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

Prepared by

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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

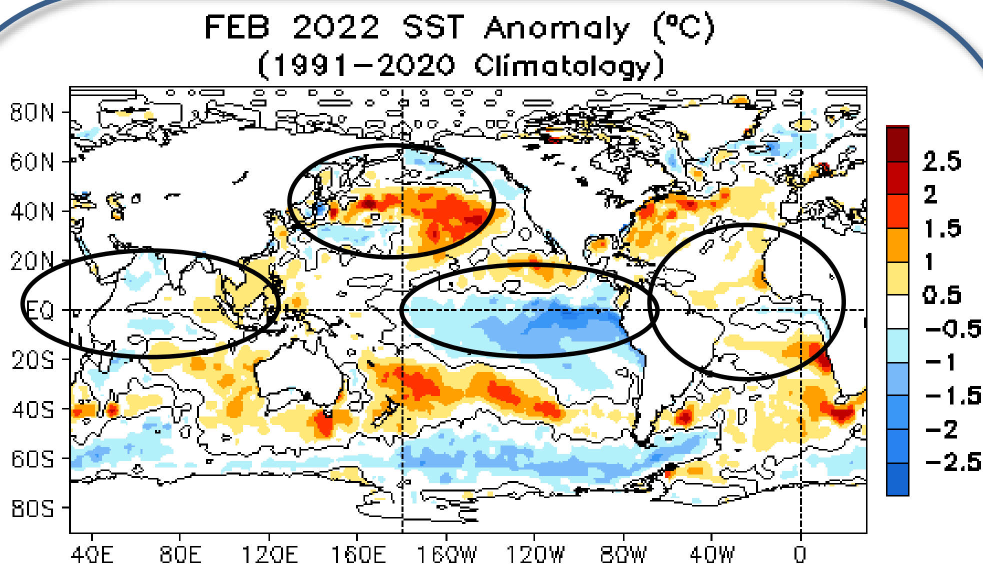
- **Overview**
- **Recent highlights**
  - Pacific/Arctic Ocean
  - Indian Ocean
  - Atlantic Ocean
- **Global SSTA Predictions**

Overview

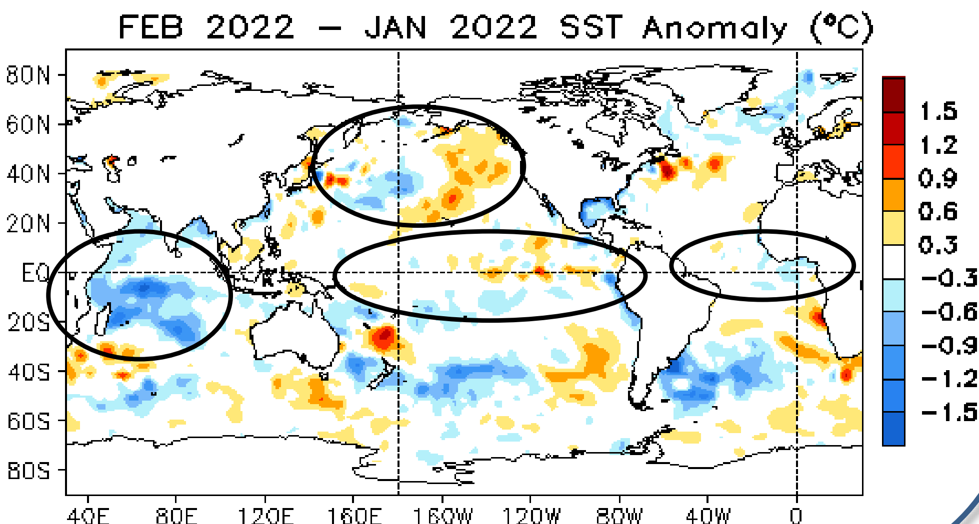
- **Pacific Ocean**
  - NOAA "ENSO Diagnostic Discussion" on 10 Mar 2022 stated *"La Niña is favored to continue into the Northern Hemisphere summer (53% chance during June-August 2022), with a 40-50% chance of La Niña or ENSO-neutral thereafter."*
  - La Niña condition persisted with Niño3.4 = -0.89°C in Feb 2022.
  - Positive SSTAs continued in the North Pacific.
  - The PDO has been in a negative phase since Feb 2020 with PDOI = -1.49.
- **Arctic Ocean**
  - "Average Arctic sea ice extent for February 2022 was 14.61 million square kilometers (5.64 million square miles), ranking fourteenth lowest in the satellite record."
- **Indian Ocean**
  - Negative (positive) SSTAs were present in the western (eastern) tropics in Feb 2022.
- **Atlantic Ocean**
  - SSTs were near average in the tropics in Feb 2022.
  - NAO switched to a positive phase in Dec 2021 with NAOI= 1.46 in Feb 2022.

Global Oceans

Global SST Anomaly (°C) and Anomaly Tendency



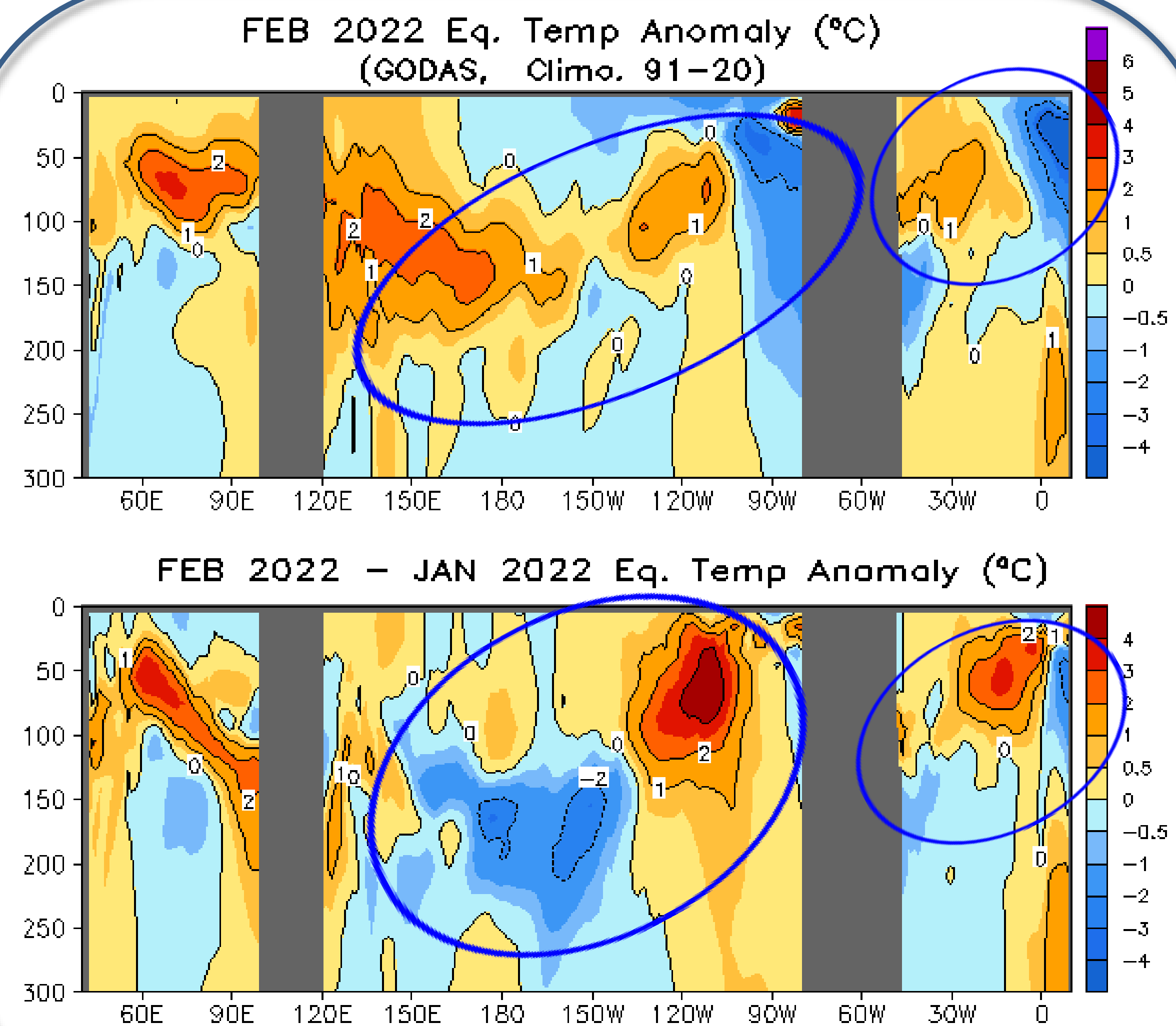
- Negative SSTAs persisted in the central and southeastern tropical Pacific.
- Positive SSTAs persisted in the North Pacific.
- Weak SSTAs were evident across the tropical Atlantic.
- SSTs were below average in the western tropical Indian Ocean.



- Positive (negative) SSTA tendencies were observed in the eastern (far-eastern) equatorial Pacific.
- Positive (negative) SSTA tendencies were evident in the eastern (western) North Pacific.
- Negative SSTA tendencies were present in the equatorial Atlantic Ocean and southwestern tropical Indian Ocean.

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

Longitude-Depth Temperature Anomaly and Anomaly Tendency in 2ºS-2ºN

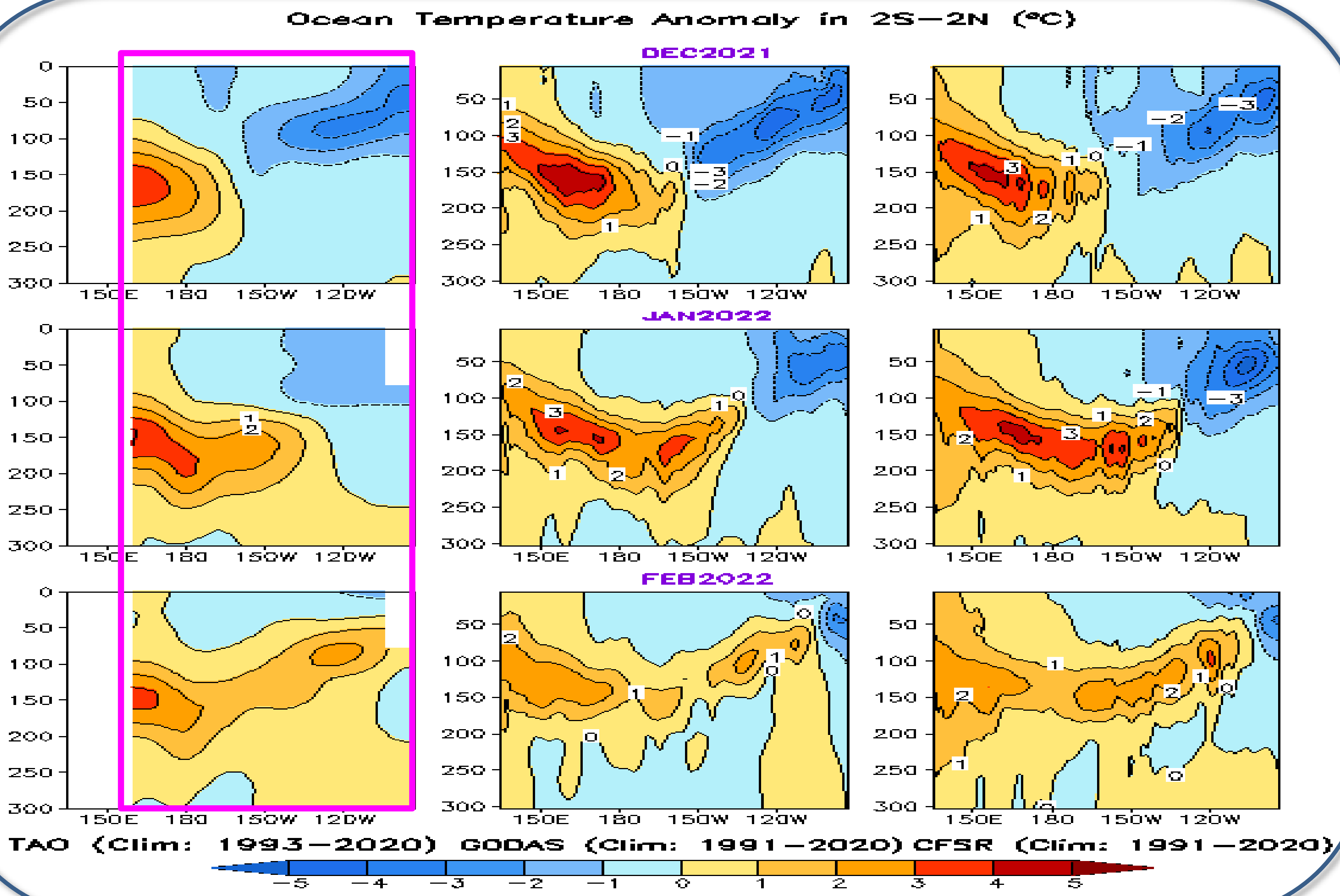


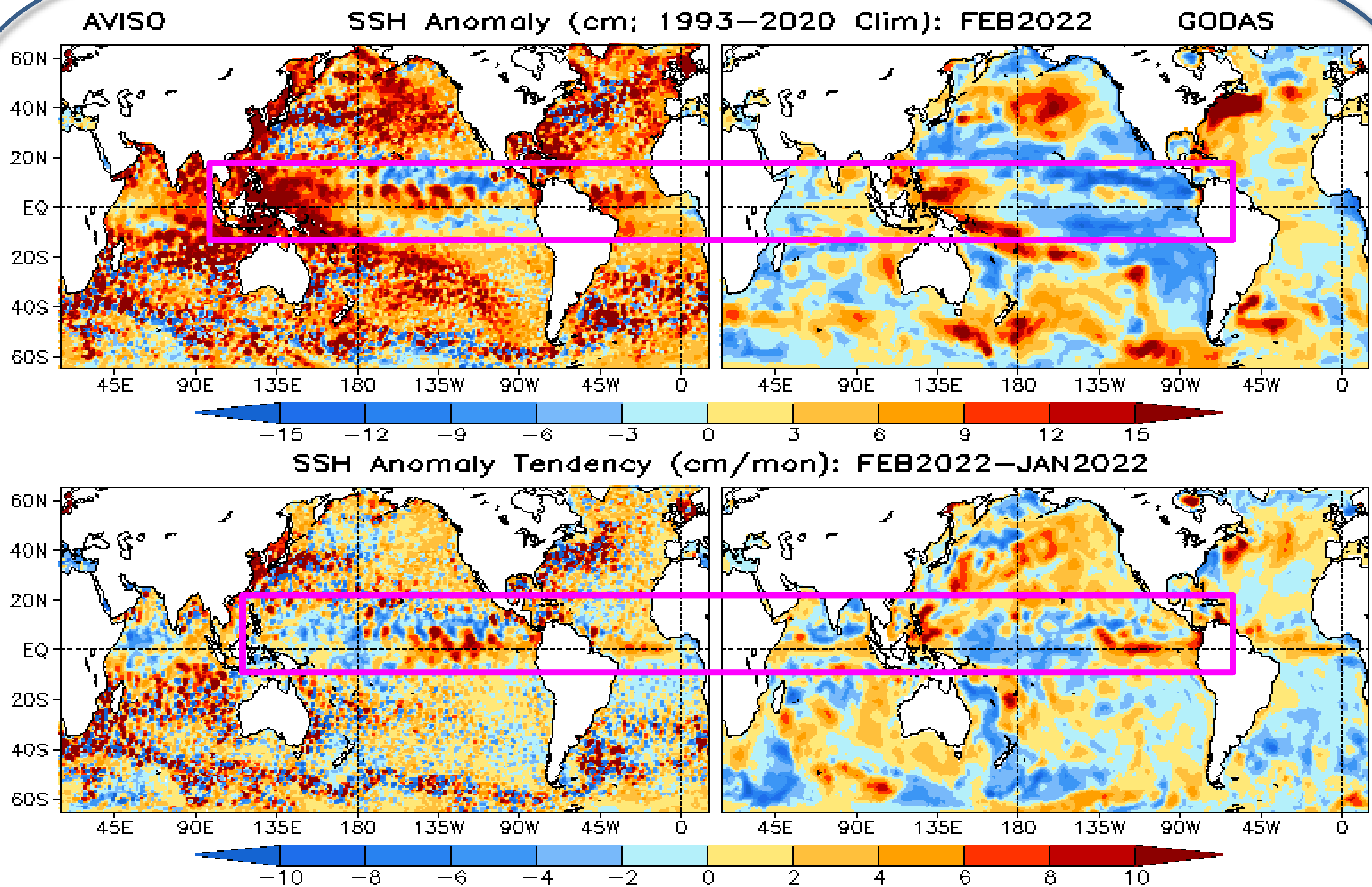
- Positive (negative) temperature anomalies were observed along the thermocline in the western and central (far-eastern) equatorial Pacific.
- Positive (negative) temperature anomalies were observed along the thermocline in the western (eastern) equatorial Atlantic Ocean.

- Temperature anomaly tendency was positive (negative) along the thermocline in the eastern (central) Pacific.
- Positive (negative) temperature anomaly tendency was evident in the central (far-eastern) 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.

TAO, GODAS, & CFSR monthly mean subsurface temperature anomalies along the Equator during the last 3 months

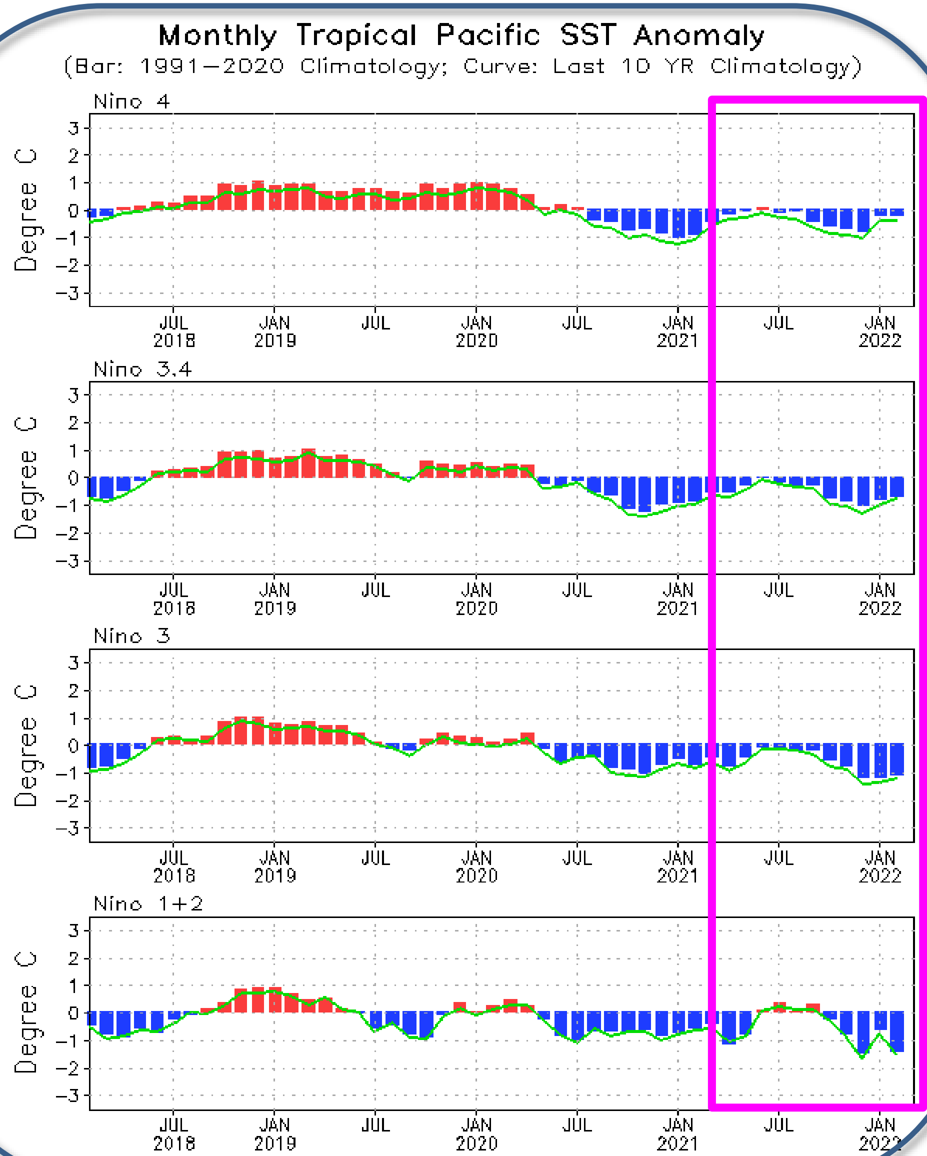


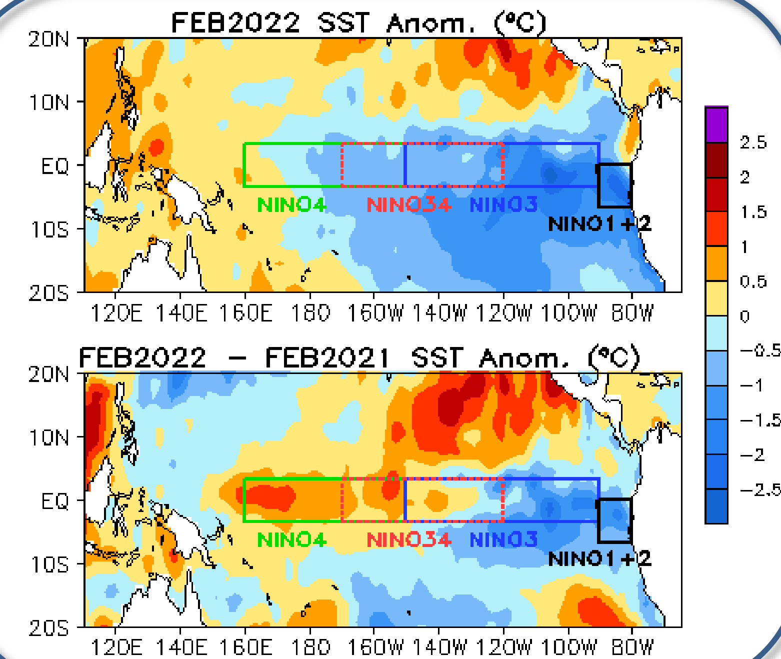


- Basic features in the tropical Pacific associated with La Nina evolution are consistent between AVISO and GODAS.
- Positive (negative) anomalous tendencies were present in the eastern (central) equatorial Pacific.
- There are some differences in details between AVISO & GODAS with a lot of small-scale variabilities in AVISO.

Tropical Pacific Ocean and ENSO Conditions

Evolution of Pacific Niño SST Indices

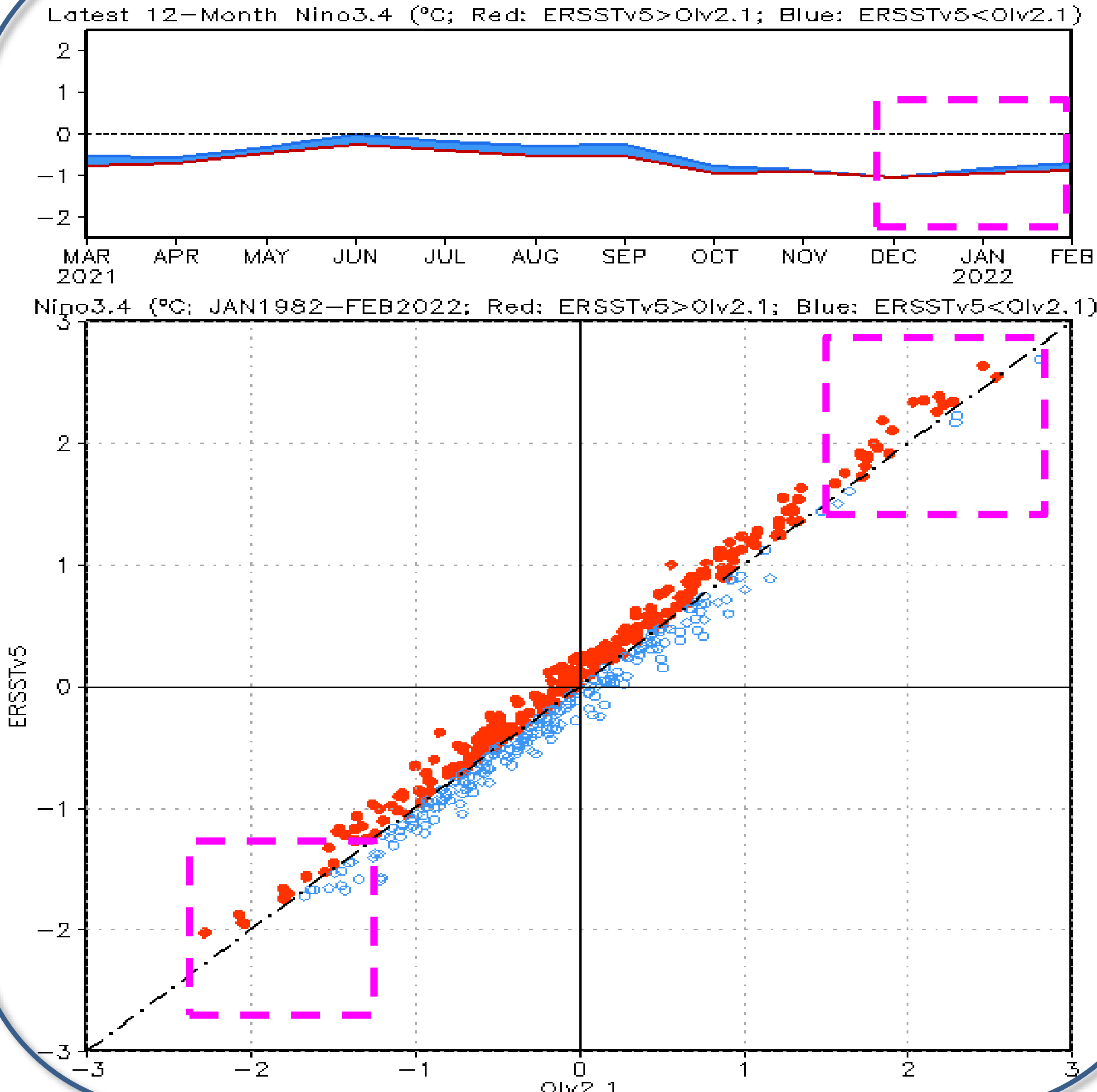




- All Niño indices were negative in Feb 2022, with Niño3.4 = -0.89C.
- Compared with Feb 2021, the central (eastern) equatorial Pacific was warmer (cooler) in Feb 2022.
- The indices may have slight differences if based on different SST products.

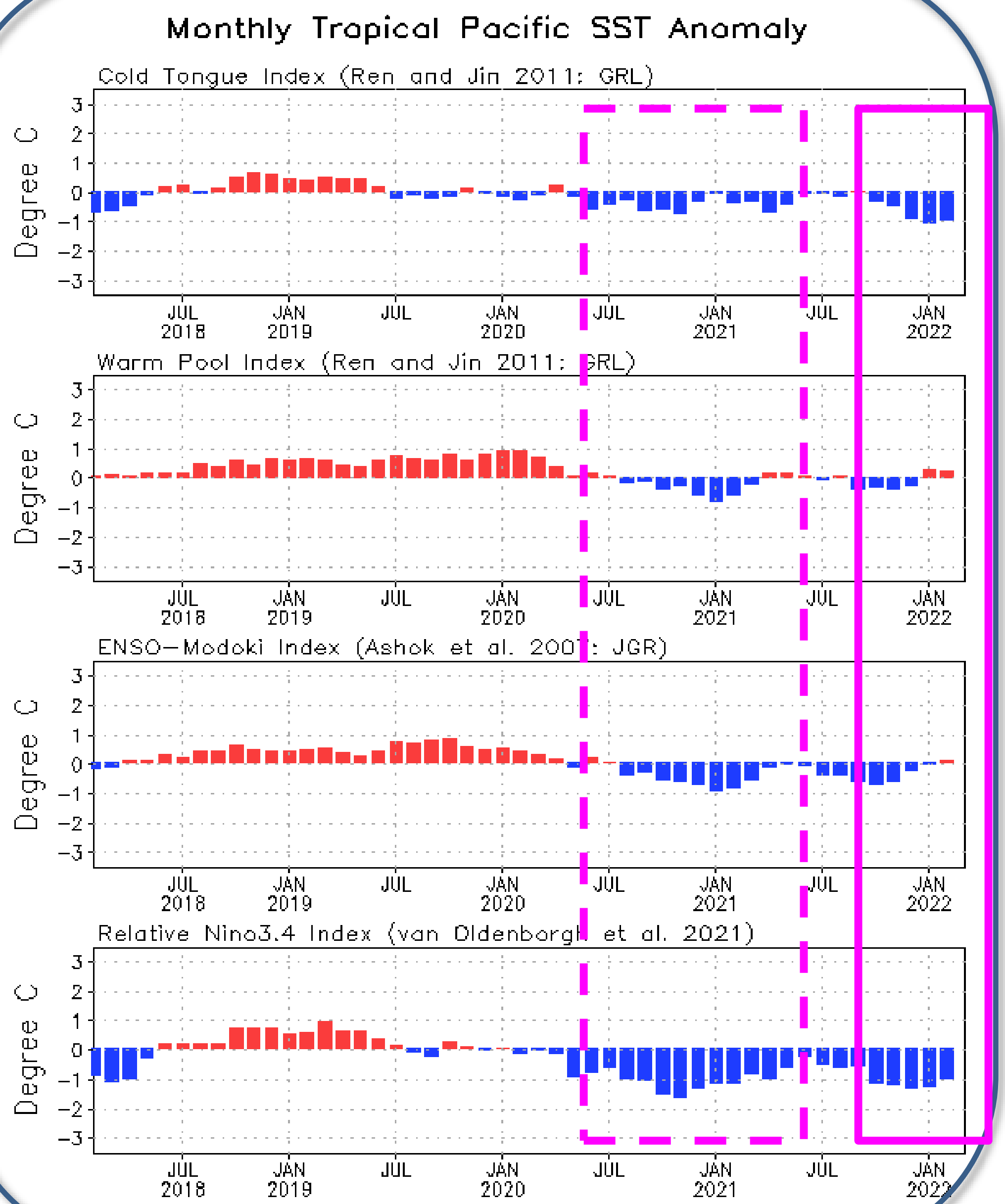
Niño region indices, calculated as the area-averaged monthly mean SSTAs (°C) for the specified region. Data are derived from the OI SST analysis, and anomalies are departures from the 1991-2020 base period means.

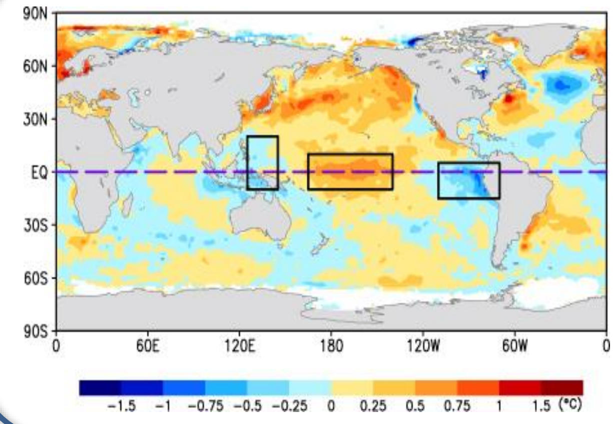
Comparison of ERSSTv5 & OIv2.1 Niño3.4 Index



- Sometimes, ERSSTv5 is warmer or cooler than OIv2.1.
- For both the extreme positive (negative; ±1.5°C) Niño3.4, ERSSTv5 is mostly warmer than OIv2.1.
- During last a couple months, ERSSTv5 was slightly cooler than OIv2.1.

Evolution of Pacific Niño SST Indices



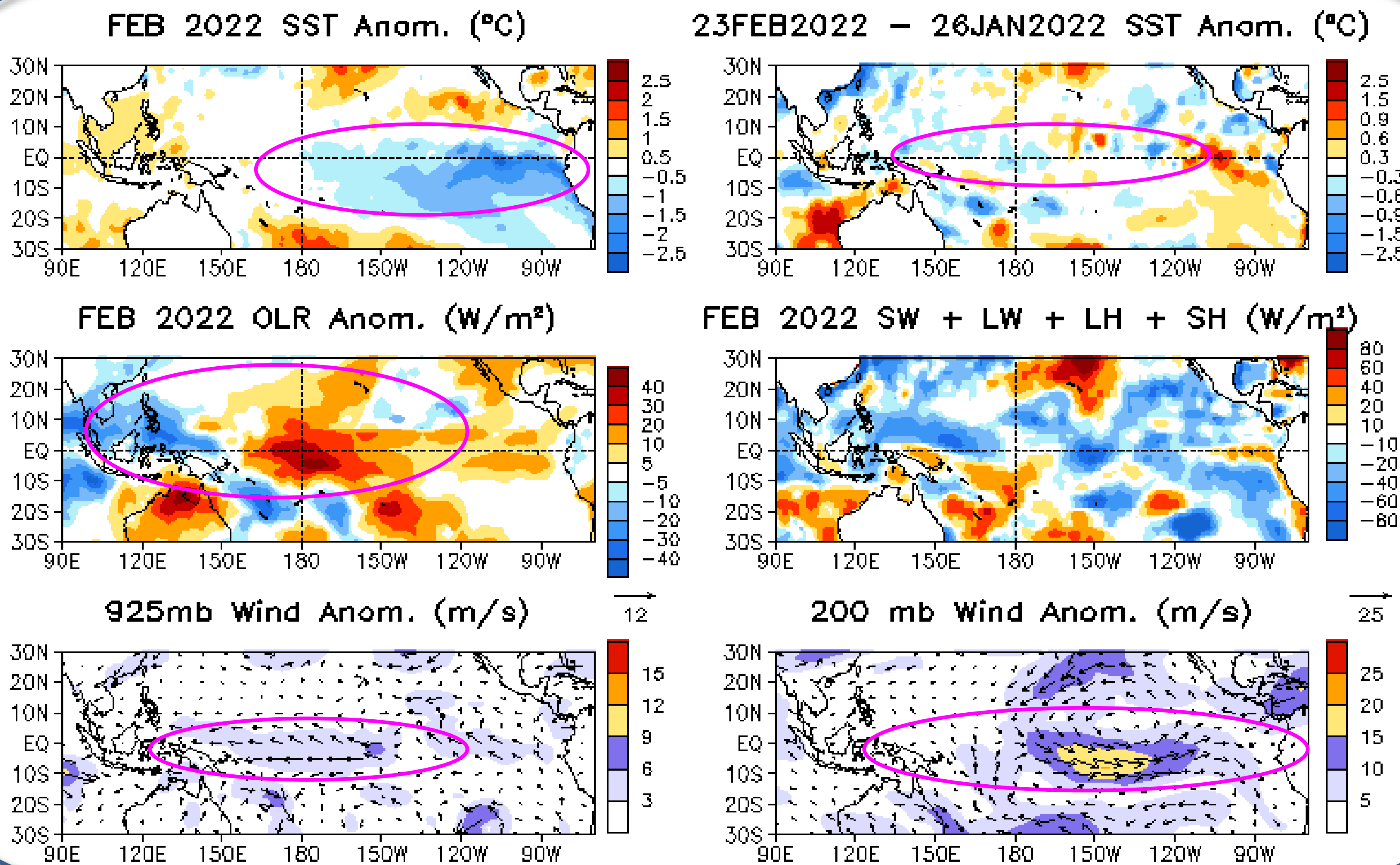


- Relative Niño3.4 index is defined as the conventional Niño3.4 index minus the SSTA averaged in the whole tropics (0º-360º, 20ºS-20ºN), in order to remove the global warming signal. Also, to have the same variability as the conventional Niño3.4 index, the relative Niño3.4 index is renormalized (van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

Relative Niño3.4 data updated monthly at:

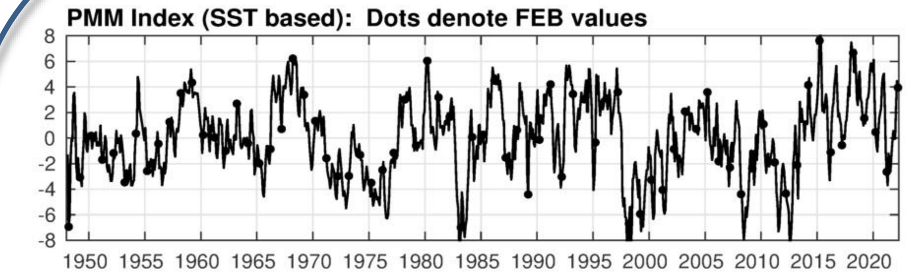
https://www.cpc.ncep.noaa.gov/data/indices/RONI.ascii.txt

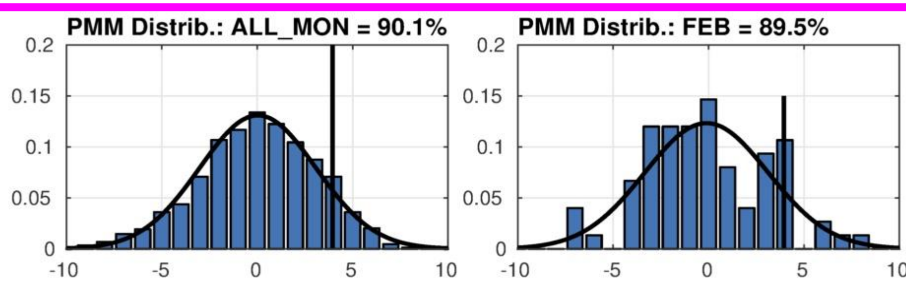
Tropical Pacific: SSTA, SSTA Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Winds

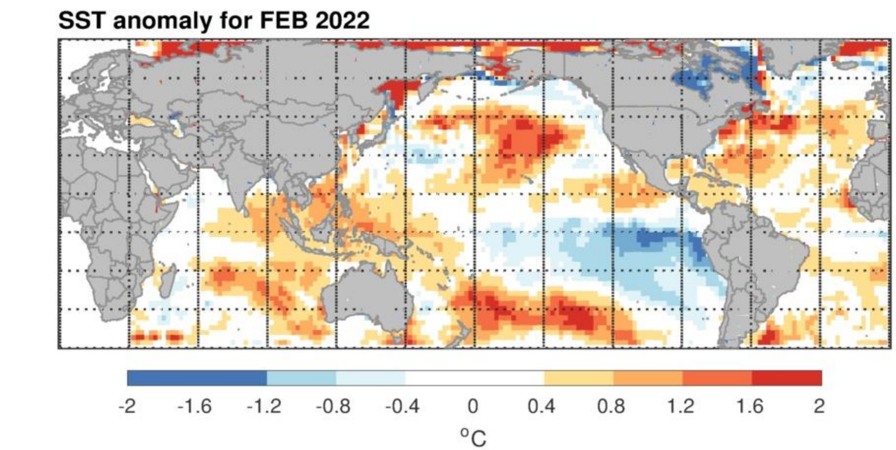


SSTAs (top-left), SSTA tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right; positive means heat into the ocean), 925-mb wind anomaly vector and its amplitude (bottom-left), 200-mb wind anomaly vector and its amplitude (bottom-right). SST are derived from the OI 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.

Current Status of the Pacific Meridional Mode (PMM)

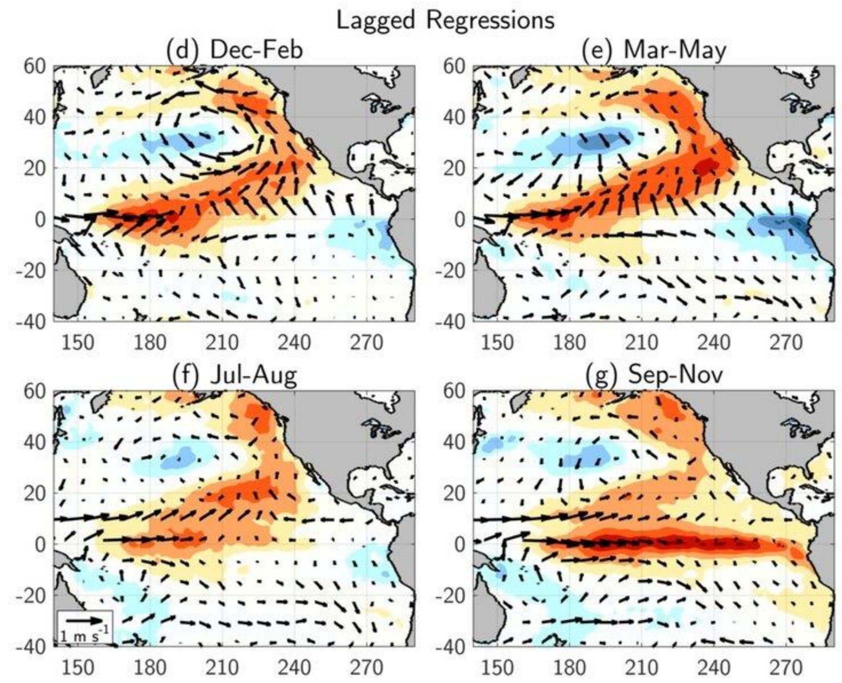






https://www.aos.wisc.edu/~dvimont/MModes/PMM.html

Lagged regressions of seasonally averaged SST and surface wind anomalies on NPMM SST time series calculated from a Maximum Covariance Analysis.

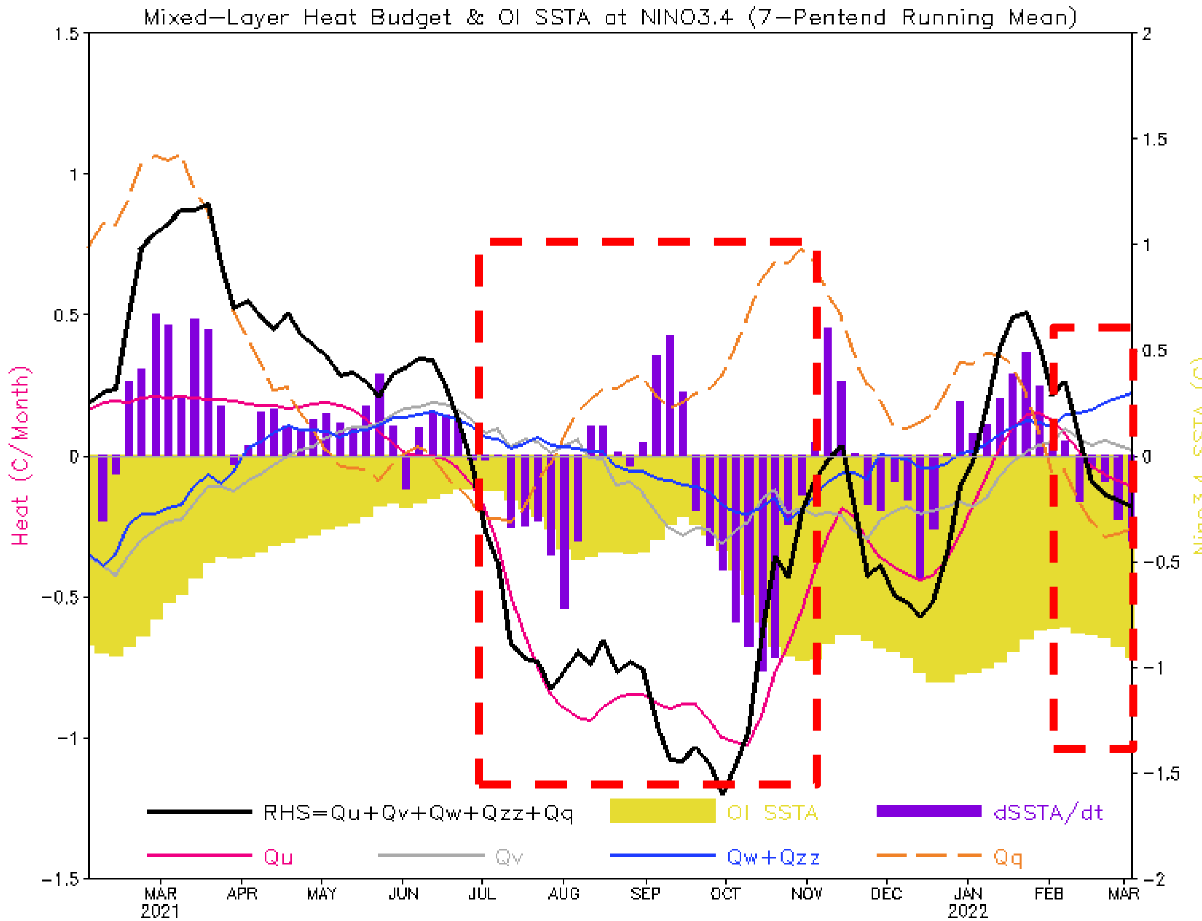


Amaya, D. J., 2019: The Pacific meridional mode and ENSO: A review. Curr. Climate Change Rep., 5, 296–307, 10.1007/s40641-019-00142-x.

Ocean Mixed-Layer Heat Budget

-Observed SSTA tendency (dSSTA/dt; bar) and total heat budget (RHS; black line) were negative recently.

- Dynamical terms (Qu, Qv, Qw+Qzz) were small and heat-flux term (Qq) were negative recently.



Huang, B., Y. Xue, X. Zhang, A. Kumar, and M. J. McPhaden, 2010 : The NCEP GODAS ocean analysis of the tropical Pacific mixed layer heat budget on seasonal to interannual time scales, J. Climate., 23, 4901-4925.

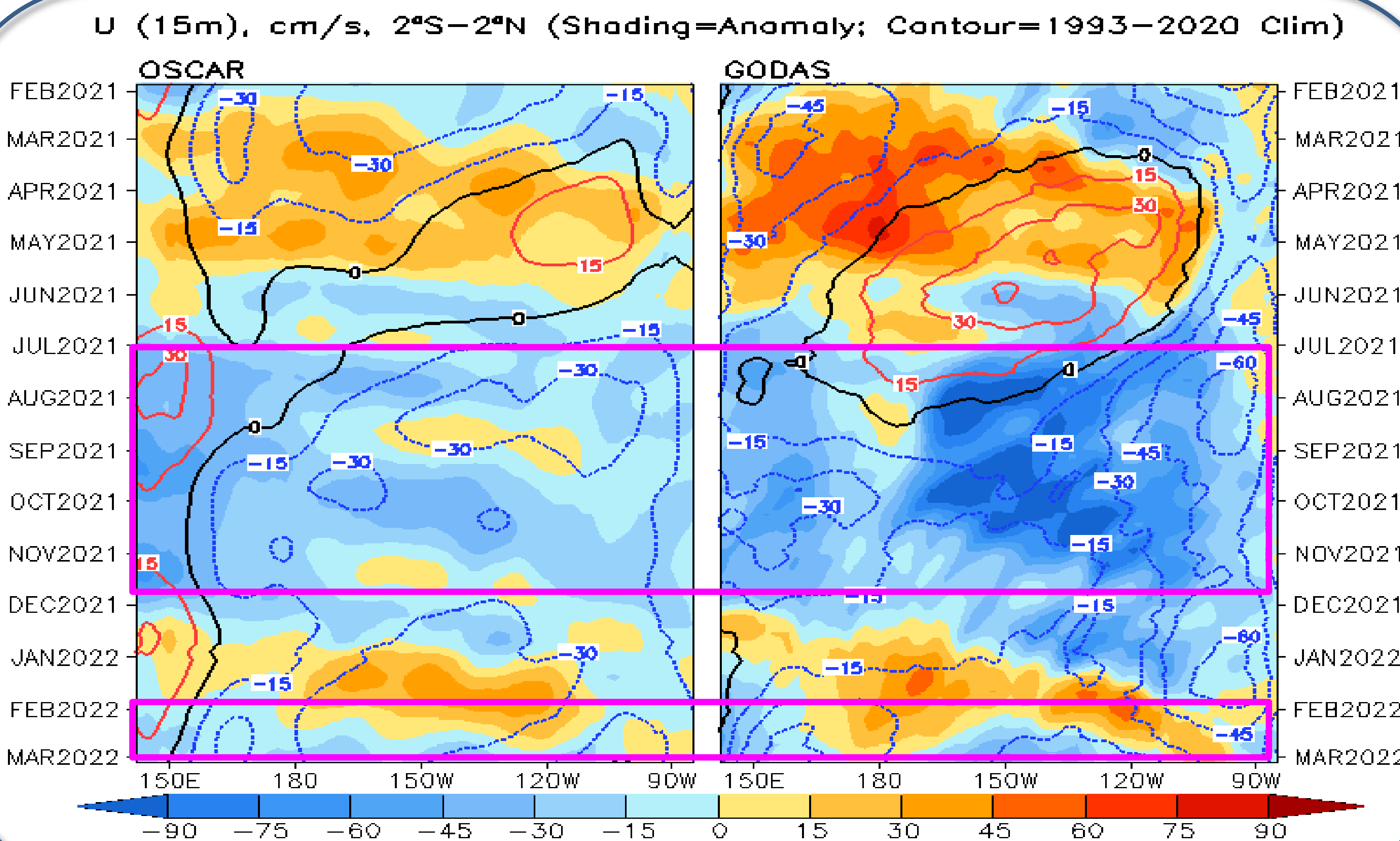
Qu: Zonal advection; Qv: Meridional advection;

Qw: Vertical entrainment; Qzz: Vertical diffusion

Qq: (Qnet - Qpen + Qcorr)/ρcph; Qnet = SW + LW + LH +SH;

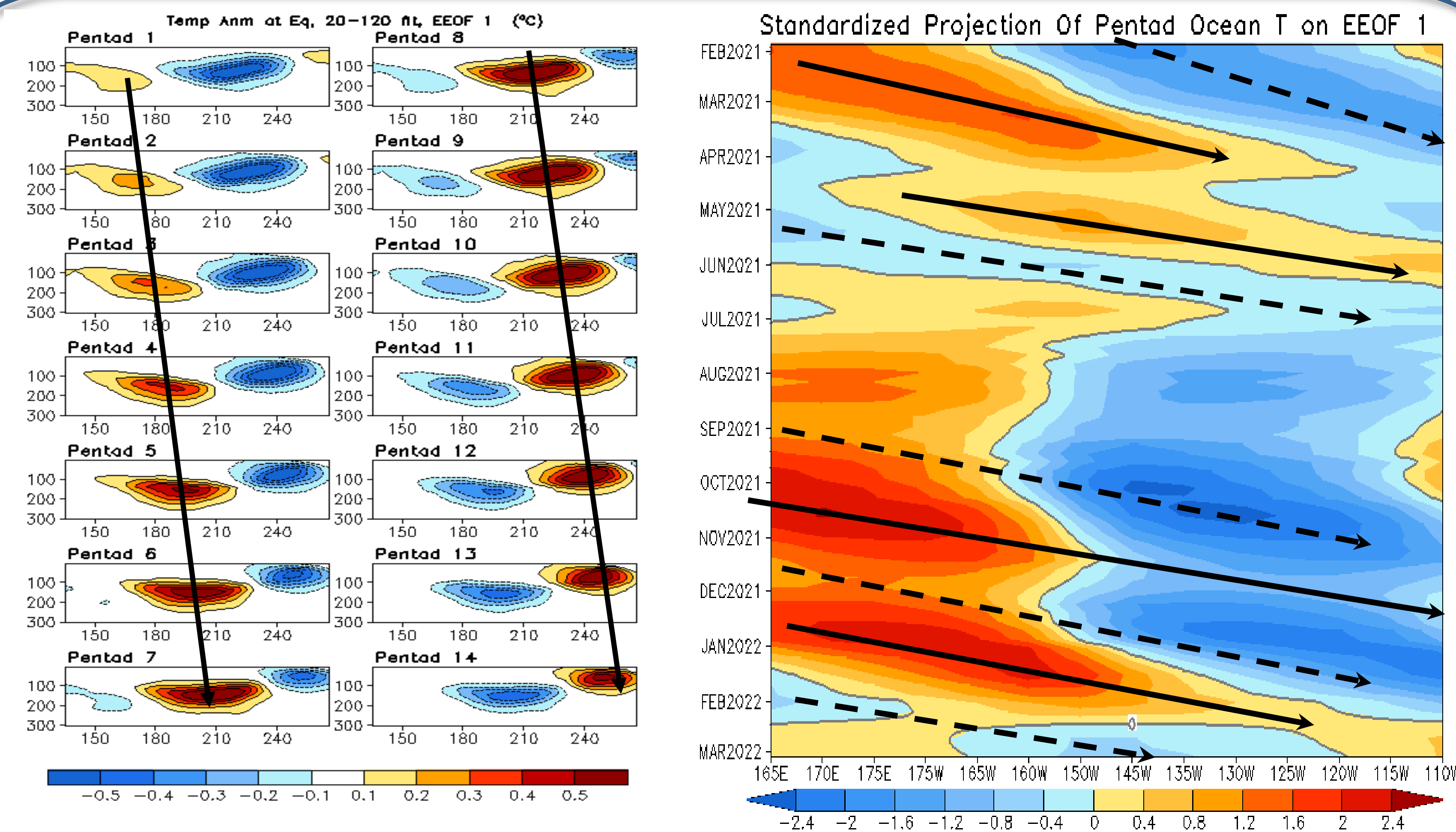
Qpen: SW penetration; Qcorr: Flux correction due to relaxation to OI SST

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



- Anomalous westward currents were observed in both OSCAR and GODAS recently.

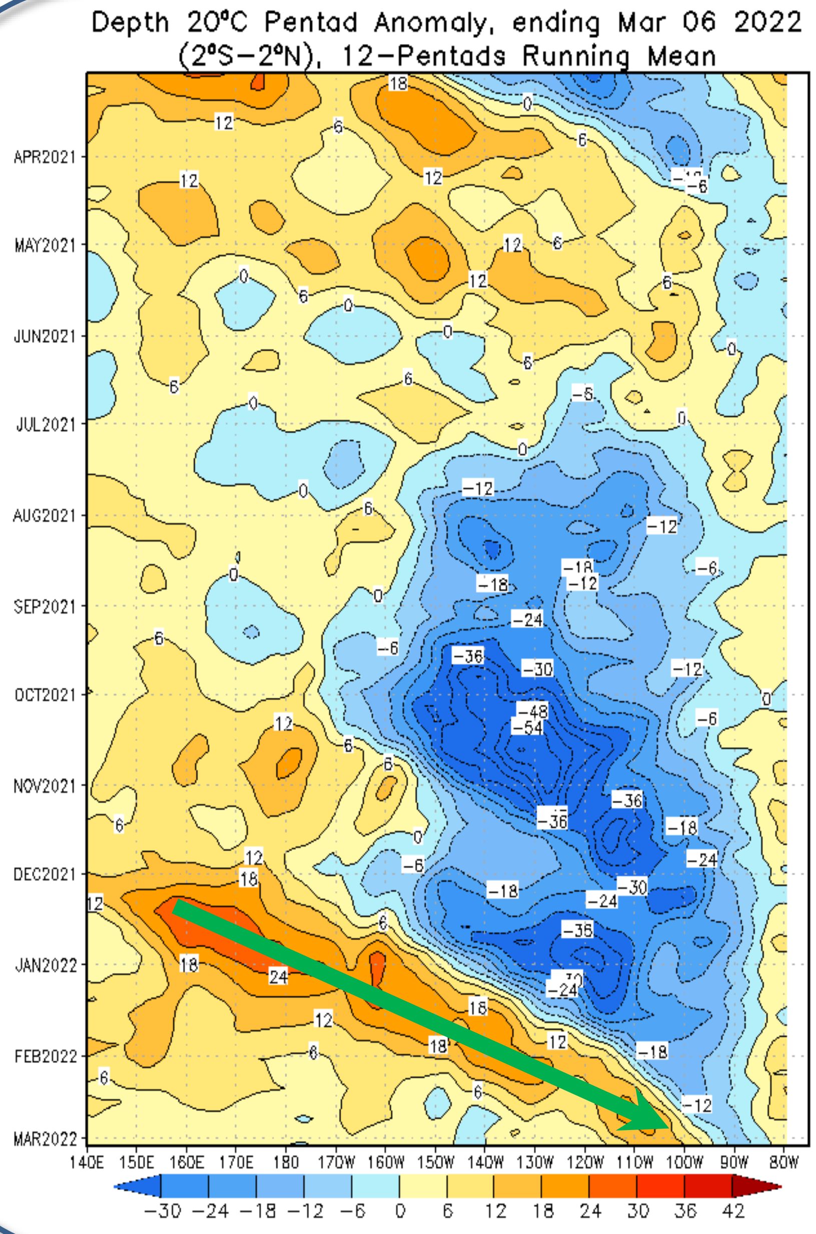
Oceanic Kelvin Wave (OKW) Index

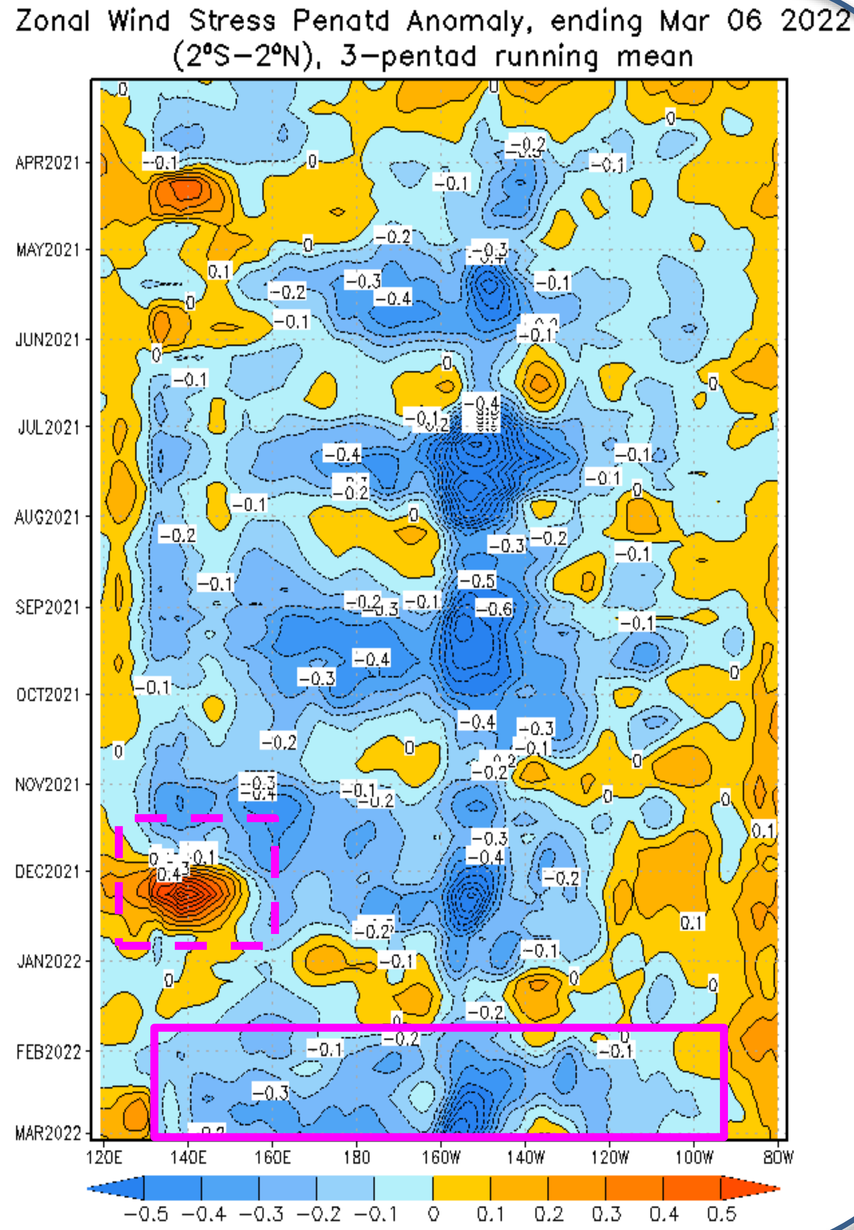


- **Upwelling Kelvin wave was initiated in May, Aug, & Nov 2021, leading to the subsurface cooling in the eastern equatorial Pacific and the development of the 2021/22 La Niña.**
- **Downwelling Kelvin wave initiated in Dec 2021 led to the weakening of 2021/22 La Niña.**

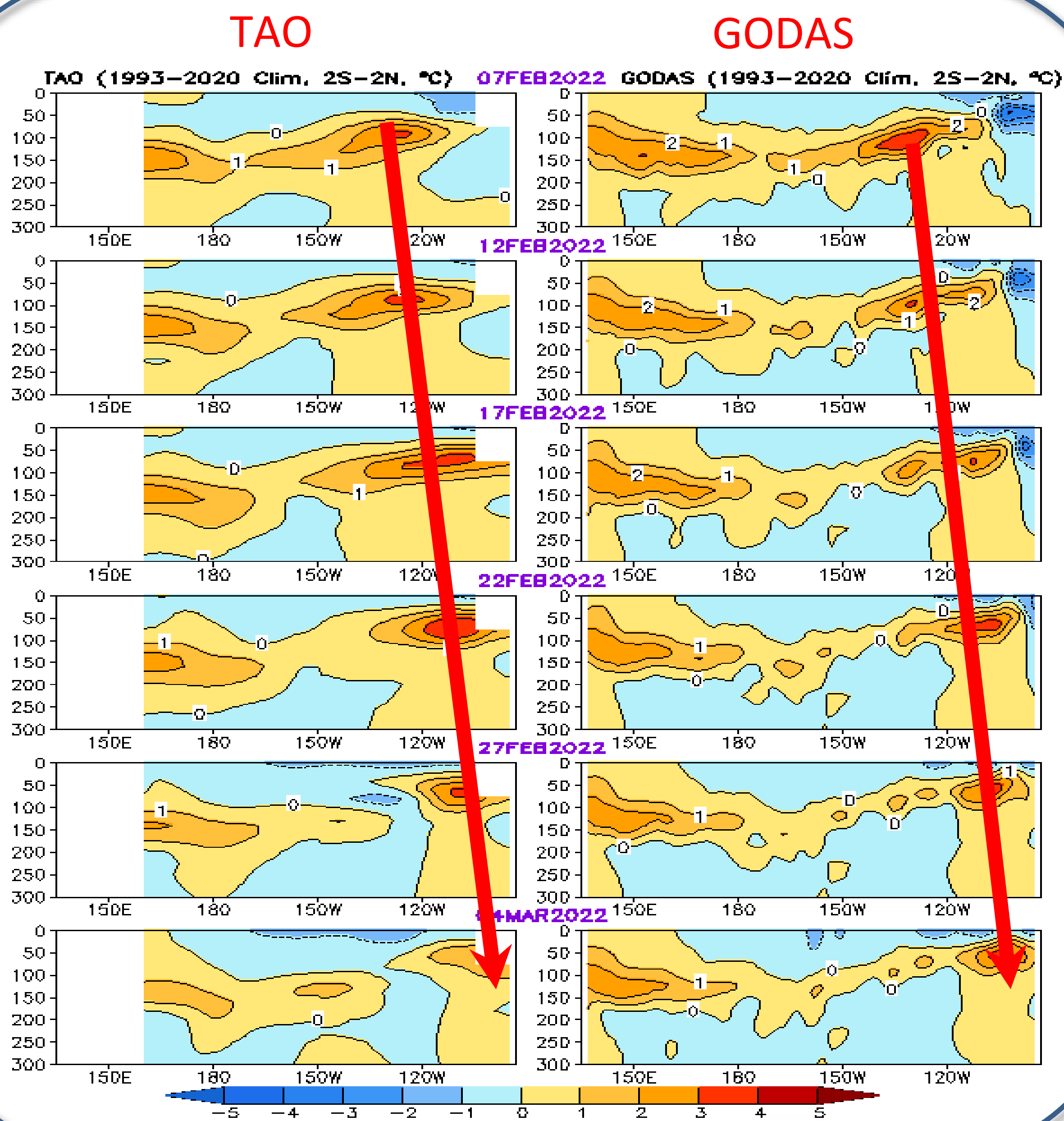
(OKW index is defined as standardized projections of total anomalies onto the 14 patterns of Extended EOF1 of equatorial temperature anomalies (Seo and Xue , GRL, 2005).)

Evolution of Pentad D20 and Taux anomalies along the equator



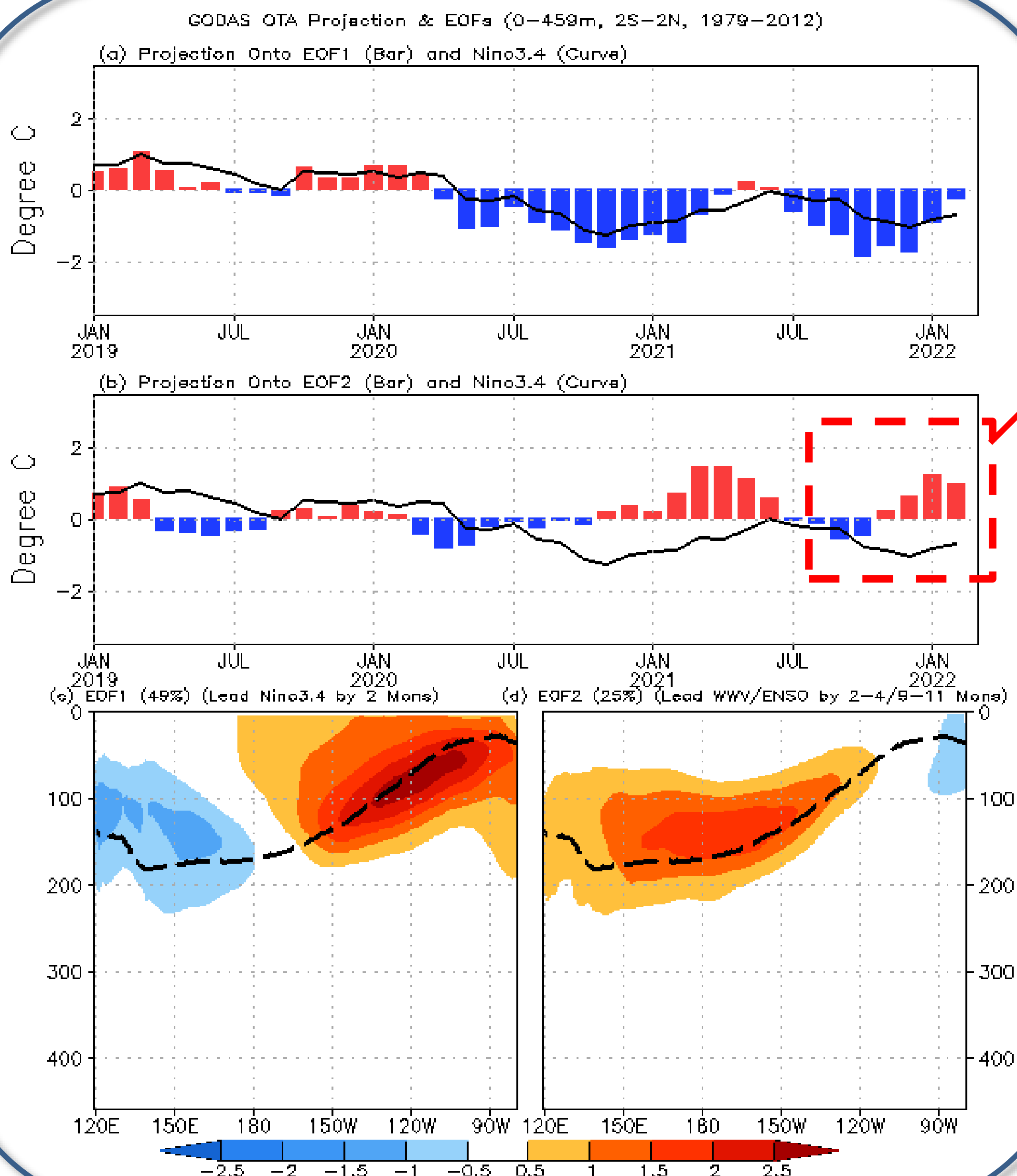


Equatorial Pacific Ocean Temperature Pentad Mean Anomaly



- Positive ocean temperature anomalies weakened and propagated eastward along the thermocline.
- The negative anomalies in the eastern Pacific weakened.

Equatorial Sub-surface Ocean Temperature Monitoring



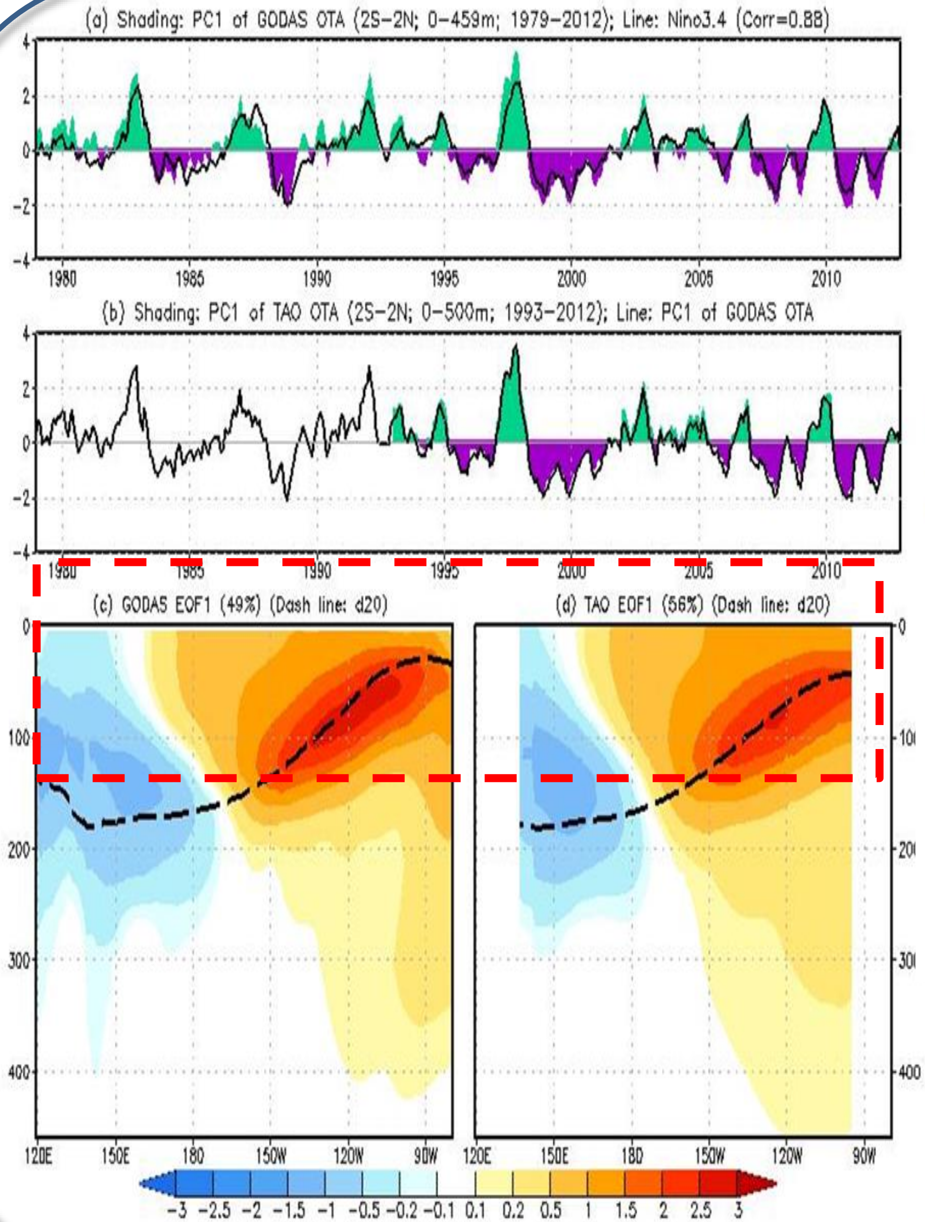
- The equatorial Pacific has been in a recharge phase since Nov 2021.

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

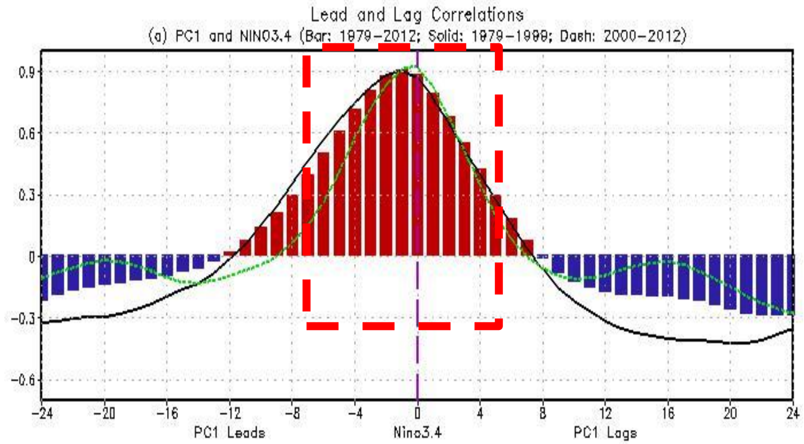
- Recharge/discharge oscillation (ENSO transition phase); Recharge process: heat transport from outside of equator to equator; Negative -> positive phase of ENSO

- For details, see: Kumar & Hu (2014) DOI: 10.1007/s00382-013-1721-0.

Dipole (Tilt) mode is in phase with ENSO

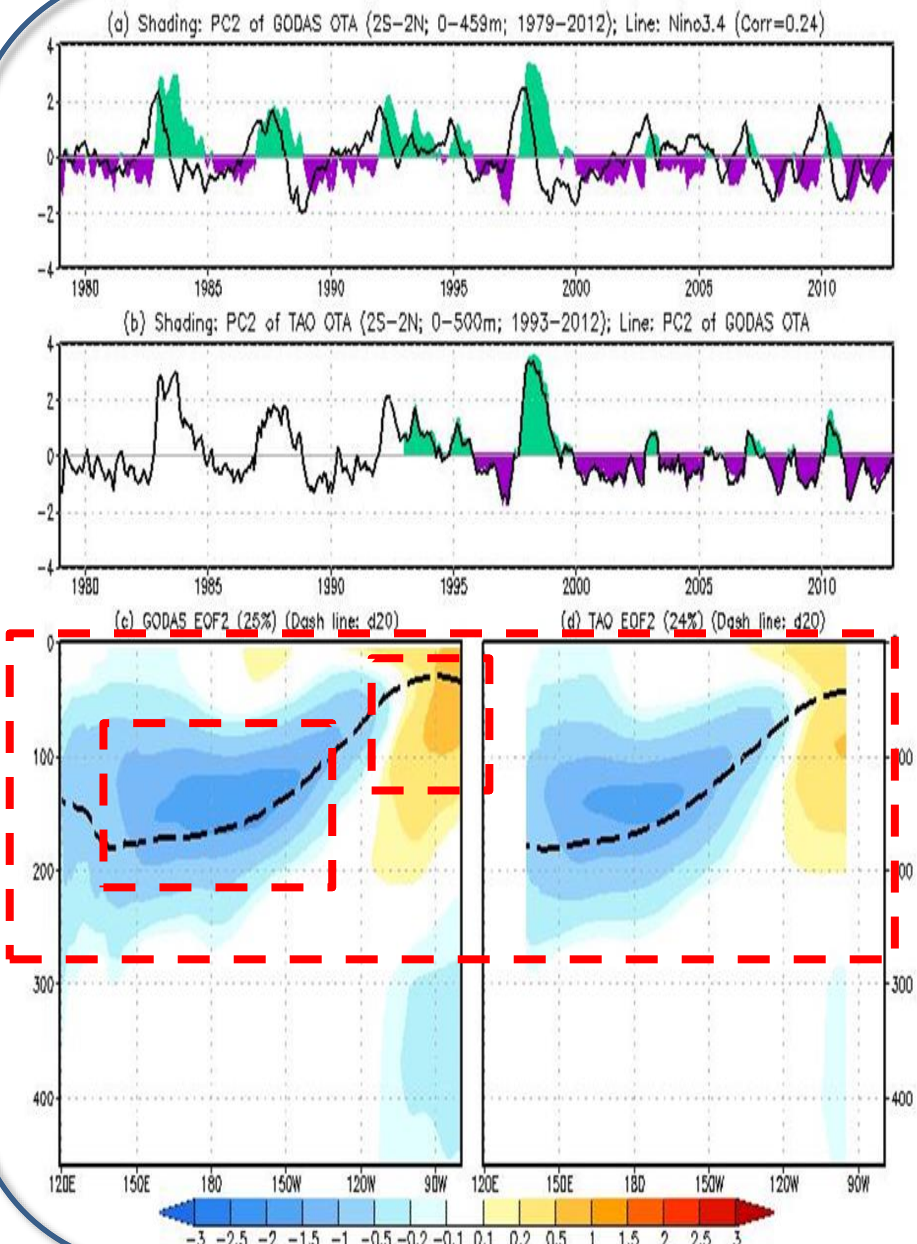


(a) PC1 of GODAS (shading) and Niño3.4 index (curve); (b) PC1 of TAO (shading) and PC1 of GODAS (curve); (c) EOF1 of GODAS; and (d) EOF1 of TAO. The percentage of total variance explained by this mode is 49% for GODAS and 57% for TAO, respectively. The spatial loading pattern is shown only between the surface and 459 m and the dash line in (c, d) is the climatological mean depth of 20oC (d20).

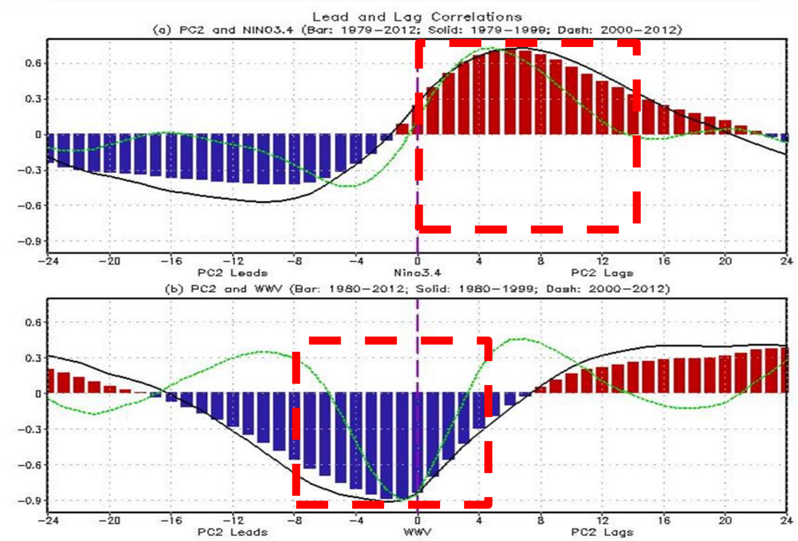


Lead and lag correlations between (a) PC1 and Niño3.4 index. Bar is the correlations for the whole period, solid line for Jan 1979/1980-Dec 1999, and dash line for Jan 2000-Dec 2012.

WWV mode leads ENSO by 4-8 months, but it is in phase with WWV



Same as Fig. 1, but (a) PC2 of GODAS (shading) and Niño3.4 index (curve); (b) PC2 of TAO (shading) and PC2 of GODAS (curve); (c) EOF2 of GODAS; and (d) EOF2 of TAO. The percentage of total variance explained by this mode is 25% for GODAS and 24% for TAO, respectively.



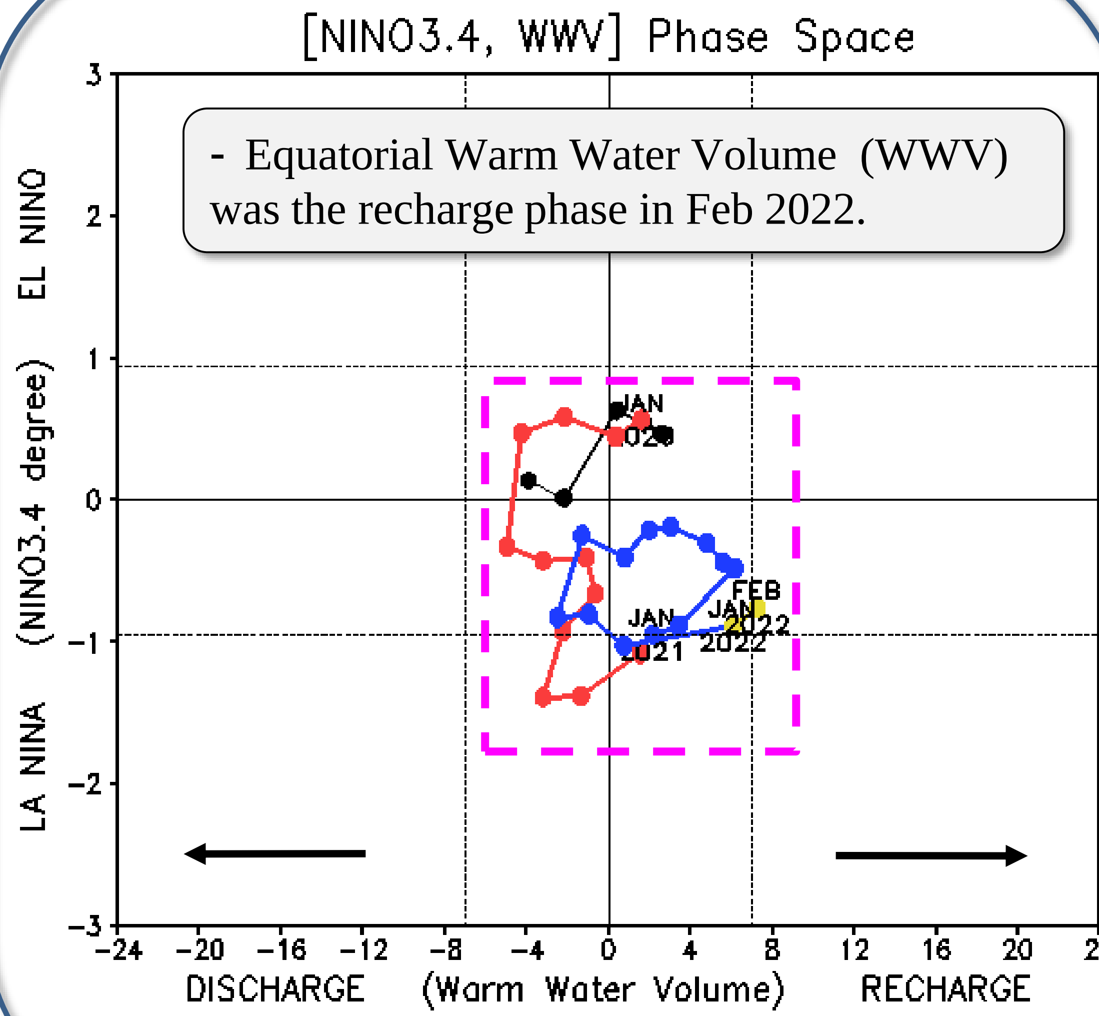
Lead and lag correlations between (a) PC2 & Niño3.4 index, (b) PC2 & WWV index. Bar is the correlations for the whole period, solid line for Jan 1979/1980-Dec 1999, & dash line for Jan 2000-Dec 2012.

Warm Water Volume (WWV) and Niño3.4 Anomalies

- As WWV is 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.

- In the WWV index definition, it is the average of ocean temperature anomaly along the whole equatorial Pacific, which sometimes have no coherent variations.

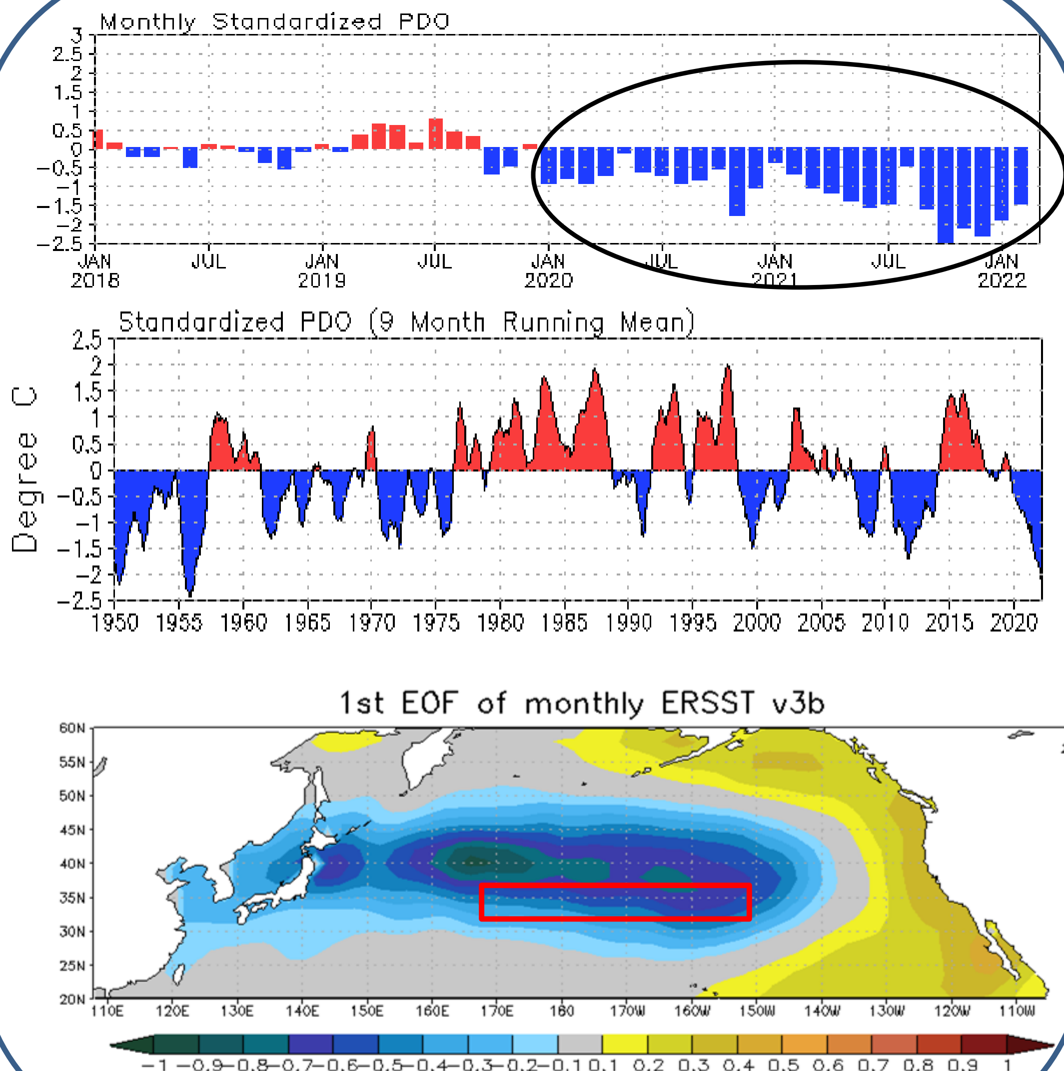
- Equatorial Warm Water Volume (WWV) was the recharge phase in Feb 2022.

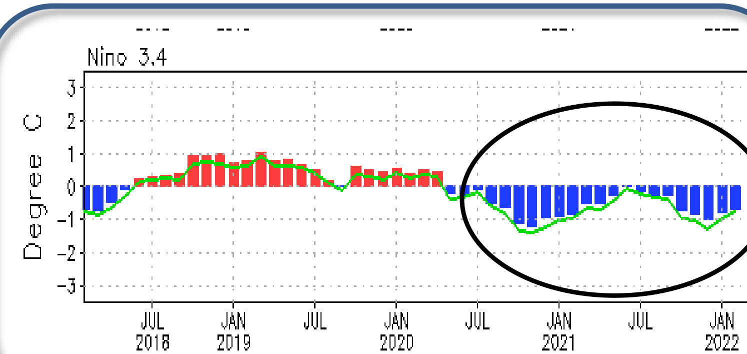


Phase diagram of Warm Water Volume (WWV) and Niño3.4 indices. WWV is the average of depth of 20ºC in [120ºE-80ºW, 5ºS-5ºN] calculated with the NCEP's GODAS. Anomalies are departures from the 1991-2020 base period means.

North Pacific & Arctic Oceans

Pacific Decadal Oscillation (PDO) Index



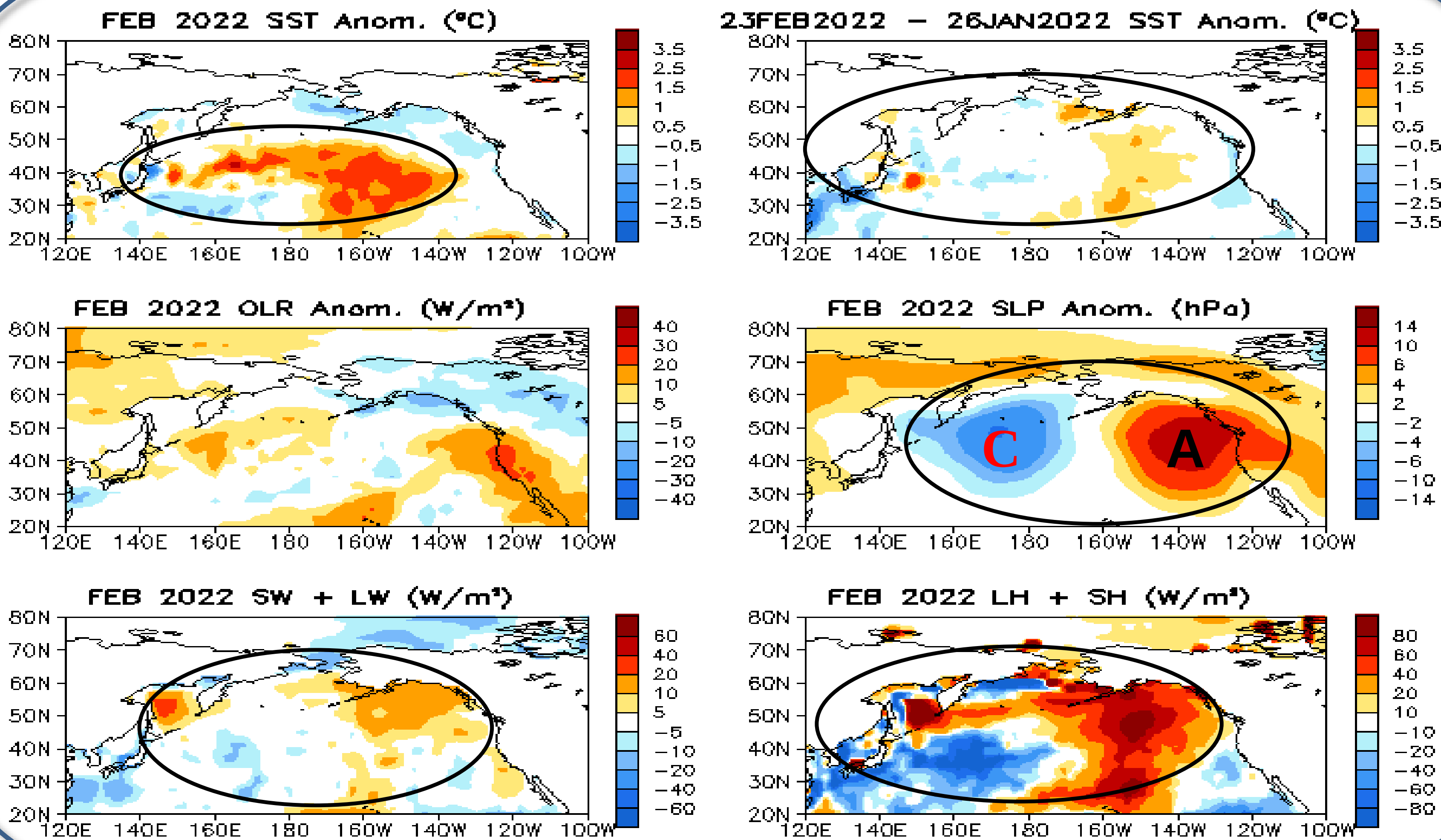


- The PDO has been in a negative phase since Jan 2020 with PDOI = -1.49 in Feb 2022.

- Statistically, ENSO leads PDO by 3-4 months, through teleconnection via atmospheric bridge, with El Niño (La Niña) associated with positive (negative) PDO Index.

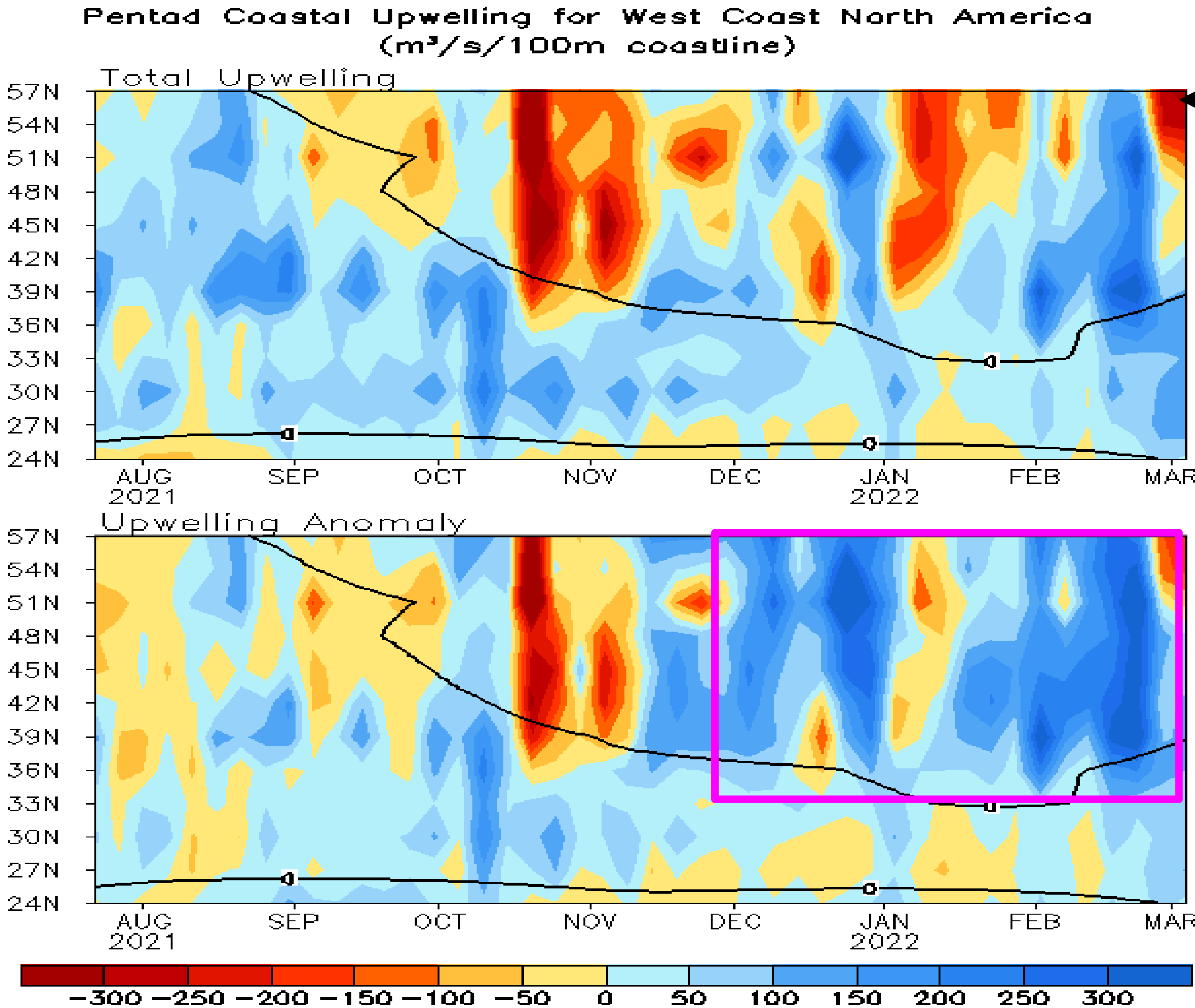
- PDO is defined as the 1st EOF of monthly ERSST v3b in the North Pacific for the period 1900-1993. PDO index is the standardized projection of the monthly SST anomalies onto the 1st EOF pattern.

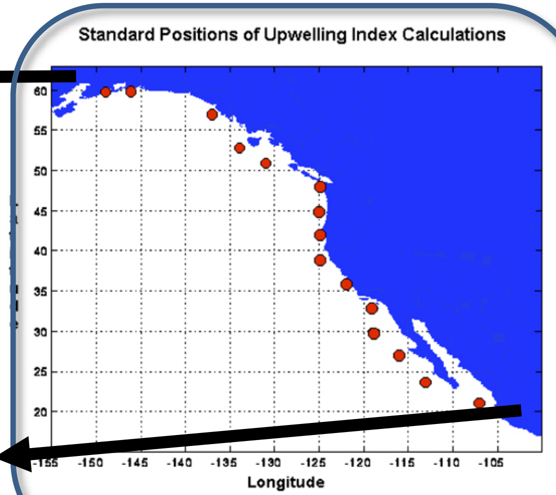
North Pacific & Arctic Ocean: SSTA, SSTA Tend., OLR, SLP, Sfc Rad, Sfc Flx Anomalies



SSTA (top-left; OI 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.

North America Western Coastal Upwelling



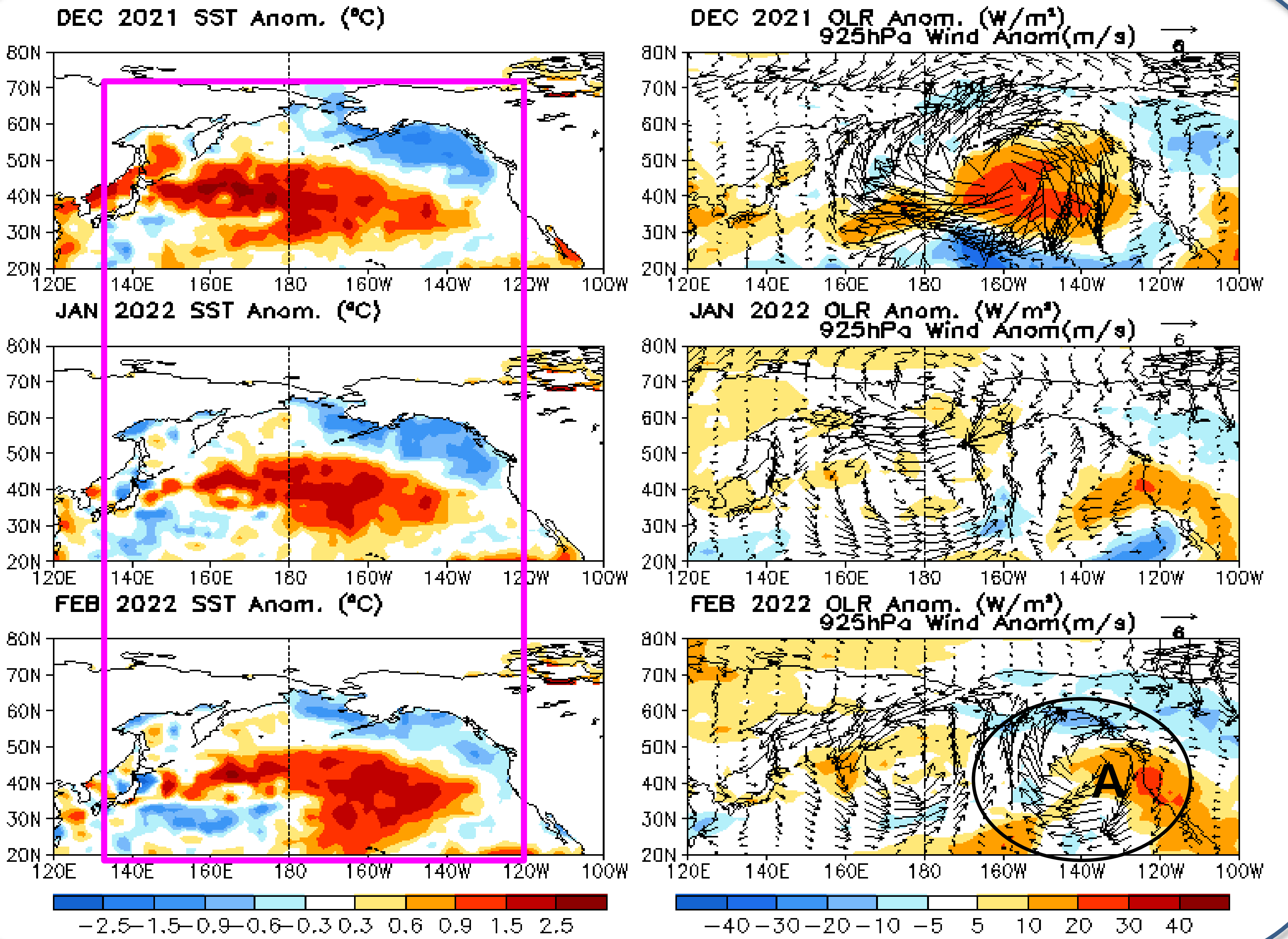


- Anomalous coastal upwelling has been present in the north of 35ºN since Dec 2021.

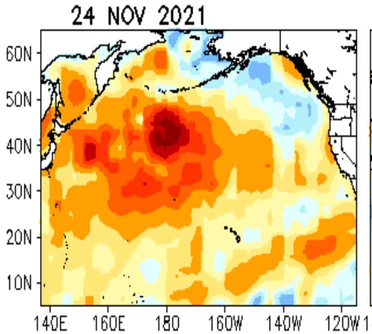
(top) Total and (bottom) anomalous upwelling indices at the 15 standard locations for the western coast of North America. Derived from the vertical velocity of the NCEP's GODAS and are calculated as integrated vertical volume transport at 50-meter depth from each location to its nearest coast point ($m^3/s/100m$ coastline). Anomalies are departures from the 1991-2020 base period pentad means.

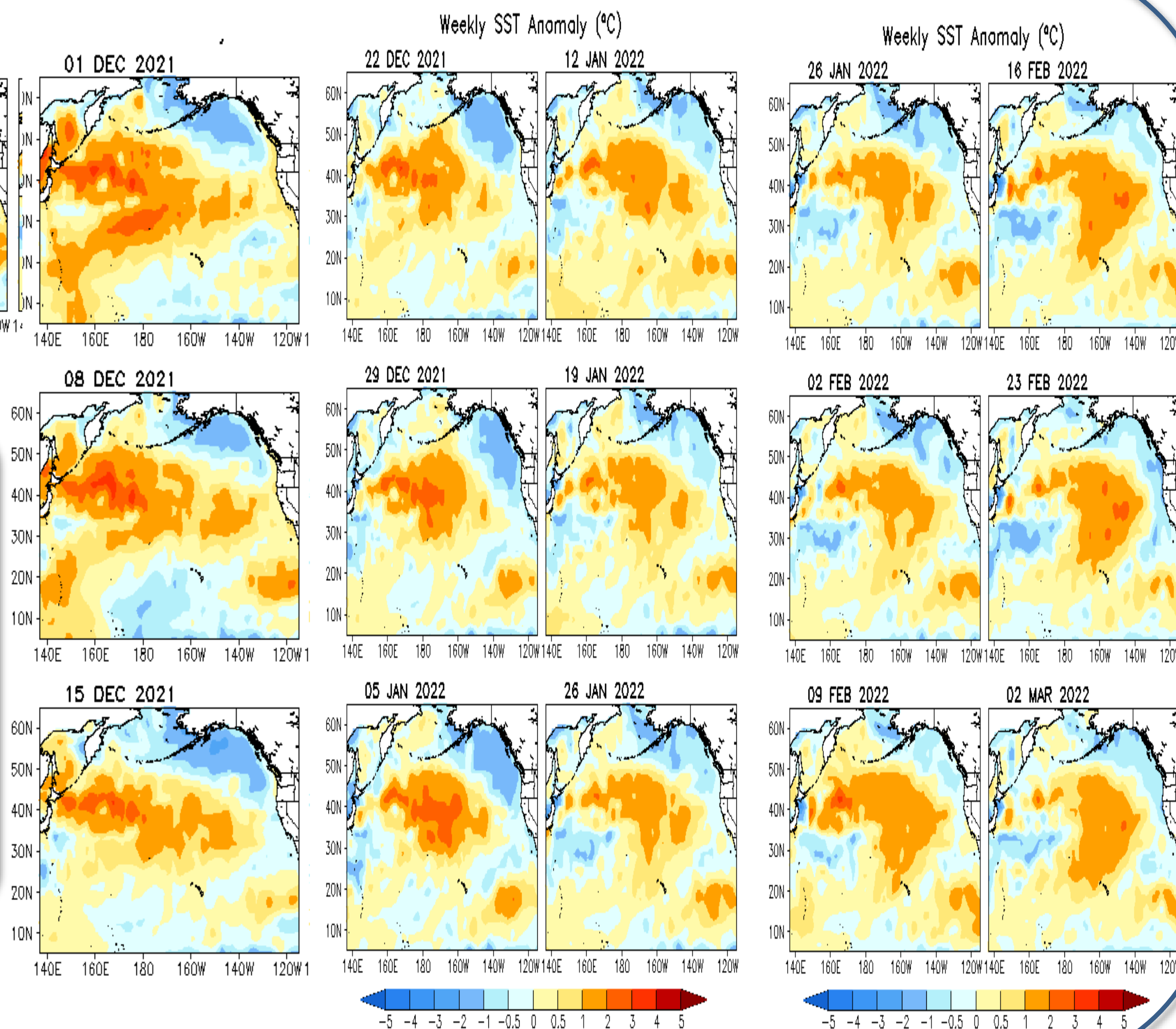
- Area below (above) black line indicates climatological upwelling (downwelling) season.
- Climatologically upwelling season progresses from March to July along the west coast of North America from 36ºN to 57ºN.

North Pacific SST, OLR, and uv925 anomalies



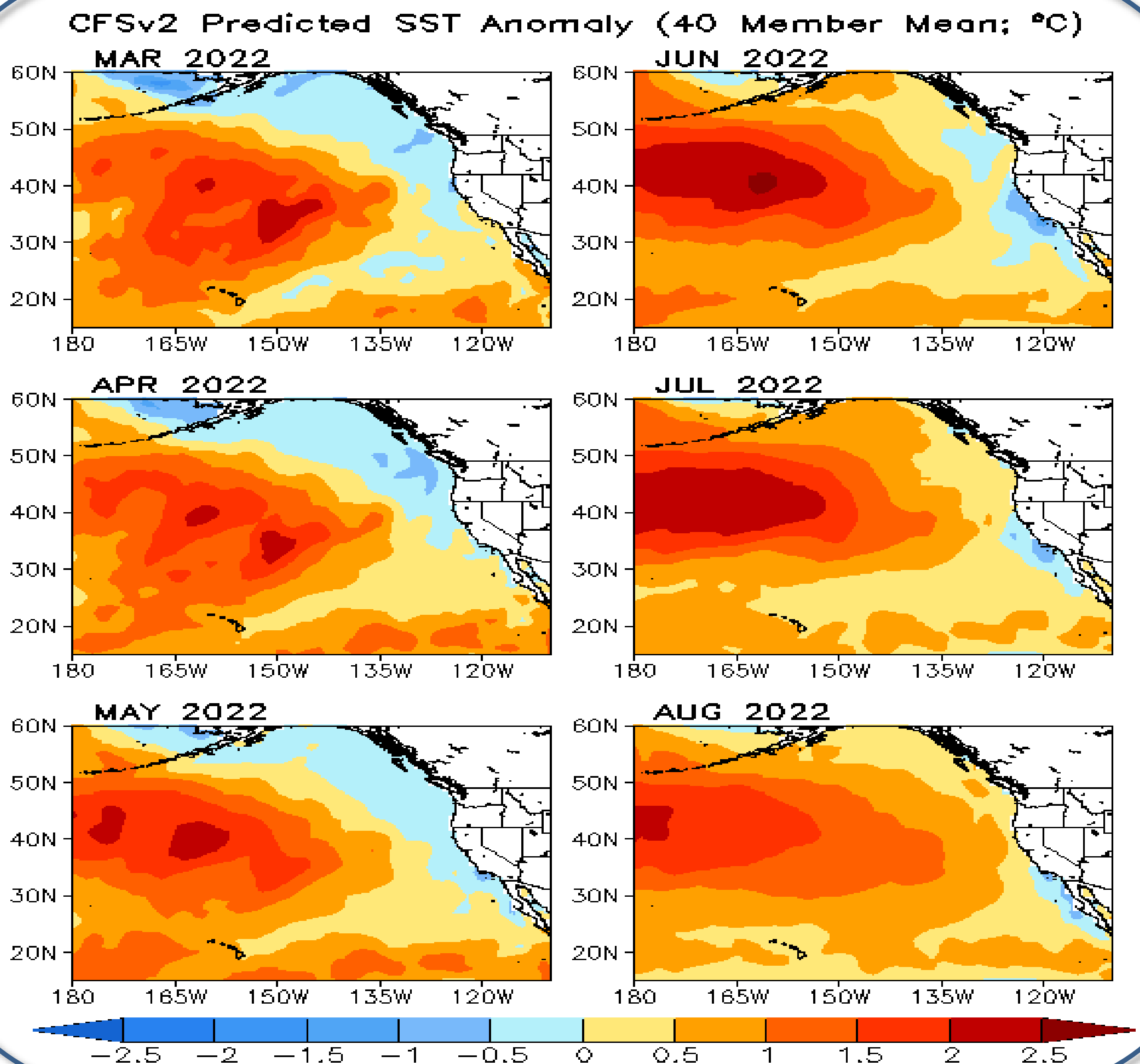
Weekly SSTA evolutions in the NE Pacific





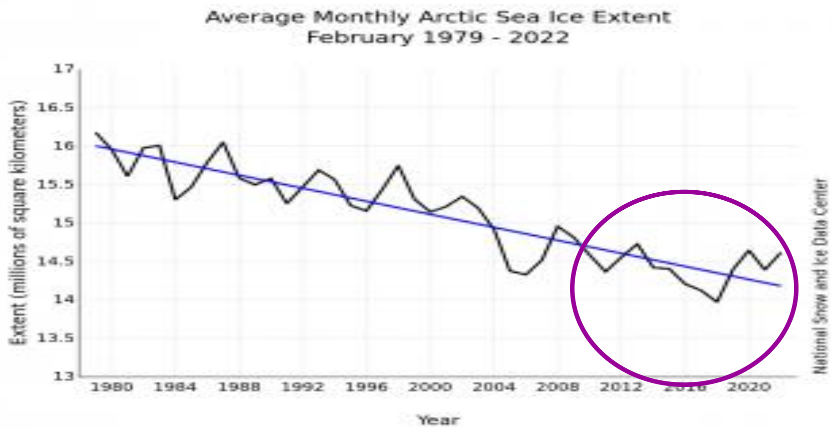
- The northern Pacific SST warming weakened during the last couple of months.

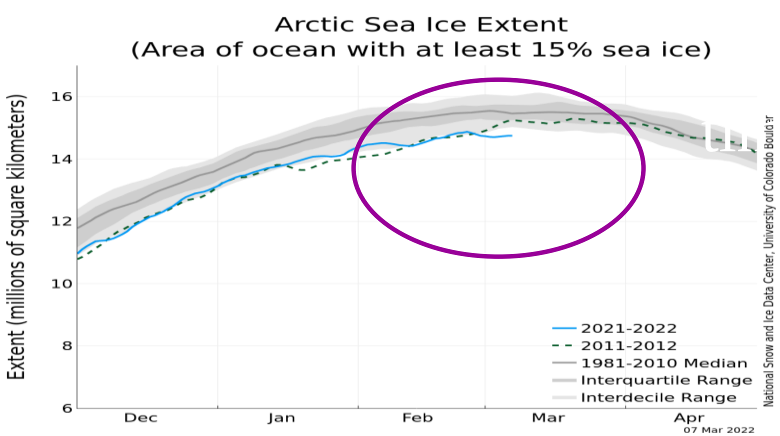
CFSv2 North Pacific SSTA Predictions



- The CFSv2 predicts that the current SST warm state will continue.

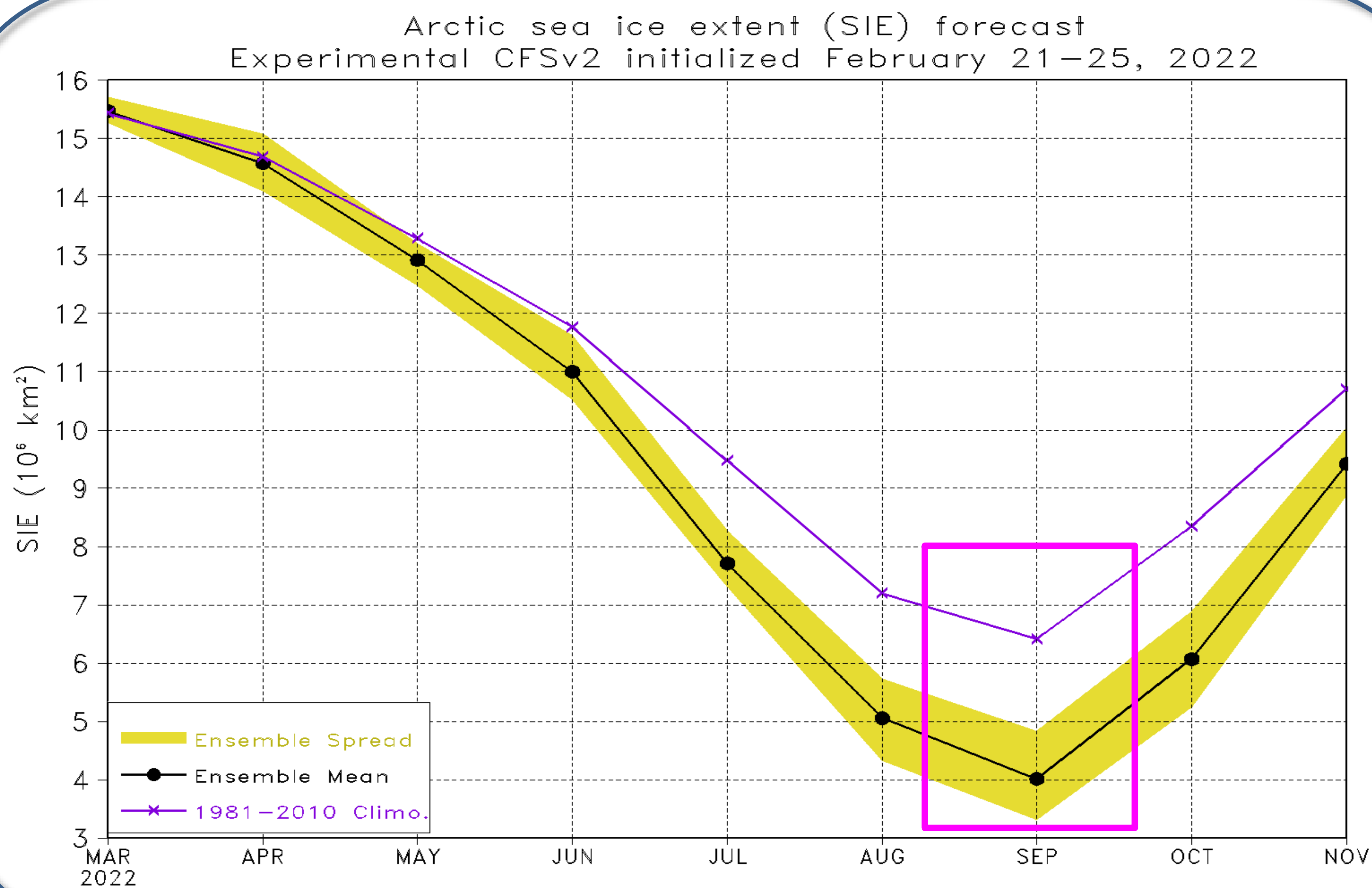
Arctic Sea Ice; NSIDC (http://nsidc.org/arcticseaicenews/index.html)





- "Average Arctic sea ice extent for February 2022 was 14.61 million square kilometers (5.64 million square miles), ranking fourteenth lowest in the satellite record."
- The downward linear trend in February sea ice extent over the 44-year satellite record is 2.8 percent per decade relative to the 1981 to 2010 average.

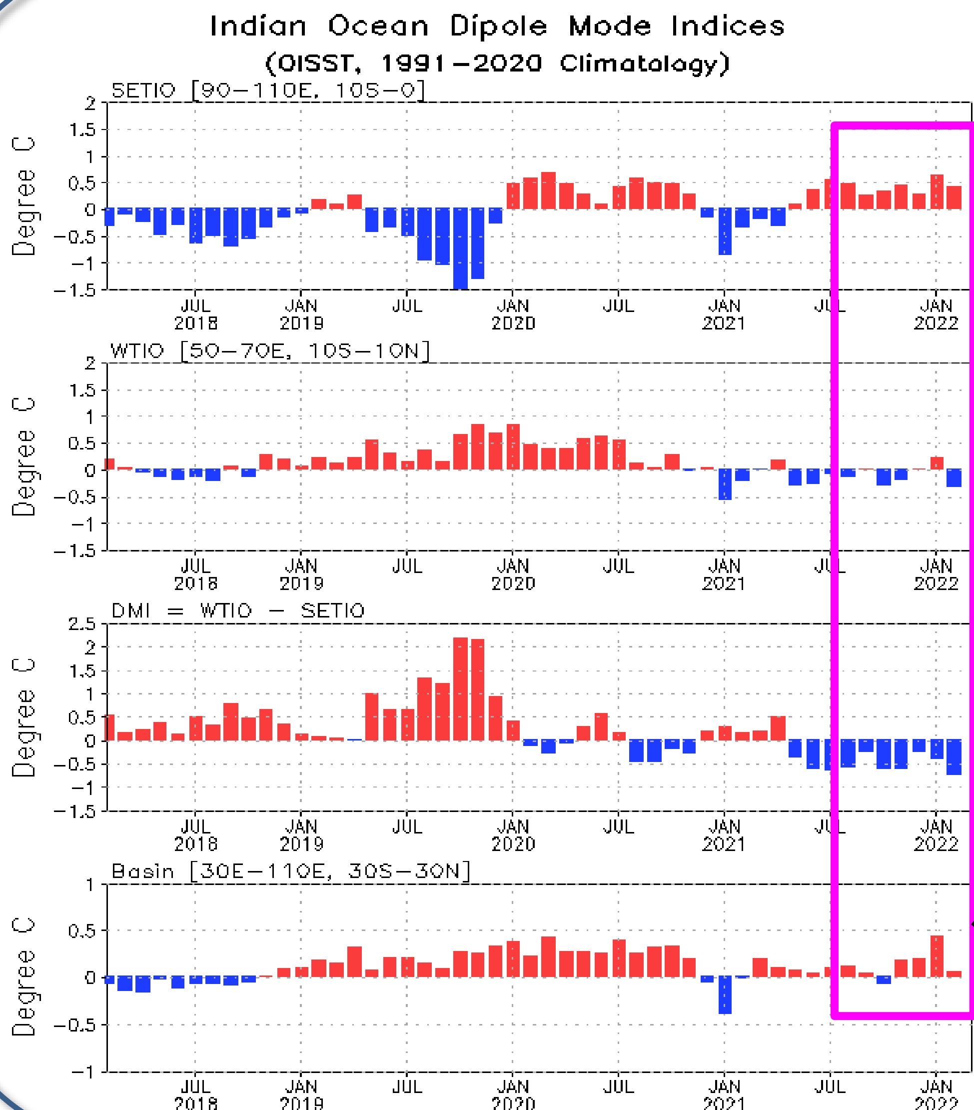
NCEP/CPC Arctic Sea Ice Extent Forecast

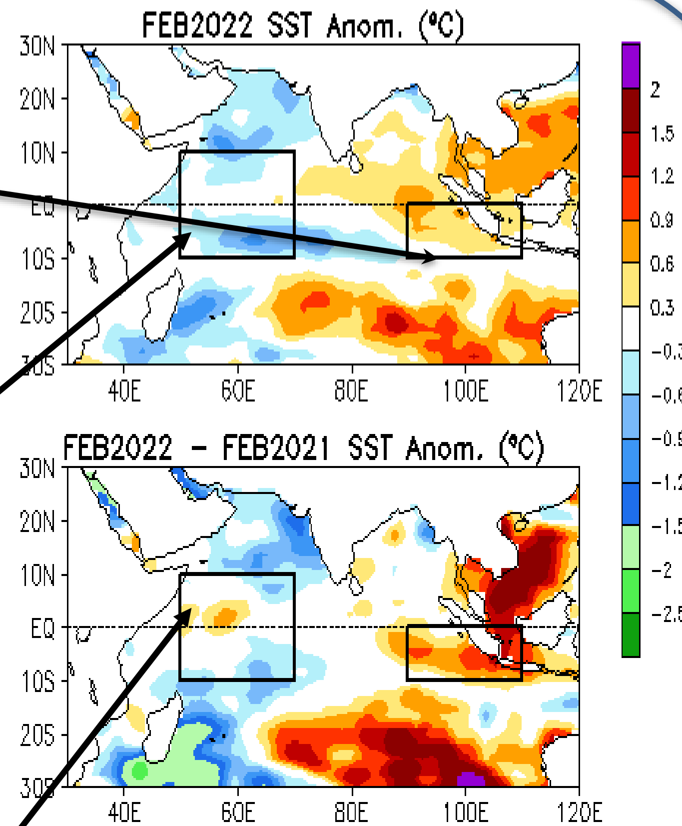


https://www.cpc.ncep.noaa.gov/products/people/wwang/seaice_seasonal/index.html

Indian Ocean

Evolution of Indian Ocean SST Indices

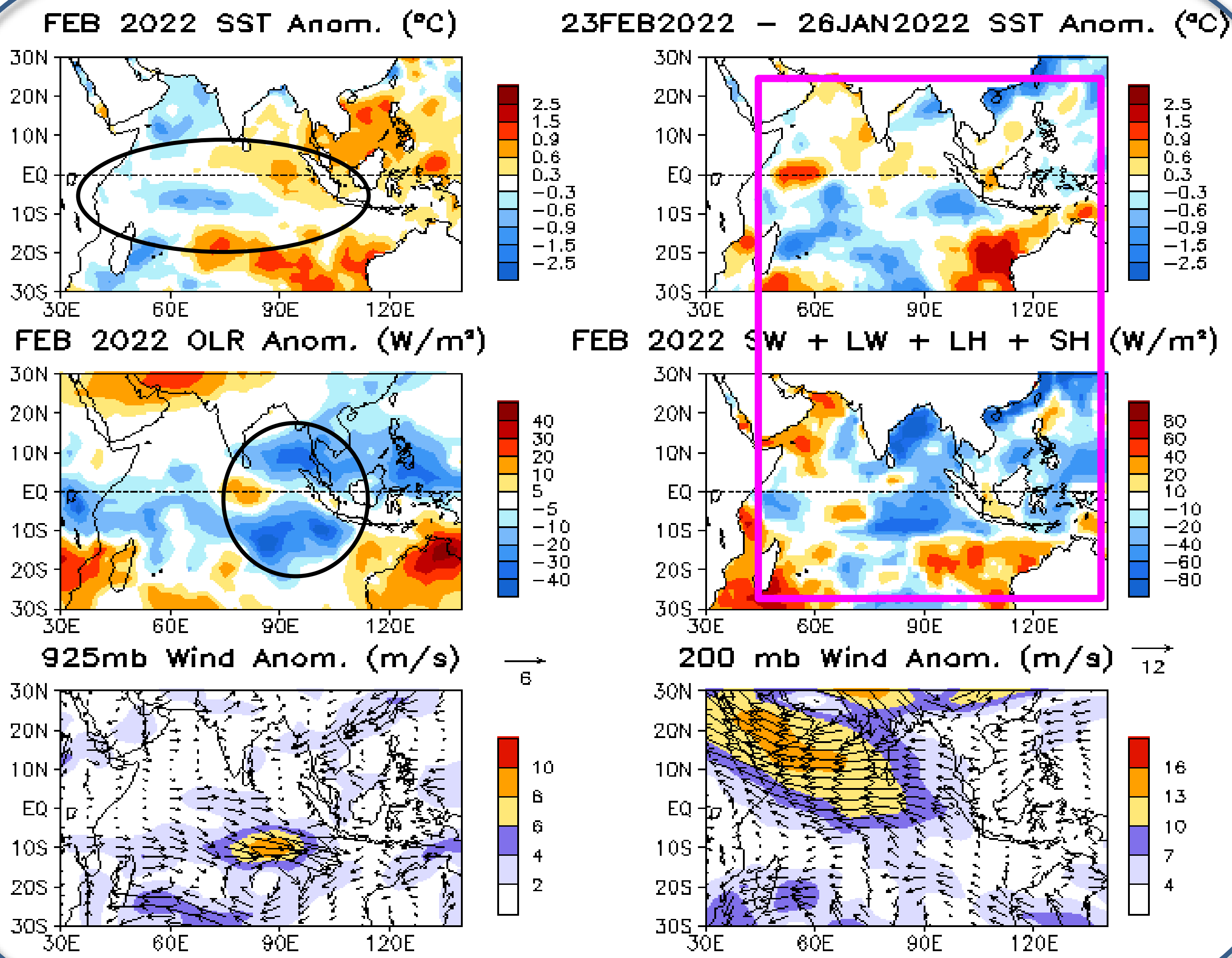




- Overall, SSTs were below (above) average in the western (eastern) tropical Indian Ocean in Feb 2022.

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 OI 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.



- SSTAs were negative (positive) in the western (eastern) tropical Indian Ocean.

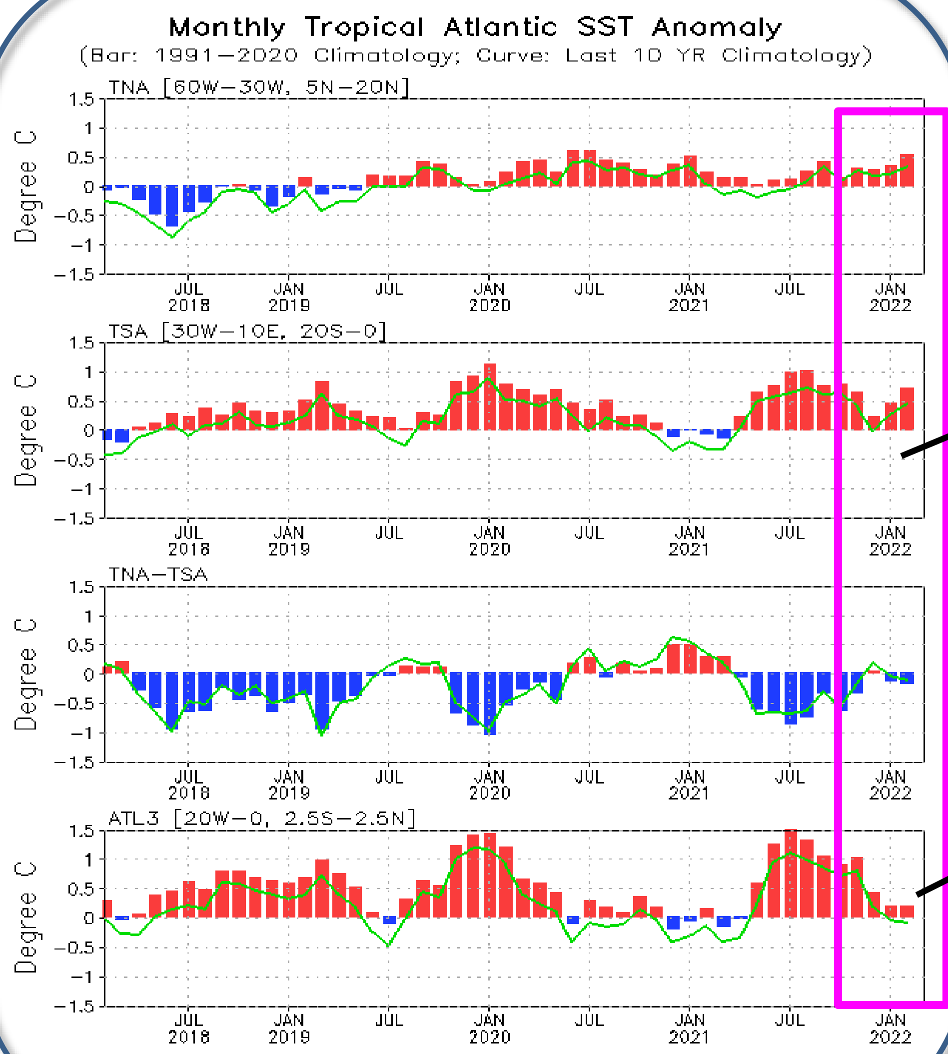
- Convection was enhanced over the eastern tropical Indian Ocean.

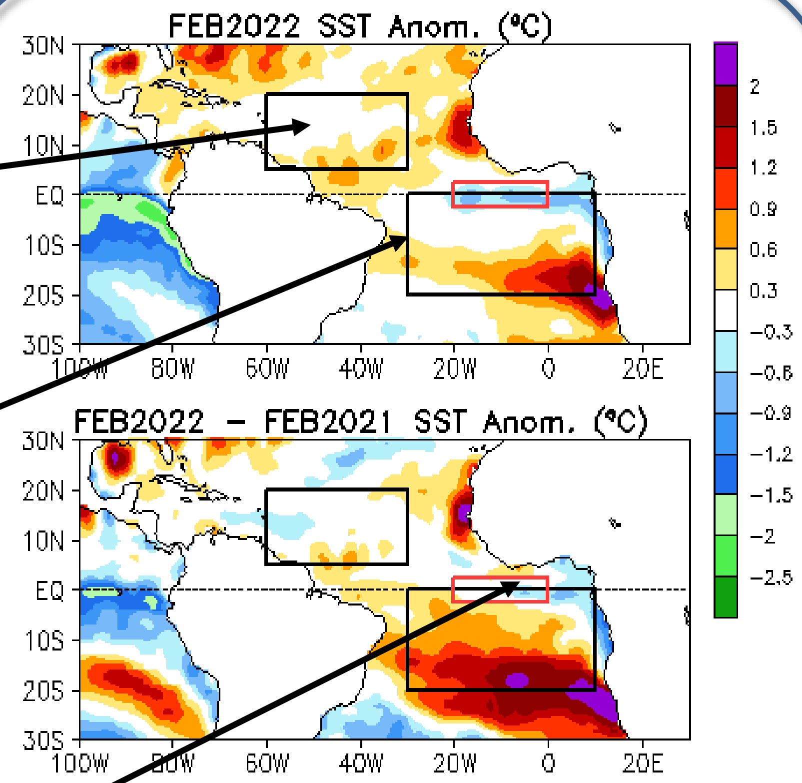
- SSTA tendencies are generally consistent with heat flux anomalies.

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 OI 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

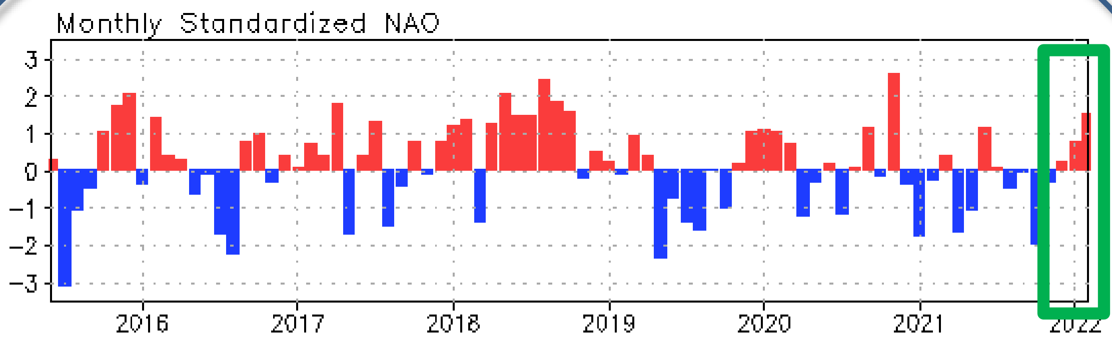


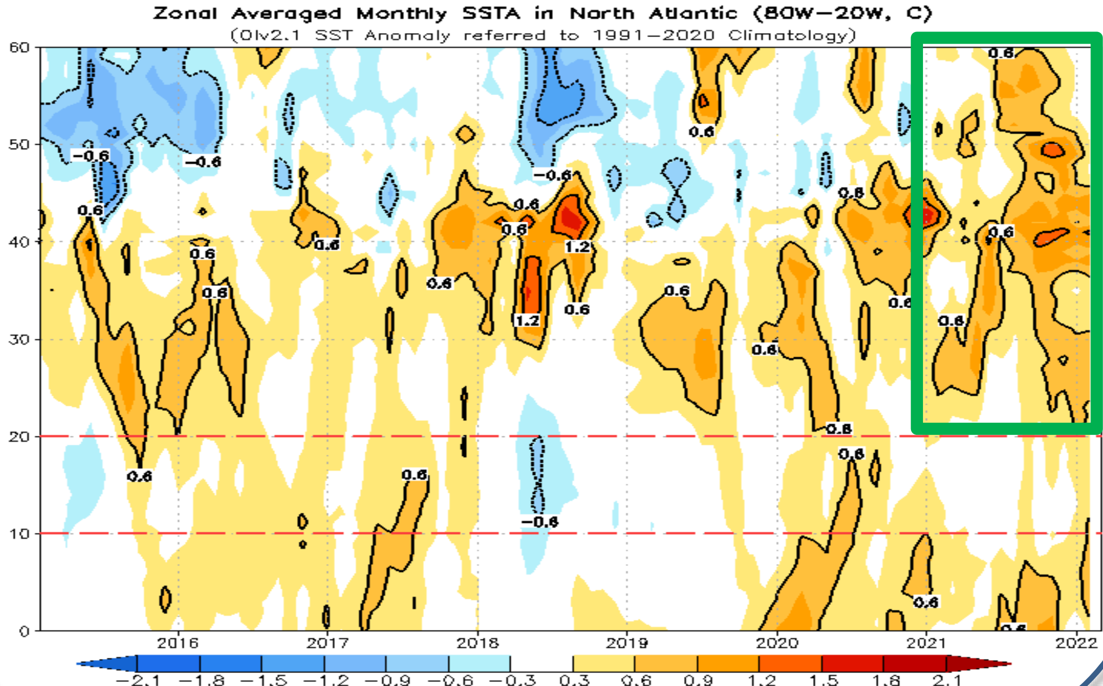


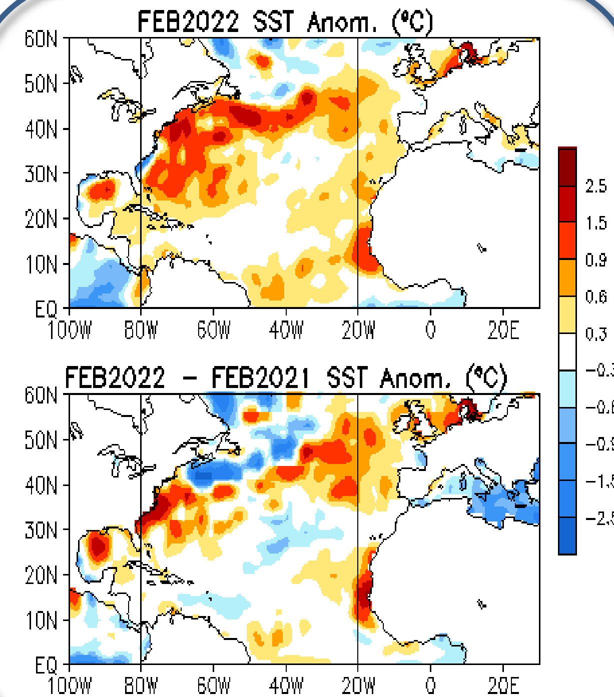
- SSTAs were small in the tropical Atlantic and large positive in the southern Atlantic.
- The Atlantic Niño event ended in Dec 2021.

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

NAO and SST Anomaly in North Atlantic



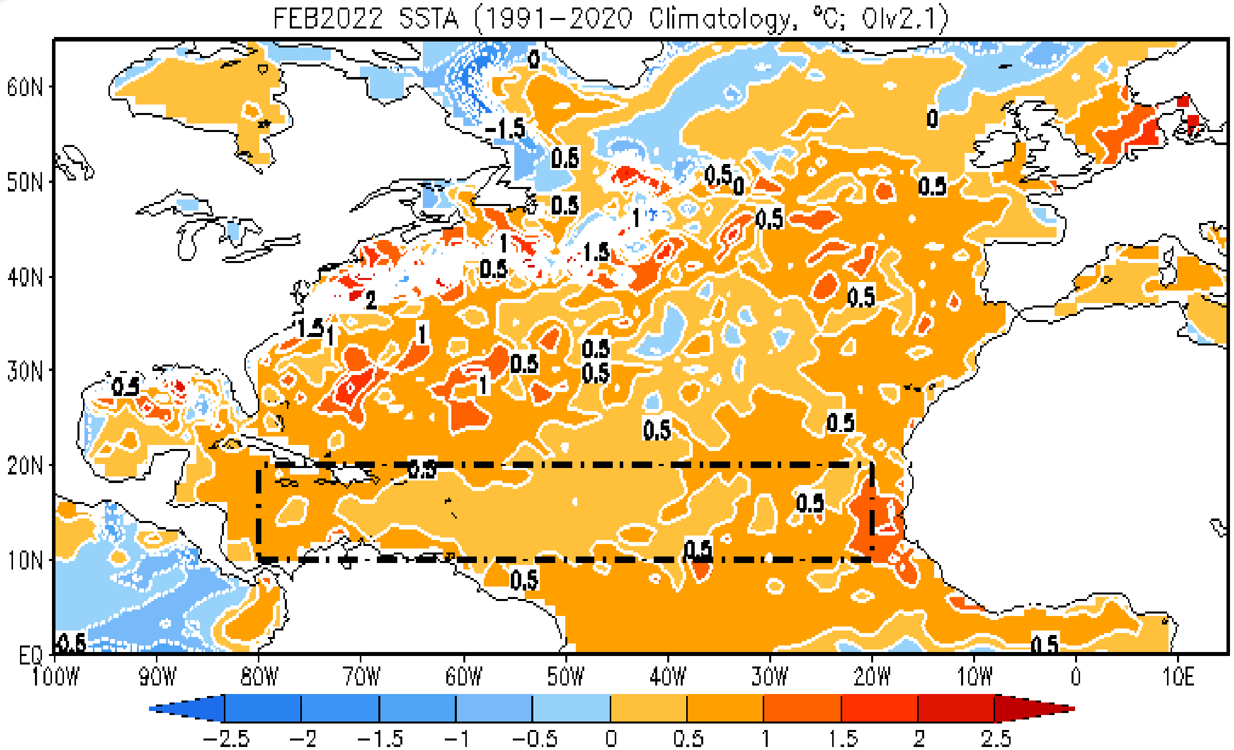


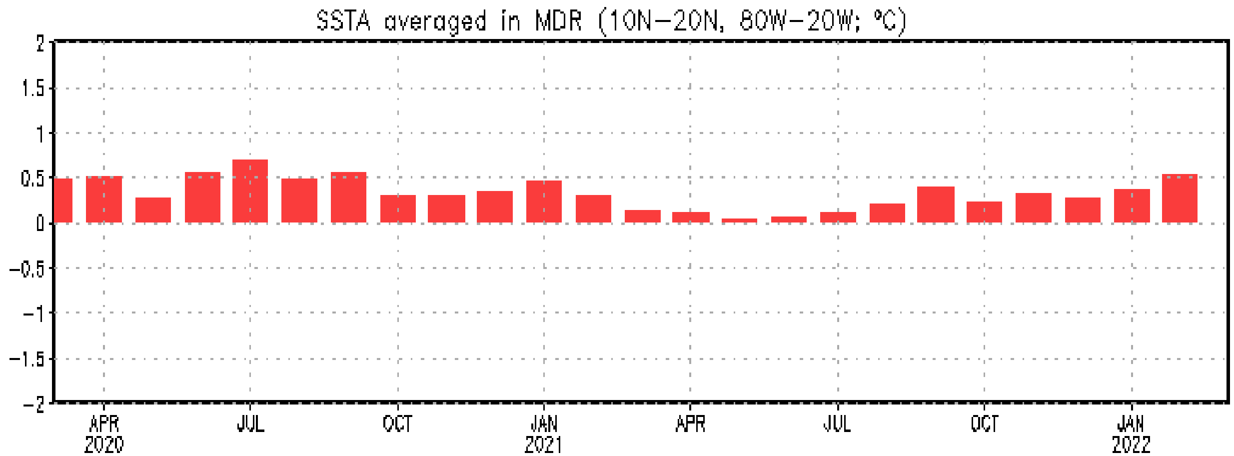


- NAO switched to a positive phase in Dec 2021 with NAOI= 1.46 in Feb 2022.
- The positive SSTAs in the mid-high latitudes of the North Atlantic Ocean were evident during last year.

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

SSTAs in the North Atlantic & MDR



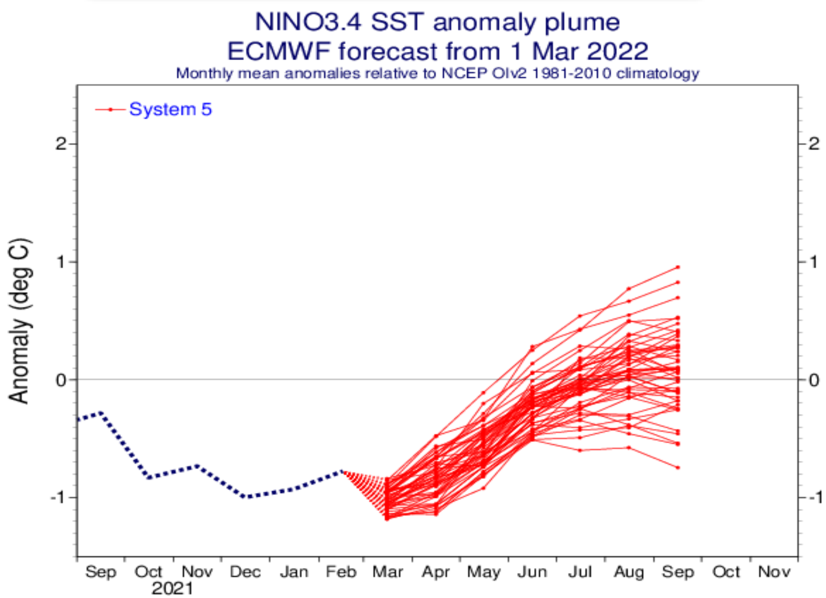


- SST in MDR was above average during the last two years.

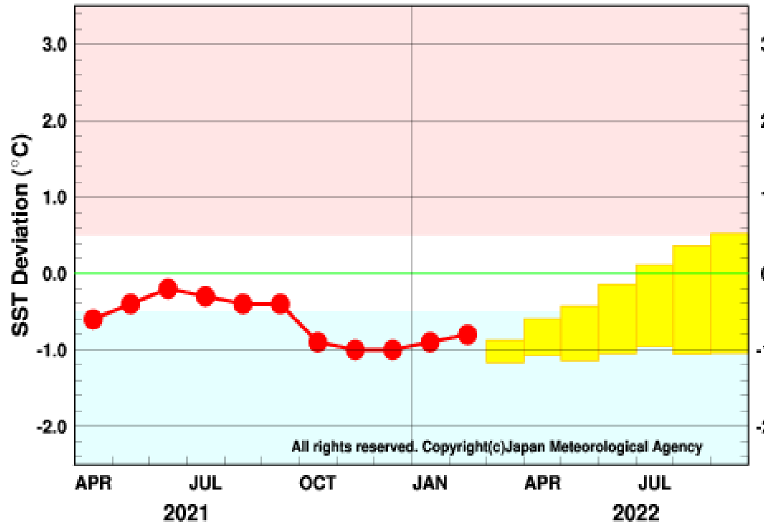
ENSO and Global SST Predictions

Individual Model Forecasts: La Niña will return to neutral in spring-summer

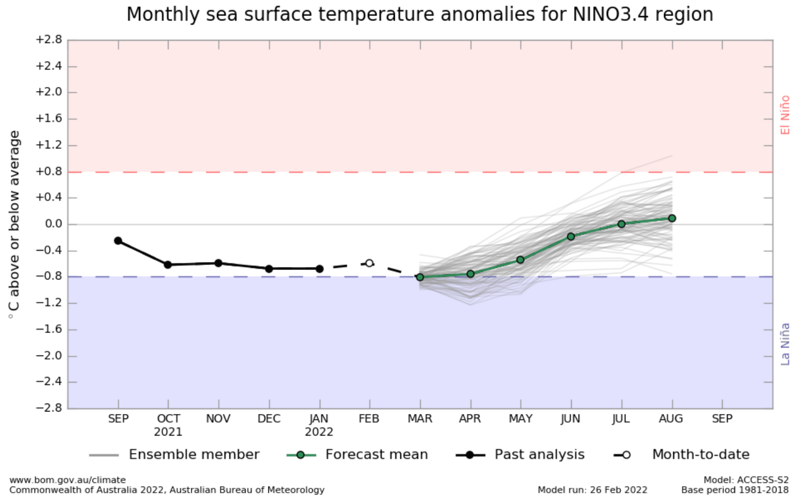
EC: Niño3.4, IC= 01Mar 2022



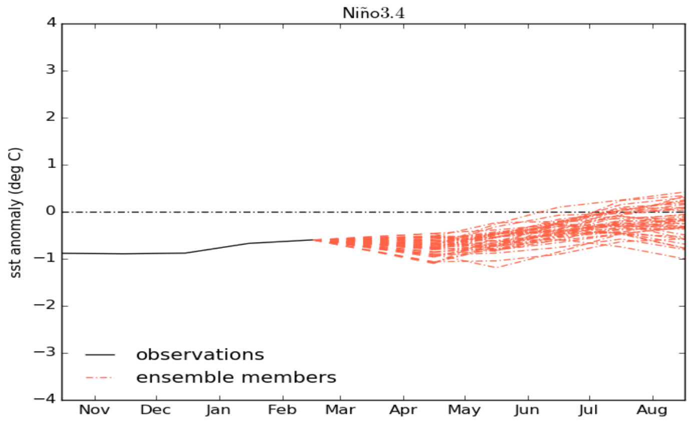
JMA: Niño3.4, Updated 10Mar 2022



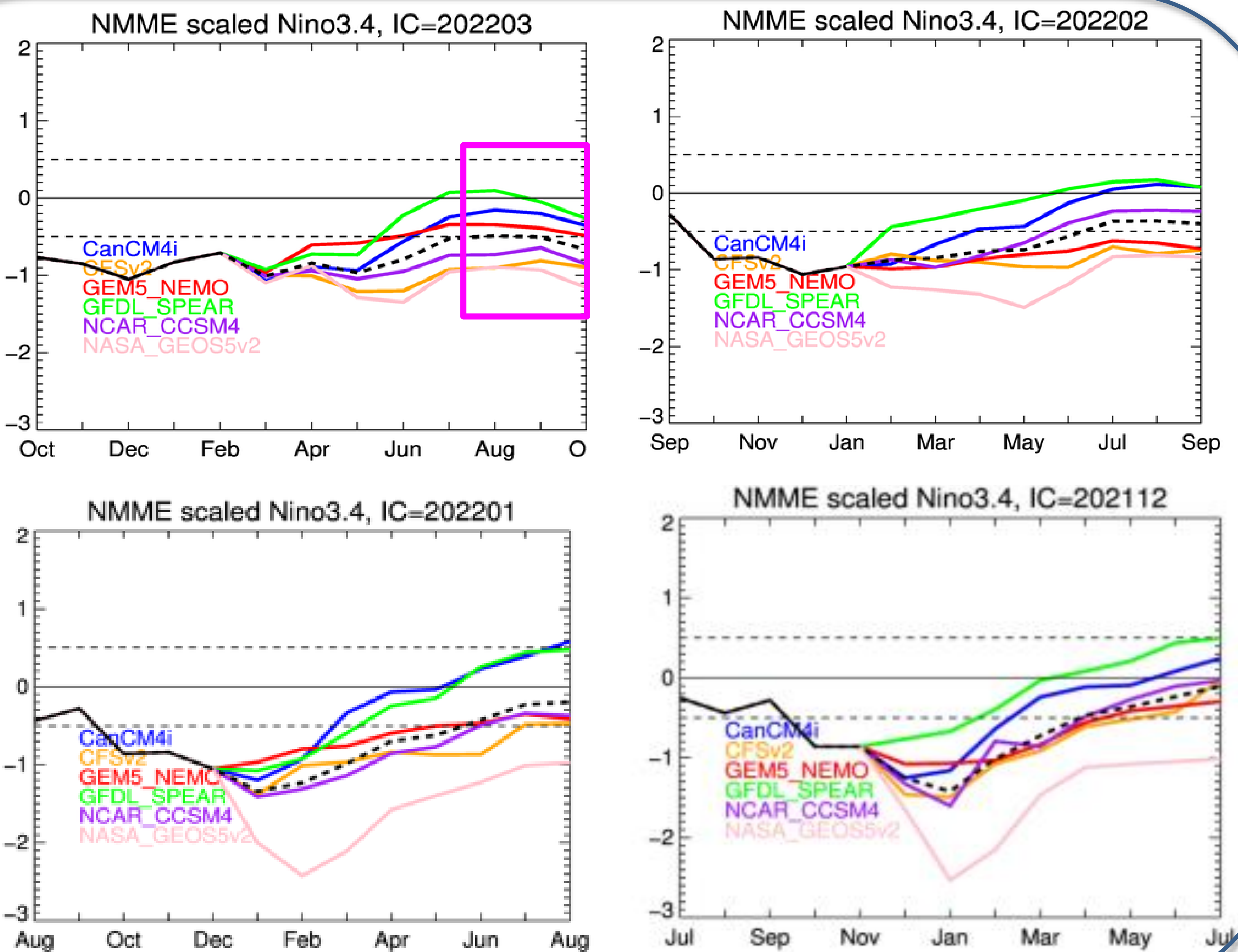
Australian BOM: Niño3.4, Updated 26 Feb 2022



UKMO: Niño3.4, Updated 11Mar 2022



NMME forecasts from different initial conditions



Excessive Momentum and False Alarms in Late-Spring ENSO Forecasts

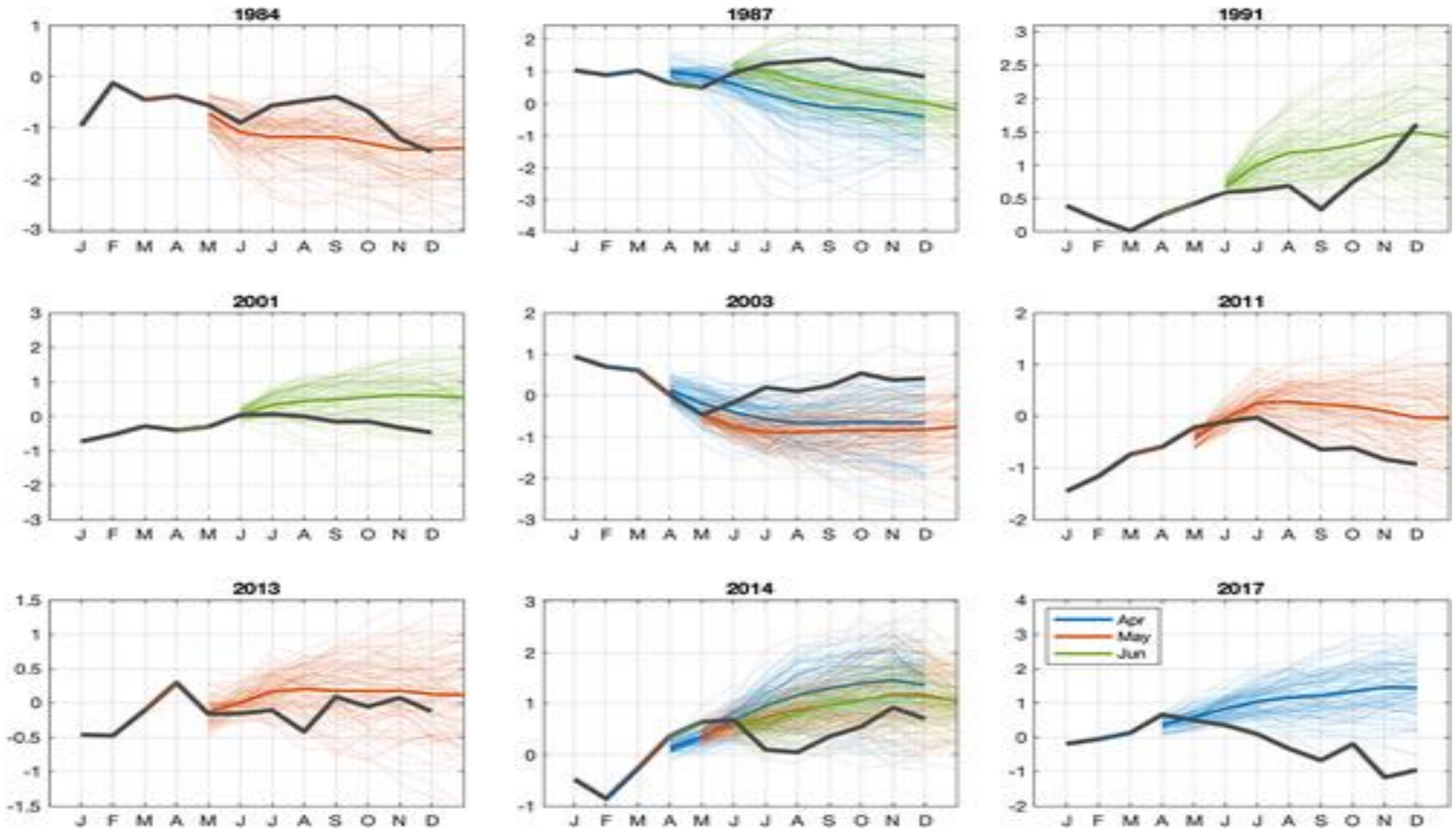
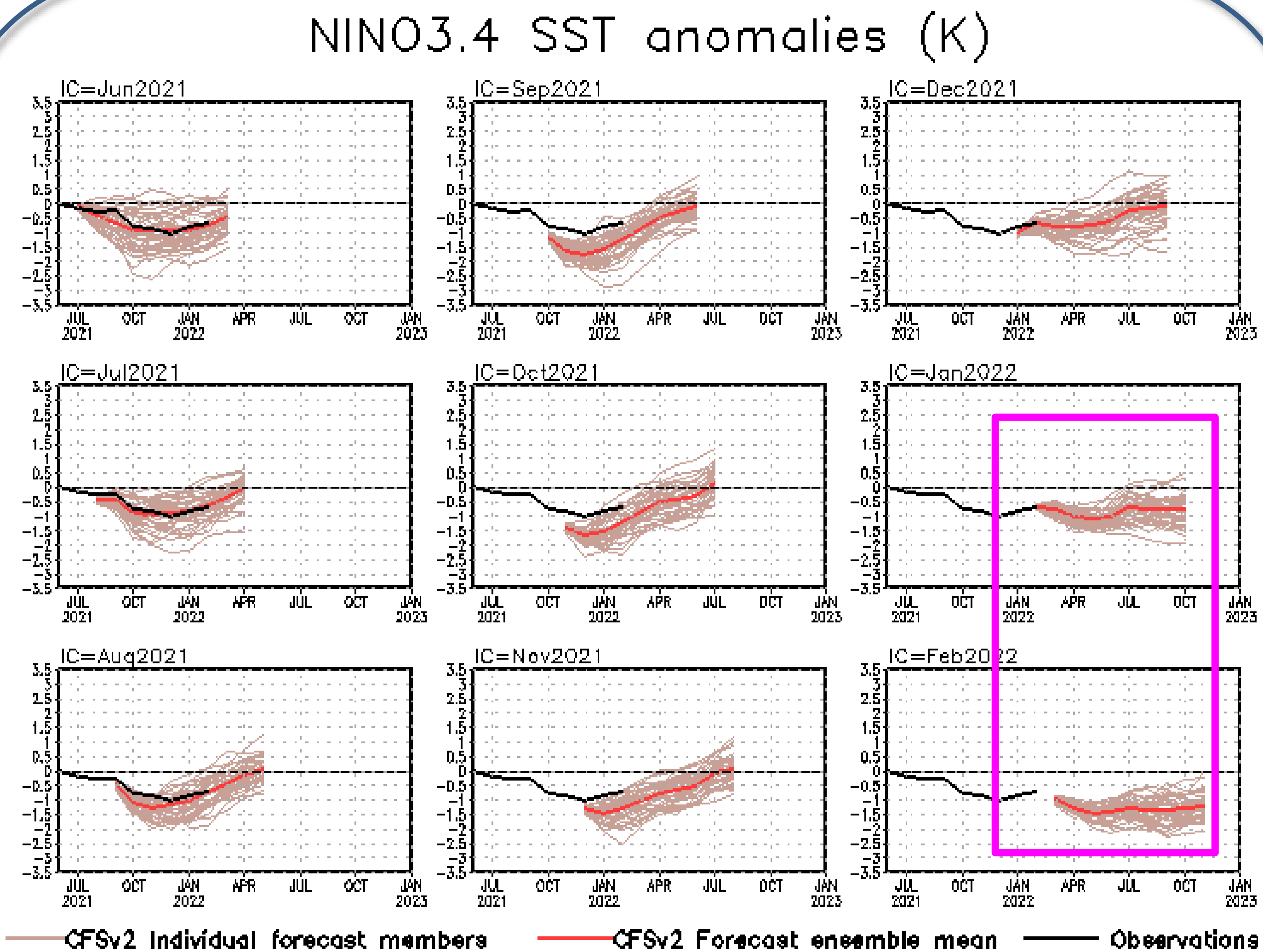


Fig. 3 False alarm years (1984, 1987, 1991, 2001, 2003, 2011, 2013, 2014, and 2017) in which the forecast probability of the wrong sign of the 3-month tendency exceeded 80% for April–June starts. The black curves are observed monthly values of the Niño 3.4 index with 1-month prior tendencies highlighted in the same color as the corresponding forecast. The colored curves are forecast values with heavy lines for the North American multimodel ensemble mean and light lines for North American multimodel ensemble members. Note the differing vertical scales.

Tippett, M. K., L'Heureux, M. L., Becker, E. J., & Kumar, A. (2020). Excessive momentum and false alarms in late-spring ENSO forecasts. Geophysical Research Letters, 47, e2020GL087008. https://doi.org/10.1029/2020GL087008

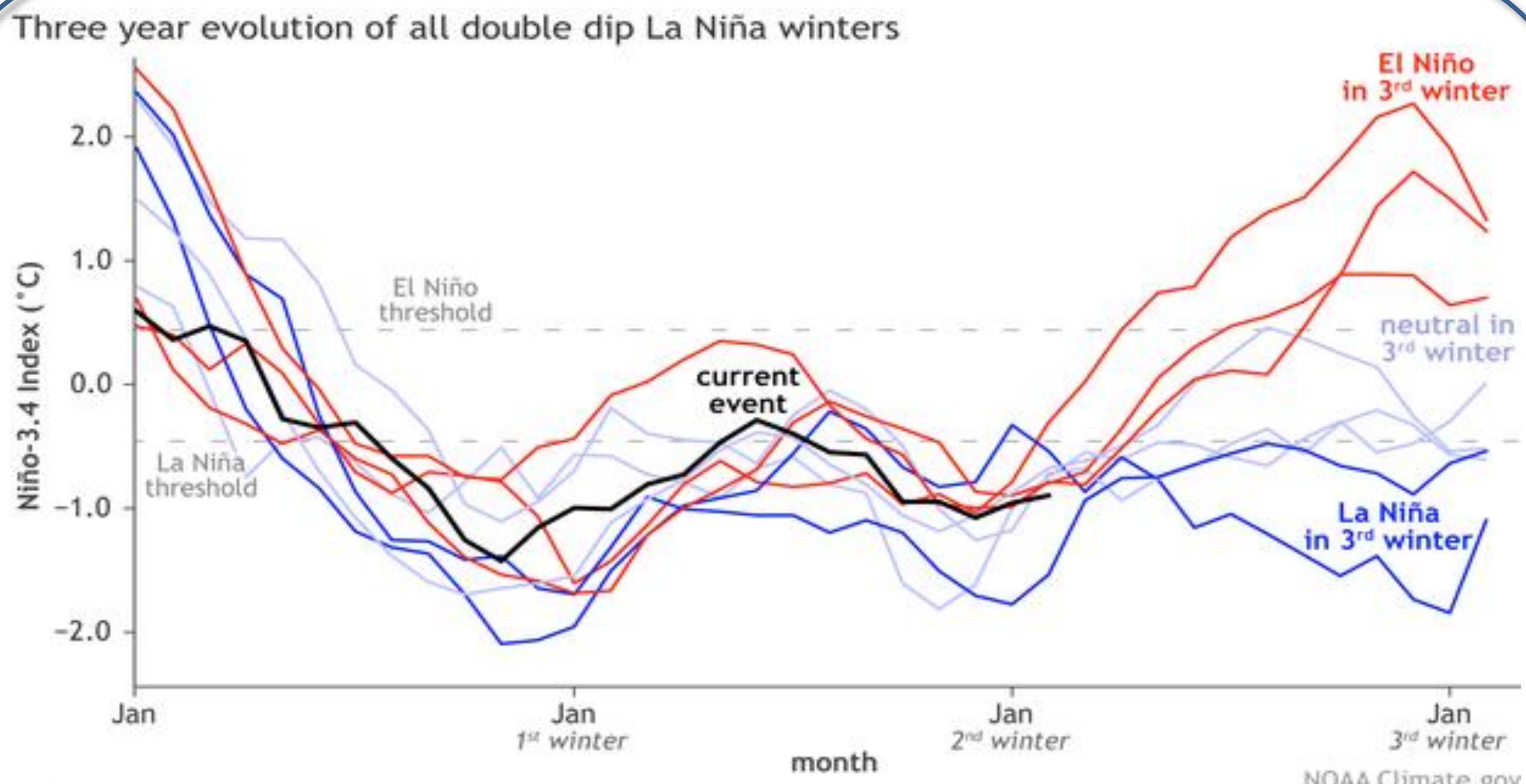
CFS Niño3.4 SST Predictions from Different Initial Months



- The latest CFSv2 forecasts indicate that La Niña will persist in summer – autumn 2022.

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.

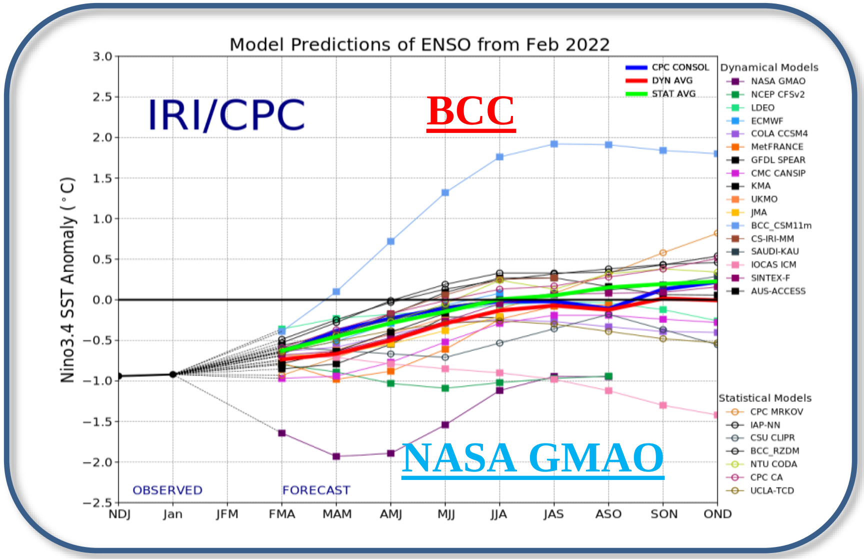
March 2022 La Niña update: three-bean salad (MICHELLE L'HEUREUX)

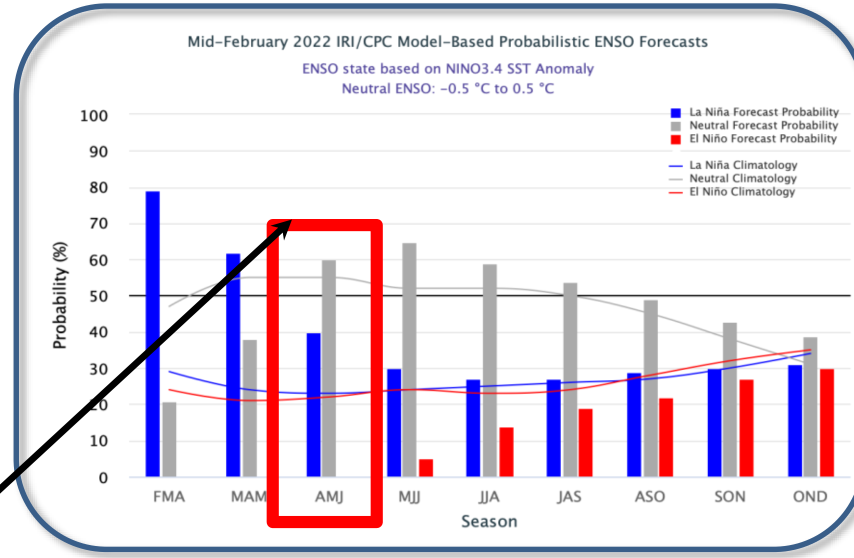


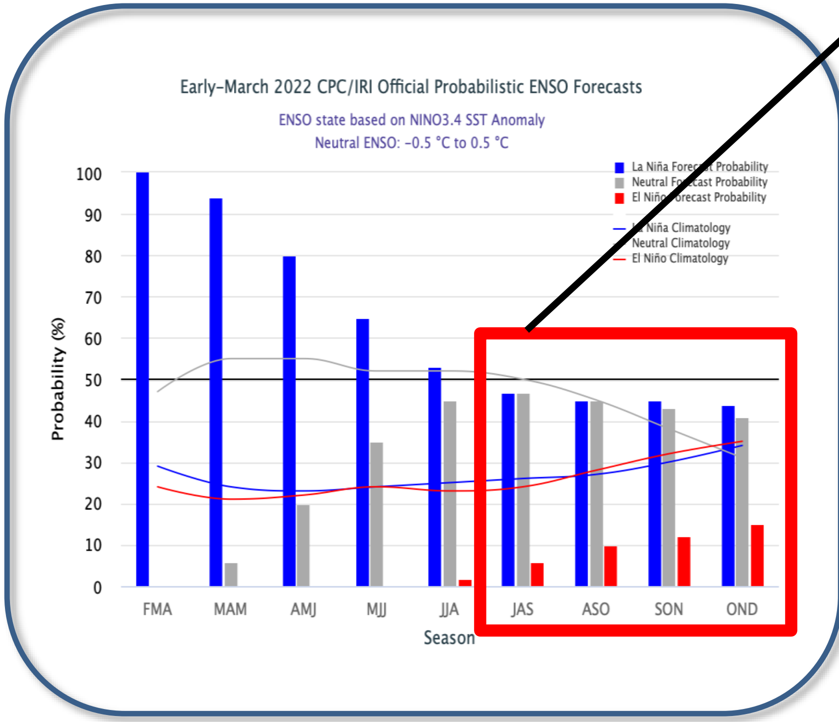
Three-year history of sea surface temperatures in the Niño-3.4 region of the tropical Pacific for 8 previous double-dip La Niña events. The color of the line indicates the state of ENSO for the third winter (red: El Niño, darker blue: La Niña, lighter blue: neutral). The black line shows the current event. Monthly Niño-3.4 index is from CPC using ERSSTv5.

https://www.climate.gov/news-features/blogs/enso/march-2022-la-ni%C3%B1a-update-three-bean-salad

IRI/CPC Niño3.4 Forecast: March 2022

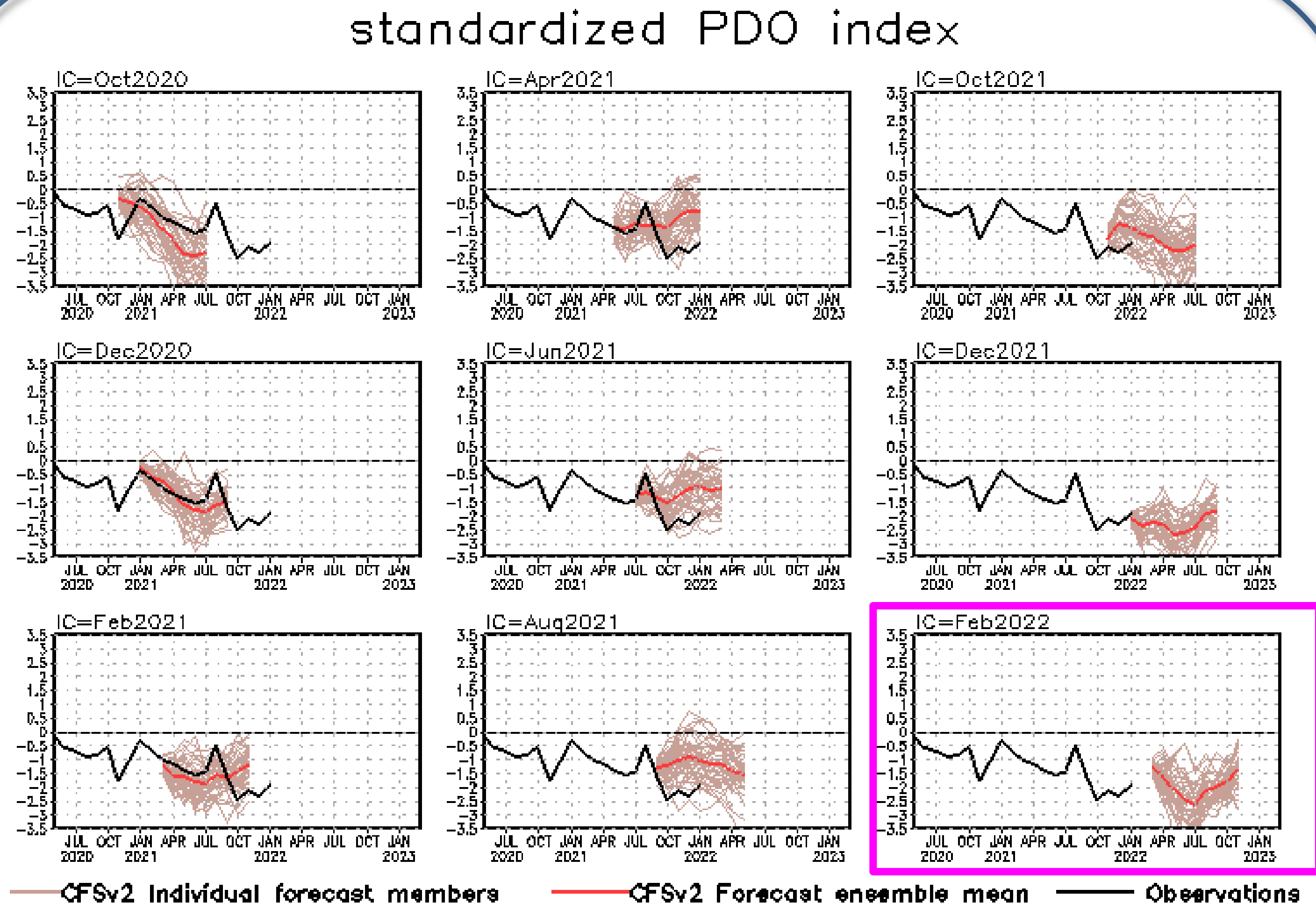






- **ENSO Alert System Status: La Niña Advisory**
- <u>Synopsis:</u> *La Niña is favored to continue into the Northern Hemisphere summer (53% chance during June-August 2022), with a 40-50% chance of La Niña or ENSO-neutral thereafter.*

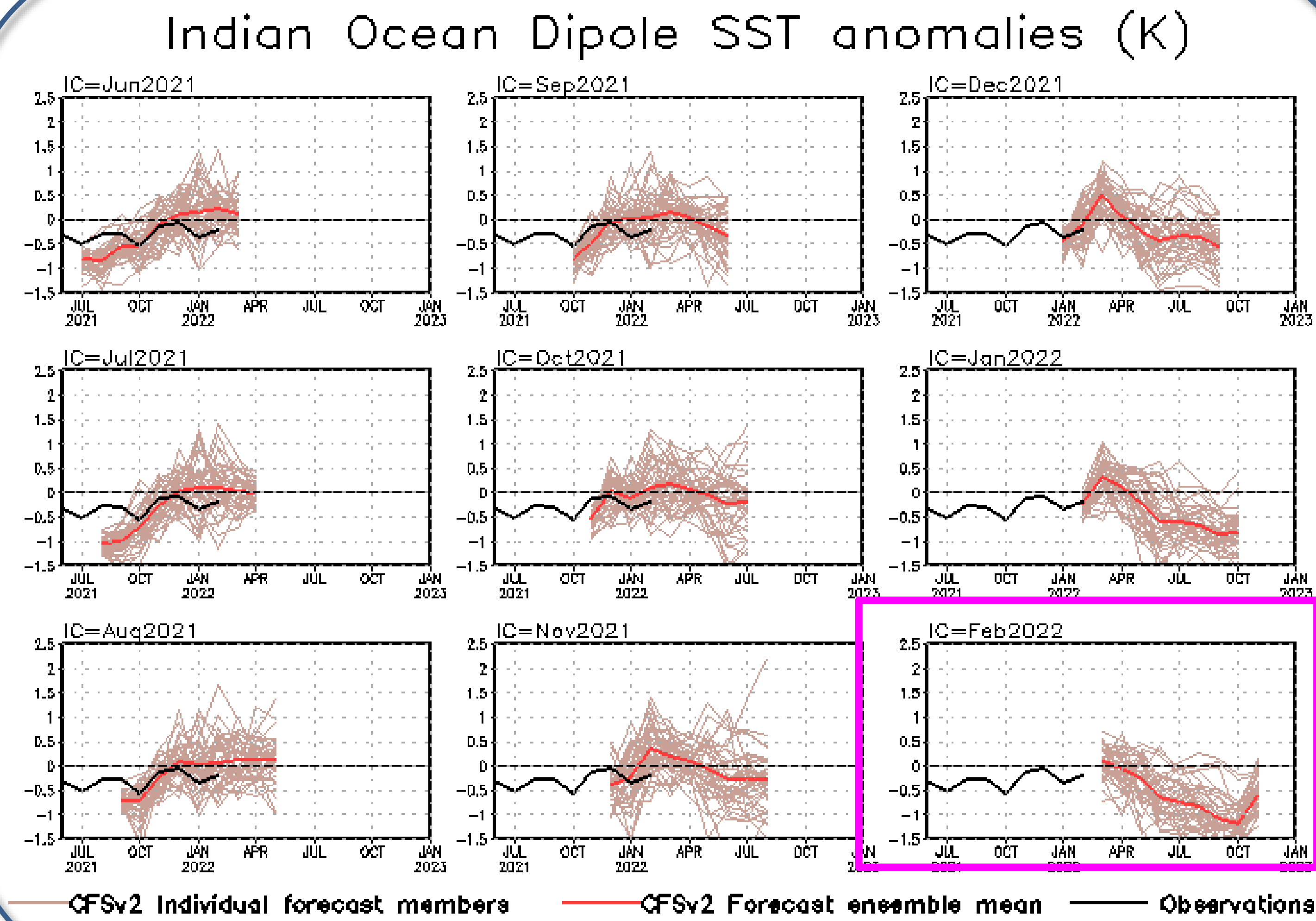
CFS Pacific Decadal Oscillation (PDO) Index Predictions from Different Initial Months



- CFSv2 predicts a negative phase of PDO in 2022.

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.

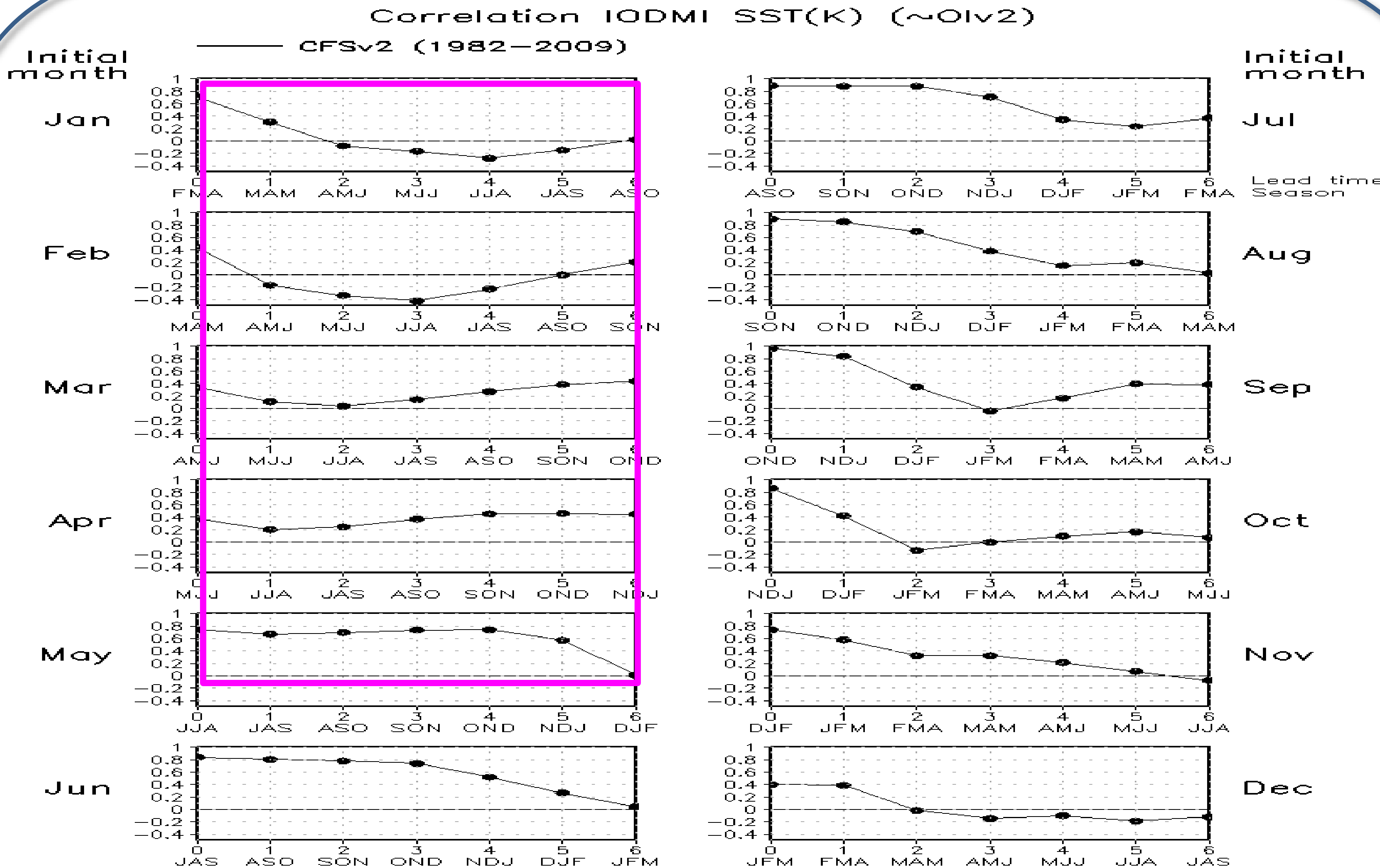
NCEP CFS DMI SST Predictions from Different Initial Months



- CFSv2 predicts a negative phase of IOD in summer-autumn 2022.

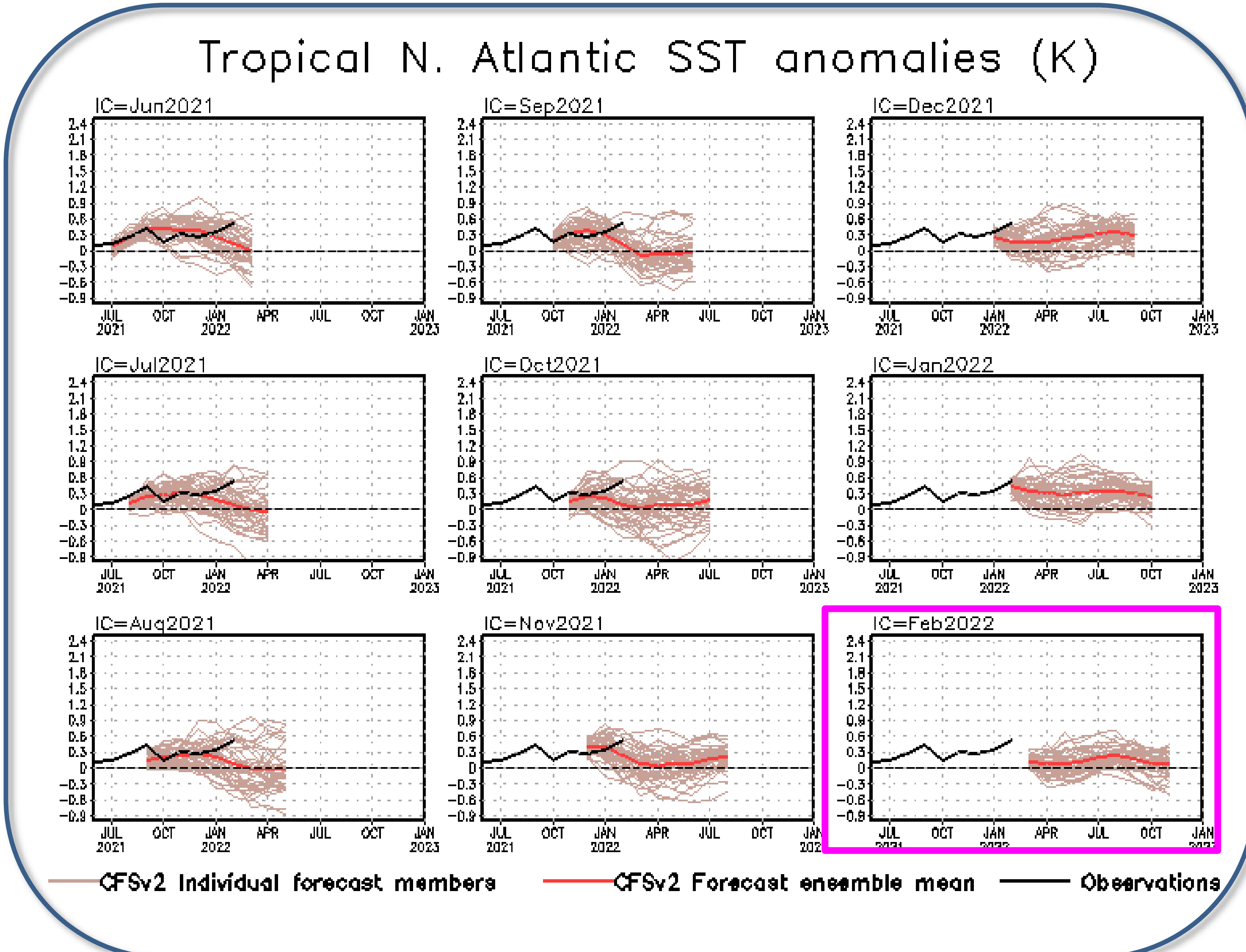
CFS Dipole Model Index (DMI) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). The hindcast climatology 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.

CFSv2 IODMI Prediction Skill: Varied with lead time



https://www.cpc.ncep.noaa.gov/products/people/mchen/CFSv2HCST/metrics/corl/CFSv2corl_iodmi_ssn.gif

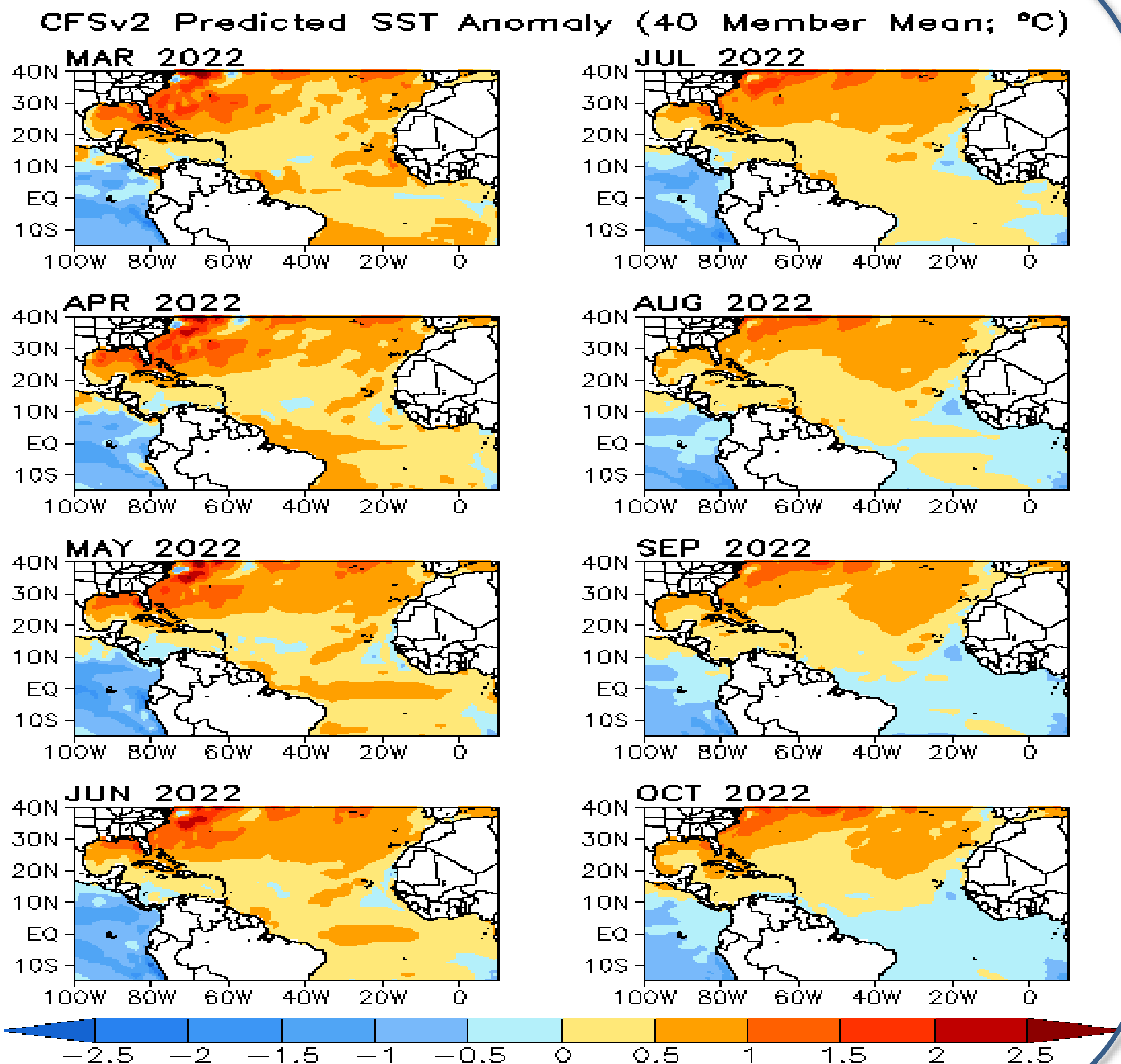
CFS Tropical North Atlantic (TNA) SST Predictions from Different Initial Months



- Latest CFSv2 predictions call for slightly above normal SST in the tropical North Atlantic in 2022.

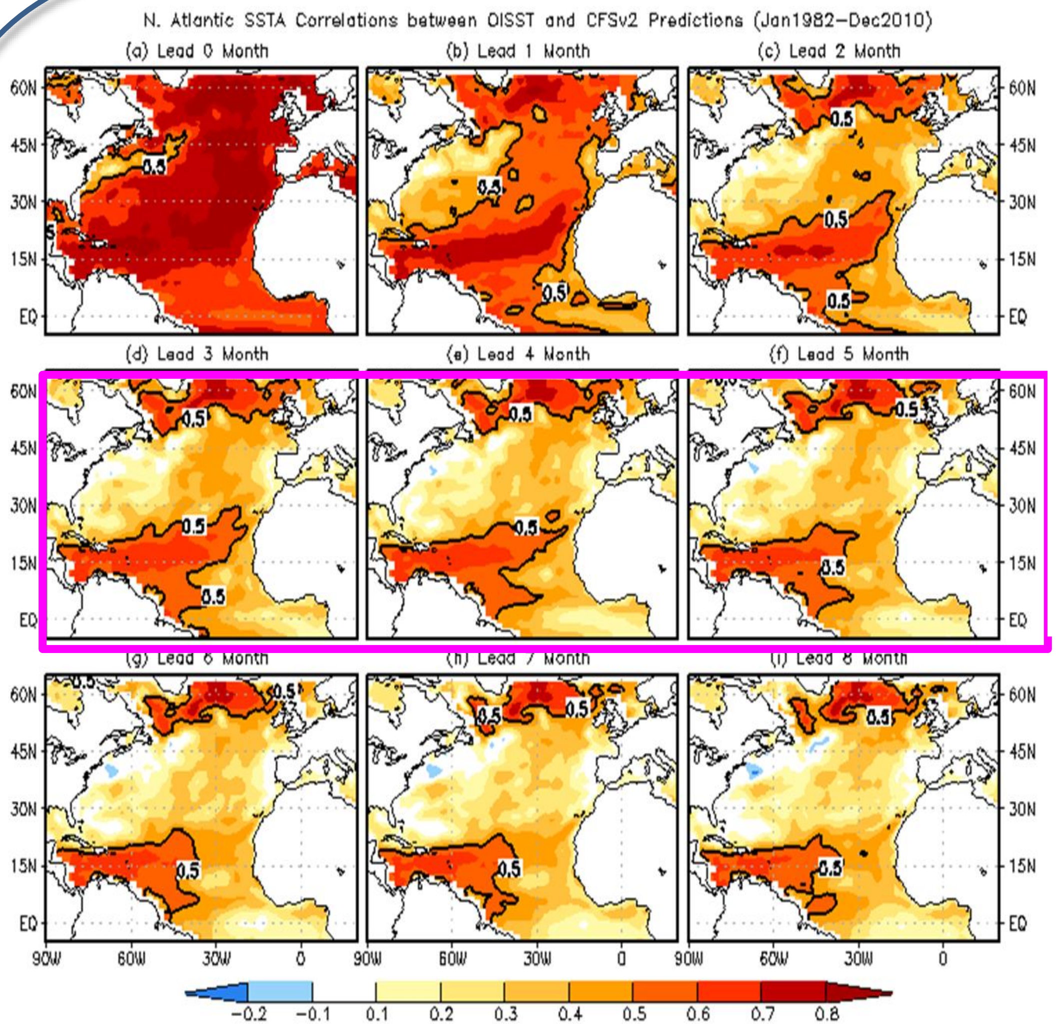
CFS Tropical North Atlantic (TNA) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). Anomalies were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

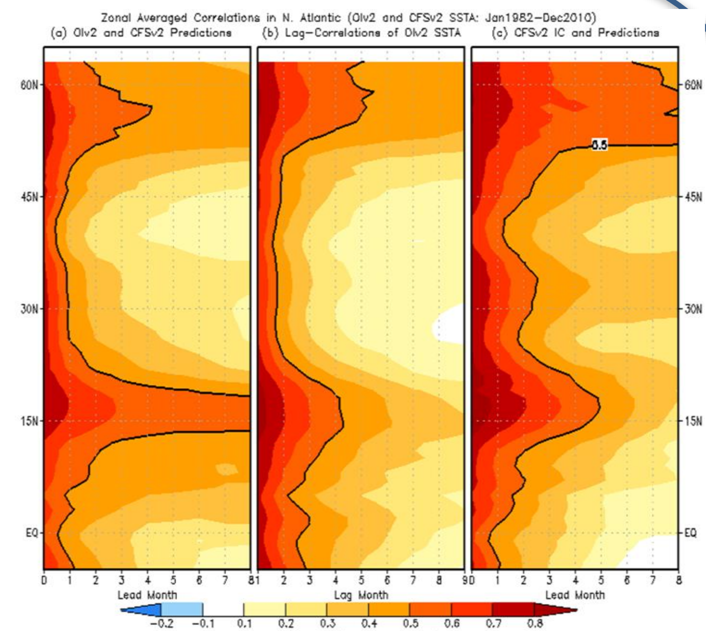
CFSv2 Atlantic SSTA Predictions



- Latest CFSv2 predictions call above or near average SST in the tropical North Atlantic in the next 8 months.

CFSv2 N. Atlantic Prediction Skill





- High skills are in high & low (mid-) latitudes.
- The prediction skill is largely due to the persistency of the SSTA.
- The persistency may be associated with ENSO & NAO's influence.

Hu, Z.-Z., A. Kumar, B. Huang, W. Wang, J. Zhu, and C. Wen, 2013: Prediction skill of monthly SST in the North Atlantic Ocean in NCEP Climate Forecast System version 2. Clim. Dyn., 40 (11-12), 2745-2756. DOI: 10.1007/s00382-012-1431-z.

Acknowledgement

- Drs. Jieshun Zhu, Caihong Wen, and Arun Kumar: reviewed PPT, and provide insightful suggestions and comments

- Drs. Li Ren and Pingping Xie provided the BASS/CMORPH/CFSR EVAP package

- Dr. Wanqiu Wang provides the sea ice forecasts and maintains the CFSv2 forecast archive

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Caihong.Wen@noaa.gov
Zeng-Zhen.Hu@noaa.gov

Data Sources (climatology is for 1991-2020)

- **Weekly Optimal Interpolation SST (OI SST) version 2 (Reynolds et al. 2002)**
- **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 2022

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

Positive SSS anomaly continues/strengthens in the western equatorial Pacific Ocean and SPCZ with reduced precipitation in these areas. Positive SSS anomaly continues between 10°N and 40°N in the North Atlantic Ocean. Negative SSS anomaly continues in the equatorial region of Atlantic Ocean. Negative SSS anomaly continues in the Bay of Bengal, while positive anomaly appears in the Arabian Sea.

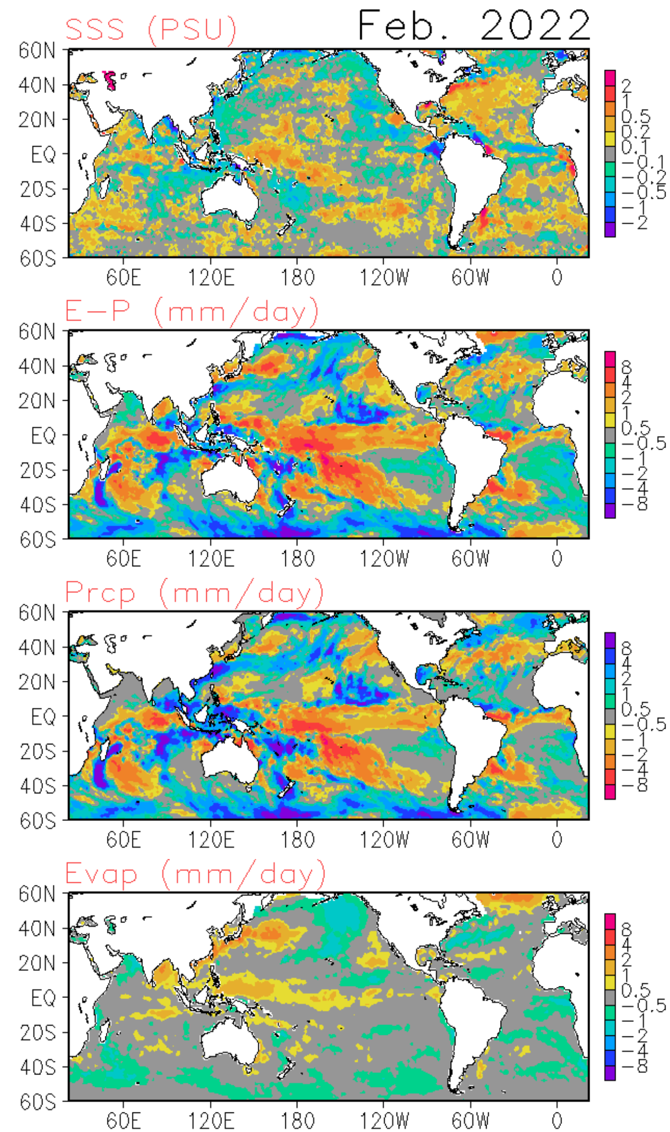
SSS : Blended Analysis of Surface Salinity (BASS) V0.Z

(a CPC-NESDIS/NODC-NESDIS/STAR joint effort)

ftp.cpc.ncep.noaa.gov/precip/BASS

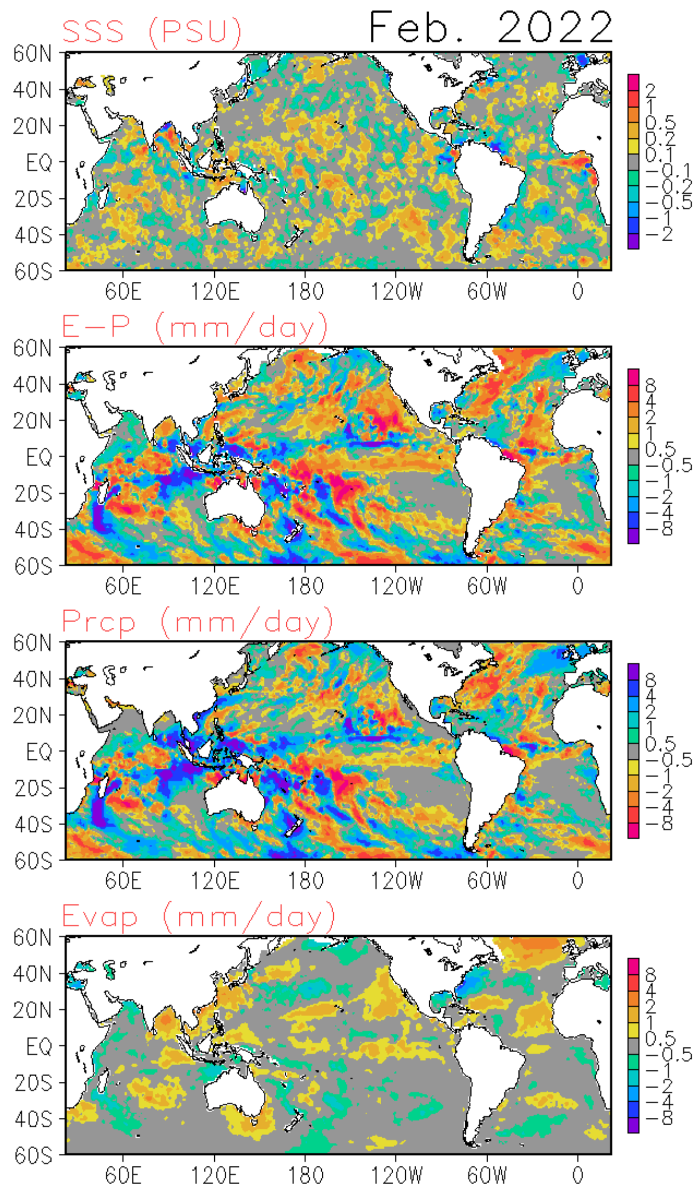
Precipitation: CMORPH adjusted satellite precipitation estimates

Evaporation: Adjusted CFS Reanalysis



Global Sea Surface Salinity (SSS): Tendency for February 2022

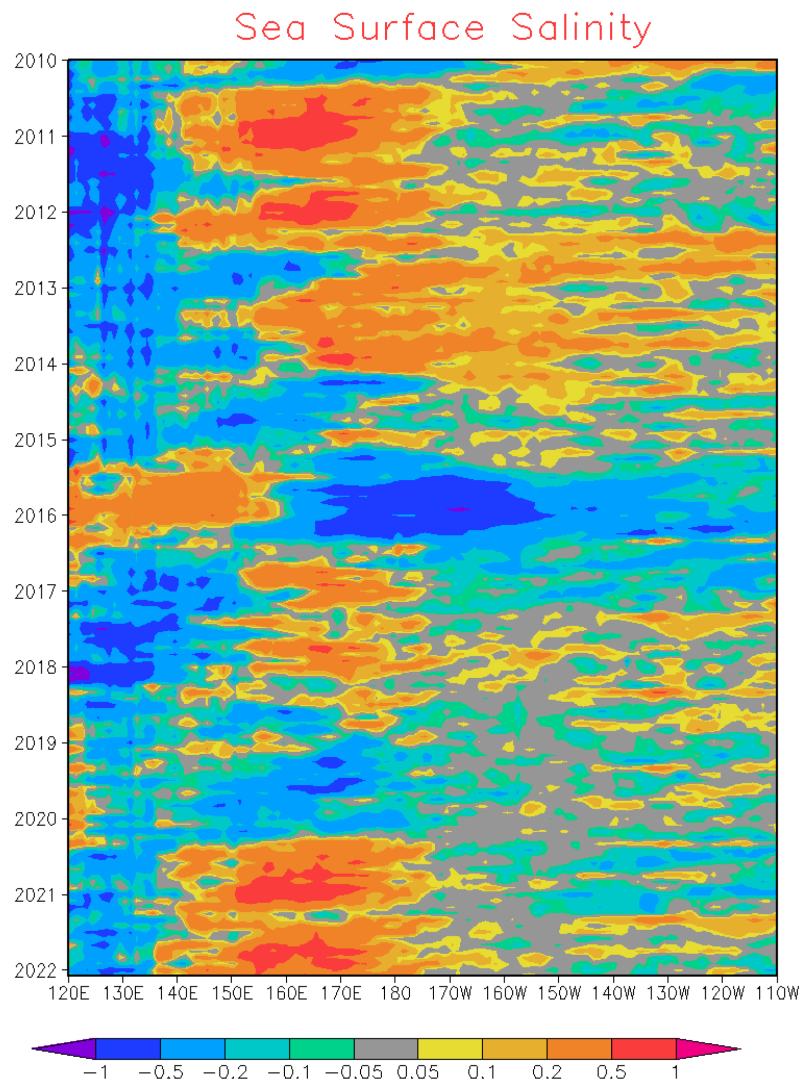
Compared with last month, SSS increased in the west Equatorial Pacific Ocean likely due to the oceanic advection/entrainments. SSS also increased along SPCZ being accompanied with decreased precipitation. In the east Equatorial Atlantic Ocean, SSS increased which is possibly due to decreased precipitation. SSS increased in the Bay of Bengal.



Monthly SSS Anomaly Evolution over Equatorial Pacific

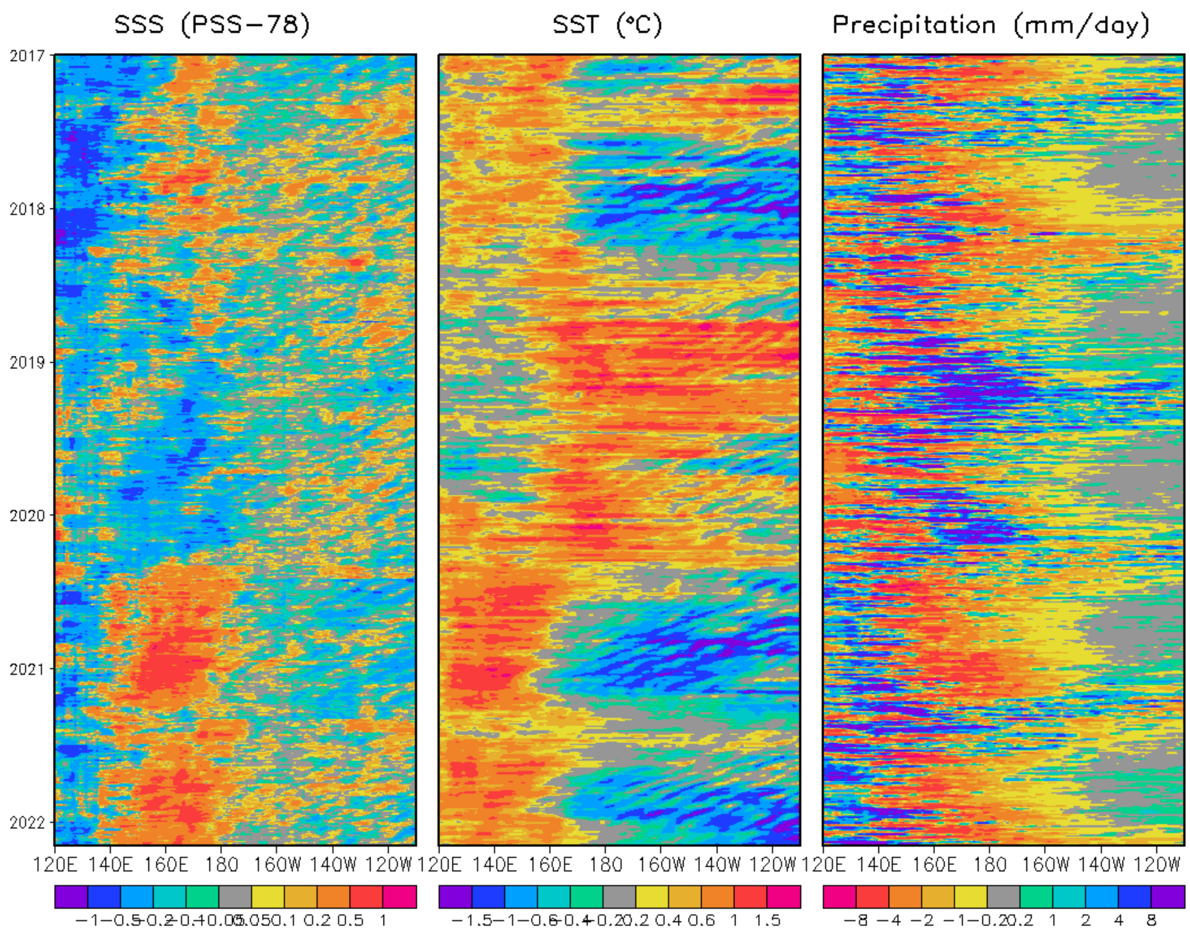
NOTE: Since June 2015, the BASS SSS is from in situ, SMOS and SMAP; before June 2015,The BASS SSS is from in situ, SMOS and Aquarius.

- Hovemoller diagram for equatorial SSS anomaly **(5˚S-5˚N);**
- In the equatorial Pacific Ocean, west of 140°E, negative SSS signal continues; positive SSS signal continues between 140°E and 170°W; neutral or likely negative signal continues east of 150°W.

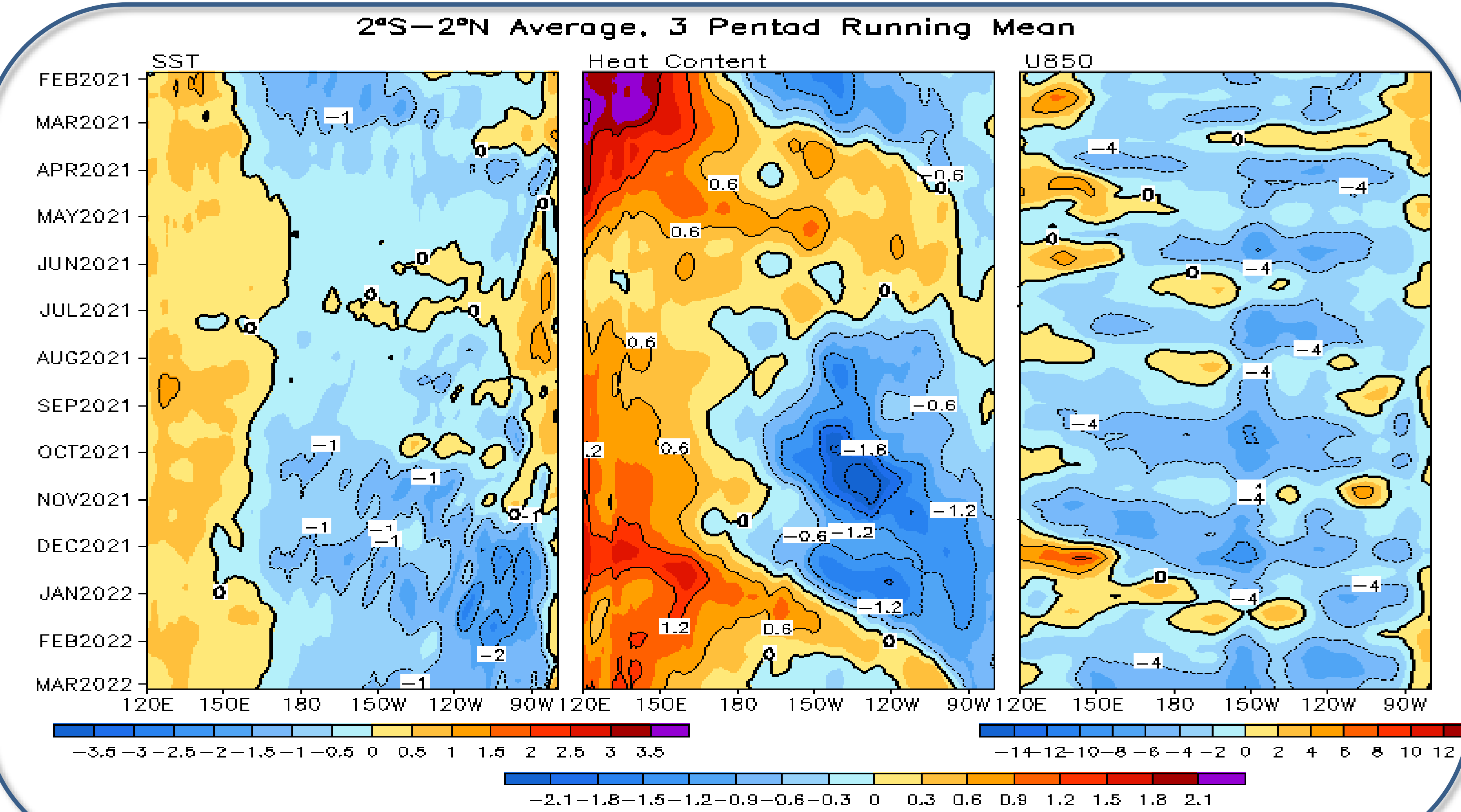


Pentad SSS Anomaly Evolution over Equatorial Pacific

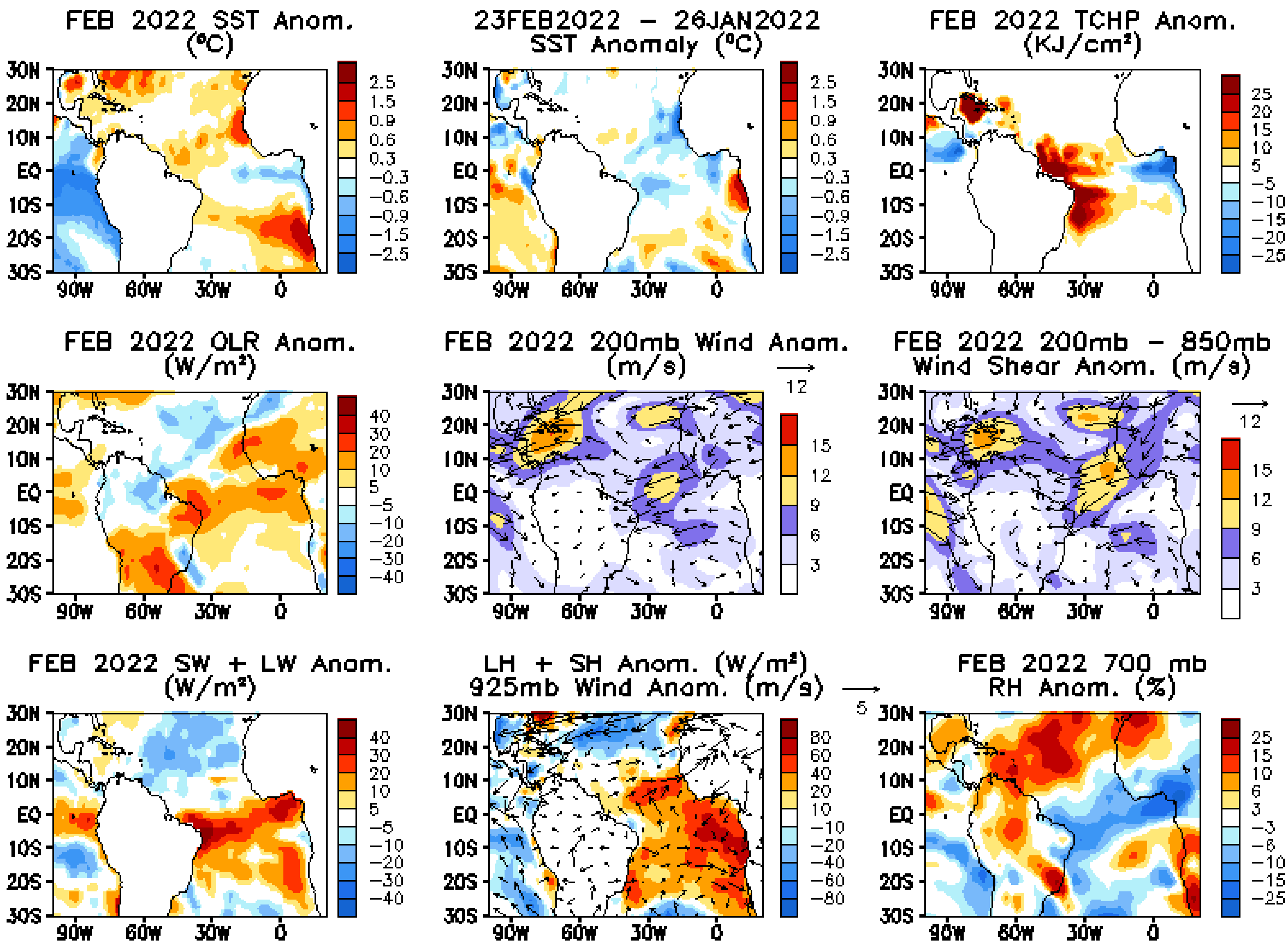
Figure caption: Hovemoller diagram for equatorial (5˚S-5˚N) 5-day mean SSS, SST and precipitation anomalies. The climatology for SSS is Levitus 1994 climatology. The SST data used here is the OISST V2 AVHRR only daily dataset with its climatology being calculated from 1985 to 2010. The precipitation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

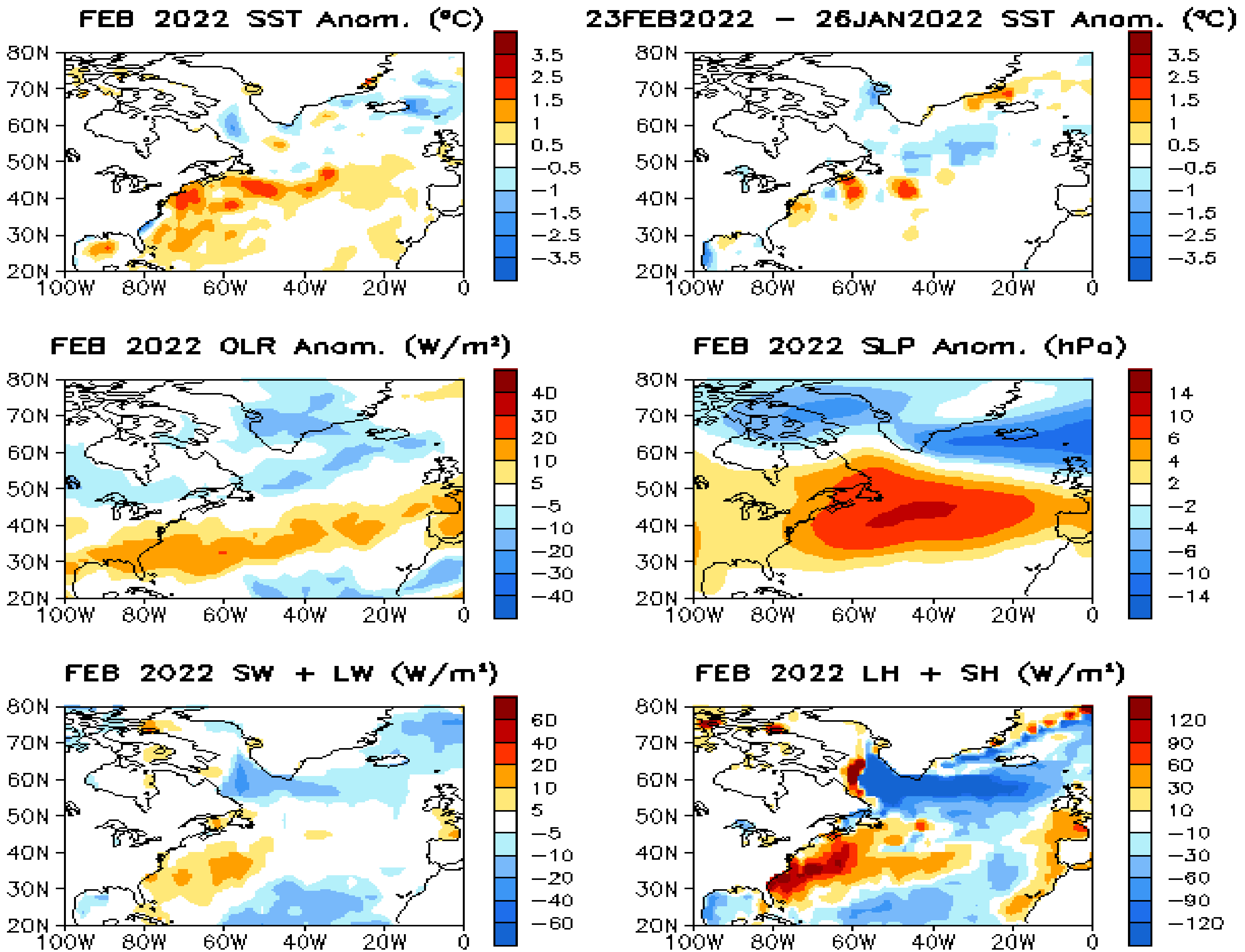


Equatorial Pacific SST (ºC), HC300 (ºC), u850 (m/s) Anomalies



- Easterly wind anomaly was present across the equatorial Pacific since Mar 2021.
- Below- average HC300 was observed in the eastern Pacific since Jul 2021.
- Negative SSTA weakened in the central and eastern equatorial Pacific in Feb 2022.


FEB 2022 SST Anom. (°C)
23FEB2022 – 26JAN2022 SST Anomaly (°C)
FEB 2022 TCHP Anom. (KJ/cm²)
FEB 2022 OLR Anom. (W/m²)
FEB 2022 200mb Wind Anom. (m/s)
FEB 2022 200mb – 850mb Wind Shear Anom. (m/s)
FEB 2022 SW + LW Anom. (W/m²)
LH + SH Anom. (W/m²) 925mb Wind Anom. (m/s)
FEB 2022 700 mb RH Anom. (%)
30N 20N 10N EQ 10S 20S 30S
90W 60W 30W 0
2.5 1.5 0.9 0.6 0.3 −0.3 −0.6 −0.9 −1.5 −2.5
25 20 15 10 5 −5 −10 −15 −20 −25
40 30 20 10 5 −5 −10 −20 −30 −40
12
15 12 9 6 3
80 60 40 20 10 −10 −20 −40 −60 −80
5
25 15 10 6 3 −3 −6 −10 −15 −25


FEB 2022 SST Anom. (°C)
23FEB2022 – 26JAN2022 SST Anom. (°C)
80N 70N 60N 50N 40N 30N 20N
100W 80W 60W 40W 20W 0
3.5 2.5 1.5 1 0.5 −0.5 −1 −1.5 −2.5 −3.5
FEB 2022 OLR Anom. (W/m²)
40 30 20 10 5 −5 −10 −20 −30 −40
FEB 2022 SLP Anom. (hPa)
14 10 6 4 2 −2 −4 −6 −10 −14
FEB 2022 SW + LW (W/m²)
60 40 20 10 5 −5 −10 −20 −40 −60
FEB 2022 LH + SH (W/m²)
120 90 60 30 10 −10 −30 −60 −90 −120