



JMA's Seasonal Prediction of South Asian Climate for June to August 2026

with an additional topic on
Characteristics of the Early Onset Monsoon and Its Impact on the Hottest Summer over Japan in 2025

YAMADA Ken, Japan Meteorological Agency

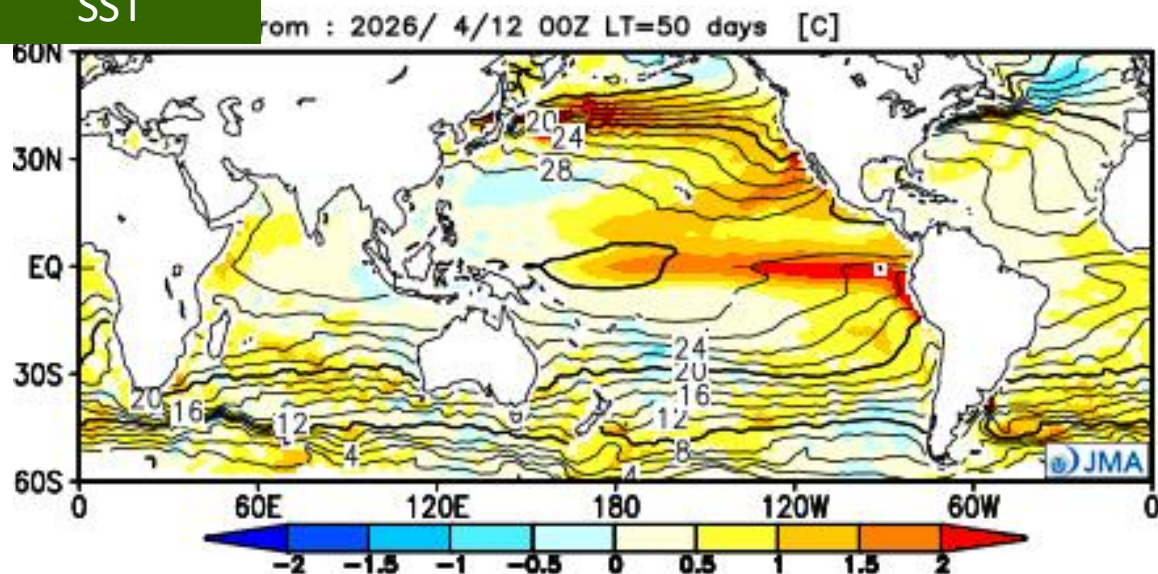
JMA's Seasonal Ensemble Prediction System (EPS)

		JMA/MRI-CPS3 (February 2022 - January 2026)	JMA/MRI-CPS4 (January 2026 -)
Horizontal resolution	Atmosphere	TL319 (approx. 55 km)	TL319 (approx. 55 km)
	Ocean	0.25 degree (longitude) × 0.25 degree (latitude)	0.25 degree (longitude) × 0.25 degree (latitude)
Vertical resolution	Atmosphere	100 layers with top at 0.01 hPa	128 layers with top at 0.01 hPa
	Ocean	60 layers	60 layers
Initial conditions	Atmosphere	Global Analysis (GA)	GA and Ozone Analysis
	Land	Offline Land Analysis	Offline Land Analysis (modified)
	Ocean/Sea ice	MOVE/MRI.COM-G3	MOVE/MRI.COM-G3
Initial perturbation	Atmosphere	Breeding of Growing Modes (BGMs)	Singular Vectors (SVs) + Local Ensemble Transform Kalman Filter (LETKF)
	Ocean	Analysis uncertainty pattern	Analysis uncertainty pattern
Model perturbation	Atmosphere	Stochastic Perturbation of Physics Tendency (SPPT)	SPPT and Stochastic Humidity Profile for Convective parametrization (SHPC)
Ensemble size		5 members / day for 6-month prediction (51 members for statistical forecasts by a LAF method)	5 members / day for 6-month prediction (85 members for statistical forecasts by a LAF method) 50 members / week for 1-month prediction

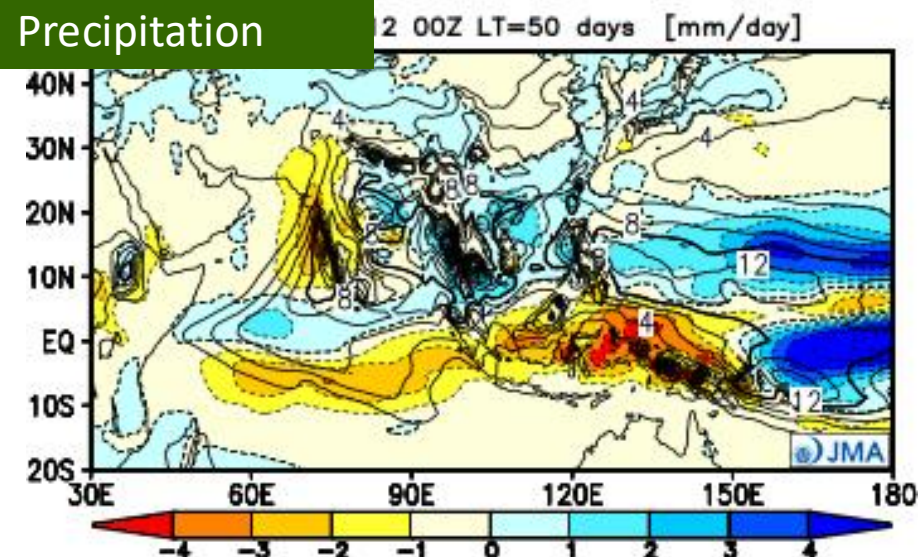
SST, Precipitation and T2m for June-July-August (JJA) 2026

85 ensemble member mean (Initial date: 12 April 2026)

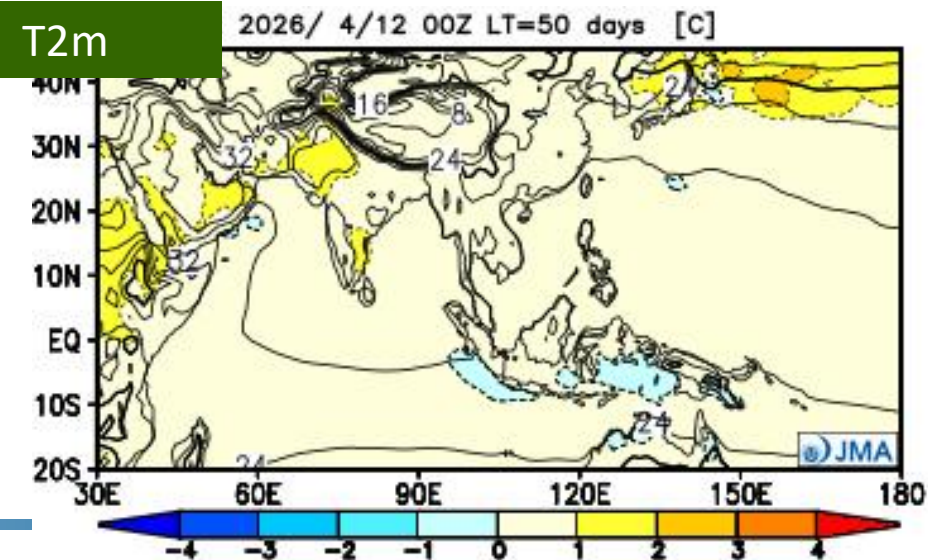
SST



Precipitation



T2m

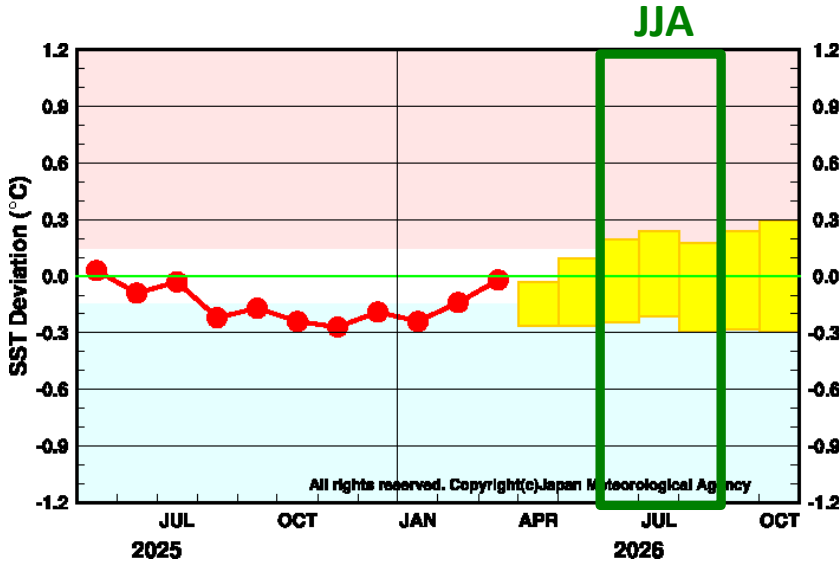


- ✓ **El Niño conditions** are predicted, including **positive SST anomalies** over the eastern and central equatorial Pacific.
- ✓ **Below-normal precipitation** is predicted over the Maritime Continent.

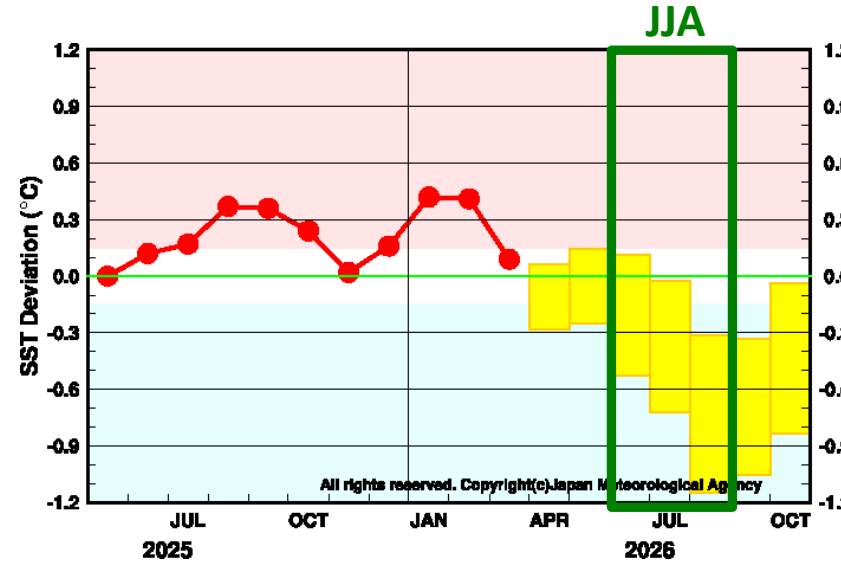
SST Indices for JJA 2026

El Niño Outlook
updated on 10 April 2026

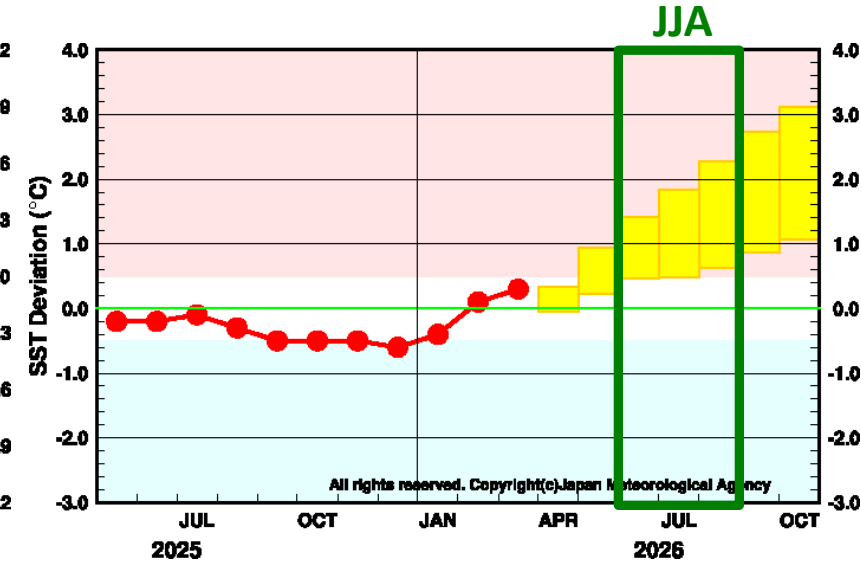
IOBW



NINO.WEST



NINO.3



Red dots indicate observed values, and yellow boxes indicate predictions. Each box denotes the range where the value will be included with the probability of 70%.

IOBW is likely to be **near or below normal** until boreal summer.

NINO.WEST will gradually decrease and is likely to be **below normal** in boreal summer.

NINO.3 is predicted to be **above normal** by boreal summer. It is likely that **El Niño conditions** will develop by boreal summer.

Prediction Skill for JJA from April (Anomaly Correlation, 1991-2020 Re-forecast)

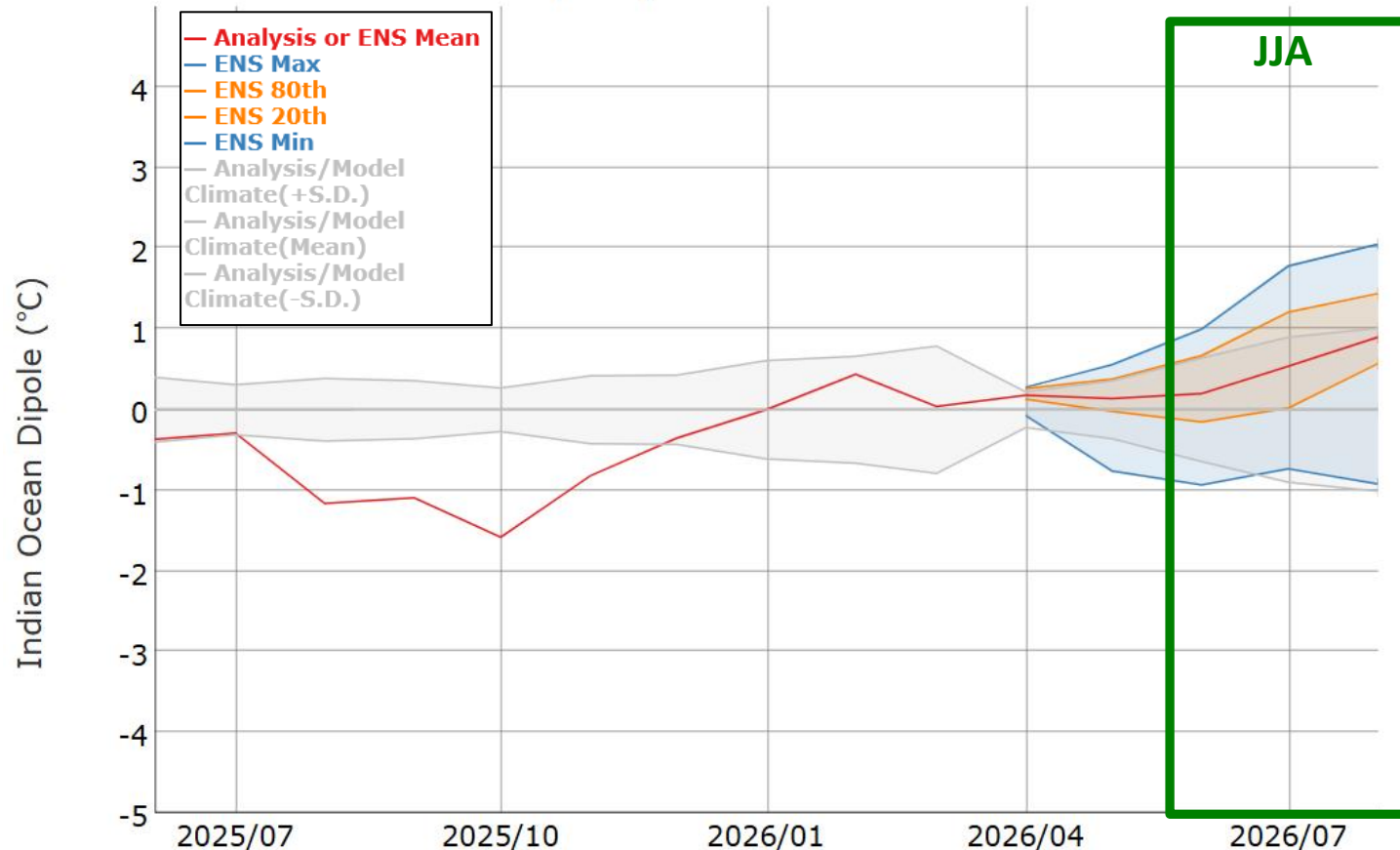
IOBW **ACC=0.72**

NINO.WEST **ACC=0.79**

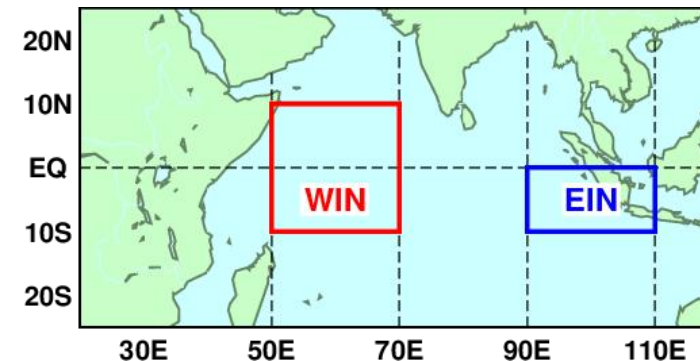
NINO.3 **ACC=0.71**

IOD Index for JJA 2026

Indian Ocean Dipole, Issued month : 202604

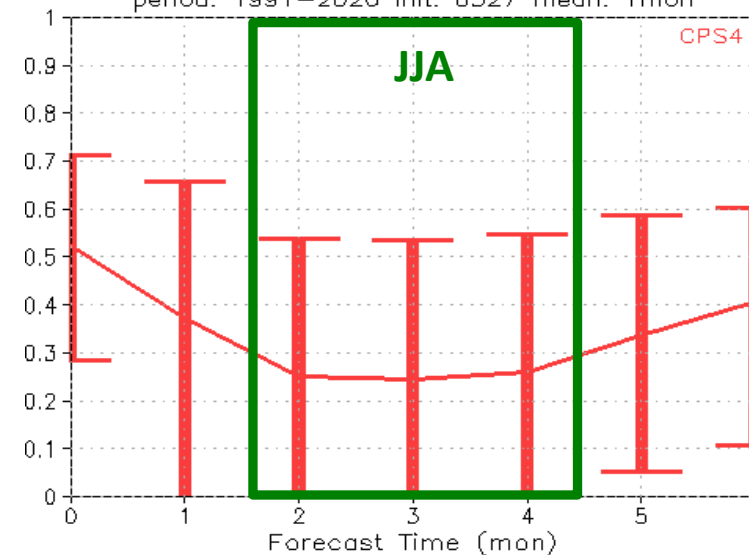


IOD: WIN - EIN



ACC of DMI (issued month: April)

SST ACC DMI(50E-70E,10S-10N-90E-110E,10S-0)
period: 1991-2020 init: 0327 mean: 1mon

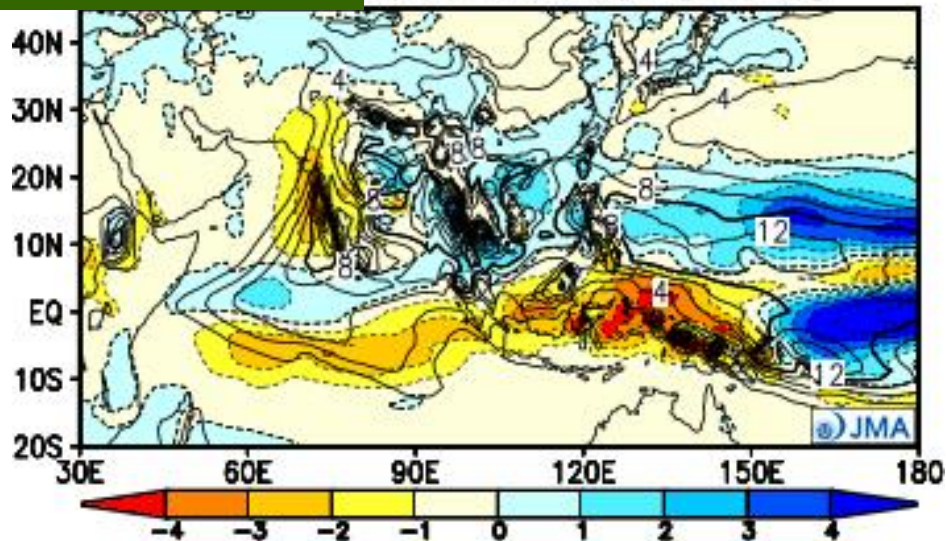


✓ **Neutral or positive values** are predicted during boreal summer, with predictive uncertainty.

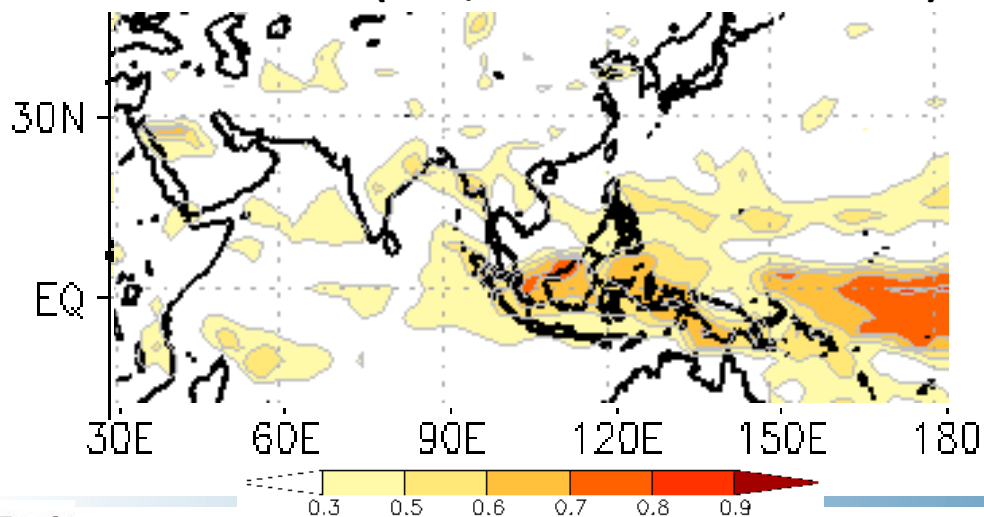
Precipitation for JJA 2026

Precipitation

12 00Z LT=50 days [mm/day]



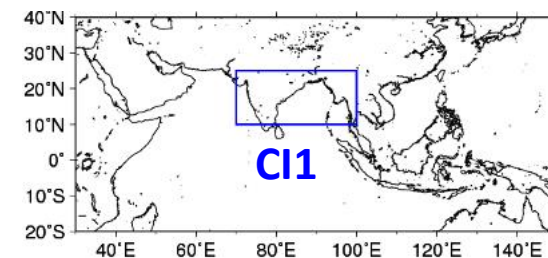
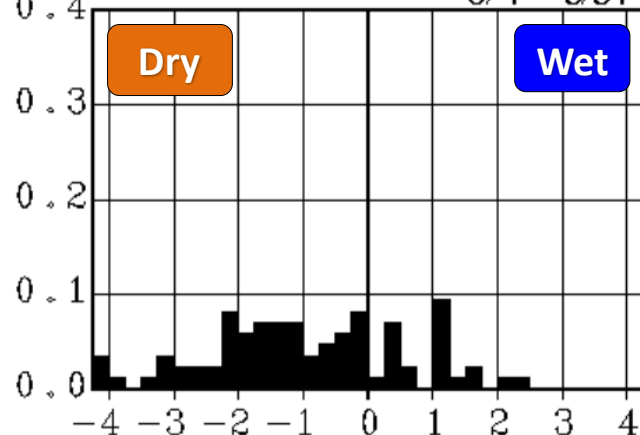
Prediction Skill (ACC, 1991-2020 re-forecast)



CI1 Region

(70E-100E, 10N-25N)

6/1 - 8/31

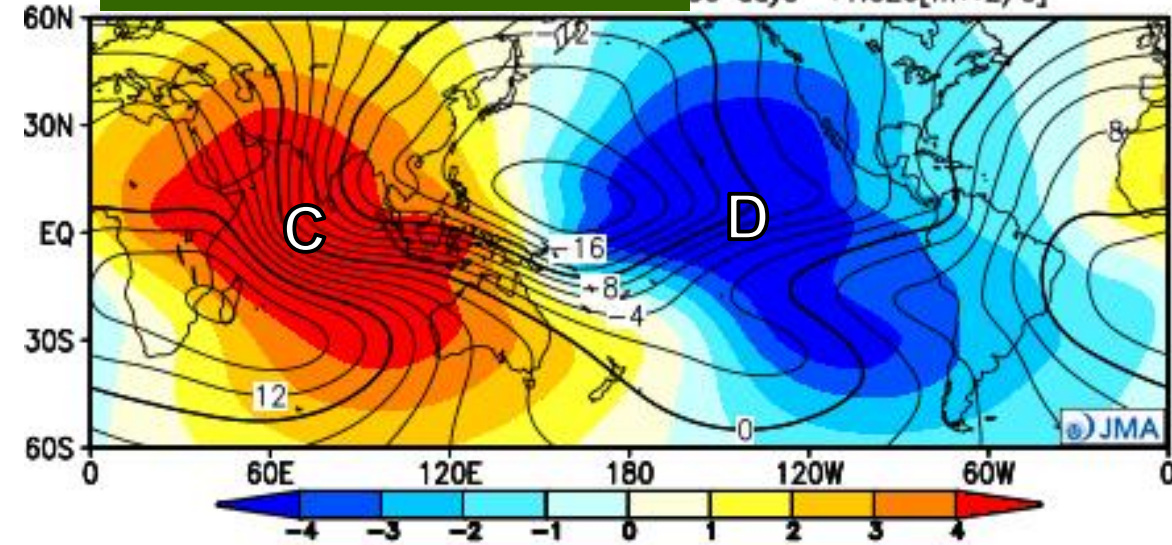


- ✓ **Below-normal precipitation** is predicted from the Arabian Sea to central South Asia.
- ✓ **Above-normal precipitation** is predicted from the northern to the eastern part of the Bay of Bengal.

Velocity Potential and Stream Function for JJA 2026

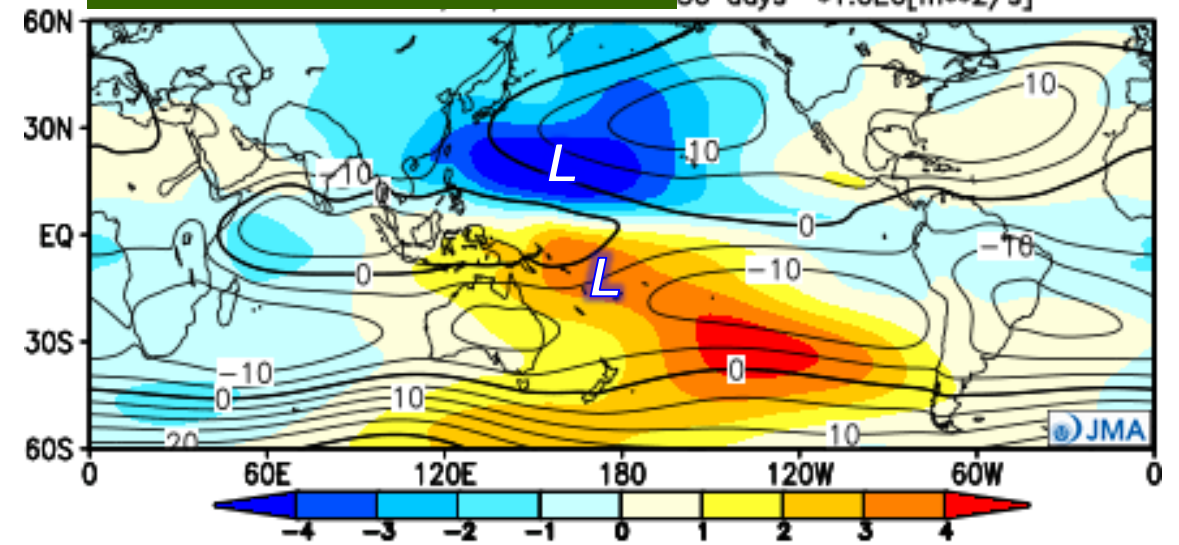
200-hPa Velocity Potential

50 days *1.0E6[m**2/s]



850-hPa Stream Function

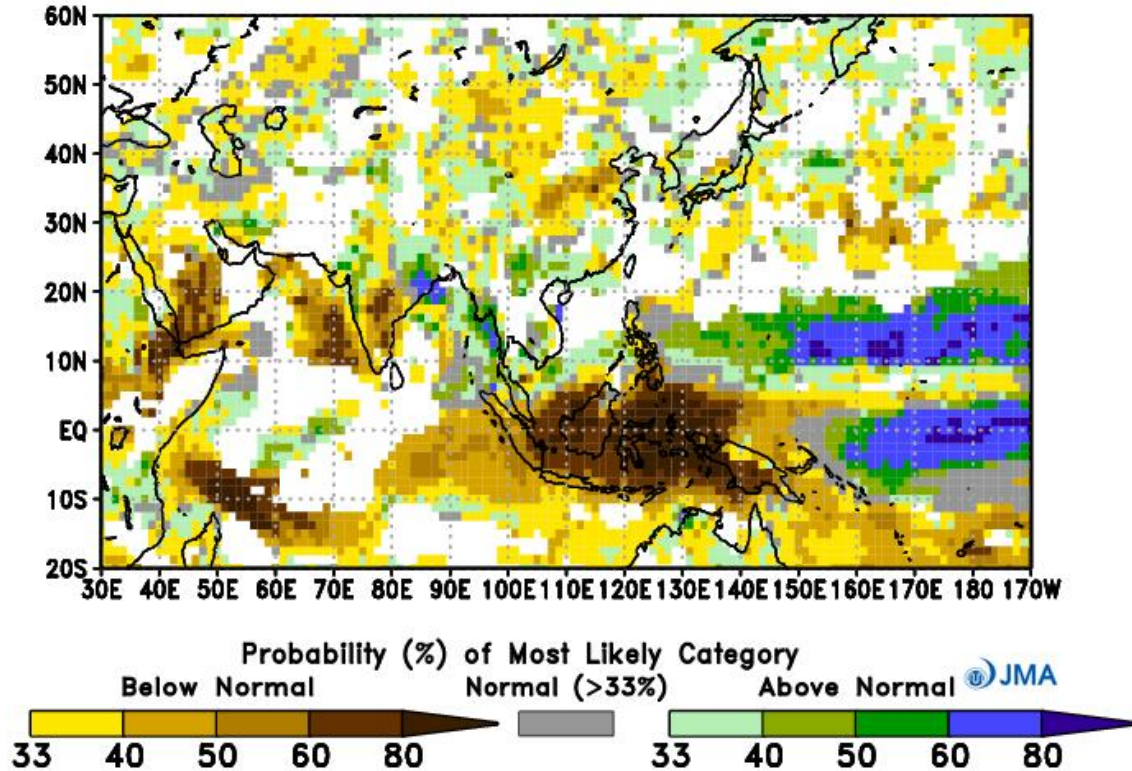
50 days *1.0E6[m**2/s]



- ✓ In the upper troposphere, large-scale **divergence anomalies** are predicted over the central to eastern tropical Pacific, while large-scale **convergence anomalies** are predicted from the Indian Ocean to the Maritime Continent.
- ✓ In the lower troposphere, **cyclonic circulation anomalies** straddling the equator are predicted over the western tropical Pacific.

Probabilistic Forecast for JJA 2026

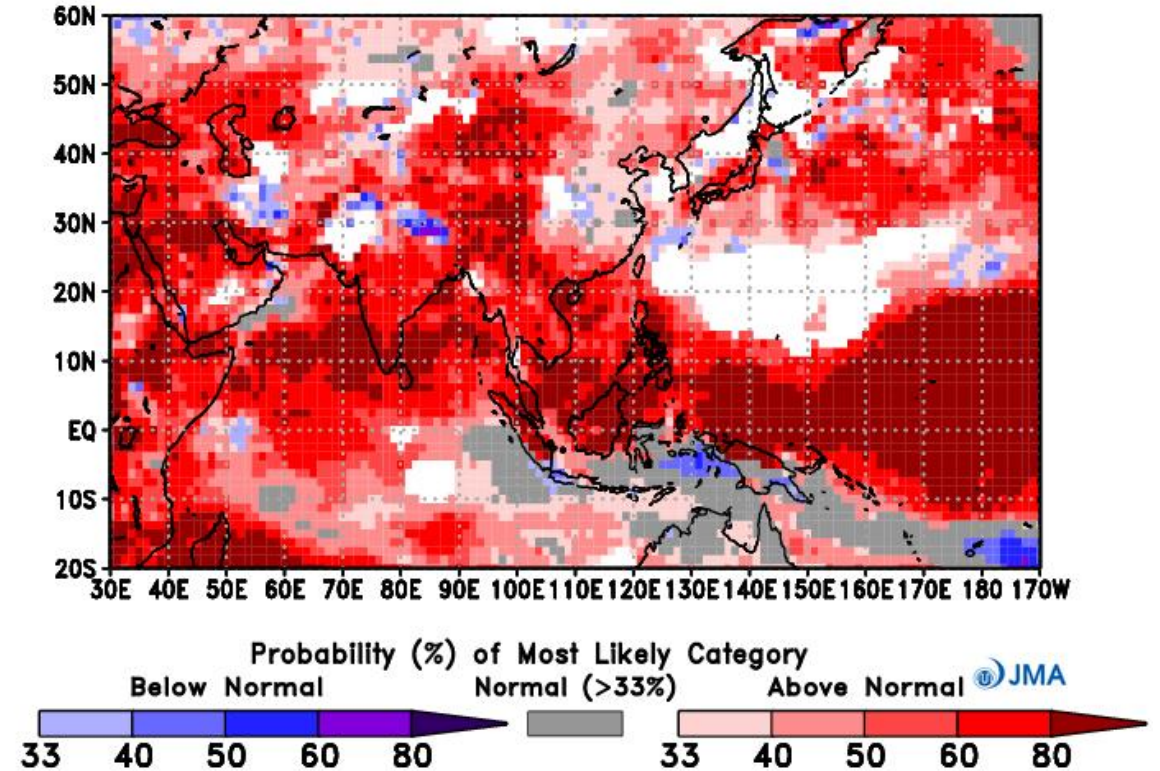
JMA Seasonal Forecast (Forecast Initial month is 04 2026)
Most likely category of Precipitation for JJA 2026



➤ Precipitation

A high probability of **below-normal precipitation** is predicted from the Arabian Sea to central South Asia.

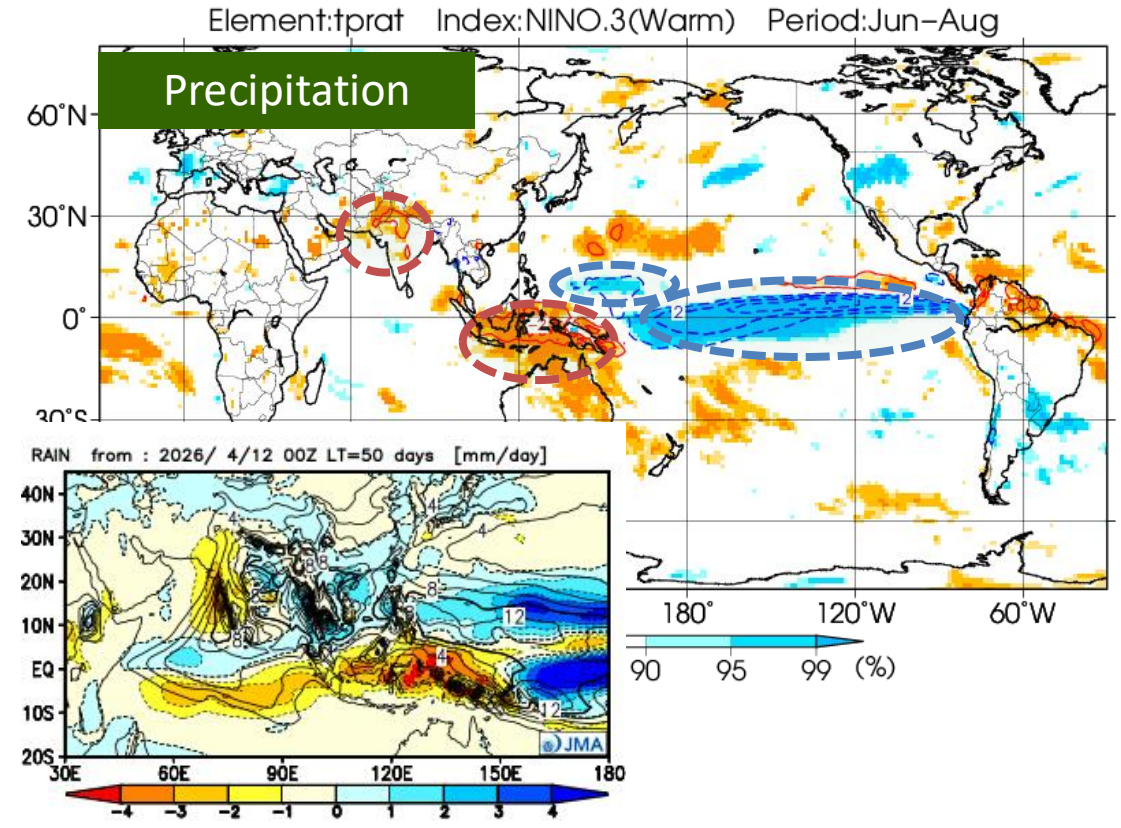
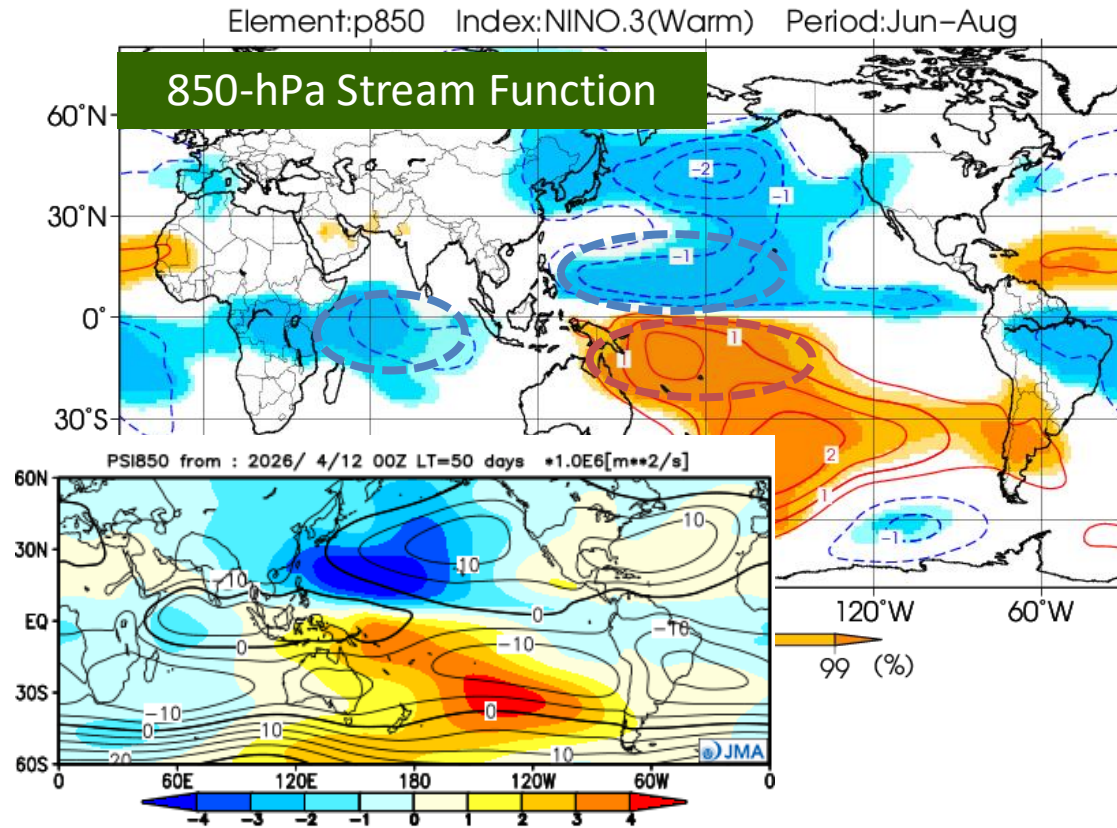
JMA Seasonal Forecast (Forecast Initial month is 04 2026)
Most likely category of Surface Temperature for JJA 2026



➤ Temperature

A high probability of **above normal temperature** is predicted in many parts of South Asia.

Composite map for El Niño based on JRA-3Q



✓ These composite maps are available on TCC Website!

https://ds.data.jma.go.jp/tcc/tcc/products/clisys/enso_statistics/index.html

3-month mean (JJA) composite of 850-hPa stream function, total precipitation rate anomalies in the El Niño phase.
 Contours show composite anomalies at intervals of $0.5 \times 10^6 \text{ m}^2/\text{s}$, 1 mm/day respectively.
 Shading indicates the confidence level.
 The base period for composite analysis is 1948 – 2021.

Summary for JJA 2026

Based on the JMA's seasonal EPS,

(Outlook for Oceanic conditions)

- It is likely that **El Niño conditions** will develop by boreal summer.

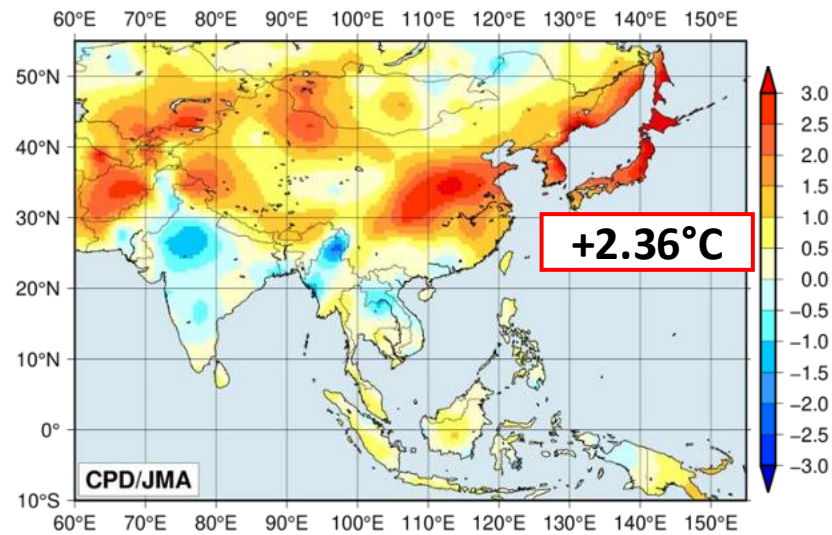
(Outlook for Precipitation in South Asia)

- **Below-normal precipitation** is predicted from the Arabian Sea to central South Asia.

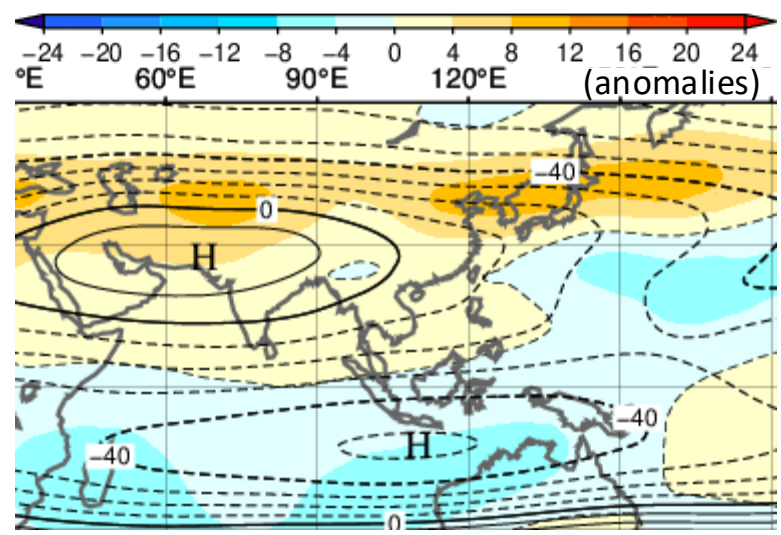
(Outlook for Temperature in South Asia)

- **Above-normal temperature** is predicted in many parts of South Asia.

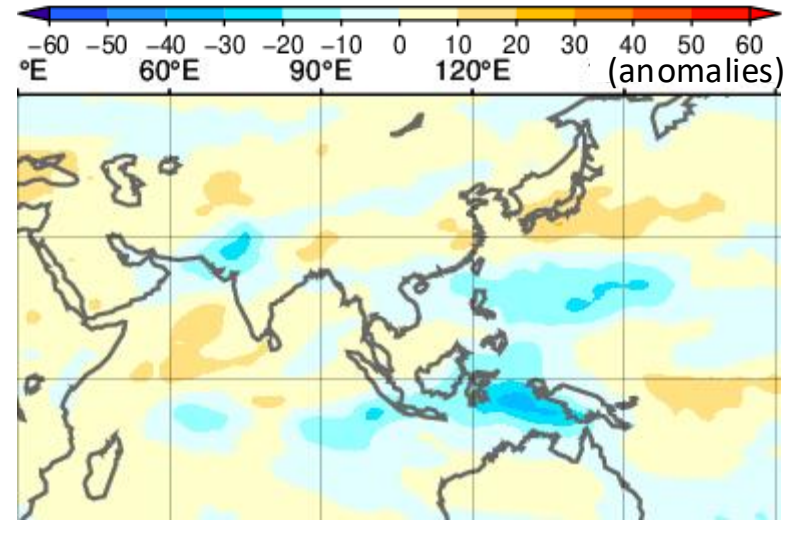
Record-breaking hot summer in Japan against the backdrop of an active monsoon in 2025



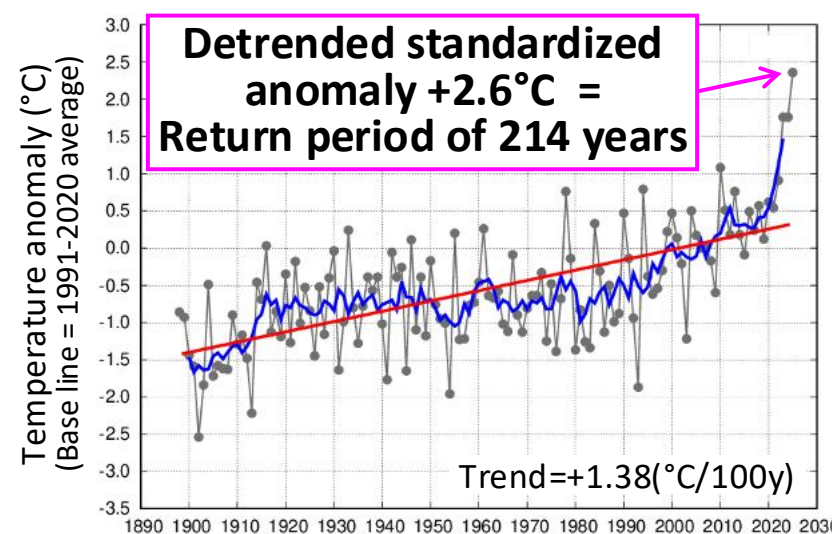
Summer mean temperature anomalies



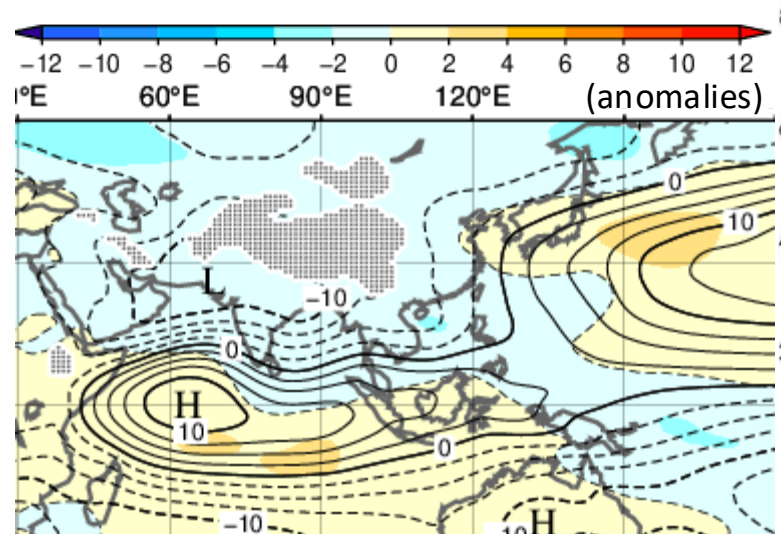
Summer mean 200hPa stream function



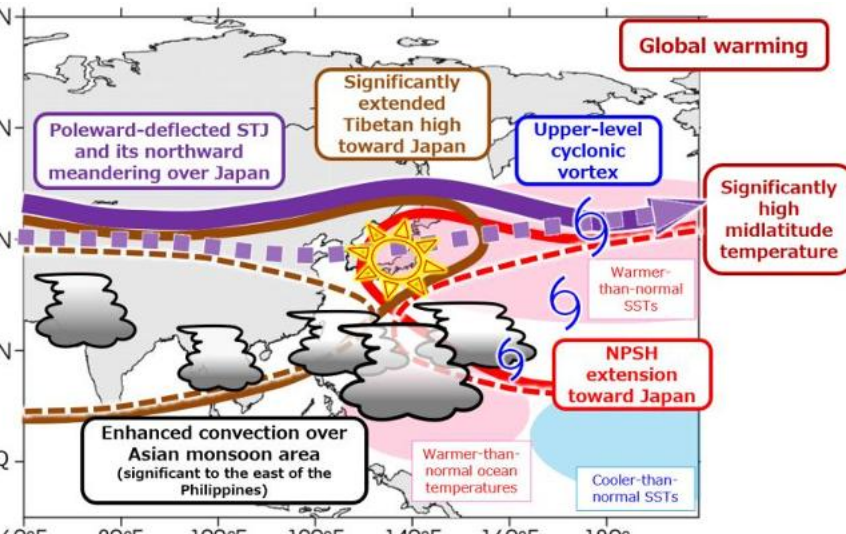
Summer mean OLR anomalies



Japan average temperature anomalies in summer

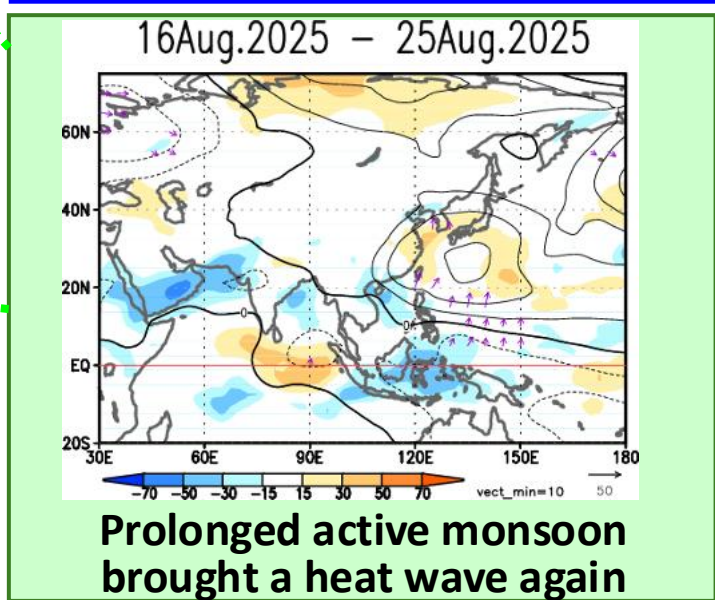
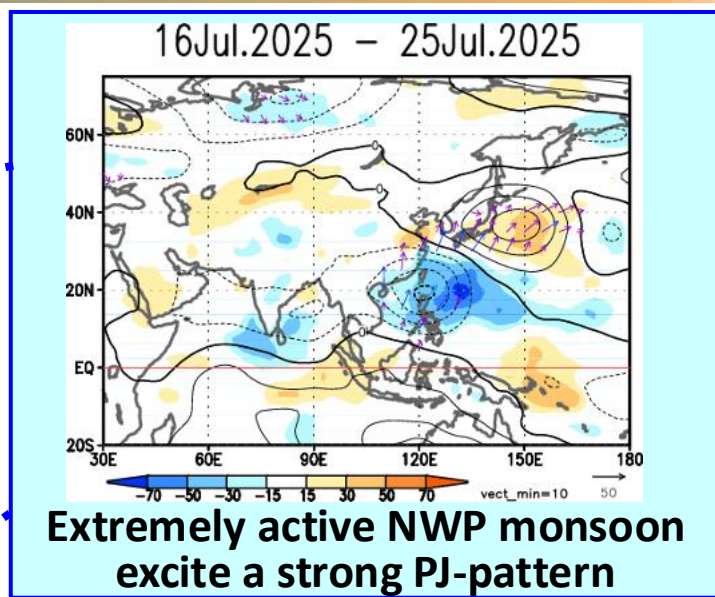
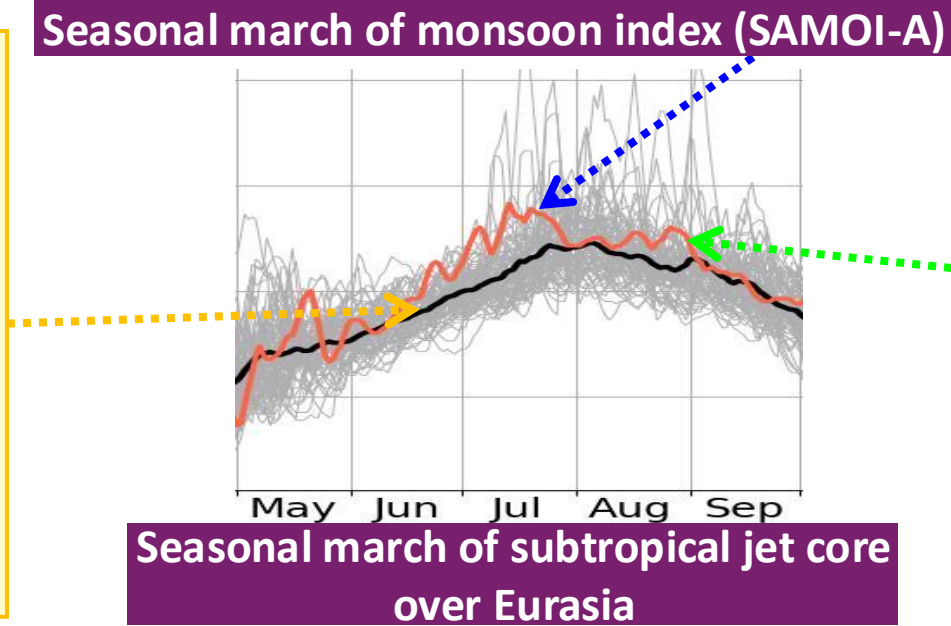
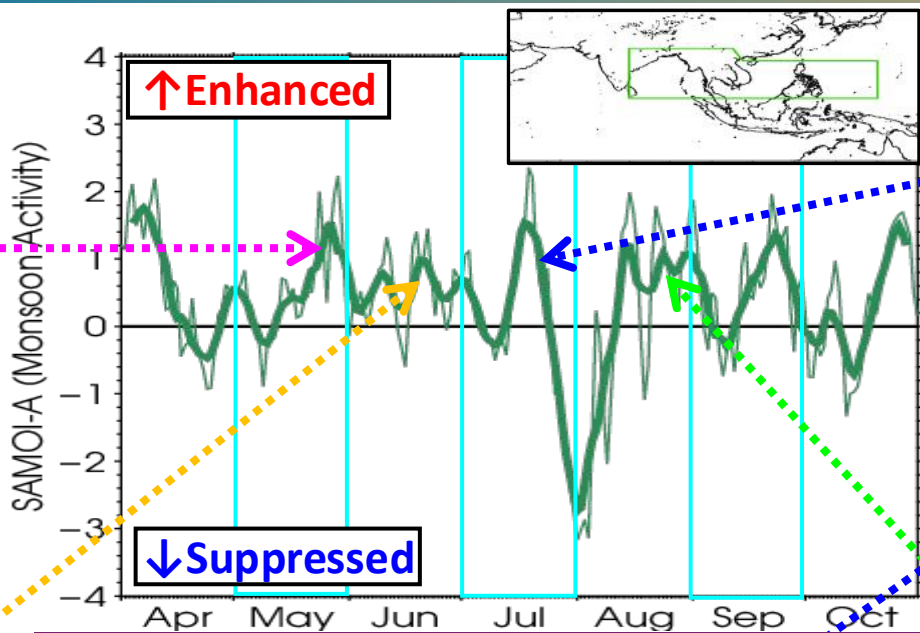
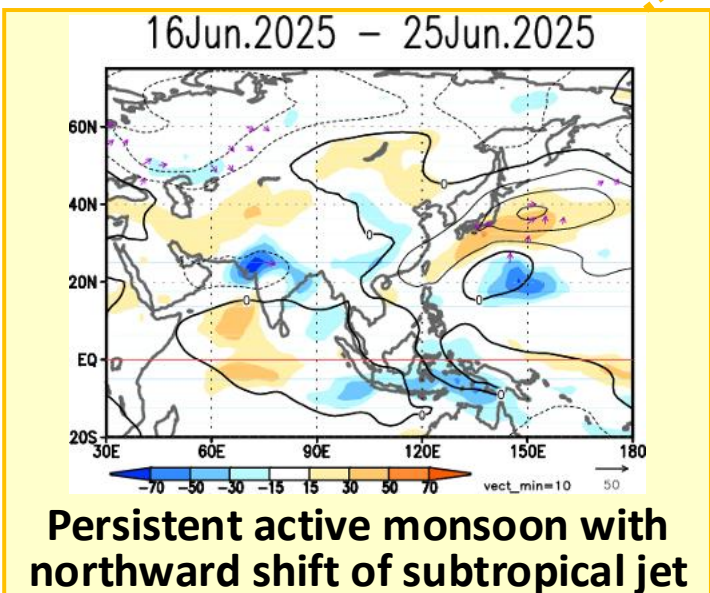
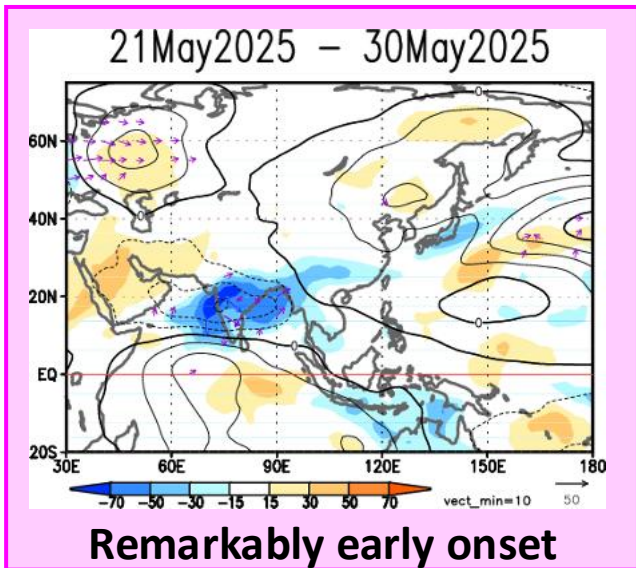


Summer mean 850hPa stream function



Schematic diagram of the summer 2025

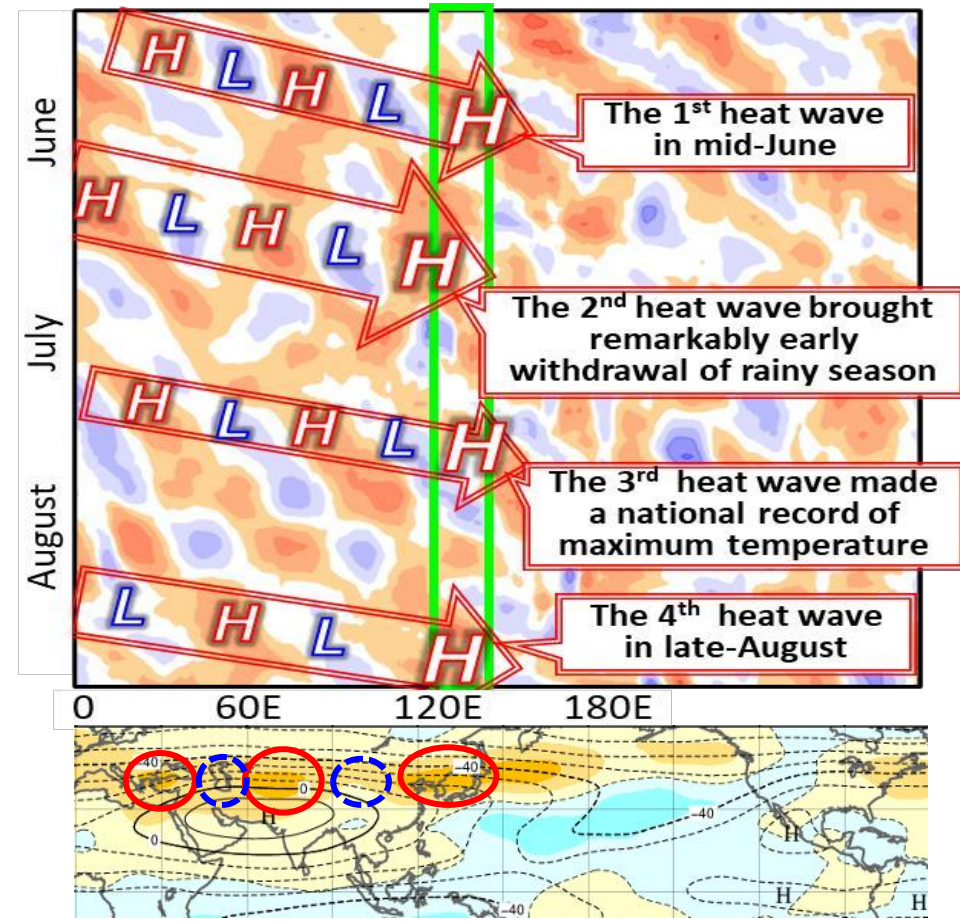
Early onset and persistent active monsoon with northward shift of subtropical jet in 2025



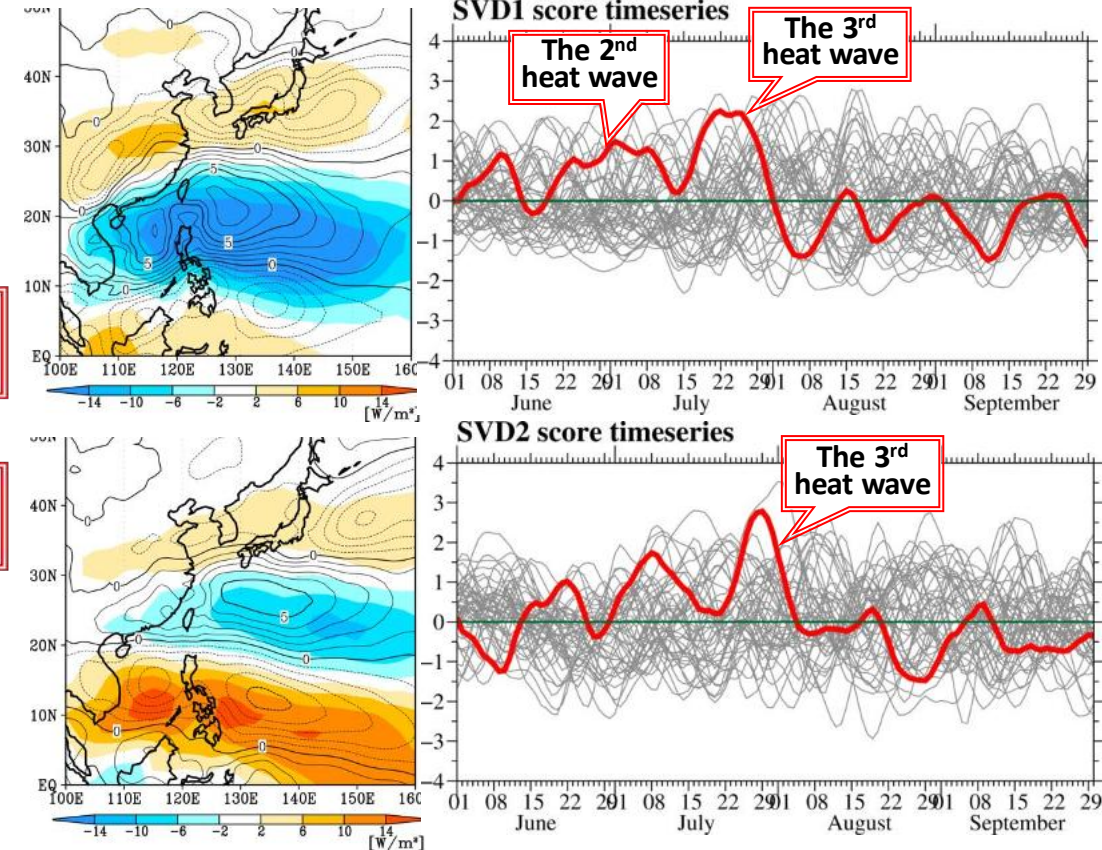
Two major drivers of heat waves in Japan in 2025

Prolonged active monsoon
 ⇒ Continuous northward shift of STJ
 ⇒ Silk-road teleconnection (+phase)

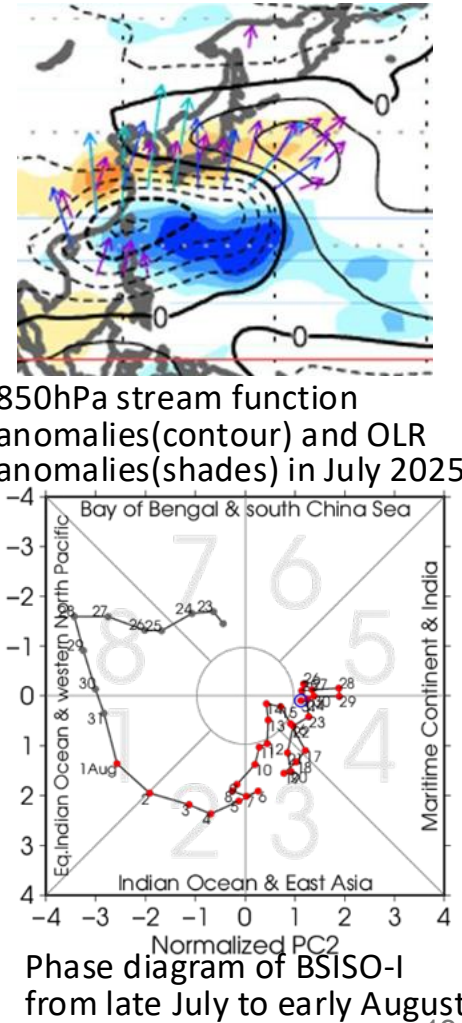
Prolonged active monsoon
 ⇒ Large amplified BSISO-I event over NW-Pacific
 ⇒ Strong excitation of Pacific-Japan teleconnection



Upper: Time-Longitude cross section of 200hPa vorticity along 30-60N
 Lower: JJA mean 200hPa stream function and anomalies



Left: SVD1(upper) and SVD2(lower) pattern calculating from 850hPa vorticity(contour) and OLR(shades)
 Right: Timeseries of SVD1(upper) and SVD2(lower) scores for each year during summer



850hPa stream function anomalies(contour) and OLR anomalies(shades) in July 2025
 Phase diagram of BSISO-I from late July to early August

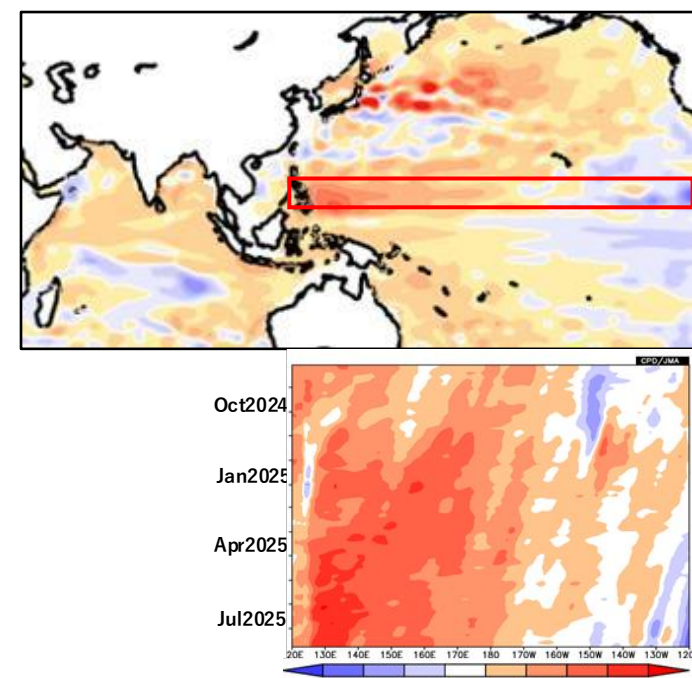
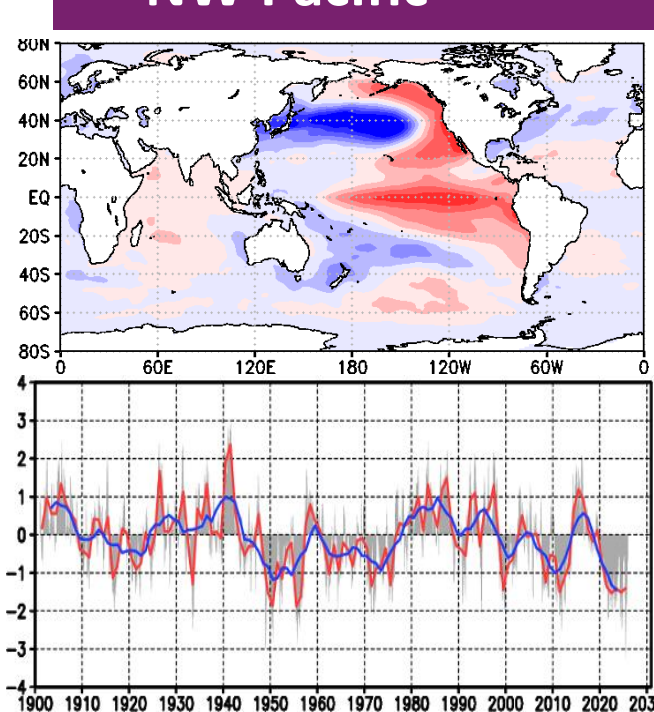
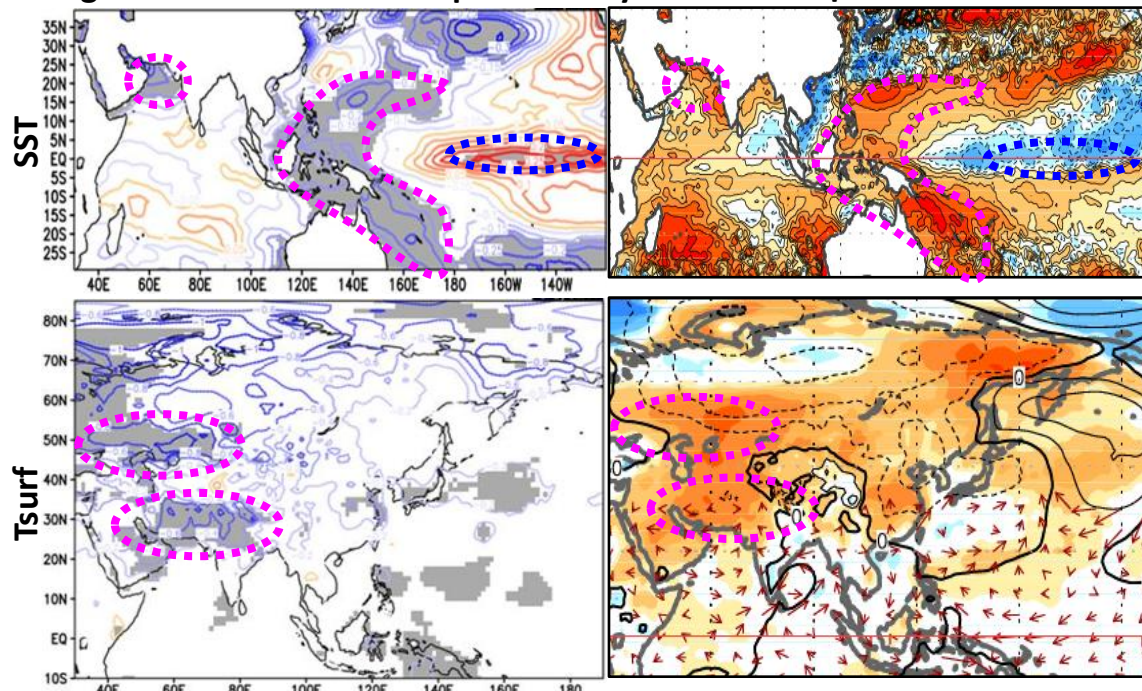
What factors seem to bring about an early onset of monsoon and a prolonged active monsoon in 2025?

La Niña like SST anomaly pattern and High surface temperature over West Asia in April
 ⇒ Enhanced convection in CI1 in May
 ⇒ Early onset of monsoon

Extremely negative phase of PDO and La Niña like SST anomaly pattern
 ⇒ The significant accumulation of warm water prevented SST from cooling in the NW Pacific
 ⇒ Persistently enhanced convection over the NW Pacific

Lag correlation between Apr. and May

April 2025



Upper: The SST anomaly pattern of Pacific Decadal Oscillation (PDO)
 Lower: Time sequence of PDO index

Upper: Ocean Heat Content (OHC) anomalies in summer 2025
 Lower: Time-Longitude cross section of OHC anomalies

Left: Lag correlation coefficient between Indian monsoon activity (CI1) in May and SST (upper) or Tsurf (lower) in April. Significant areas are shaded in grays.
 Right: SST anomalies (upper) and surface temperature anomalies (lower) in April 2025.

Thank You !!

Information on Tokyo Climate Center

Mailing Address : Tokyo Climate Center
Climate Prediction Division
Atmosphere and Ocean Department
Japan Meteorological Agency
3-6-9 Toranomom, Minato City, Tokyo 105-8431
Japan

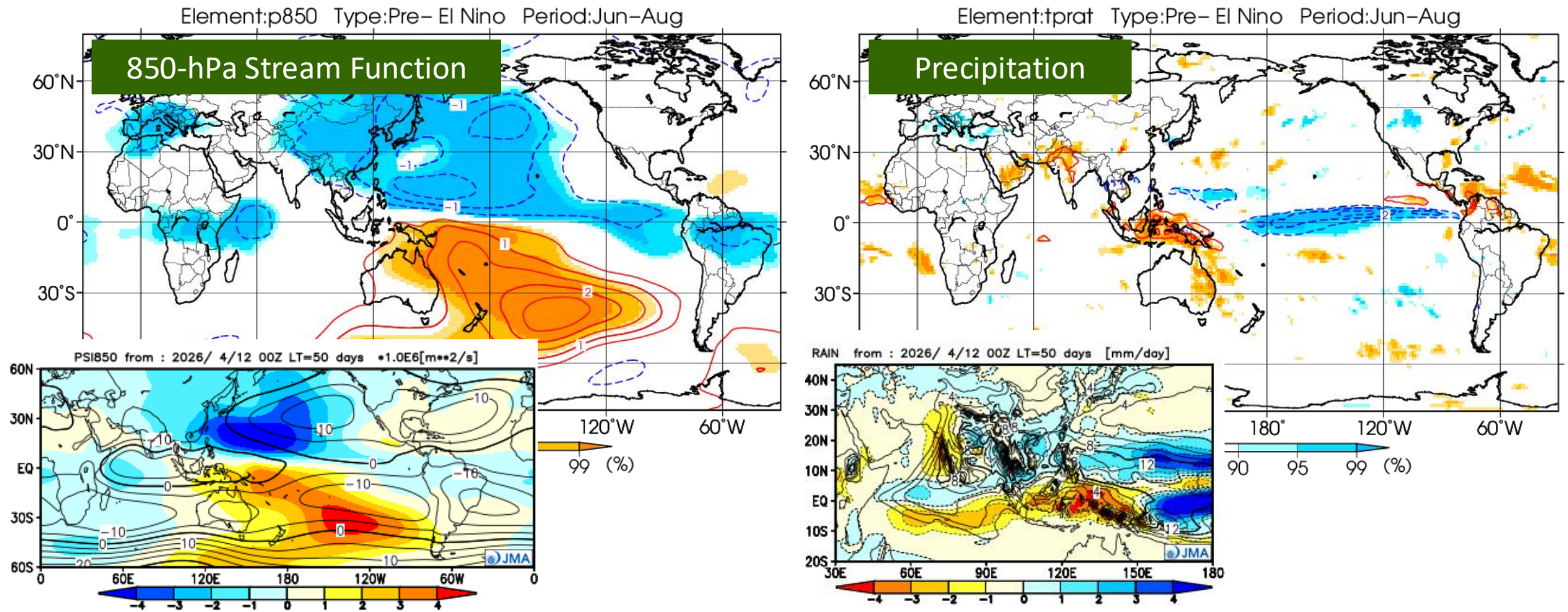
Web Site : <https://ds.data.jma.go.jp/tcc/tcc/index.html>

E-mail : tcc@met.kishou.go.jp



Backup Slide

Composite map for Pre-El Niño based on JRA-3Q



3-month mean (JJA) composite of 850-hPa stream function, total precipitation rate anomalies in the pre-El Niño phase.

Contours show composite anomalies at intervals of 0.5×10^6 m²/s, 1 mm/day respectively.

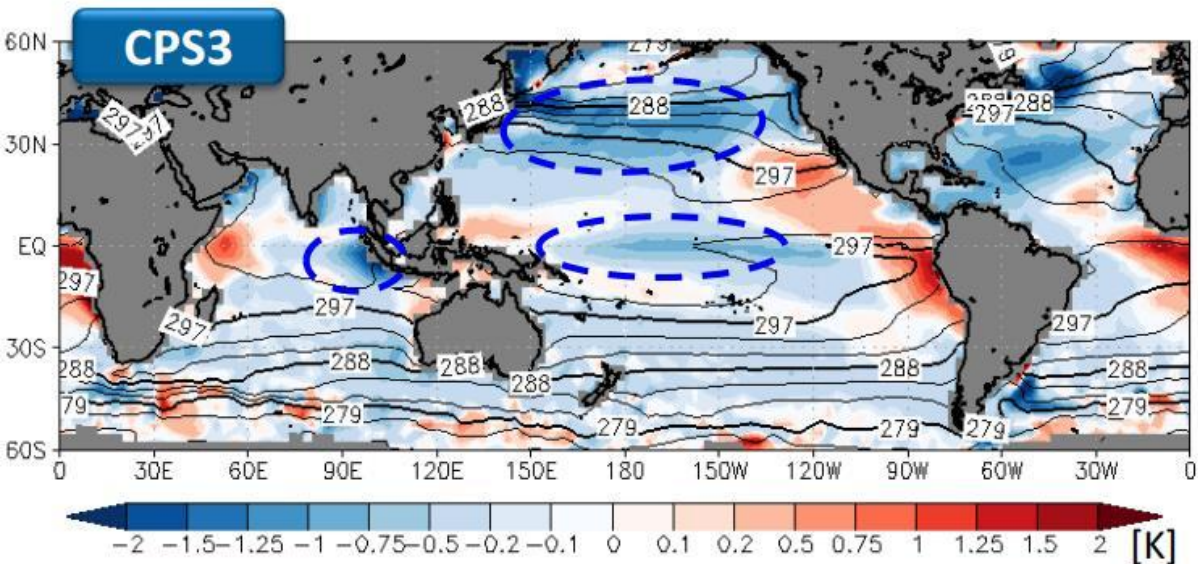
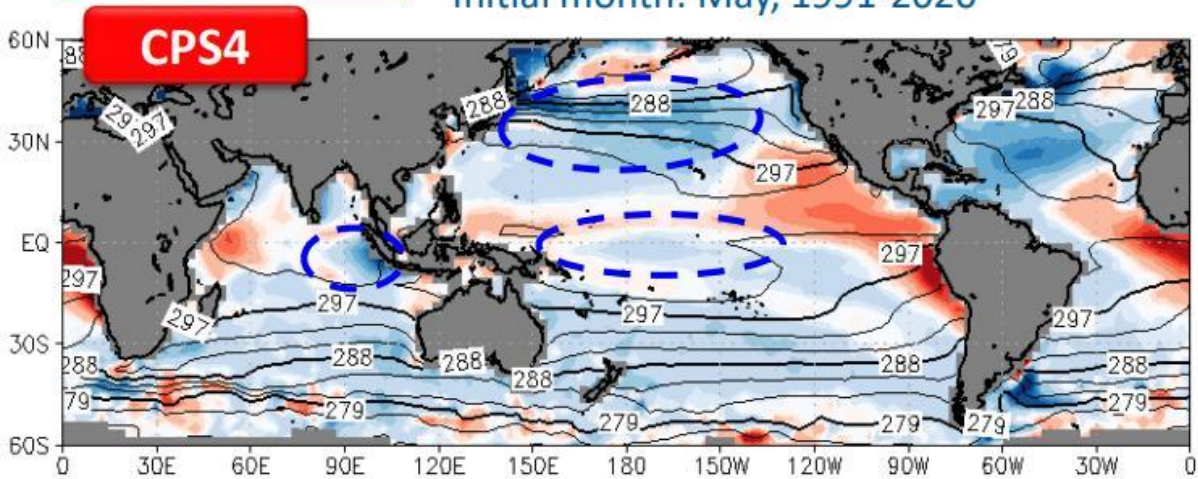
Shading indicates the confidence level.

The base period for composite analysis is 1948 – 2021.

Performance of CPS4 for SST

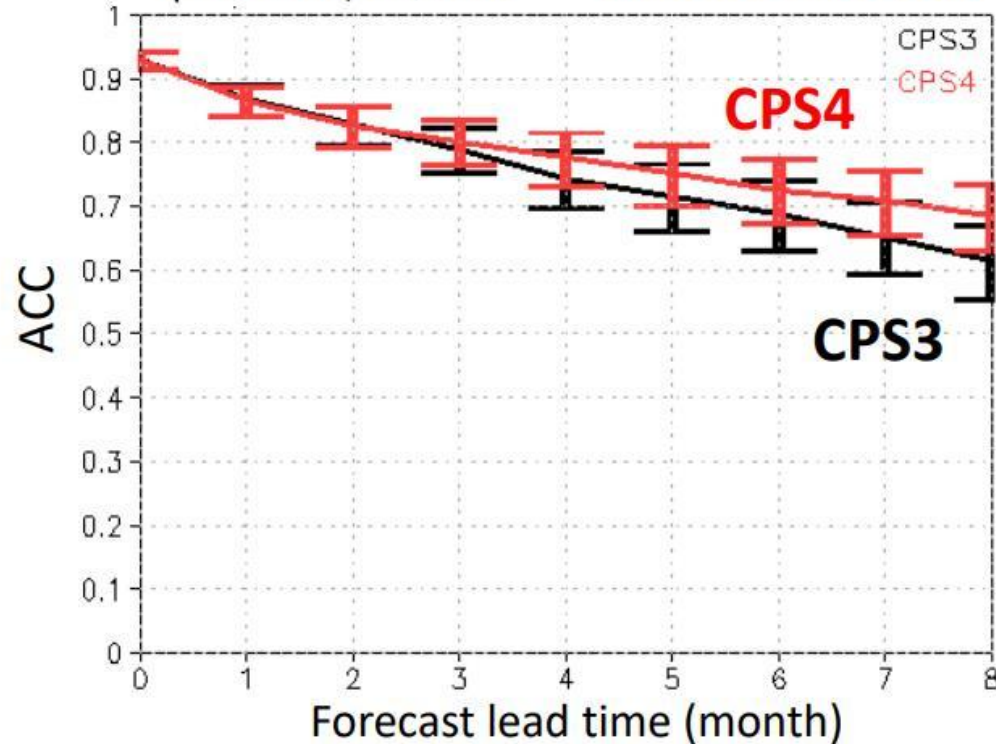
Mean Error

3-month Mean (June-August)
Initial month: May, 1991-2020



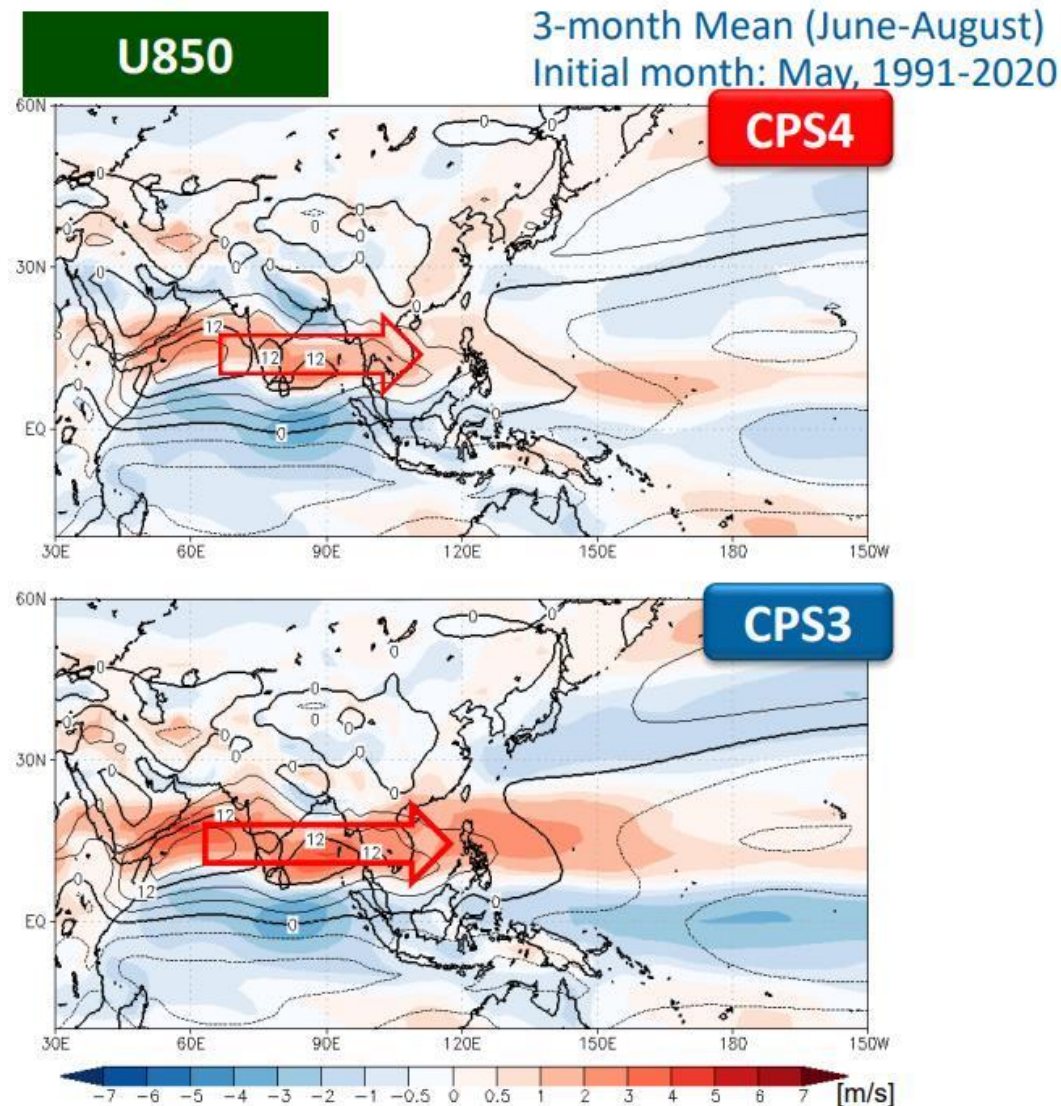
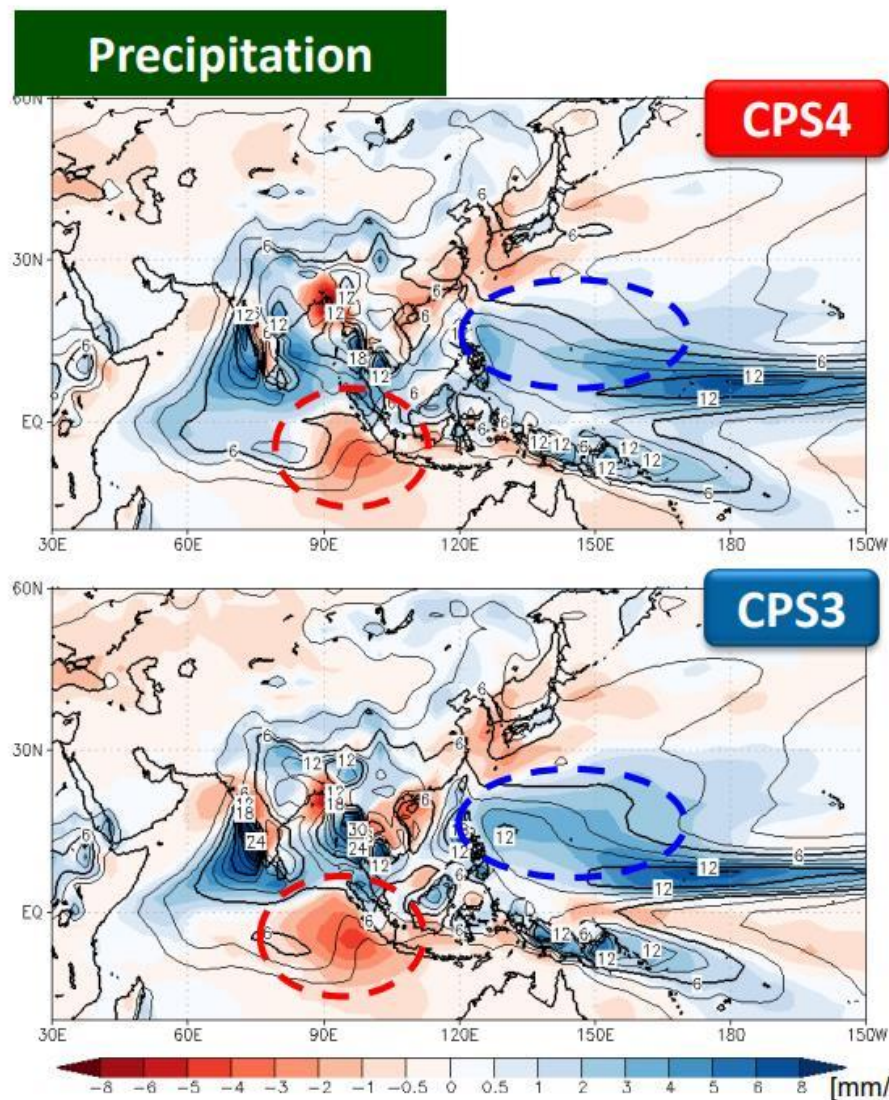
ACC (NINO.WEST)

(130-150E, EQ-15N) All months 1991-2020



- The cold tongue (low SST) bias in the equatorial Pacific and low SST biases in the eastern equatorial Indian Ocean and the mid-latitude North Pacific are reduced.
- ACCs in the western tropical Pacific improve.

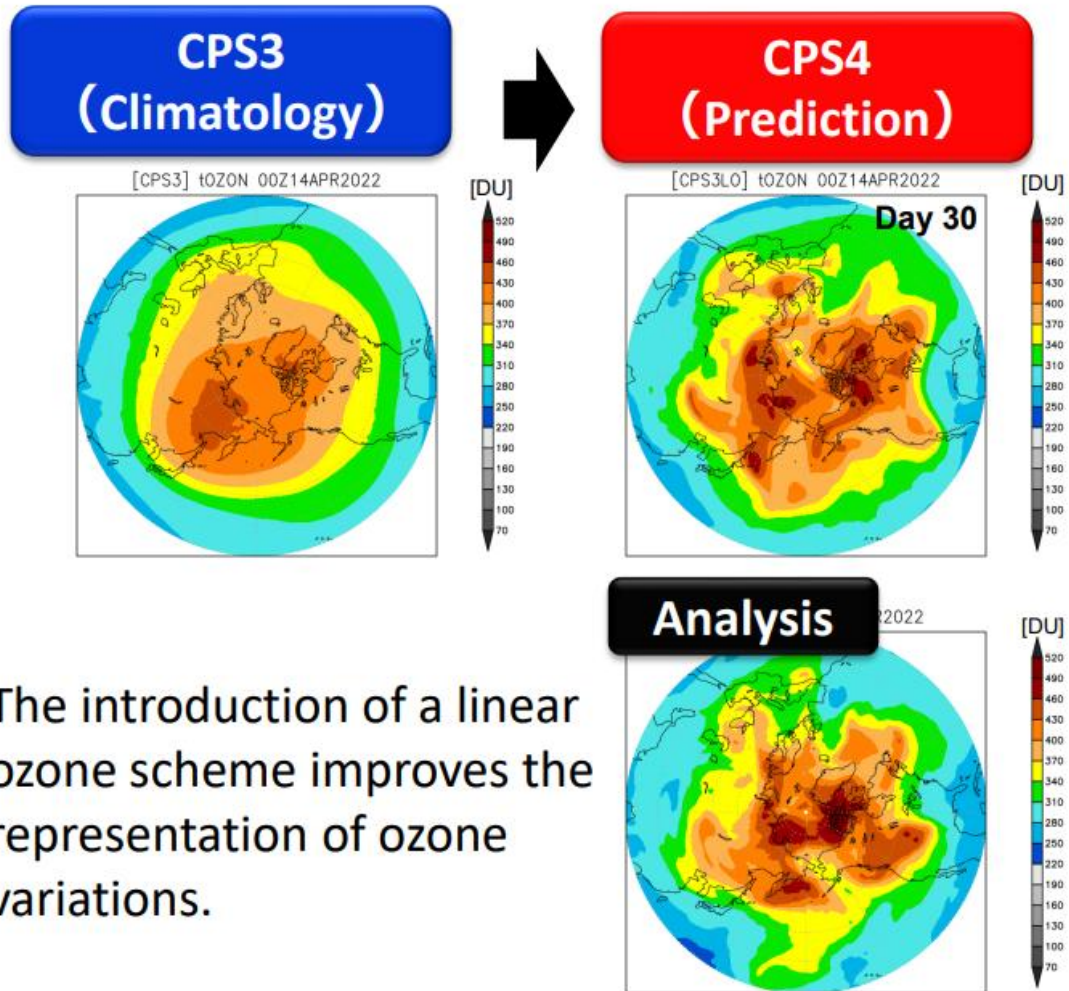
Mean Error of CPS4 for Precipitation and U850



- The excess precipitation biases over the tropical western North Pacific and under-biases over the southeastern tropical Indian Ocean are reduced.
- The biases in the lower troposphere such as excessively strong monsoon westerly winds are reduced.

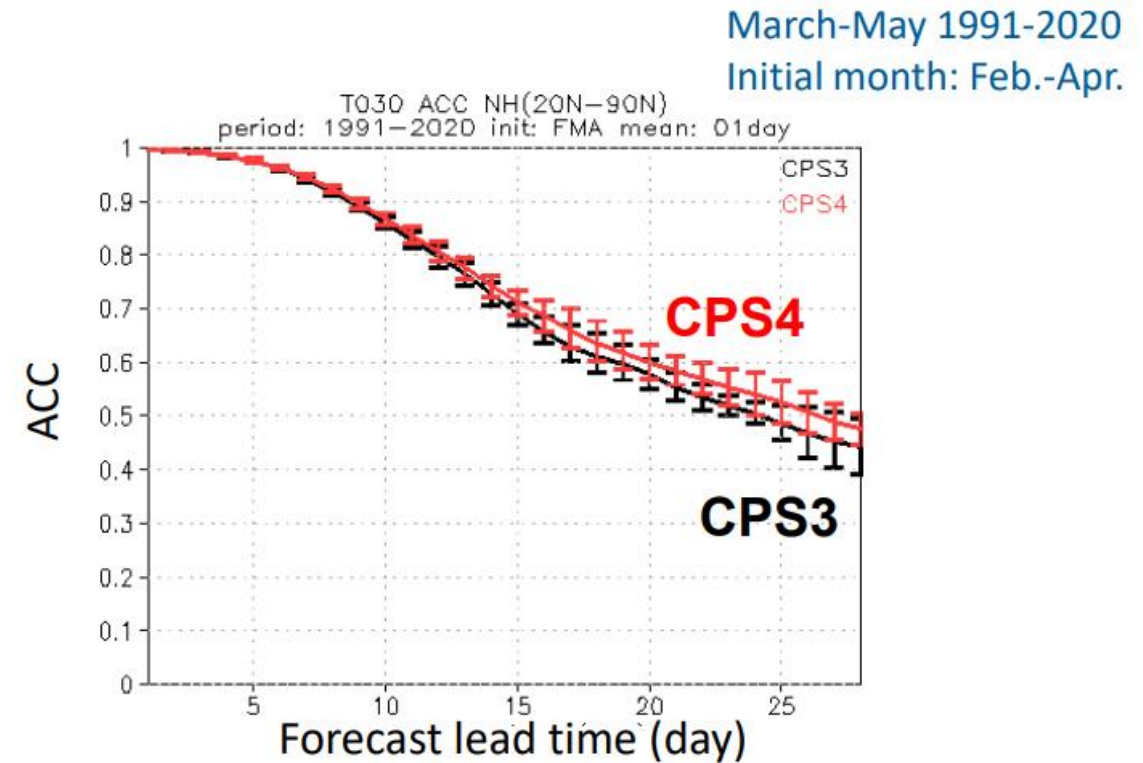
Improvement in the Stratosphere

Total Ozone



The introduction of a linear ozone scheme improves the representation of ozone variations.

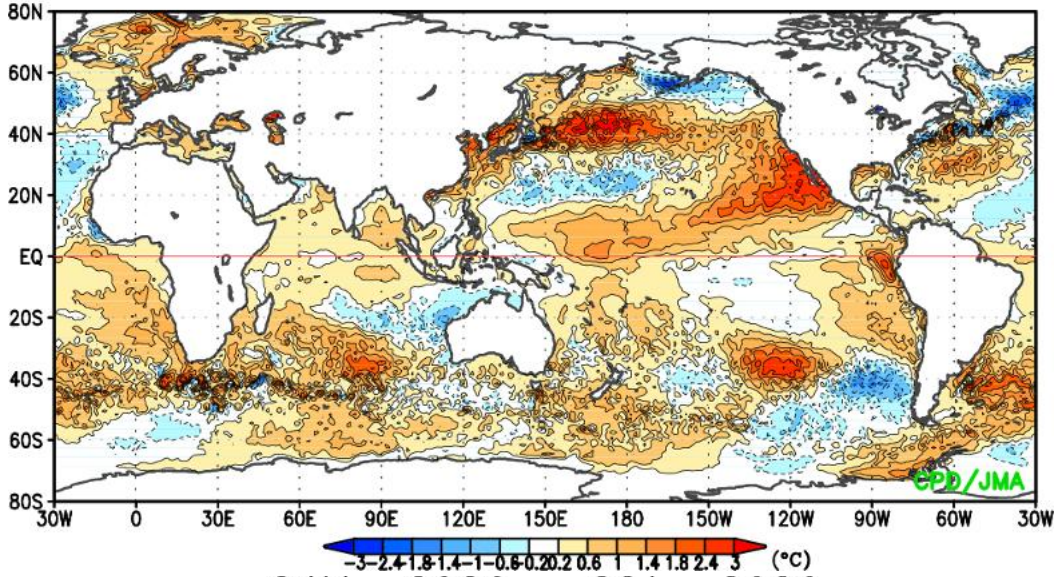
ACC of T30 in the Northern Hemisphere



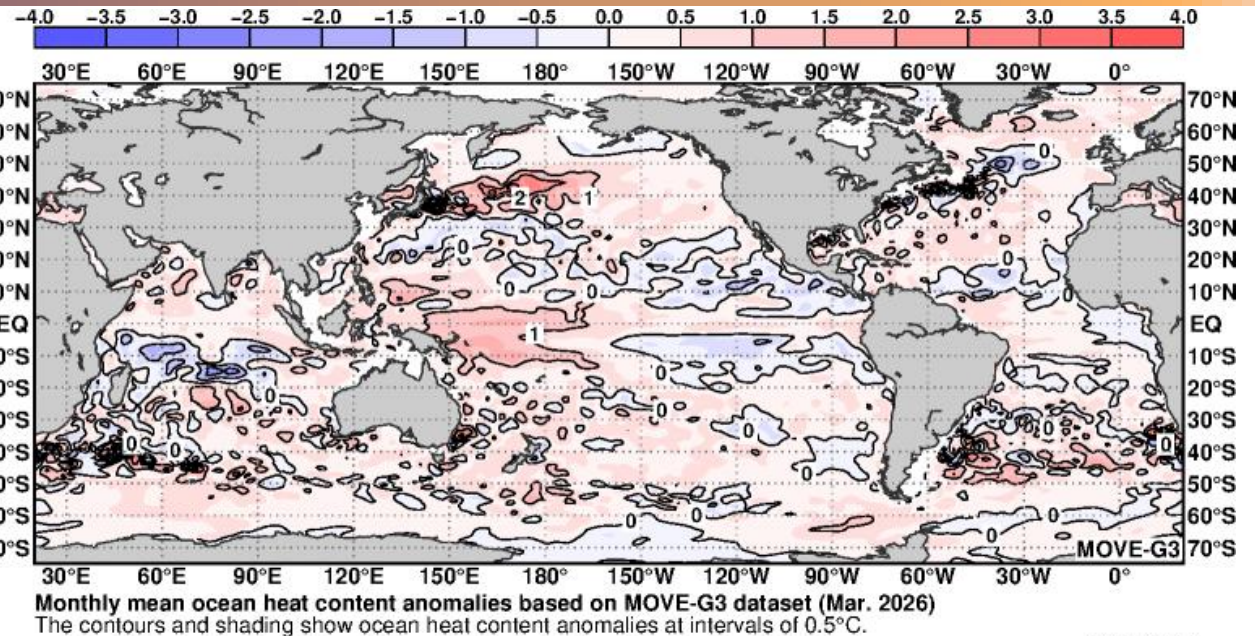
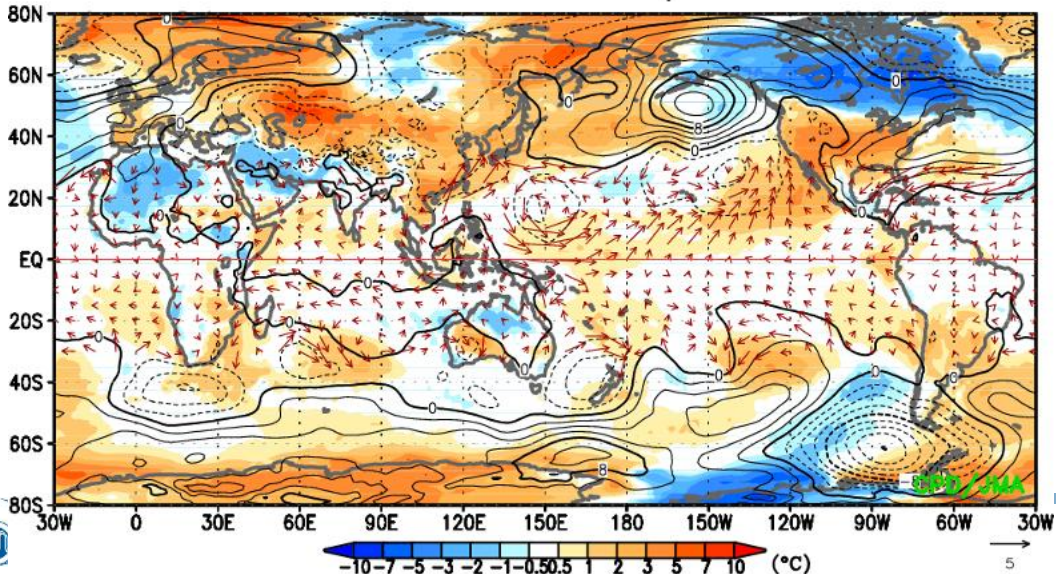
- The prediction skills of stratospheric temperature are improved.

How are those factors behaving now?

24Mar.2026 - 22Apr.2026



24Mar.2026 - 22Apr.2026



PDO INDEX based COBE-SST2 (10 years)

