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

Prepared by

Climate Prediction Center, NCEP/NOAA

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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

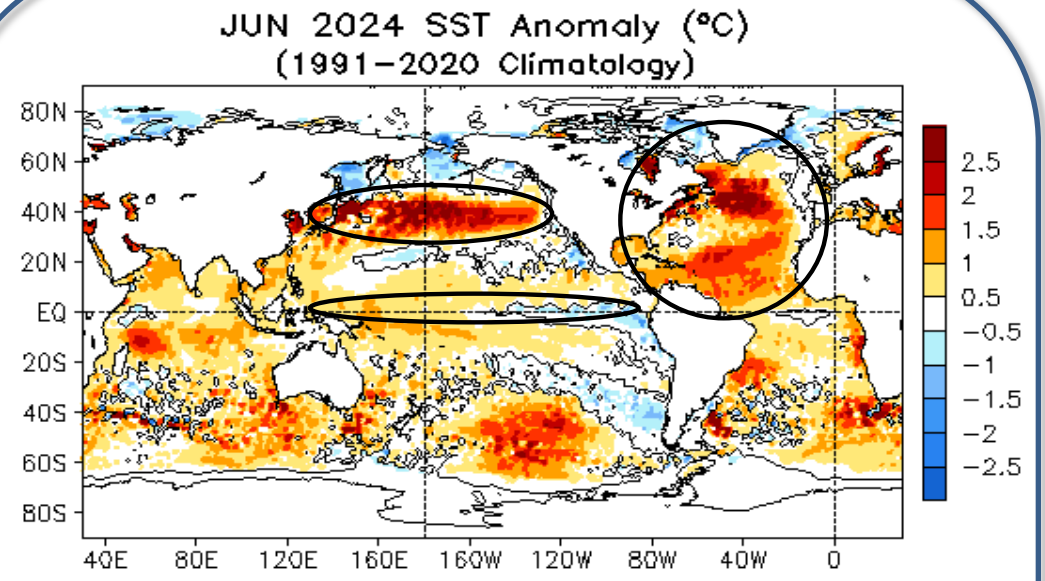
- Overview
- Recent highlights
  - Pacific Ocean
  - Arctic & Antarctic Oceans
  - Indian Ocean
  - Atlantic Ocean
- Global SSTA Predictions

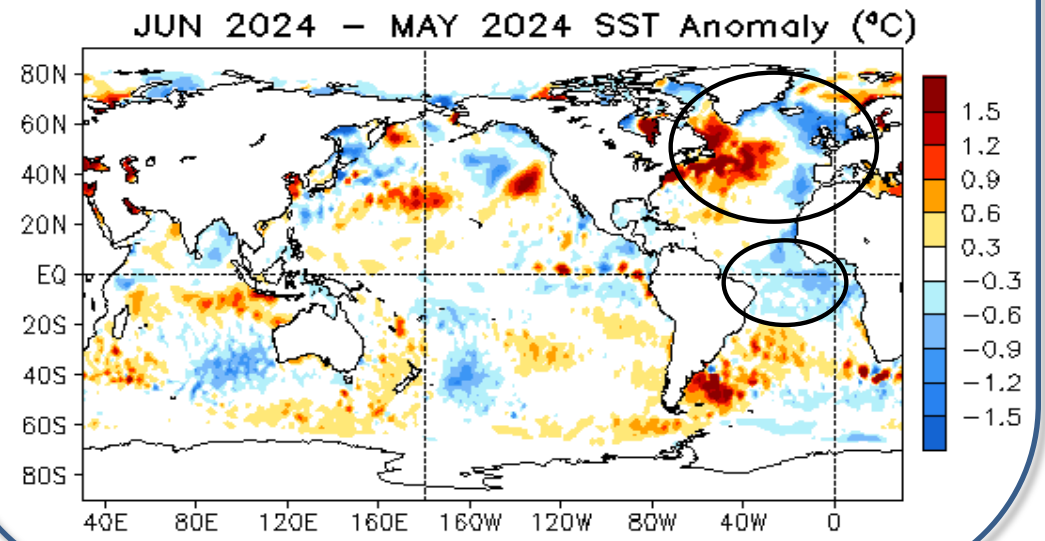
Overview

- Pacific Ocean
  - ENSO neutral conditions persisted with Niño3.4 = 0.2°C in Jun 2024.
  - NOAA "ENSO Diagnostic Discussion" on 11 Jul 2024 *continued with "La Niña Watch."*
  - The positive SSTA in the North Pacific continued and the negative phase of PDO strengthened with PDOI = -2.4 in Jun 2024.
  - Strong subsurface warming has persisted in the central North Pacific Ocean since 2020.
- Arctic & Antarctic Oceans
  - The average Arctic sea ice extent for Jun 2024 was 10.9 million km^2, ranking the 12^{th} lowest Jun since 1979.
  - Antarctic sea ice extent continues to track at the 2^{nd} historical low value.
  - CPC forecasts a below-normal Arctic sea ice extent minimum in Sep 2024.
- Indian Ocean
  - Positive SSTAs dominated the tropical Indian Ocean basin in Jun 2024.
  - The Indian Ocean dipole (IDO) was neutral in Jun 2024. Most of NMME models suggest that IOD will remain neutral through winter 2024.
- Atlantic Ocean
  - NOAA's outlook for the 2024 Atlantic Hurricane Season indicates that an above-normal season is most likely.
  - Strong Marine heat waves have persisted in the north tropical Atlantic since May 2023.

Global Oceans

Global SST Anomaly (°C) and Anomaly Tendency



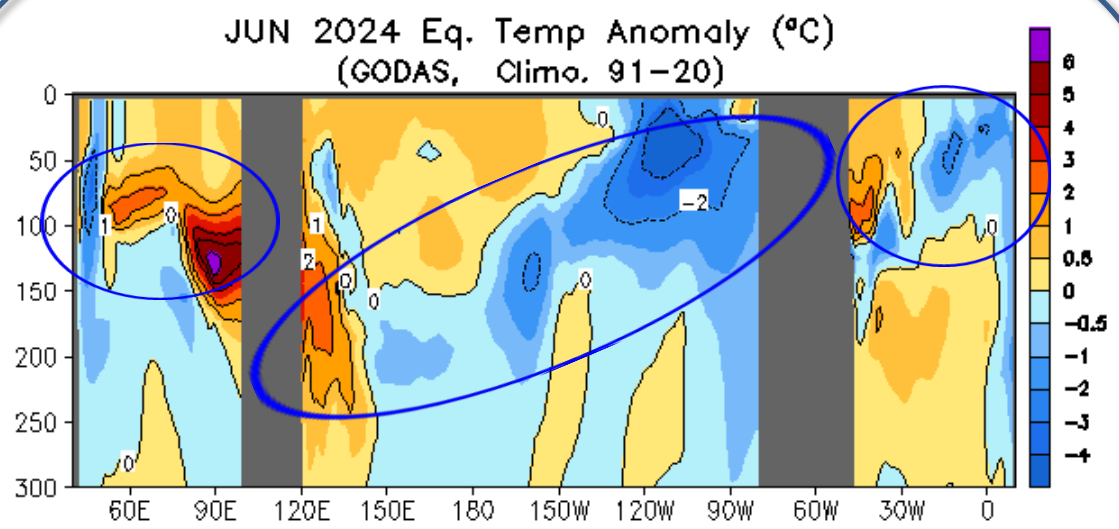


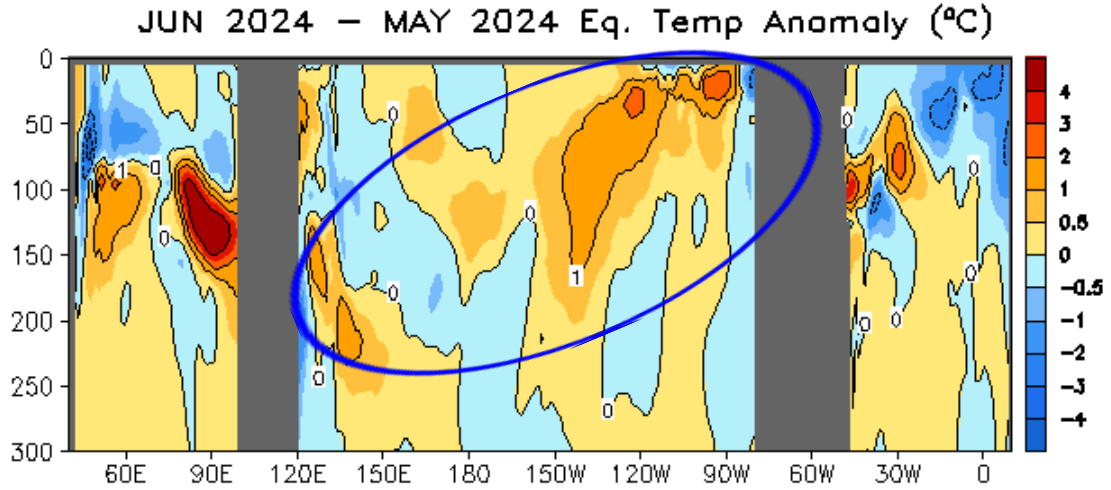
- SSTs were above average in the west-central Pacific Ocean, while near to below average SSTs were present in the eastern Pacific.
- Strong positive SSTAs were observed in the mid-latitude of North Pacific.
- Positive SSTAs dominated the Atlantic, Indian and Southern Oceans.

- Positive (negative) SSTA tendencies were present in the western (eastern) North Atlantic Ocean.
- SSTA tendencies were mostly negative in the tropical Atlantic Ocean.

SSTAs (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.

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



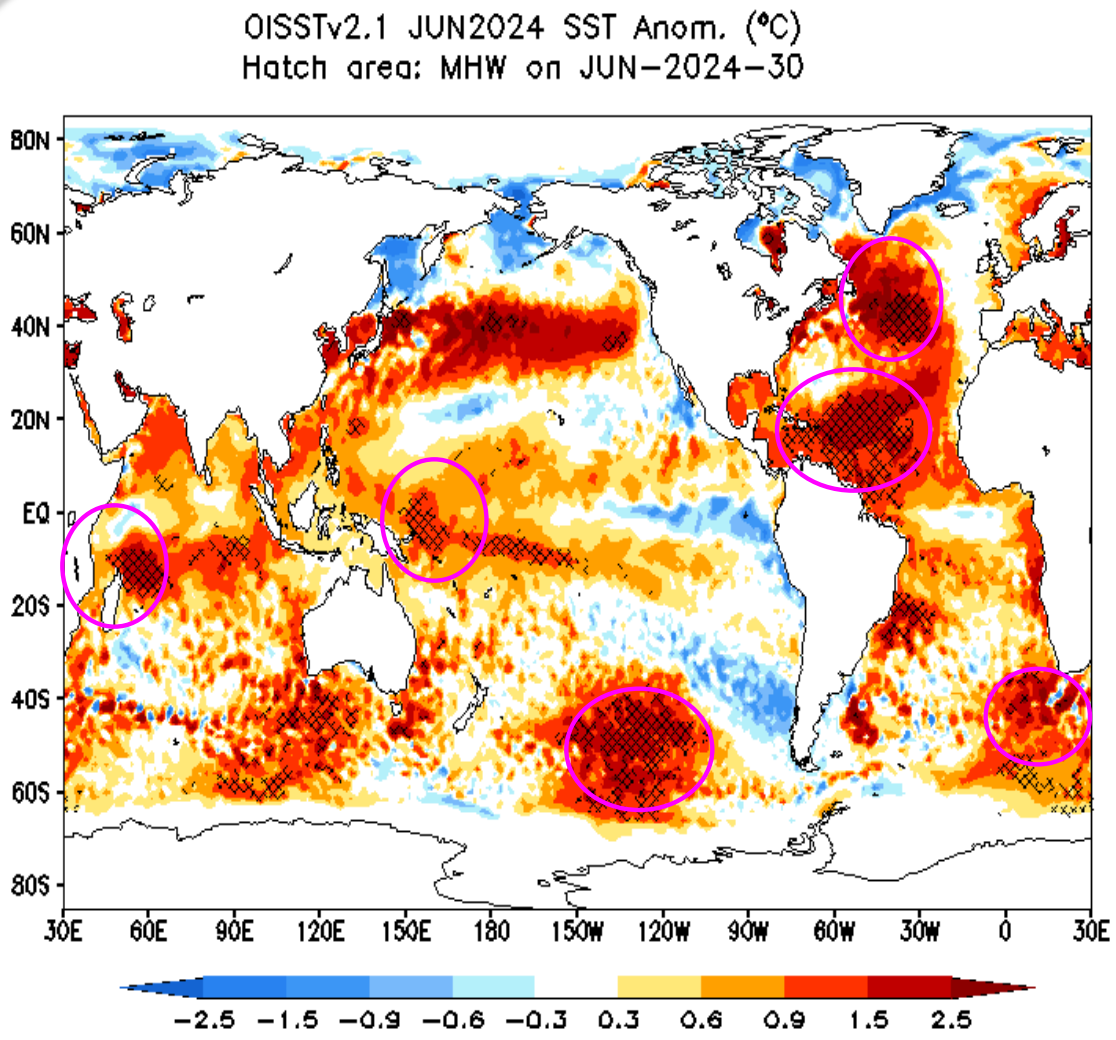


- Negative temperature anomalies persisted near the central-eastern thermocline in the Pacific.
- Positive temperature anomalies dominated the upper 150m of Indian Ocean.
- Negative temperature anomaly was present near the thermocline in the Atlantic Ocean.

- Positive temperature anomaly tendency dominated the Pacific Ocean.
- Both positive and negative anomaly tendencies were present along the thermocline in the Atlantic Ocean.

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.

Global Monthly SST anomaly and Marine Heat Waves

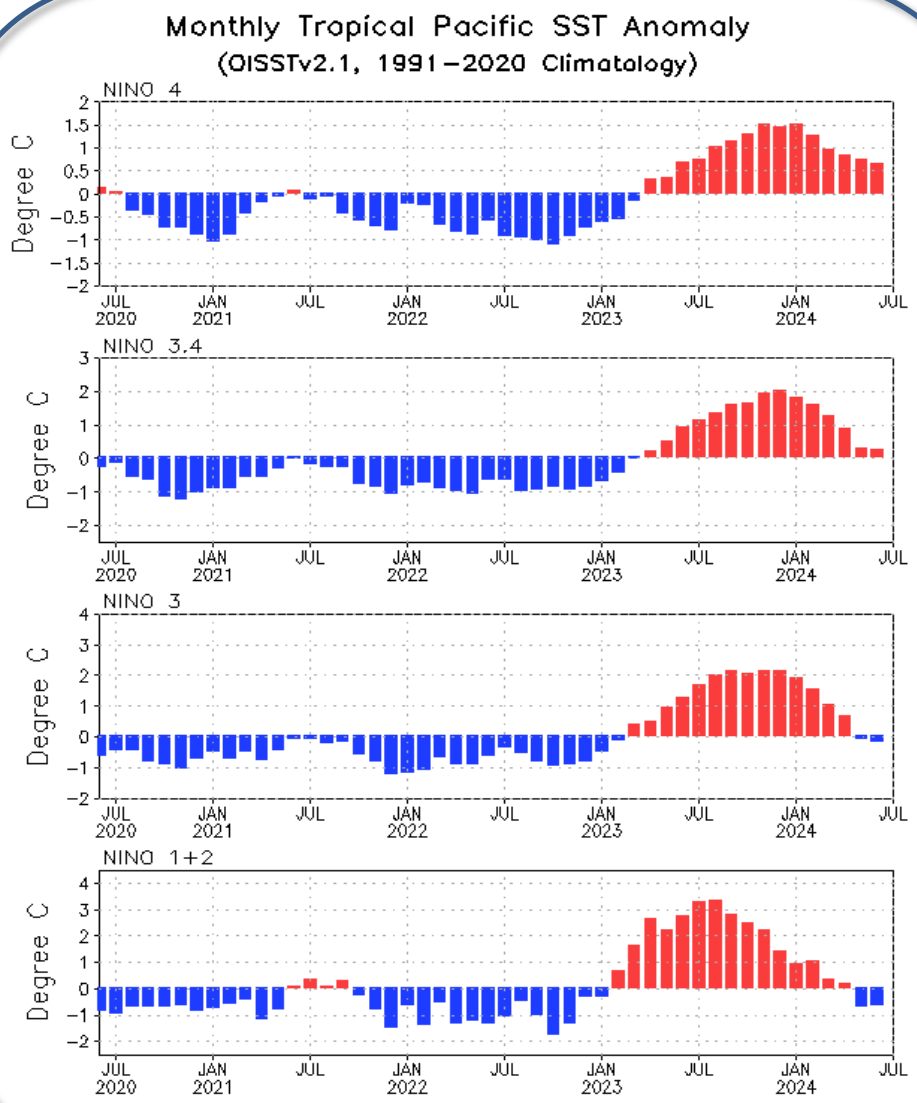


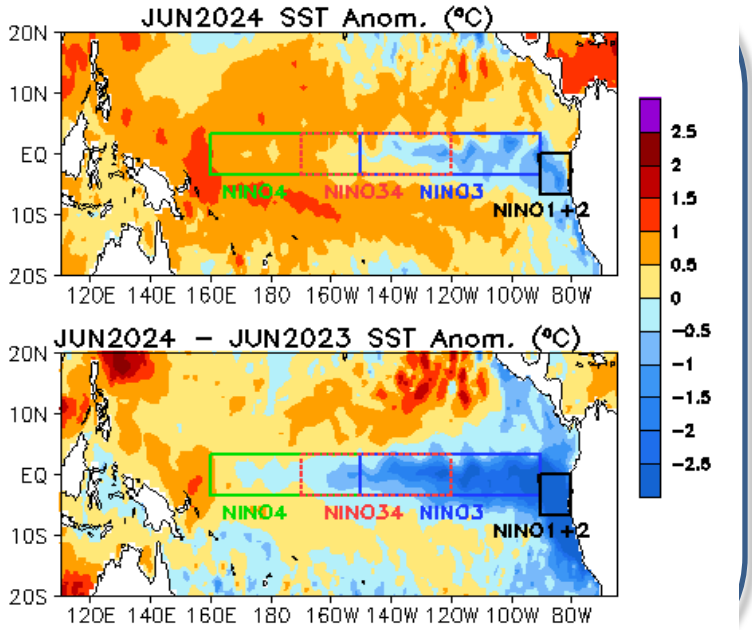
- MHWs were observed in much of the north tropical Atlantic, east of Newfoundland, western equatorial Pacific, portions of the Southern Oceans and north of Madagascar.

((Left panel) Monthly SST anomaly (shaded) and locations experiencing marine heat waves (hatched) by the end date labelled in the plot. (right panel) SST evolution at a specific location. Green line and blue line are the 90th percentile and daily climatology, respectively. Shaded area denotes the periods experiencing MHW. MHW is defined as a prolonged warming exceeding 90th percentile of daily SST for at least 14 consecutive days. Data is derived from NCEI OISSTv2.1 and the reference period is 1991-2020

Tropical Pacific Ocean and ENSO Conditions

Evolution of Pacific Niño SST Indices

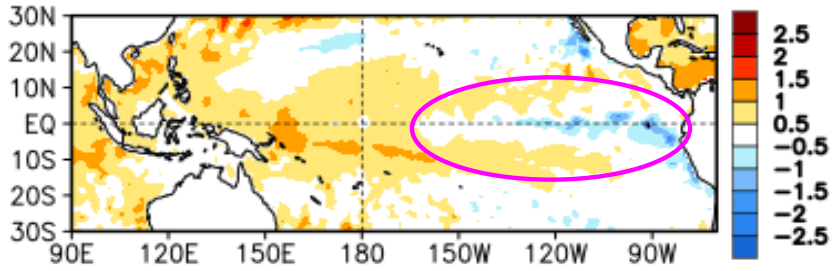


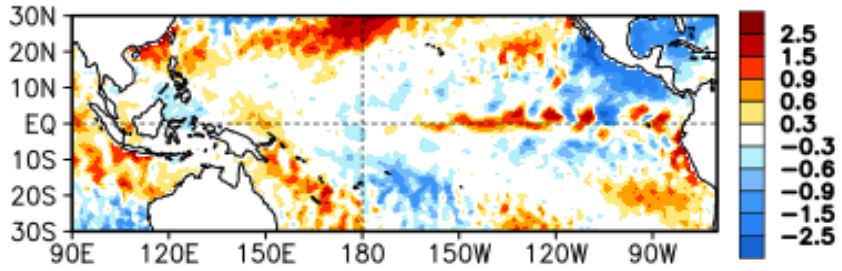


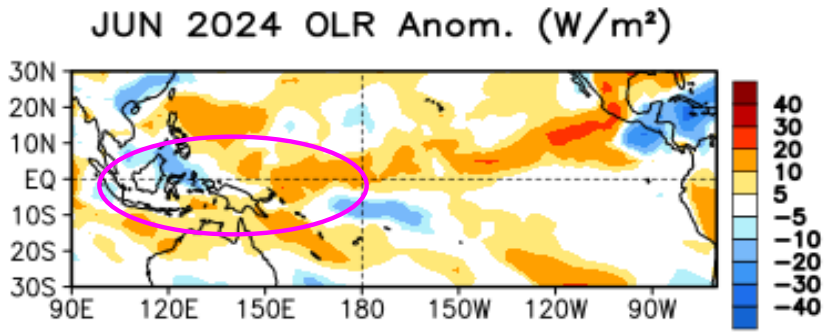
- Both Niño3.4 and Niño3 were near average in Jun 2024, with Niño3.4 = 0.2°C.
- Niño4 remained above 0.5 °C.
- Compared with Jun 2023, the tropical eastern Pacific was cooler in Jun 2024
- The indices may have differences if based on different SST products.

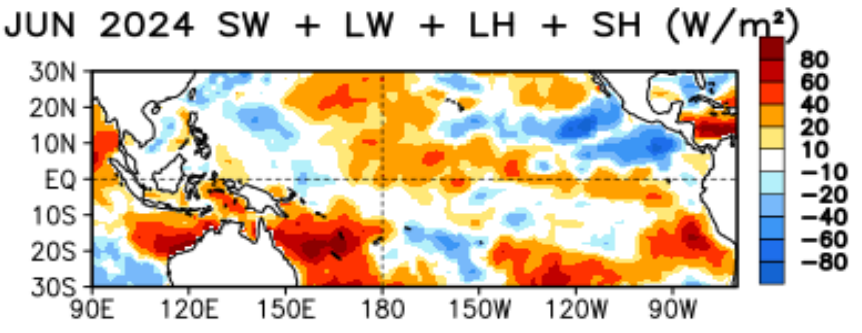
Niño region indices, calculated as the area-averaged monthly mean SSTAs (°C) for the specified region. Data are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020 base period means.

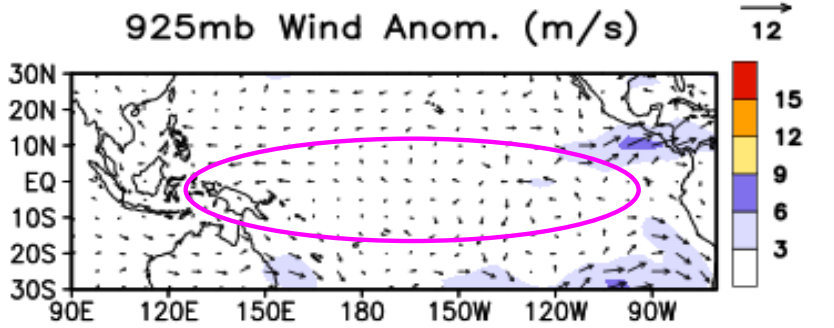
Tropical Pacific: SSTA, SSTA Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Winds

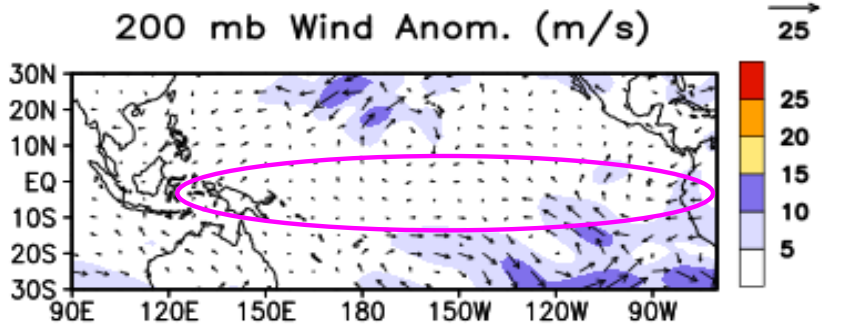






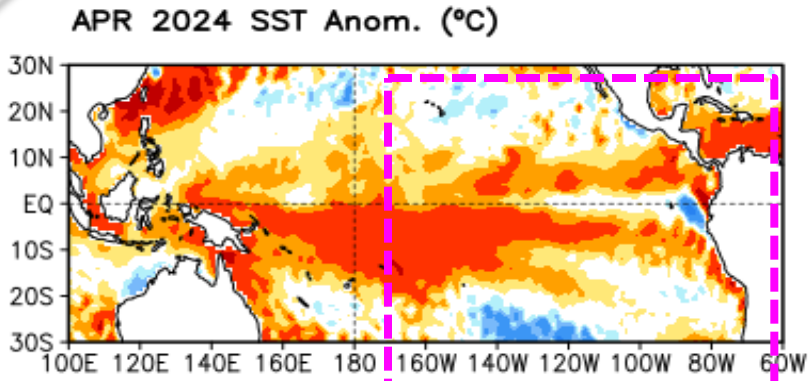


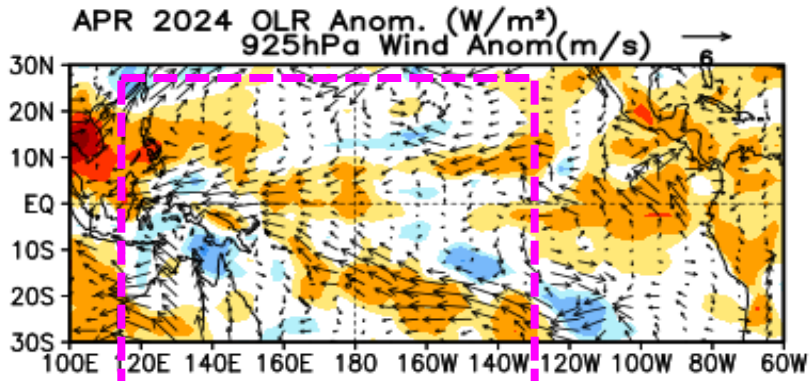


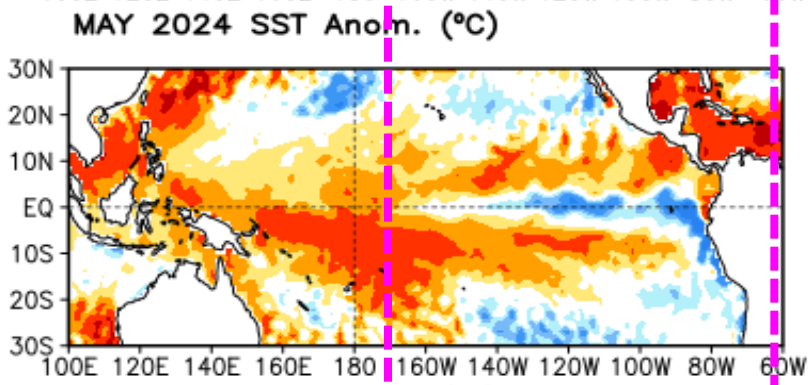


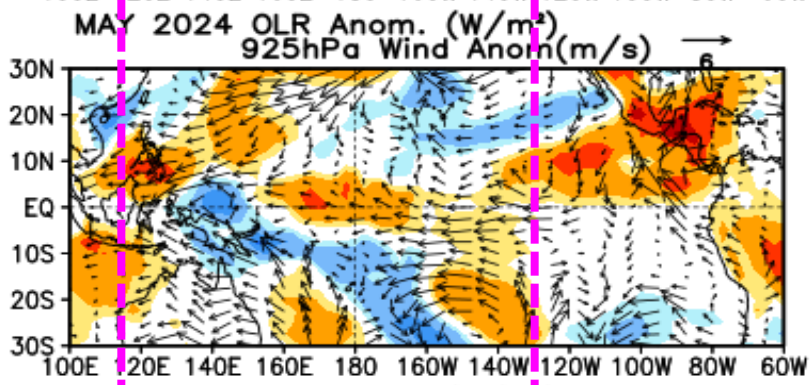
SSTAs (top-left), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right; positive means heat into the ocean), 925-mb wind anomaly vector and its amplitude (bottom-left), 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.

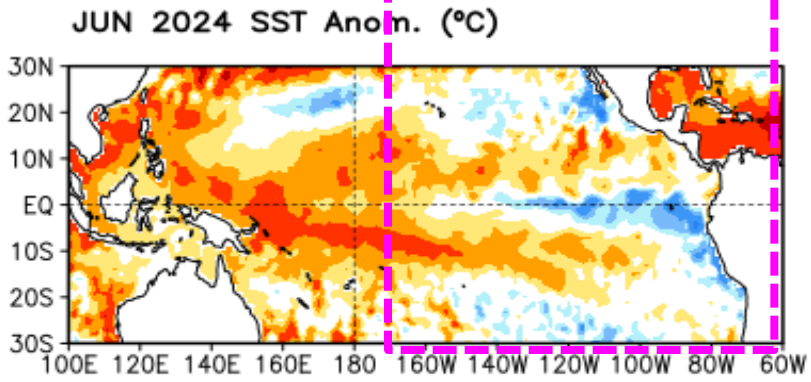
Last 3- month tropical Pacific SST, OLR, and uv925 anomalies

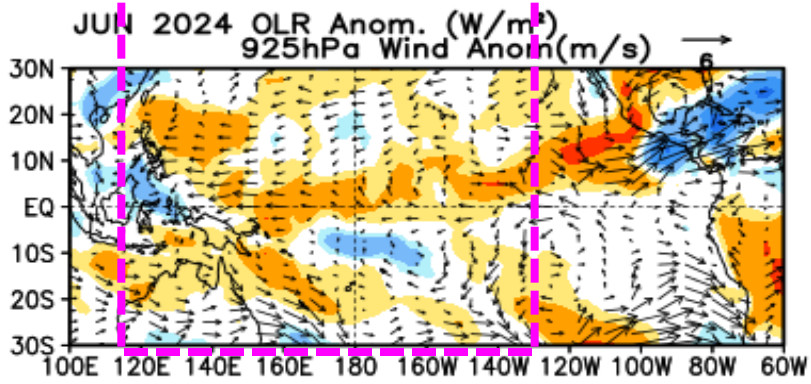


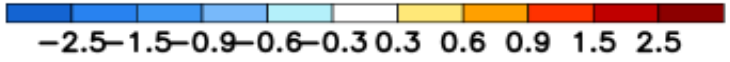


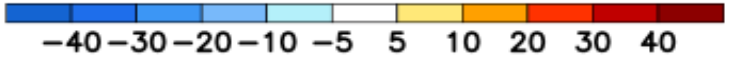




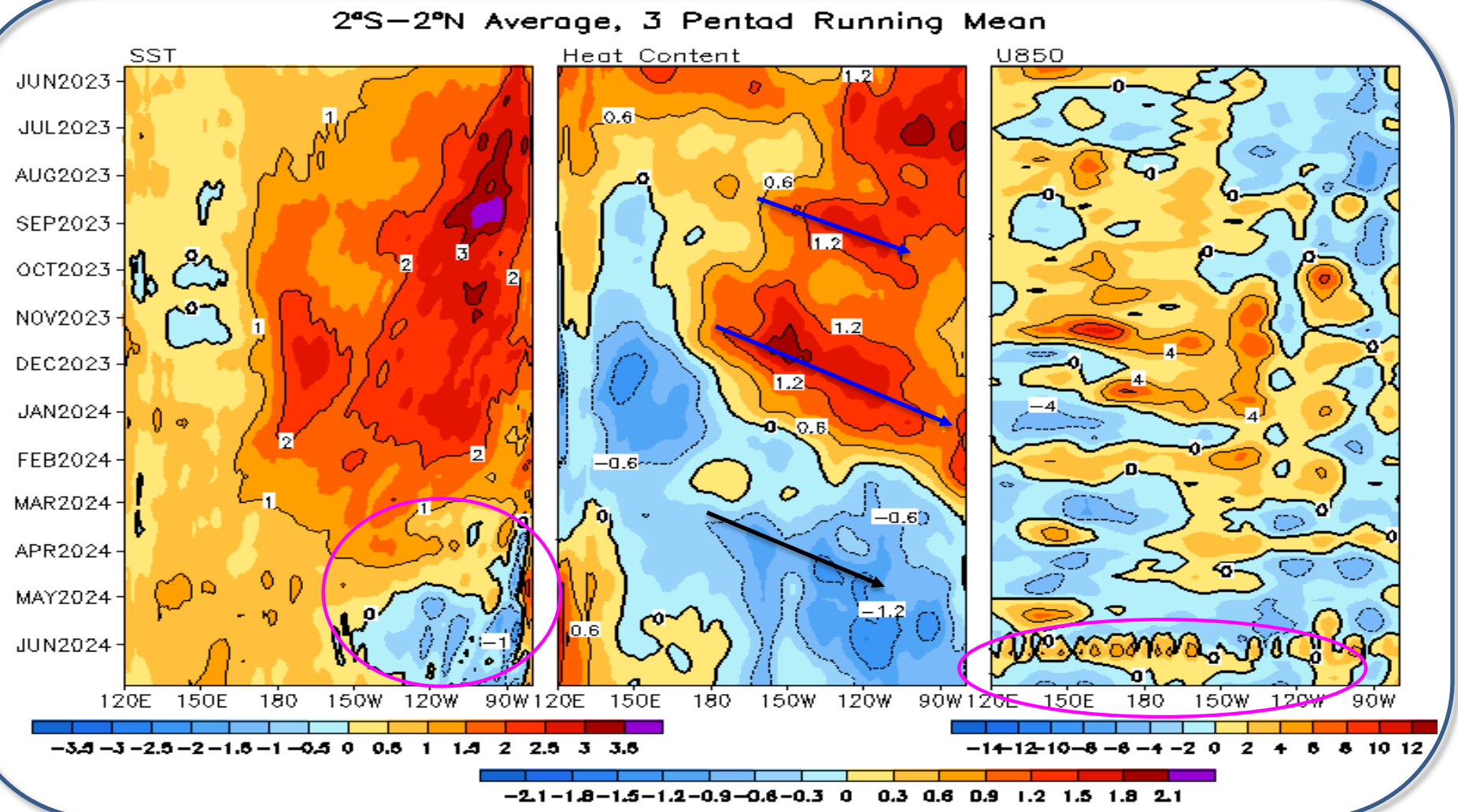








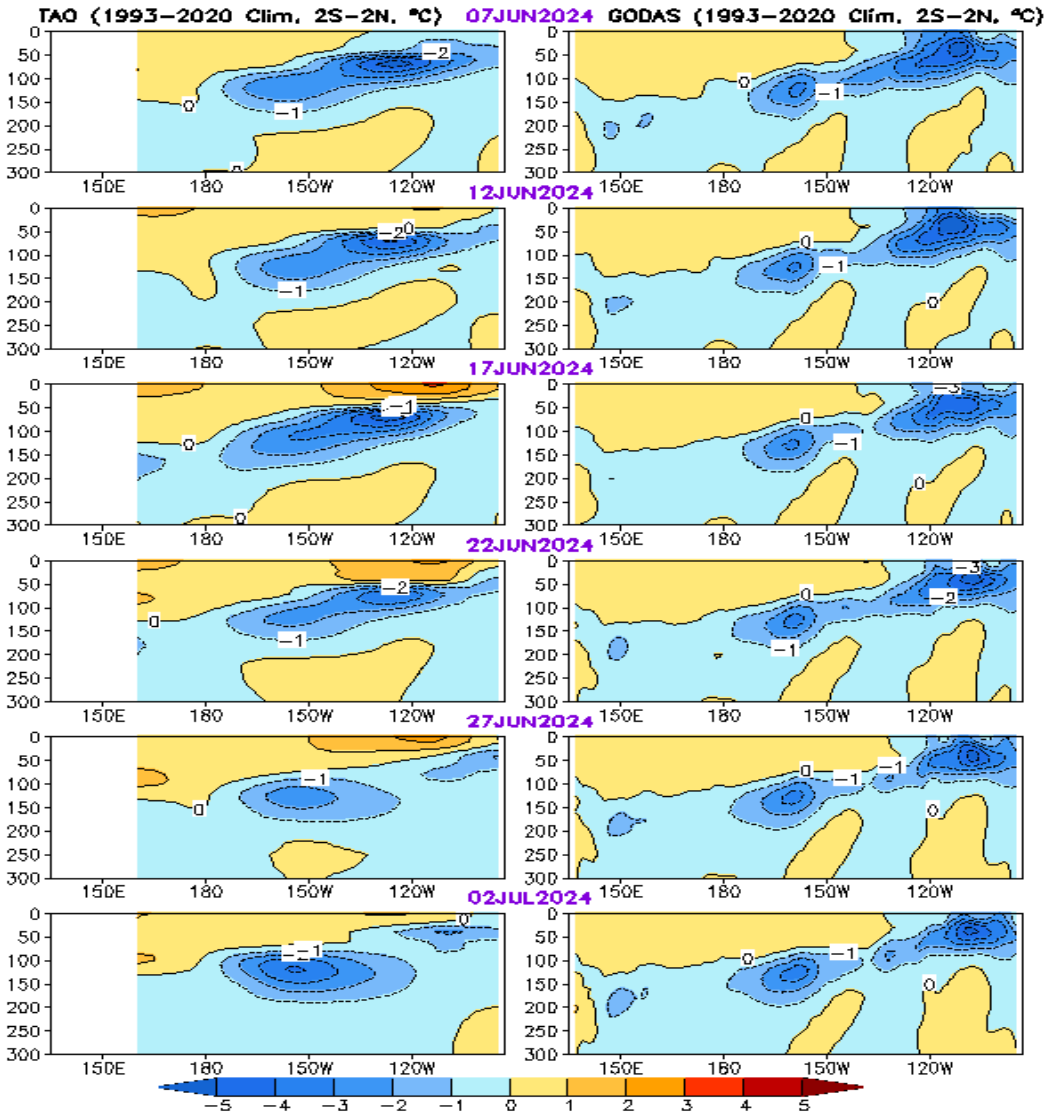
Equatorial Pacific SST (°C), HC300 (°C), u850 (m/s) Anomalies



- Negative SSTA have emerged in the far eastern Pacific since Mar 2024, and then extended westward. The below average area contracted slightly in Jun 2024.
- Negative H300 anomaly has persisted in the central-eastern Pacific since Mar 2024.
- Westerly wind anomalies were present over much of equatorial Pacific during early Jun, contributing to weakened SSTA in the eastern Pacific.

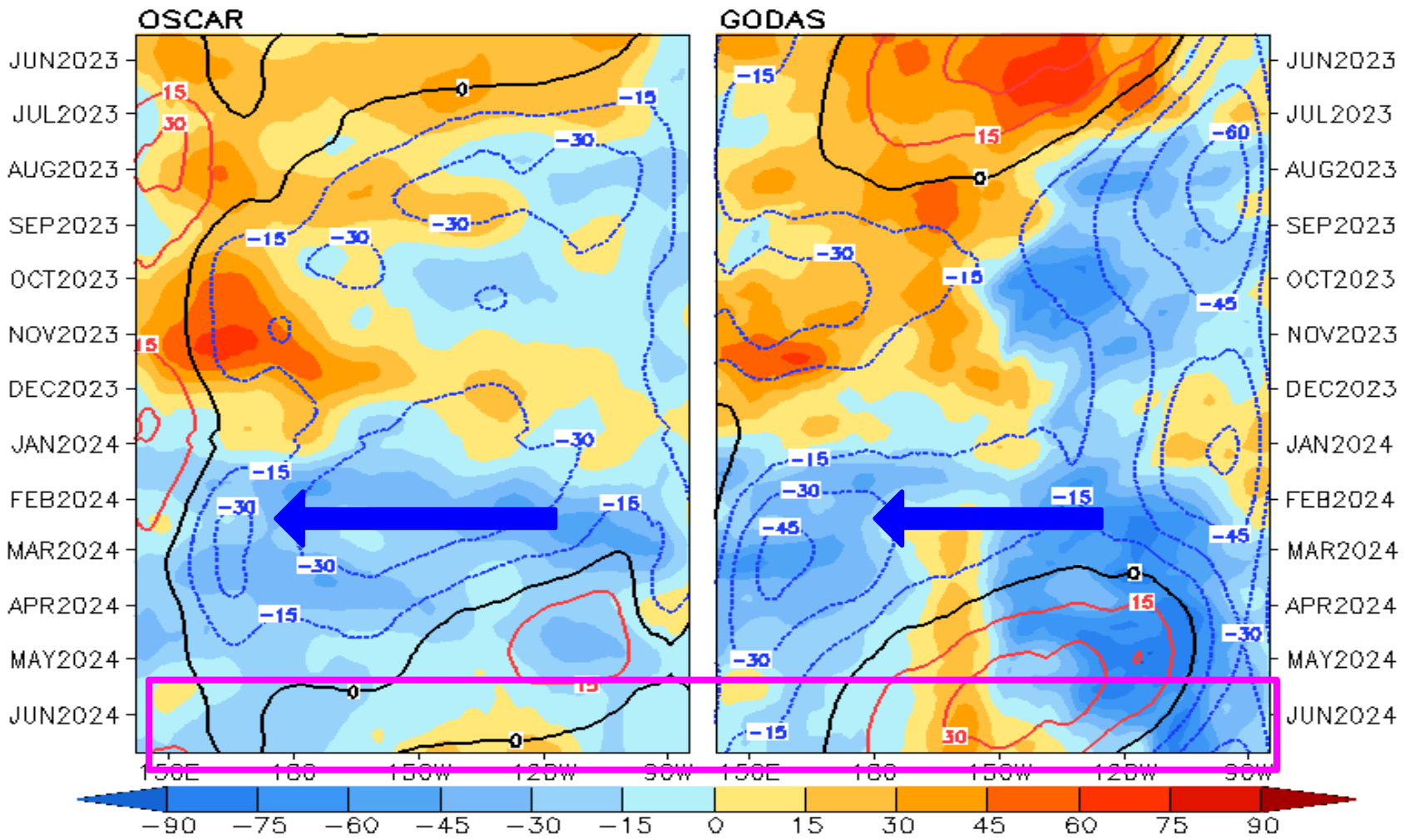
Equatorial Pacific Ocean Temperature Pentad Mean Anomaly

TAO GODAS



- Negative ocean temperature anomalies near the central-eastern Pacific persisted during the last six pentads.
- Positive SSTA reemerged east of 150ºW in TAO, while negative SSTA persisted in GODAS.

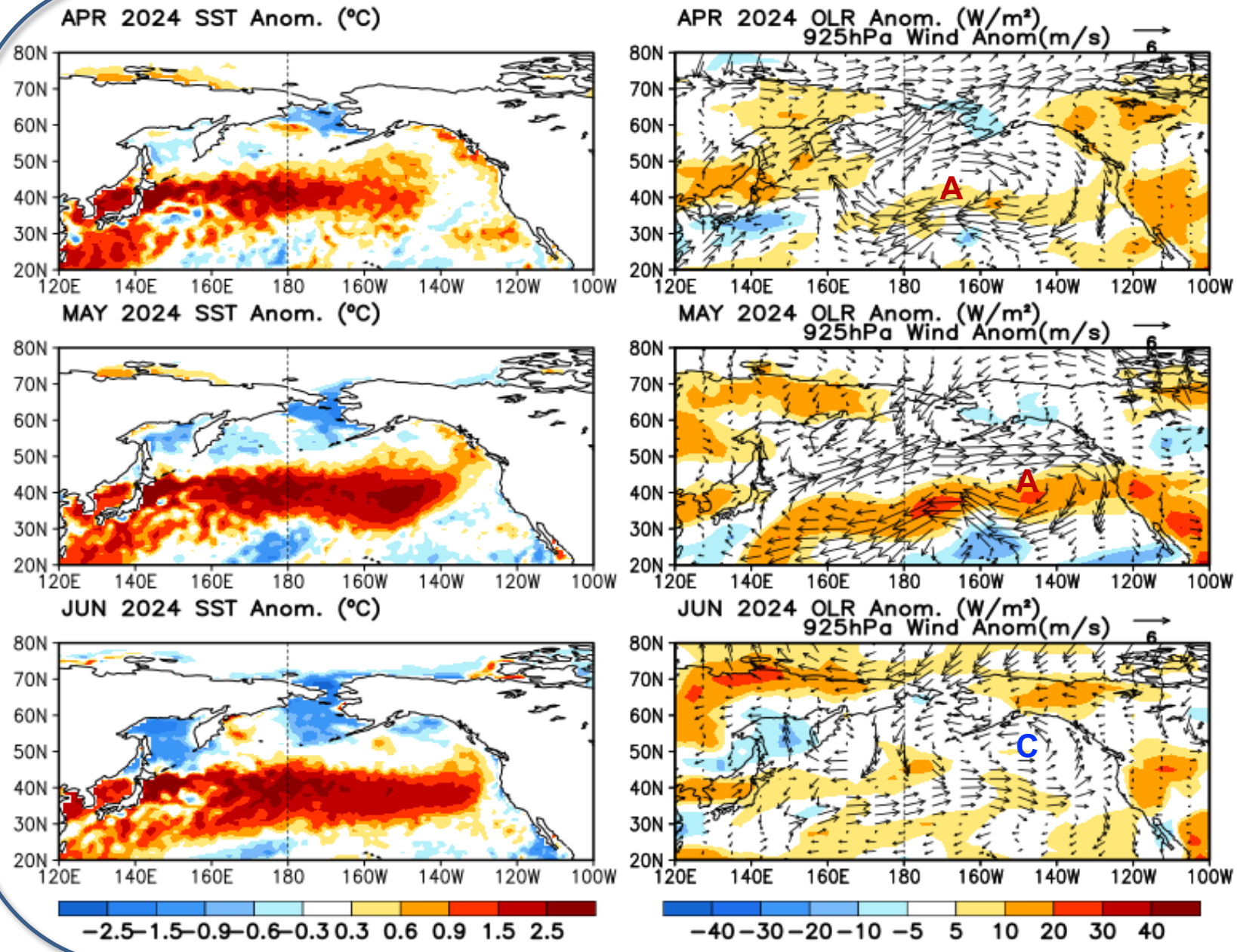
Evolution of Equatorial Pacific Surface Zonal Current Anomaly (cm/s)



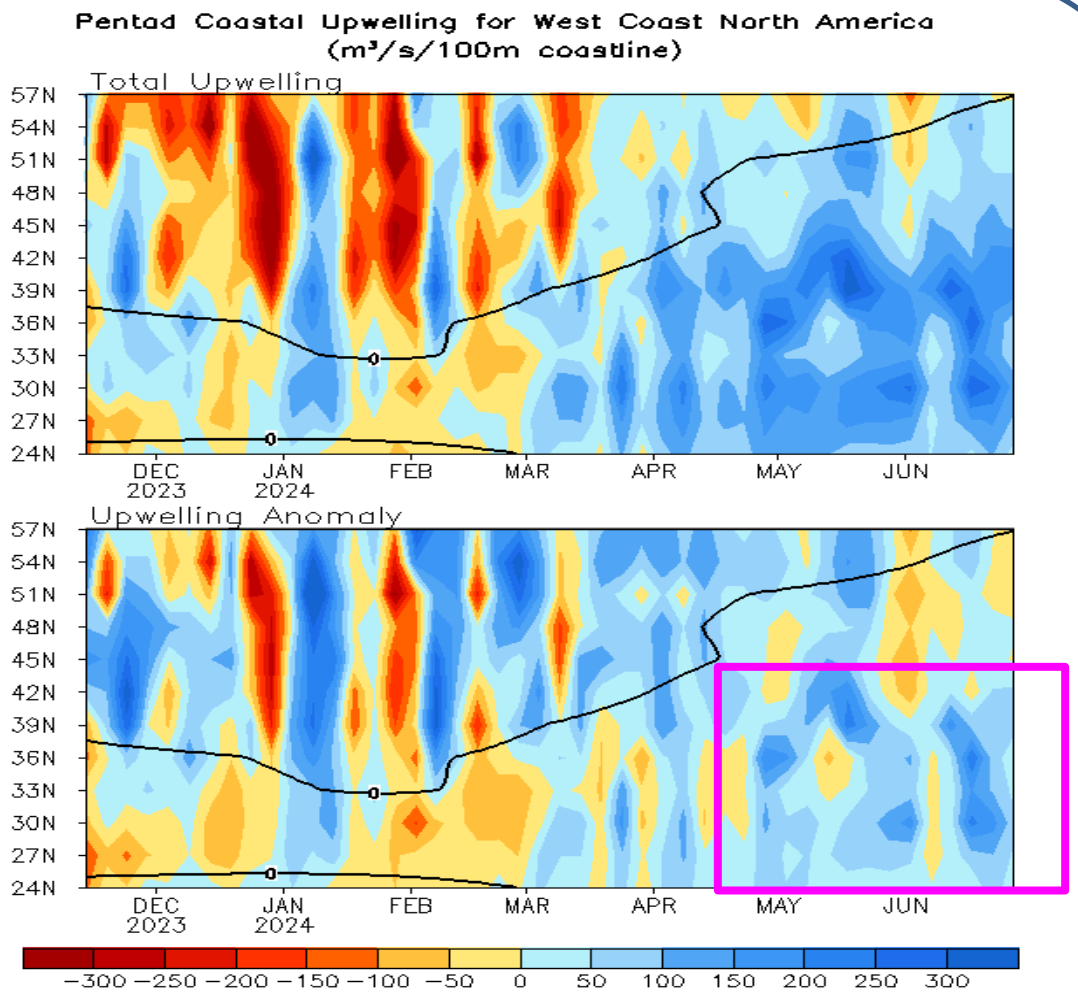
- Anomalous westward currents have been observed since mid-Dec 2023 and weakened since May 2024.
- Anomalous eastward current emerged in the central-eastern Pacific in Jun 2024, which were consistent with the weakened SST cooling in the eastern Pacific.

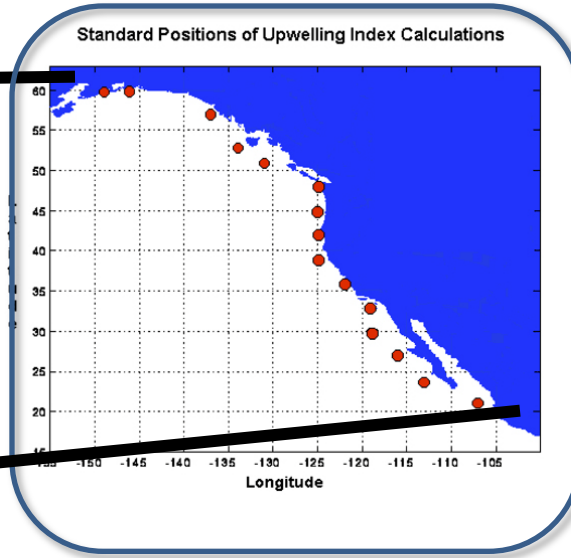
North Pacific & Arctic Oceans

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



North America Western Coastal Upwelling

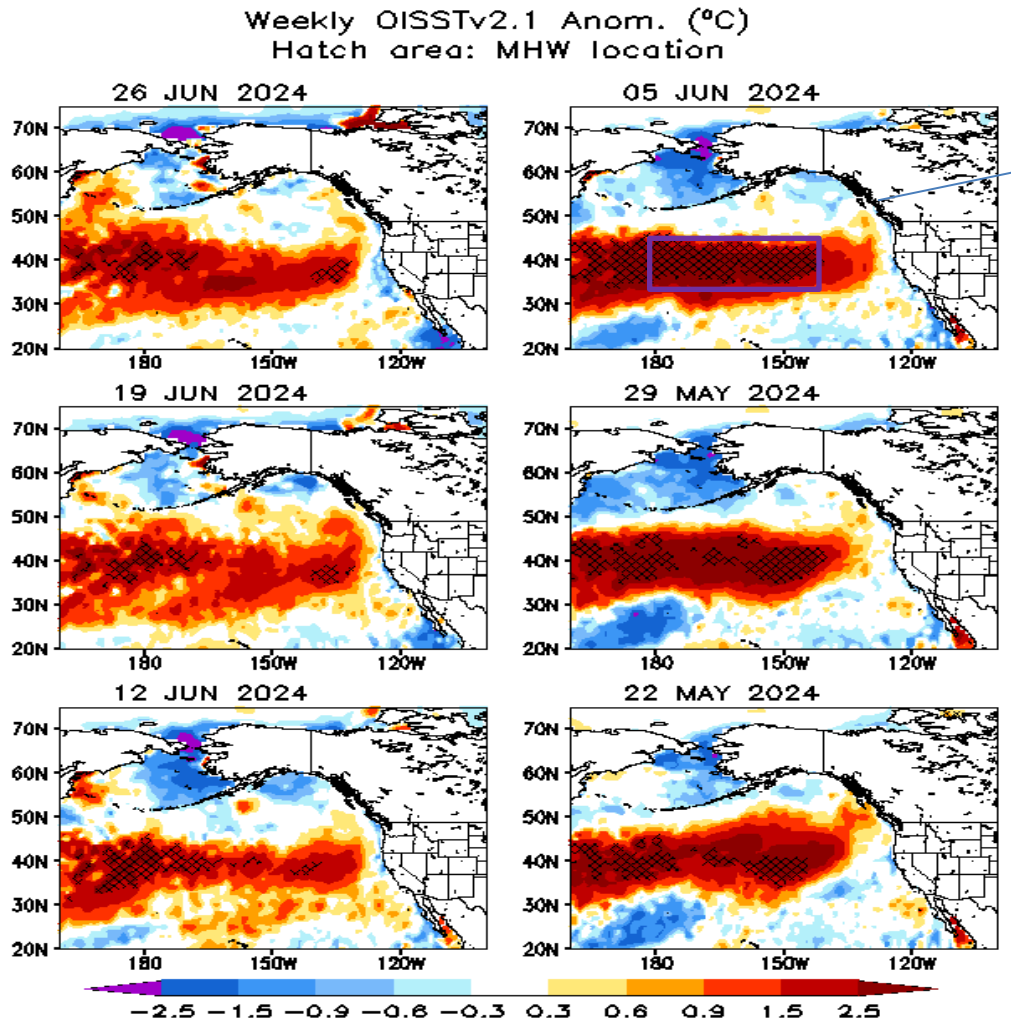


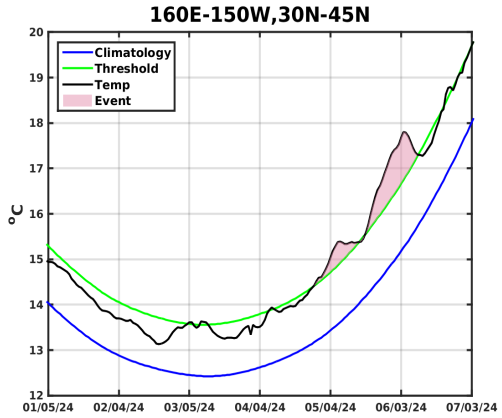


- Anomalous upwelling dominated south to 40N since May 2024, contributing to SST cooling along the coast.

(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 (m³/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.

Weekly SST anomaly and MHWs in the North Pacific

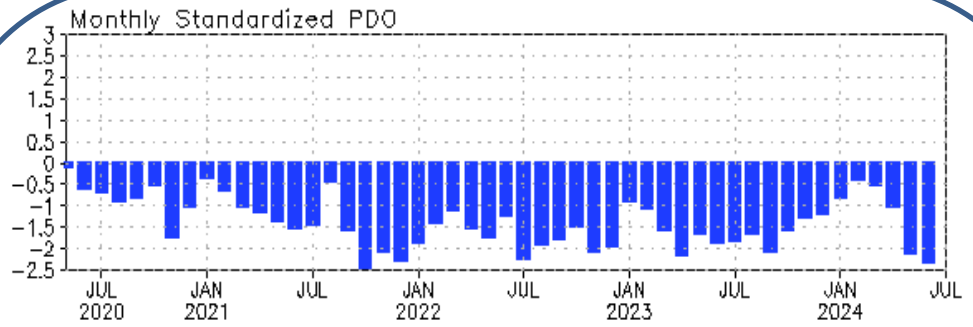


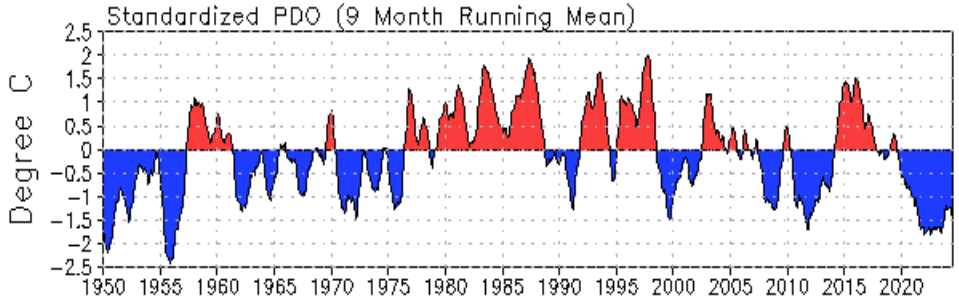


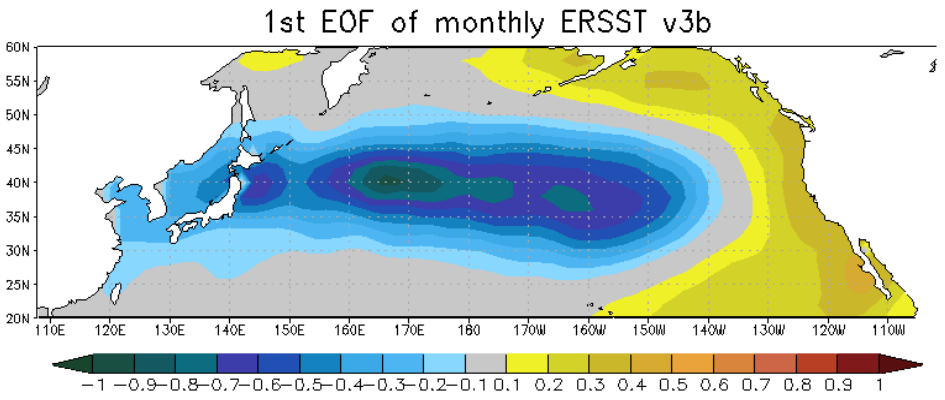
- MHWs has persisted in the central North Pacific since early May andthe amplitude weakened slightly in late June.

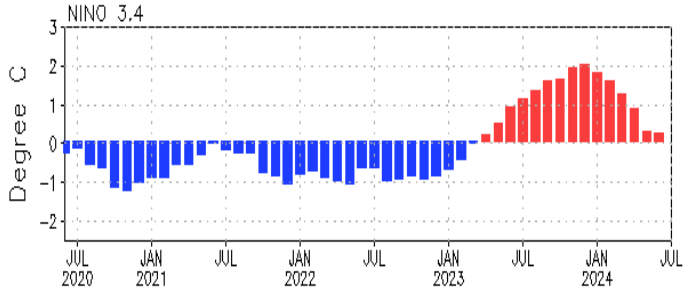
(Left panel) Weekly SST anomaly (shaded) and locations experience Marine heat waves (hatched) by the date labelled in the plot. (right panel) SST evolution at a specific location. Green line and blue line denote the seasonal 90th percentile and daily climatology, respectively. Shaded area denotes the periods experiencing MHW. MHW is defined as a discrete prolonged warmer than 90th percentile of daily SST for at least 14 days. Data is derived from NCEI OISSTv2.1 and the climatology reference period is 1991-2020

Pacific Decadal Oscillation (PDO) Index





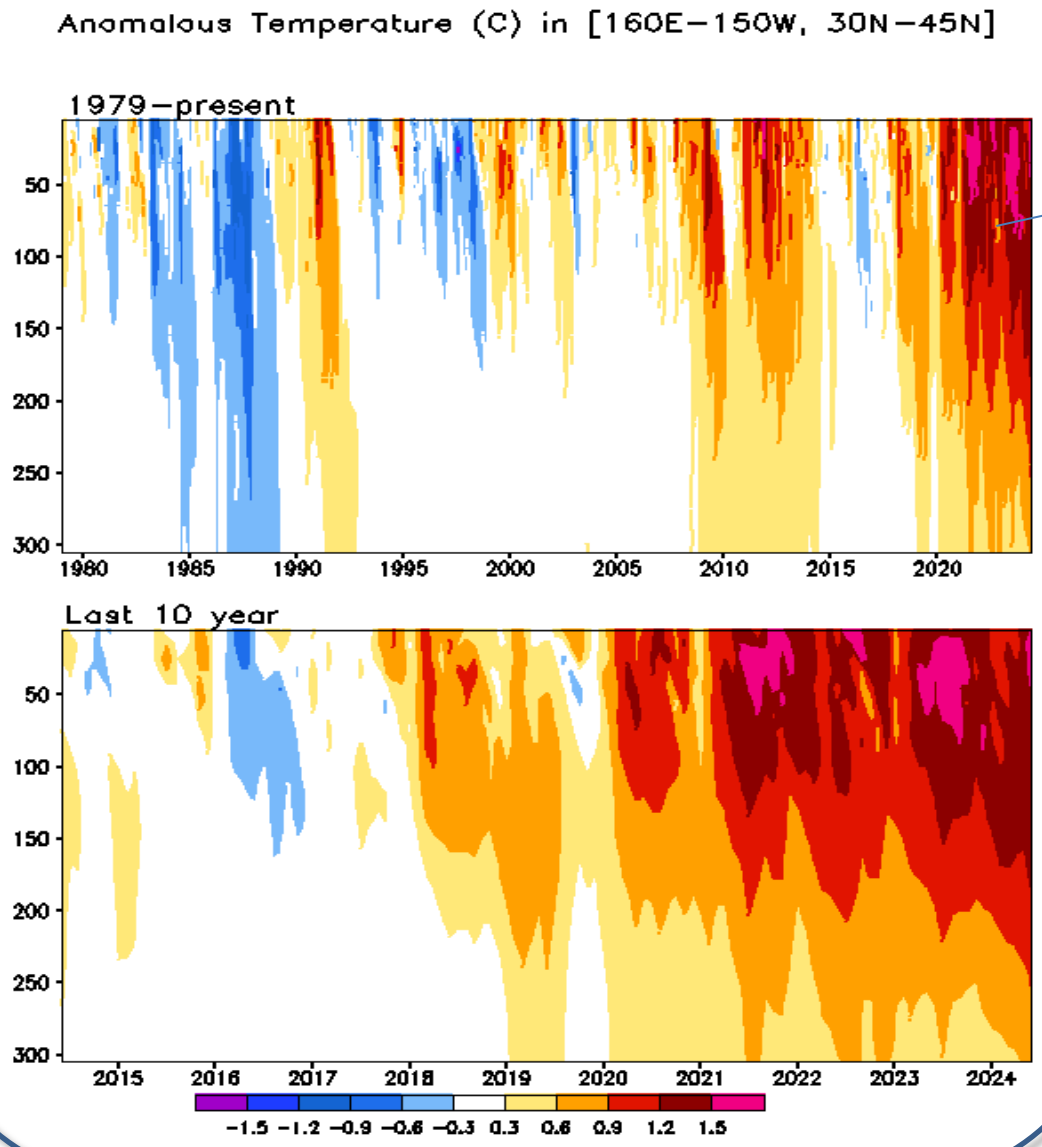


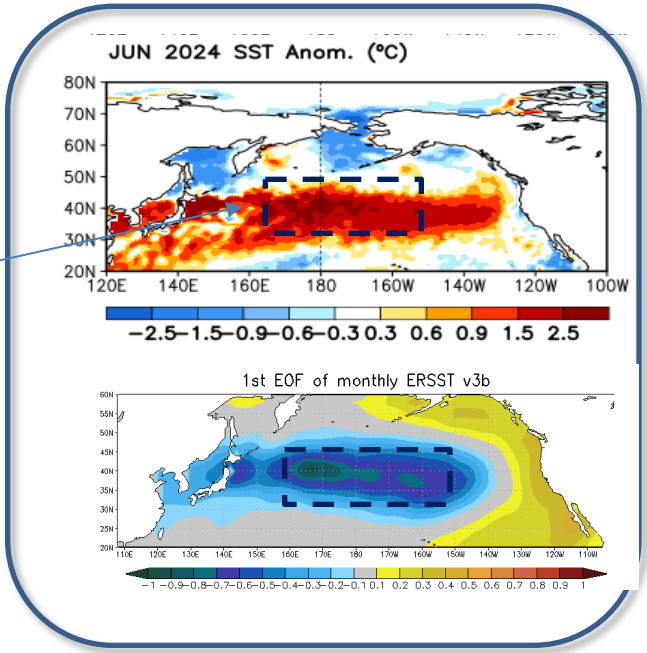


- The PDO has been in a negative phase since Jan 2020 and strengthened with PDOI = -2.4 in Jun 2024.
- Statistically, ENSO leads PDO by 3-4 months, through teleconnection via atmospheric bridge, with El Niño (La Niña) associated with positive (negative) PDO Index, but this relationship weakened in recent years.

• 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.

Subsurface Temperature Anomaly in the Northcentral Pacific

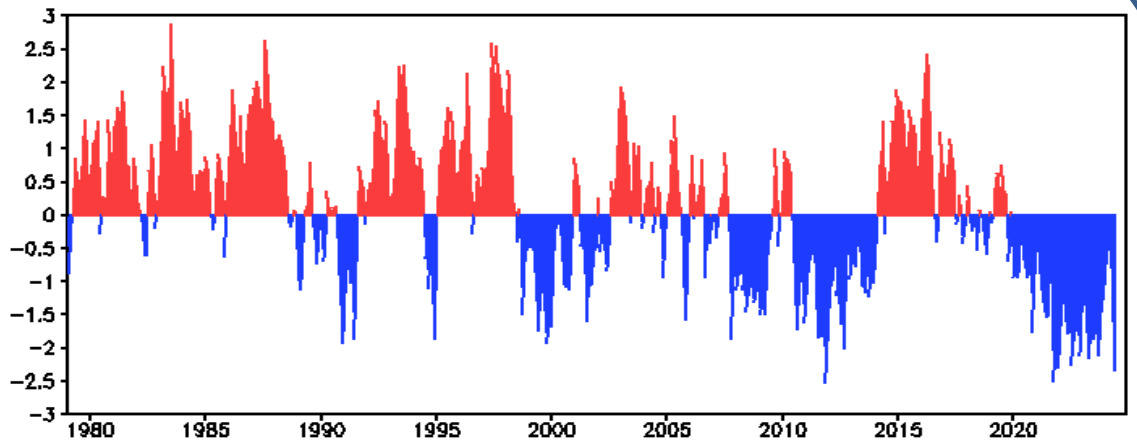




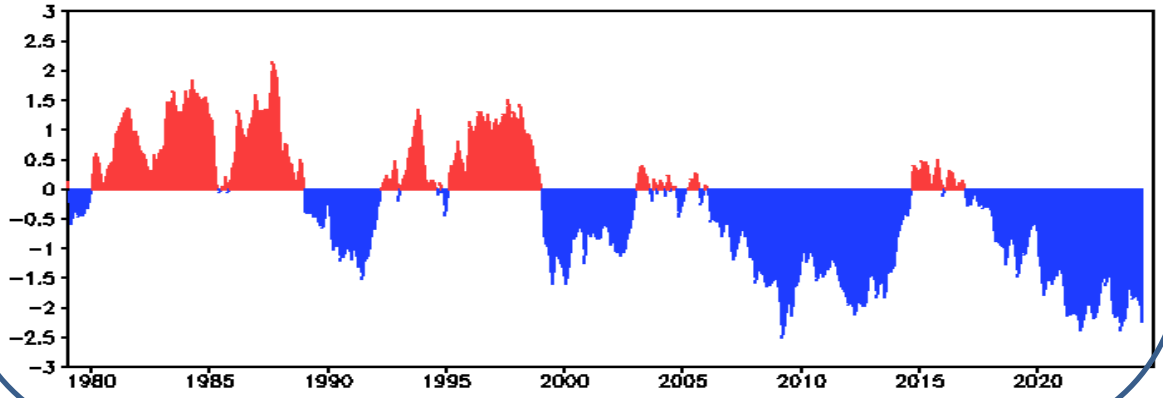
- Positive temperature anomaly (>0.9ºC) has persisted in the upper 100m since 2020, and penetrated to 250m in Jun 2024.
- Subsurface warming in the last four years is the strongest episode since 1979.

Two Oceanic PDO indices

SST-based PDO (Wen et al. 2014: GRL)



H300-based PDO (Arun and Wen 2016:Mon.Wea.Rev.)



- The negative phase of PDO has persisted since Jan 2020 with PDOI = -2.4. in Jun 2024.

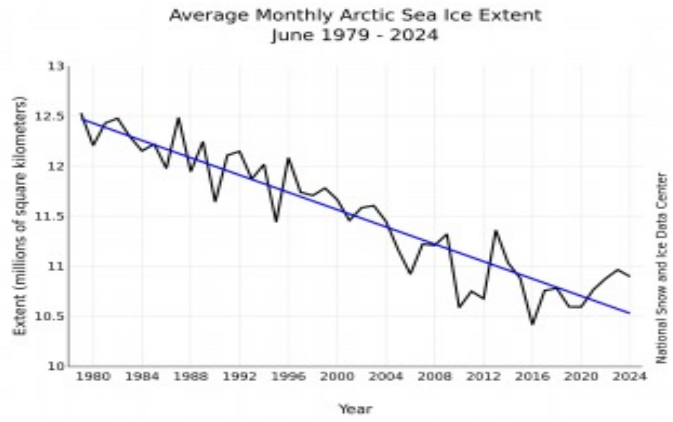
- Negative H300-based PDO index has persisted since Nov 2016, with HPDO = - 2.3 in Jun 2024.

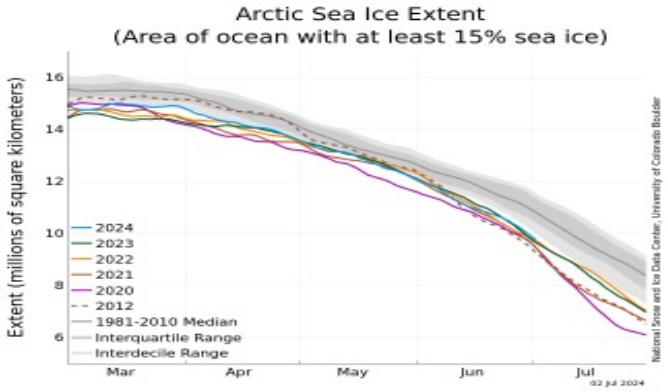
- SST-based PDO index has considerable variability both on seasonal and decadal time scales.

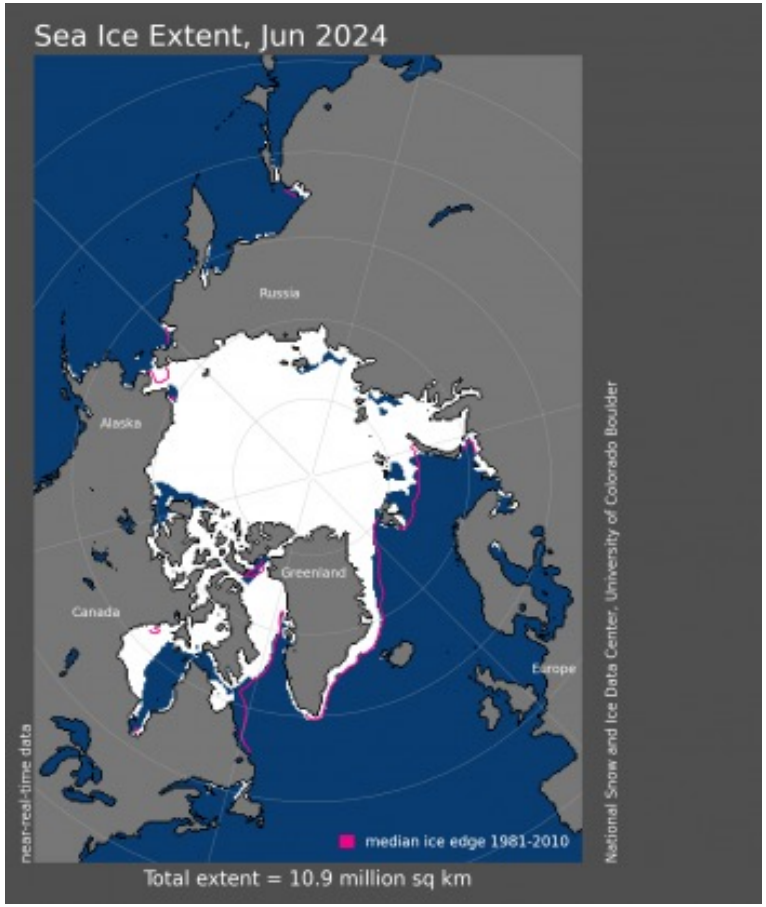
- H300-based PDO index highlights the slower variability and encapsulates an integrated view of temperature variability in the upper ocean.

SST-based 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 ERSSTv5 SST anomalies onto the 1st EOF pattern. H300-based Pacific Decadal Oscillation is defined as the projection of monthly mean H300 anomalies from NCEP GODAS onto their first EOF vector in the North Pacific. PDO indices are downloadable from https://www.cpc.ncep.noaa.gov/products/GODAS/ocean_briefing.shtml.

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

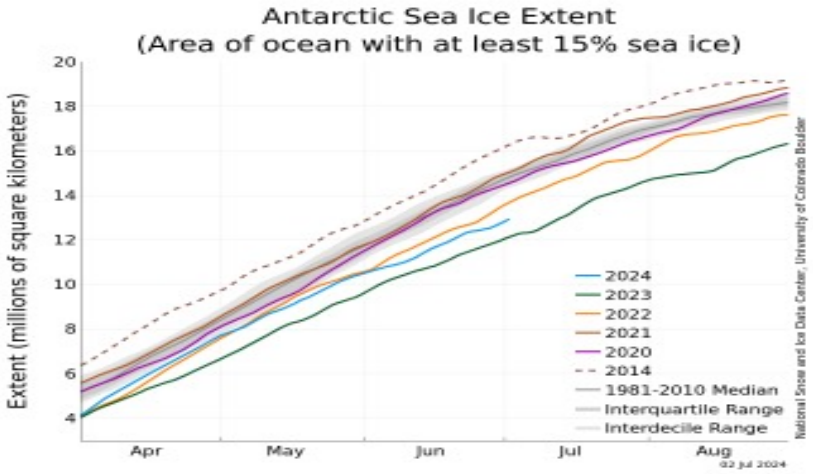


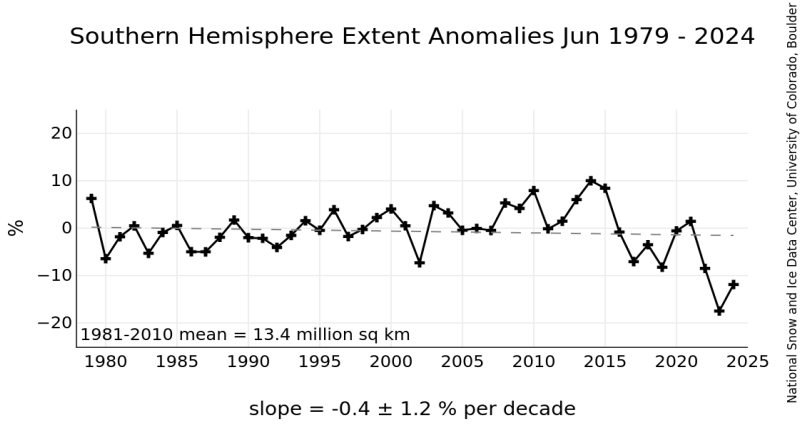


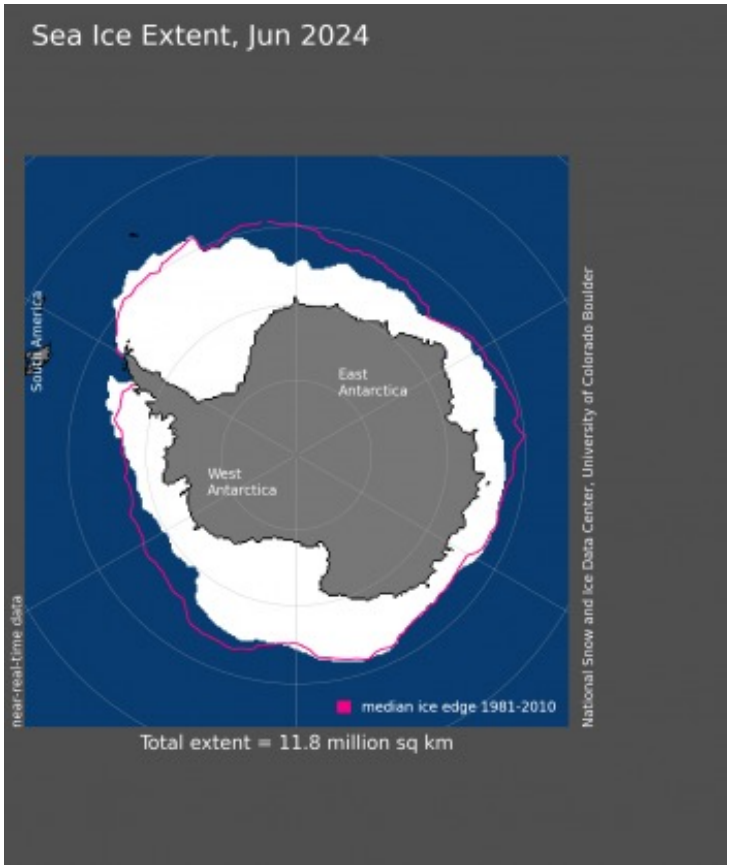


- Average Arctic sea ice extent during Jun 2024 was 10.9 million square kilometers, the 12th lowest Jun in the satellite record.

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

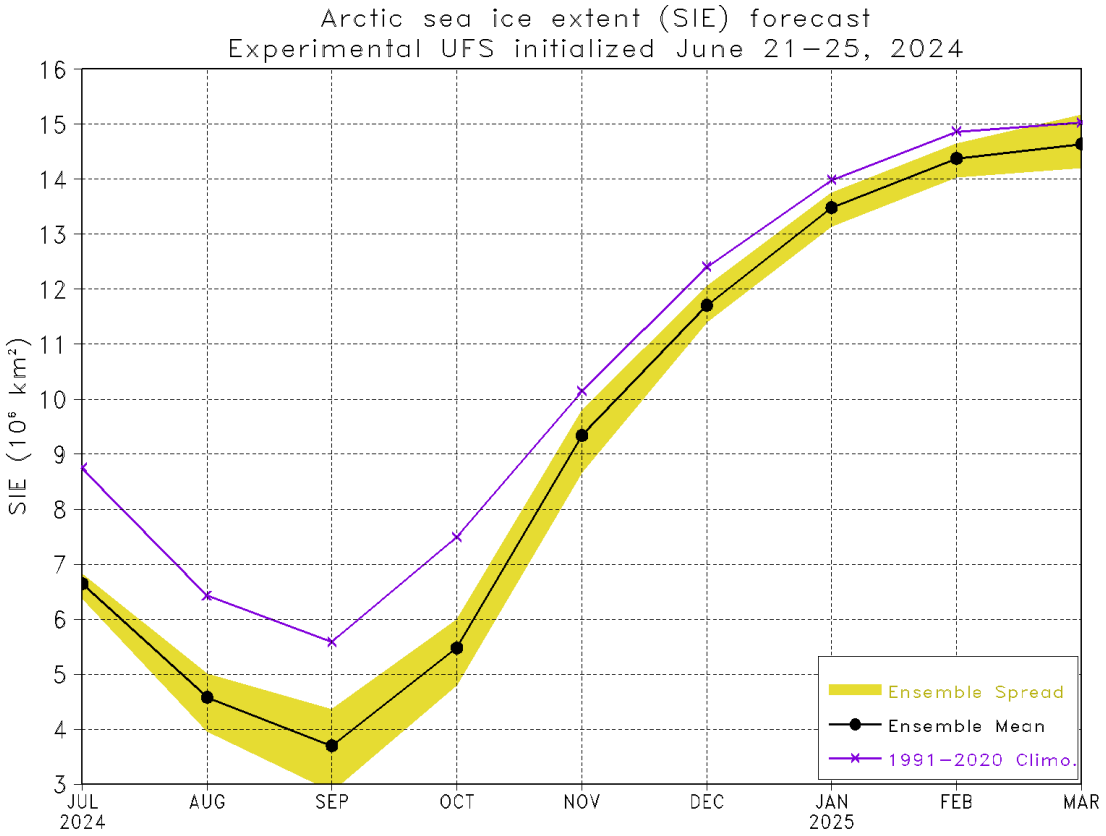






- Antarctic sea ice extent continues to track the second lowest ice extent in the satellite data record.

NCEP/CPC Arctic Sea Ice Extent (SIE) Forecast

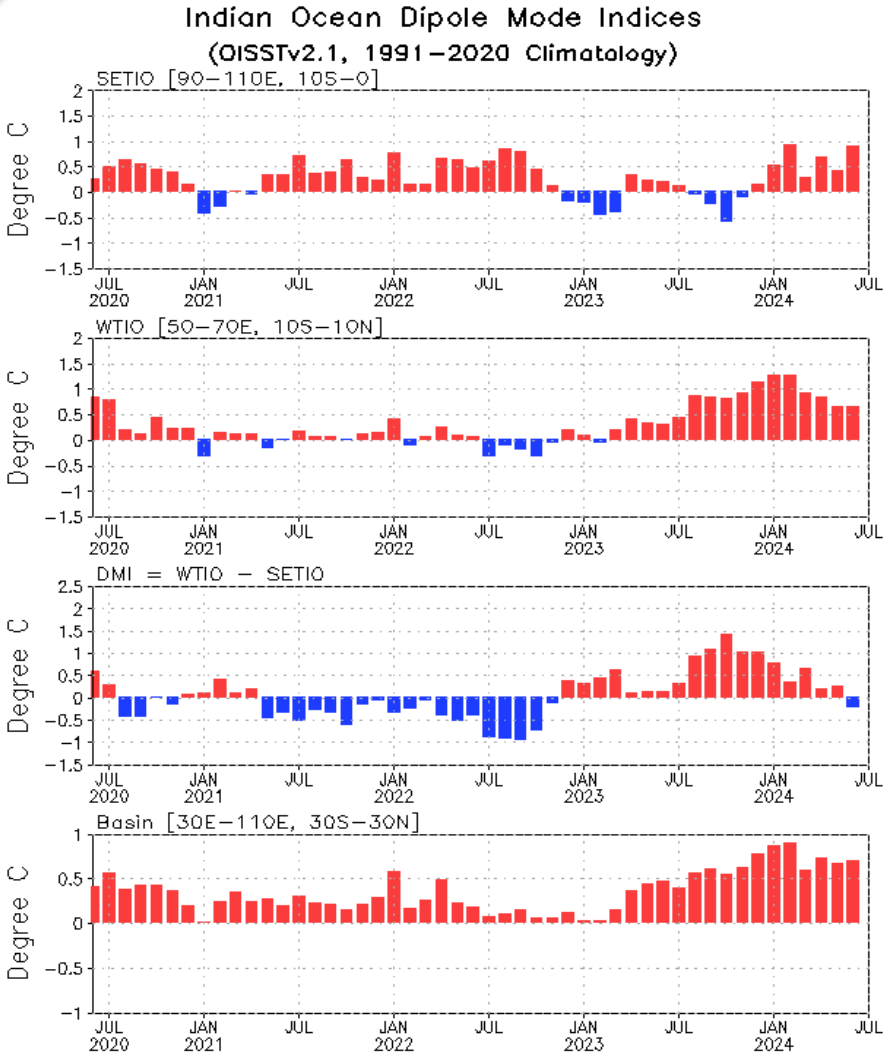


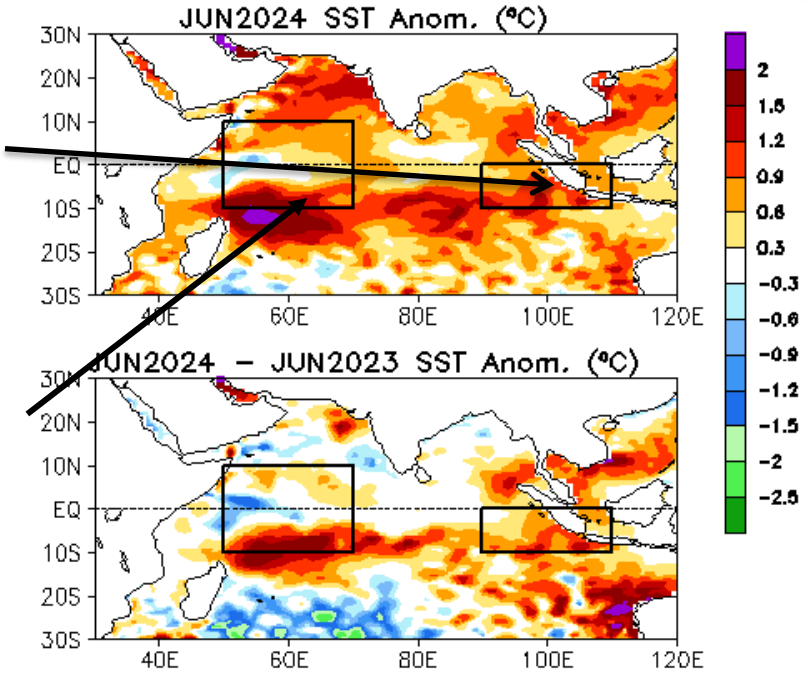
https://www.cpc.ncep.noaa.gov/products/people/jszhu/seaice_seasonal/index.html

- CPC forecasts call a below normal sea ice extent minimum in the Arctic in Sep 2024.

Indian Ocean

Evolution of Indian Ocean SST Indices

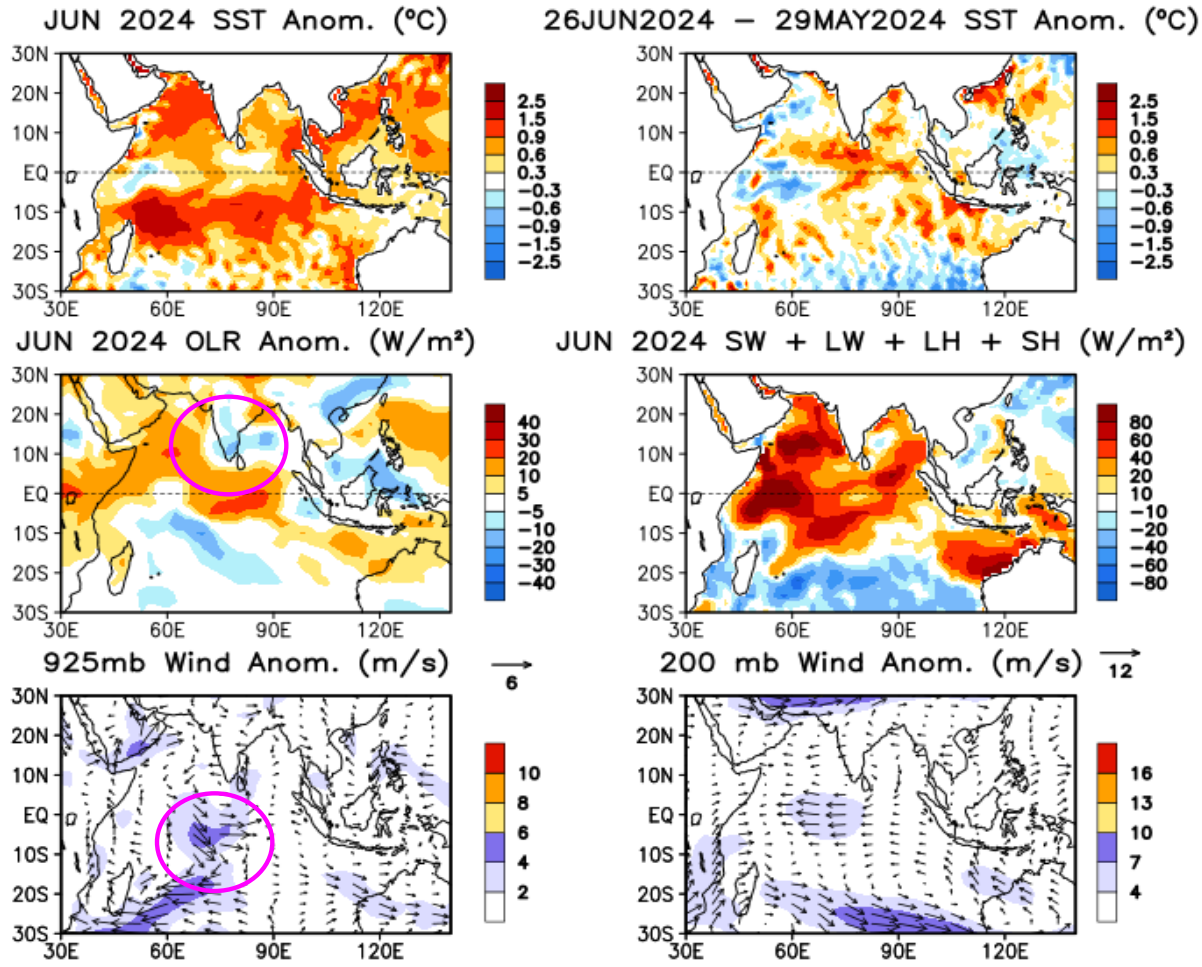




- Positive SSTAs dominated the tropical Indian Ocean basin in Jun 2024.
- Positive SSTA increased substantially in the southeastern tropical Indian Ocean (SETIO) region, leading to a negative phase of Indian dipole mode.

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.

Tropical Indian: SSTA, SSTA Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Wind Anom.

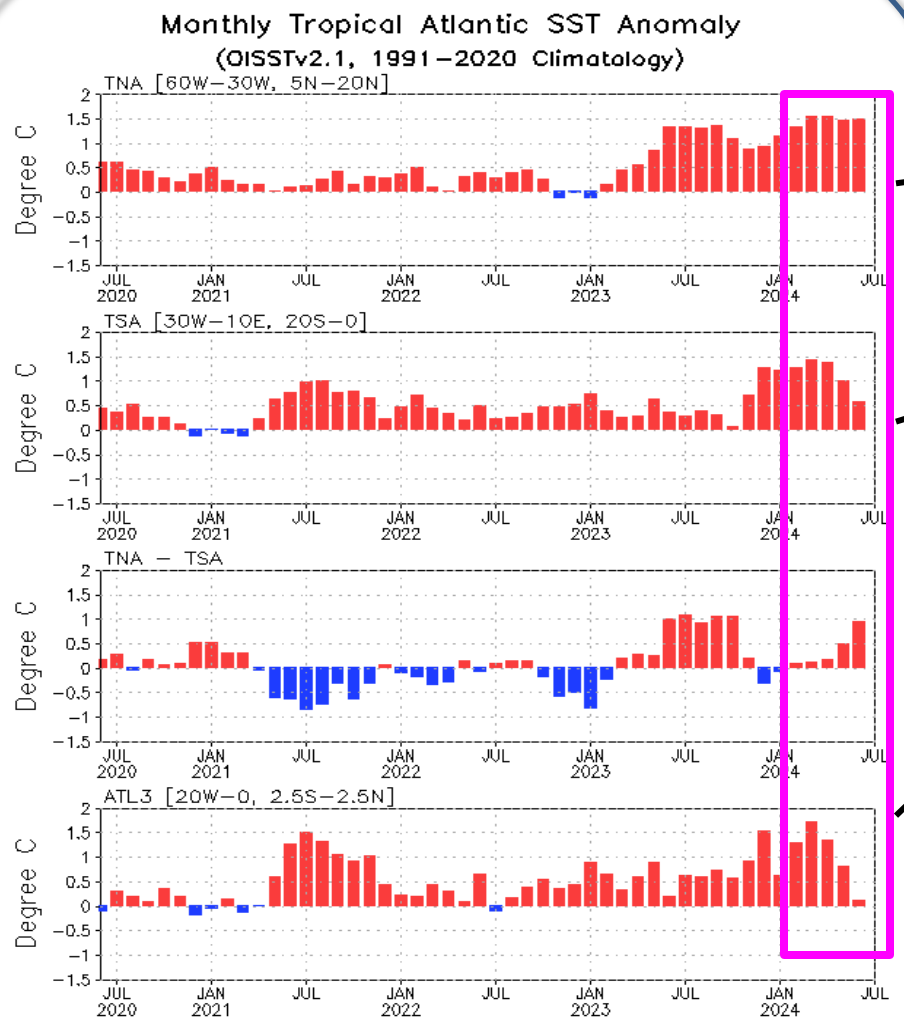


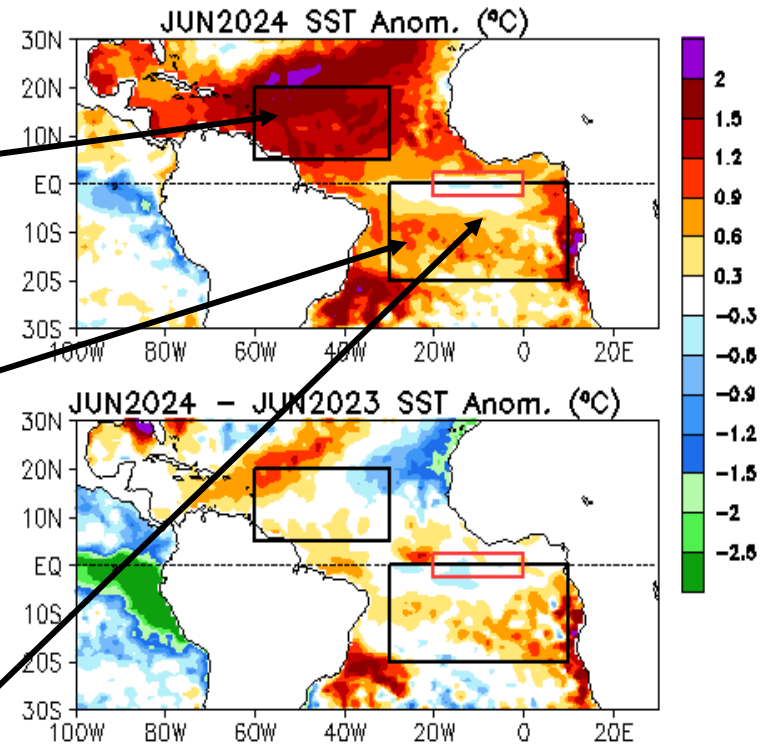
- Positive (negative) SST tendencies were present in the central-eastern (western) tropical Indian Ocean.
- Westerly wind anomaly weakened in Jun 2024, consistent with neutral phase of IOD.

SSTAs (top-left), SSTA tendency (top-right), OLR anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right), 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.

Tropical and North Atlantic Ocean

Evolution of Tropical Atlantic SST Indices

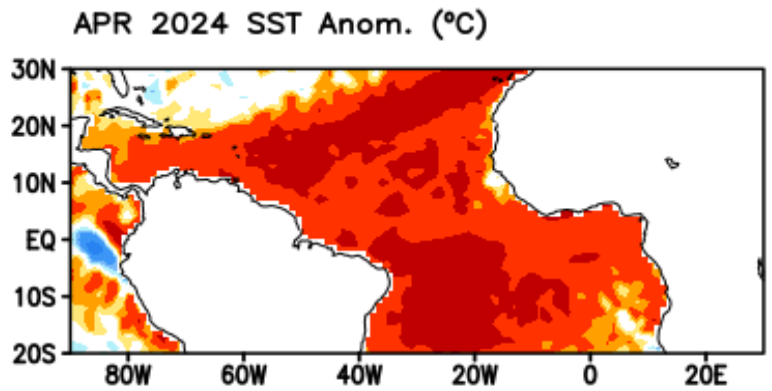


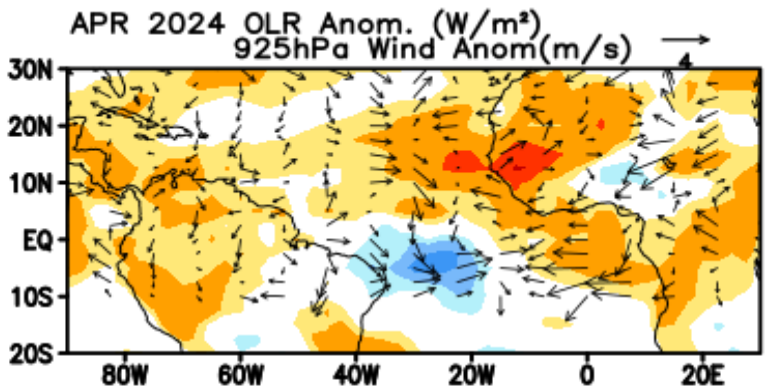


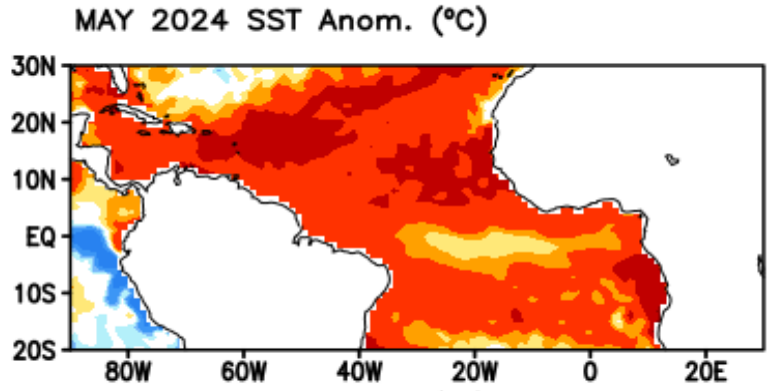
- Positive SSTA in the tropical south Atlantic weakened in Jun 2024, contributing to the enhanced Meridional mode index.
- Positive ATL3 index decreased by 0.7 ^{O}C in Jun 2024.

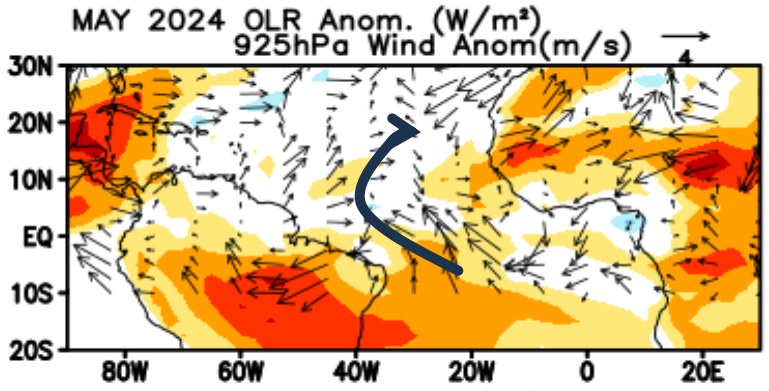
Tropical Atlantic Variability region indices, calculated as the area-averaged monthly mean SSTAs (^{O}C) for the TNA [60^{O}W-30^{O}W, 5ºN-20^{O}N], TSA [30^{O}W-10^{O}E, 20^{O}S-0] and ATL3 [20^{O}W-0, 2.5^{O}S-2.5^{O}N] regions, and Meridional Gradient Index, defined as differences between TNA and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

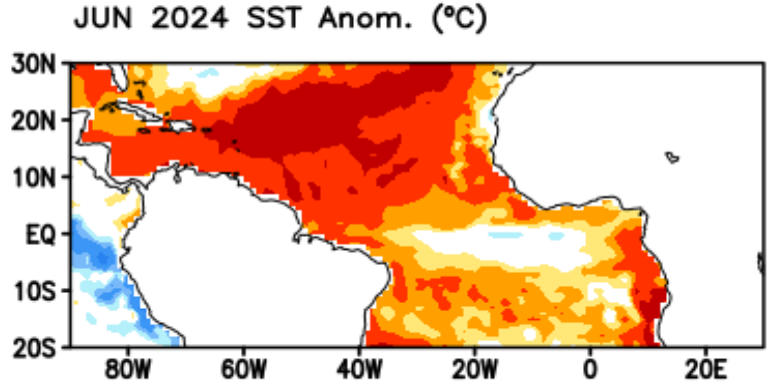
Last 3-month Atlantic SST , OLR & uv925 and D20 anomalies

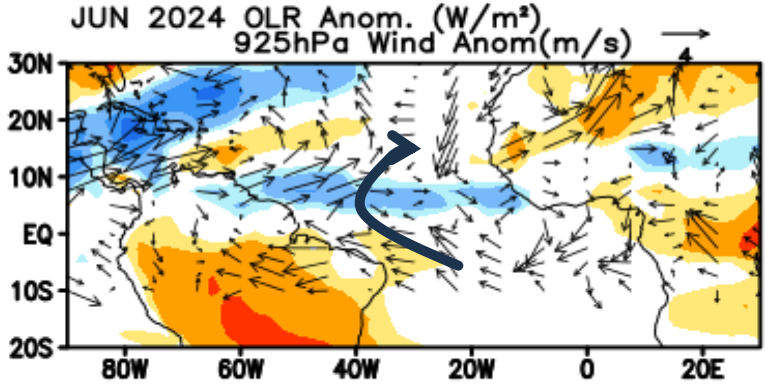




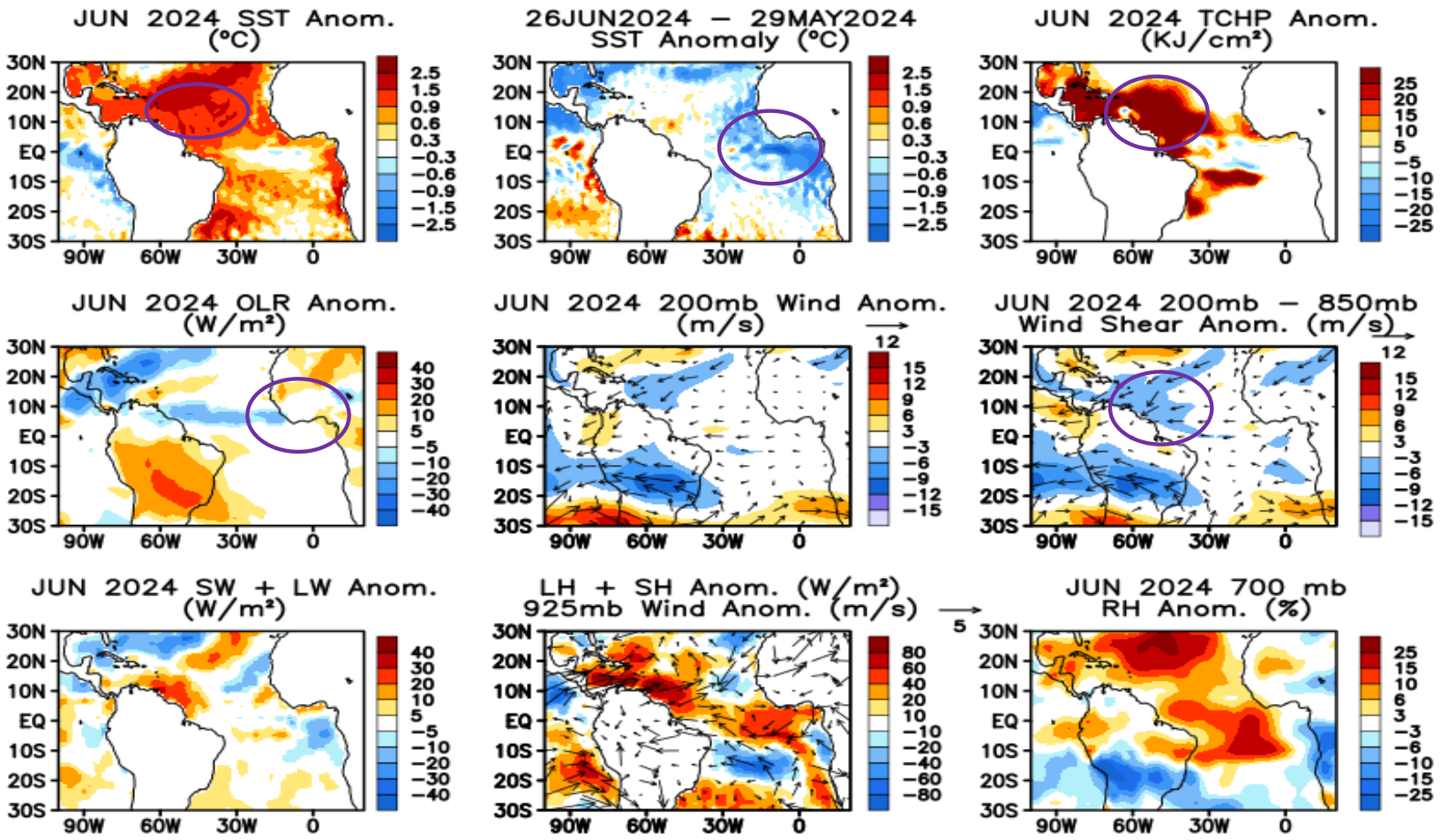






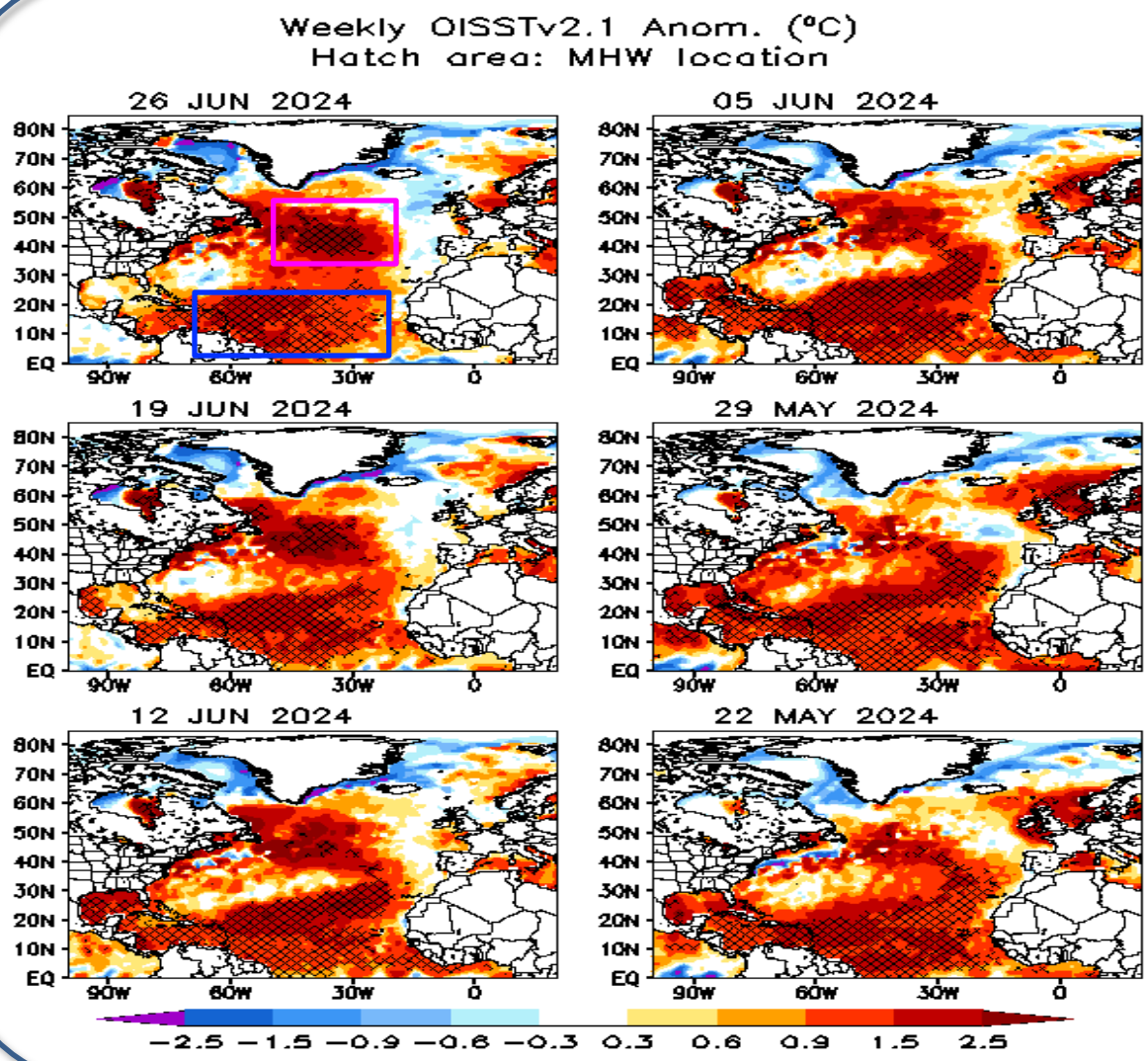


Tropical Atlantic: SST, SST tend., TCHP, OLR, 200 hPa wind, wind share, heat flex, & RH anom.



Top Row: SSTA (left; OI SST), SSTA tendency (central), Tropical Cyclone Heat Potential anomaly (right; GODAS).
Middle row: OLR (left; NOAA 18 AVHRR IR), UV200 (central; NCEP CDAS), UV200-UV850 (right; NCEP CDAS) anomalies.
Bottom row: SW+LW (left), LH+SH (central), Relative humidity at 700 hPa (right; NCEP CDAS) anomalies.
Anomalies are departures from the 1991-2020 base period means.

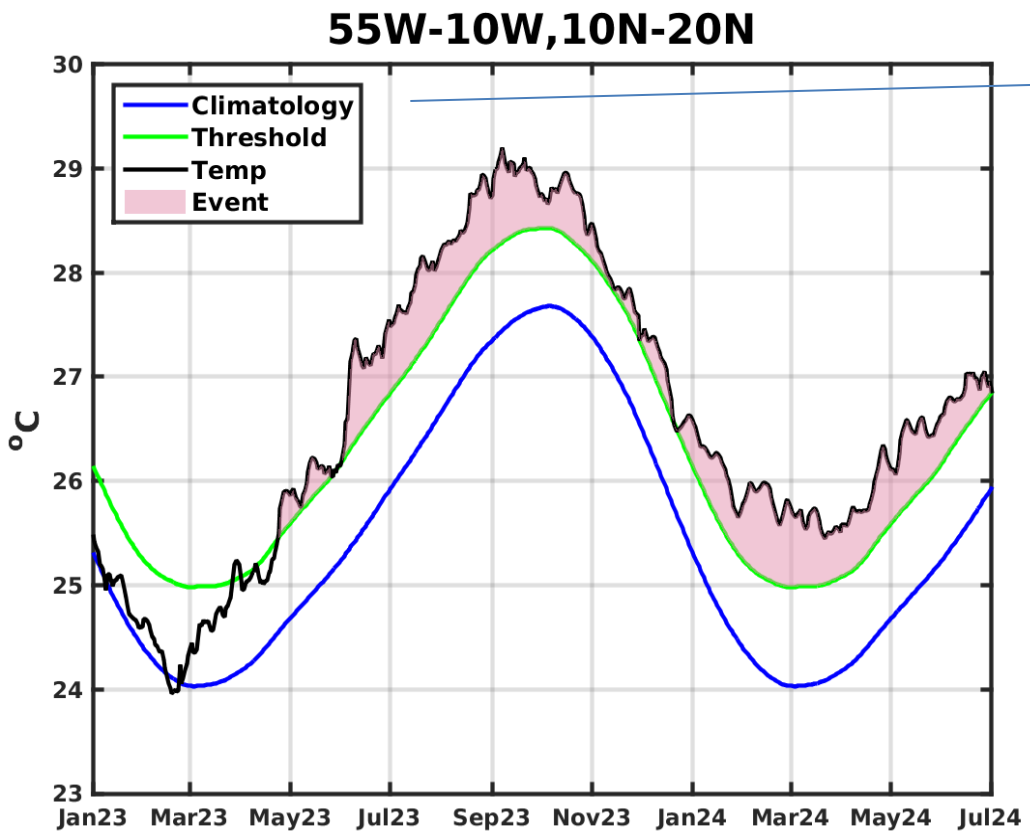
Weekly SST anomaly and MHWs in the North Atlantic

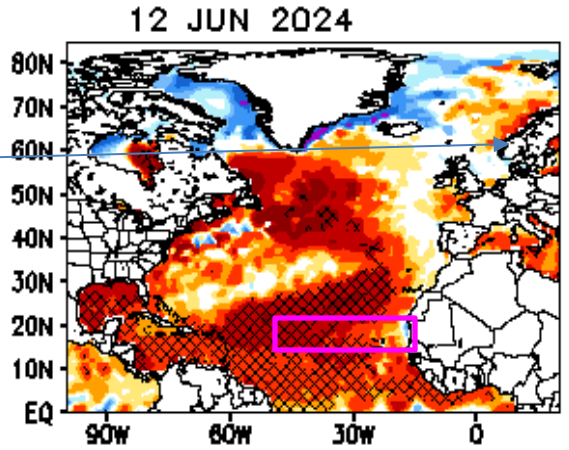


- Strong MHWs persisted in the northern tropical Atlantic.
- New MHWs developed west of Newfoundland in Jun 2024.

(Left panel) Weekly SST anomaly (shaded) and locations experience Marine heat waves (hatched) by the date labelled in the plot. (right panel) SST evolution at a specific location. Green line and blue line denote the seasonal 90th percentile and daily climatology, respectively. Shaded area denotes the periods experiencing MHW. MHW is defined as a discrete prolonged warmer than 90th percentile of daily SST for at least 14 days. Data is derived from NCEI OISSTv2.1 and the climatology reference period is 1991-2020

Prolonged MHWs in the northern tropical Atlantic

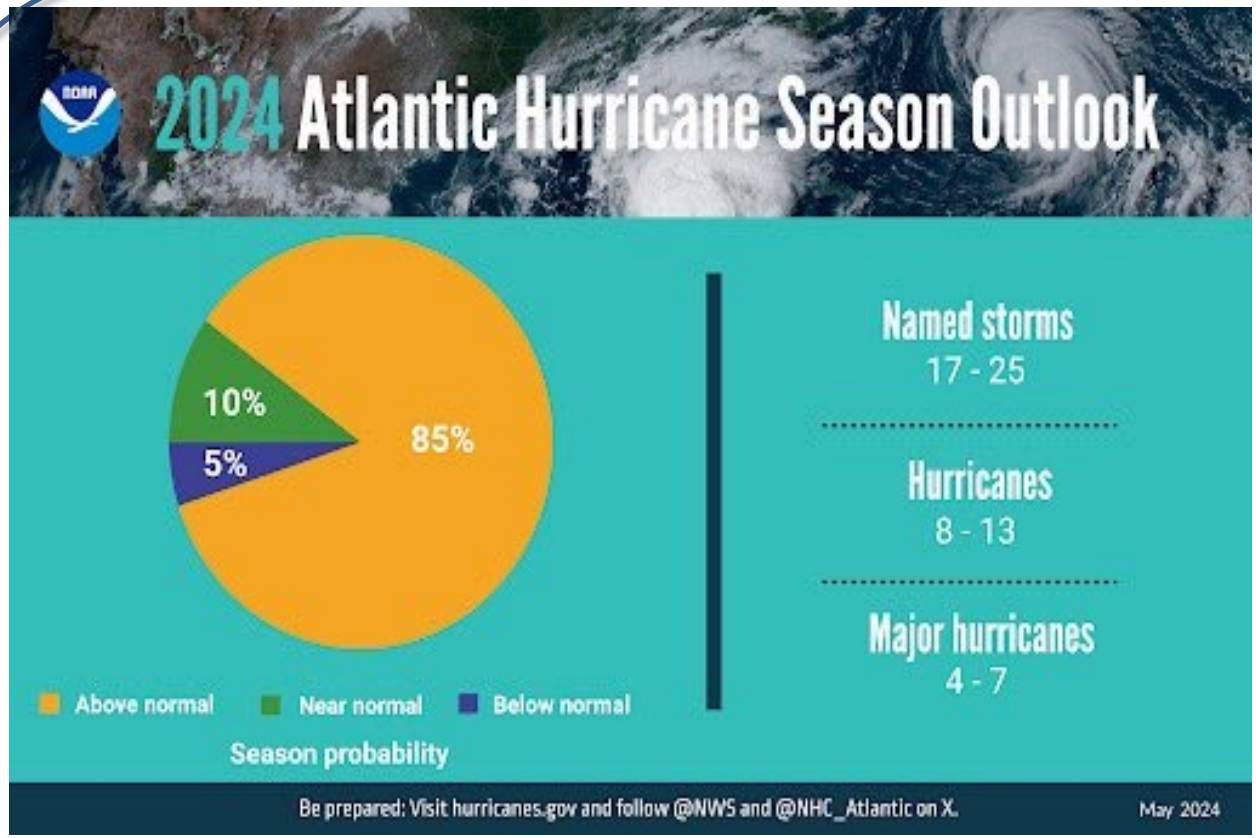




- MHWs in the northern tropical Atlantic has persisted since May 2023.

(Left panel) Weekly SST anomaly (shaded) and locations experience Marine heat waves (hatched) by the date labelled in the plot. (right panel) SST evolution at a specific location. Green line and blue line denote the seasonal 90th percentile and daily climatology, respectively. Shaded area denotes the periods experiencing MHW. MHW is defined as a discrete prolonged warmer than 90th percentile of daily SST for at least 14 days. Data is derived from NCEI OISSTv2.1 and the climatology reference period is 1991-2020

NOAA's 2024 Atlantic Hurricane Season Outlook



- May 23, 2024: NOAA CPC forecast a range of 17-25 total named storms. Of those, 8-13 could become hurricanes, including 4-7 major hurricanes (category 3, 4 or 5).
- The corresponding climatological averages are 14, 7, & 3.

"…. the continuation of the high-activity era for Atlantic hurricanes, which began in 1995 in association with a transition to the warm phase of the Atlantic Multidecadal Oscillation (AMO). The recently observed and predicted atmospheric conditions for ASO 2024 reflect the warm AMV phase….

The SSTs in the MDR (North Atlantic) are at (near) record high levels.

…. a 77% chance that La Niña conditions will develop through the hurricane season…."

(https://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml)

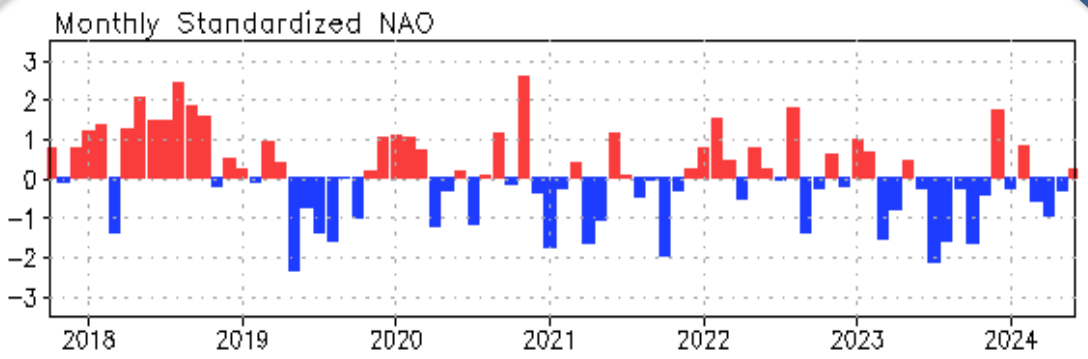
2024 Atlantic Hurricane Season Activities

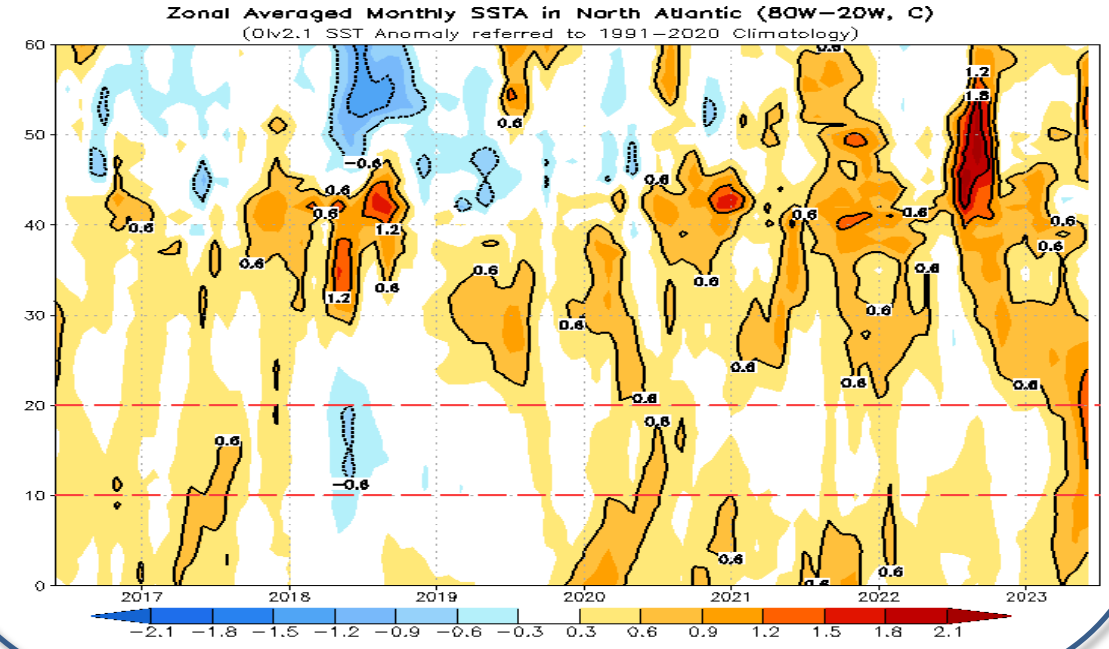
https://en.wikipedia.org/wiki/2024_Atlantic_hurricane_season

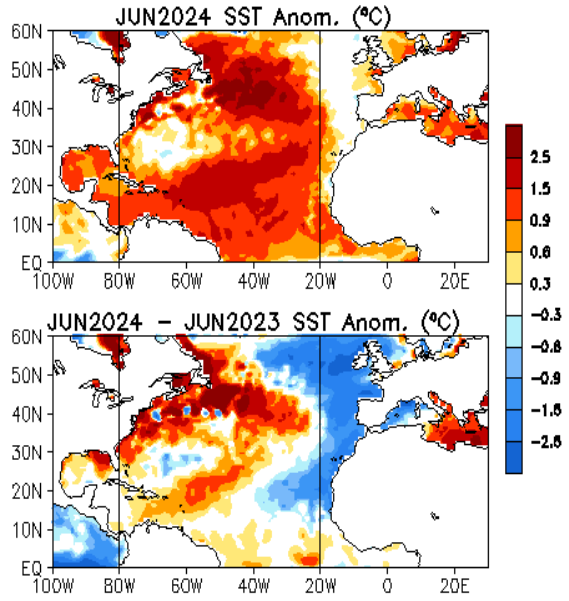
- By Jul 10 2024, three tropical storms formed, with one developing into major hurricane.

Atlantic	Observations (By Jul 6)	Outlook (May 23) 85% above-normal	(1991-2020)
Total storms	3	17-25	14
Hurricanes	1	8-13	7
Major hurricanes	1	4-7	3

NAO and SST Anomaly in North Atlantic





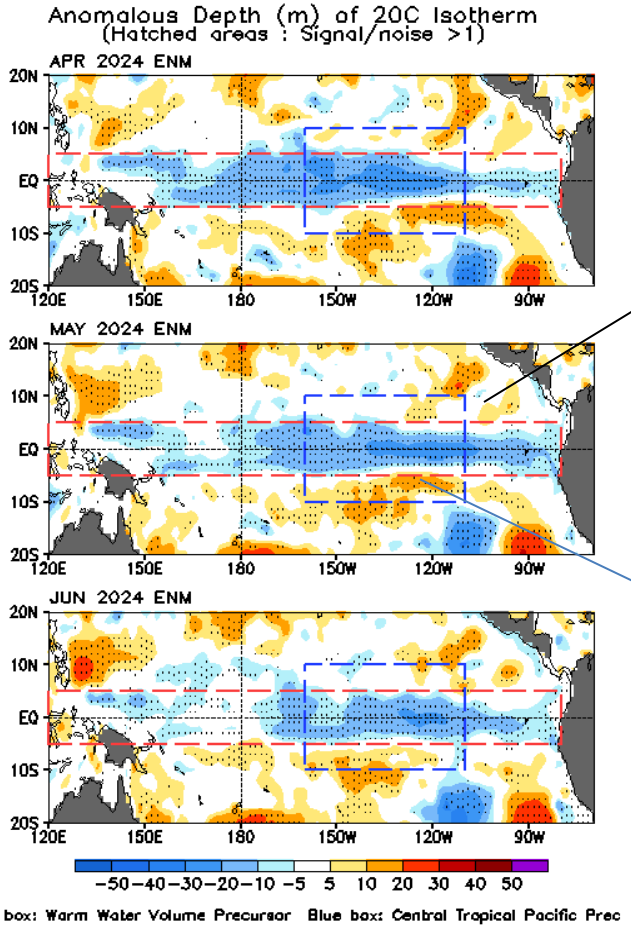


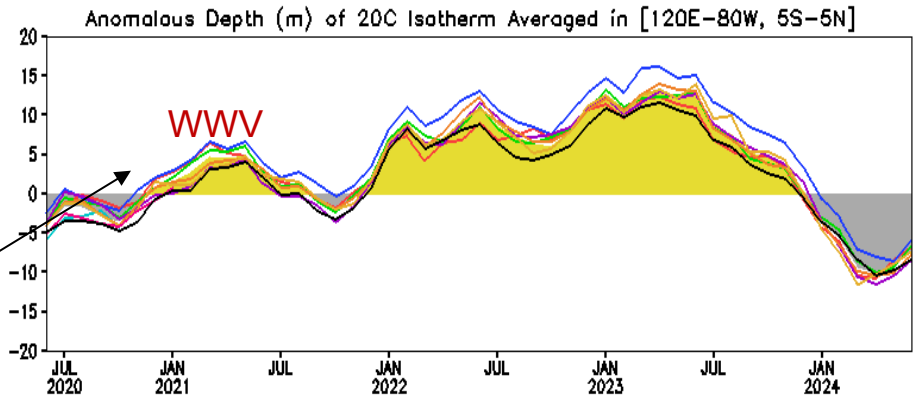
- NAO was near-normal in Jun 2024.
- Strong warming continued in the eastern North Atlantic Ocean.
- The prolonged positive SSTAs in the middle latitudes were evident, due to dominance of the positive phase of NAO during the last 5-6 years.

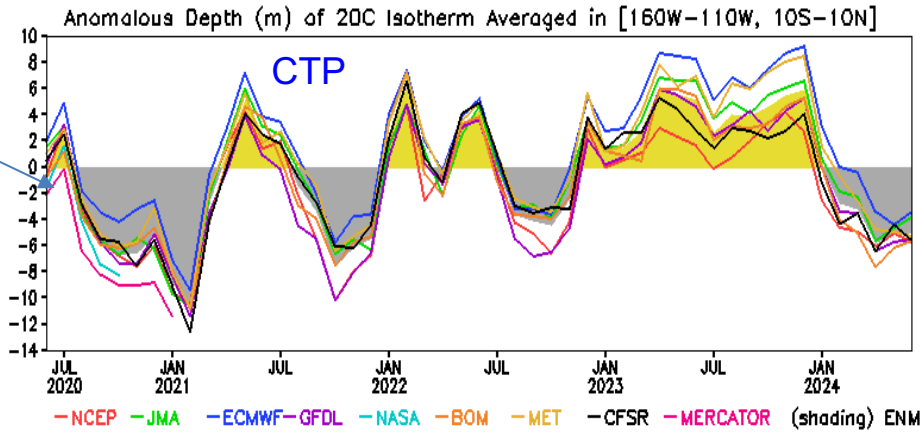
Monthly standardized NAO index (top) derived from monthly standardized 500-mb height anomalies obtained from the NCEP CDAS in 20°N-90°N. Time-latitude section of SSTAs averaged between 80ºW and 20ºW (bottom). SST are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020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

ENSO and Global SST Predictions

Oceanic ENSO Precursors: WWV & CTP

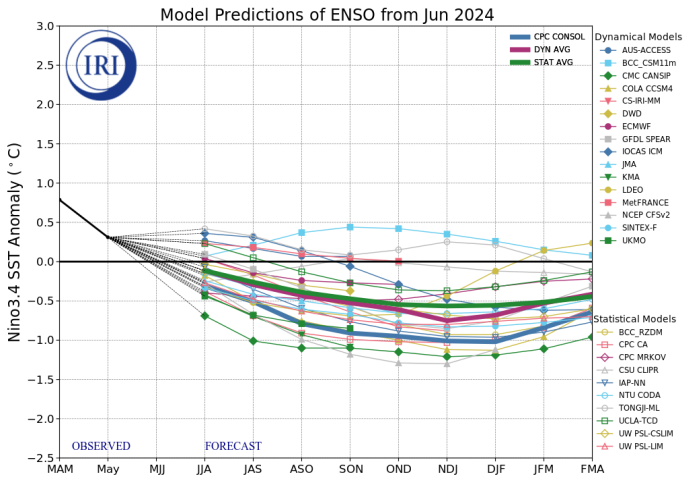


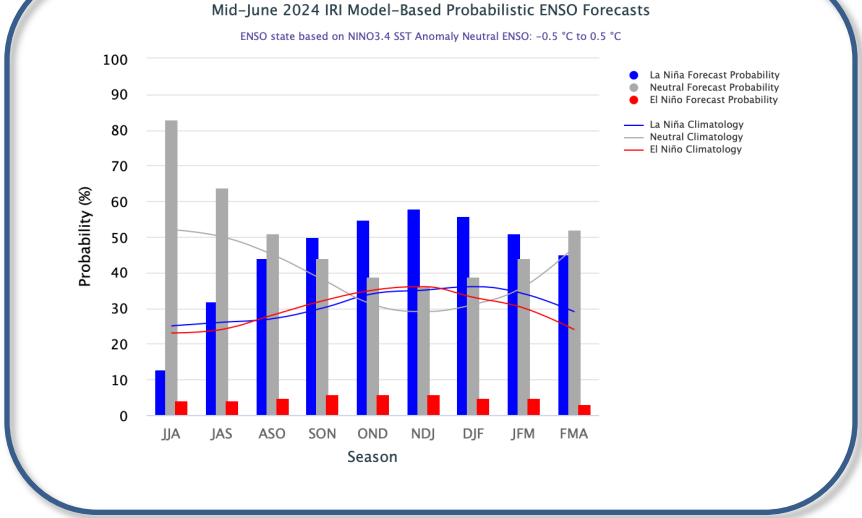


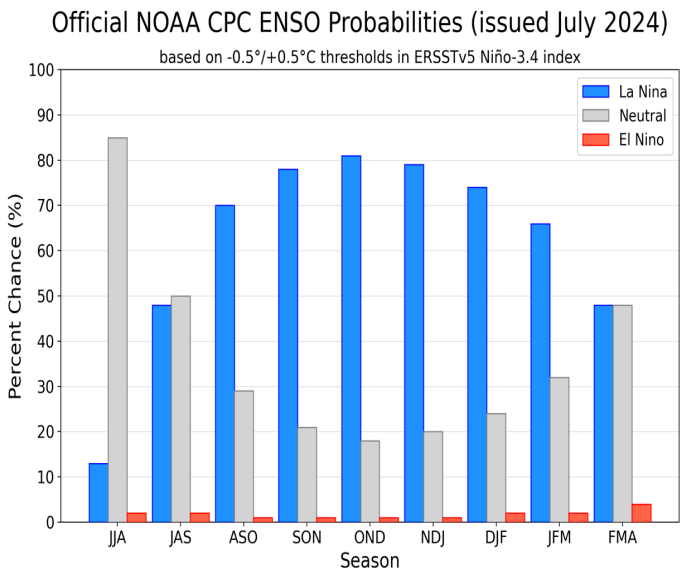


Warm water volume (WWV) is defined as an average of D20 anomaly across the equatorial Pacific (120° E – 80° W, 5° S-5° N) (Meinen and McPhaden 2000). Central tropical Pacific (CTP) index is calculated as the averaged D20 anomaly in the central tropical Pacific (160° W-110° W, 10° S-10° N) (Wen et al. 2014). The monthly D20 data is obtained from the Real-time Ocean Reanalysis Intercomparison Project(https://www.cpc.ncep.noaa.gov/products/GODAS/multiora93_body.html).

IRI/CPC Niño3.4 Forecast





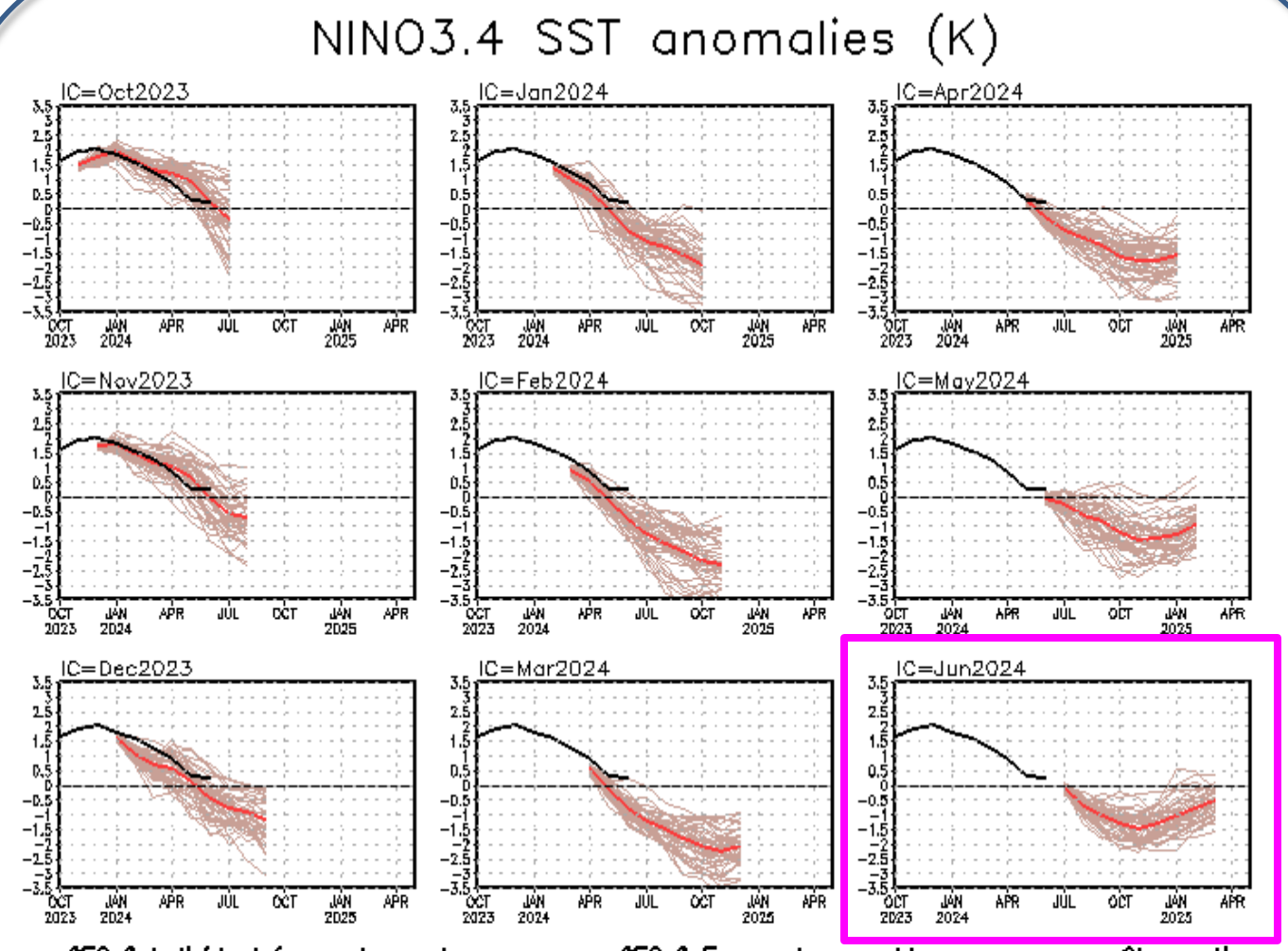


- Most of models favor ENSO neutral condition through Sep-Oct and La Niña since Oct-Dec 2024.

- On 11 Jul 2024, CPC maintained a "La Niña Watch".

- Synopsis: "***ENSO-neutral is expected to continue for the next several months, with La Niña favored to emerge during August-October (70% chance) and persist into the Northern Hemisphere winter 2024-25 (79% chance during November-January)***"

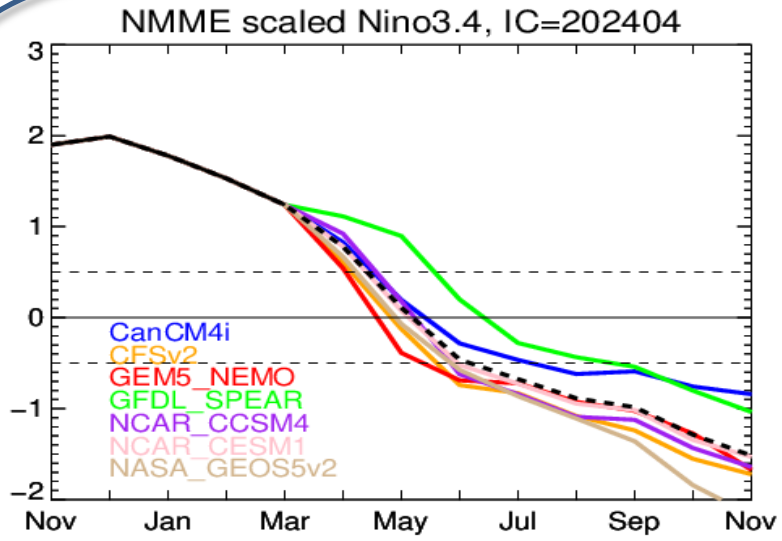
CFS Niño3.4 SST Predictions from Different Initial Months

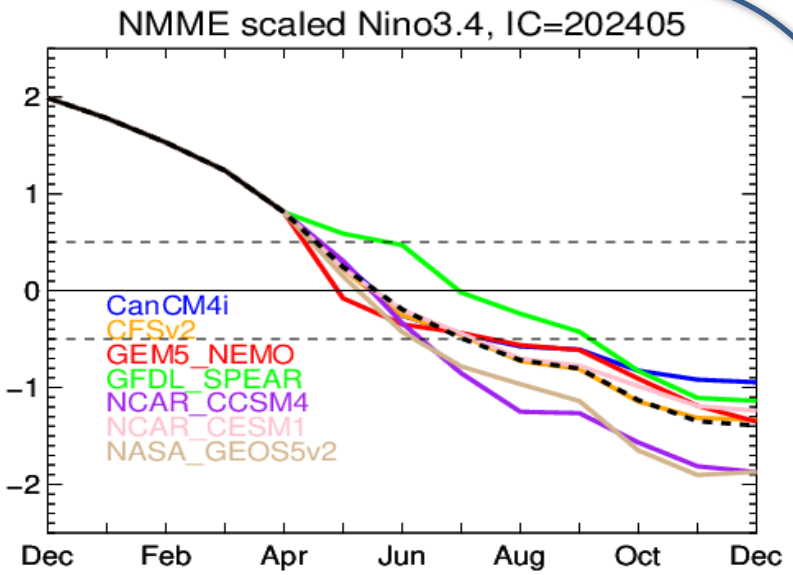


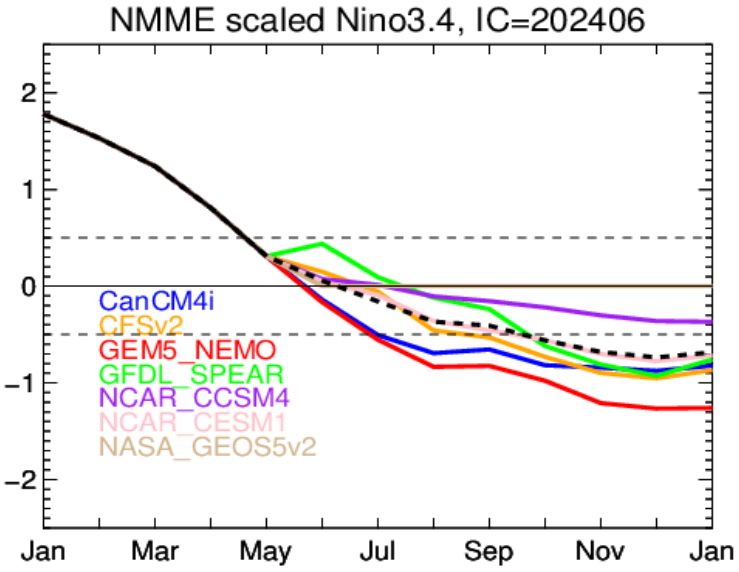
- The latest CFSv2 forecasts an La Niña will develop in Aug 2024.

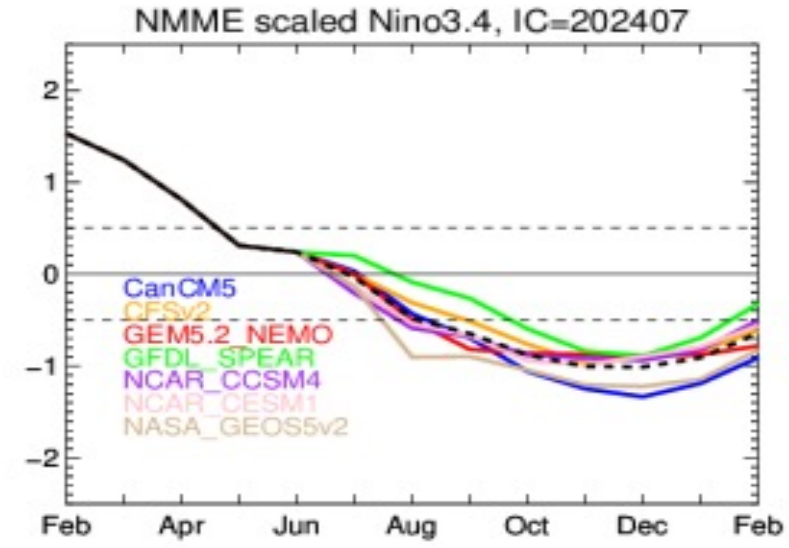
CFS Niño3.4 SST prediction from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). Anomalies were computed with respect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

NMME forecasts from different initial conditions



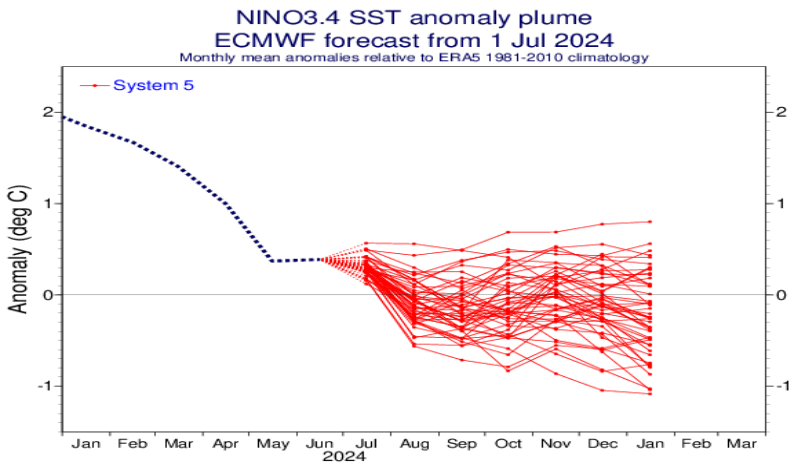




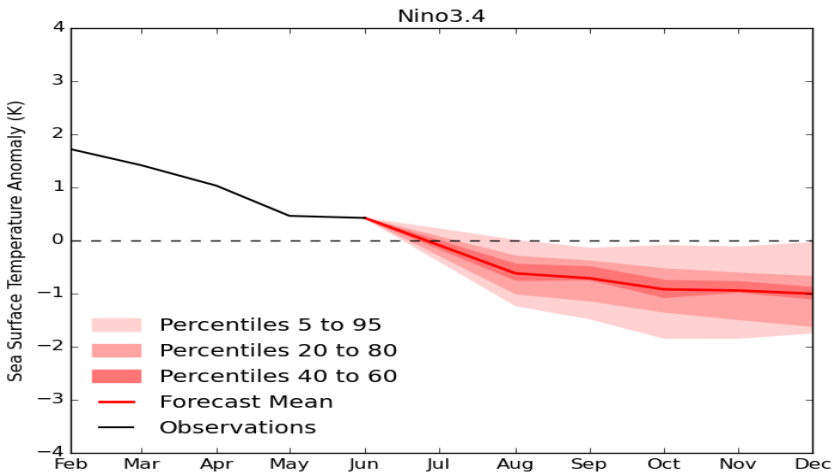


Individual Model Forecasts: El Niño transitions to neutral or La Niña in Summer-Autumn 2024

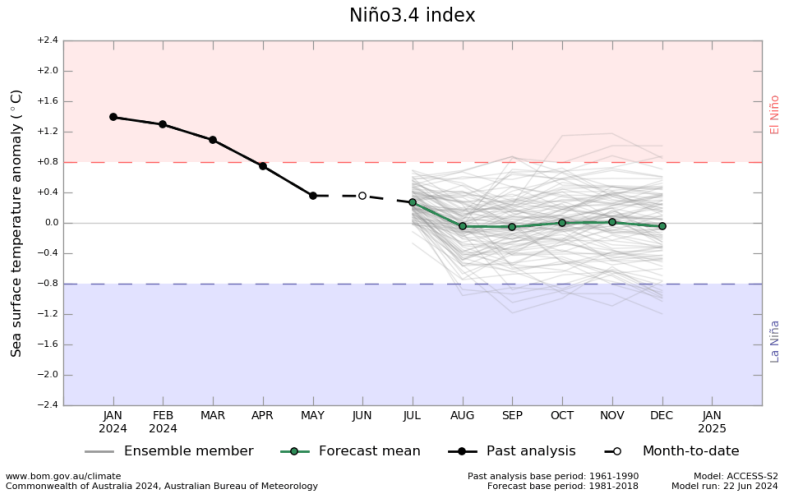
EC: Niño3.4, IC= 1 Jul 2024



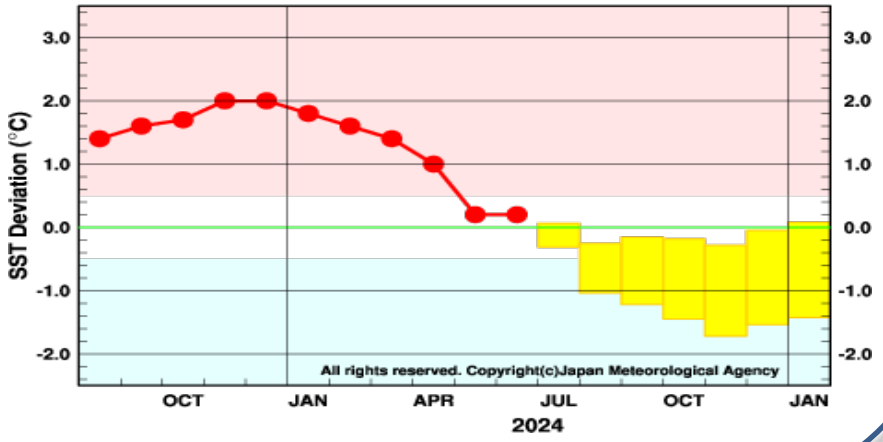
UKMO: Niño3.4, Updated 11 Jul 2024



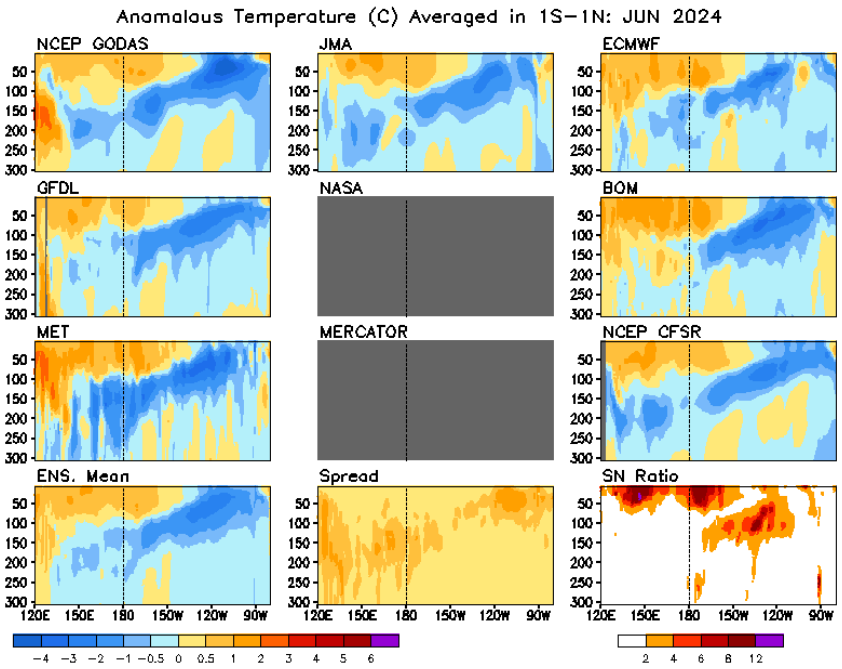
BOM: Niño3.4, Updated 22 Jun 2024



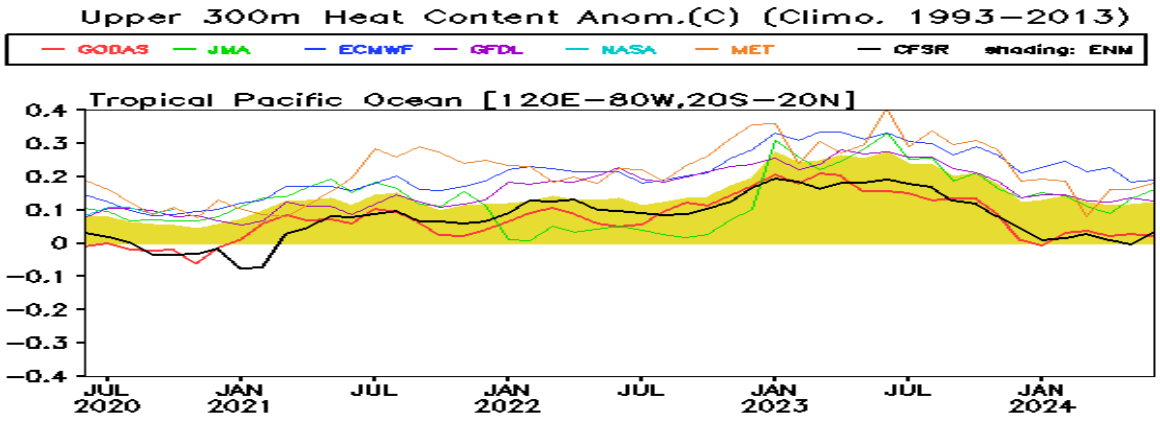
JMA: Niño3.4, Updated 11 Jul 2024



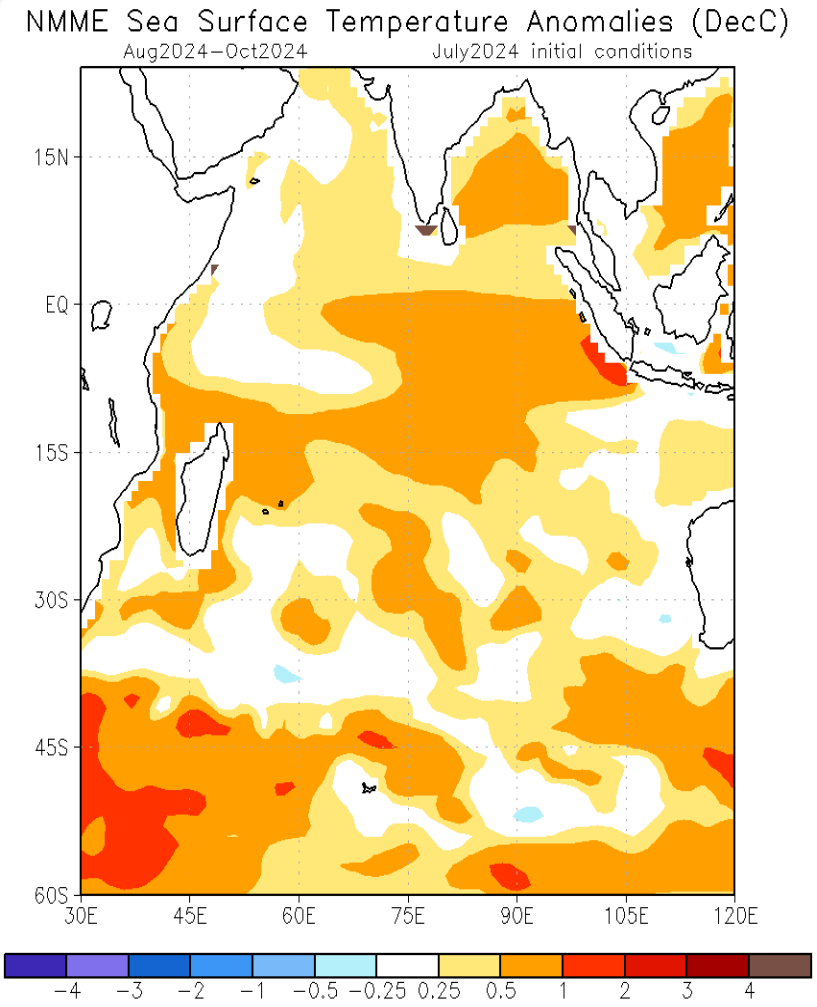
Potential Impact of ocean initial conditions on ENSO forecasts

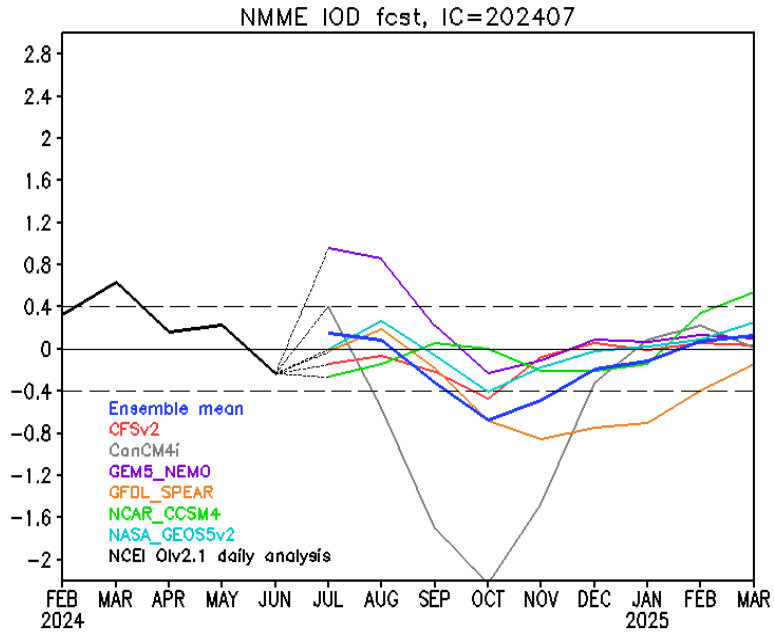


- Compared with other ocean reanalysis, CFSR has colder subsurface temperature near the thermocline in the western Pacific and near surface in the eastern Pacific.
- Both ECMWF and GFDL have greater H300 anomaly in the tropical Pacific during the last four years, which is consistent with difference in ENSO forecasts.



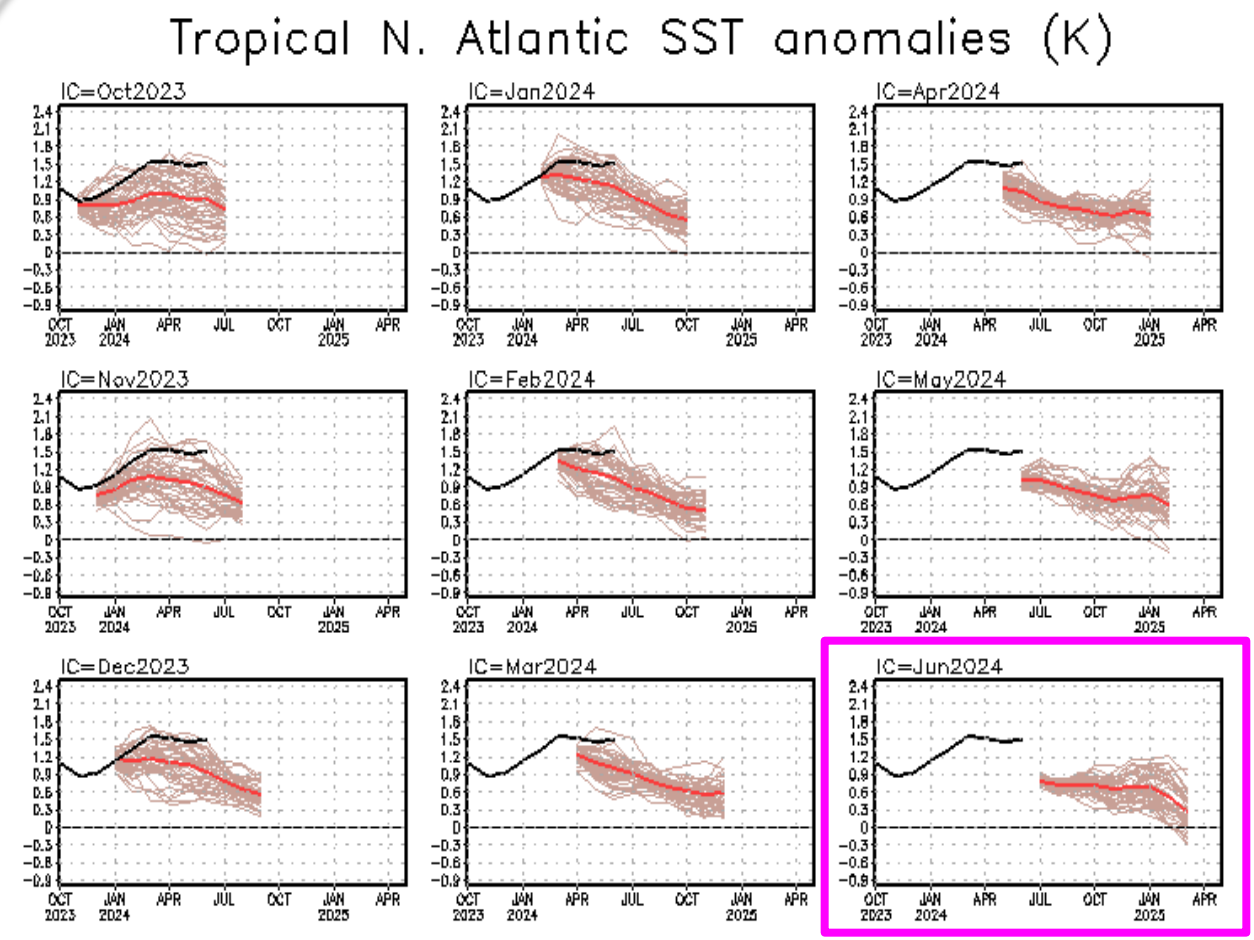
NMME Forecasts in the Indian Ocean





- Most of NMME members suggest neutral IOD condition to last through winter 2024.

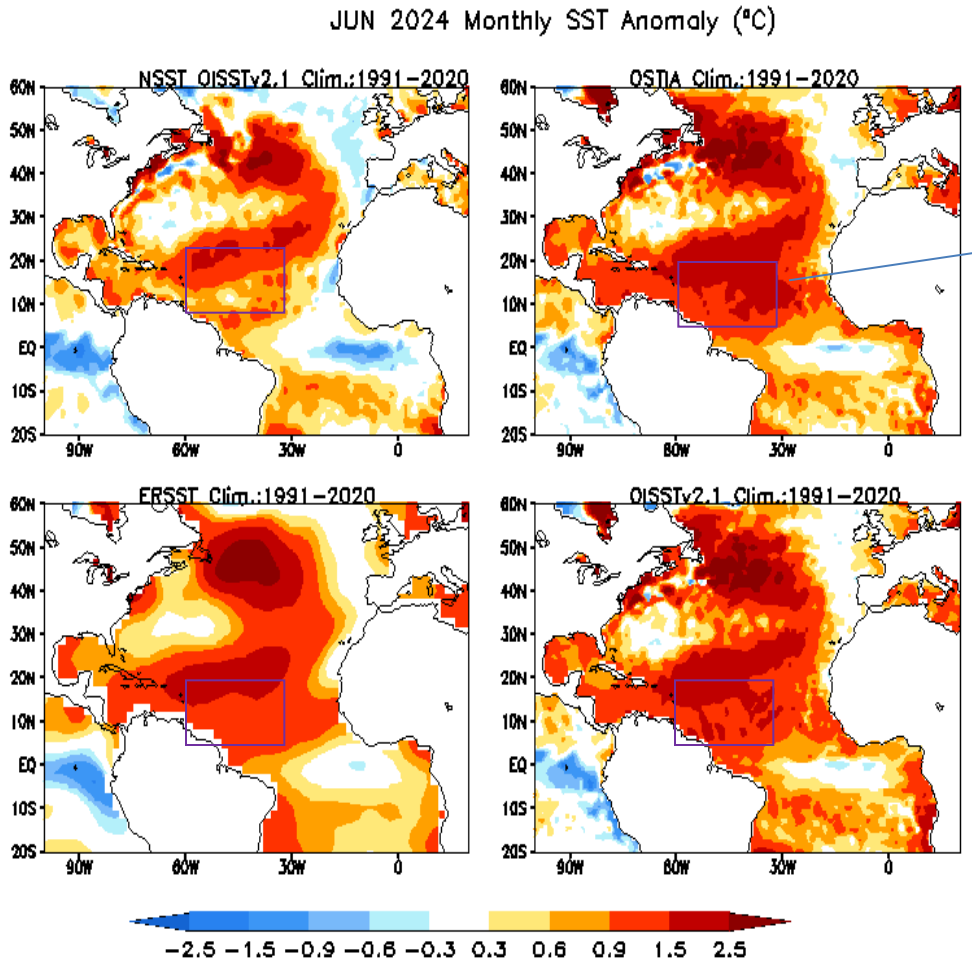
CFS Tropical North Atlantic (TNA) SST Predictions from Different Initial Months

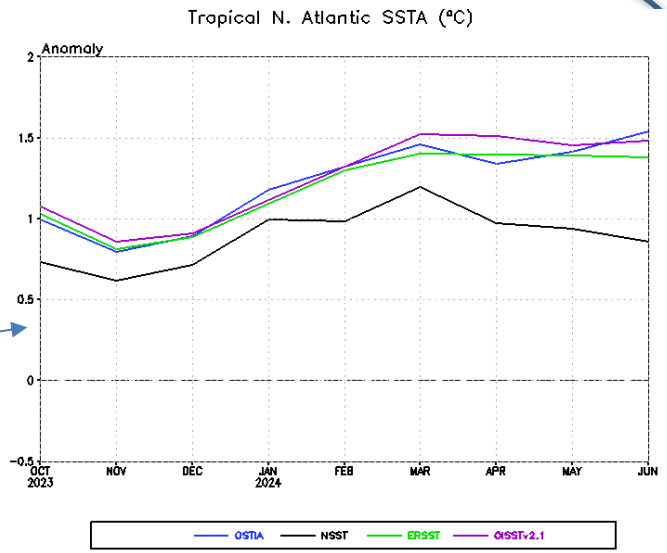


- Latest CFSv2 predictions call for above-normal SST in the tropical North Atlantic.
- CFSv2 has large cold bias at 0-month lead since Feb 2024.

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].

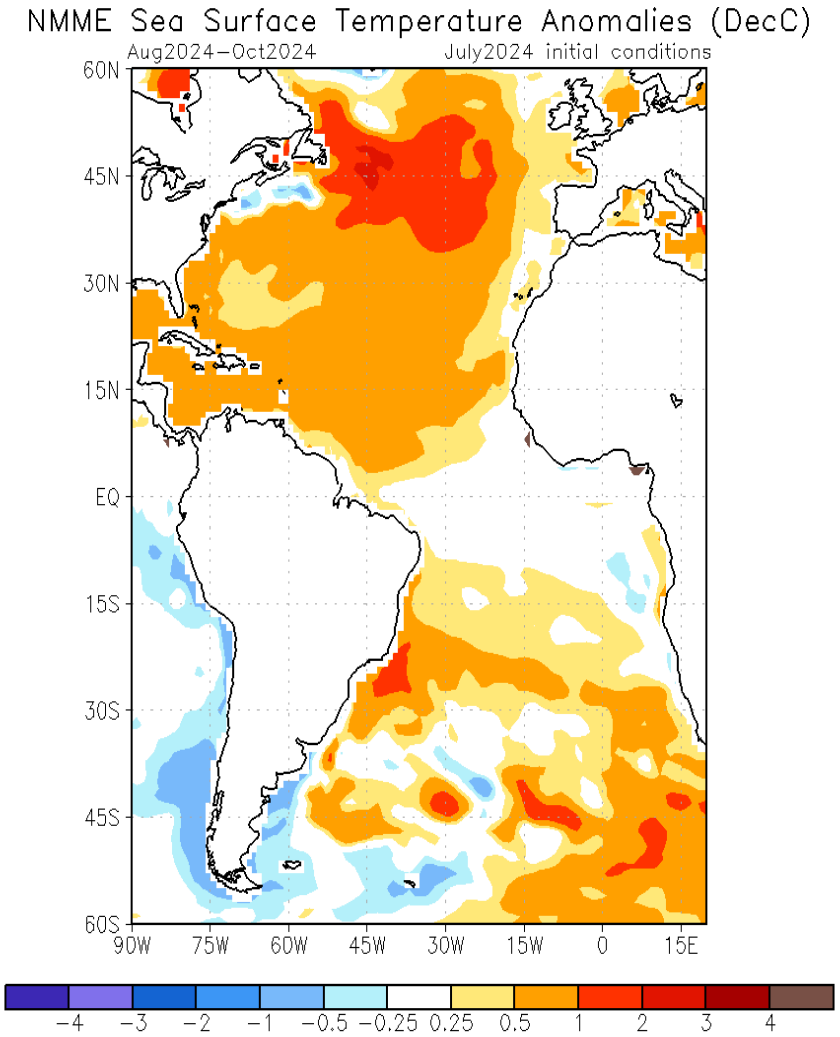
Monthly SST Anomaly in the Atlantic Ocean

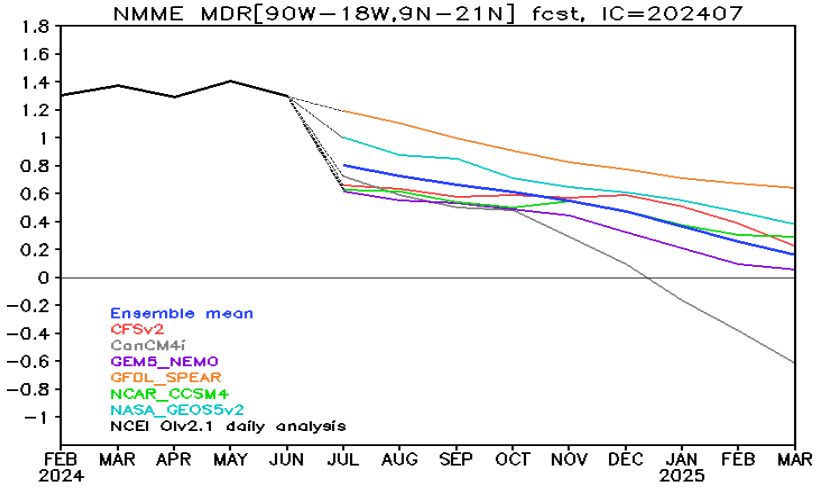


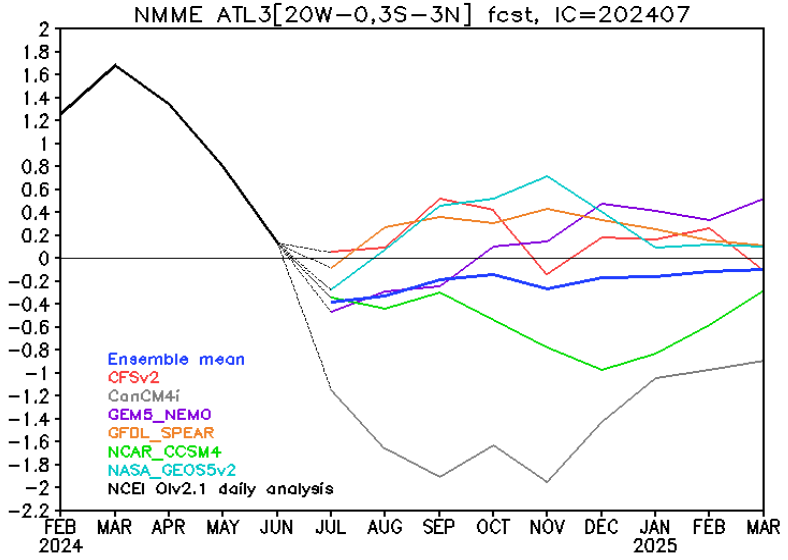


- NSST provide SST nudging source for CFSR.
- NSST was cooler than other SST analysis in most of tropical Atlantic Ocean.
- NSST anomaly in the northern tropical Atlantic Ocean region was colder than OISST v2.1 anomaly by 0.6C in Jun 2024.
- NSST cold bias at least partially contributed to cold bias in CFSv2 short-lead forecasts.

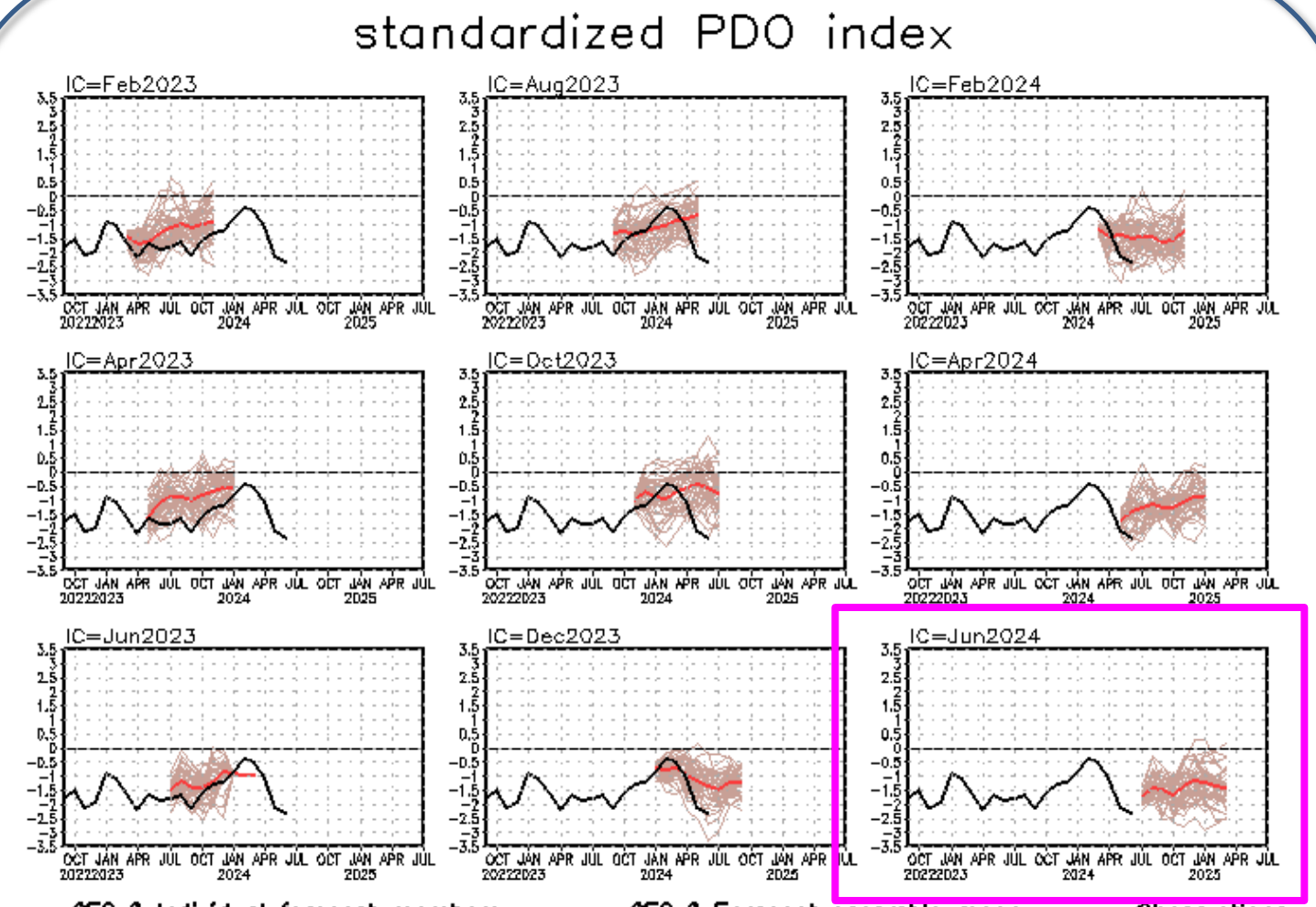
NMME Forecasts in the Atlantic Ocean







CFS Pacific Decadal Oscillation (PDO) Index Predictions from Different Initial Months



- CFSv2 predicts the negative phase of PDO will continue through winter 2023.

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.

Acknowledgement

- Drs. Zeng-Zhen Hu and Arun Kumar: reviewed PPT, and gave insightful suggestions and comments
- Drs. Yanjuan Guo and Pingping Xie provided the BASS/CMORPH/CFSR EVAP package
- Drs. Jieshun Zhu & Wanqiu Wang maintained 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 – Realtime (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

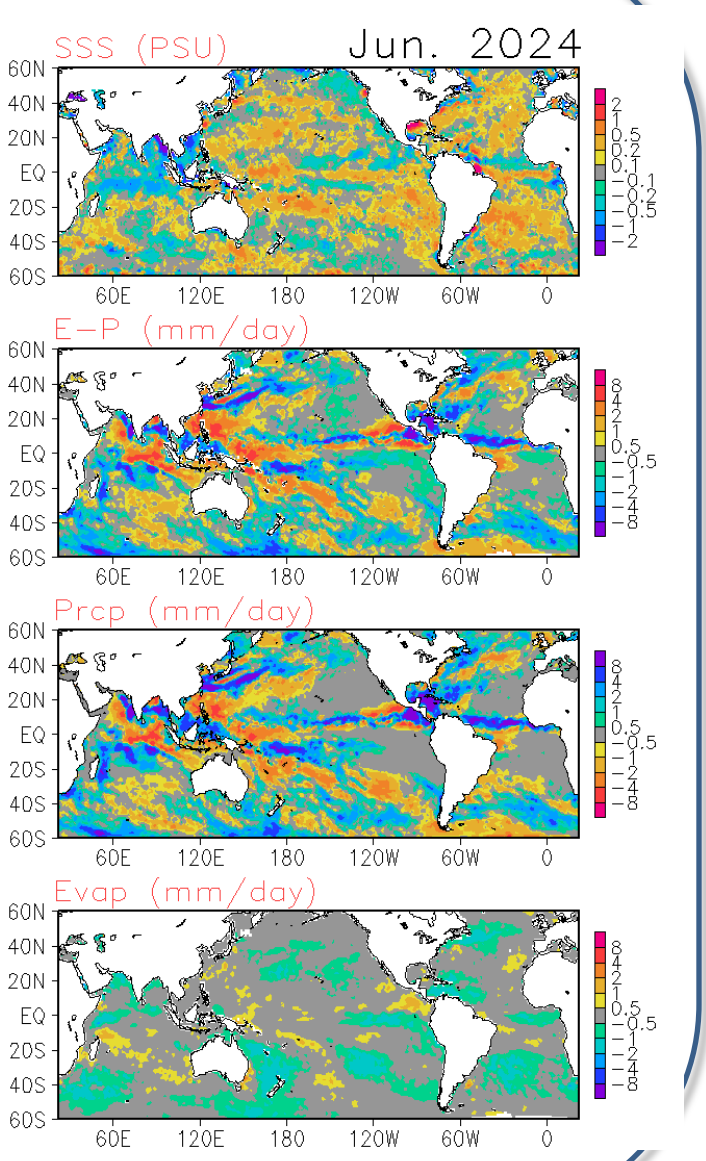
http://www.cpc.ncep.noaa.gov/products/GODAS/multiora93_body.html

Backup Slides

Global Sea Surface Salinity (SSS): Anomaly for June 2024

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

The SSS exhibits positive anomalies in many regions over the Pacific and Atlantic oceans, while negative anomalies in the northern Indian ocean and the sea water around the mainland Southeast Asia. The anomalous pattern in the Indian ocean is partly due to large fresh water run off since it's much stronger than what can be explained by the E-P anomalies alone. The Pacific ITCZ is enhanced; the SPCZ is also enhanced largely. The E-P anomalies are dominated by the precipitation anomalies over these regions, thus the salinity anomalies show overall consistent anomaly patterns.



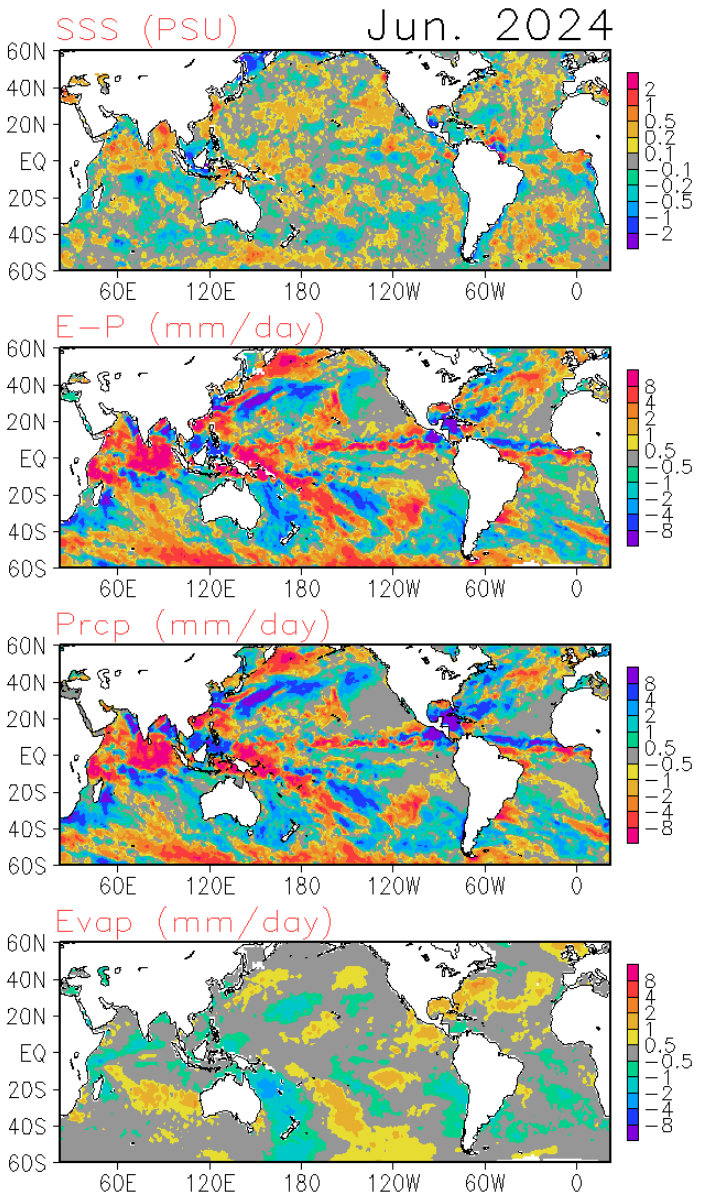
SSS : Blended Analysis of Surface Salinity (BASS) V0.Z
(a CPC-NESDIS/NODC-NESDIS/STAR joint effort)
ftp.cpc.ncep.noaa.gov/precip/BASS

Precipitation: CMORPH adjusted satellite precipitation estimates

Evaporation: Adjusted CFS Reanalysis

Global Sea Surface Salinity (SSS): Tendency for June 2024

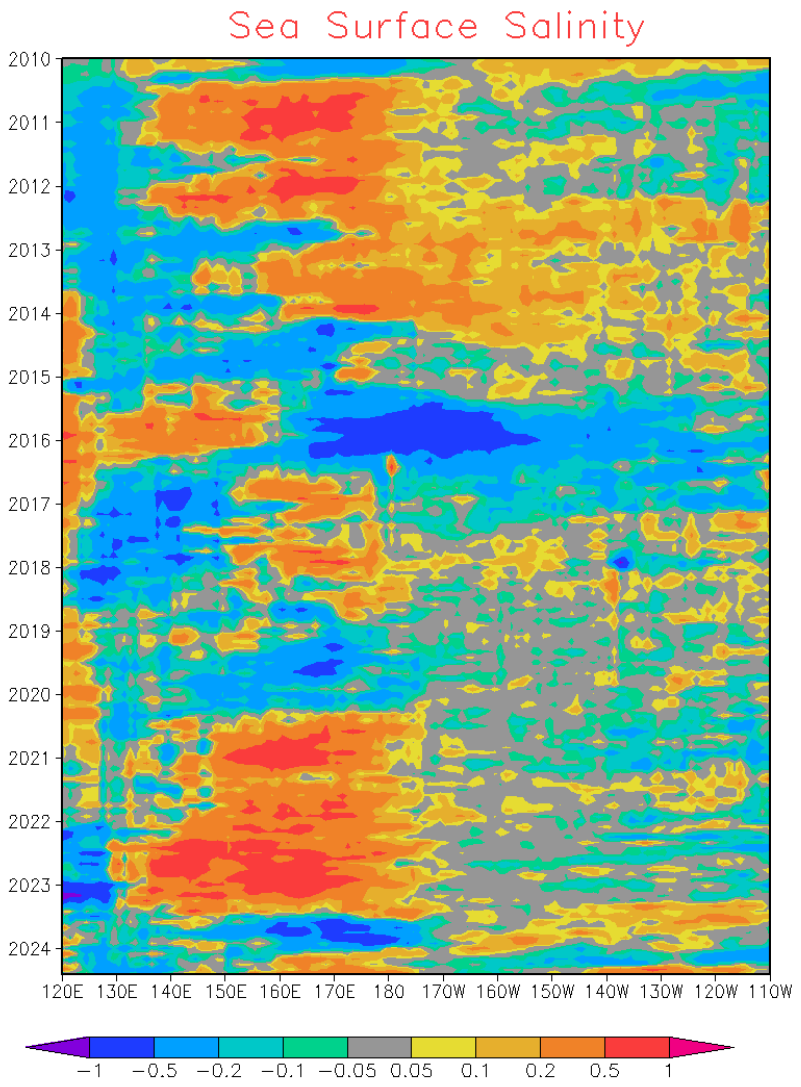
The global SSS tendency in June 2024 is overall weak and with mixed signs. The Precipitation are generally decreasing along the equator but enhancing off equator. Strong decreasing of precipitation is found in the tropical Indian ocean, while increasing . Stronger SPCZ is found with further extended precipitation into southern Pacific ocean. Large scale trends in the evaporation (e.g., decreasing/increasing in the western/eastern side of Pacific) are found, but still dominated by the precipitation trends. Overall the SSS trend doesn't show pronounced large scale pattern for this month.



Monthly SSS Anomaly Evolution over Equatorial Pacific

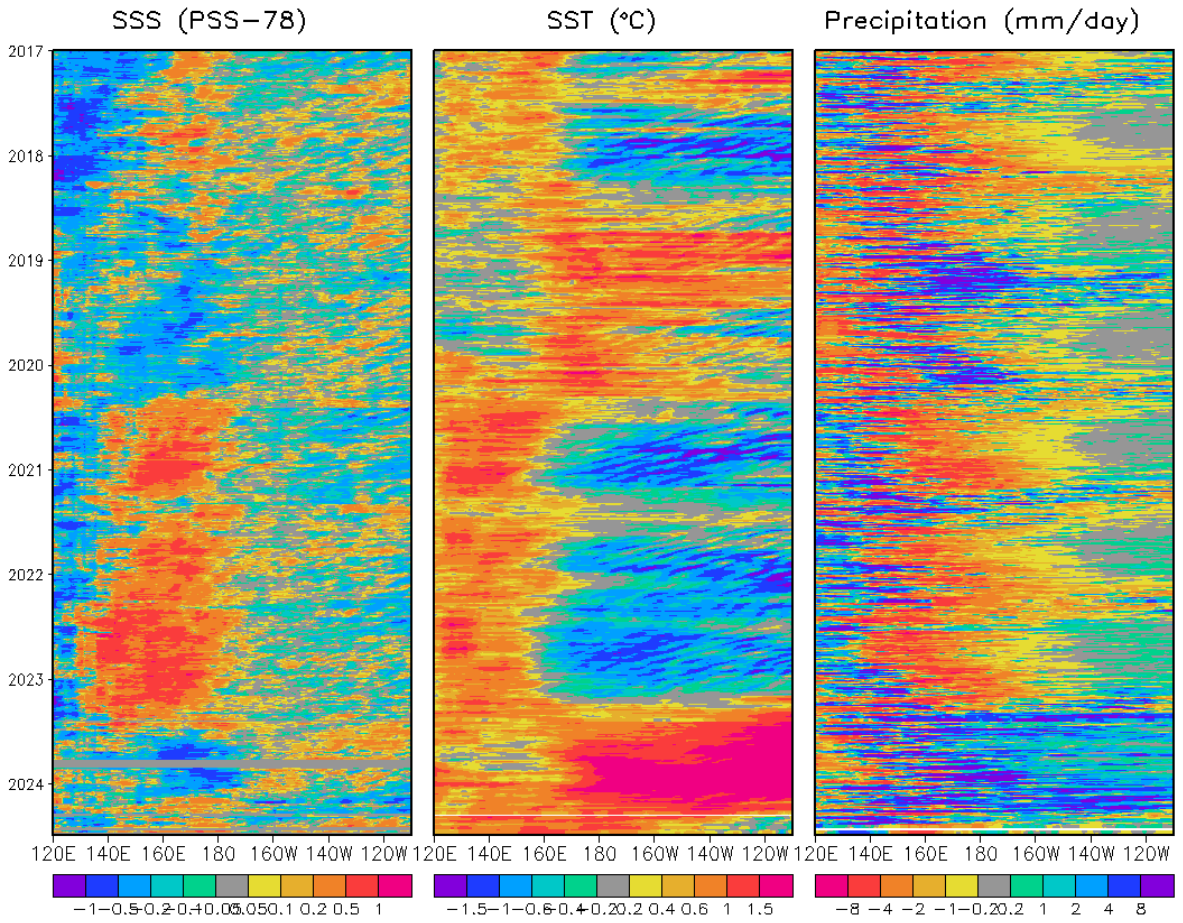
NOTE: Since June 2015, the BASS SSS is from in situ, SMOS and SMAP; before June 2015,The BASS SSS is from in situ, SMOS and Aquarius.

- Hovermoller diagram for equatorial SSS anomaly **(5S-5˚N);**
- Decreased SSS is found over the equatorial western Pacific, but is increased over the central Pacific. Freshening is also found over the equatorial eastern Pacific. Generally, these anomalies are not very strong.

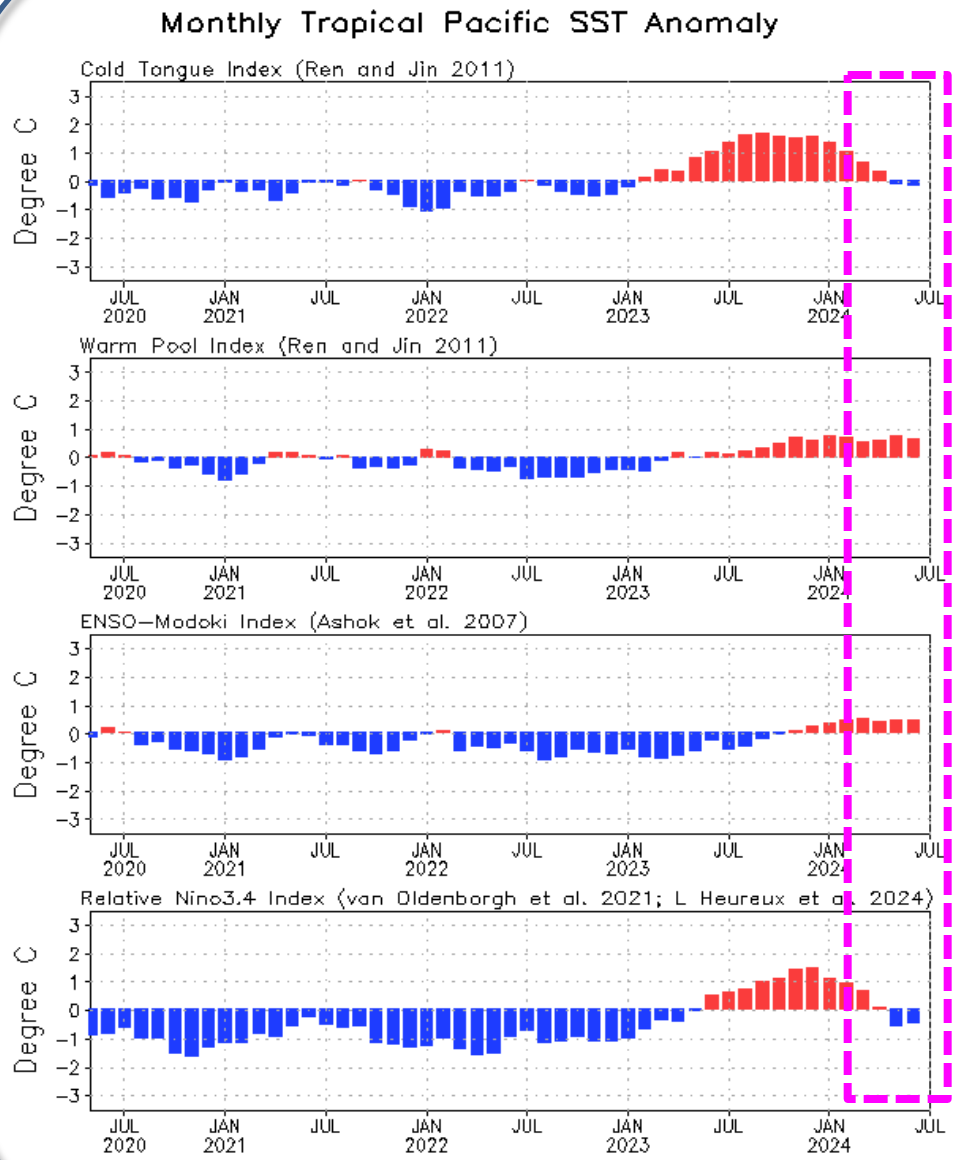


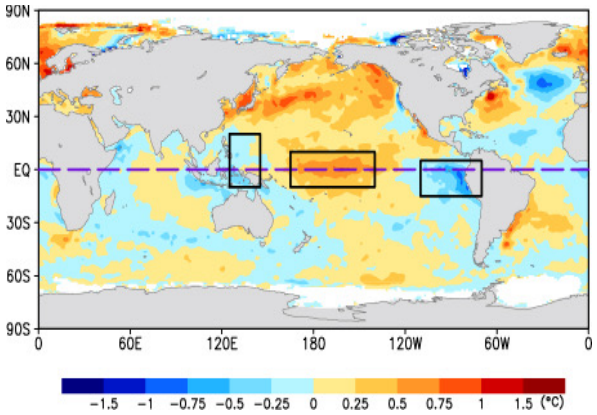
Pentad SSS Anomaly Evolution over Equatorial Pacific

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.



Evolution of Pacific Niño SST Indices



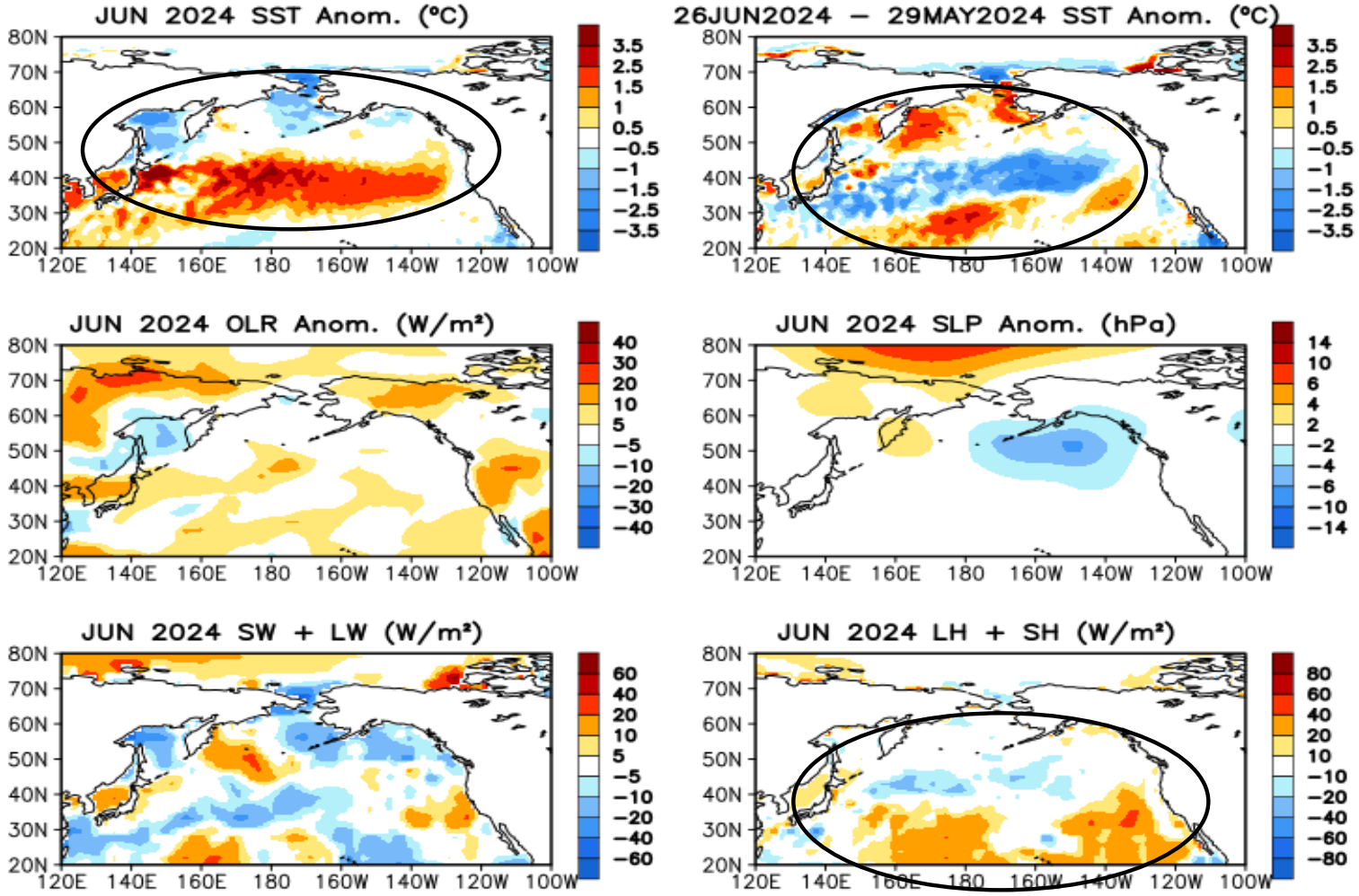


- Relative Niño3.4 index is now included in ENSO monitoring, which is defined as the conventional Niño3.4 index minus the SSTA averaged in the whole tropics (0°-360°, 20°S-20°N), in order to remove the global warming signal. Also, to have the same variability as the conventional Niño3.4 index, the relative Niño3.4 index is renormalized (van Oldenborgh et al. 2021: ERL, 10.1088/1748-9326/abe9ed).

Relative Niño3.4 data updated monthly at:

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

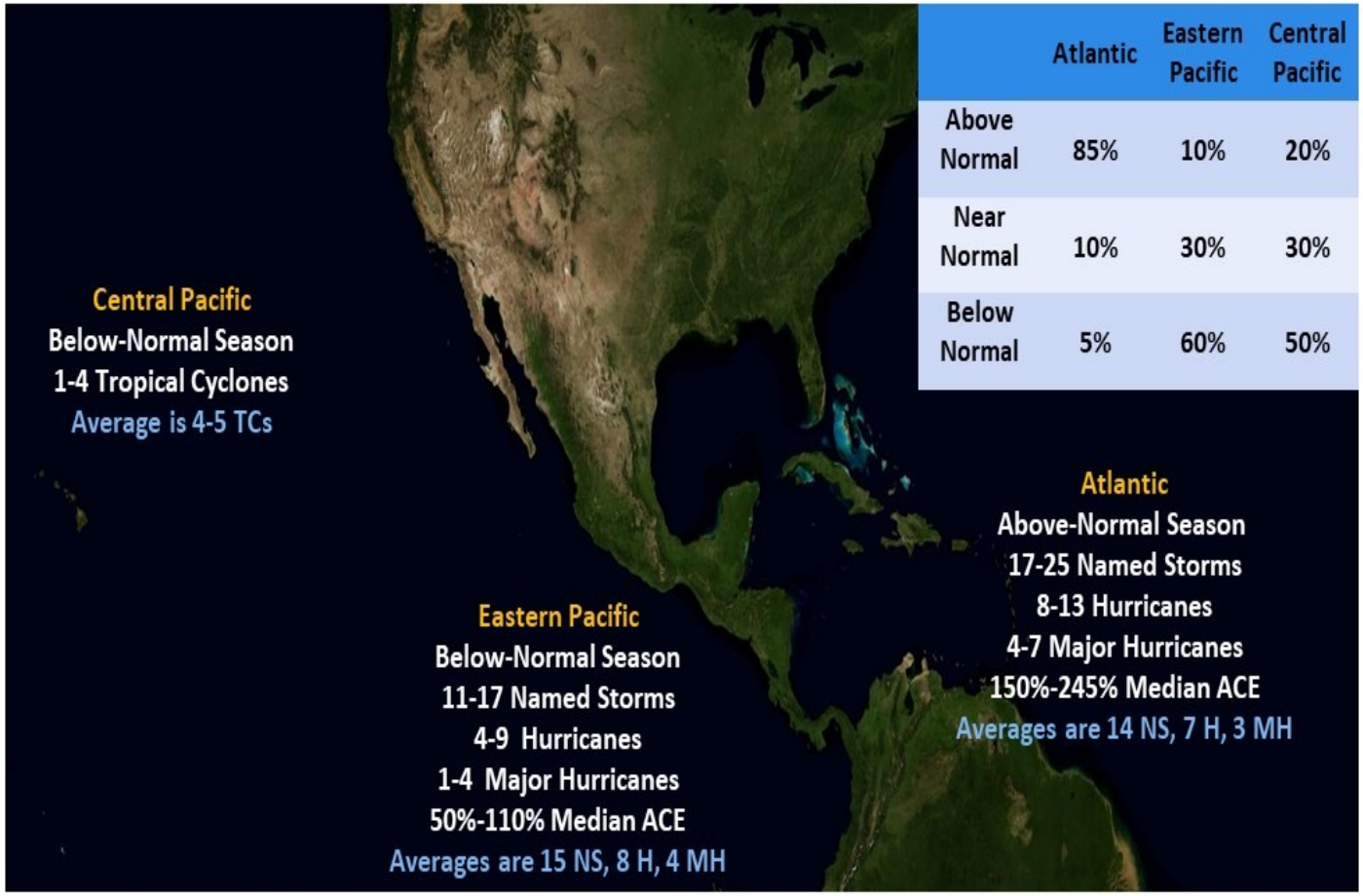
North Pacific & Arctic Ocean: SSTA, SSTA Tend., OLR, SLP, Sfc Rad, Sfc Flx Anomalies



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.

NOAA's 2024 Hurricane Season Outlook

NOAA's 2024 Hurricane Season Outlooks

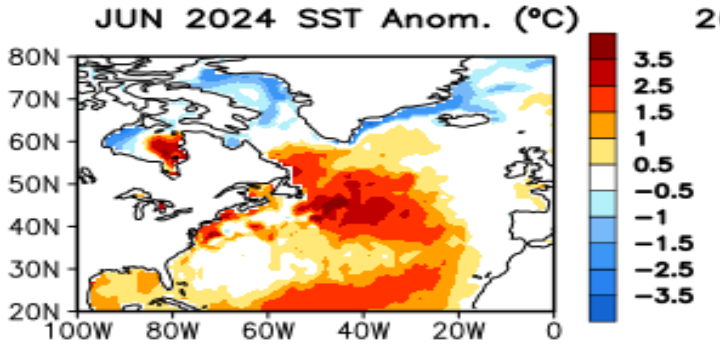


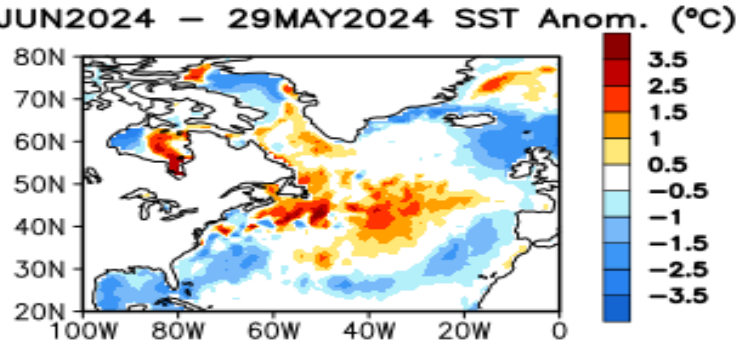
	Atlantic	Eastern Pacific	Central Pacific
Above Normal	85%	10%	20%
Near Normal	10%	30%	30%
Below Normal	5%	60%	50%

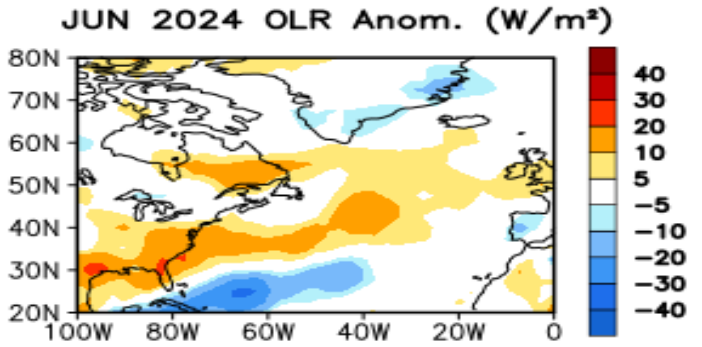
For the Atlantic hurricane region, the outlooks indicate a 85% chance of an above-normal season, a 10% chance of a near-normal season, and a 5% chance of a below-normal season. For the East Pacific Hurricane season, the outlooks indicate a 60% chance of below-normal activity, with a 30% chance for near-normal levels, and a 10% chance for below-normal levels.

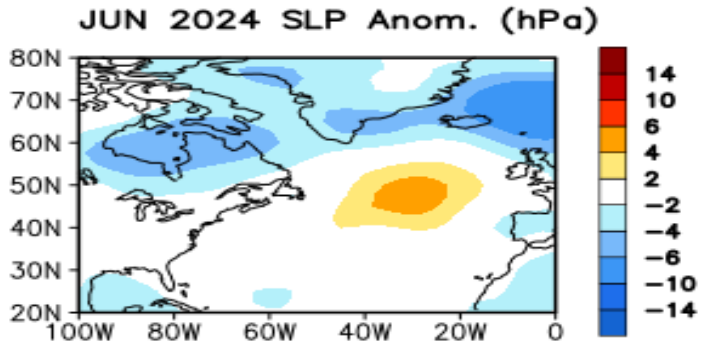
These outlooks are for the overall seasonal activity. They are not a hurricane landfall forecast.

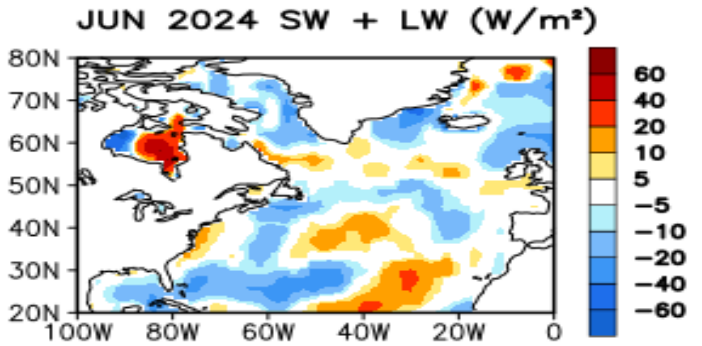
N. Atlantic: SST, SST tend., OLR, SLP, & heat flex anom.

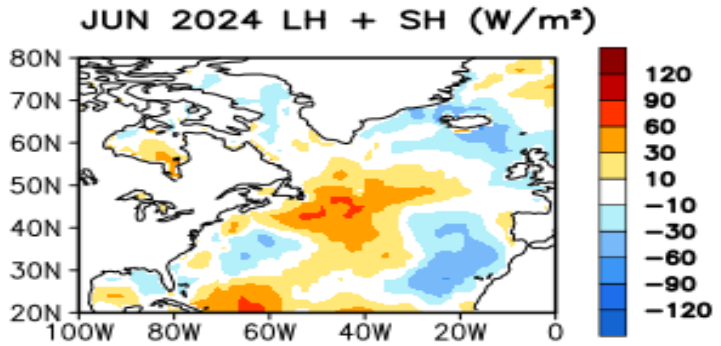




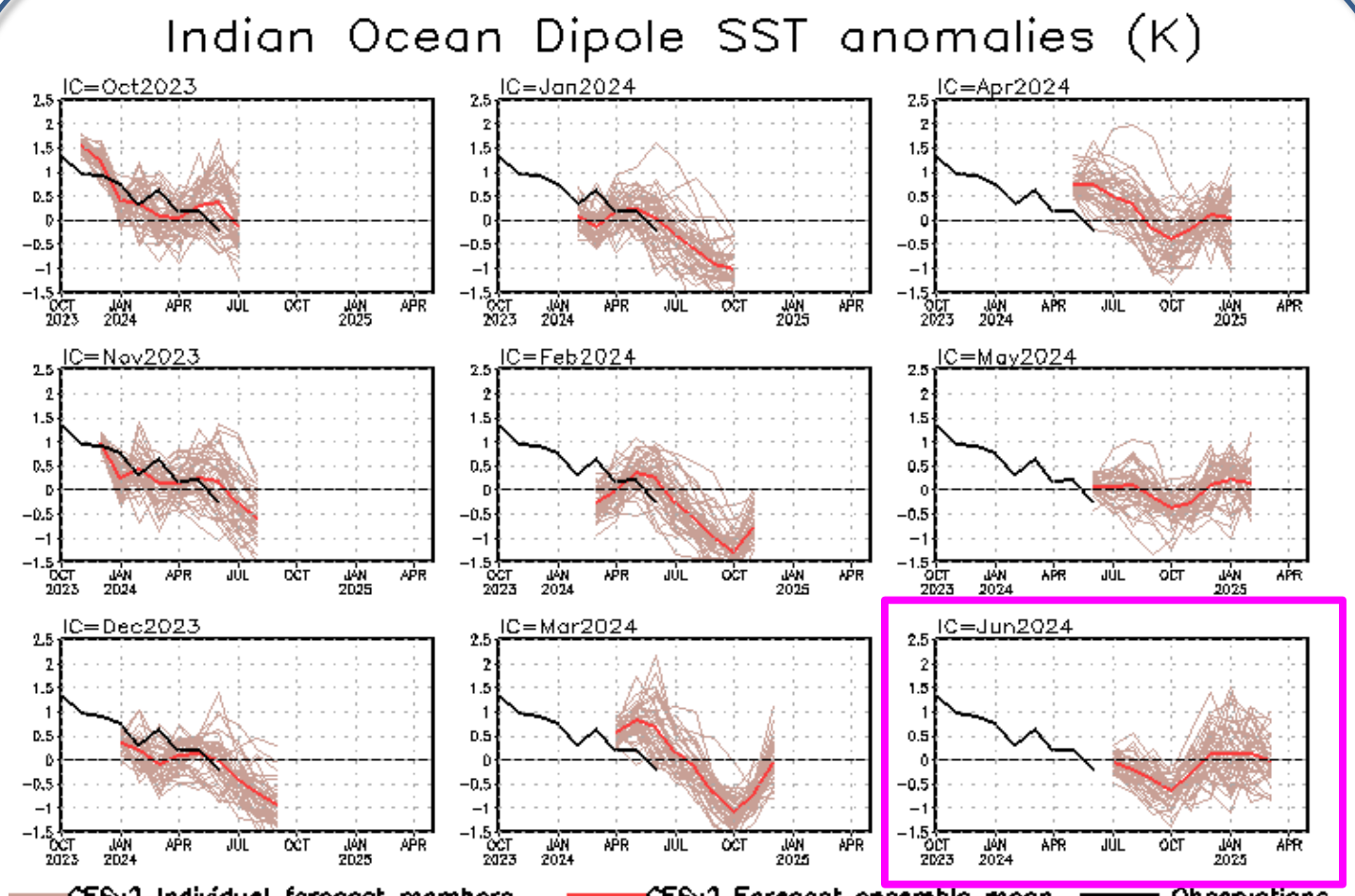








NCEP CFS DMI SST Predictions from Different Initial Months



- CFSv2 predicts a positive phase of IOD in the 2nd half of 2023.

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.