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

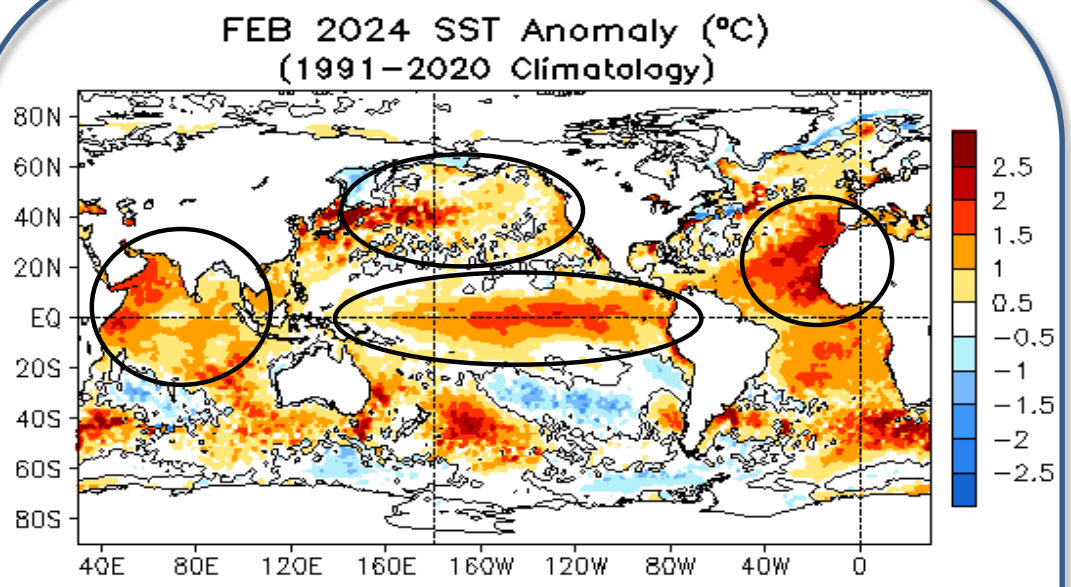
- **Overview**
- **Recent highlights**
  - Pacific Ocean
  - Arctic & Antarctic Oceans
  - Indian Ocean
  - Atlantic Ocean
- **Global SSTA Predictions**

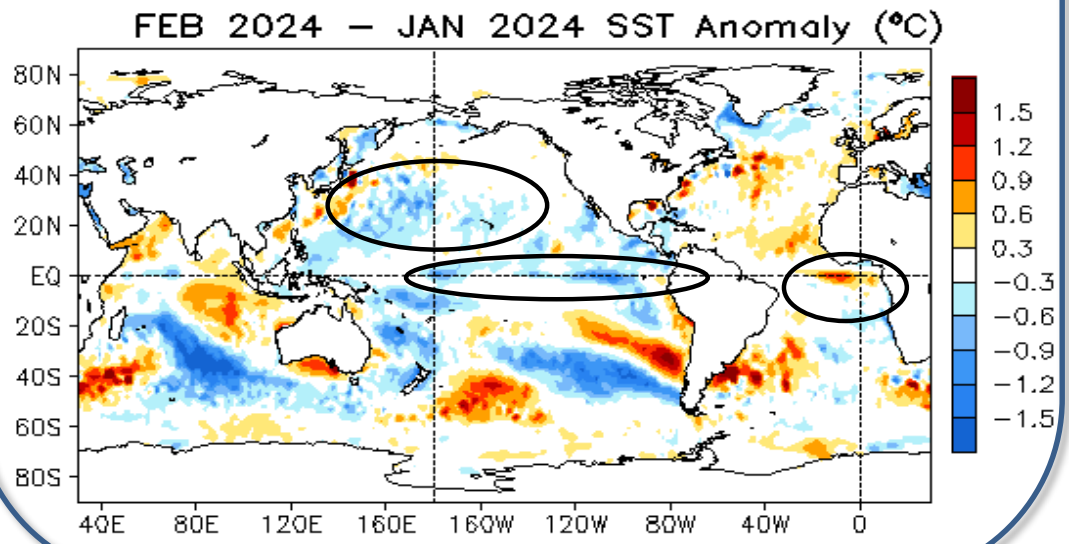
Overview

- Pacific Ocean
  - El Niño condition weakened with Niño3.4 = 1.6^{o}C in Feb 2024.
  - NOAA "ENSO Diagnostic Discussion" on 9 Feb 2024 issued "*El Niño Advisory / La Niña Watch.*"
  - Both positive SSTAs in the North Pacific and the negative phase of PDO weakened further with PDOI = -0.4 in Feb 2024.
- Arctic & Antarctic Oceans
  - Arctic sea ice extent was 14.61 million square kilometers in Feb 2024, the15th lowest in the 46-year satellite record for Feb.
  - On Feb 20th, 2024, sea ice surrounding Antarctica reached the annual minimum extent of 1.99 million square kilometers, tying for the 2nd lowest minimum with 2022 in the 46-year satellite record.
  - CPC UFS forecasts a below normal sea ice extent minimum in Arctic in Sep 2024.
- Indian Ocean
  - Positive SSTAs were observed in the tropical Indian Ocean with stronger warming in the west than in the east in Feb 2024.
- Atlantic Ocean
  - Positive SSTAs persisted in the tropical Atlantic Ocean, especially in the northeast.
  - NAO returned to a positive phase in Feb 2024 with NAOI= 0.8.

Global Oceans

Global SST Anomaly (°C) and Anomaly Tendency



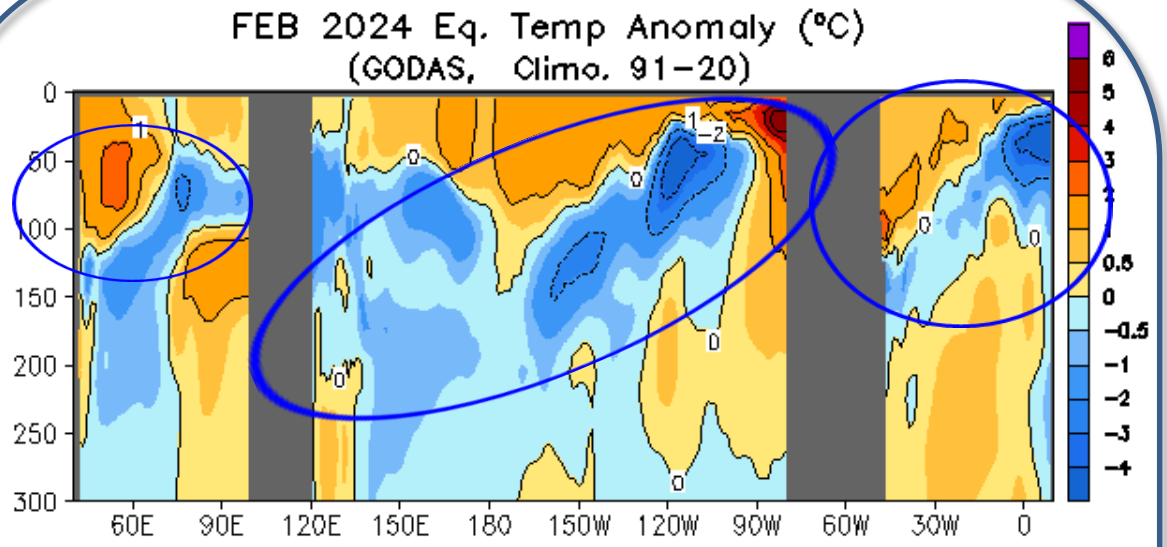


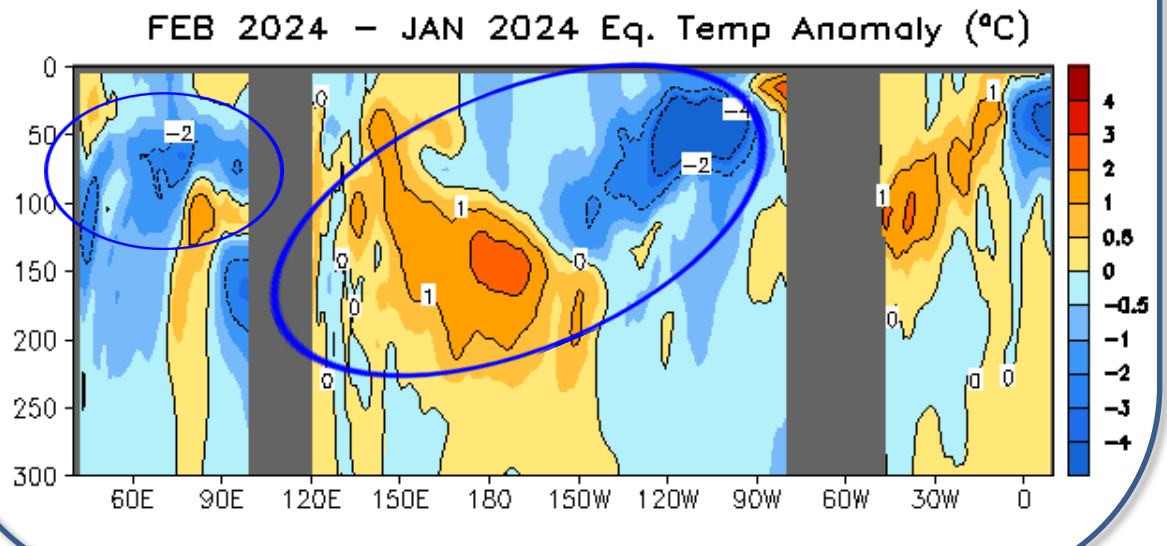
- Positive SSTAs persisted in the central and eastern equatorial Pacific Ocean.
- Positive SSTAs were present in the North Pacific and the eastern subtropical North Atlantic Oceans.
- Positive SSTAs were observed in the tropical Indian Ocean, with warmer SST in the west.

- Negative SSTA tendencies were present in the central and eastern equatorial Pacific Ocean, implying that El Niño is decaying.
- Positive SSTA tendencies were observed in the central and eastern equatorial Atlantic Ocean.
- Negative SSTA tendencies dominated the North Pacific 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





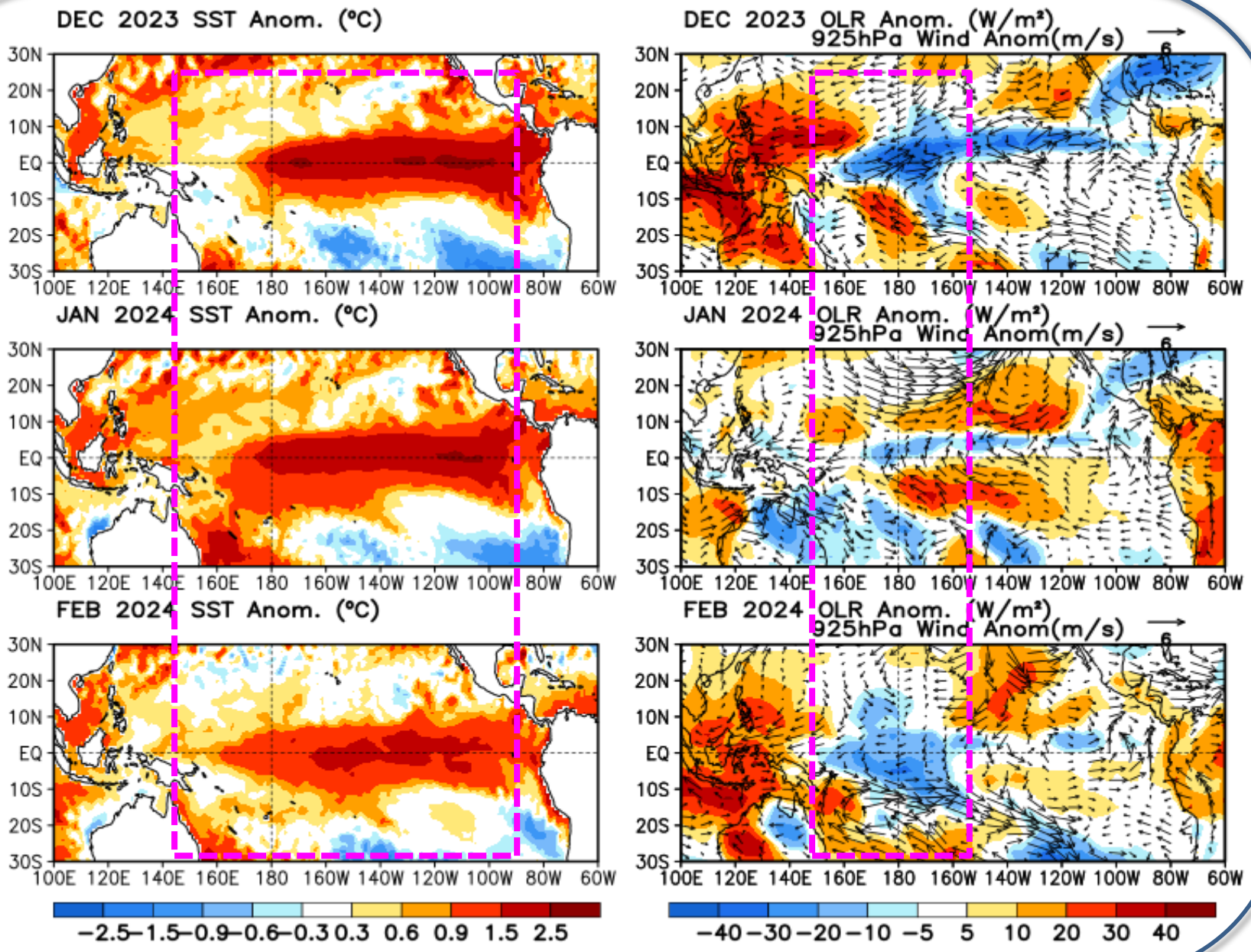
- Positive anomalies in the mixed-layer and negative anomalies around the thermocline were present in the equatorial Pacific, Indian, and Atlantic Oceans.
- Strong warming was observed in the far-eastern Pacific.

- Negative (positive) anomaly tendencies dominated along the thermocline in the eastern (western) Pacific and Atlantic Oceans.
- Negative anomaly tendencies were present along the thermocline in the Indian 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.

Tropical Pacific Ocean and ENSO Conditions

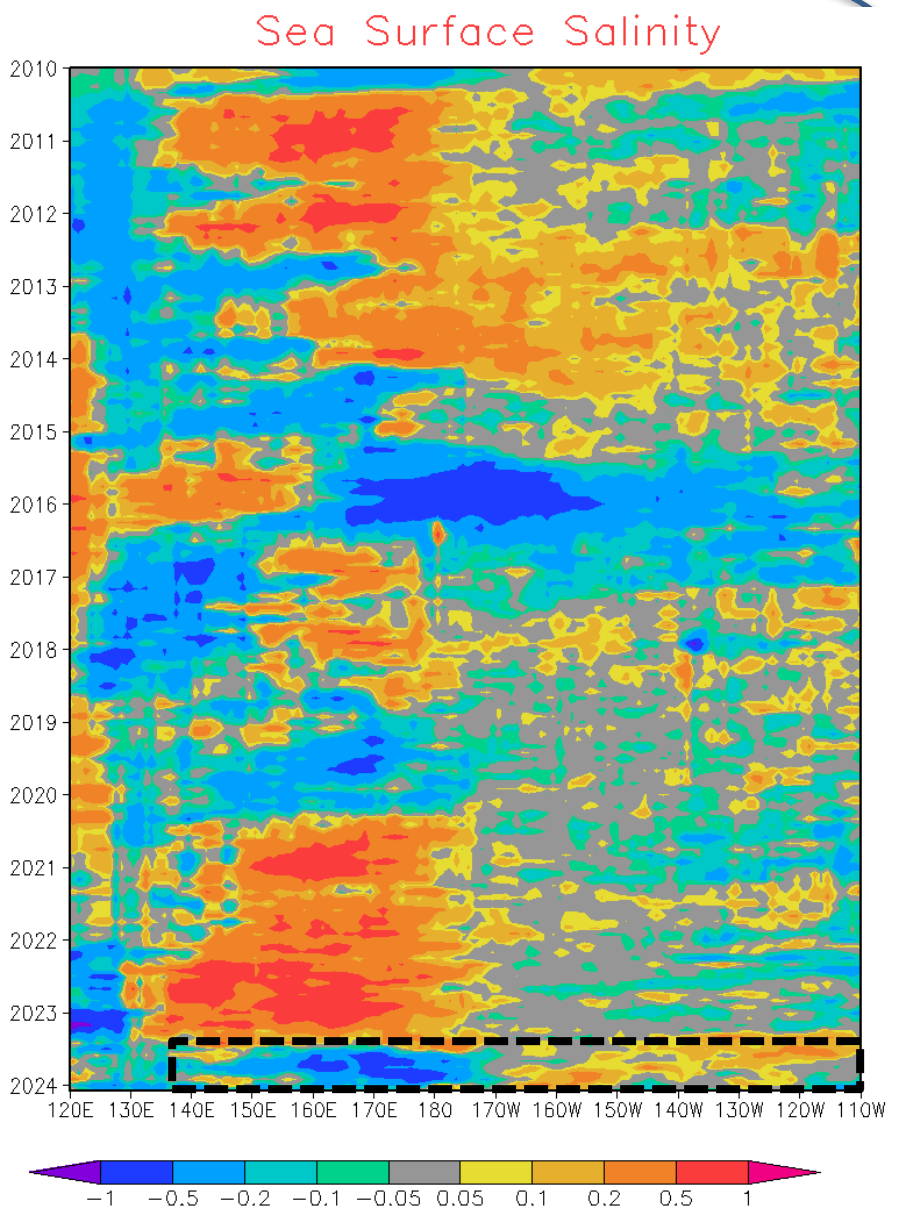
Last 3-month Tropical Pacific Ocean SST, OLR, and uv925 Anomalies



Monthly SSS Anomaly Evolution over Equatorial Pacific

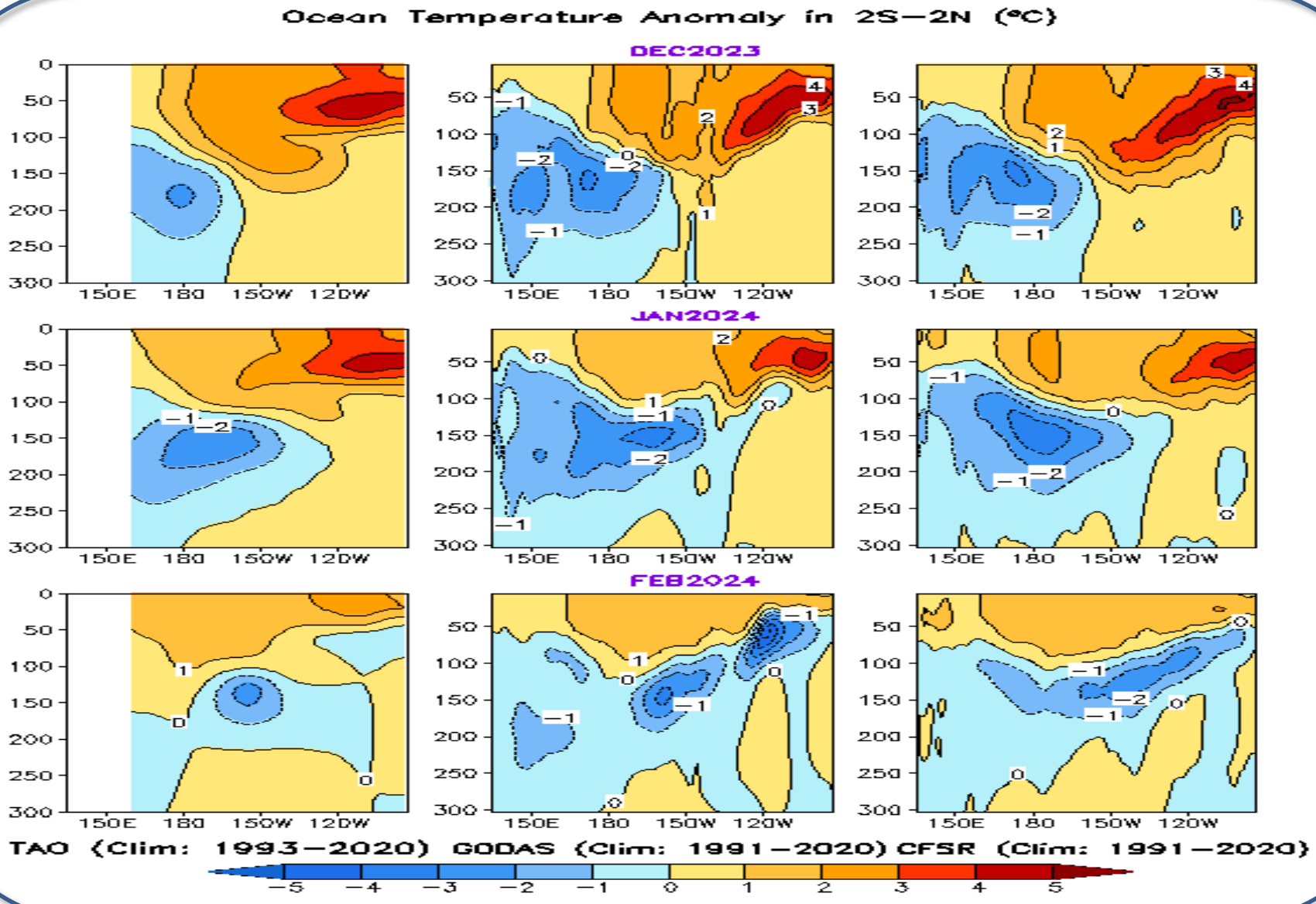
NOTE: Since June 2015, the BASS SSS is from in situ, SMOS and SMAP; before June 2015,The BASS SSS is from in situ, SMOS and Aquarius.

- Hovermoller diagram for equatorial SSS anomaly **(5S-5° N);**
- Freshened SSS anomalies maintain but are weakened over the western and central Pacific during February 2024. SSS anomalies over the equatorial eastern Pacific present mixed signs and are not very strong in general.

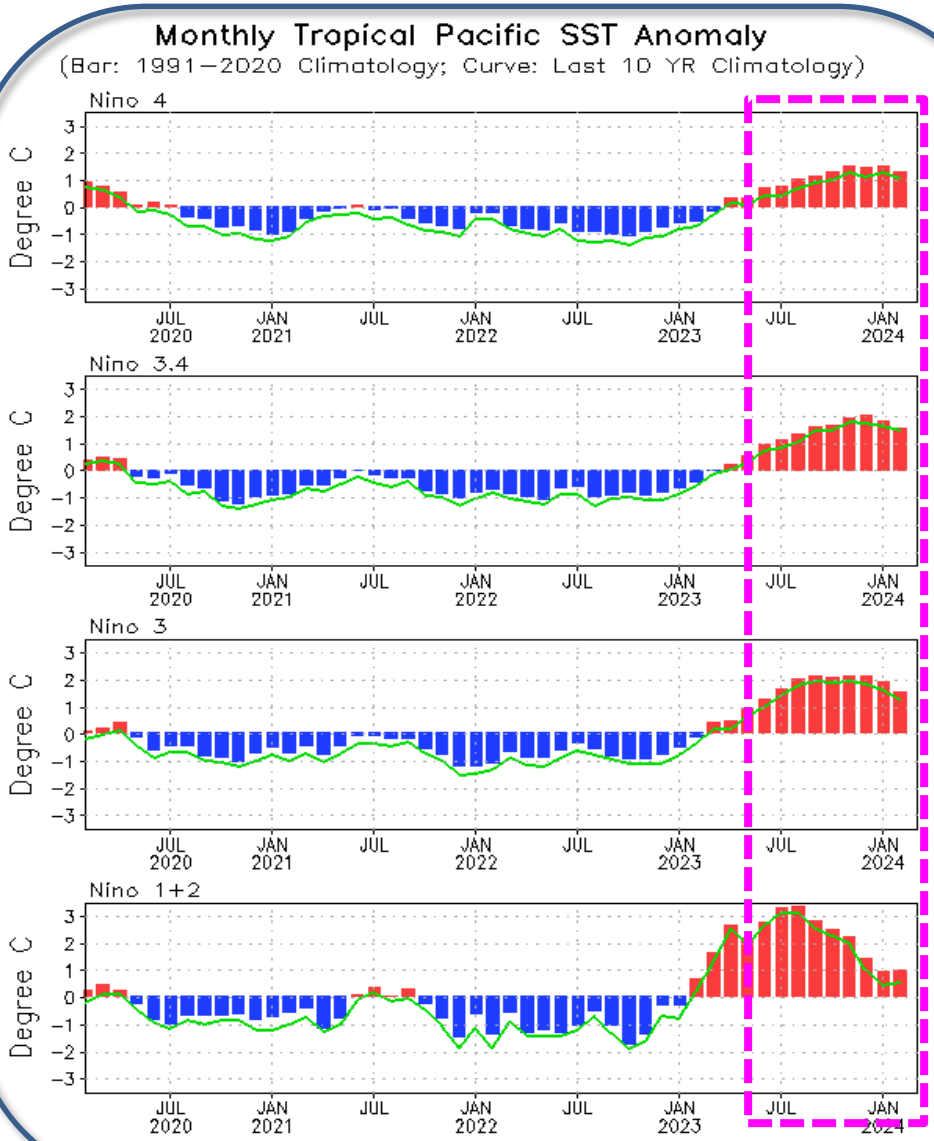


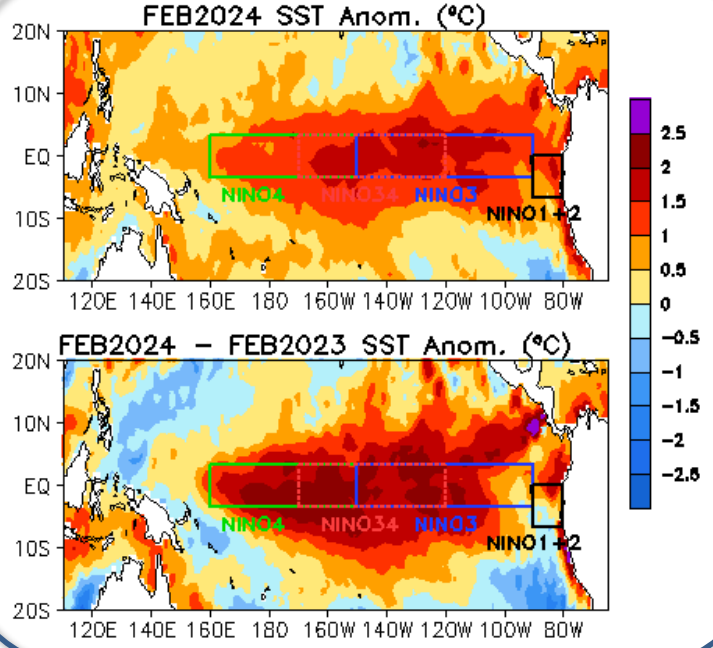
Monthly mean subsurface temperature anomaly along the Equator:

Consistent among 3 products with reduction in both negative and positive anomalies.in Feb 2024



Evolution of Pacific Niño SST Indices





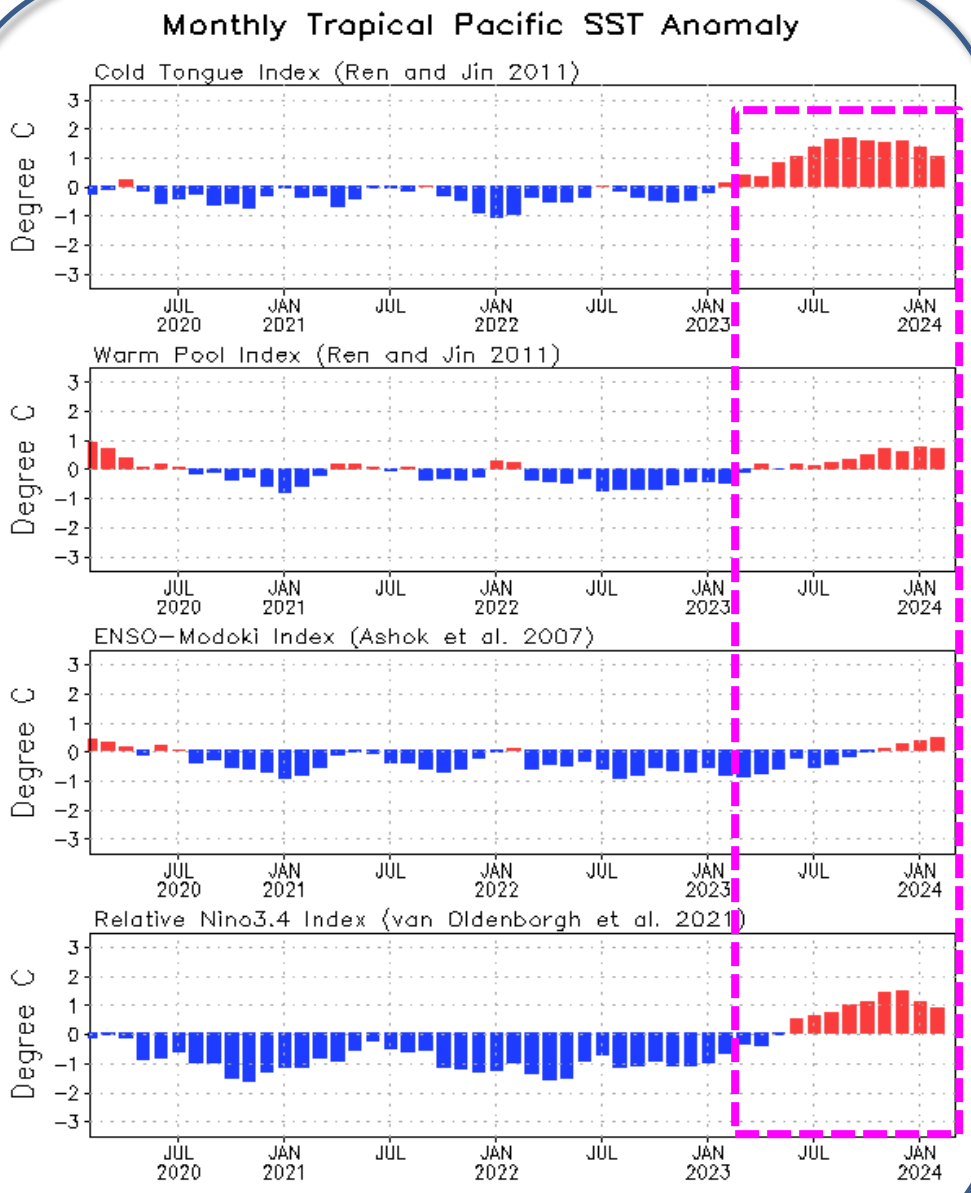
- In Feb 2024, Niño3.4 weakened further with Niño3.4 = 1.5°C (1.6°C in ERSSTv5 data); Nino1+2 persisted at 0.9°C.

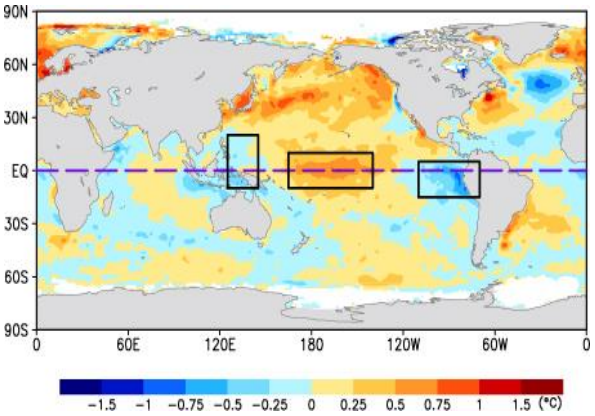
- Compared with Feb 2023, the tropical Pacific was much warmer in Feb 2024.

- The values of 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.

Evolution of Pacific Niño SST Indices: Warming mainly in the cold tongue



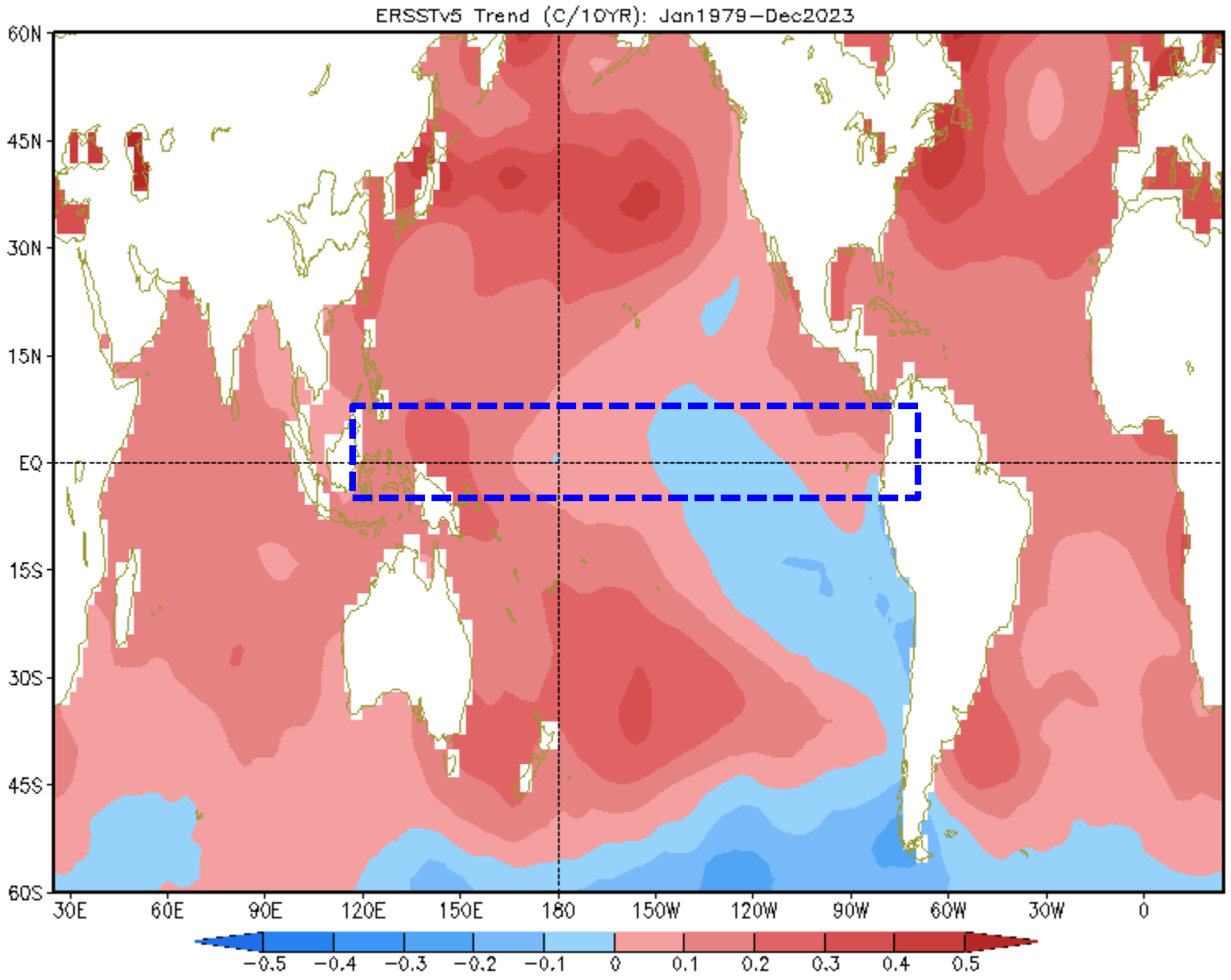


- Relative Niño3.4 index is now included in ENSO monitoring, which is defined as the conventional Niño3.4 index minus the SSTA averaged in the whole tropics (0°-360°, 20°S-20°N), in order to remove the global warming signal. Also, to have the same variability as the conventional Niño3.4 index, the relative 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).

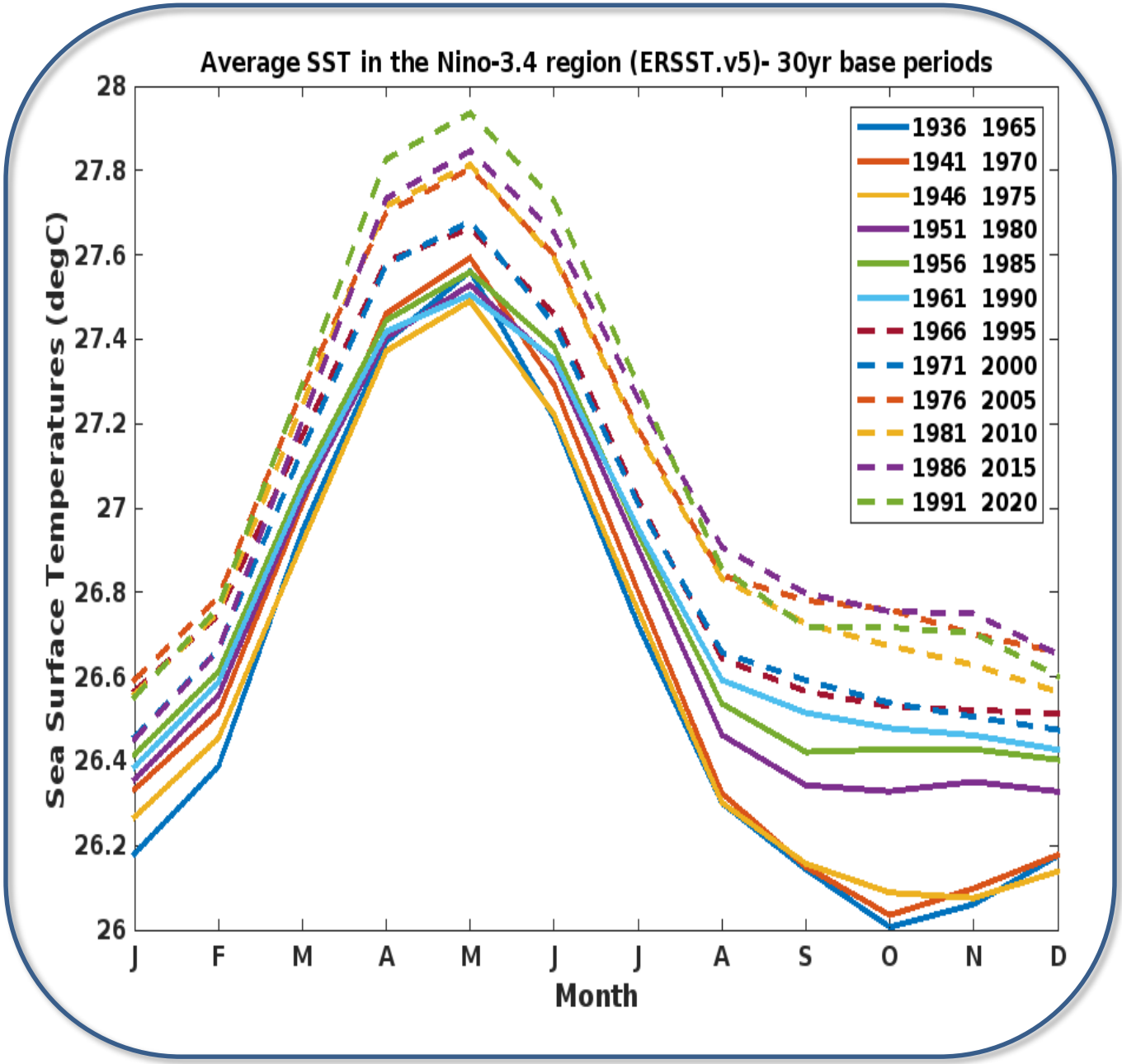
Relative Niño3.4 data updated monthly at:

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

Why Relative Niño3.4 Index?



Why Relative Niño3.4 Index?

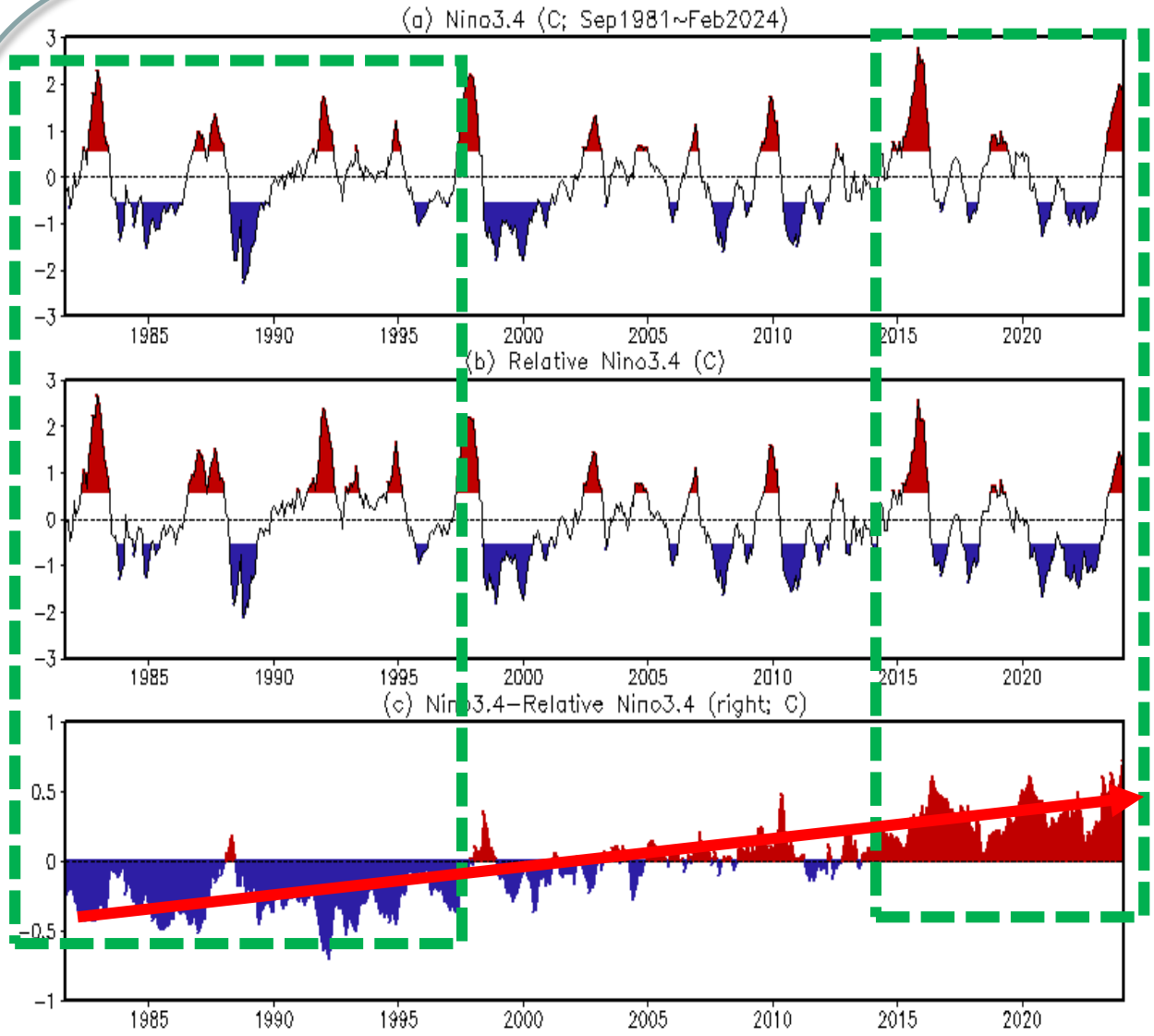


- CPC's the Oceanic Niño Index (ONI) is 3-month running mean of ERSST.v5 SSTAs in the Niño 3.4 region (5°N-5°S, 120°-170°W), based on centered 30-year base periods updated every 5 years.

- **So, the ENSO classifications based on the CPC's ONI in the latest 15-years are subject to change with the climatological base period.**

https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php

Why Relative Niño3.4 Index?



OIv2.1 (a) Niño3.4, (b) relative Niño3.4, and (c) Niño3.4-relative Niño3.4.

- Due to the warming trend, the intensity of El Niño (La Niña) is underestimated (overestimated) in the early period, while it is overestimated (underestimated) in the late period, if one climatology is applied.

L'Heureux, M., M. Tippett, M. Wheeler, H. Nguyen, S. Narsey, N. C. Johnson, Z.-Z. Hu, A. Watkins, C. Lucas, C. Ganter, E. Becker, W. Wang, and T. DiLiberto, 2024: A Relative Sea Surface Temperature Index for Classifying ENSO Events in a Changing Climate. J. Climate, 37 (4), 1197–1211. DOI: 10.1175/JCLI-D-23-0406.1.

Why Relative Niño3.4 Index?

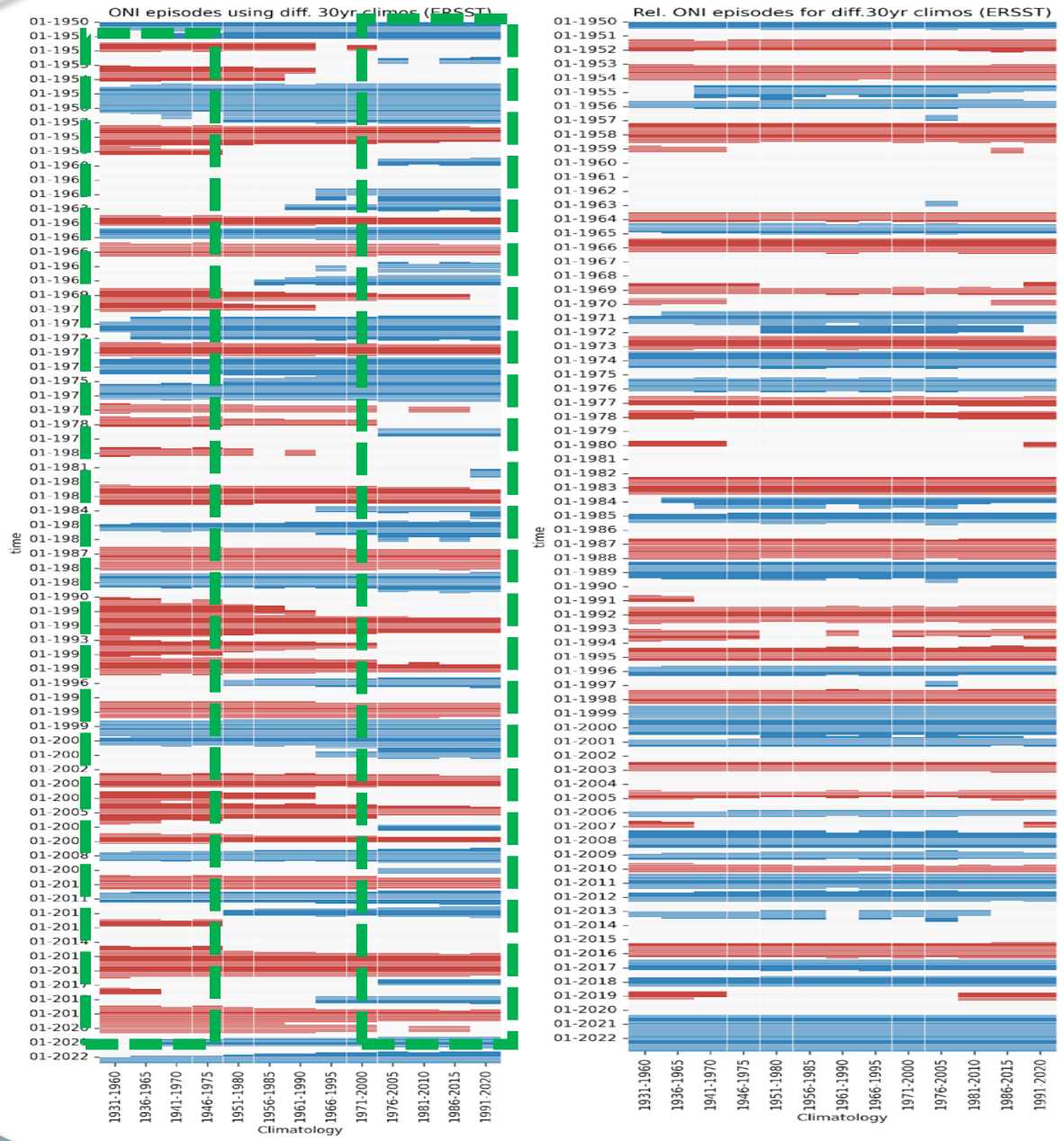
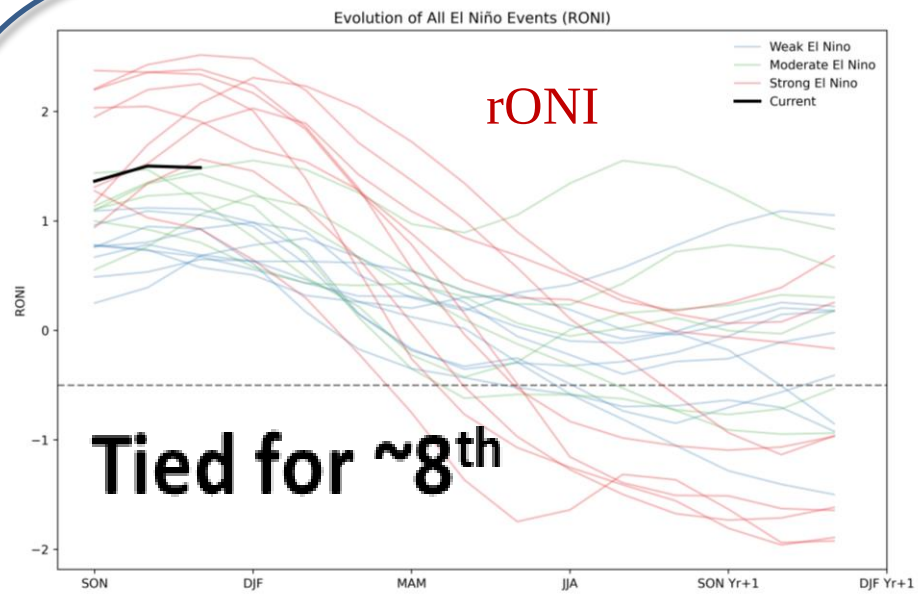
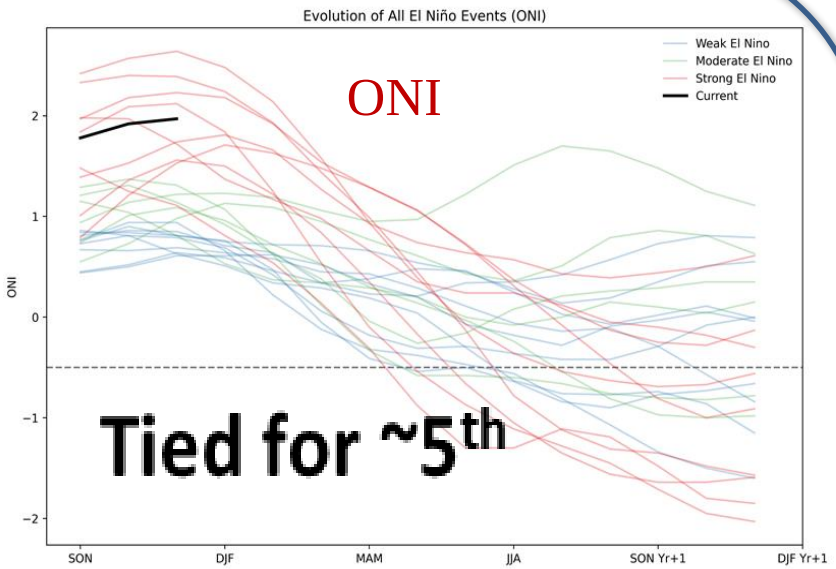


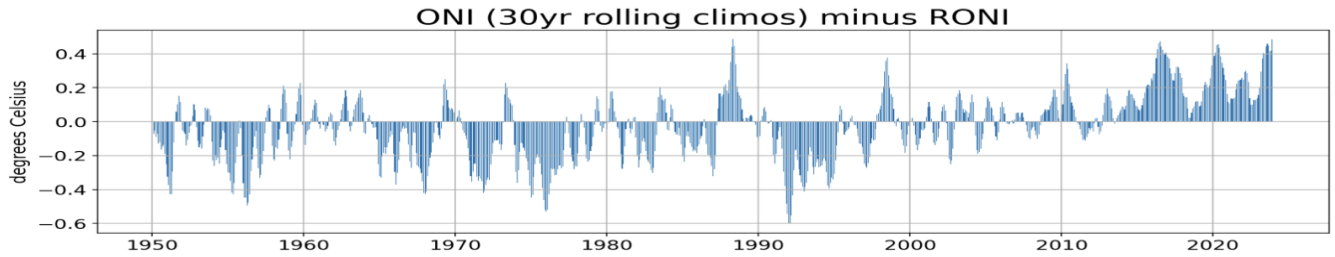
Fig. 4. Heat maps of historical El Niño (in red shading) and La Nino (in blue shading) episodes as defined by NOAA's +/-0.5◦C threshold and requirement that ENSO periods last at least 5 consecutive overlapping seasons. Each column on the x-axis represents a different 30-year climatology period. The left panel shows the historical ENSO classifications based on the ONI (using only a single climatology for the entire historical record) and the right panel shows the same for the RONI. Data are from ERSSTv5.Niño3.4.

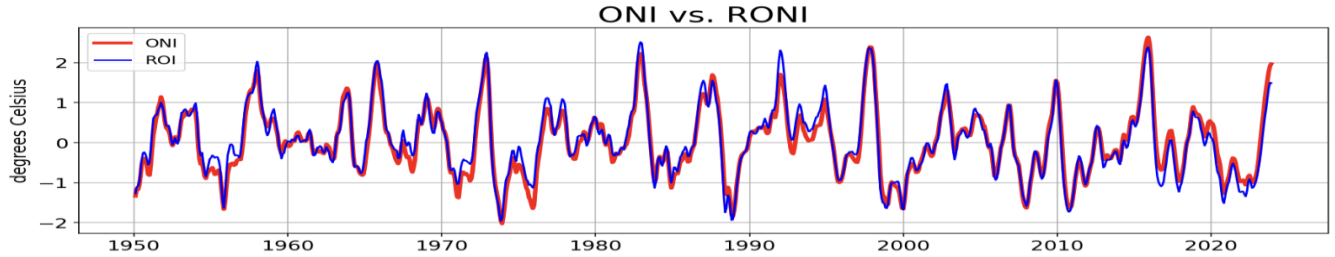
L'Heureux, M., M. Tippett, M. Wheeler, H. Nguyen, S. Narsey, N. C. Johnson, Z.-Z. Hu, A. Watkins, C. Lucas, C. Ganter, E. Becker, W. Wang, and T. DiLiberto, 2024: A Relative Sea Surface Temperature Index for Classifying ENSO Events in a Changing Climate. J. Climate, 37 (4), 1197–1211. DOI: 10.1175/JCLI-D-23-0406.1.

El Niños since 1950: 2023/24 is a strong event (Michelle L'Heureux)









The difference between ONI and rONI in NDJ 2023/24 is 0.48 C

Relative Niño3.4 Index
rONI-ONI: High frequency variations in the 20S-20N averaged SST

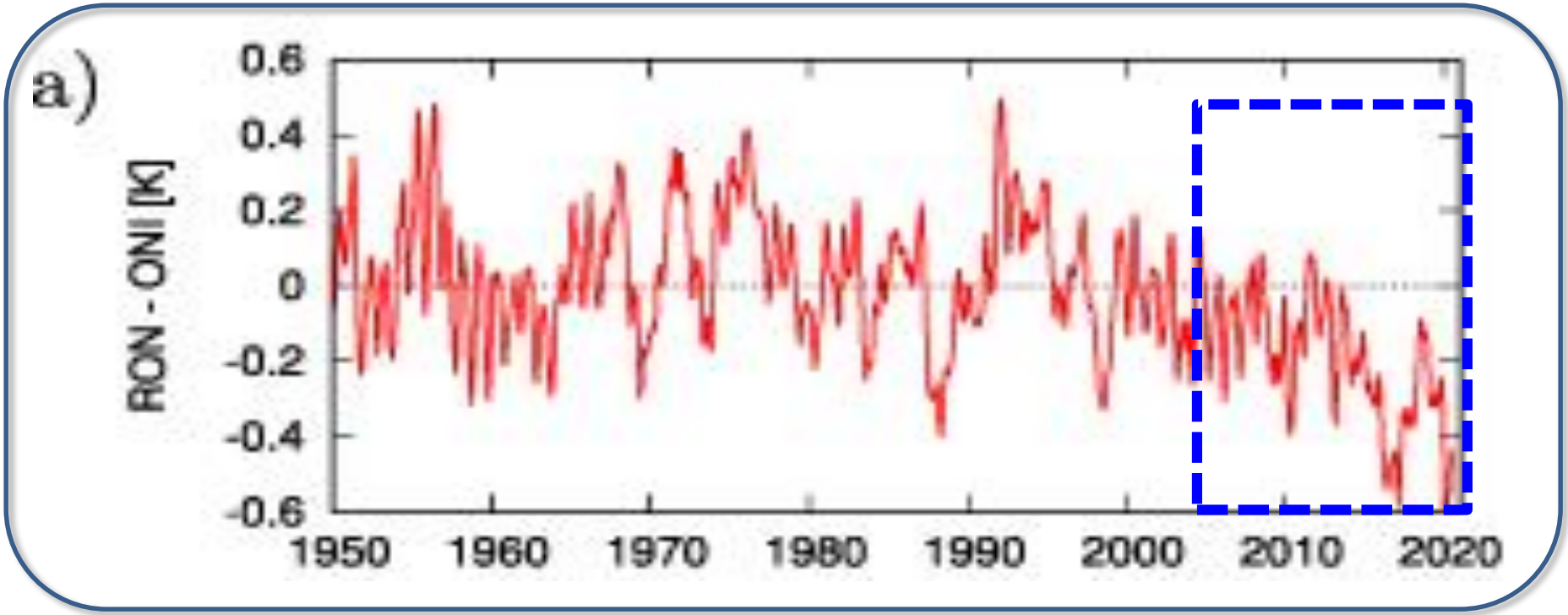
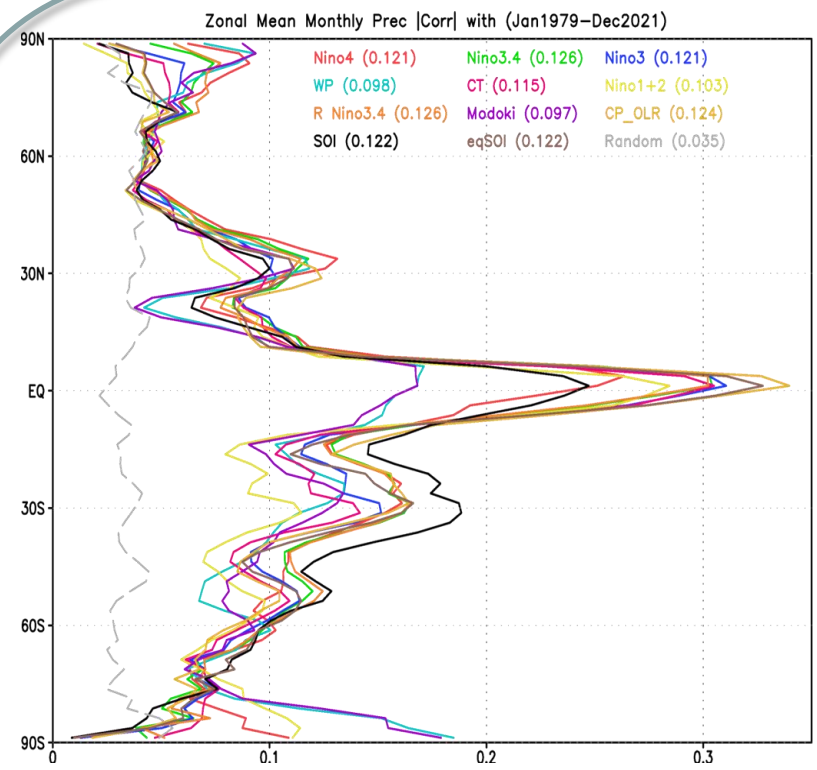
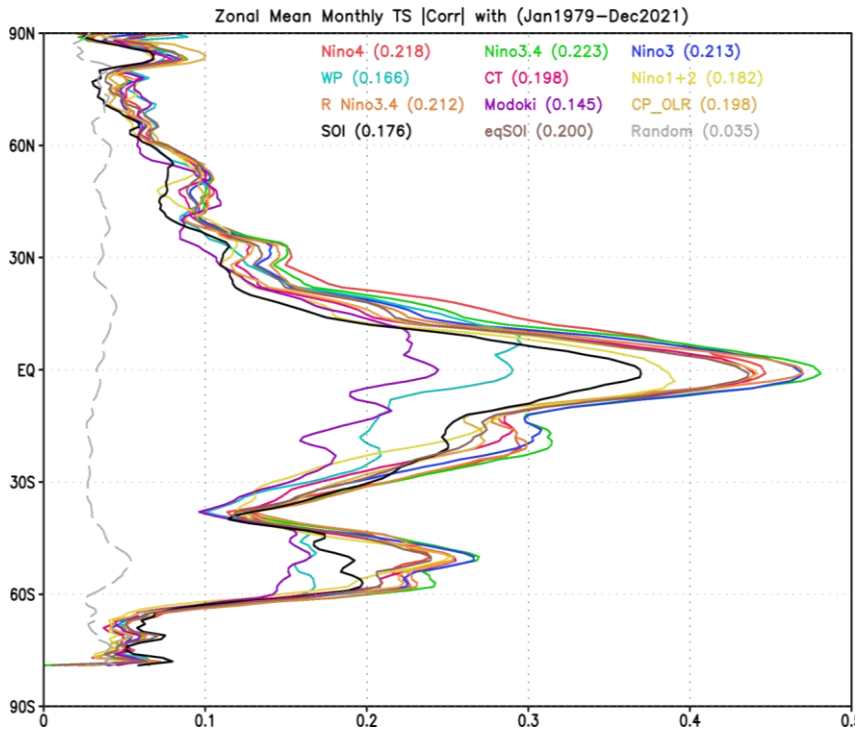


Figure 3. (a) Difference between the relative Ocean Niño Index (ONI) proposed here and the current NOAA/NCEP ONI definition

- Relative Niño3.4 index is now included, which is define as the conventional Niño3.4 index minus the SSTA averaged in the whole tropics (0º-360º, 20ºS-20ºN), 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 Index: Global connection with monthly P & T



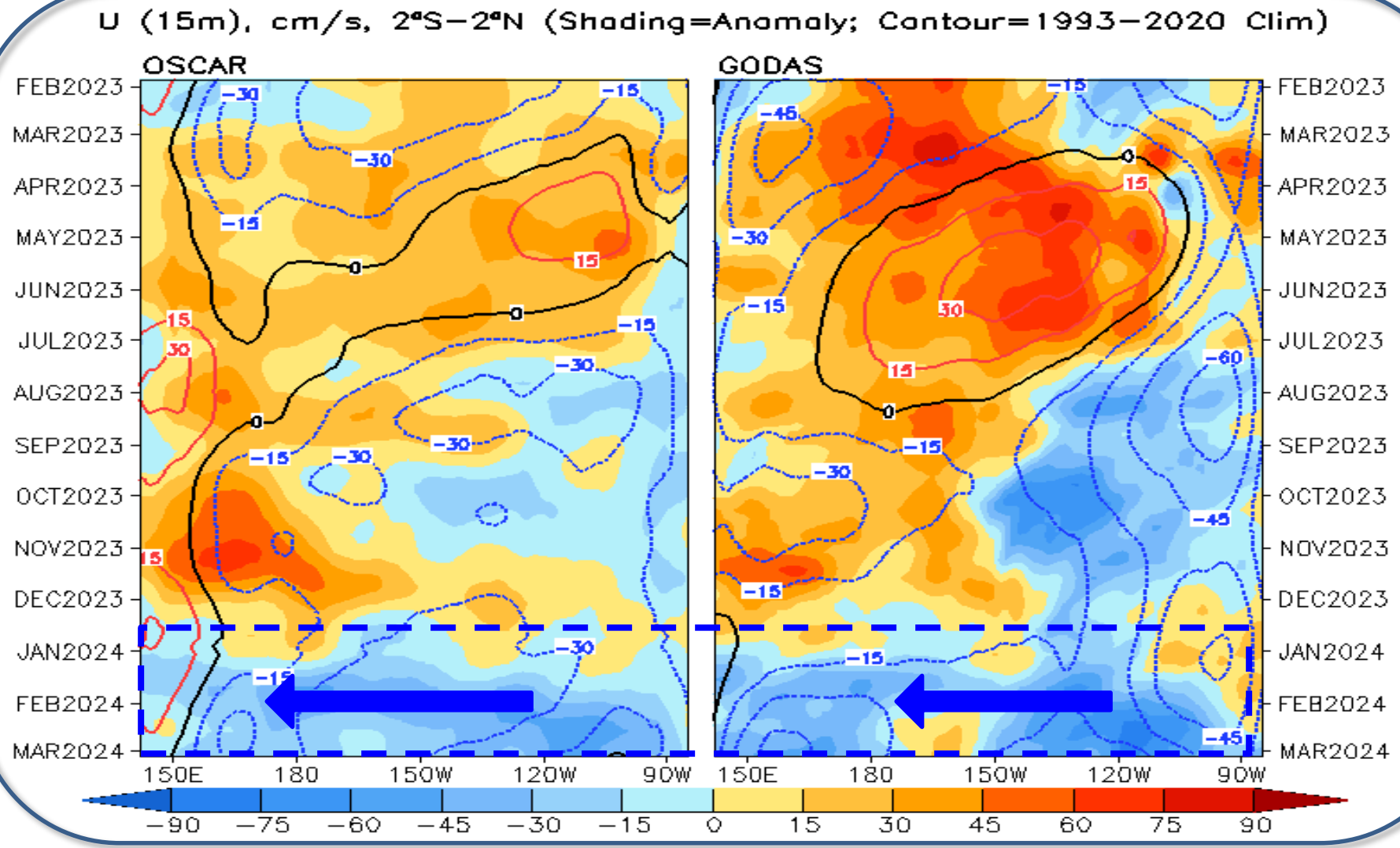


- For the global connection with monthly precipitation, Nino3.4 and rNino3.4 have the strongest overall connection.
- For the global connection with monthly TS+SST, Nino3.4 has the strongest overall connection, and rNino3.4 has the 4th strongest connection.

Zonal averaged and area-weighted absolute simultaneous correlations of monthly precipitation (left) and Ts (right) anomaly with the ENSO indices in January 1979-December 2021 (10-year HP filter).

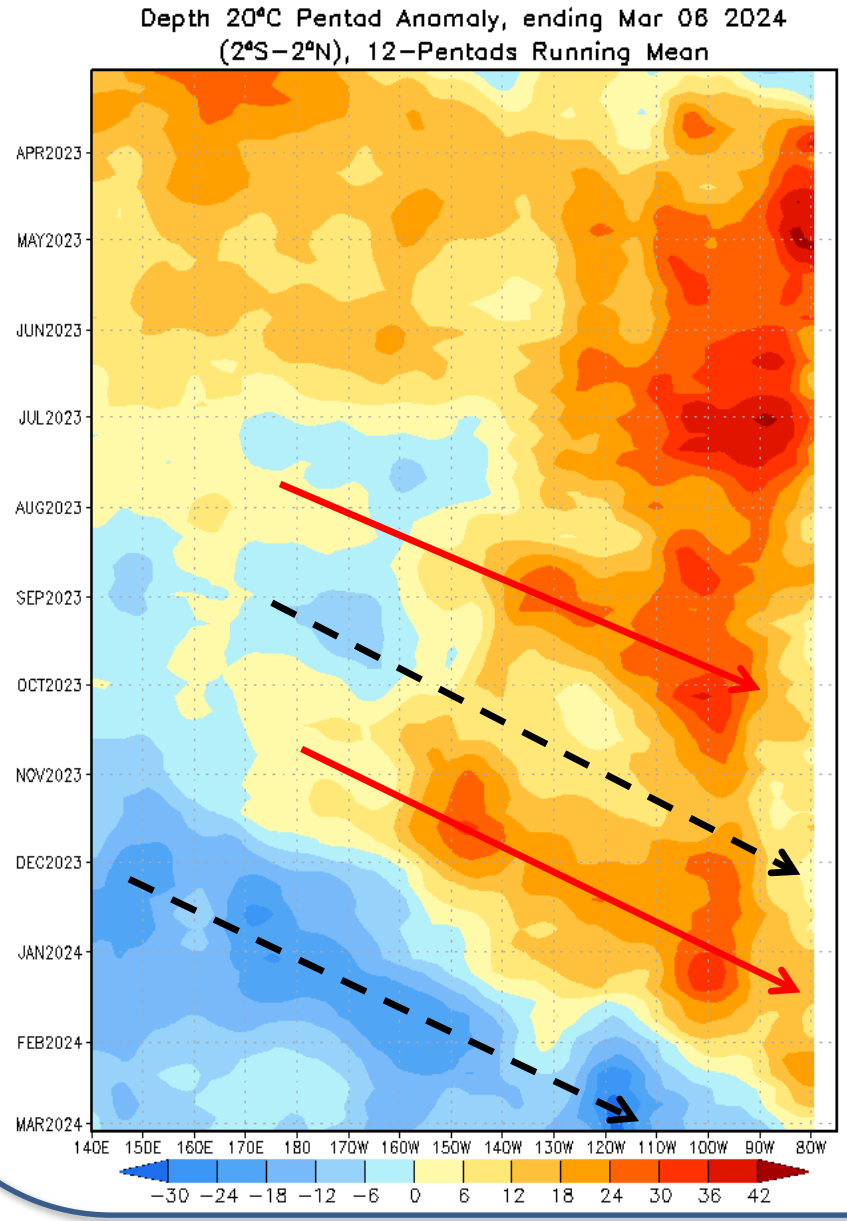
Li, et al., 2023: Which ENSO Index Best Represents Its Global Influences? Climate Dyn., 61 (9-10), 4899-4913. DOI: 10.1007/s00382-023-06804-9.

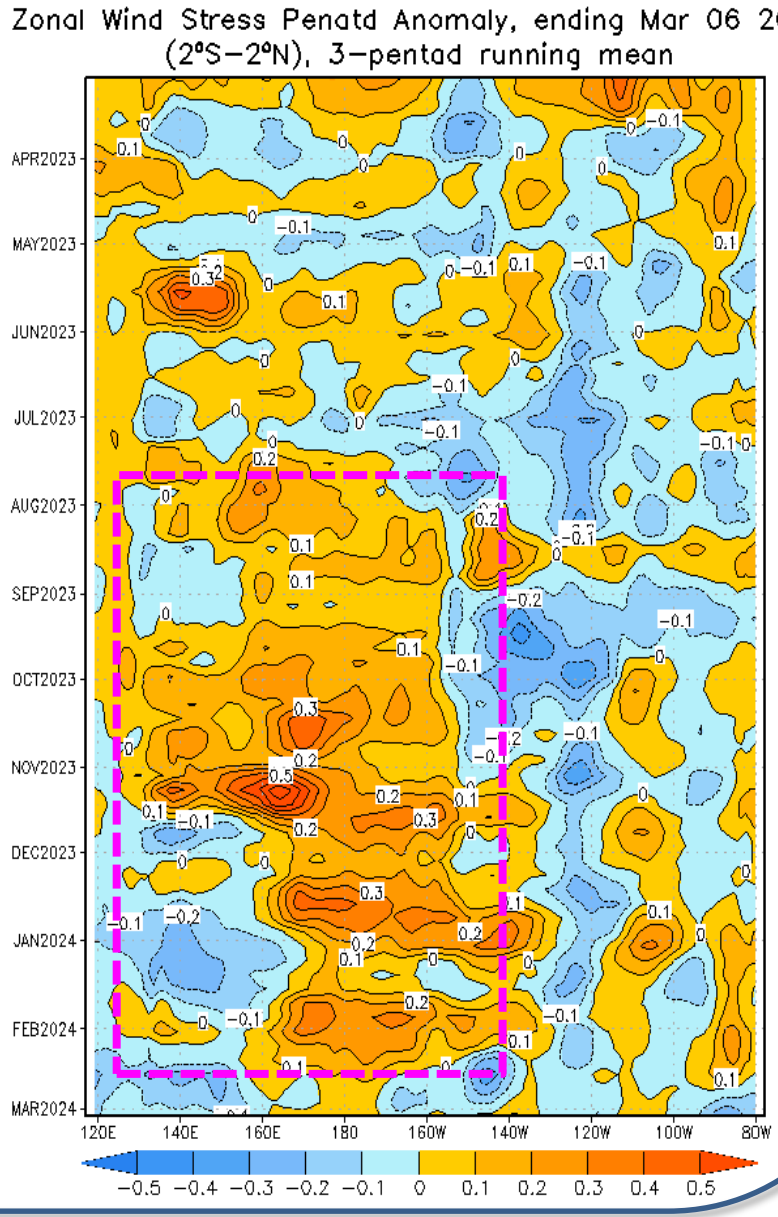
Evolution of Equatorial Pacific Surface Zonal Current Anomaly (cm/s)



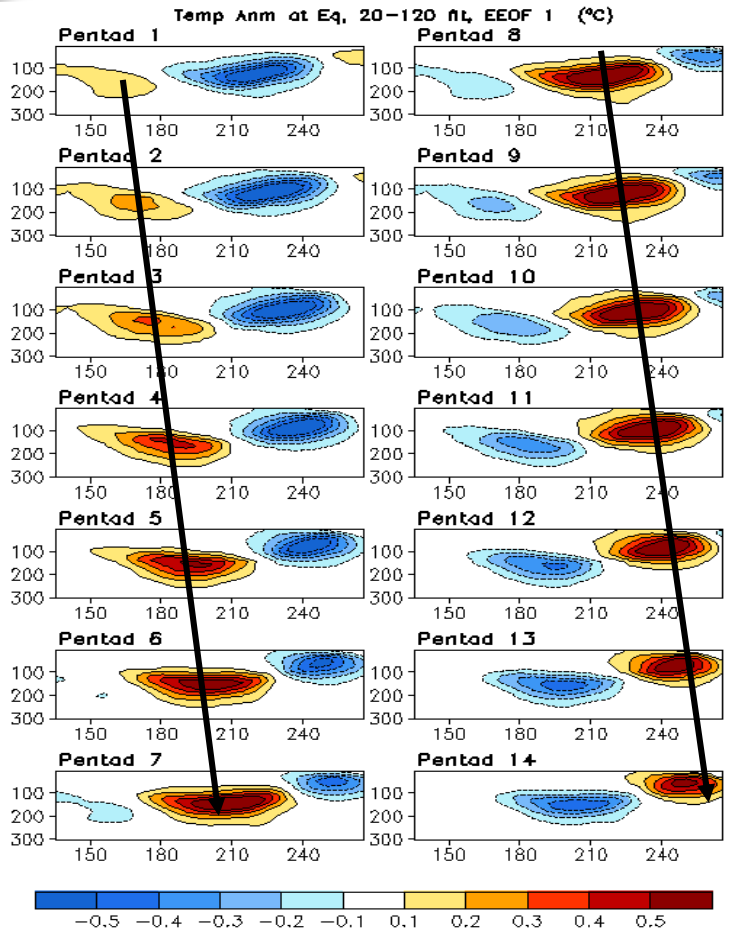
- Anomalous eastward currents were present in the equatorial Pacific in both OSCAR and GODAS during Feb-Jul 2023, which were consistent with the growth of the positive SSTA.
- Anomalous westward currents have been observed since mid-Dec 2023.

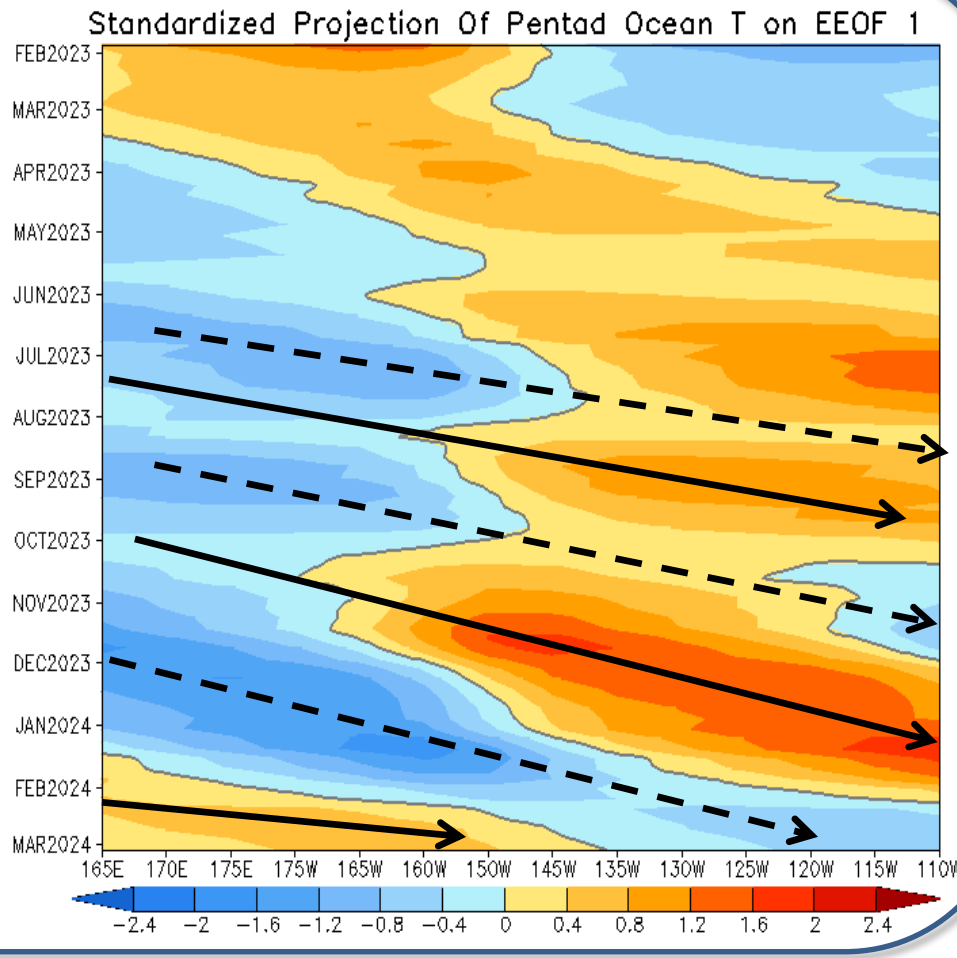
Evolution of Pentad D20 and Taux anomalies along the equator





Oceanic Kelvin Wave (OKW) Index



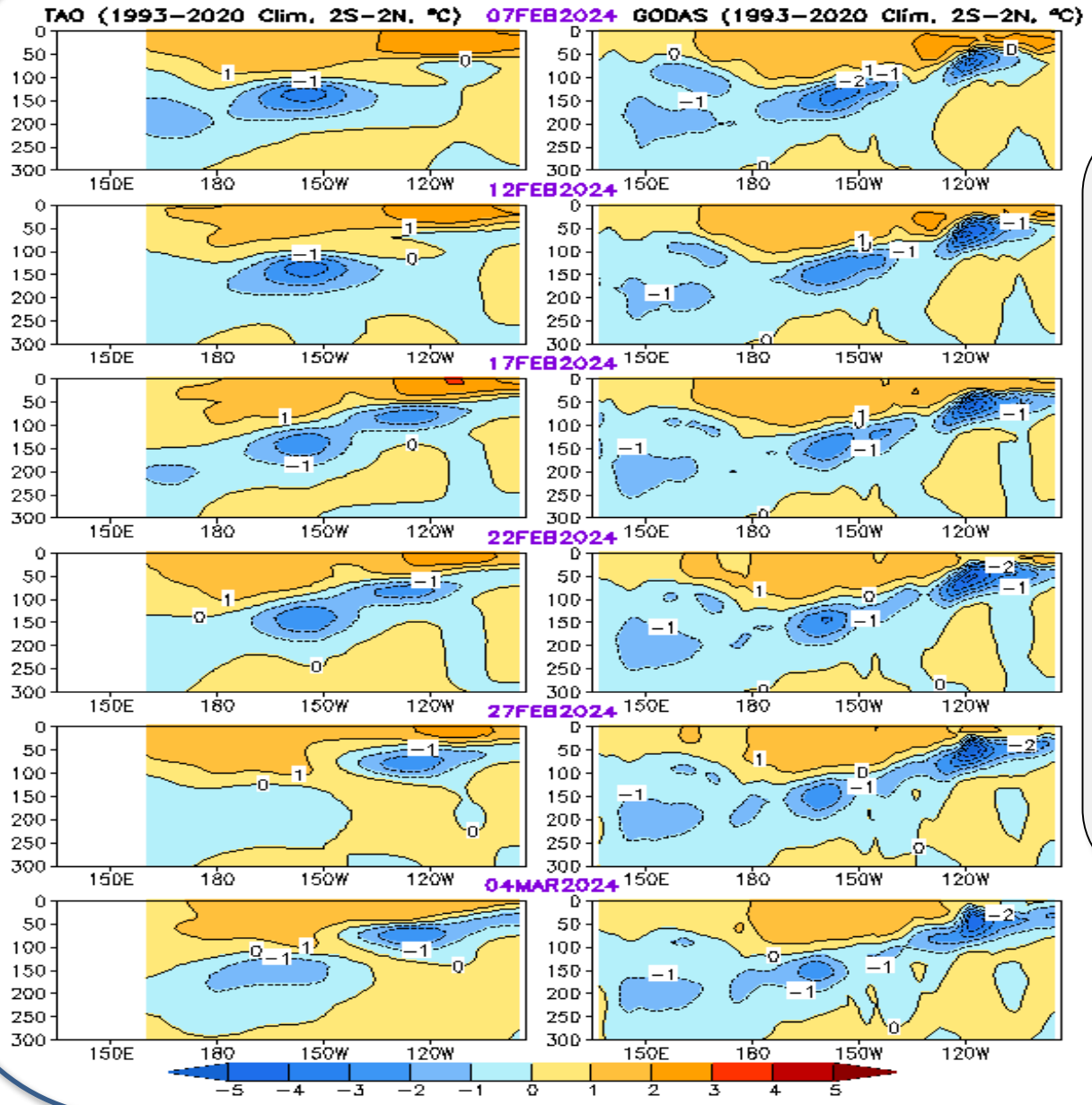


- **Multiple downwelling and upwelling Kelvin waves were observed in 2023-24, leading to the fluctuation of SSTA in the central and eastern equatorial Pacific and ENSO evolution.**

- **A weak downwelling Kelvin wave propagated eastward since Feb 2024.**

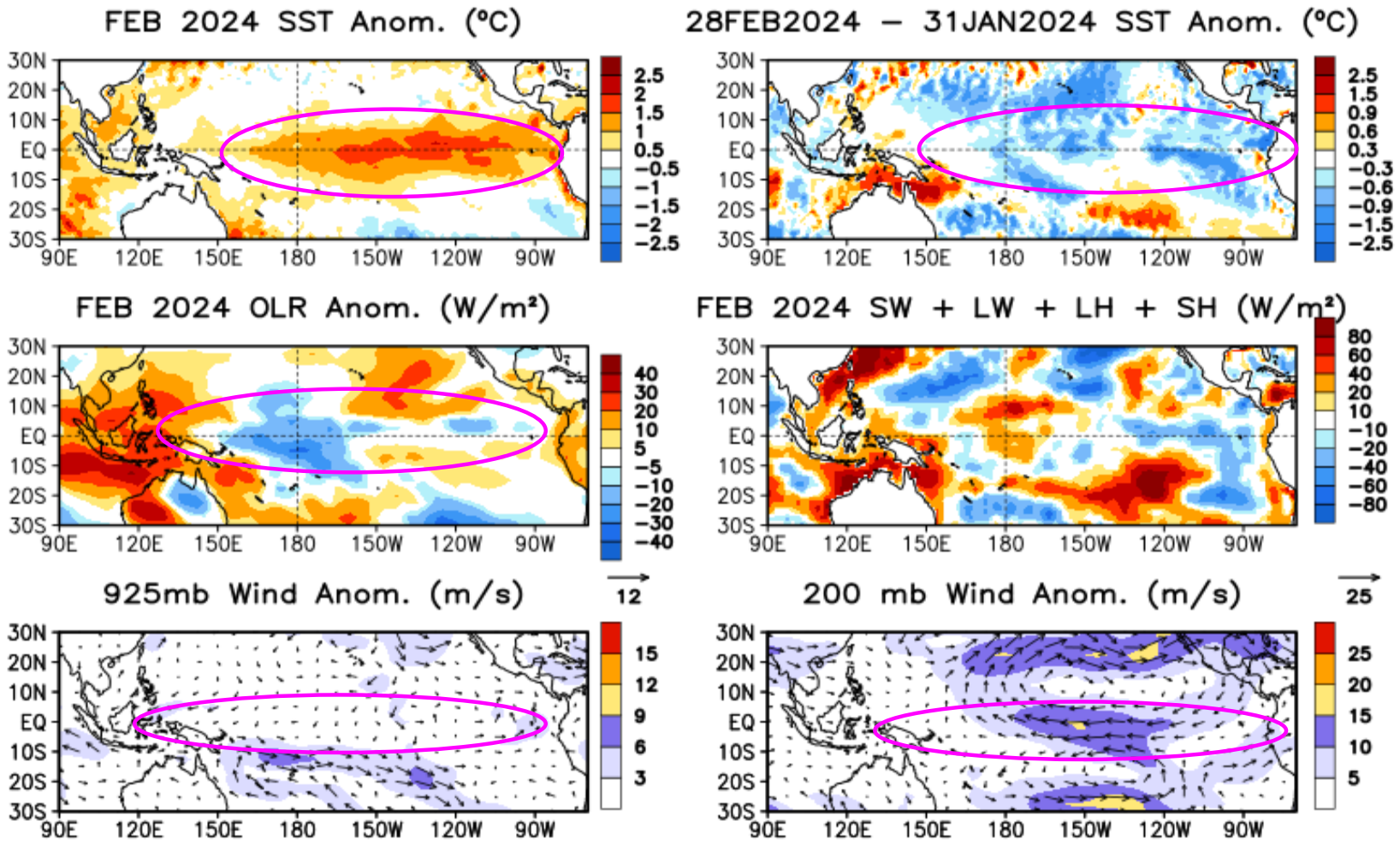
(OKW index is defined as standardized projections of total anomalies onto the 14 patterns of Extended EOF1 of equatorial temperature anomalies (Seo and Xue , GRL, 2005).)

Equatorial Pacific Ocean Temperature Pentad Mean Anomaly



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

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

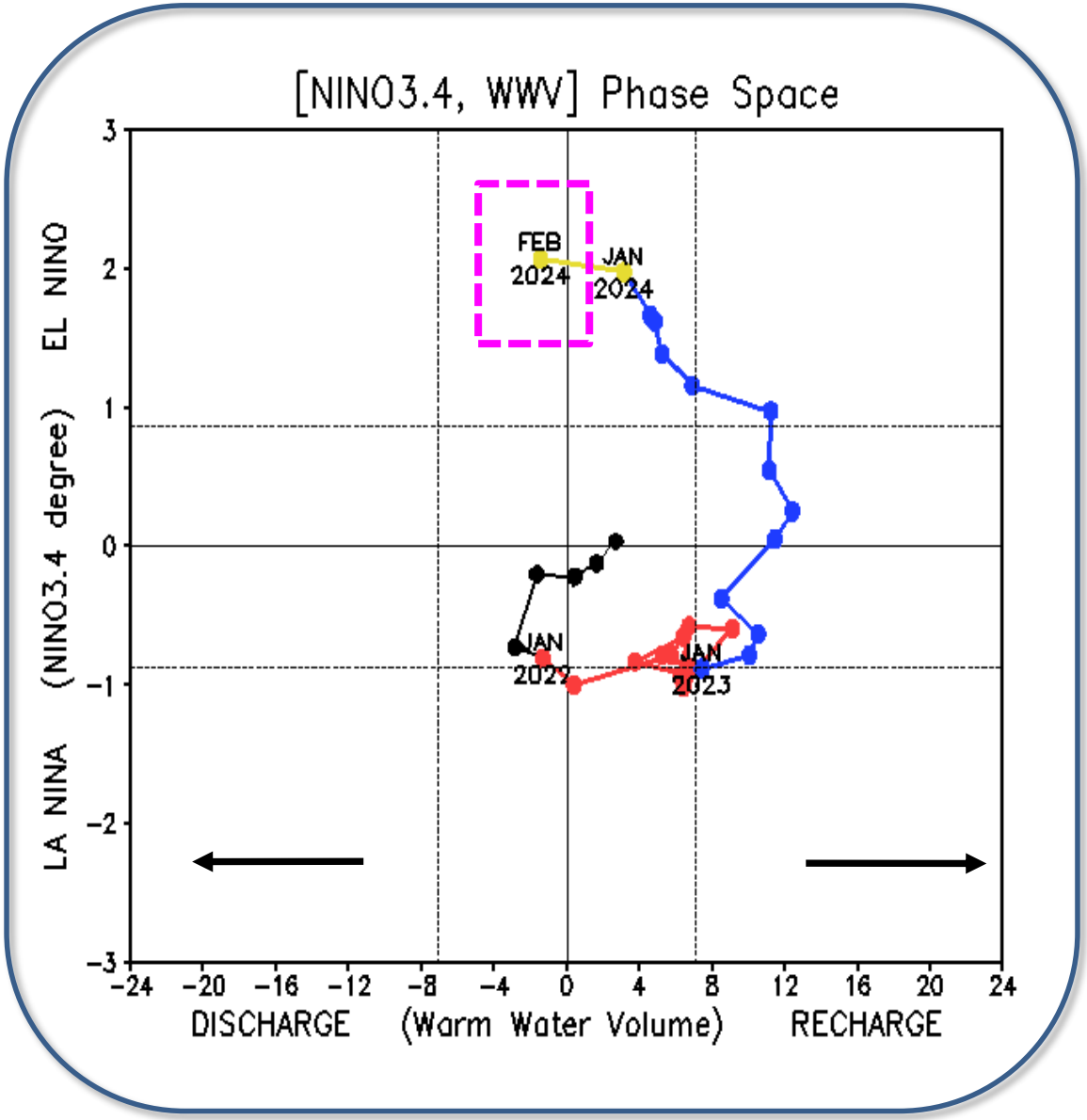


SSTAs (top-left), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right; positive means heat into the ocean), 925-mb wind anomaly vector and its amplitude (bottom-left),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

Warm Water Volume (WWV) and Niño3.4 Anomalies

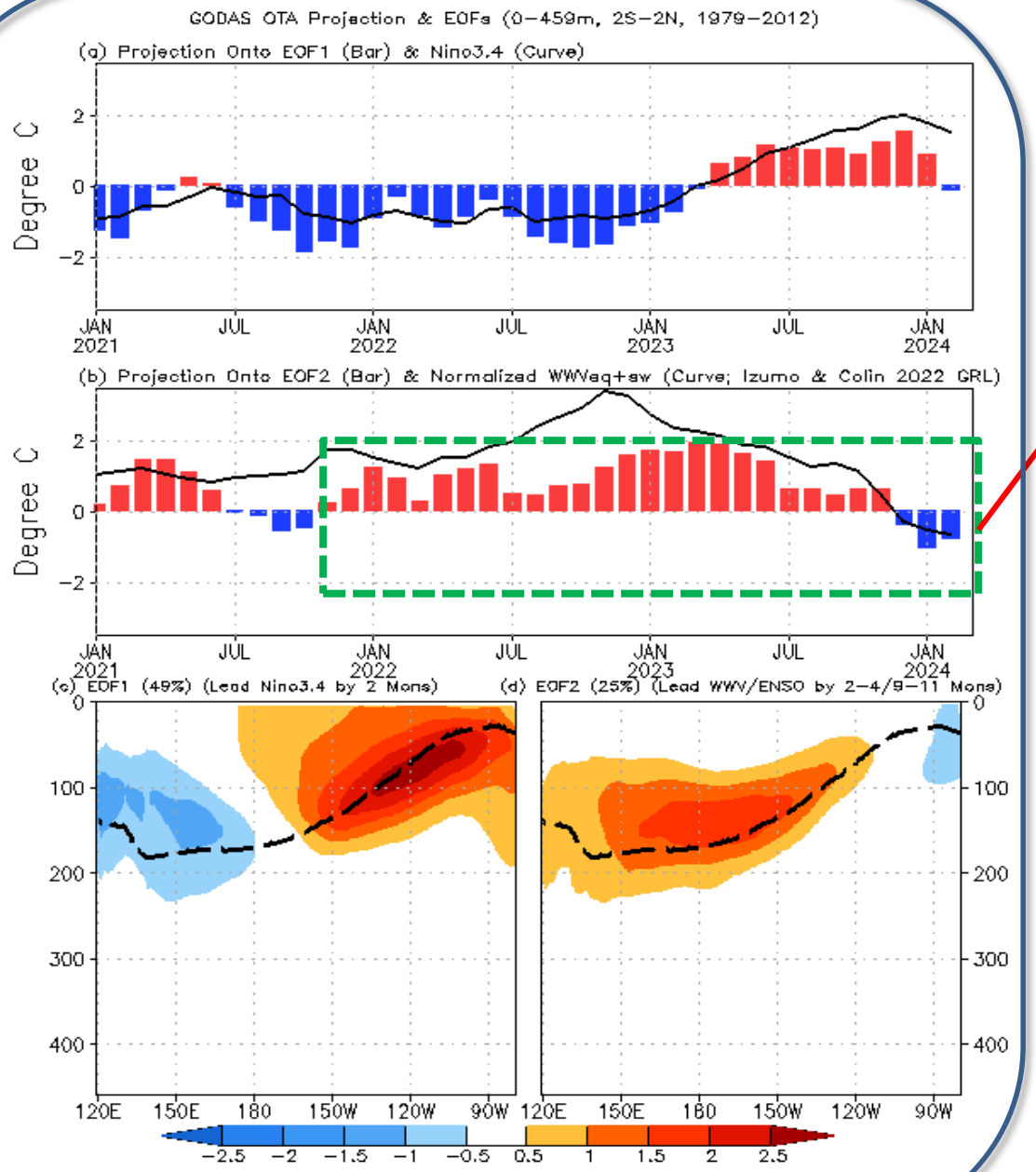
- Pacific equatorial Warm Water Volume (WWV) switched to a discharge phase in Feb 2024.

-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.

Equatorial Sub-surface Ocean Temperature Monitoring



- After an extended-period of recharging since Nov 2021, the equatorial Pacific switched to a discharge phase in Dec 2023.

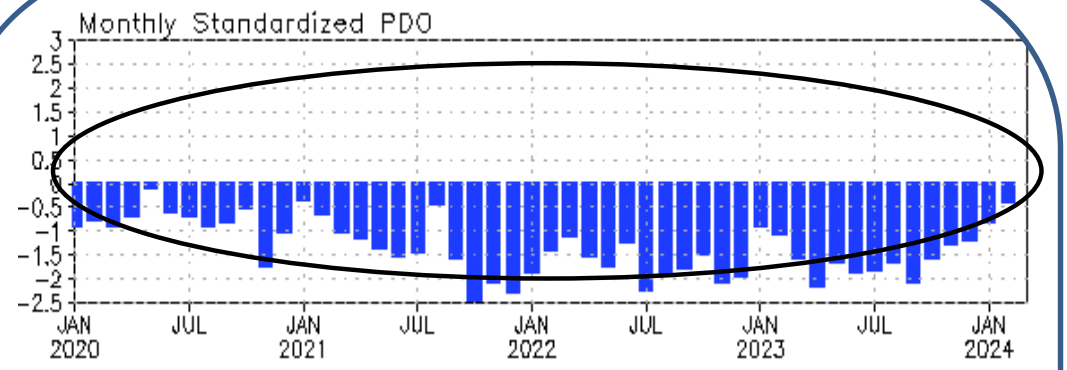
- Projection of ocean temperature anomalies onto EOF1 and EOF2; EOF1: Tilt/dipole mode (ENSO peak phase); EOF2: WWV mode.

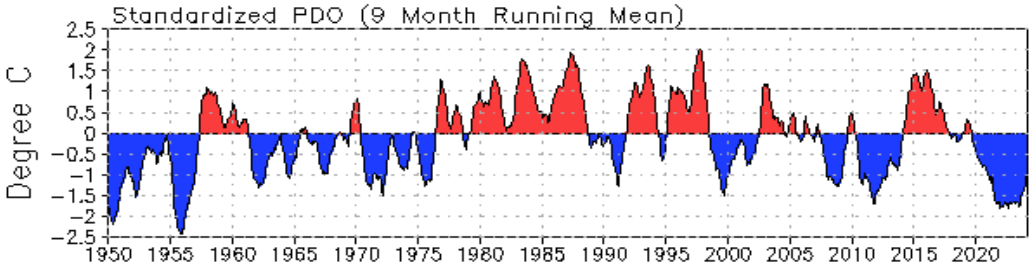
- Recharge/discharge oscillation (ENSO transition phase); Recharge process: heat transport from outside of equator to equator; Negative -> positive phase of ENSO

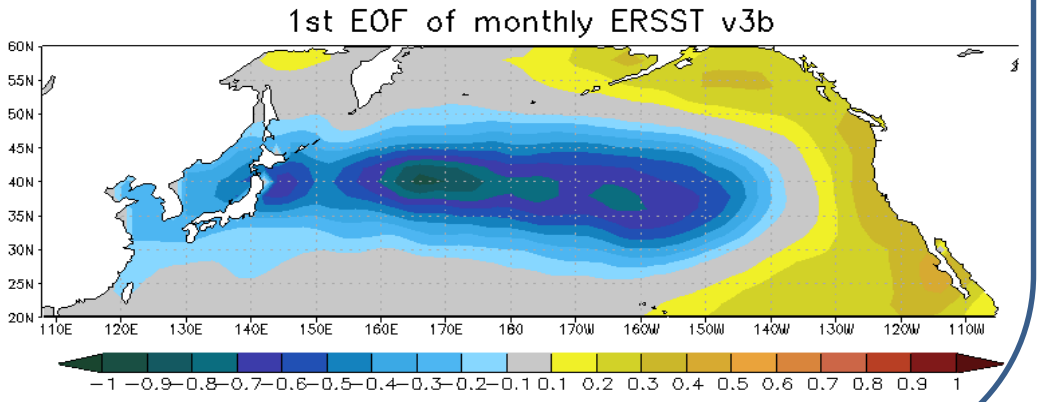
- For details, see: Kumar and Hu (2014) DOI: 10.1007/s00382-013-1721-0; Izumo & Colin (2022) DOI: 10.1029/2022GL101003.

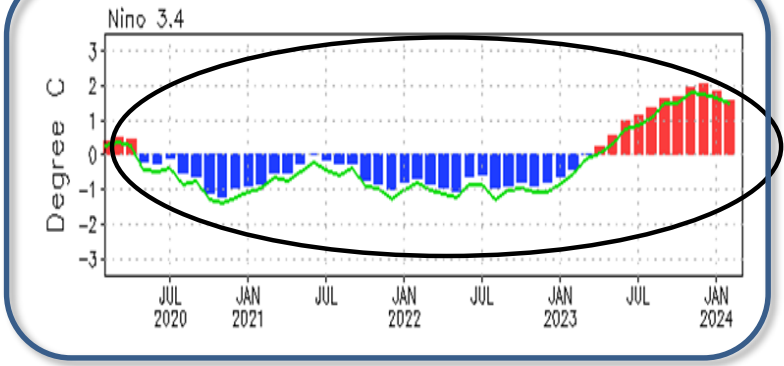
North Pacific, Arctic, & Antarctic Oceans

Pacific Decadal Oscillation (PDO) Index





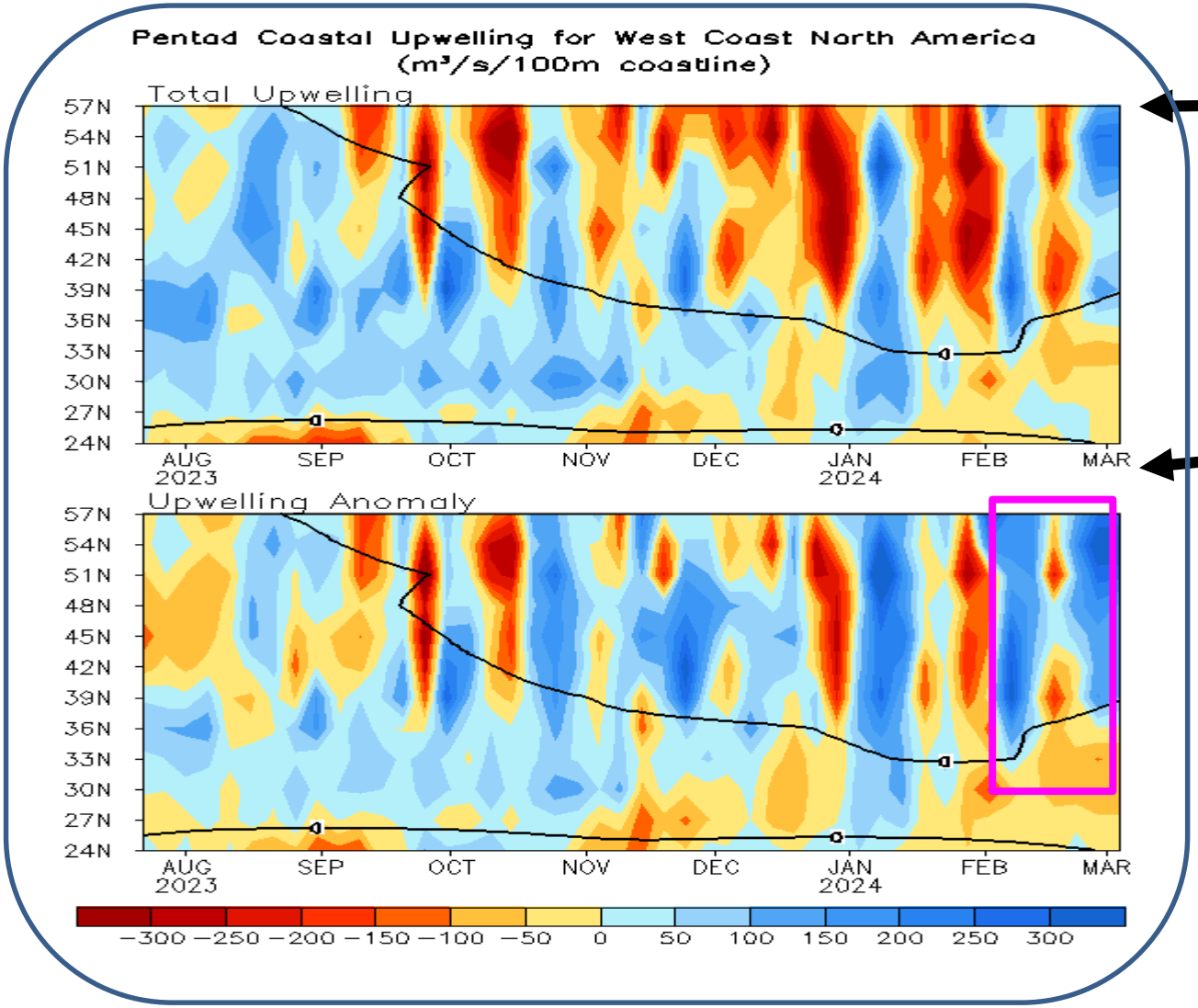


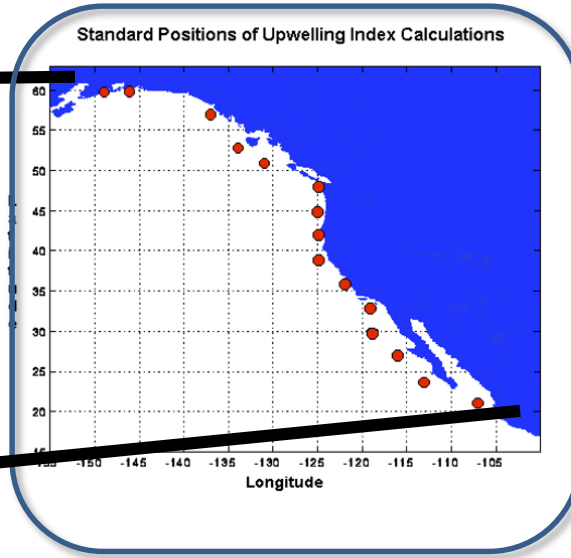


- The PDO has been in a negative phase since Jan 2020 and weakened further with PDOI = -0.4 in Feb 2024.
- The negative phase of PDO since the 2nd half of 2023 is opposite to what is expected during El Niño.
- Statistically, ENSO leads PDO by 3-4 months, through teleconnection via atmospheric bridge, 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

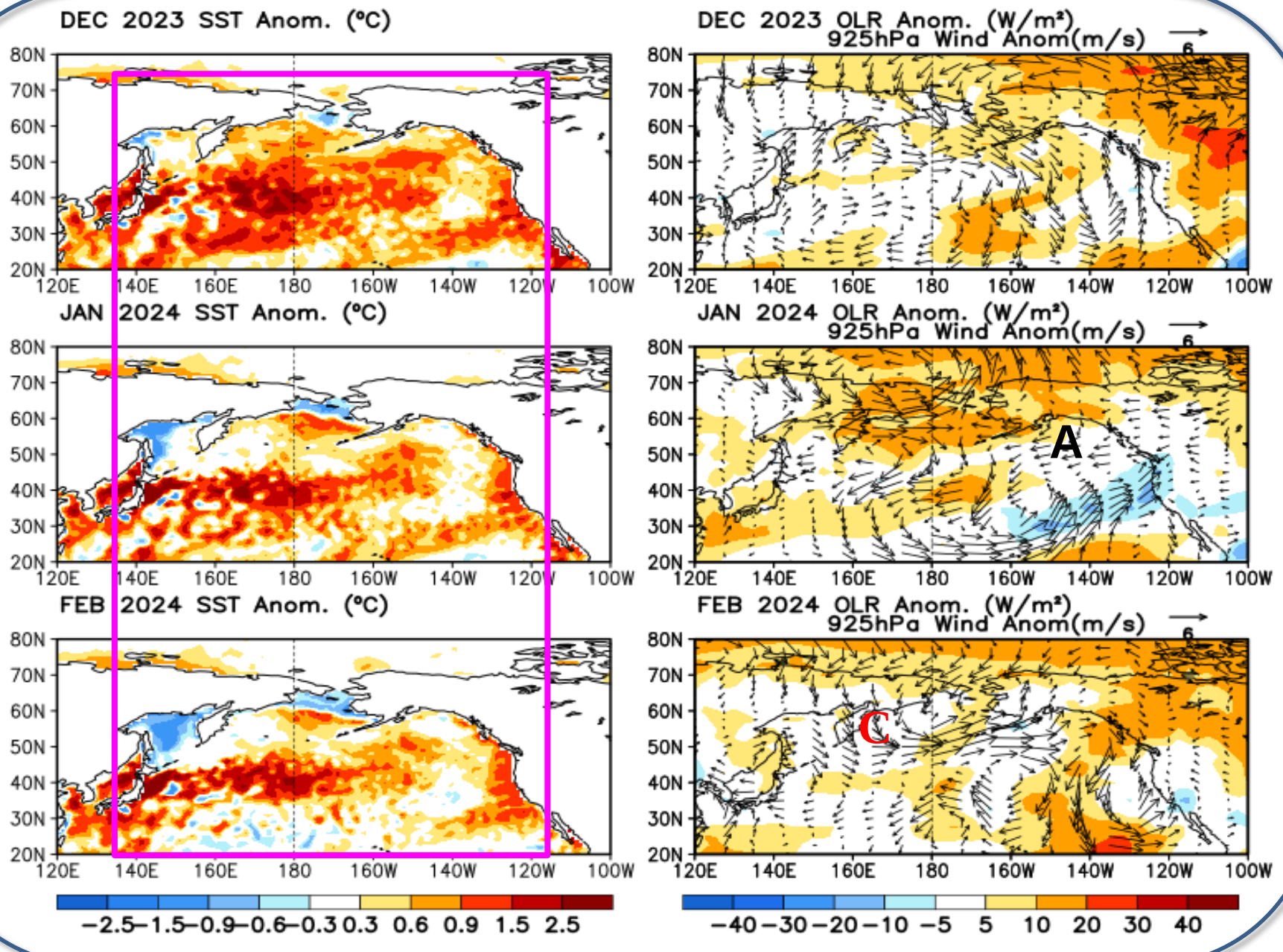




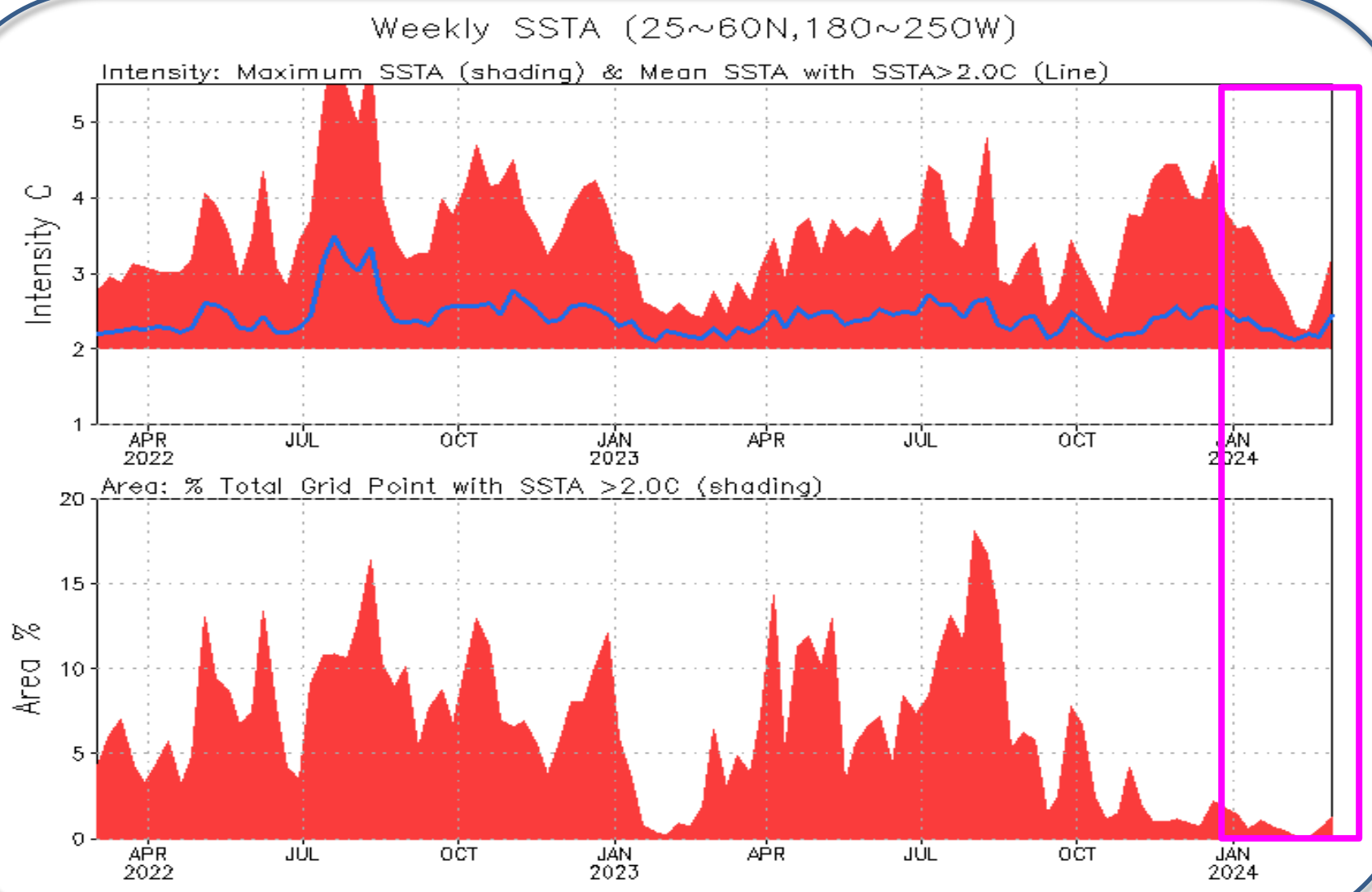
- Anomalous upwelling was present in Feb 2024.

(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

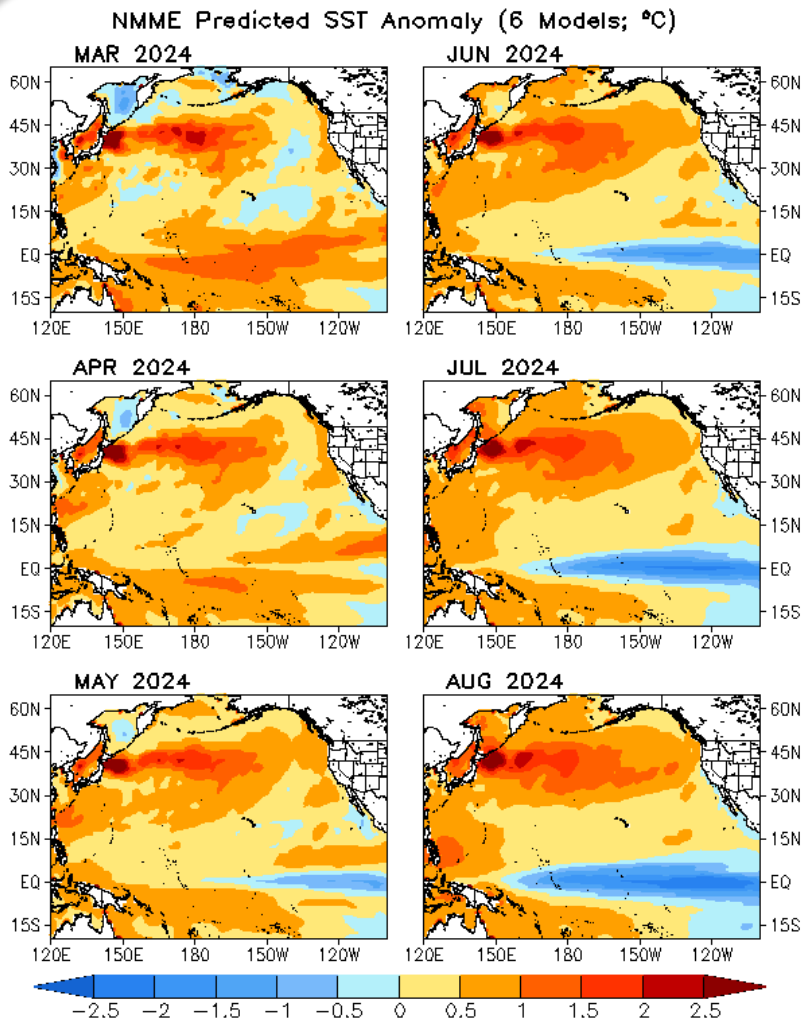


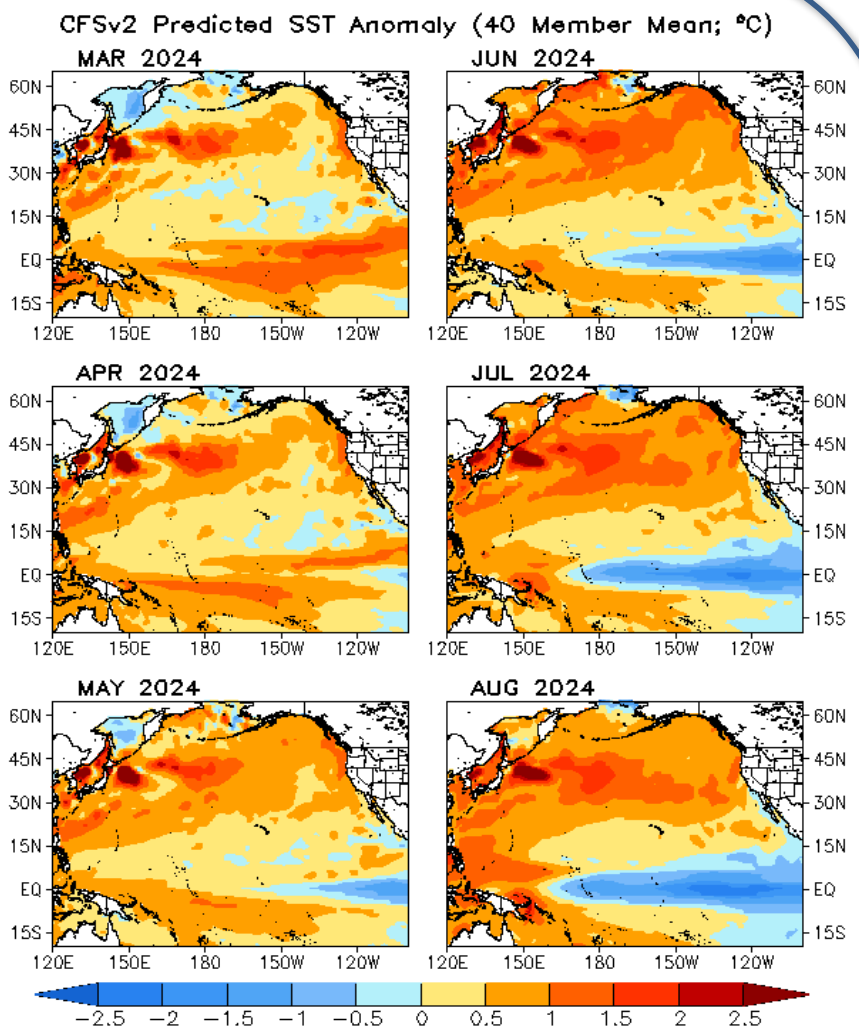
N. Pacific Marine Heat Wave Weakened



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

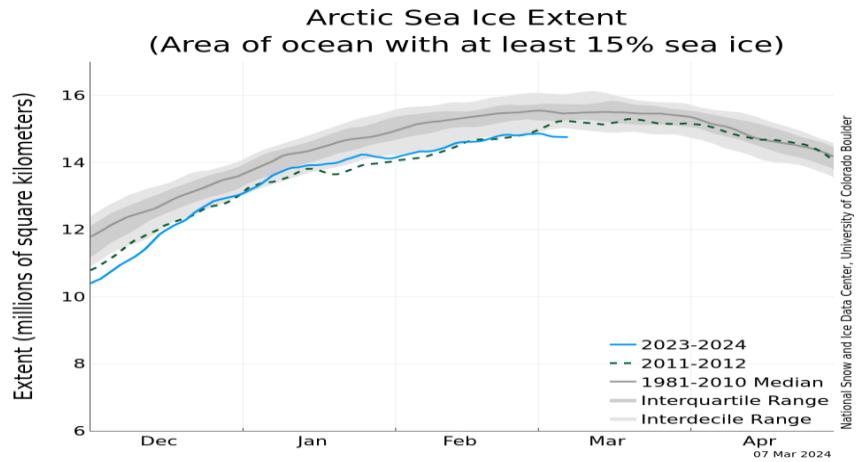
NMME & CFSv2 NE Pacific SSTA Predictions

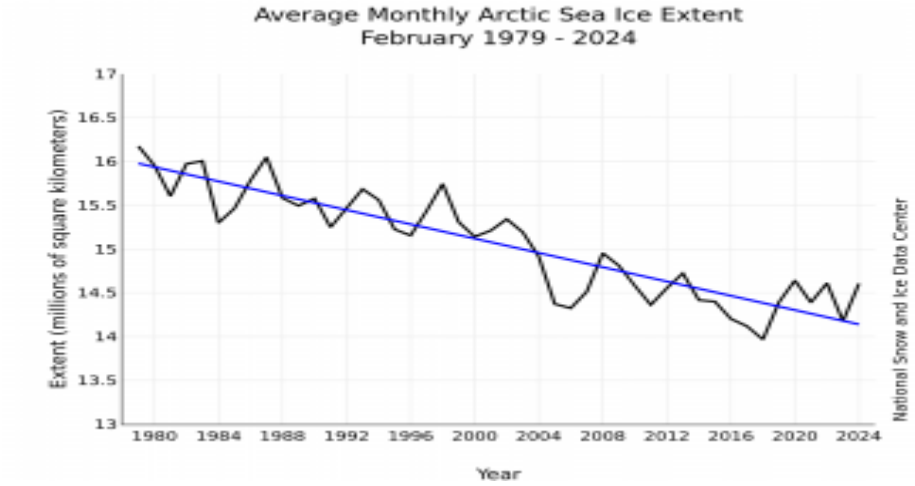


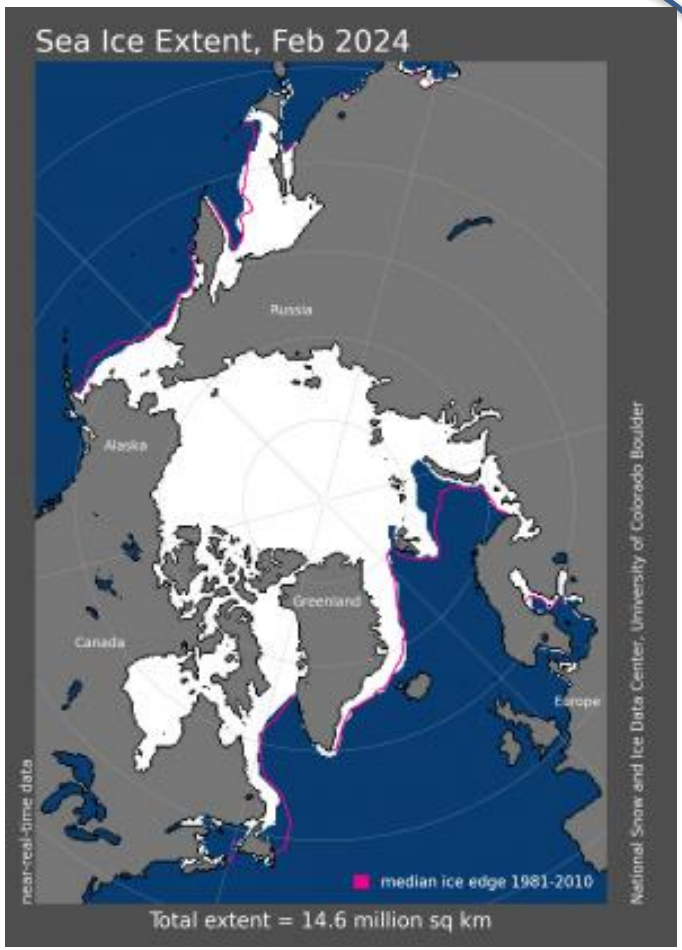


- NMME & CFSv2 predicts that the current SST warm condition in the North Pacific will persist or strengthen during the summer 2024.

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

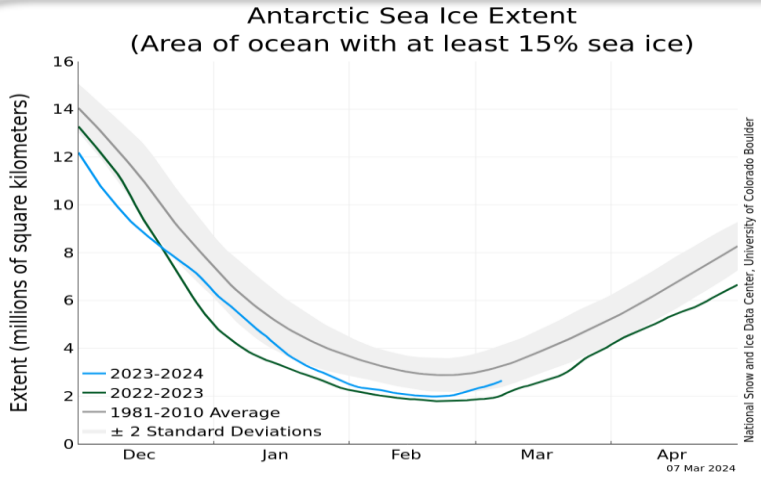


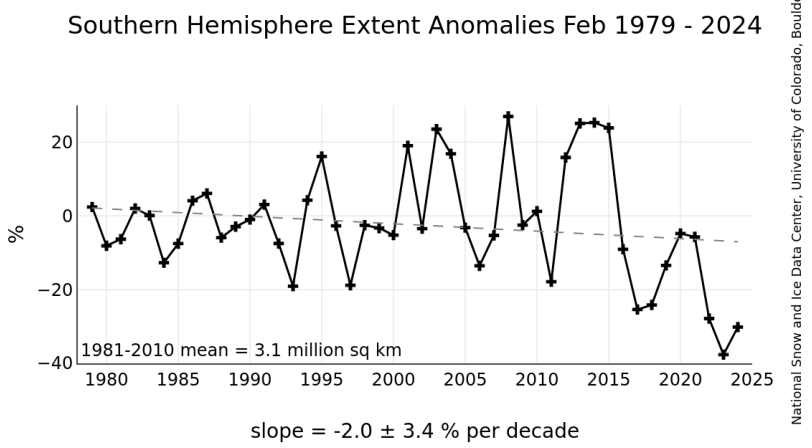


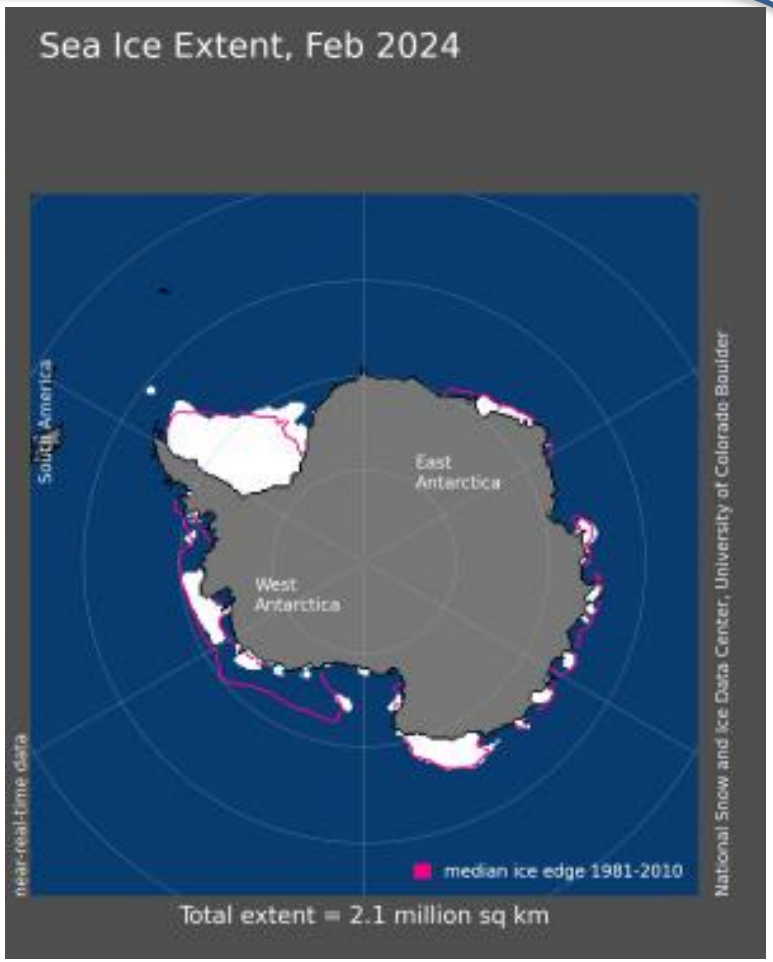


- Arctic sea ice extent was 14.61 million square kilometers in Feb 2024, the 15th lowest in the 46-year satellite record in Feb.
- The downward linear trend in Arctic sea ice extent for Feb over the 46-year satellite record is 2.7% per decade relative to the 1981 to 2010 average.

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



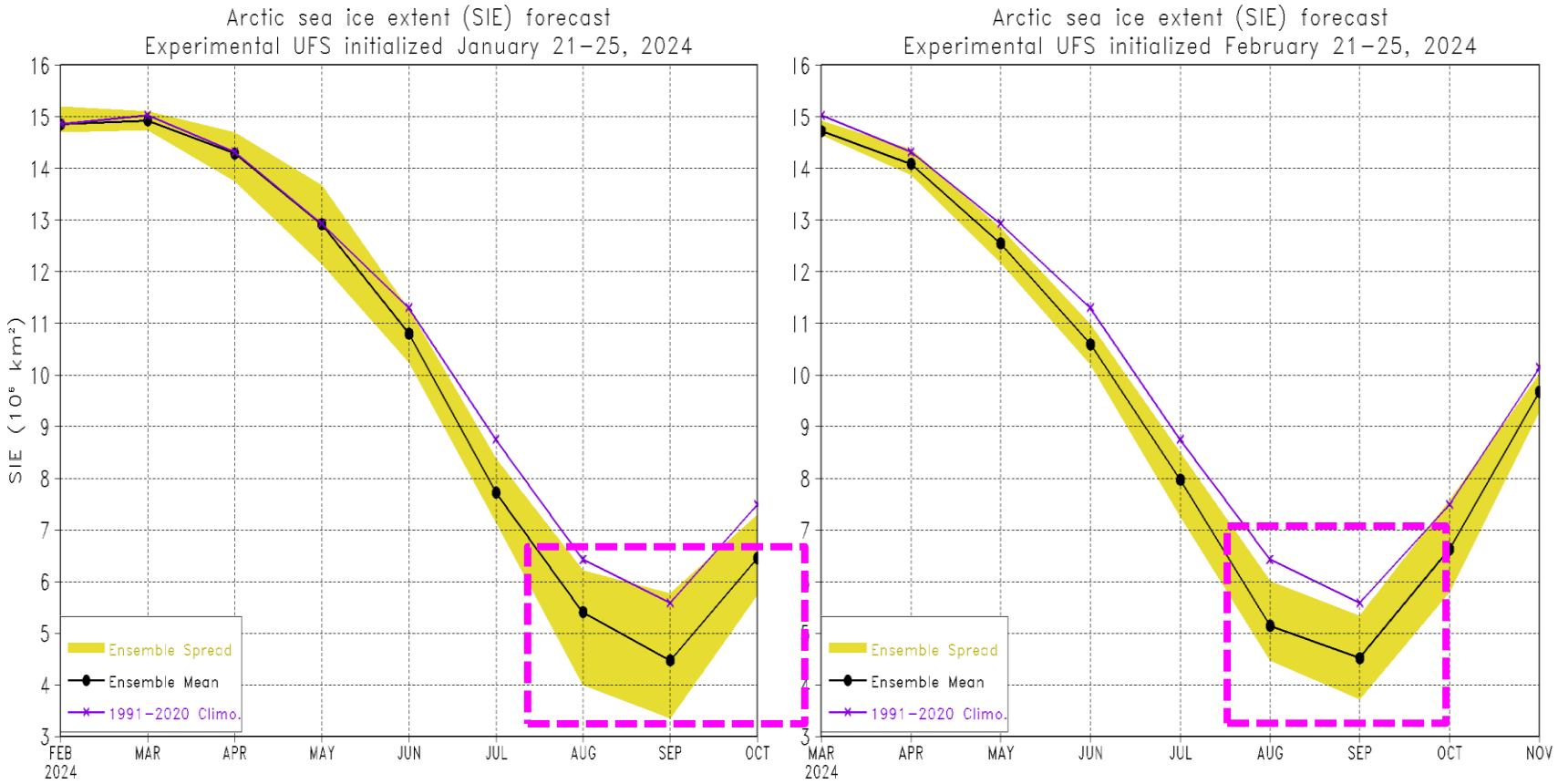




- On Feb 20th, 2024, sea ice surrounding Antarctica reached an annual minimum extent of 1.99 million square kilometers, tying for the 2nd lowest minimum with 2022 in the 46-year satellite record.
- This is the 3rd consecutive year that Antarctic sea ice has reached a minimum below 2.0 million square kilometers.

NCEP/CPC UFS Arctic Sea Ice Extent (SIE) Forecast

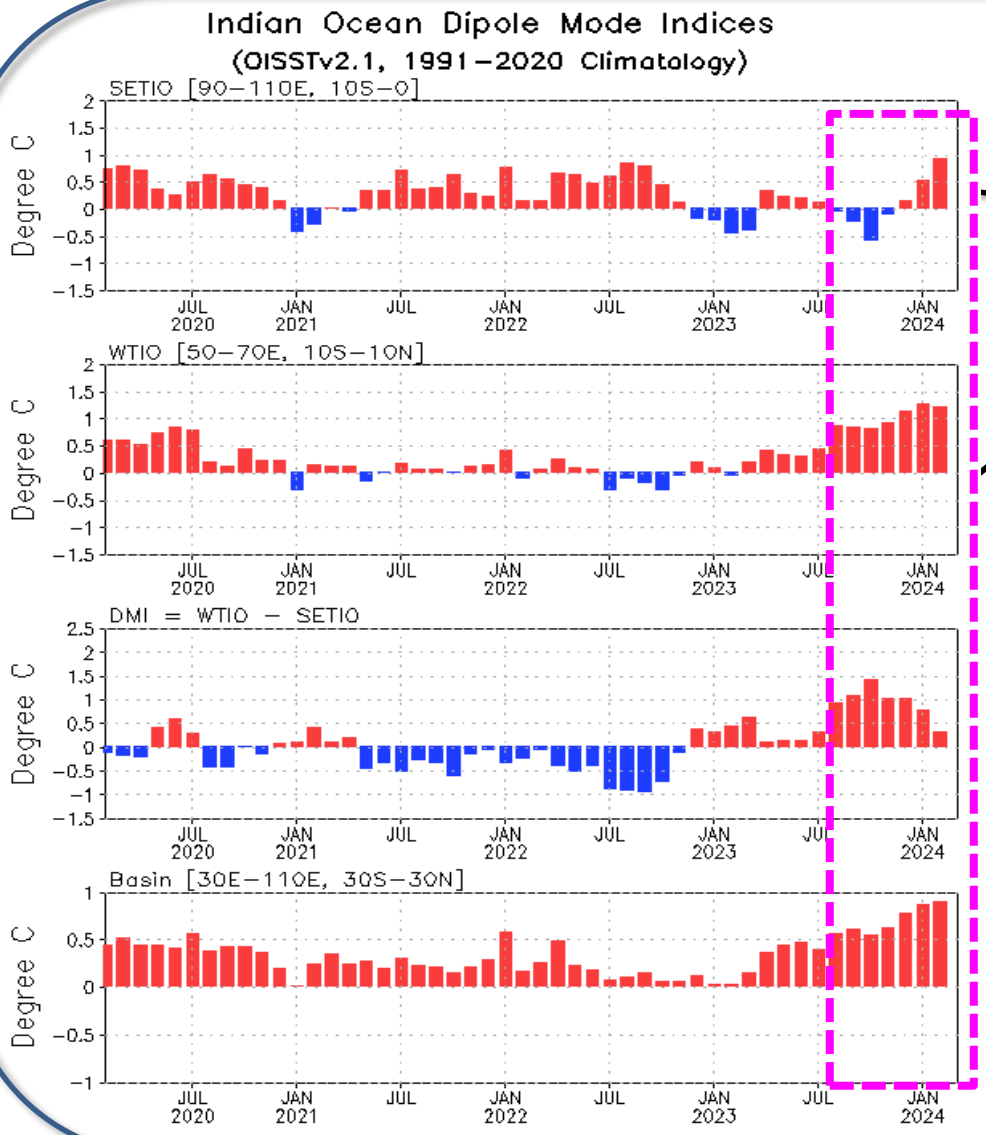
- UFS forecasts suggest a below normal sea ice extent minimum in the Arctic in Sep 2024.

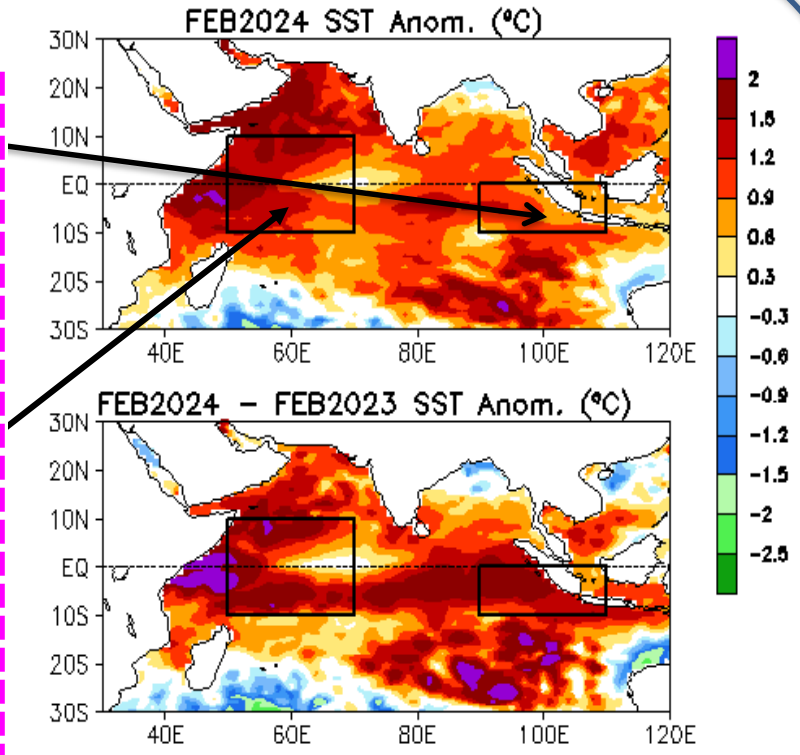


https://www.cpc.ncep.noaa.gov/products/people/jszhu/seaice_seasonal/index.html

Indian Ocean

Evolution of Indian Ocean SST Indices

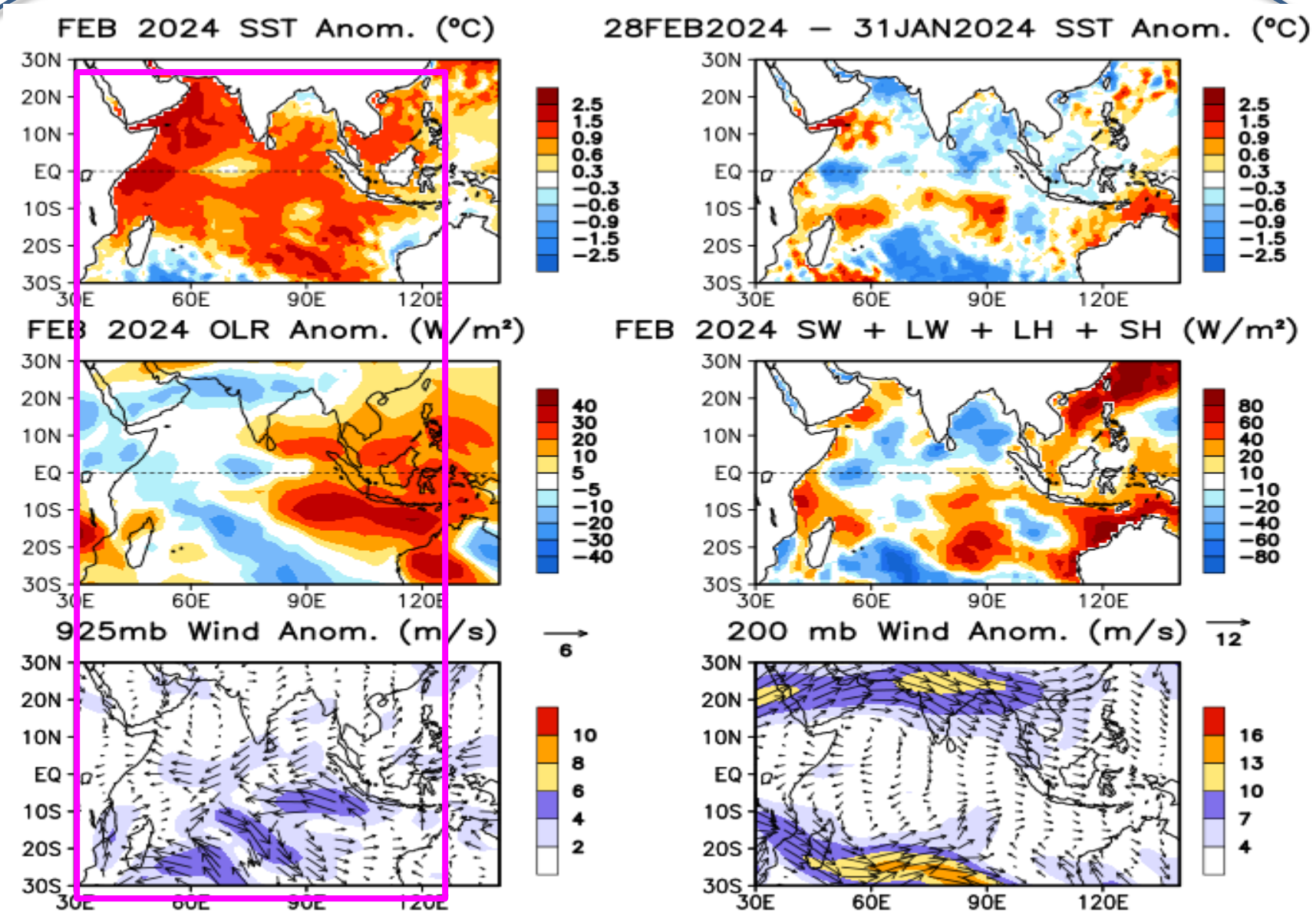




- Positive SSTAs were present in the tropical Indian Ocean with warmer SST in the west in Feb 2024, featuring in a weak positive phase of the IOD.

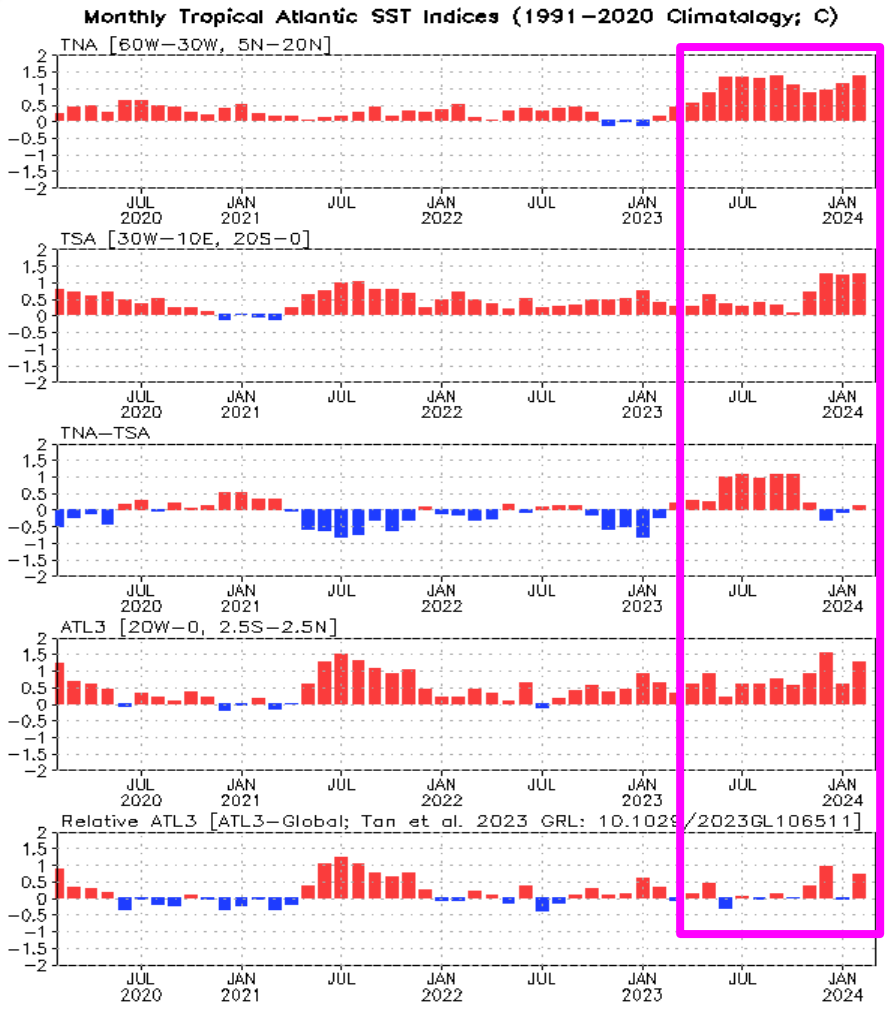
Indian Ocean region indices, calculated as the area-averaged monthly mean SSTA (OC) for the SETIO [90ºE-110ºE, 10ºS-0] and WTIO [50ºE-70ºE, 10ºS-10ºN] regions, and Dipole Mode Index, defined as differences between WTIO and SETIO. Data are derived from the OIv2.1 SST analysis, and anomalies are departures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

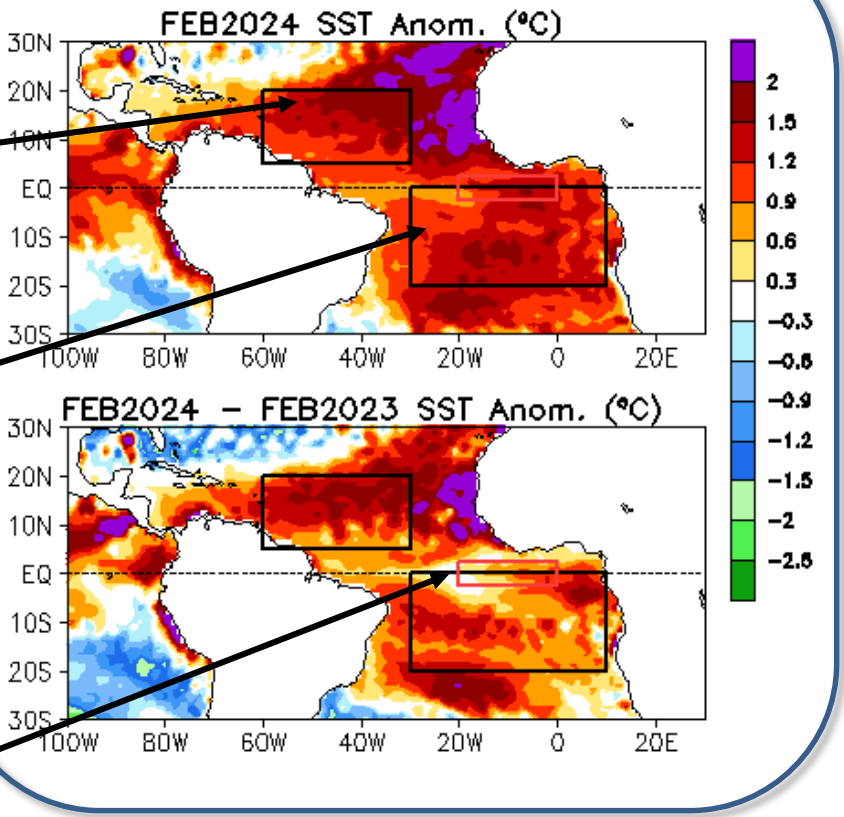
Tropical Indian: SSTA, SSTA Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Wind Anom.



Tropical and North Atlantic Ocean

Evolution of Tropical Atlantic SST Indices

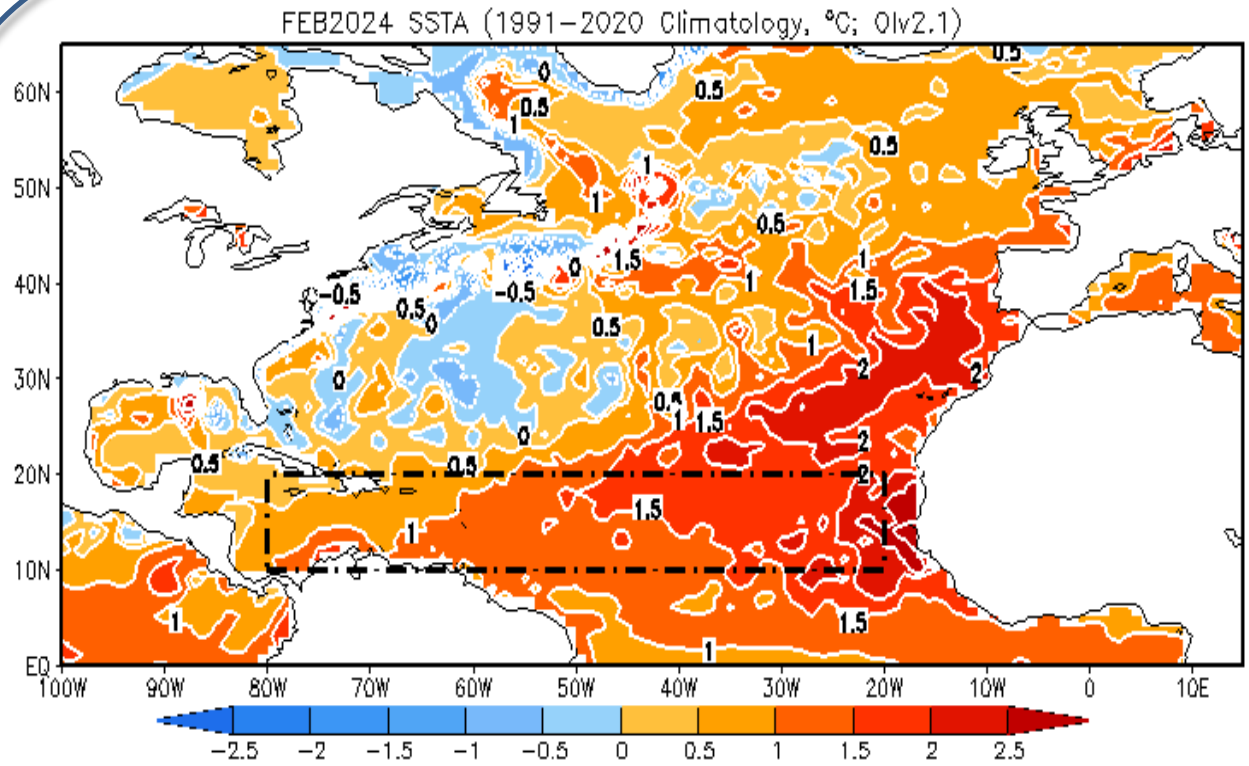


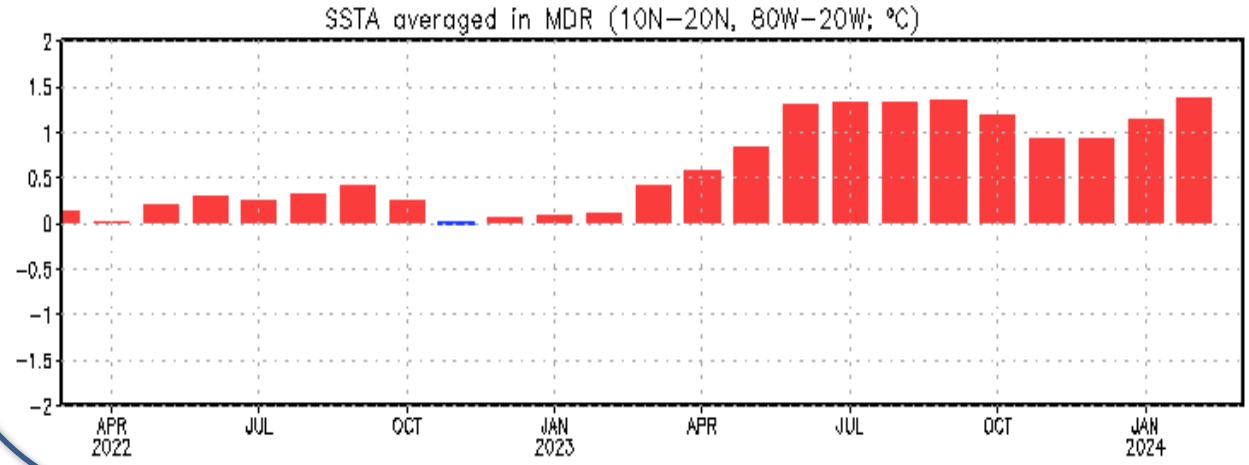


- Positive SSTAs in the tropical Atlantic were observed in Feb 2024.
- ATL3 index was 0.8 in Feb 2024.
- A relative ATL3 index has been included.

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.

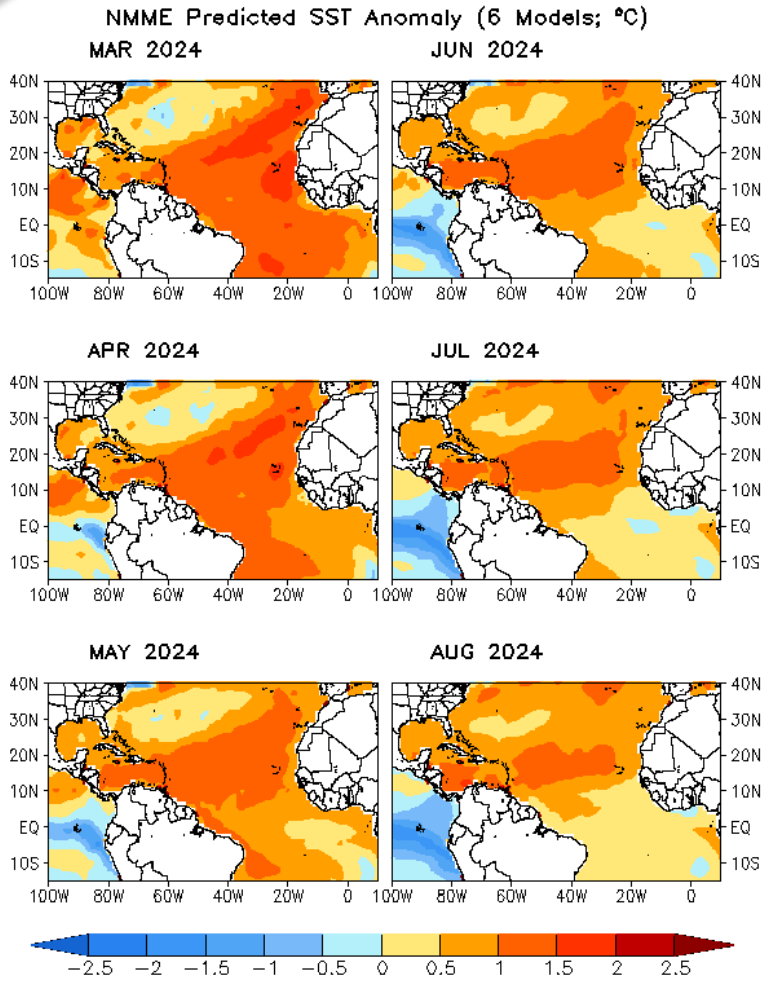
SSTAs in the North Atlantic & MDR

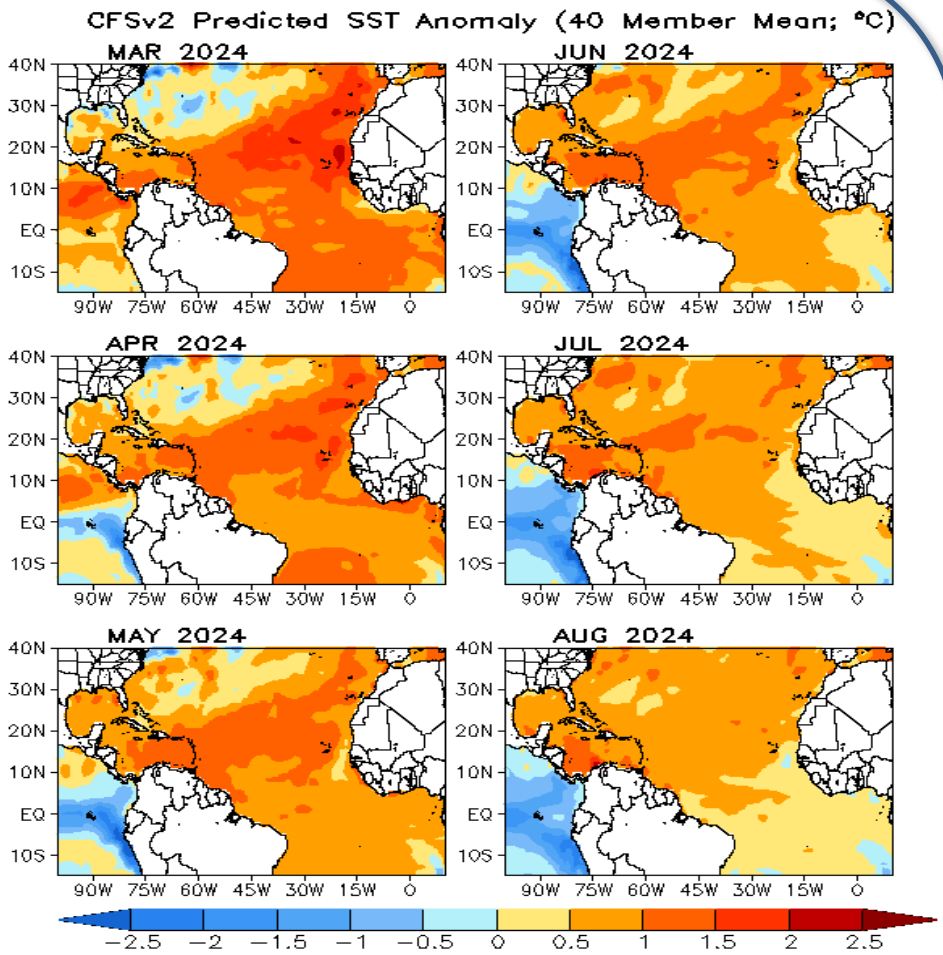




- SST in MDR was above average during the last 15 months.

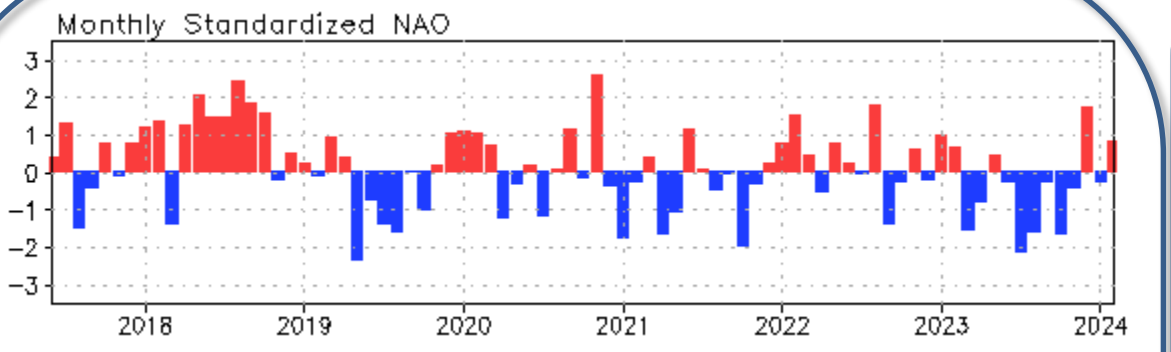
NMME & CFSv2 Atlantic SSTA Predictions

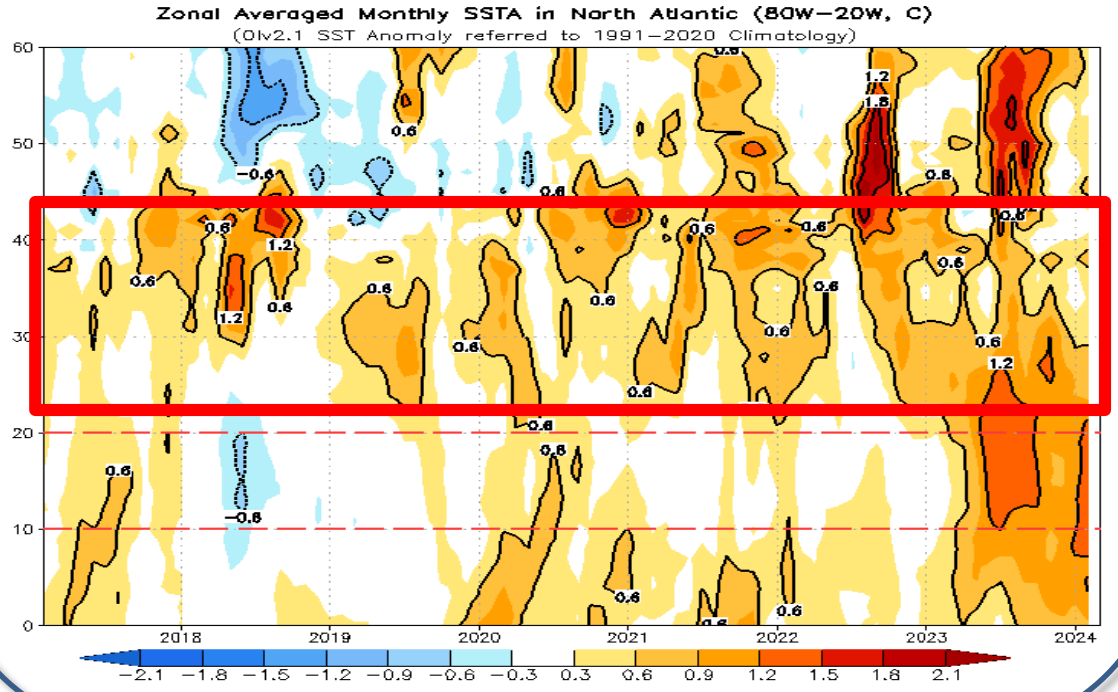


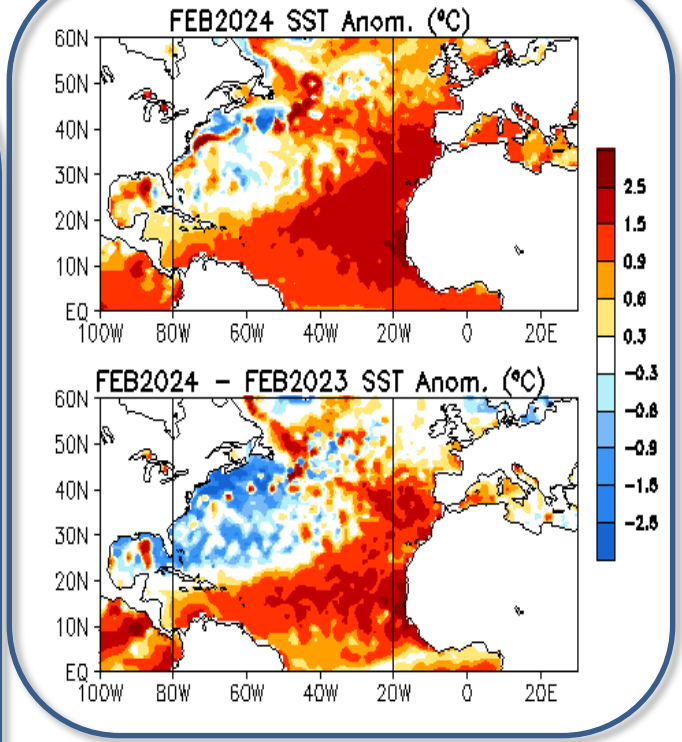


- Latest NMME & CFSv2 predictions call that positive SST anomalies in the middle-latitudes of the North Atlantic will weaken in summer 2024.

NAO and SST Anomaly in North Atlantic





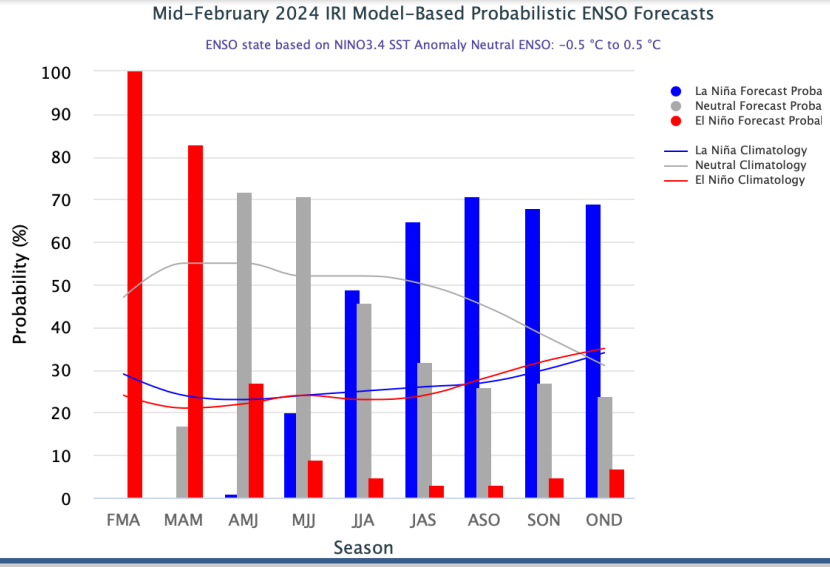


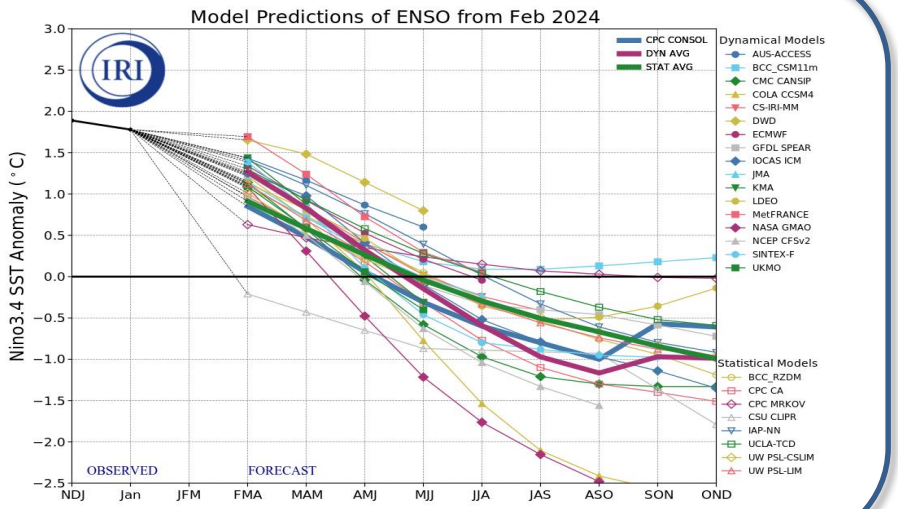
- NAO retuned to a positive phase in Feb 2024 with NAOI=0.8.
- The prolonged positive SSTAs in the middle latitudes were evident during the last 5-6 years.

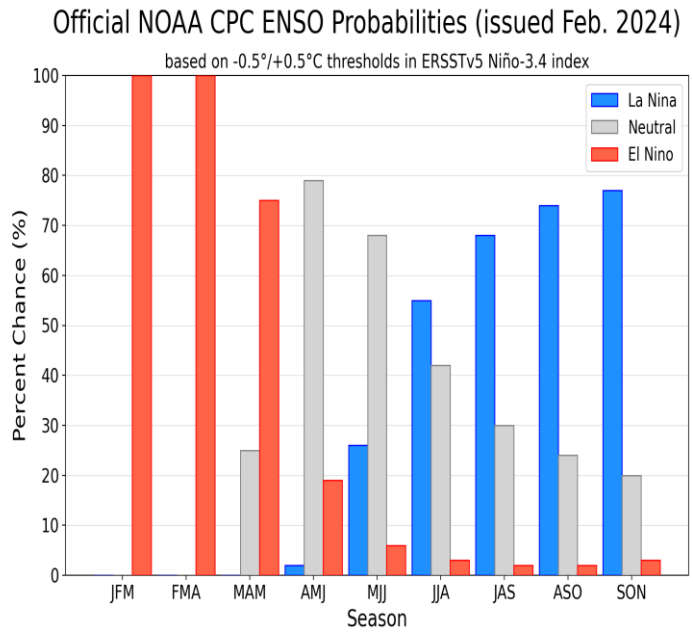
Monthly standardized NAO index (top) derived from monthly standardized 500-mb height anomalies obtained from the NCEP CDAS in 20^{O}N-90^{O}N. Time-latitude section of SSTAs averaged between 80ºW and 20ºW (bottom). SST are derived from the OIv2.1 SST analysis, and anomalies are departures from the 1991-2020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

ENSO and Global SST Predictions

CPC & IRI Niño3.4 Forecast



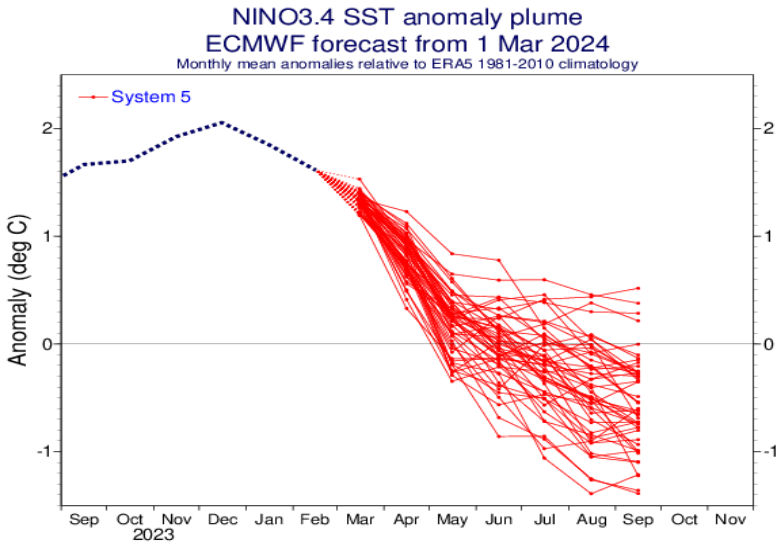




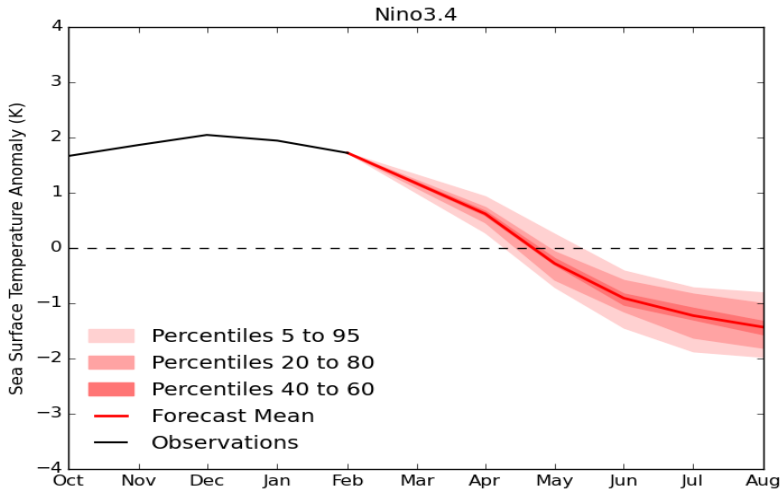
- Model ensemble mean predicts a neutral condition from Apr-Jun to Jun-Aug 2024.
- **On 9 Feb 2024, CPC issued: El Niño Advisory / La Niña Watch.**
- Synopsis: "*A transition from El Niño to ENSO-neutral is likely by April-June 2024 (79% chance), with increasing odds of La Niña developing in June-August 2024 (55% chance).*"

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

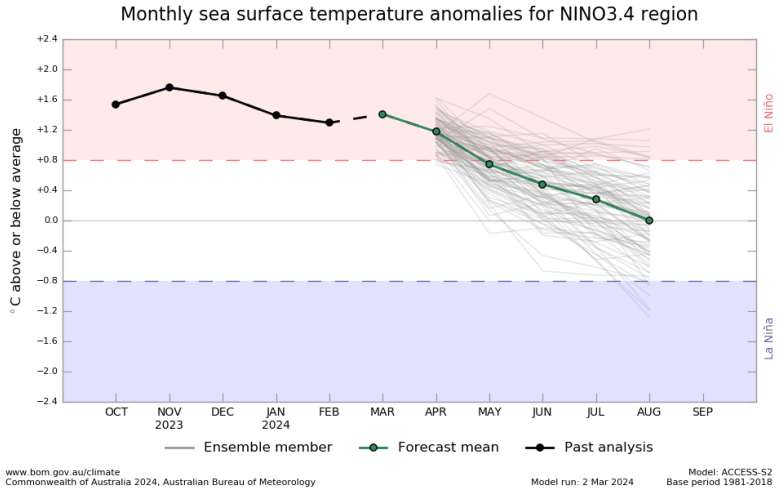
EC: Niño3.4, IC= 1 Mar 2024



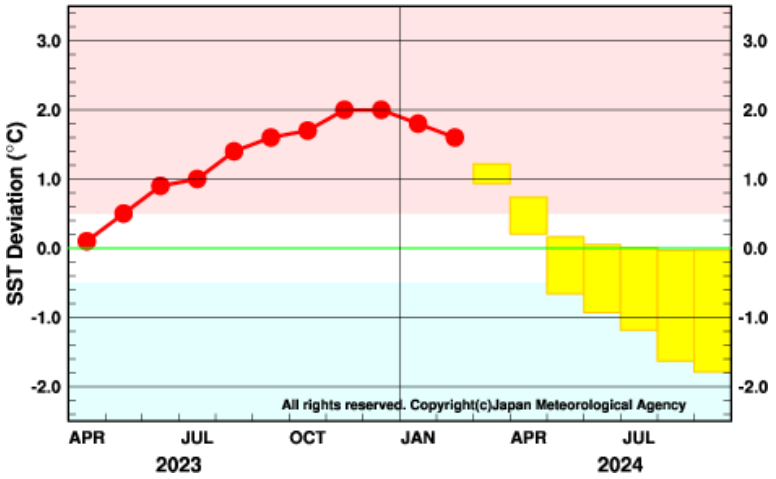
UKMO: Niño3.4, Updated 11 Mar 2024



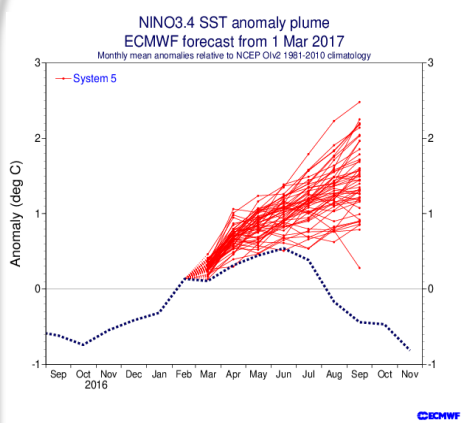
BOM: Niño3.4, Updated 2 Mar 2024

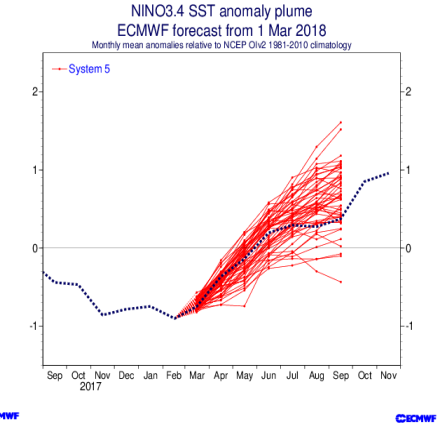


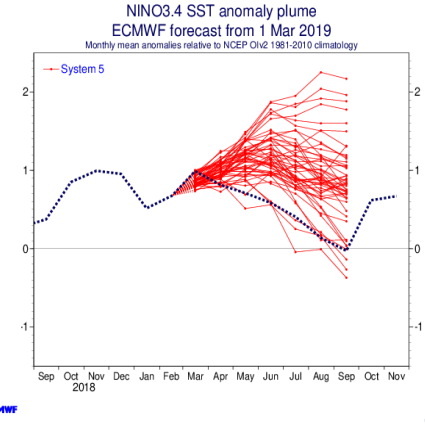
JMA: Niño3.4, Updated 11 Mar 2024

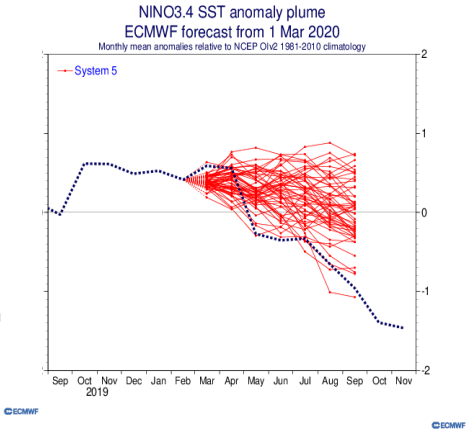


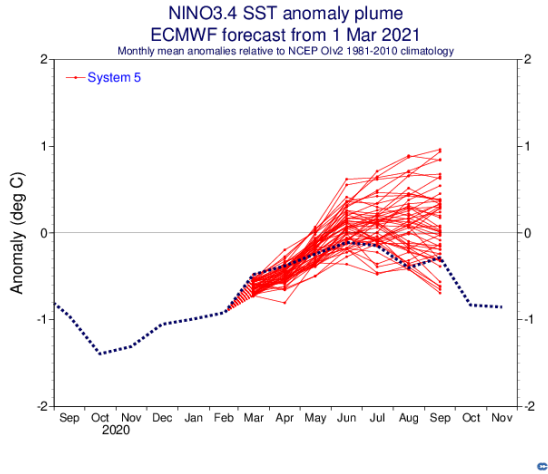
ECMWF Forecasts with IC in Mar since 2017

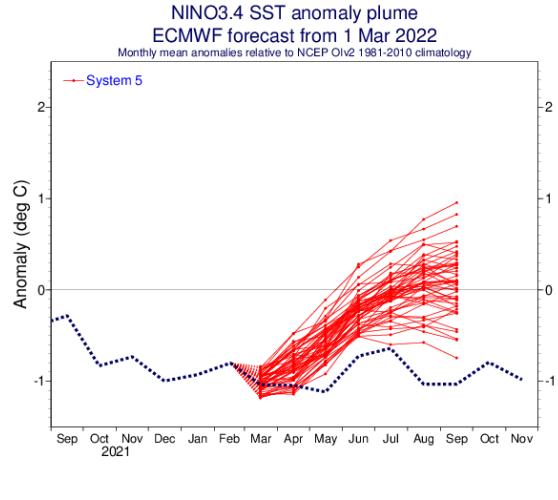


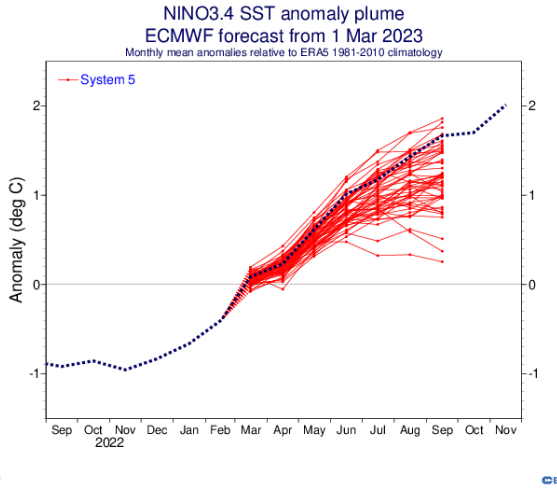




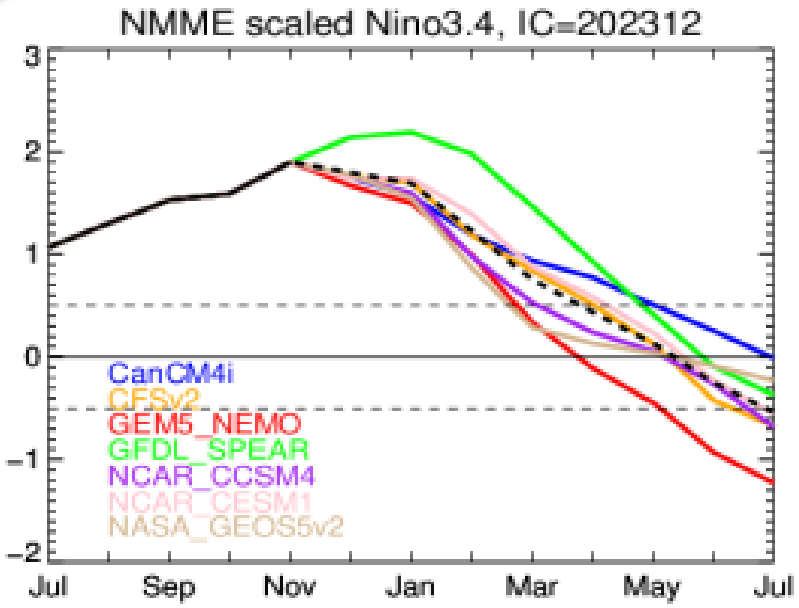


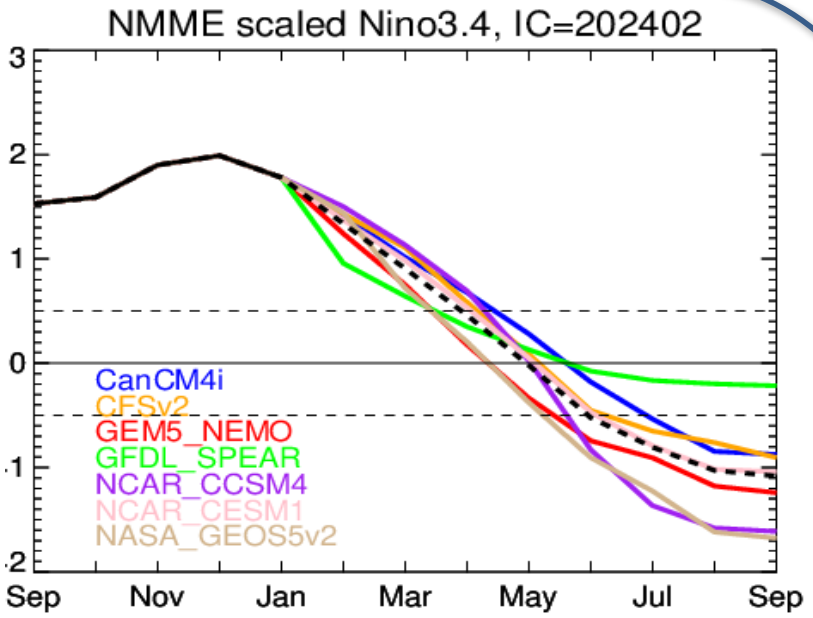


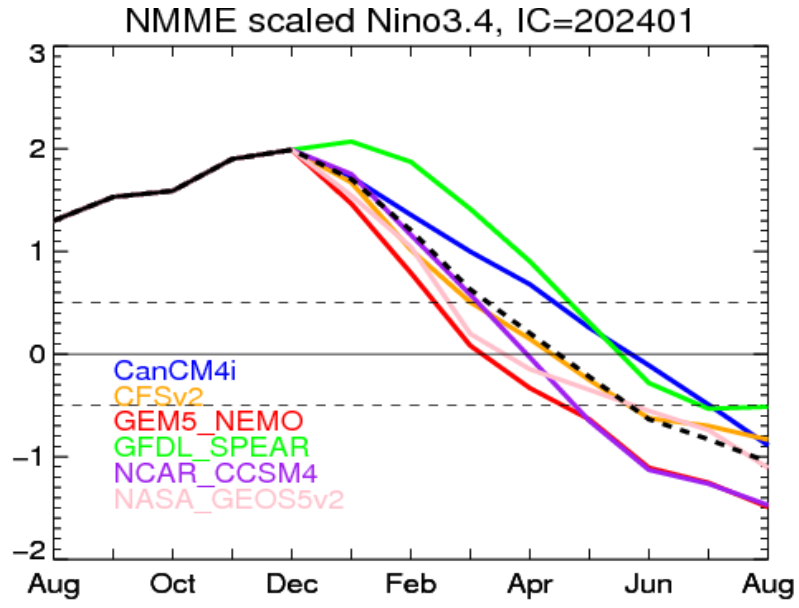


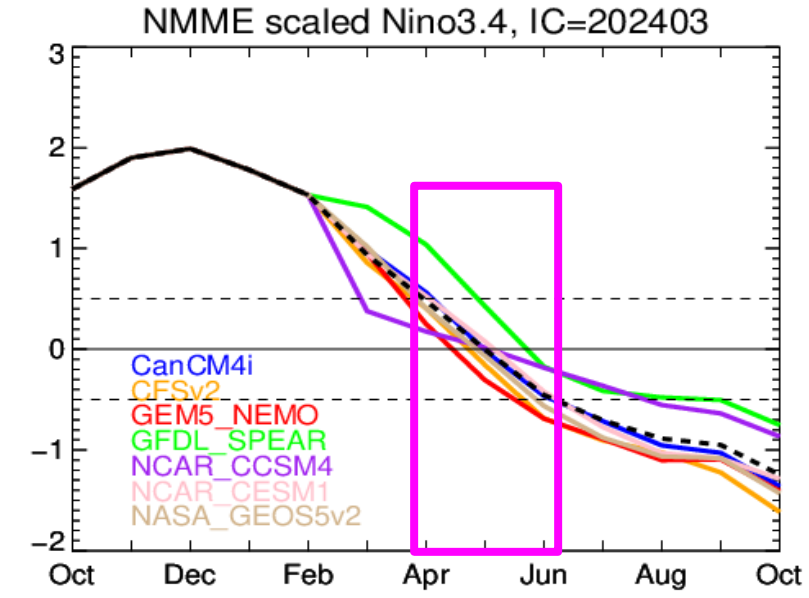


NMME forecasts from different initial conditions

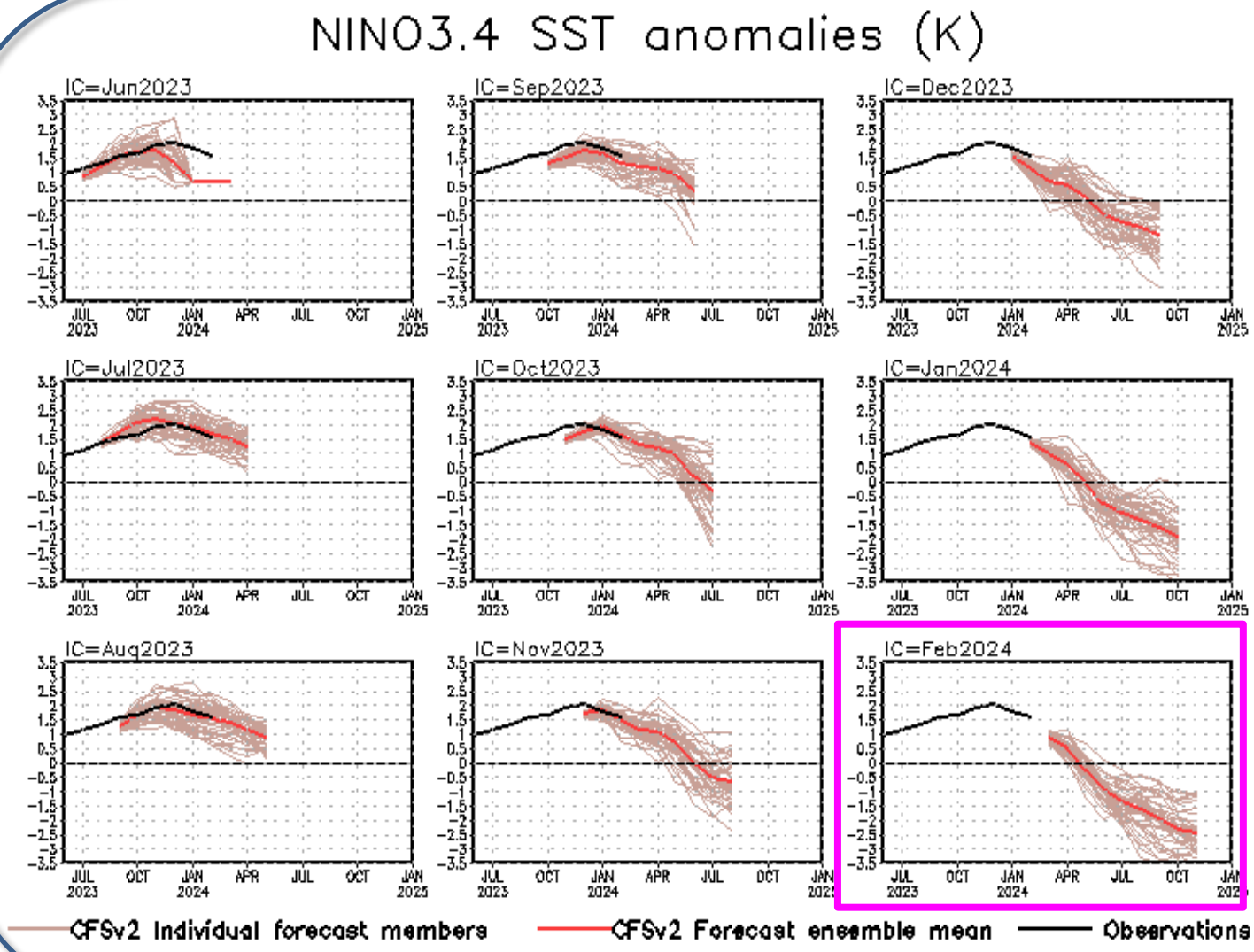








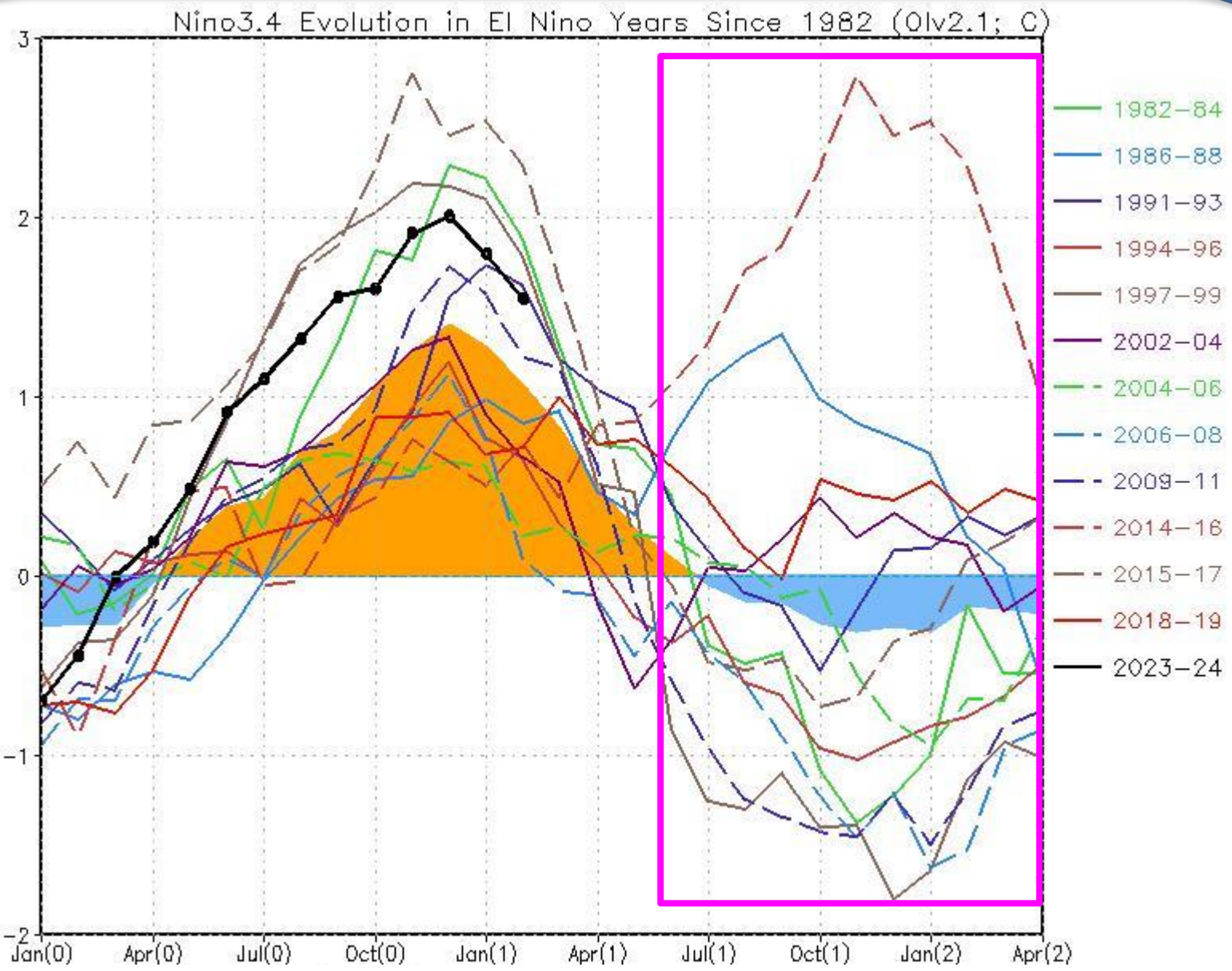
CFS Niño3.4 SST Predictions from Different Initial Months



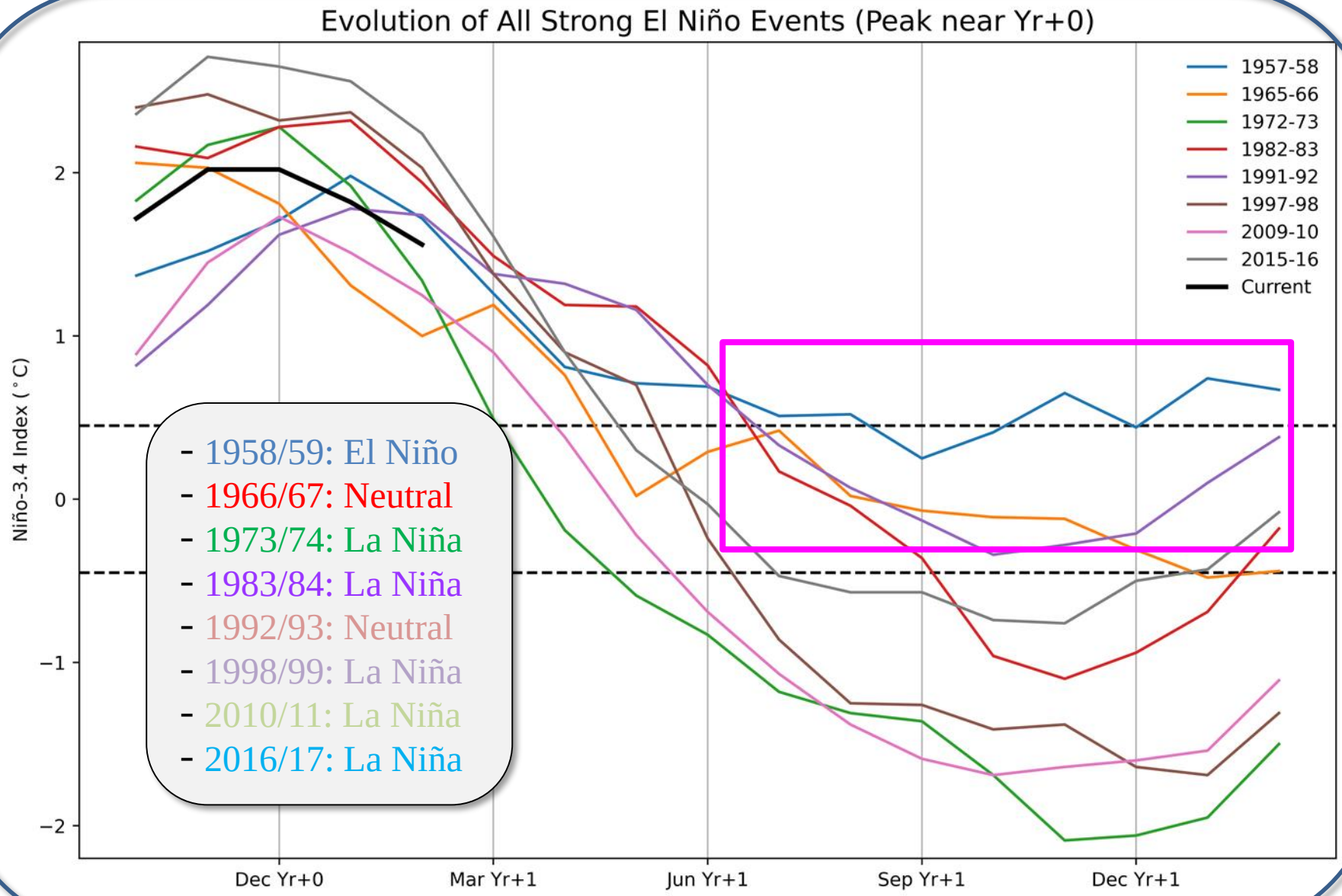
- The latest CFSv2 forecasts call for a neutral condition in spring 2024 and La Niña in the 2nd half of 2024.

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.

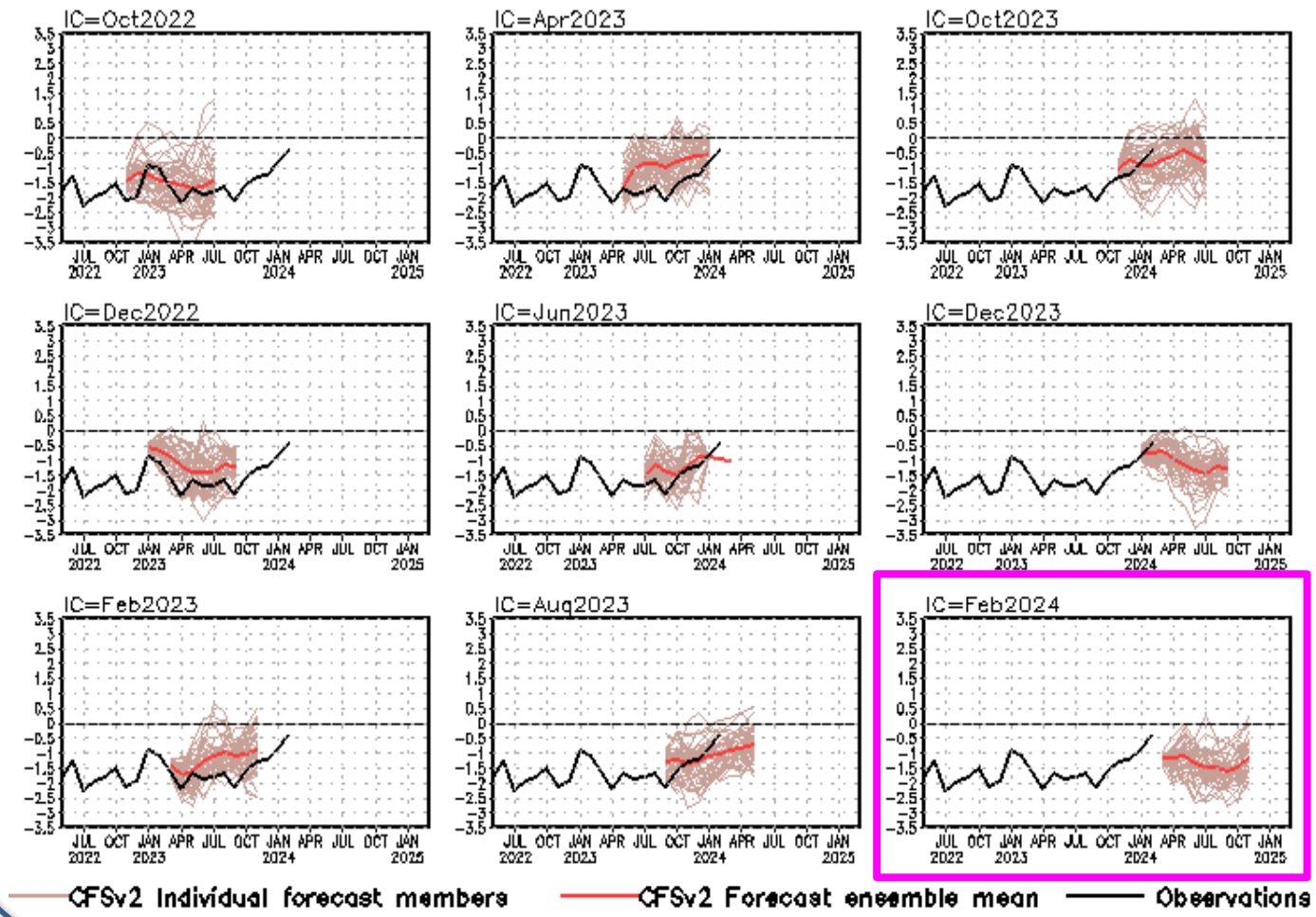
All El Niños since 1982 & their evolution for the following year



Strong El Niños (since 1950) and their evolution for the following year (Michelle L'Heureux)



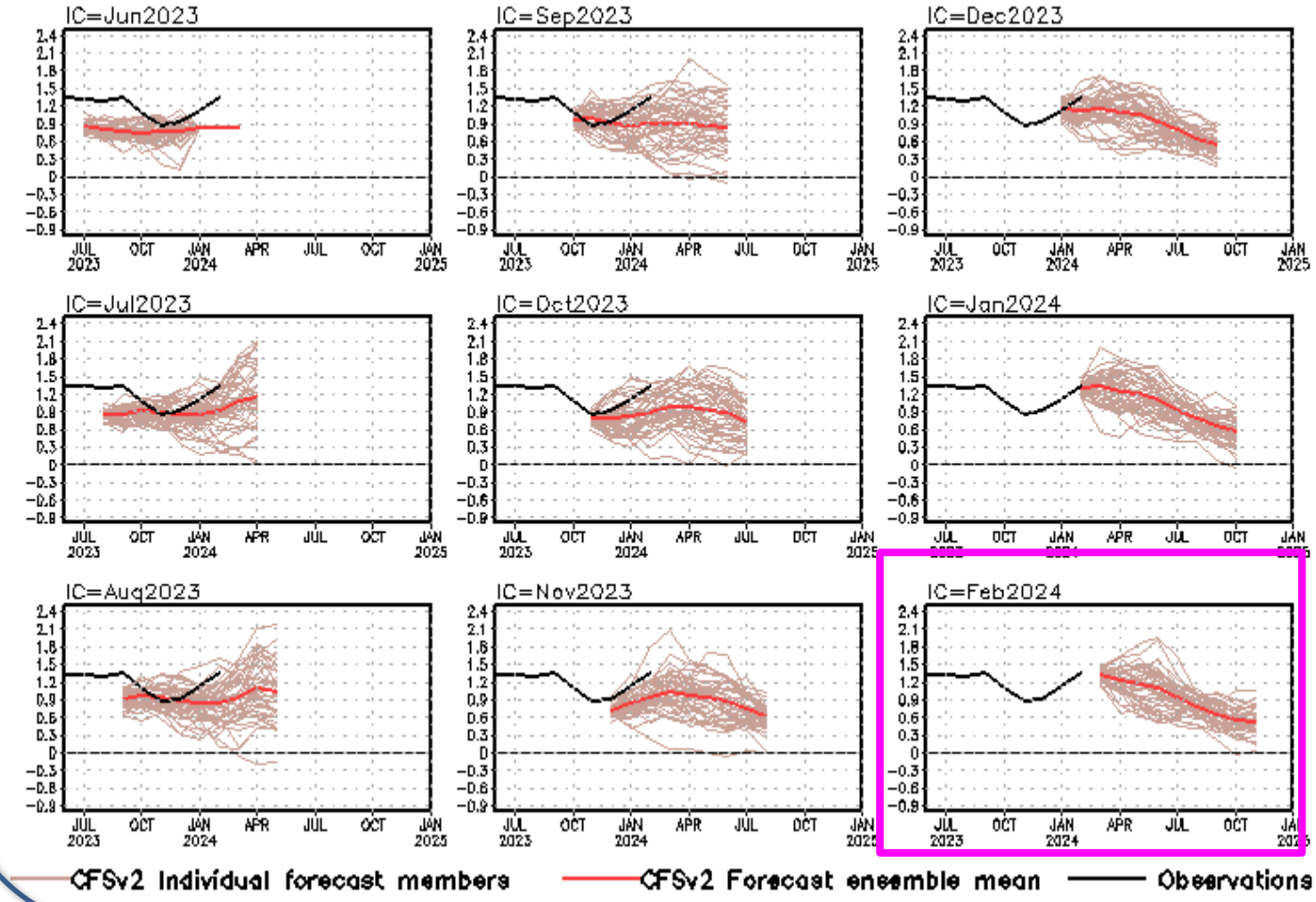
NCEP CFSv2 PDO Index Predictions from Different Initial Months



- CFSv2 predicts a persistent negative phase of PDO in 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.

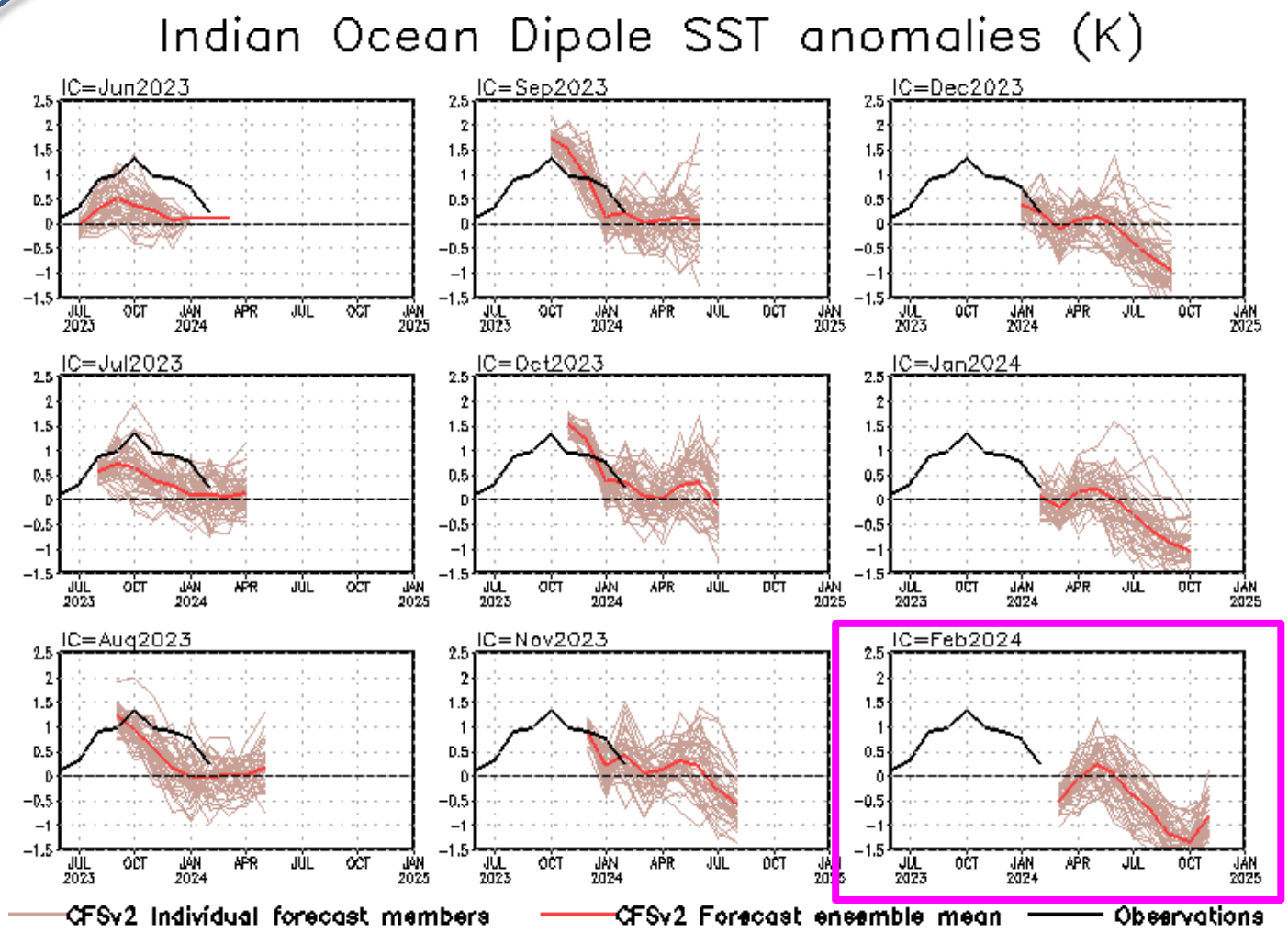
NCEP CFSv2 Tropical North Atlantic (TNA) SST Predictions from Different Initial Months



- Latest CFSv2 predictions call for 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].

NCEP CFSv2 DMI SST Predictions from Different Initial Months



- CFSv2 predicts a negative phase of IOD since the summer of 2024.

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, Caihong Wen, and Arun Kumar: reviewed PPT, and provide insightful suggestions and comments
- Dr. Pingping Xie provided the BASS/CMORPH/CFSR EVAP package
- Drs. Jieshun Zhu & Wanqiu Wang provided 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

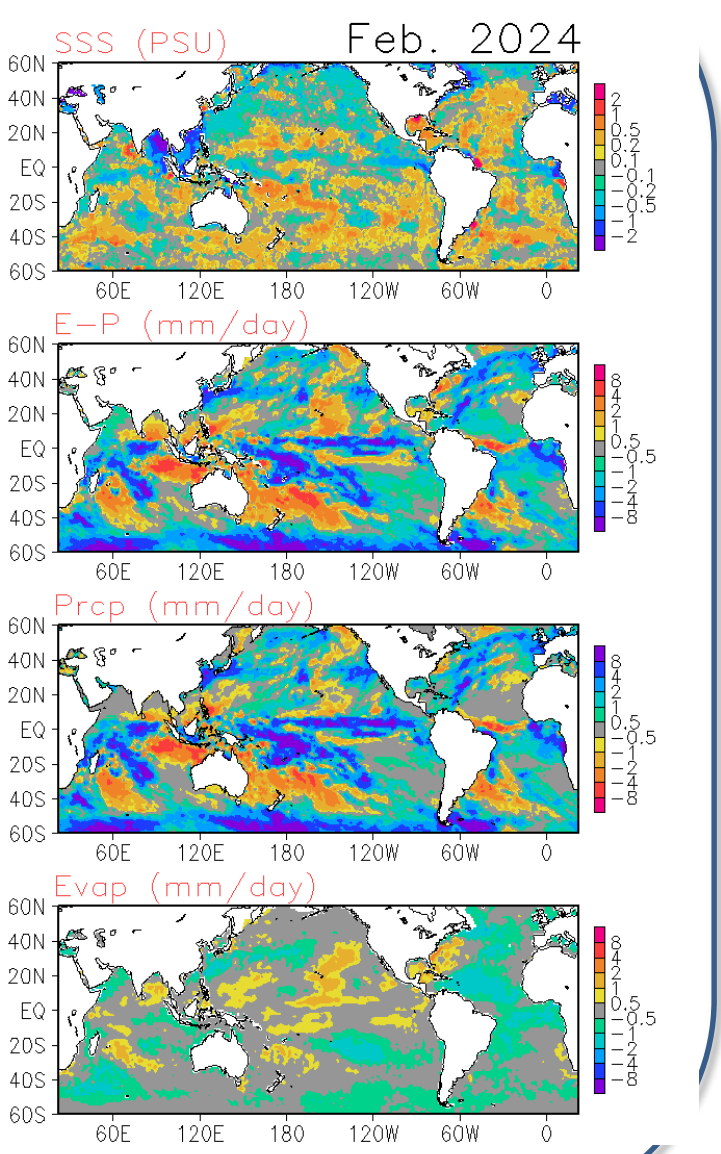
http://www.cpc.ncep.noaa.gov/products/GODAS/multiora93_body.html

Backup Slides

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

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

Pacific ITCZ and SPCA are both enhanced and located northward than their normal positions. This creates parallel bands of fresh water flux (precipitation) and thereby salinity anomalies of opposite signs over the oceanic regions. Similar intensification and northward shift of convection and resulting SSS anomaly patterns are also present with SACA and SIOCZ over the southern Atlantic and southwest Indian ocean. Freshened SS anomalies are observed over the Bay of Bengal despite the deficit ocean entering E-P there, suggesting impacts of river runoff and oceanic circulations.



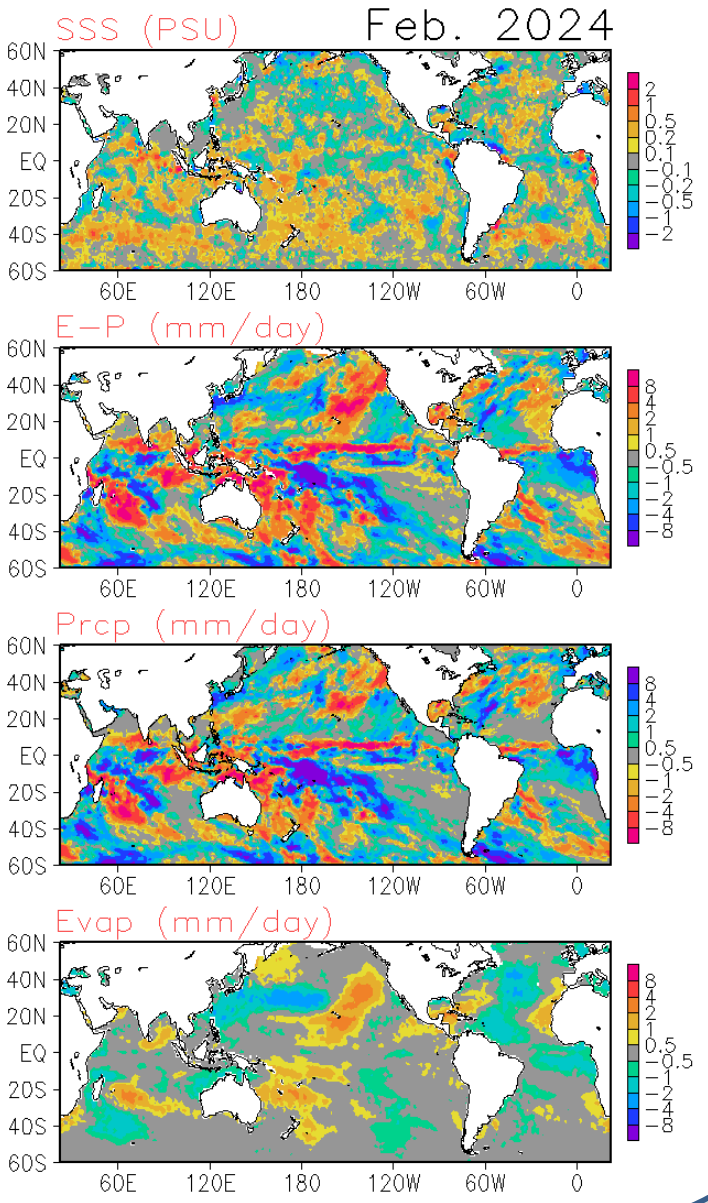
SSS : Blended Analysis of Surface Salinity (BASS) V0.Z
(a CPC-NESDIS/NODC-NESDIS/STAR joint effort)
ftp.cpc.ncep.noaa.gov/precip/BASS

Precipitation: CMORPH adjusted satellite precipitation estimates

Evaporation: Adjusted CFS Reanalysis

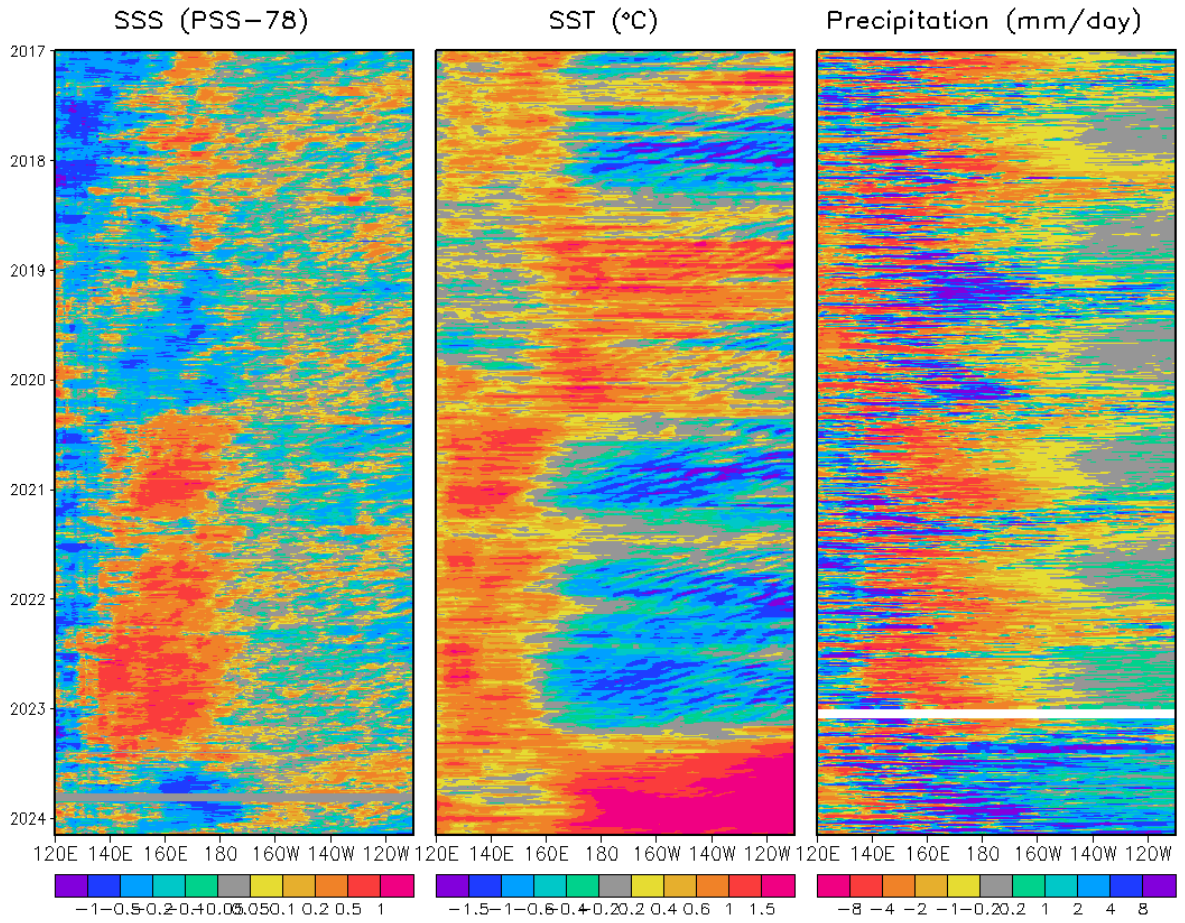
Global Sea Surface Salinity (SSS): Tendency for February 2024

Precipitation (and freshwater flux) anomalies are enhanced over the western and central tropical Pacific, creating freshened SSS tendencies. Over the equatorial Pacific, a tendency pattern if zonally oriented three-line parallel bands appear in both precipitation (fresh water flu) and the SSS, a reflection of intensified and slightly southwardly moved convection anomalies compared to those of the previous month. Similar intensification and southward move of convection anomalies are also observed for the Atlantic ITCZ, creating a zonally oriented band of saltier SSS tendency over the region.

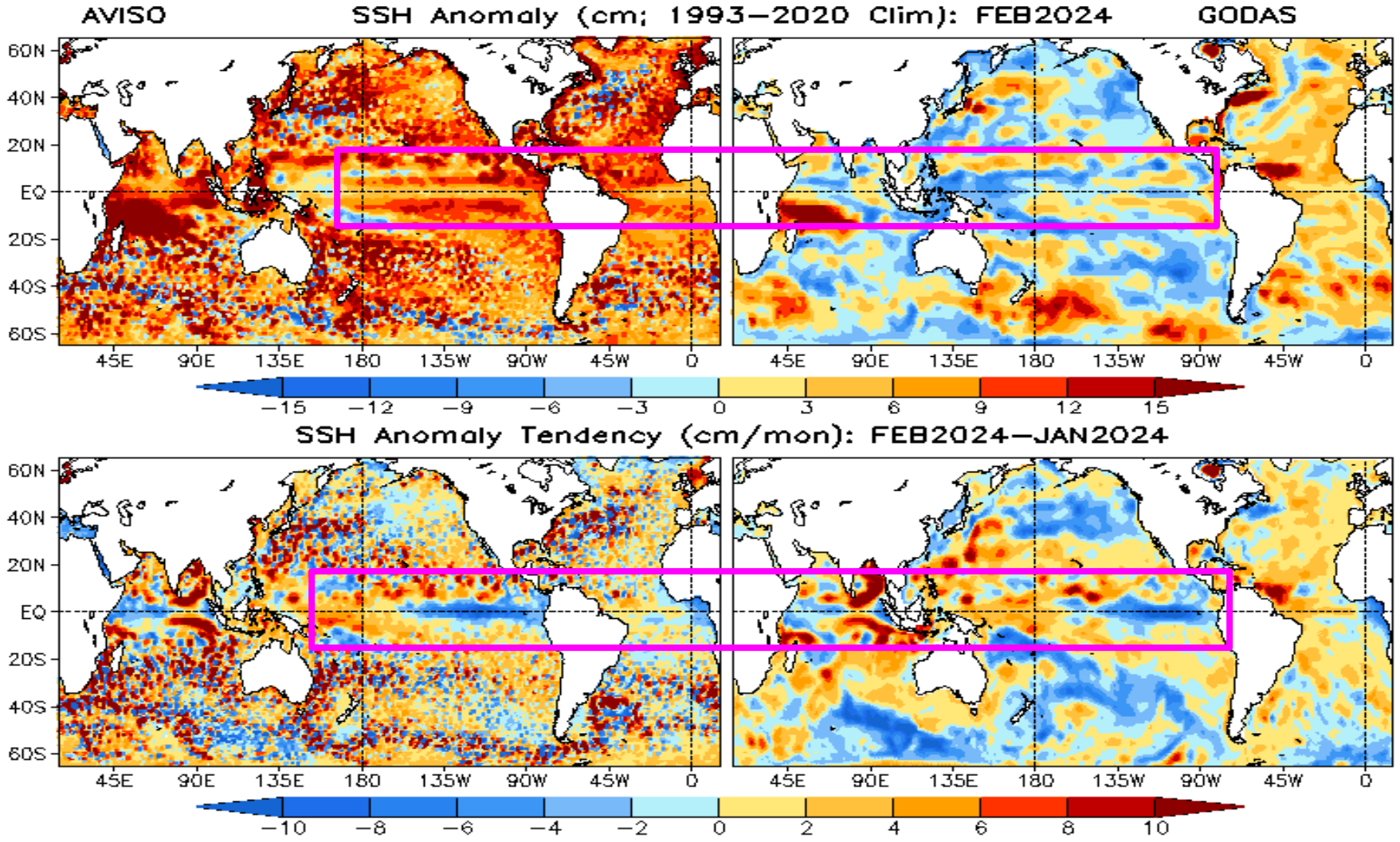


Pentad SSS Anomaly Evolution over Equatorial Pacific

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.

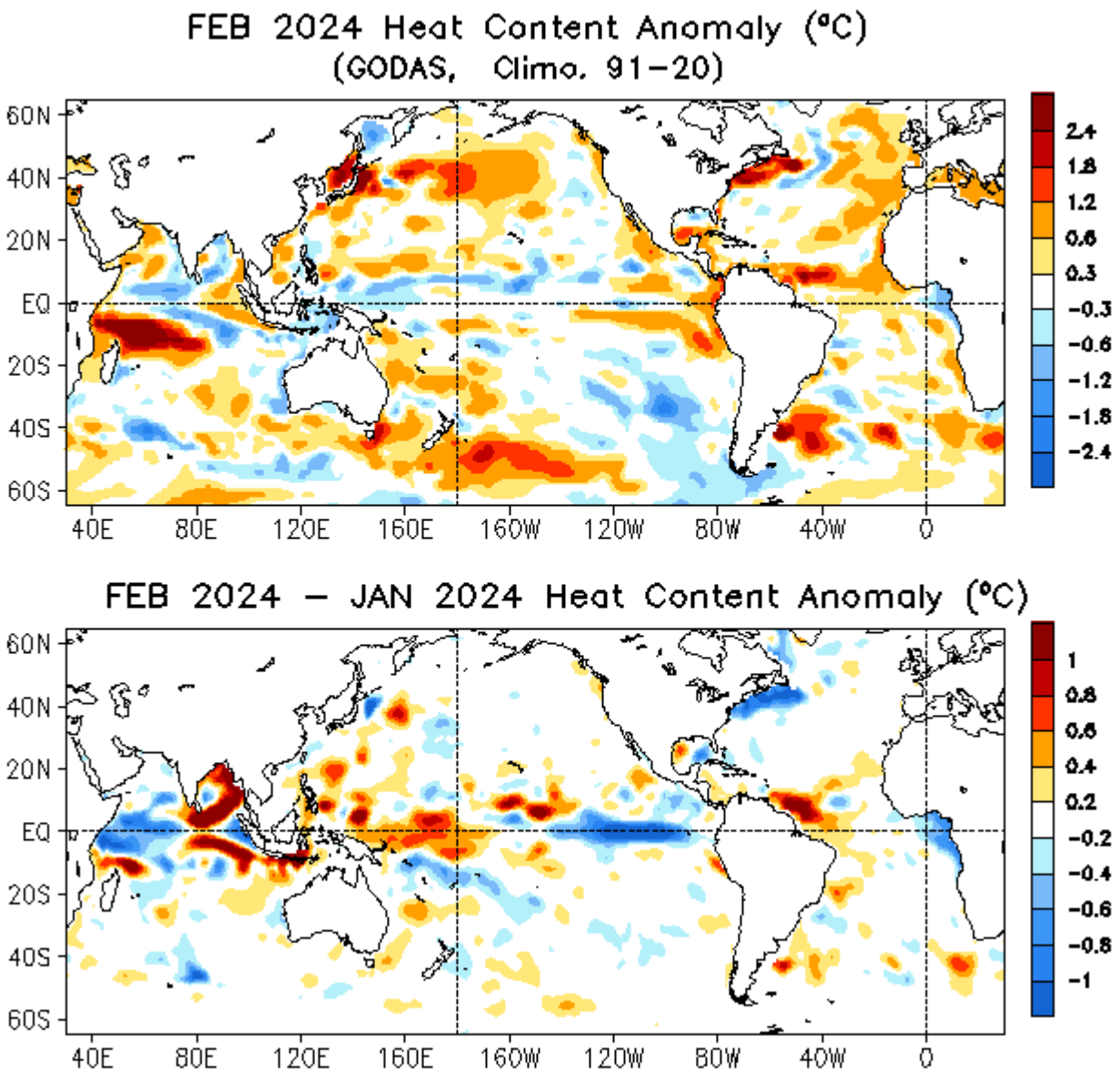


AVISO & GODAS SSH Anomaly (cm) and Anomaly Tendency

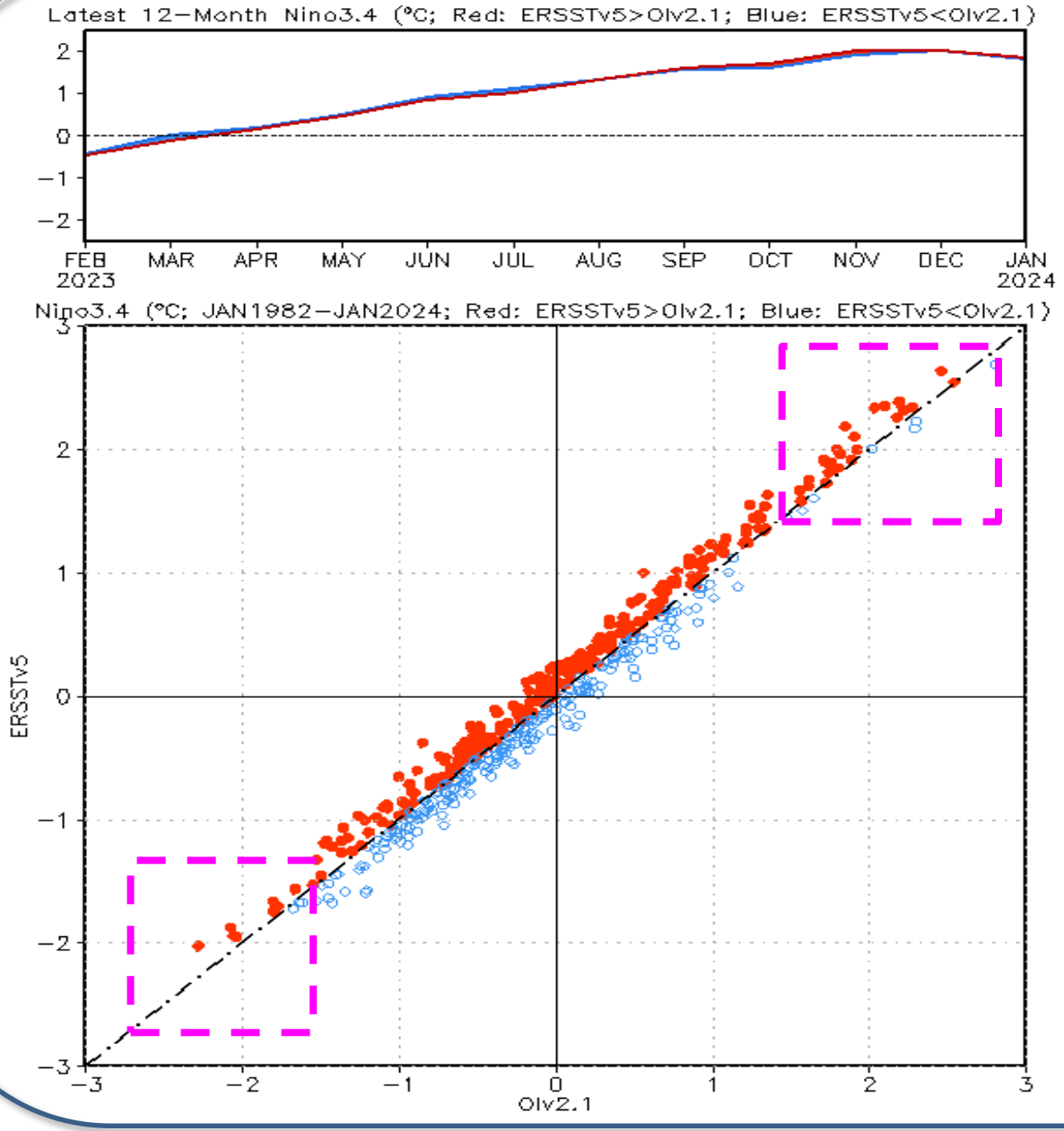


- The tendencies indicated a weakening trend of the El Niño conditions in the eastern tropical Pacific.

Global HC300 Anomaly & Anomaly Tendency

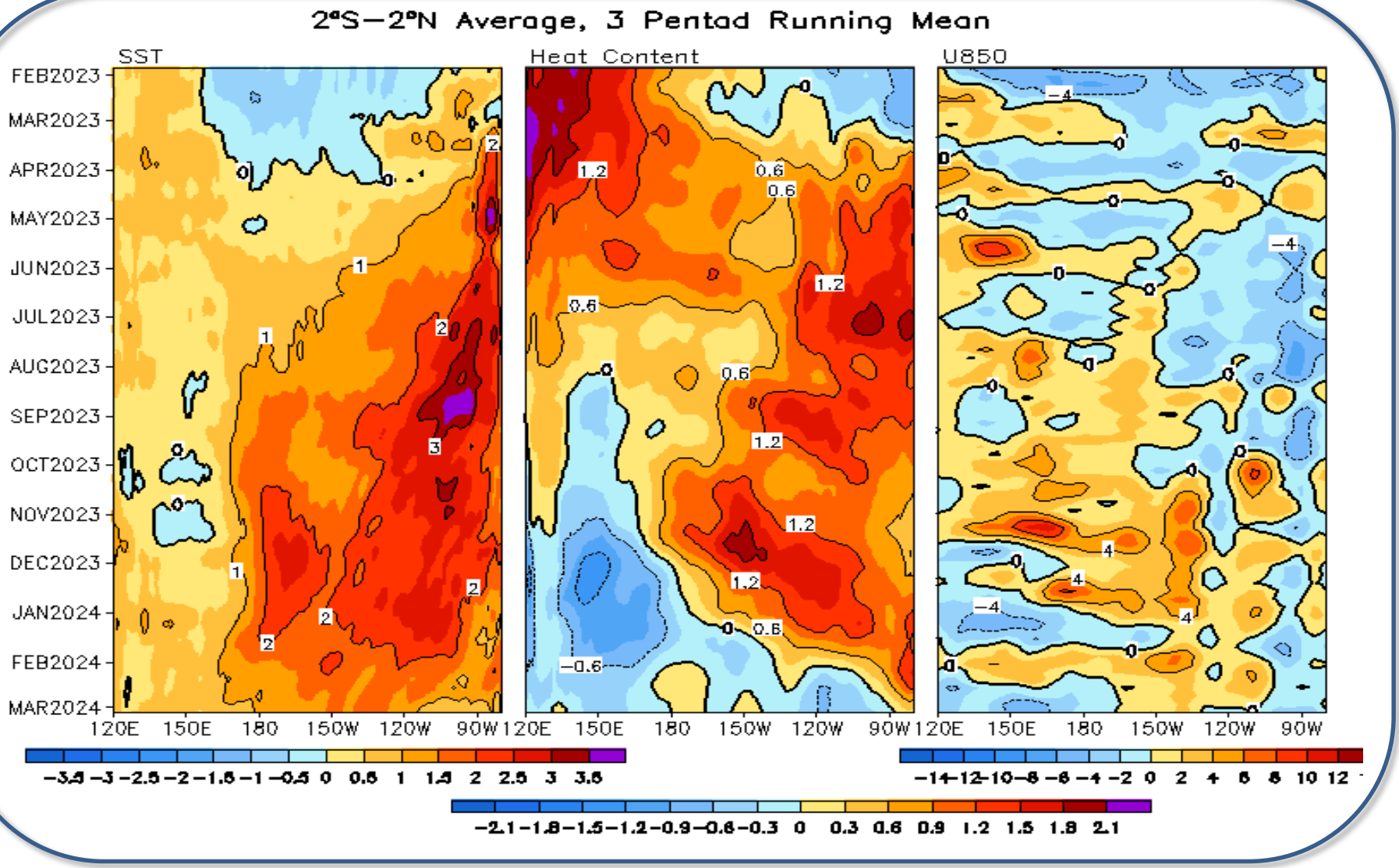


Comparison of ERSSTv5 & OIv2.1 Niño3.4 Index



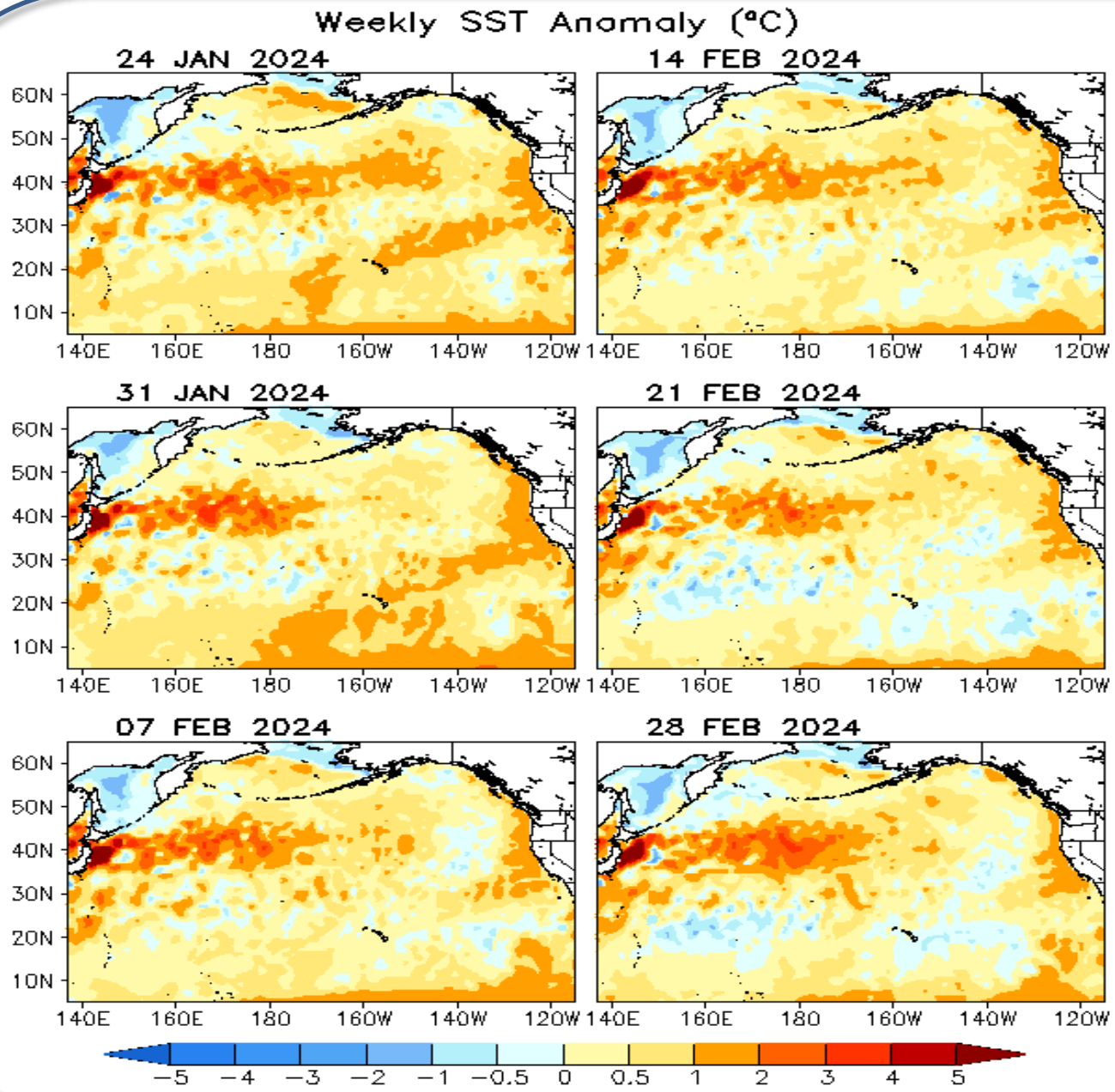
- During the last year, ERSSTv5 was close to OIv2.1.
- Sometimes, ERSSTv5 is either warmer or cooler than OIv2.1.
- For both the extreme positive and negative (>1.5°C or <-1.5°C) Niño3.4, ERSSTv5 is mostly warmer than OIv2.1.

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



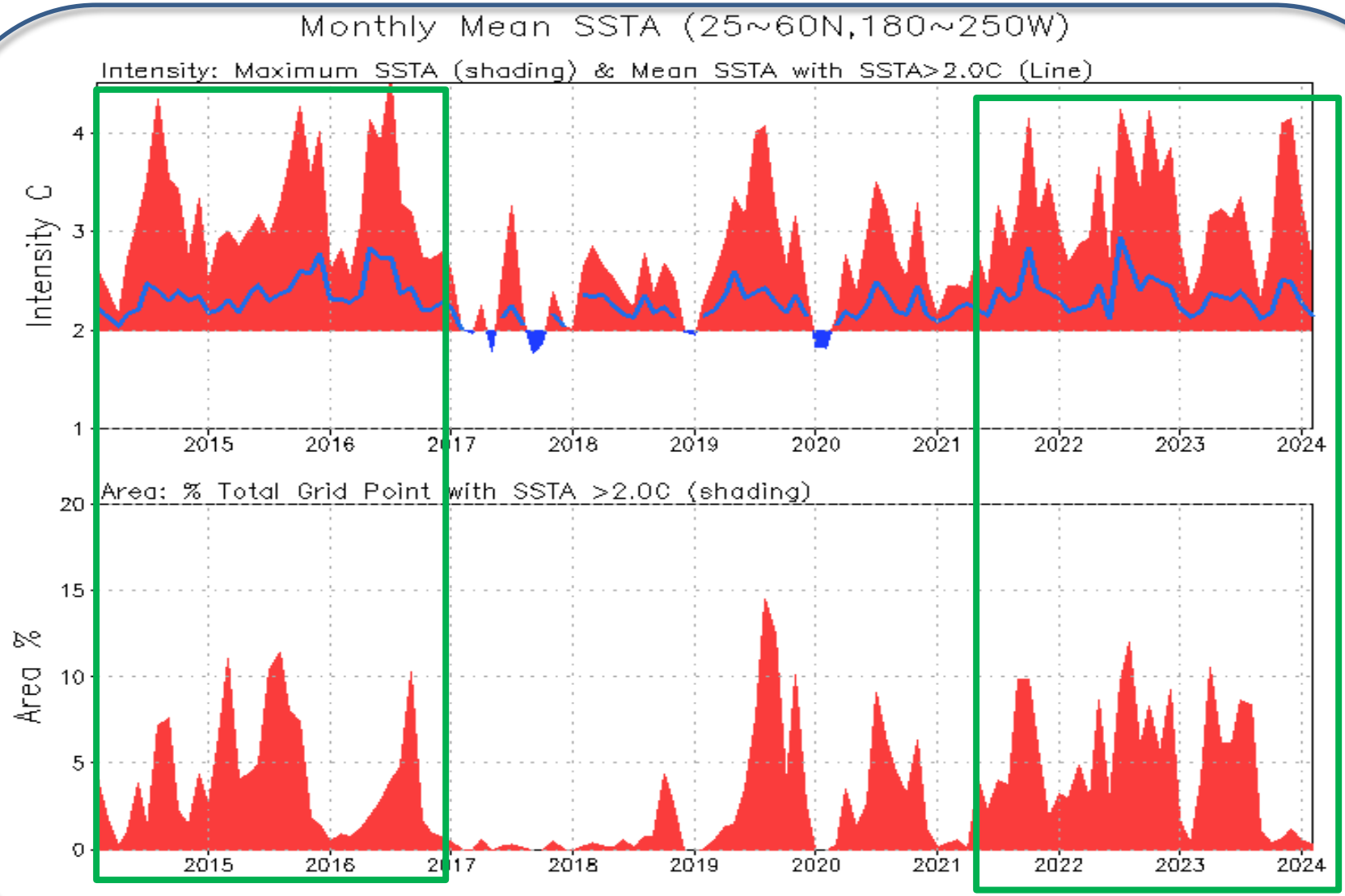
- Since Feb 2023, a set of westerly wind surges triggered downwelling Kelvin waves, reinforcing the subsurface warming in the central and eastern Pacific.

Weekly SSTA evolutions in the NE Pacific



- Positive SST anomalies persisted in the northern Pacific during the last six weeks.

N. Pacific Marine Heat Wave



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

NOAA/NWS/NCEP CPC Marine Heat Wave Webpage

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

NOAA/NCEP Climate Prediction Center

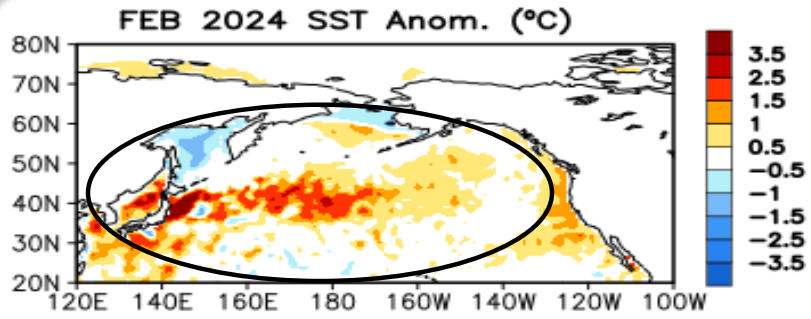
Marine Heatwave Monitoring and Forecast

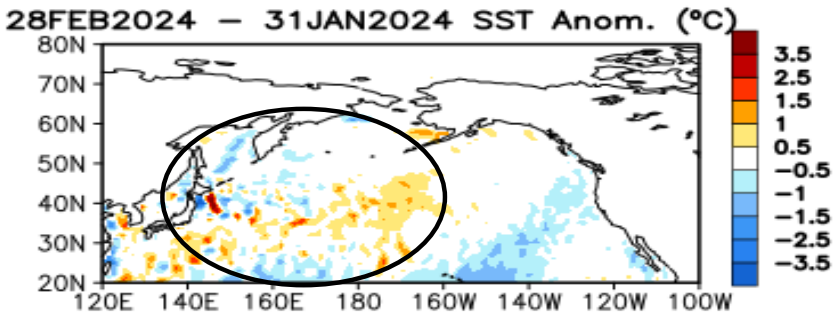
- **Indices & Time Series**
  - N. Pacific MHW Intensity & Area Indices: Weekly Monthly
  - Regional Mean SST: Global Monthly & Nino3.4 Since 1854 N. Pacific Weekly Gulf of Alaska & Subtropical Coast Weekly

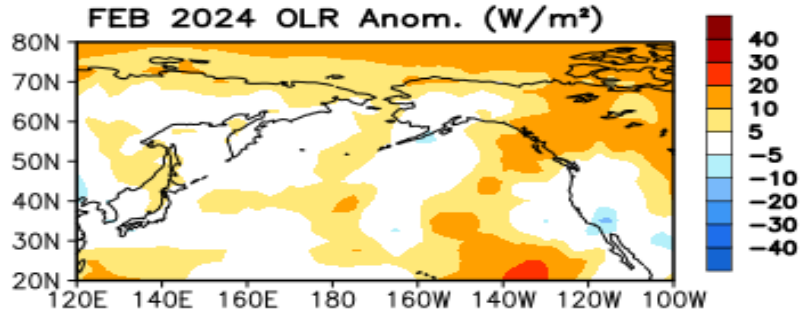
- **Spatial Distribution**
  - Global Monthly Anomaly
    - SST
  - N. Pacific Anomaly
    - Pentad Subsurface Ocean Temperature: 5m 55m 105m 155m
    - Weekly SST Weekly SST2
    - Pentad 300m Ocean Heat Content Pentad Ocean Surface Heigh Pentad Surface Heat Flux
    - 3-month SST, SLP, & UV925 SST 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

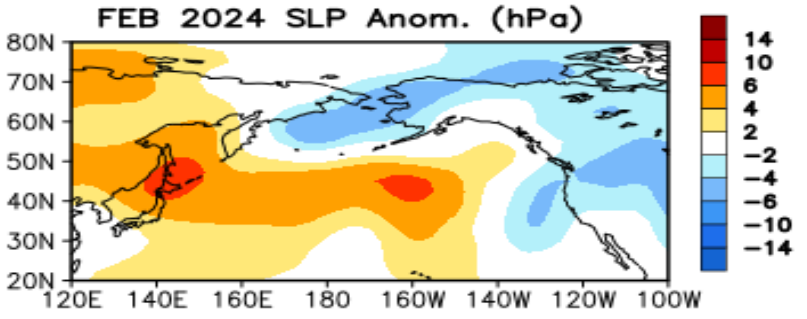
- **NMME & CFSv2 Forecasts**
  - Tropical N. Atlantic SSTA: NMME CFSv2
  - N. Pacific SSTA: NMME CFSv2
  - CFSv2: N. Pacific Sea Surface Height Anomaly
  - CFSv2 SSTA Index: Last month Last 9 months

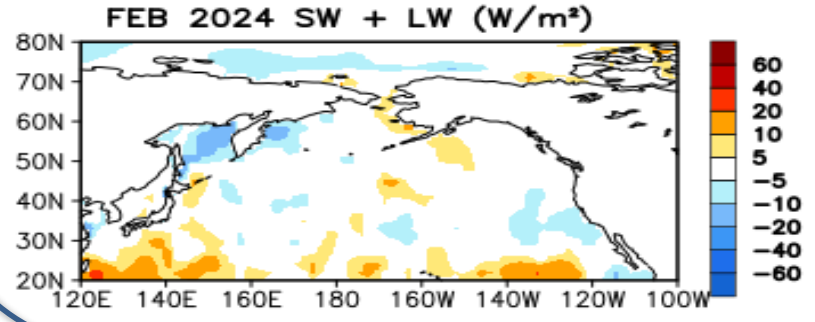
North Pacific Ocean: SSTA, SSTA Tend., OLR, SLP, Sfc Rad, Sfc Flx Anomalies

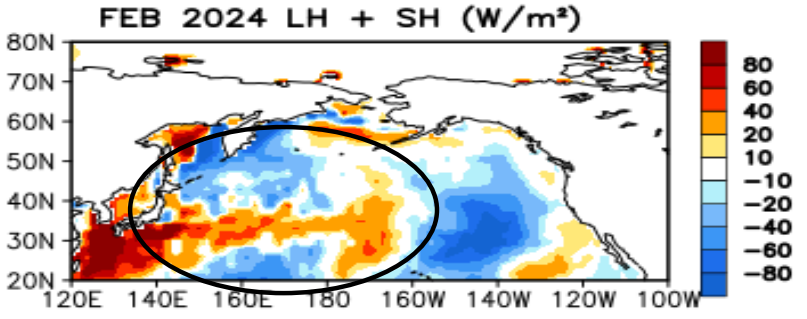






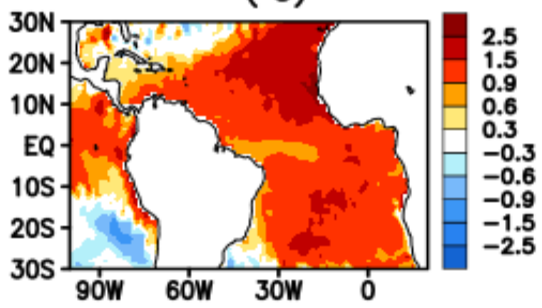


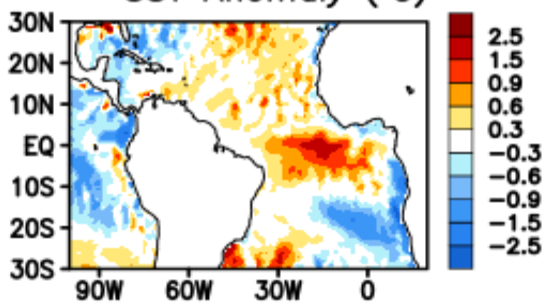


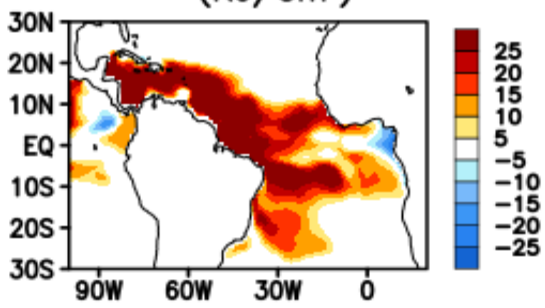


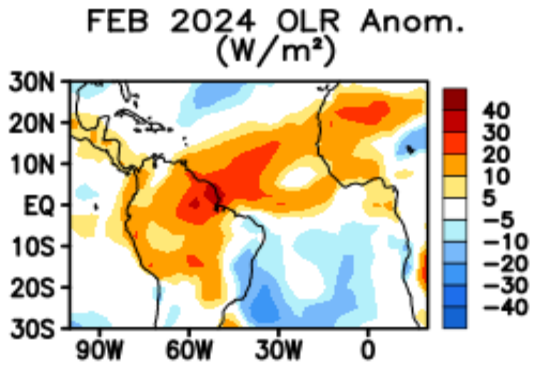
SSTA (top-left; OIv2.1 SST Analysis), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) (middle-left; NOAA 18 AVHRR IR), sea surface pressure (middle-right; NCEP CDAS), sum of net surface short- and long-wave radiation (bottom-left; positive means heat into the ocean; NCEP CDAS), sum of latent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

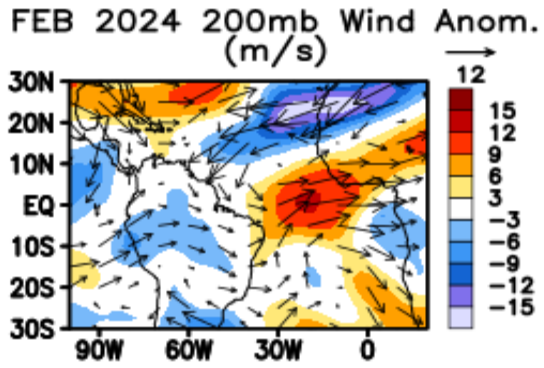
Tropical Atlantic: SST, SST tend., TCHP, OLR, 200 hPa wind, wind share, heat flex, & RH anom.

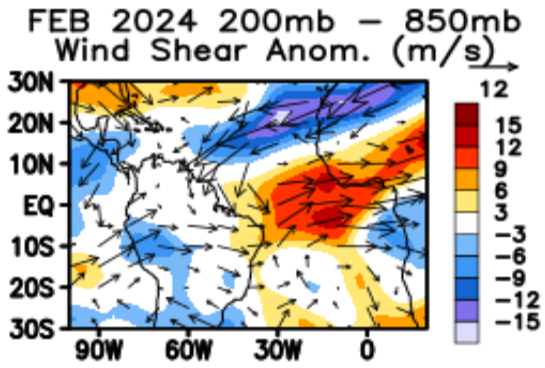


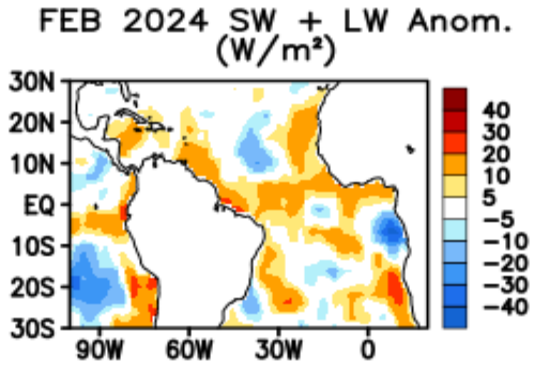


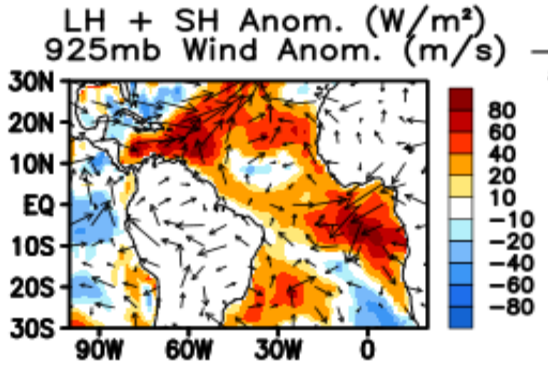


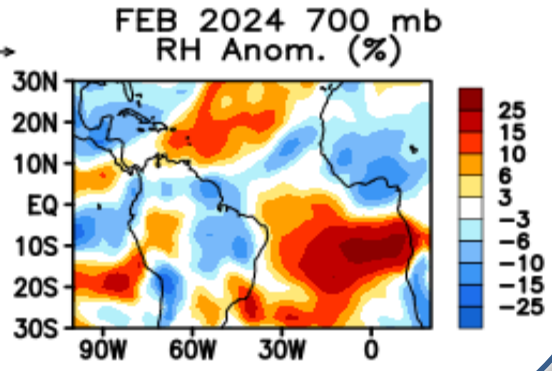












N. Atlantic: SST, SST tend., OLR, SLP, & heat flex anom.