The Sixth Session of the East Asia winter Climate Outlook Forum
7–9 November 2018

El Niño Outlook
(October 2018 - April 2019)

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Outline

1. JMA's El Niño monitoring and prediction system

2. Oceanic and atmospheric conditions (September 2018)

3. El Niño Outlook by JMA (11 October 2018)

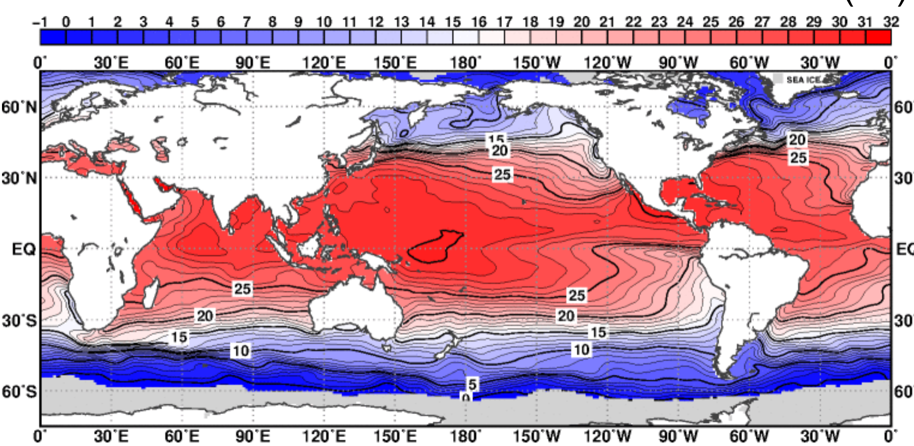
1. JMA's El Niño monitoring and prediction system

Sea Surface Temperature Analysis

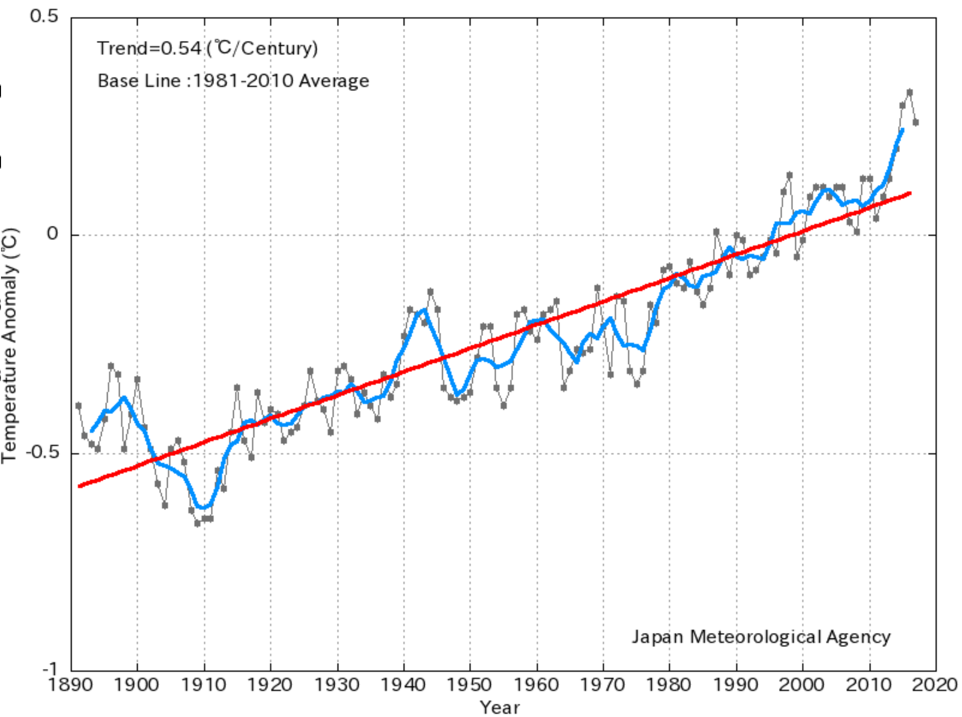
COBE-SST is a spatially complete, interpolated 1°x1° SST product for 1891 to present. It combines SSTs from ICOADS(*), the Japanese Kobe collection, and reports from ships and buoys. Data are gridded using optimal interpolation (*).

* Data up to 1941 were bias-adjusted using the "bucket correction." Prior to the interpolation analyses, data were also subject to quality control using a-priori thresholds, and nearby observations were combined.

Monthly mean SST (Sep. 2018)



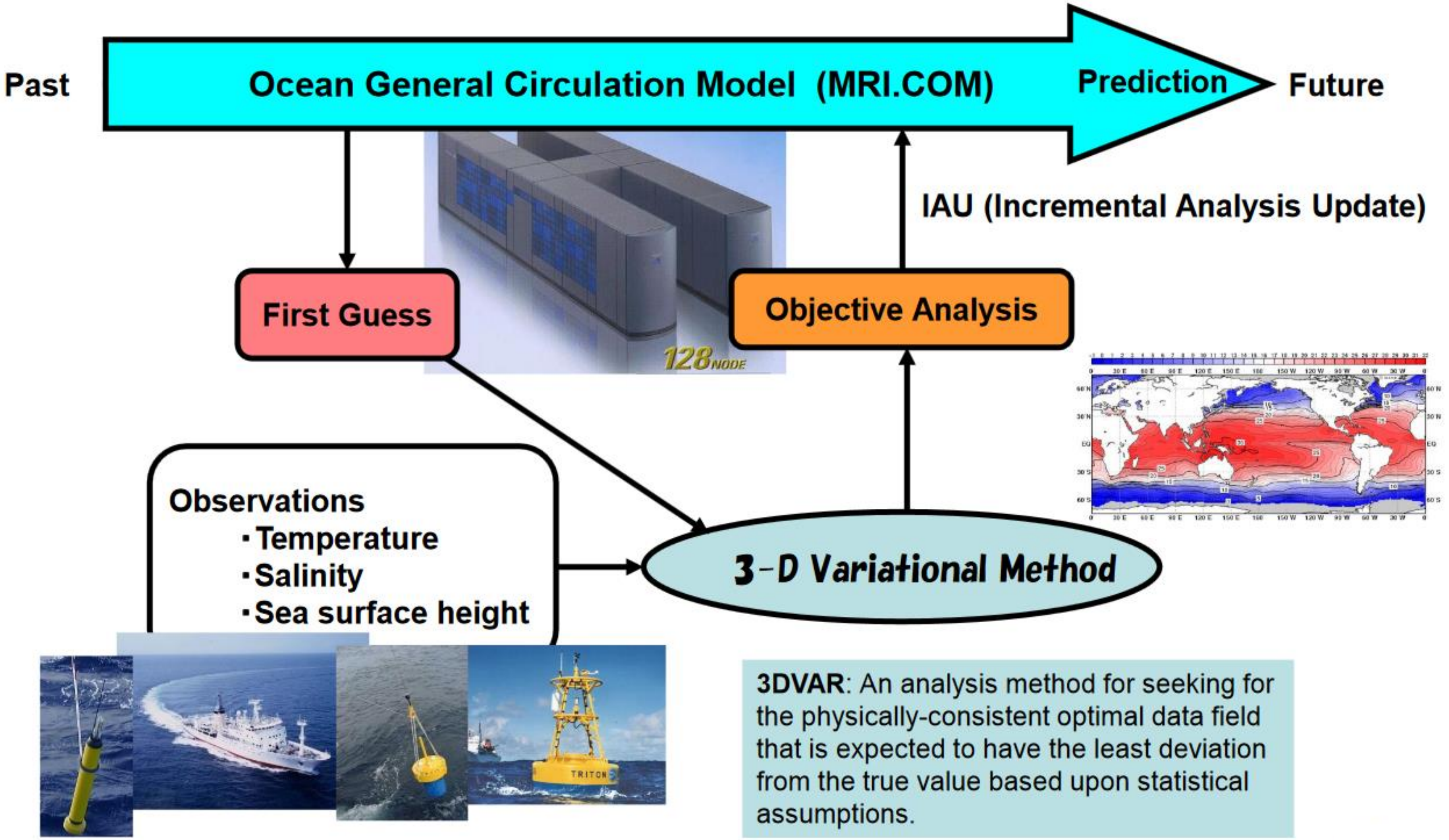
Time-series representation of annual global SST anomalies



ICOADS is the International Comprehensive Ocean-Atmosphere Data Set.

Ocean Data Assimilation System (MOVE-G2)

The JMA has been operating a global ocean data assimilation system (MOVE-G2) since 1995 to monitor El Niño. The system consists of an objective analysis scheme and an ocean general circulation model.

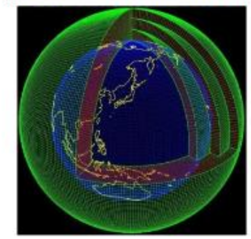


Atmosphere Data Assimilation System (JRA-55)

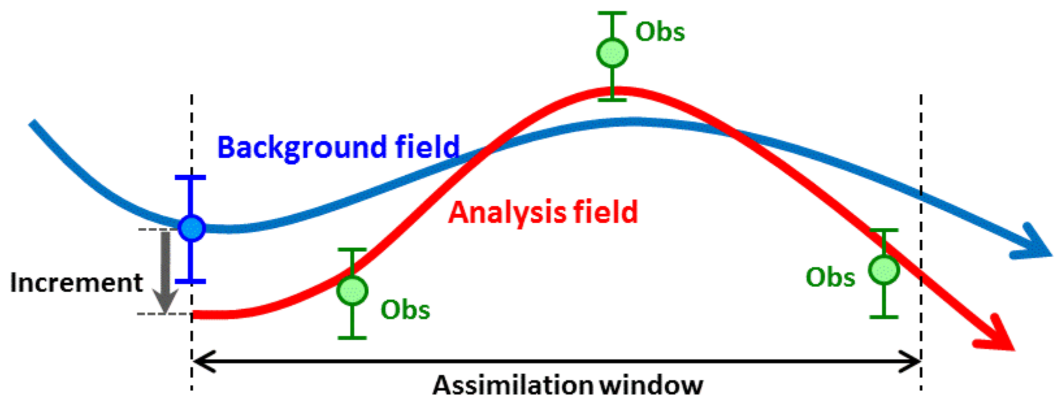
The JRA-55 is a meteorological reanalysis (*) which covers more than 50 years since 1958. After 2013, it has been operational analysis in JMA.

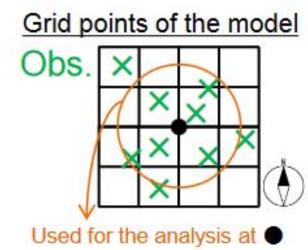
* Reanalysis: analysis of the past atmospheric conditions using a constant, state-of-the-art NWP model and data assimilation system with the latest observation to produce a high-quality, spatially and temporally consistent dataset.

Forecast model



4DVAR data assimilation





Supercomputer

Observations (example)

Surface

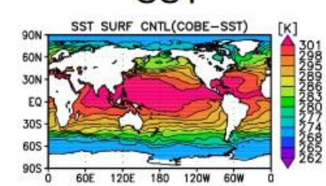
Radiosonde

Ship

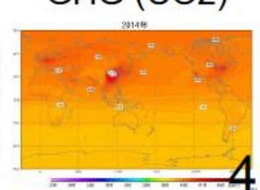
Satellite

Boundary conditions (example)

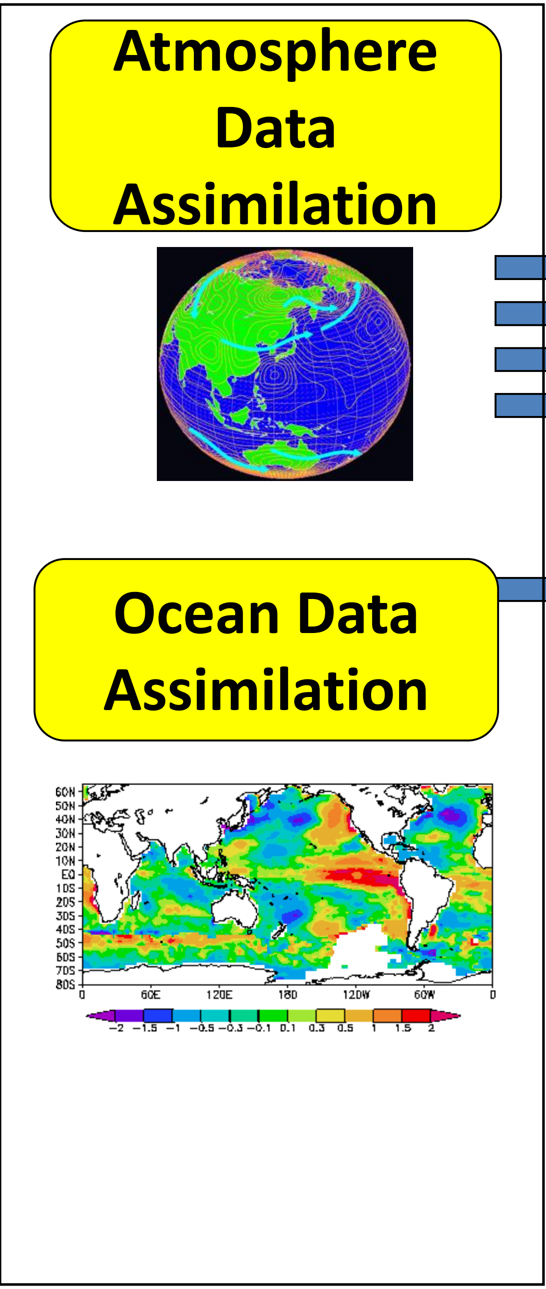
SST

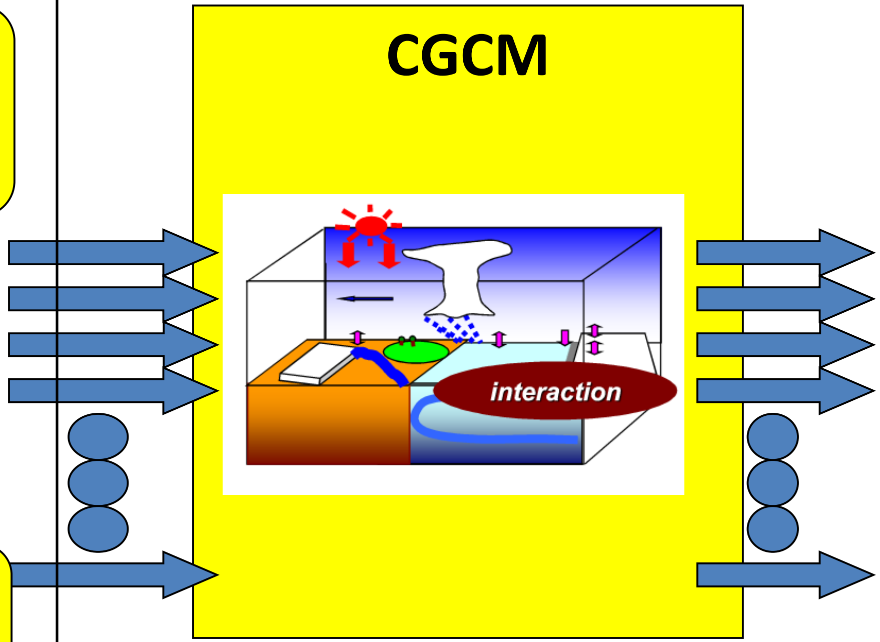


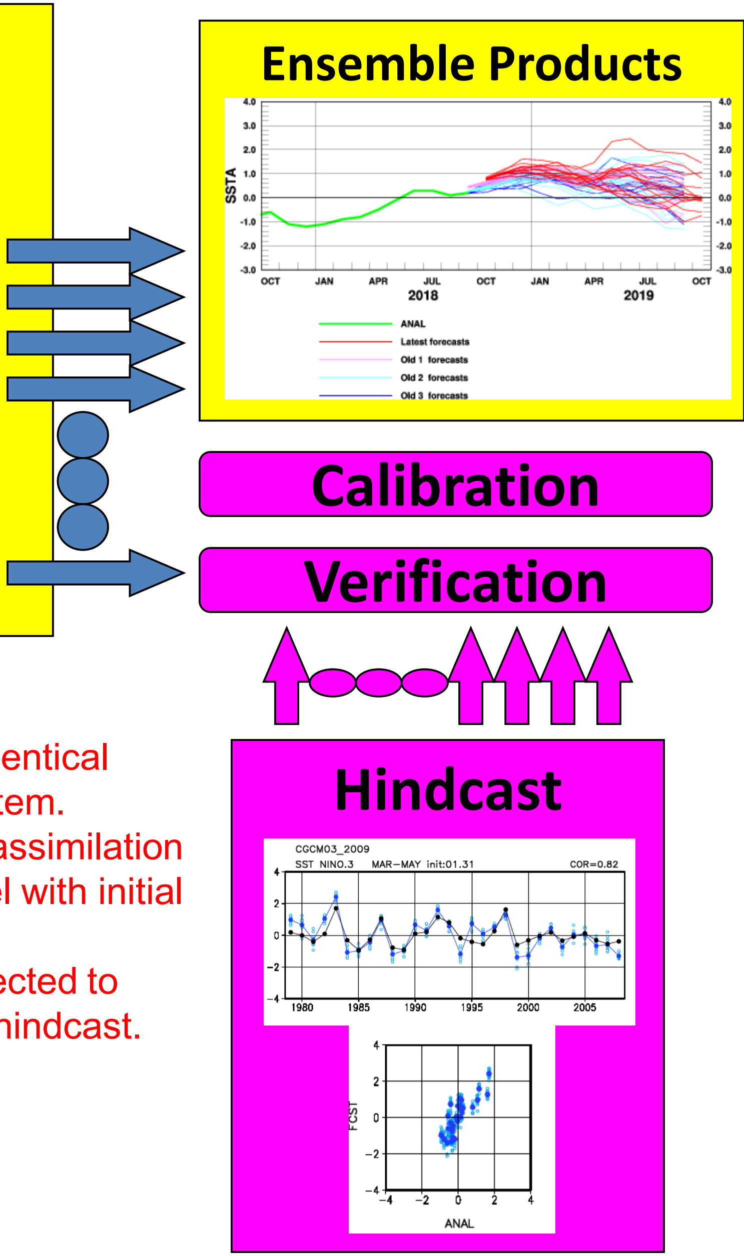
GHG (CO2)



El Niño Ensemble Prediction System





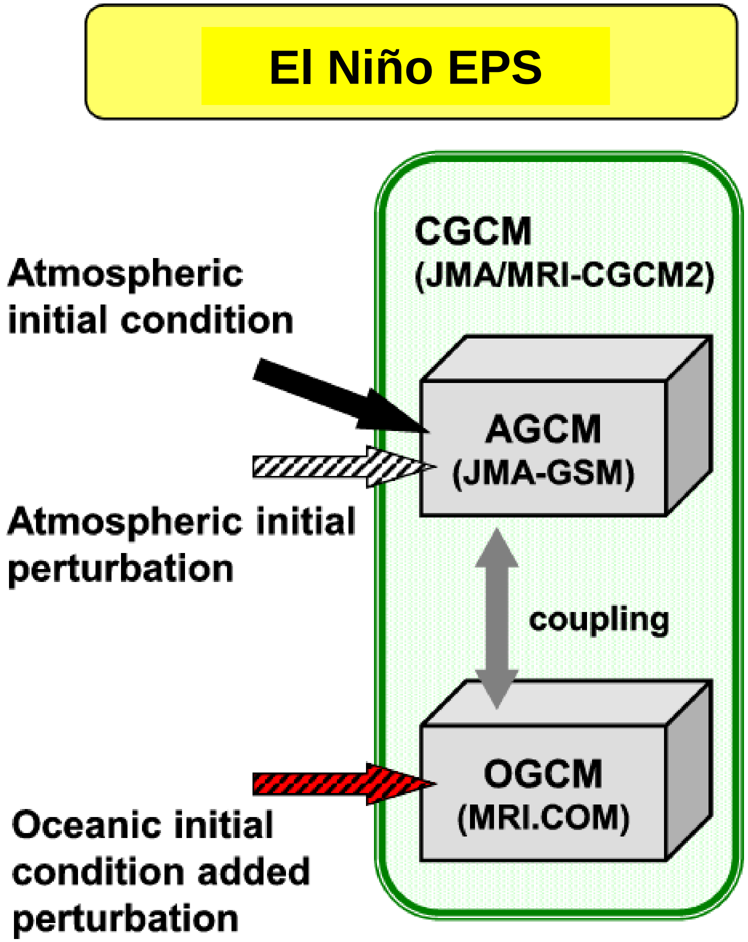


The coupled model consists of identical models used data assimilation system. Both ocean and atmosphere data assimilation systems provide the coupled model with initial conditions.

The ensemble products are corrected to adjust for bias using the results of hindcast.

Specification of El Niño EPS

as of Jan. 2018

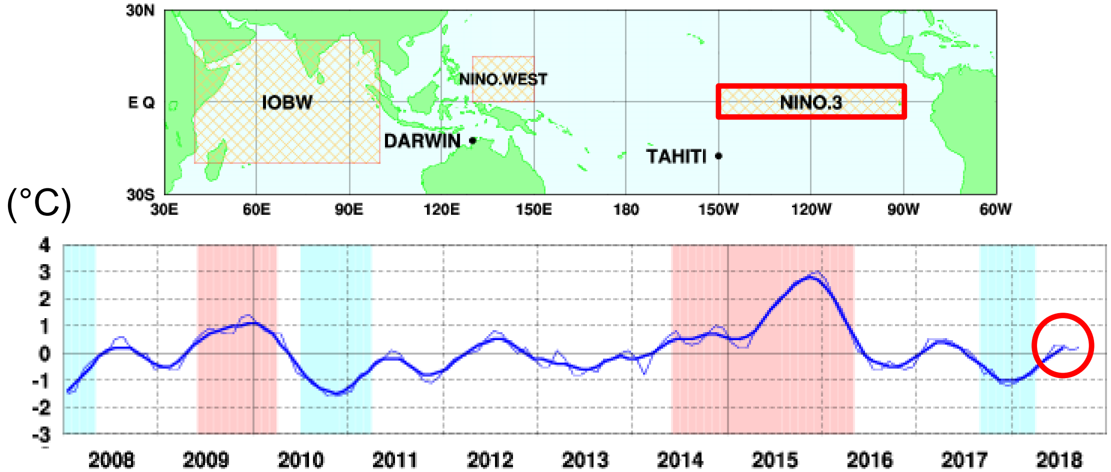


Upgrade	Last: June 2015 Frequently: Every Half Decade
Model	CGCM
Atmosphere Resolution	Horizontal: 110km (TL159) Vertical: 60 Levels up to 0.1hPa
Ocean Resolution	Horizontal: 1.0 Lon x 0.3-0.5 Lat Vertical: 52 Levels + BBL With Tri-polar Grid
Forecast range	Up to 4 or 7 months
Initial Condition	Atmosphere: JRA-55 Land: JRA-55 Ocean: MOVE/MRI.COM-G2
Ensemble method	BGM, LAF, Stochastic Physics Scheme
Ensemble size	51 (13-12 BGMs x 4 days LAF at 5-day interval)
Freq. of model product creation	Once a month (Around 20th of every month)

This system is used also for long-range seasonal forecast over Japan.

2. Oceanic and atmospheric conditions (September 2018)

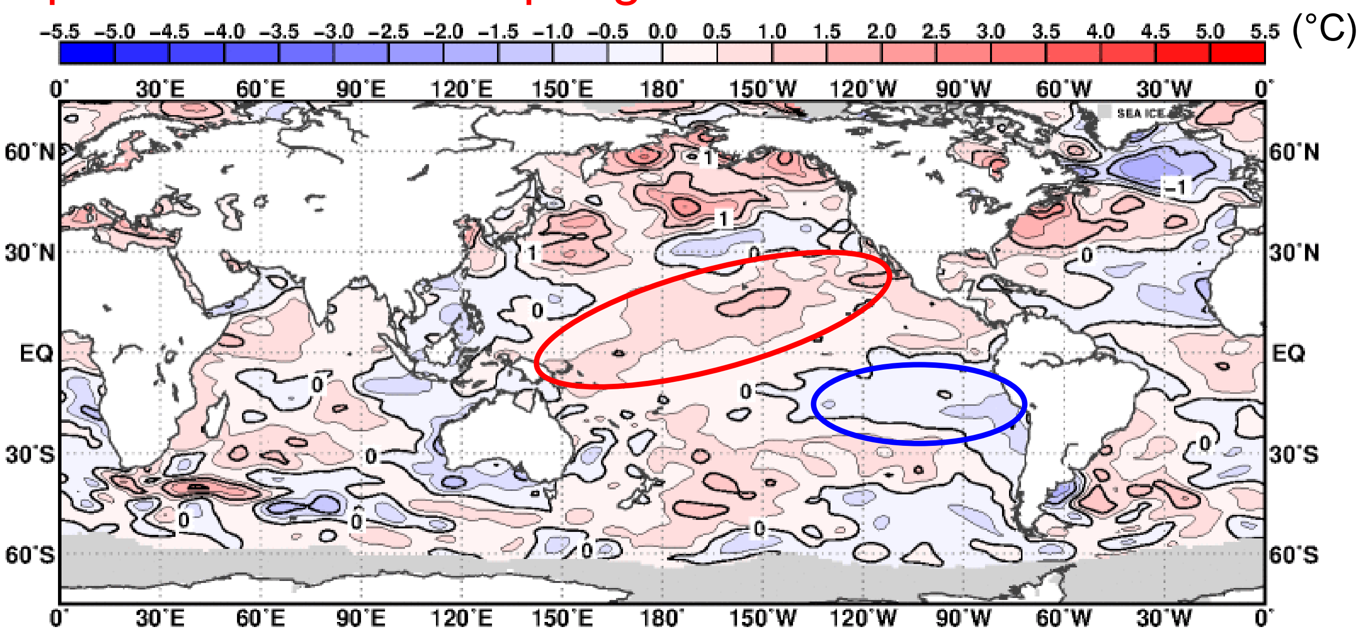
Sea Surface Temperature



The NINO.3 SST deviation was near normal (+0.2°C) in September 2018.

Time series of SST deviations from the climatological mean based on the latest sliding 30-year period for NINO.3

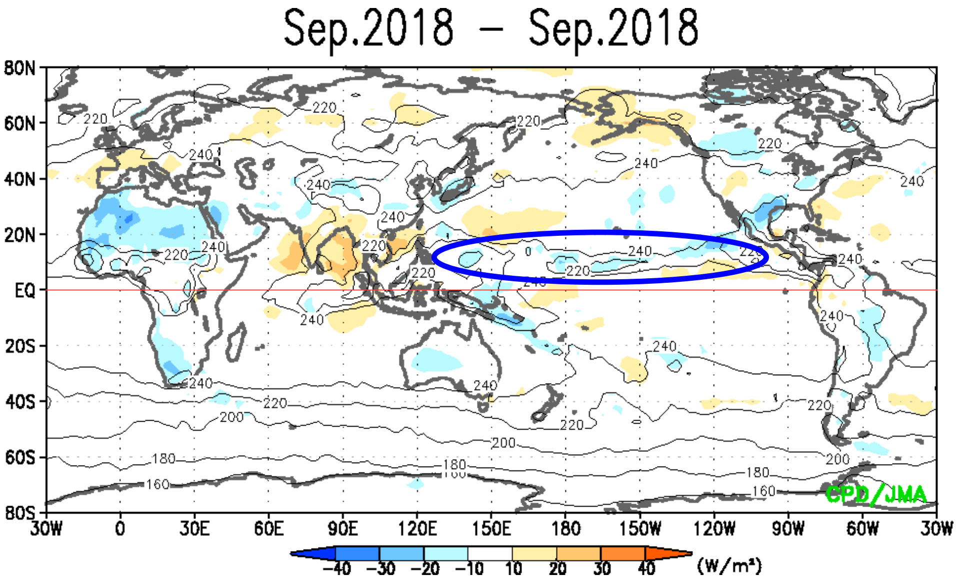
"The North Pacific meridional mode (*) (Chiang and Vimont 2004)" had been predominant since spring 2018.



*Reference
https://www.esrl.noaa.gov/psd/data/timeseries/monthly/PMM/

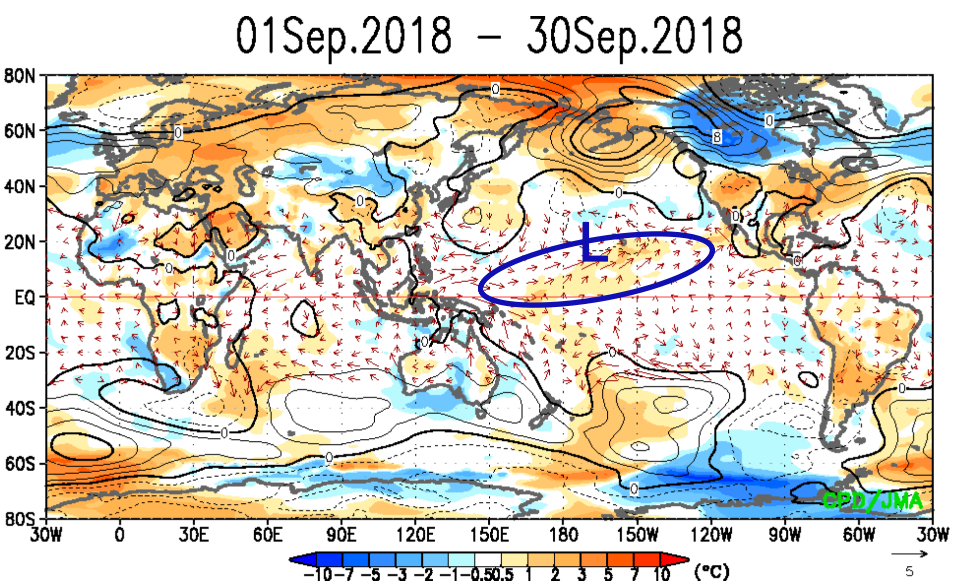
SST anomalies for Sep. 2018. Base period for normal is 1981-2010.

Atmospheric condition for September



Atmospheric convective activity was active (OLR anomalies were negative) in the subtropical North Pacific corresponding to the SST meridional mode.

OLR anomalies for Sep.2018. Base period for normal is 1981-2010. Original data were provided by NOAA.



Anomalous westerly surface winds were predominant from the western equatorial Pacific to the central subtropical North Pacific, where lower-than-normal SLP prevailed.

Anomalies of 10-m wind (vectors), SLP (contours), and 2-m temperature (shadings) for Sep. 2018. Base period for normal is 1981-2010.

Ocean Heat Content

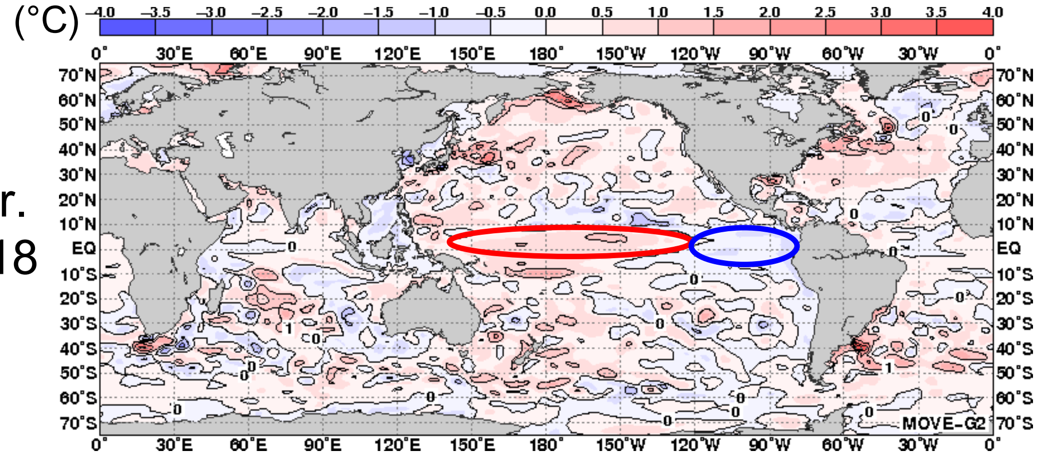
In spring, OHC(*) anomalies were positive in the western to central equatorial Pacific due to the La Niña 2017/18.

* OHC is defined as the depth averaged temperature over the upper 300 m.

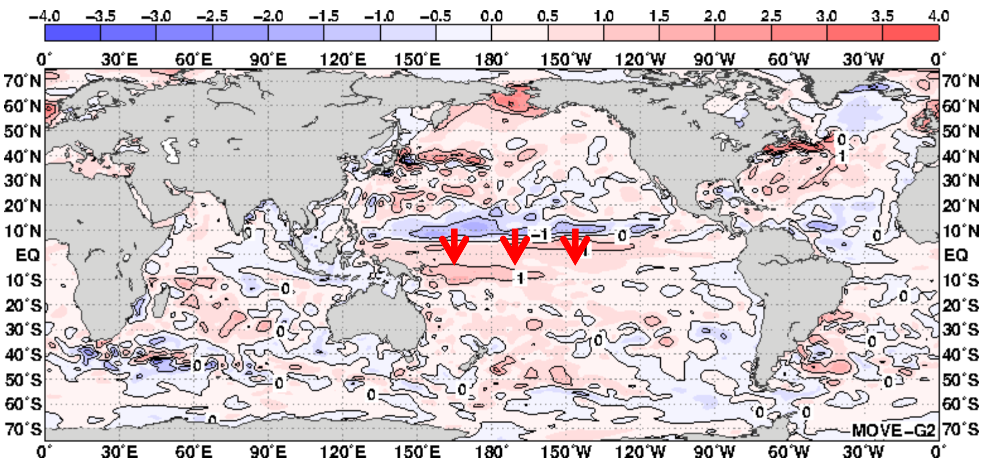
After the La Niña terminated in spring, OHC anomalies in the equatorial Pacific gradually increased due to Sverdrup transport induced by anomalous westerly surface winds in the off-equatorial North Pacific (*).

* This situation is consistent with the argument by Anderson and Perez (2015) that the SST meridional mode causes trade-wind charging mechanism.

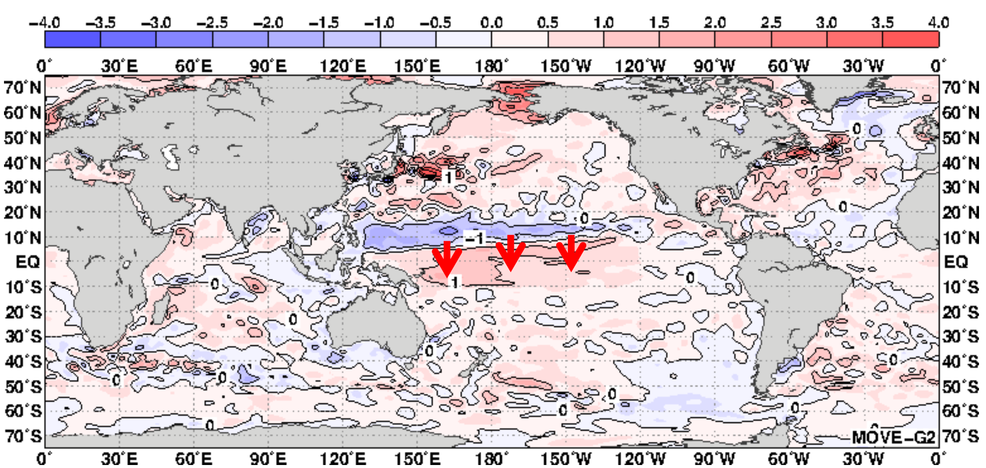
Mar. 2018



Jun. 2018



Sep. 2018

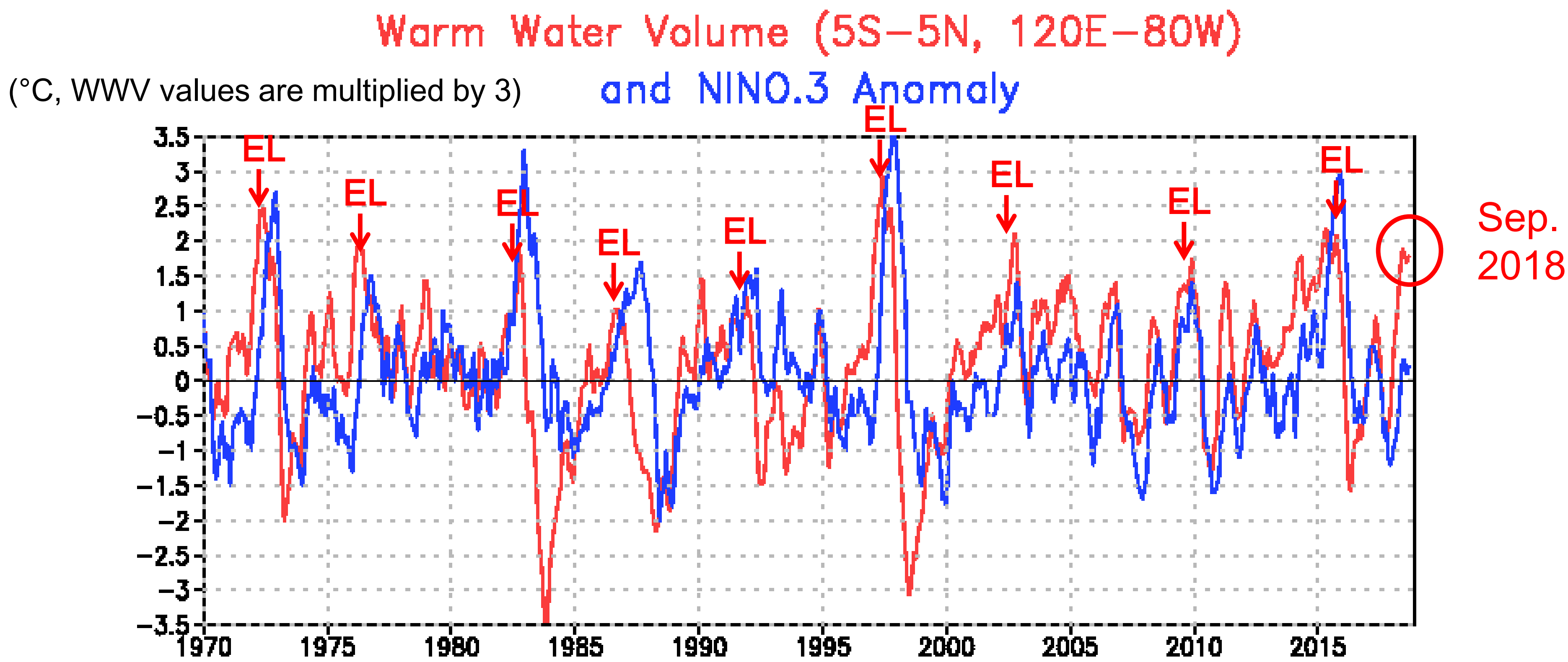


Monthly mean OHC anomalies for Mar., Jun., Sep. 2018. Base period for normal is 1981-2010.

The Warm Water Volume in the equatorial Pacific

The Warm Water Volume in the equatorial Pacific was as large as those observed before the onset of El Niño events in the past.

* The Warm Water Volume is defined as the averaged temperature over the upper 300 m from 5°S to 5°N and from 120°E to 80°W.



Sea Surface Temperature

In spring, SST anomalies were negative from the central to eastern equatorial Pacific (La Niña condition).

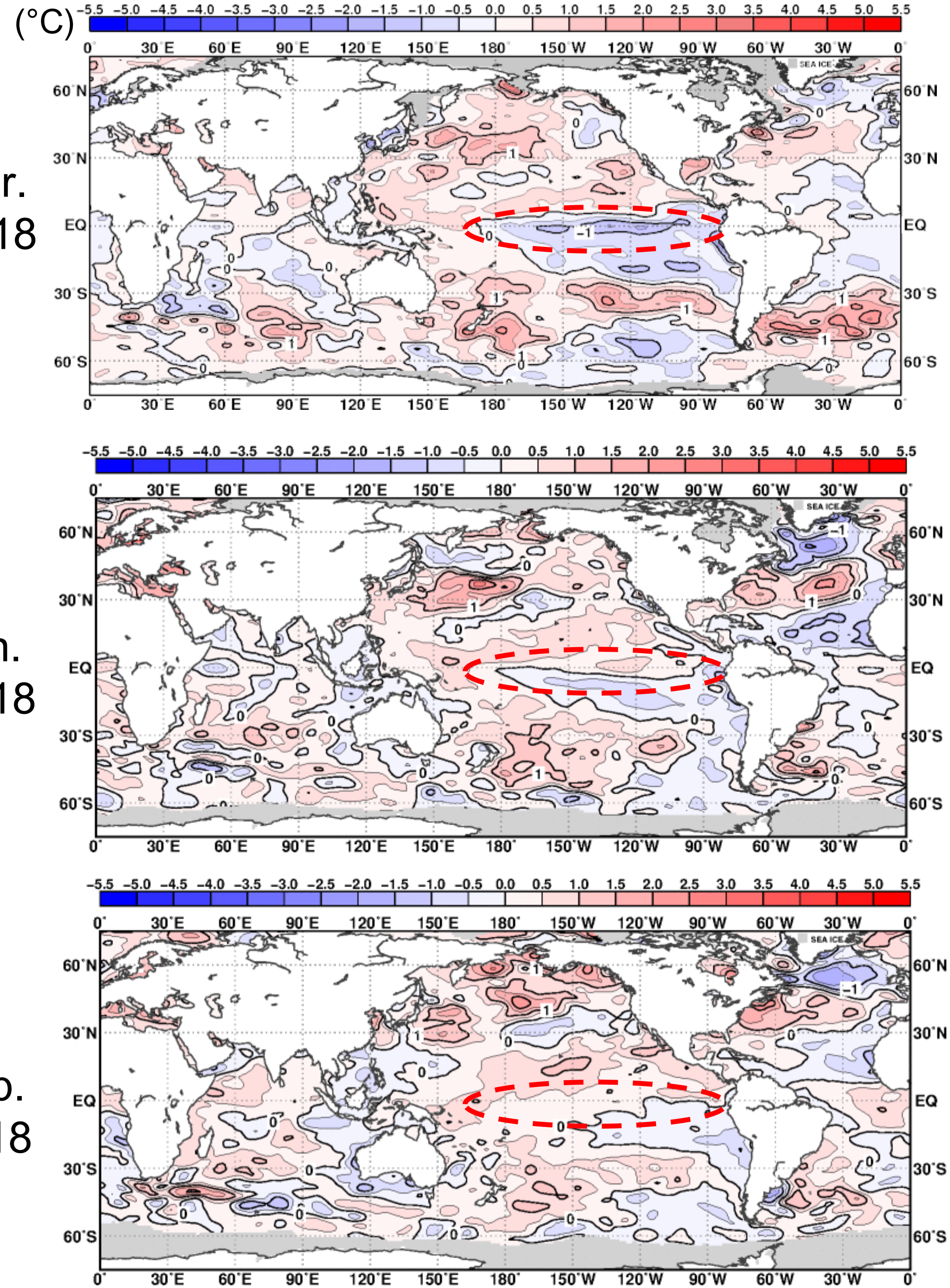
After the La Niña terminated in spring, SST anomalies in the central to eastern equatorial Pacific gradually increased.

* This situation is consistent with the argument by Min et al. (2017) that the SST meridional mode can be an important predictor of ENSO.

Mar. 2018

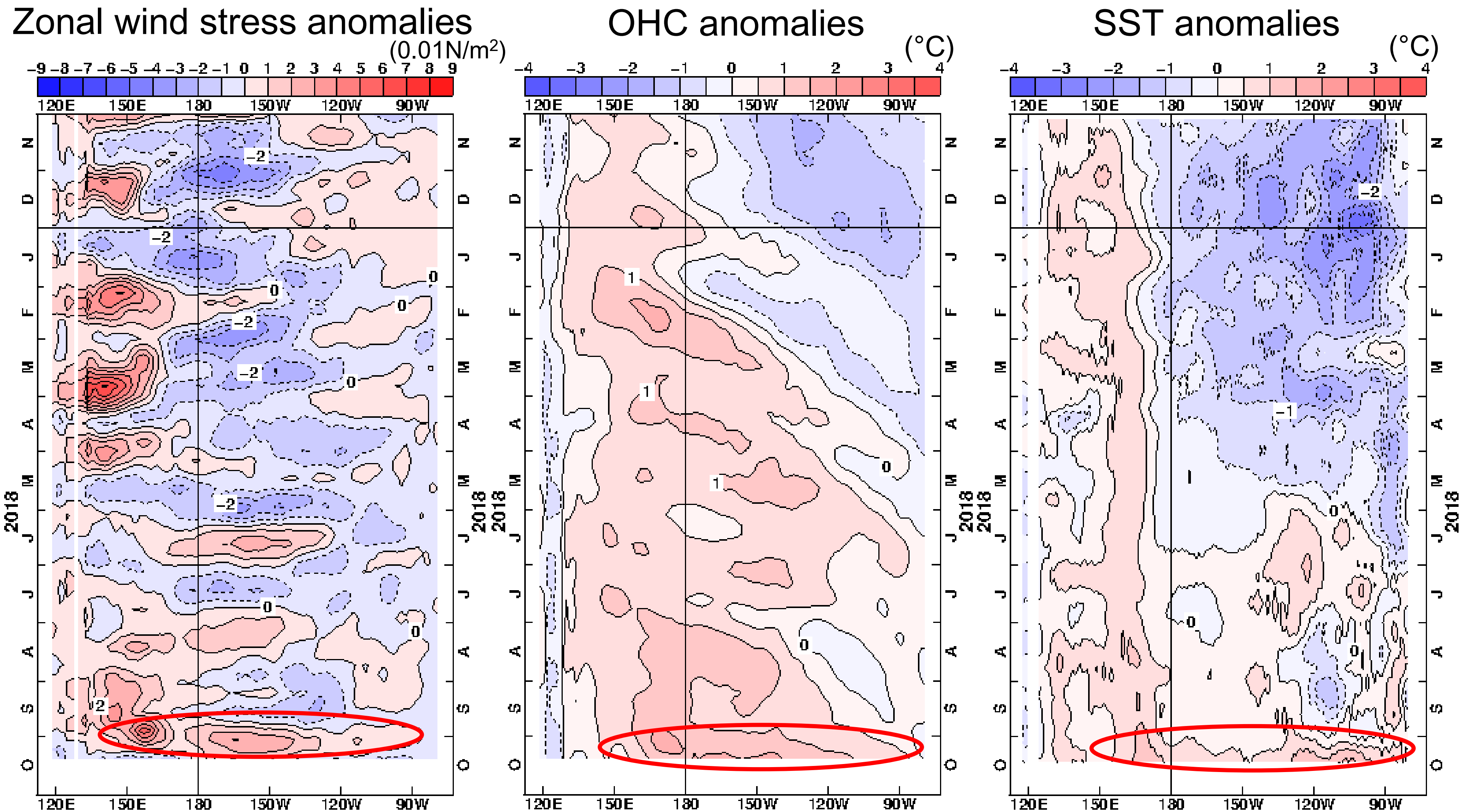
Jun. 2018

Sep. 2018



Monthly mean SST anomalies for Mar., Jun., Sep. 2018. Base period for normal is 1981-2010.

Time-longitude cross sections along the equatorial Pacific

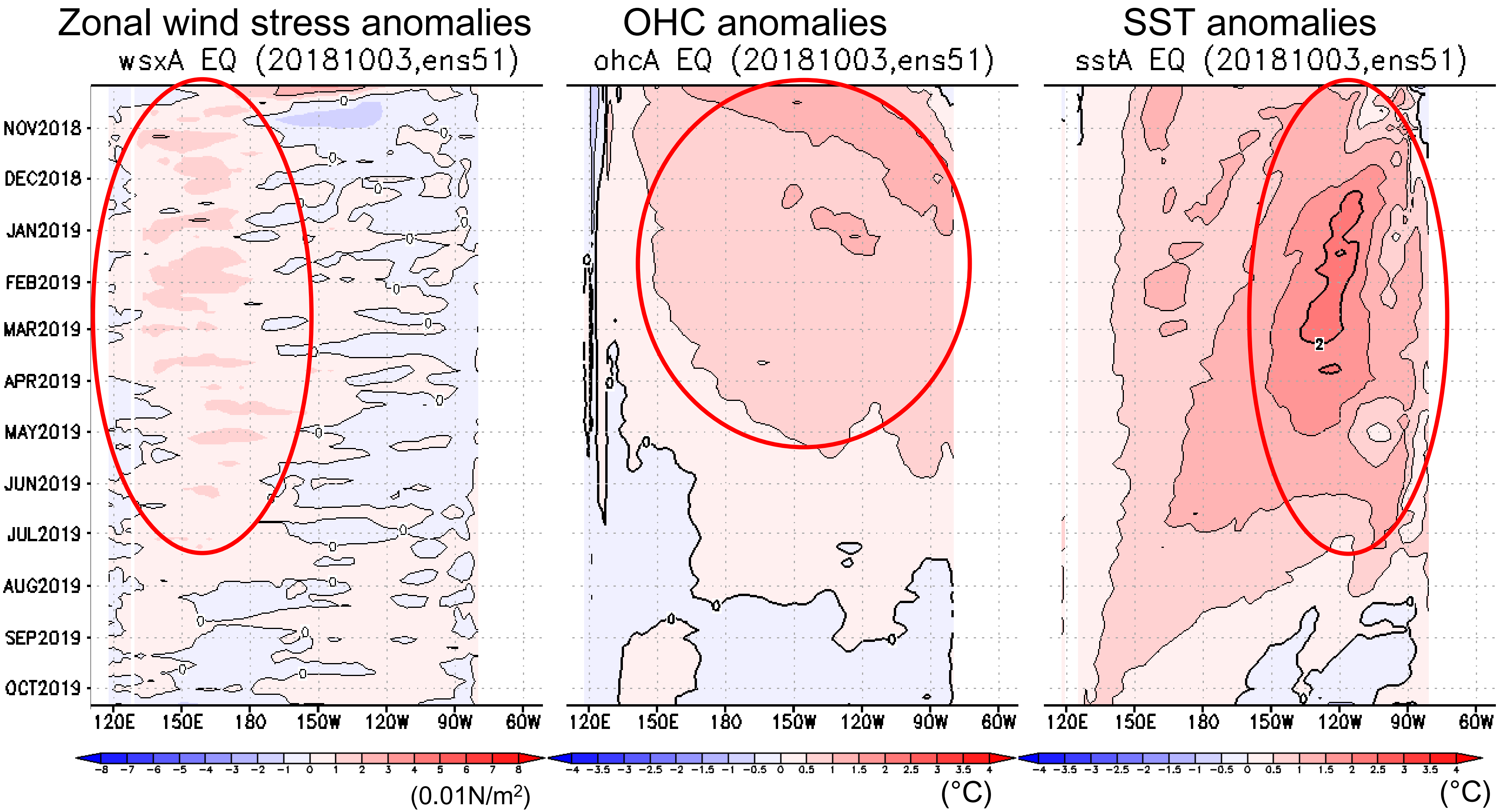


Until the middle of September 2018, anomalous westerly surface winds had been prevailing only in the western Pacific.

However, after that, anomalous westerly surface winds prevailed all over the equatorial Pacific (weakening of easterly trade winds), which induced positive OHC anomalies and positive SST anomalies all over the equatorial Pacific.

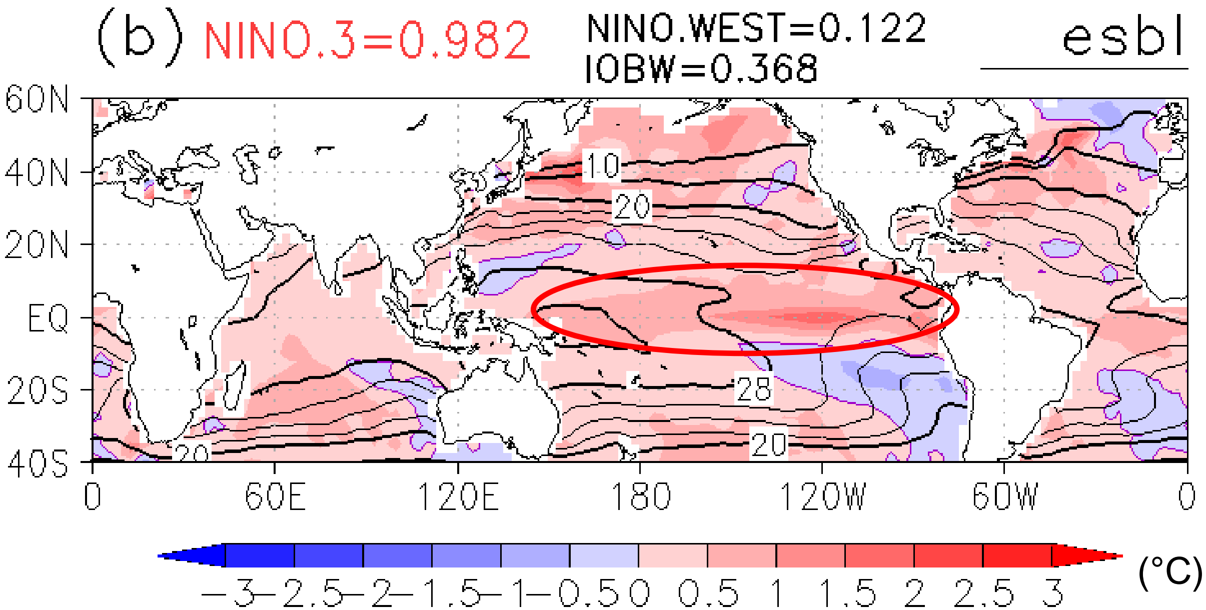
3. El Niño Outlook by JMA
(11 October 2018)

Time-longitude cross sections along the equatorial Pacific



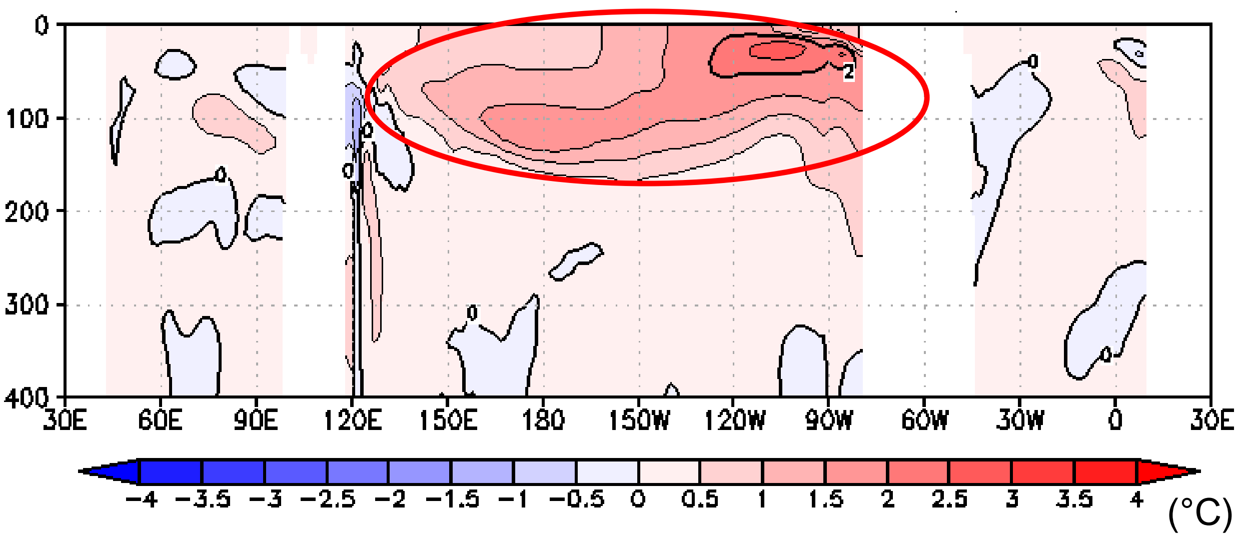
JMA's El Niño prediction model (CGCM) suggests that easterly trade winds will be weak in the western to central equatorial Pacific, positive OHC anomalies will be strong almost all over the equatorial Pacific, and the NINO.3 (5°S - 5°N, 150°W - 90°W) SST will be above normal from boreal autumn to spring.

SST and Subsurface seawater temperature for winter 2018/19



SST will be above normal from the central to eastern equatorial Pacific.

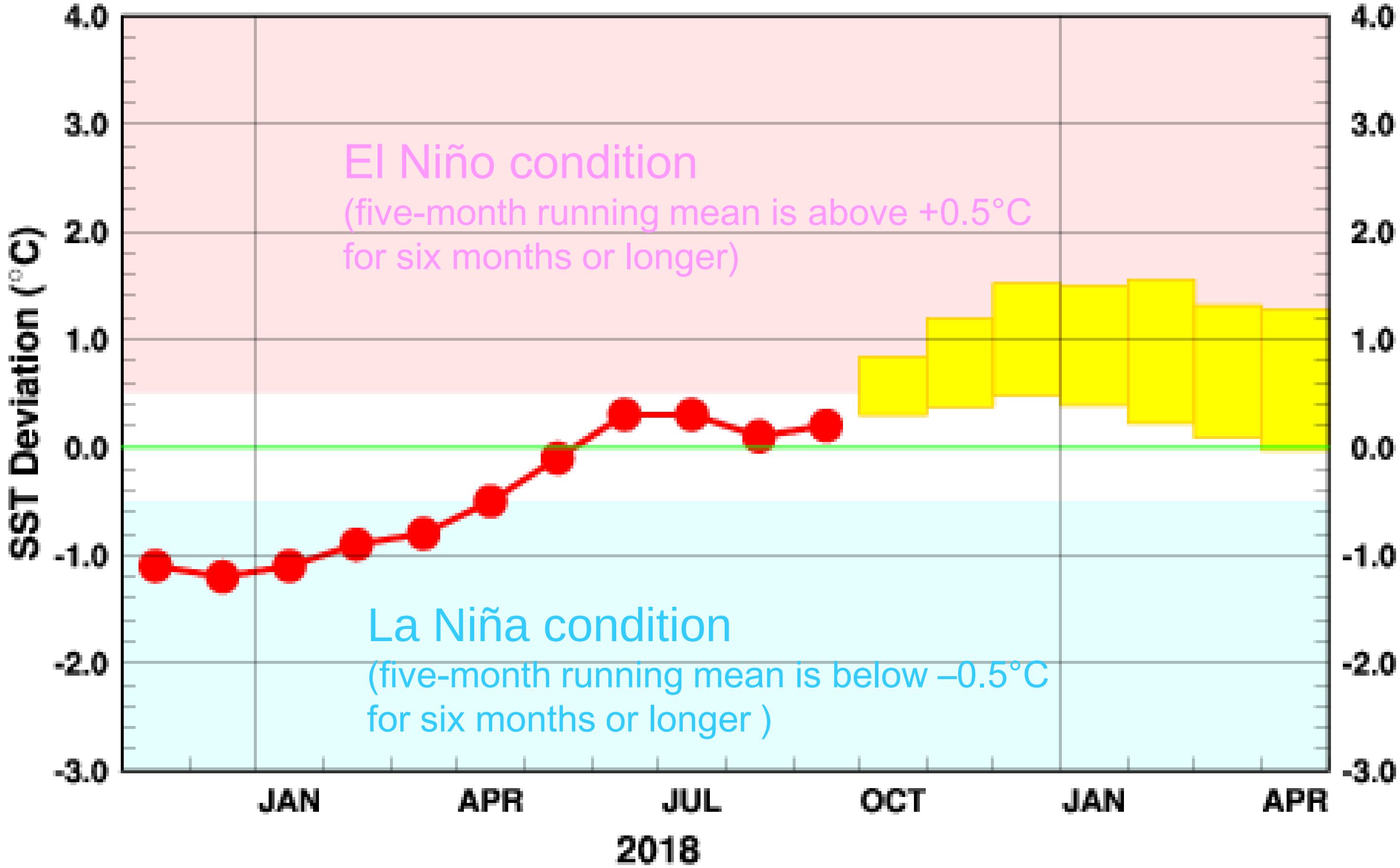
SST anomalies for winter 2018/19.



Subsurface seawater temperature will be also above normal in the equatorial Pacific.

Depth-longitude cross section of Subsurface seawater temperature anomalies along the equator for winter 2018/19.

El Niño Outlook



The SST deviation for NINO.3 predicted by JMA's El Niño prediction model (CGCM).
Red dots indicate observed values, and boxes indicate predictions.
Each box denotes the range where the value will be included with the probability of 70%.

In conclusion, the probability of occurrence of El Niño event by the end of boreal autumn is 70%.

Thank you!

JMA Mascot Character ‘Hare-run’
‘Hare’ means sunny weather in Japanese
‘Hare-ru’ means ‘it becomes sunny’.
‘Run-run’ means happiness feeling.