- **NCEP's GODAS temperature, heat content, currents (Behringer and Xue 2004)**
- **Aviso altimetry sea surface height from CMEMS**
- **Ocean Surface Current Analyses – Real-time (OSCAR)**
- **In situ data objective analyses (IPRC, Scripps, EN4.2.1, PMEL TAO)**
- **Operational Ocean Reanalysis Intercomparison Project**

http://www.cpc.ncep.noaa.gov/products/GODAS/multiora_body.html

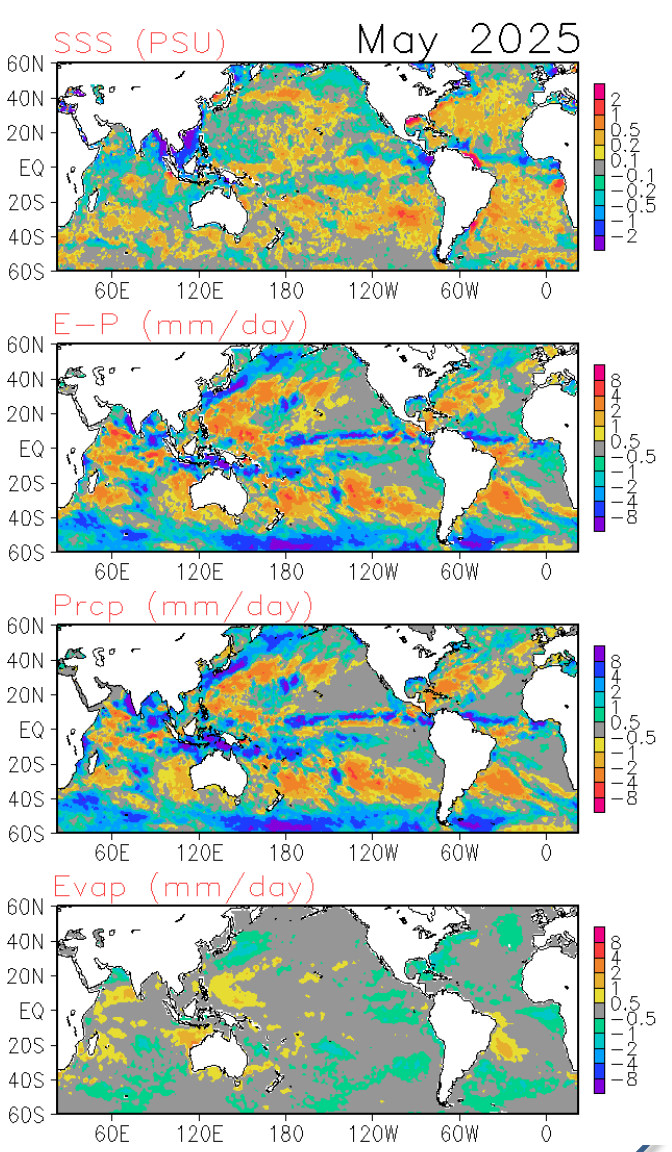
http://www.cpc.ncep.noaa.gov/products/GODAS/multiora93_body.html

Backup Slides

Global Sea Surface Salinity (SSS): Anomaly for May 2025

New Update: The NCEI SST data used in the quality control procedure has been updated to version 2.1 since May 2020;

The ITCZ is displaced northward, with decreased precipitation at the equator and increased precipitation off equator. Also, enhanced precipitation is found over the maritime continent and the sea surrounding the south and southeastern continents. Regions controlled by the subtropical high in both hemispheres generally show decreased precipitation. And the E-P map is overall dominated by the precipitation. The large-scale SSS map is overall consistent with the E-P map, but with much stronger negative salinity anomalies found over the sea water surrounding the southeastern continent likely due to strong fresh water discharge over there.



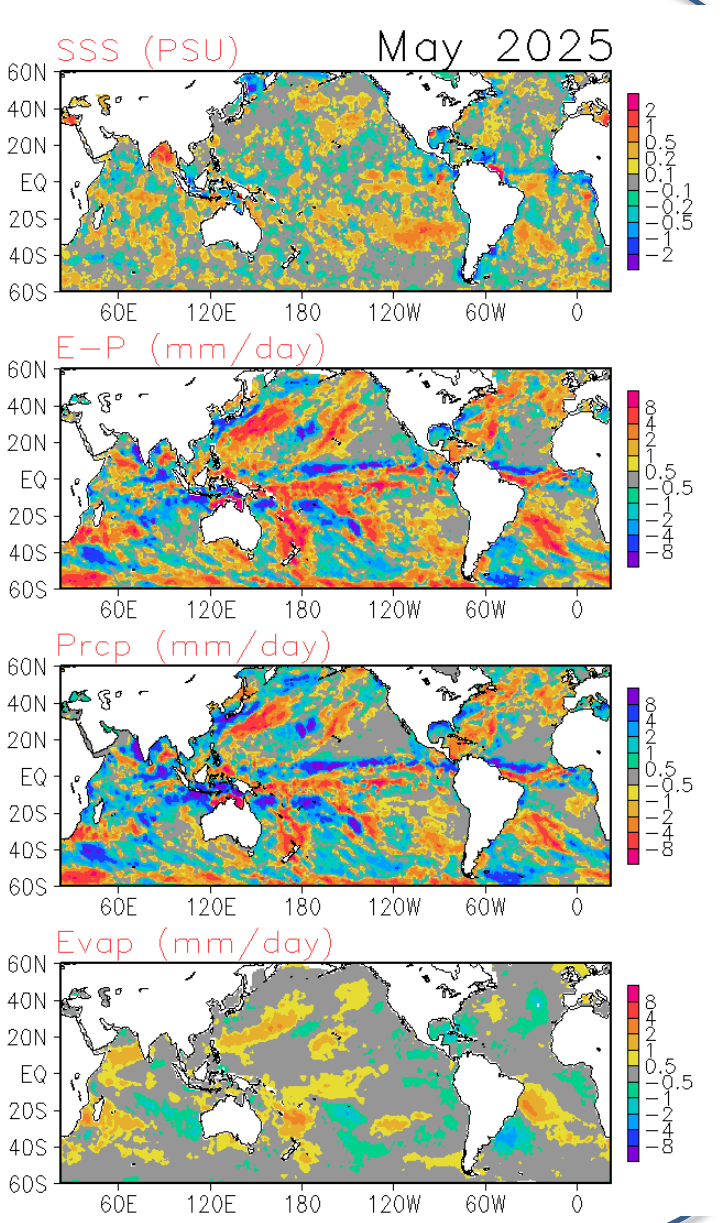
SSS : Blended Analysis of Surface Salinity (BASS) V0.Z
(a CPC-NESDIS/NODC-NESDIS/STAR joint effort)
ftp.cpc.ncep.noaa.gov/precip/BASS

Precipitation: CMORPH adjusted satellite precipitation estimates

Evaporation: Adjusted CFS Reanalysis

Global Sea Surface Salinity (SSS): Tendency for May 2025

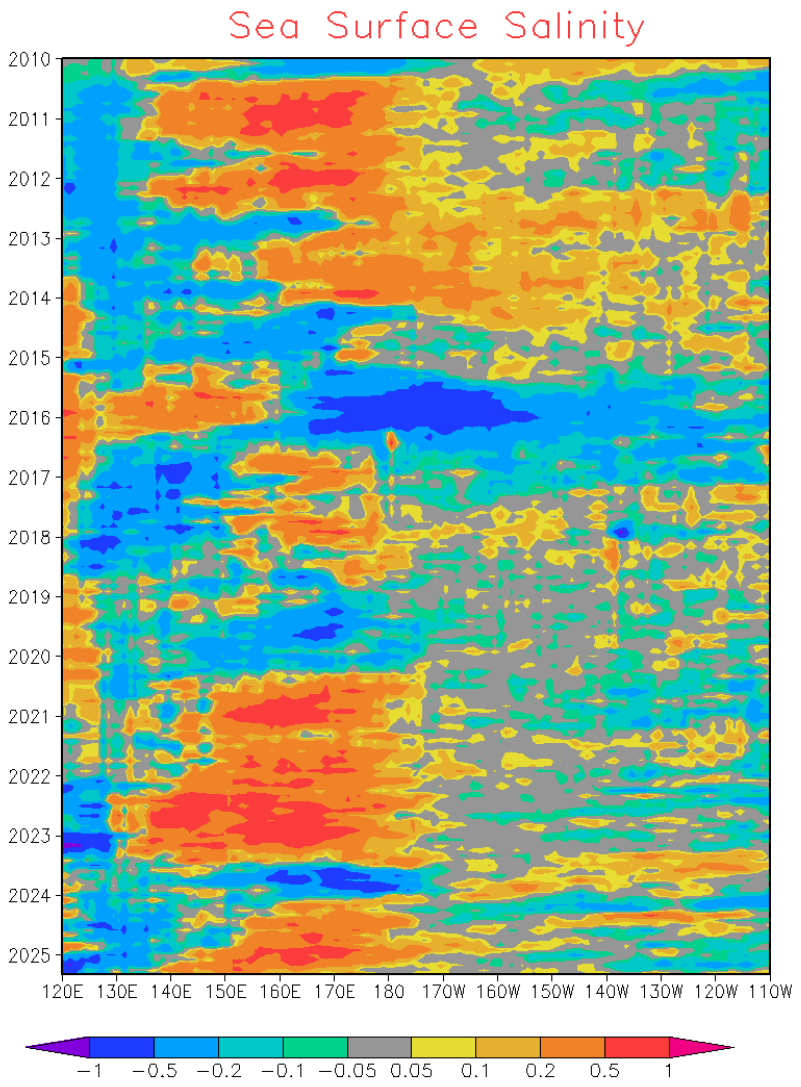
The tendency of the precipitation also shows northward displacement of the ITCZ. Trend of increasing precipitation is also found over the maritime continent and the SPCZ region. In the midlatitude oceans, both positive and negative trends are found, probably corresponding to regional variations in this month. The E-P trend resembles largely with the precipitation trend. The SSS trend is quite noisy, but consistency can still be found over regions such as the southeast of South Pacific, overall the Atlantic, and etc.



Monthly SSS Anomaly Evolution over Equatorial Pacific

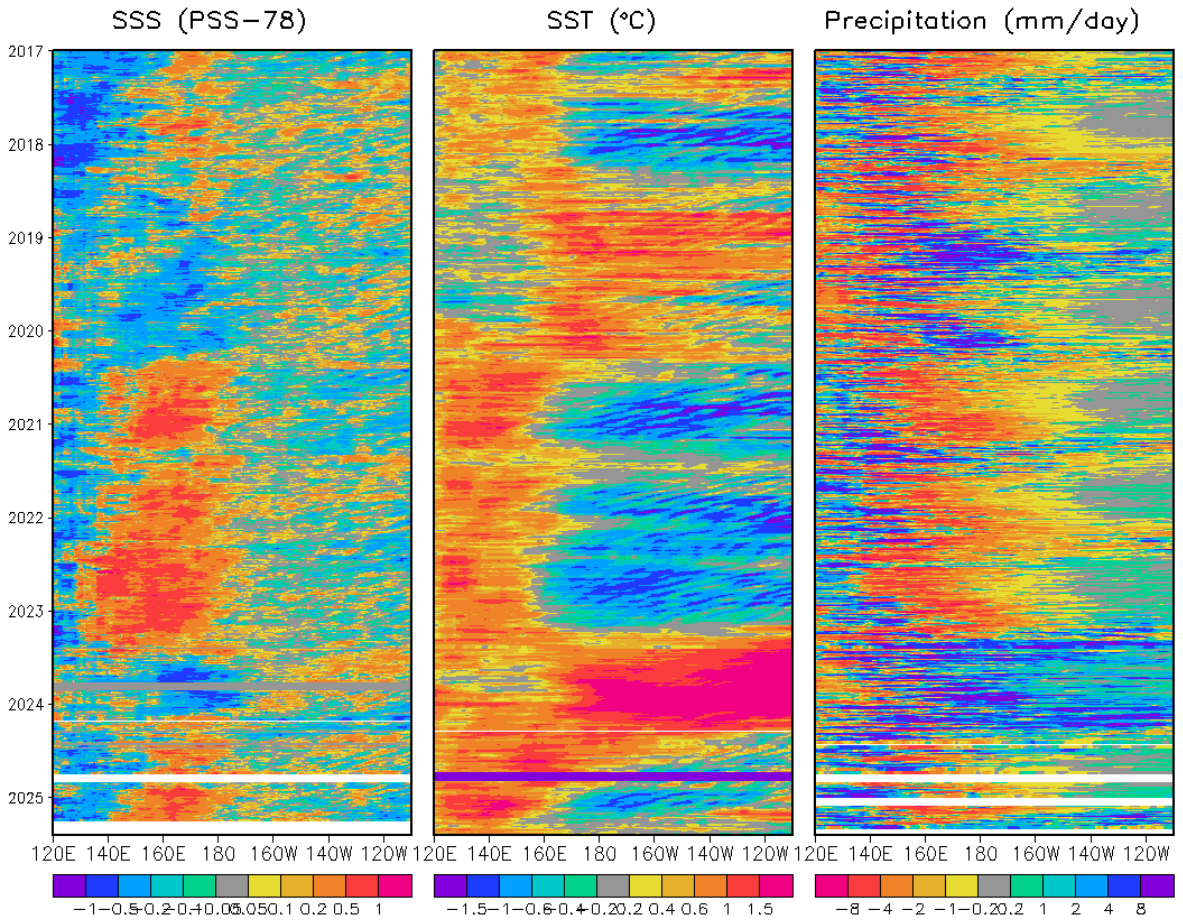
NOTE: Since June 2015, the BASS SSS is from in situ, SMOS and SMAP; before June 2015,The BASS SSS is from in situ, SMOS and Aquarius.

- Hovermoller diagram for equatorial SSS anomaly **(5S-5˚N);**
- Decreased SSS is found over the warm pool region, but increased over the central Pacific. SSS increasing is also found over the equatorial eastern Pacific.

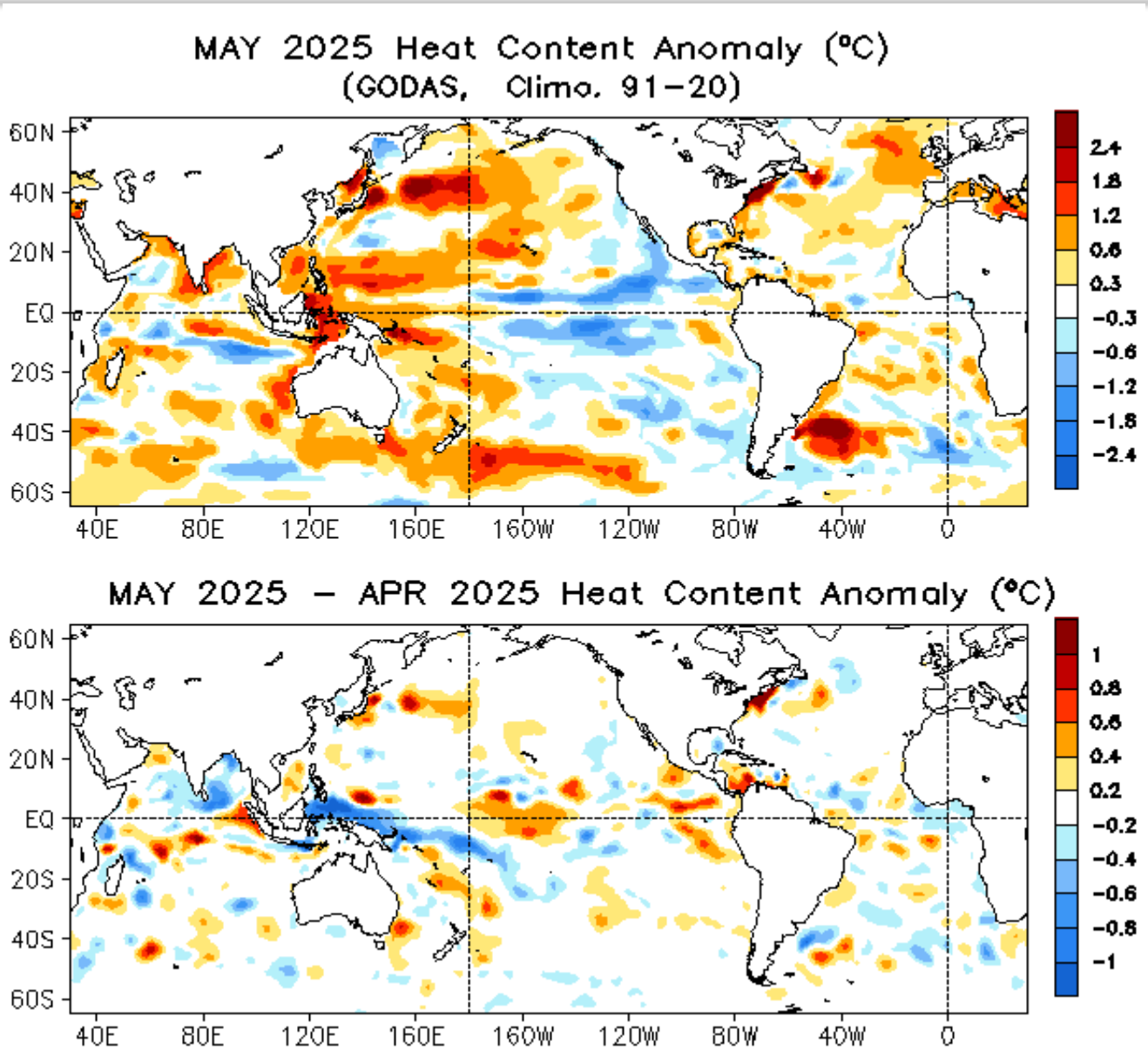


Pentad SSS Anomaly Evolution over Equatorial Pacific

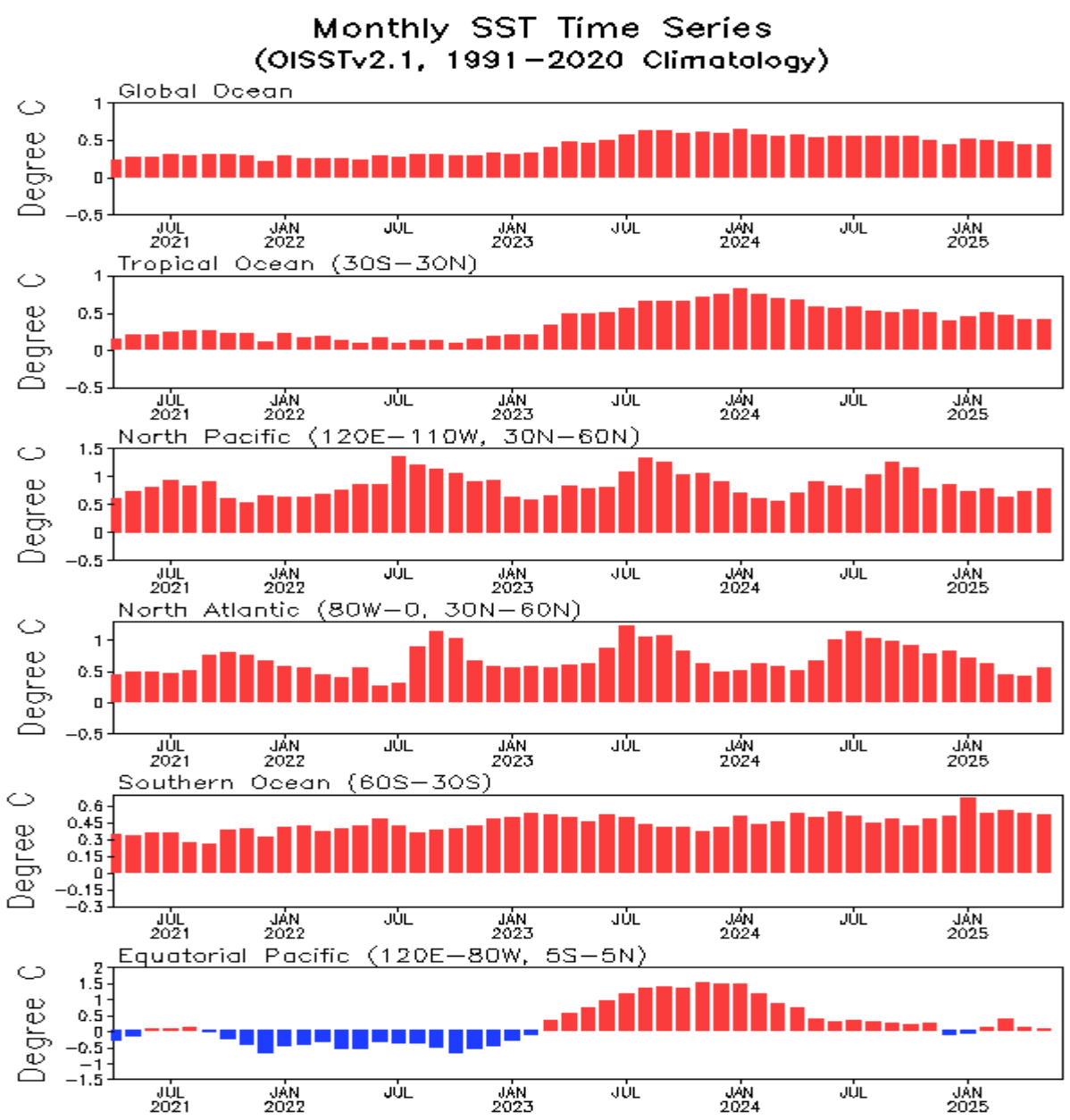
Figure caption: Hovermoller diagram for equatorial (5˚S-5˚N) 5-day mean SSS, SST and precipitation anomalies. The climatology for SSS is Levitus 1994 climatology. The SST data used here is the OISST V2 AVHRR only daily dataset with its climatology being calculated from 1985 to 2010. The precipitation data used here is the adjusted CMORPH dataset with its climatology being calculated from 1999 to 2013.



Global HC300 Anomaly & Anomaly Tendency



Evolution of Basin-Averaged SST Anomalies

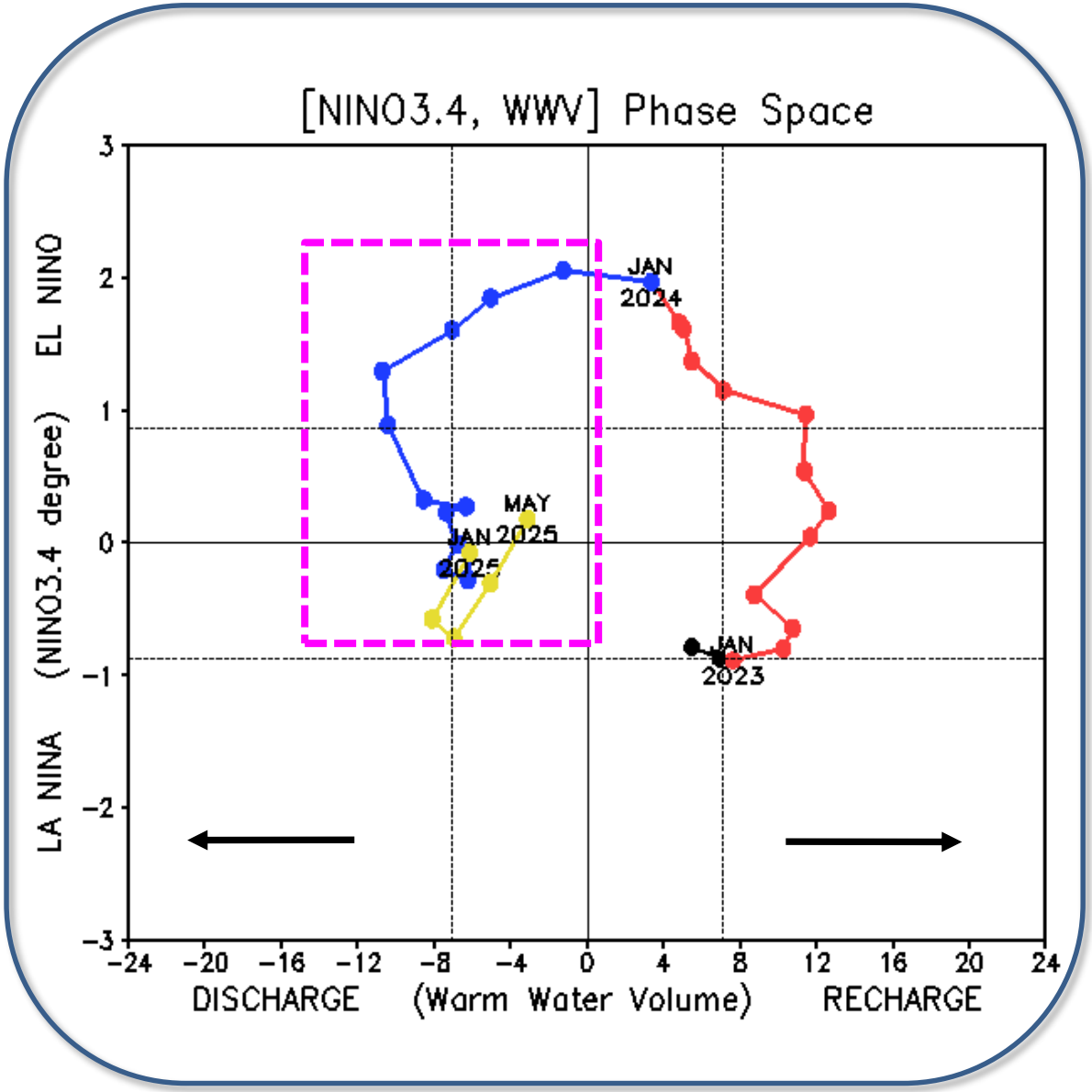


Monthly mean OISSTv2.1 SSTA for global, tropical, N. Pacific, N. Atlantic, Southern Ocean, and equatorial Pacific averages since Jan 2021.

Warm Water Volume (WWV) and Niño3.4 Anomalies

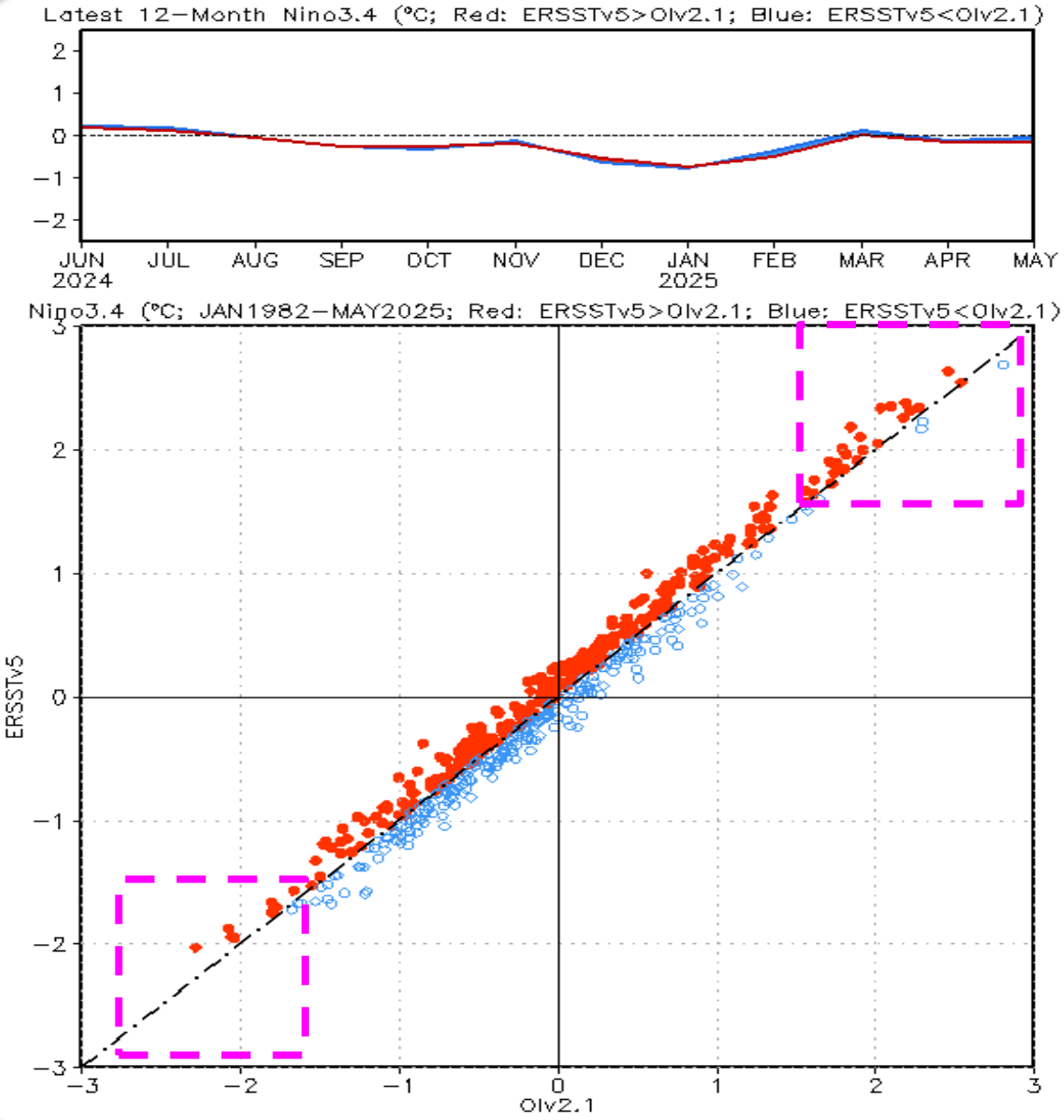
- Pacific equatorial Warm Water Volume (WWV) switched to a discharge phase after Feb 2024.

-As WWV is intimately linked to ENSO variability (Wyrtki 1985; Jin 1997), it is useful to monitor ENSO in a phase space of WWV and Niño3.4 (Kessler 2002).
- Increase (decrease) of WWV indicates recharge (discharge) of the equatorial oceanic heat content.



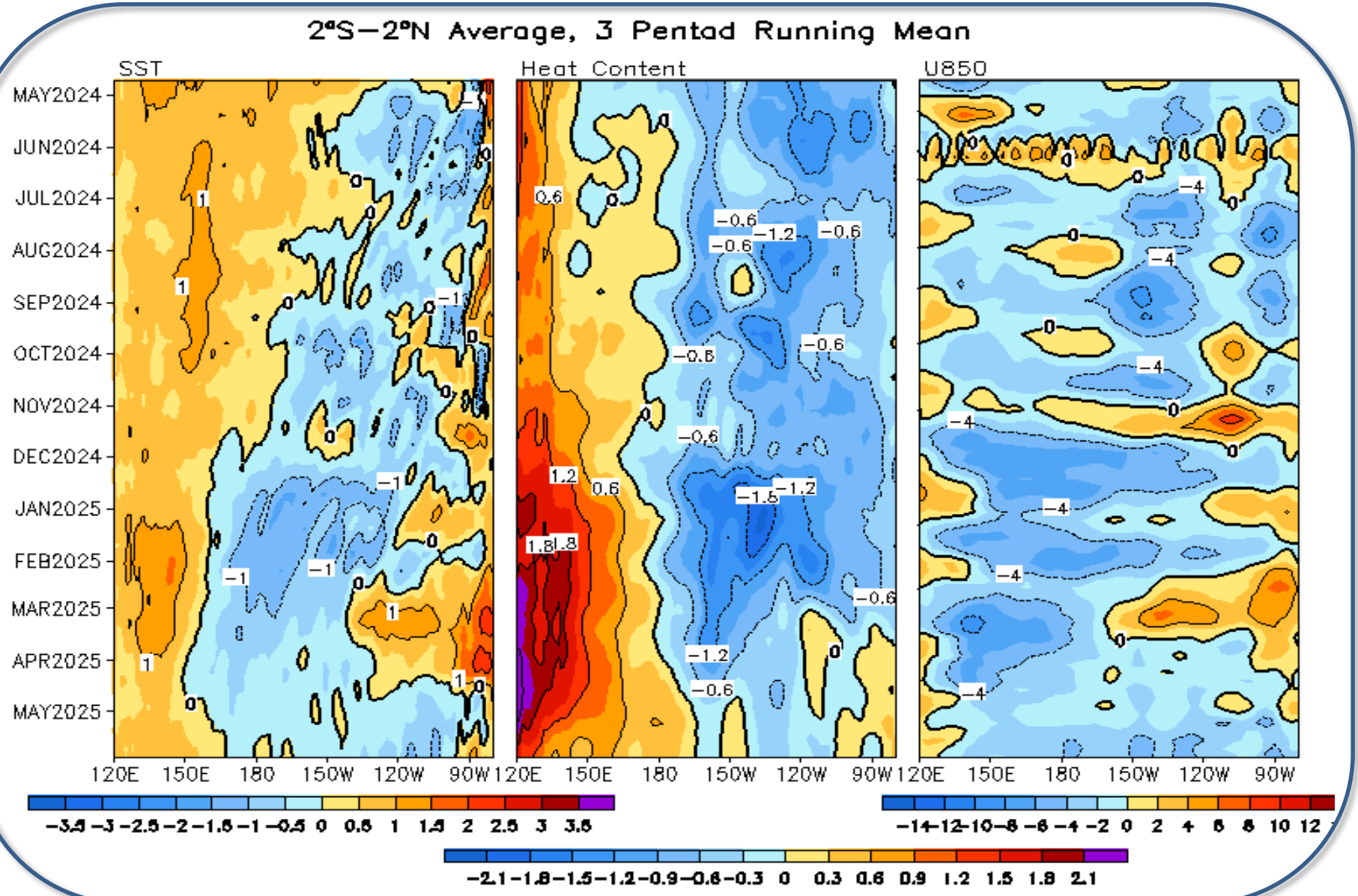
Phase diagram of Warm Water Volume (WWV) and Niño3.4 indices. WWV is the average of depth of 20ºC in [120ºE-80ºW, 5ºS-5ºN] calculated with the NCEP's GODAS. Anomalies are departures from the 1991-2020 base period means.

Comparison of ERSSTv5 with OIv2.1 Niño3.4 Index



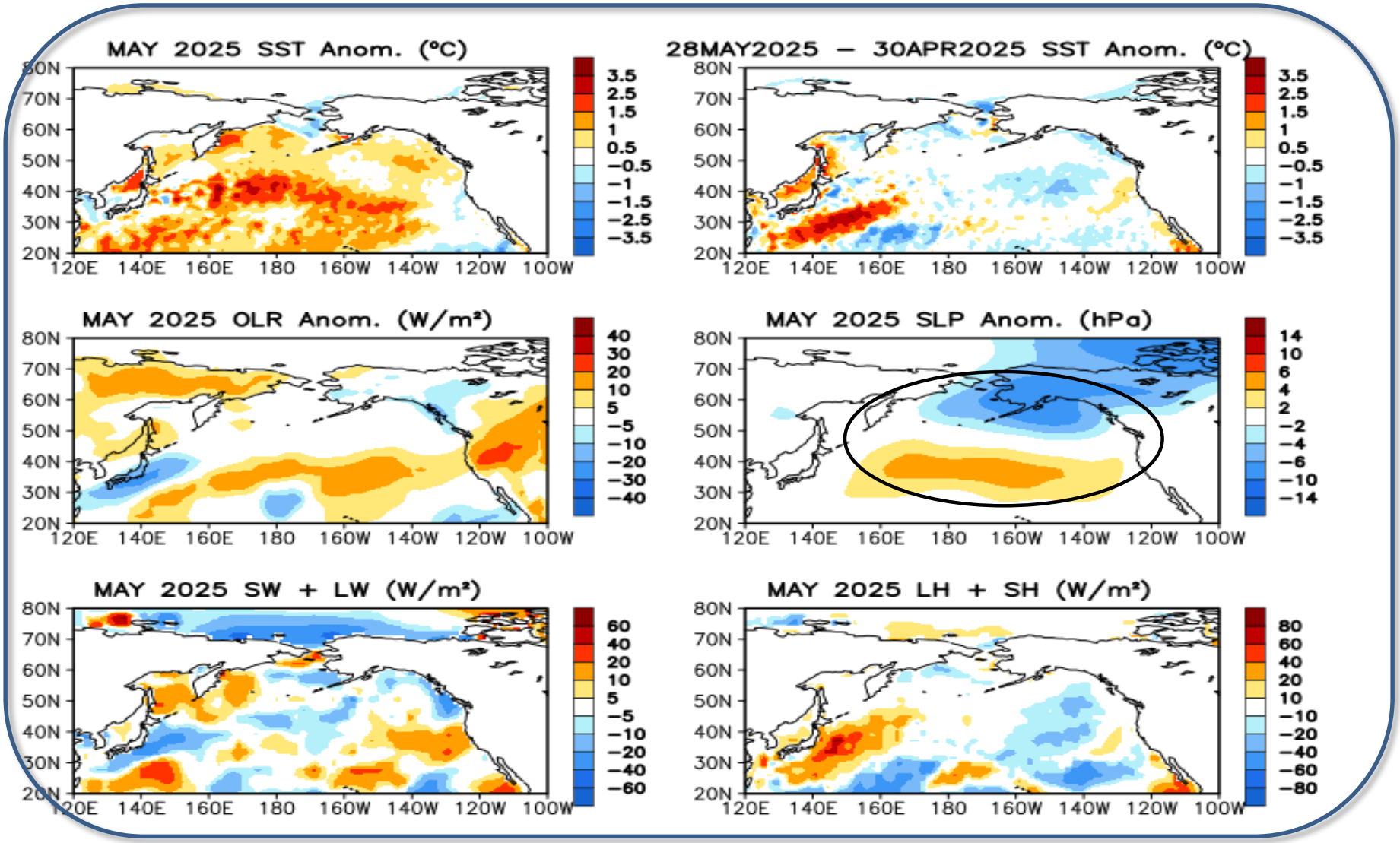
- During the last year, ERSSTv5 was close to OIv2.1.
- Sometimes, ERSSTv5 is either warmer or cooler than OIv2.1.
- For both the extreme positive and negative (>1.5°C or <-1.5°C) Niño3.4, ERSSTv5 is mostly warmer than OIv2.1.

Equatorial Pacific SST (°C), HC300 (°C), u850 (m/s) Anomalies



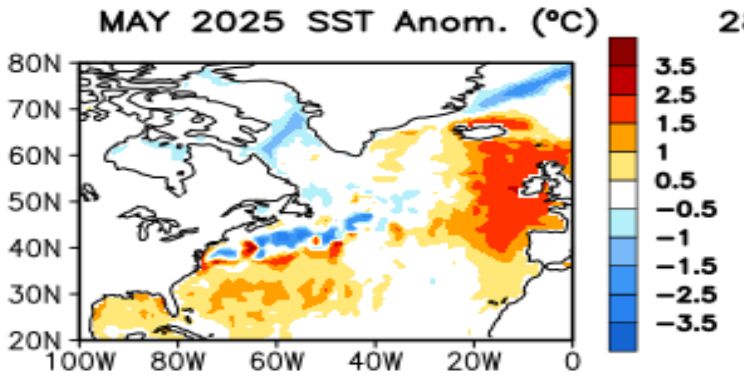
- In May 2025, SST & wind anomalies were small.

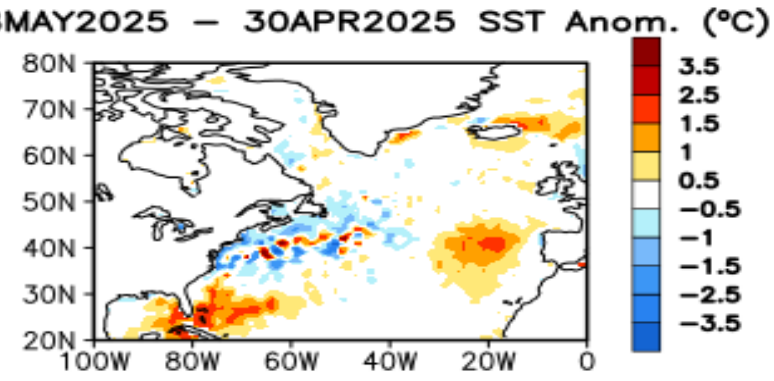
North Pacific Ocean: SSTA, SSTA Tend., OLR, SLP, Sfc Rad, Sfc Flx Anomalies

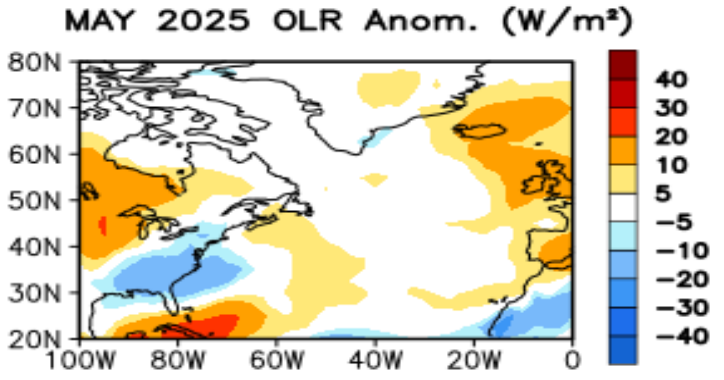


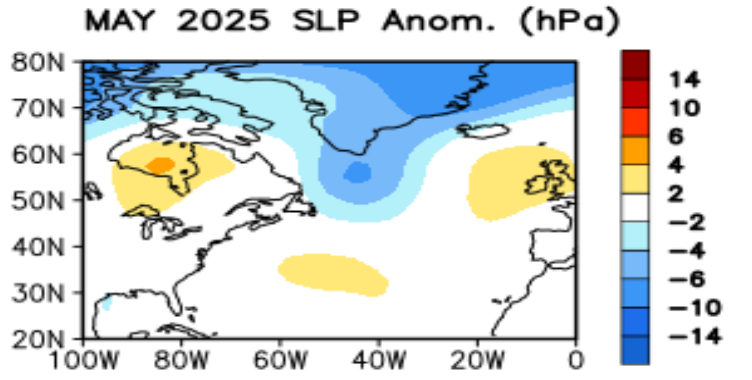
SSTA (top-left; OIv2.1 SST Analysis), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) (middle-left; NOAA 18 AVHRR IR), sea surface pressure (middle-right; NCEP CDAS), sum of net surface short- and long-wave radiation (bottom-left; positive means heat into the ocean; NCEP CDAS), sum of latent and sensible heat flux (bottom-right; positive means heat into the ocean; NCEP CDAS). Anomalies are departures from the 1991-2020 base period means.

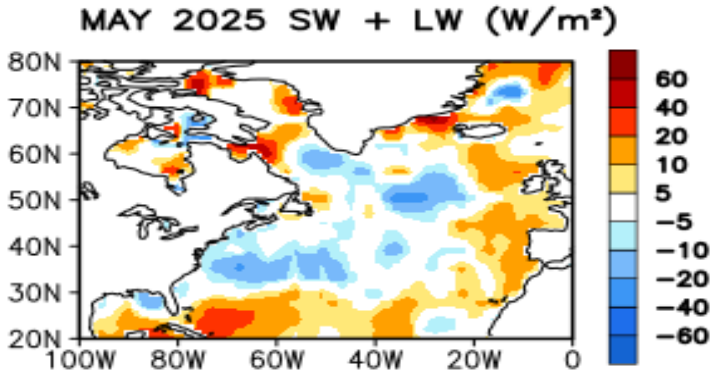
N. Atlantic: SST, SST tend., OLR, SLP, & heat flex anom.

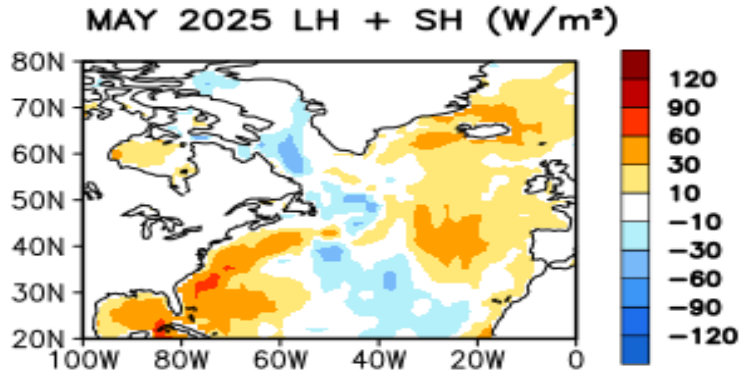












NOAA/NCEP Climate Prediction Center

Marine Heatwave Monitoring and Forecast

(This is an experimental webpage for NOAA/NWS/NCEP/CPC marine heatwave monitoring and forecast with foucus on the North Pacific and North Atlantic Oceans which directly affect U.S.A.)

- **Spatial Distribution: Global, N. Pacific & N. Atlantic**
  - Global Monthly Anomaly
    - SST
  - N. Pacific Anomaly
    - Pentad Subsurface Ocean Temperature: 5m 55m 105m 155m
    - Weekly SST Weekly SST2
    - Pentad 300m Ocean Heat Content
    - Pentad Ocean Surface Height
    - Pentad Surface Heat Flux
    - 3-month SST, SLP, & UV925
    - SST Tendency & 3-Month Heat Flux
    - Ocean Temperature Profile
    - GODAS Ocean Temperature Profile
  - N. Atlantic Anomaly
    - Weekly SSTA
    - Monthly MDR SSTA
    - 3-month SST, SLP, & UV925
    - SST Tendency & 3-Month Heat Flux
- **Indices & Time Series**
  - N. Pacific MHW Intensity & Area Indices: Weekly Monthly
  - Regional Mean SST:
    - Global Monthly & Nino3.4 Since 1854
    - N. Pacific Weekly
    - Gulf of Alaska & Subtropical Coast Weekly
- **NMME & CFSv2 Forecasts**
  - Tropical N. Atlantic SSTA: NMME CFSv2
  - N. Pacific SSTA: NMME CFSv2
  - CFSv2: N. Pacific Sea Surface Height Anomaly
  - CFSv2 SSTA Index: Last month Last 9 months
- **Links**
  - NOAA PSL
  - NOAA Fisheries
  - International Working Group

NOAA/NWS/NCEP CPC Marine Heat Wave Webpage

https://www.cpc.ncep.noaa.gov/products/GODAS/MarineHeatWave.html