

The Characteristics of 2021/22 Winter Monsoon and Climate Conditions in Japan¹ & Seasonal Outlook for Summer 2022 over Japan²

1. YAMADA Ken

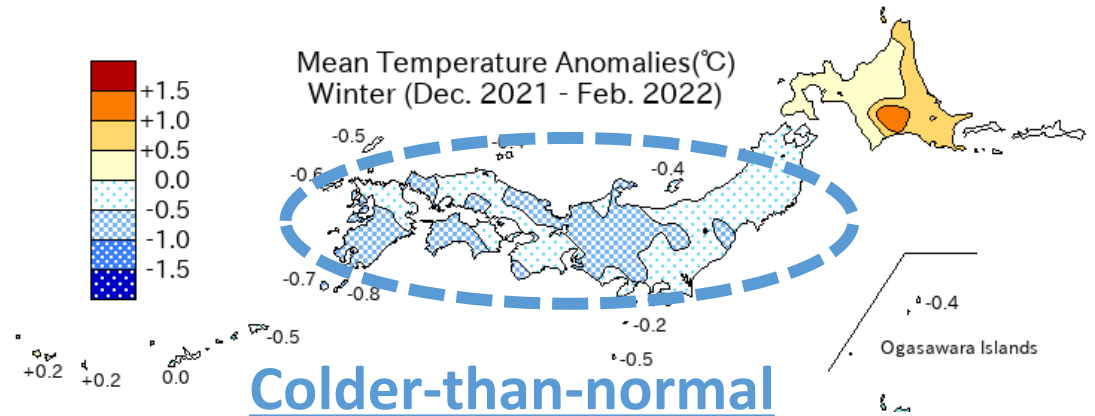
2. OIKAWA Yoshinori

Tokyo Climate Center, Japan Meteorological Agency

Climate Conditions

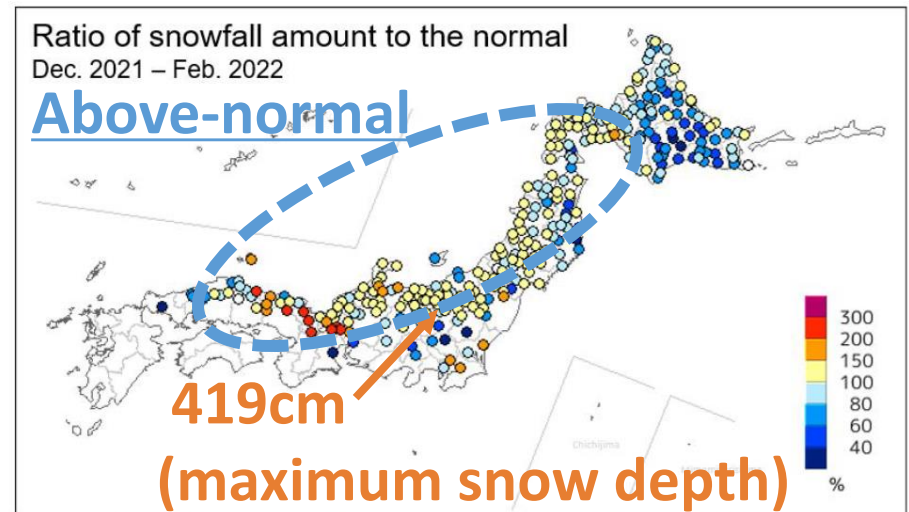
- ✓ Seasonal temperatures were below normal in eastern and western Japan
- ✓ Frequent heavy snowfall over northern to western parts of the country's Sea of Japan side

What the cause of these climate conditions is?



Distribution of mean temperature anomalies [°C] for December 2021 – February 2022

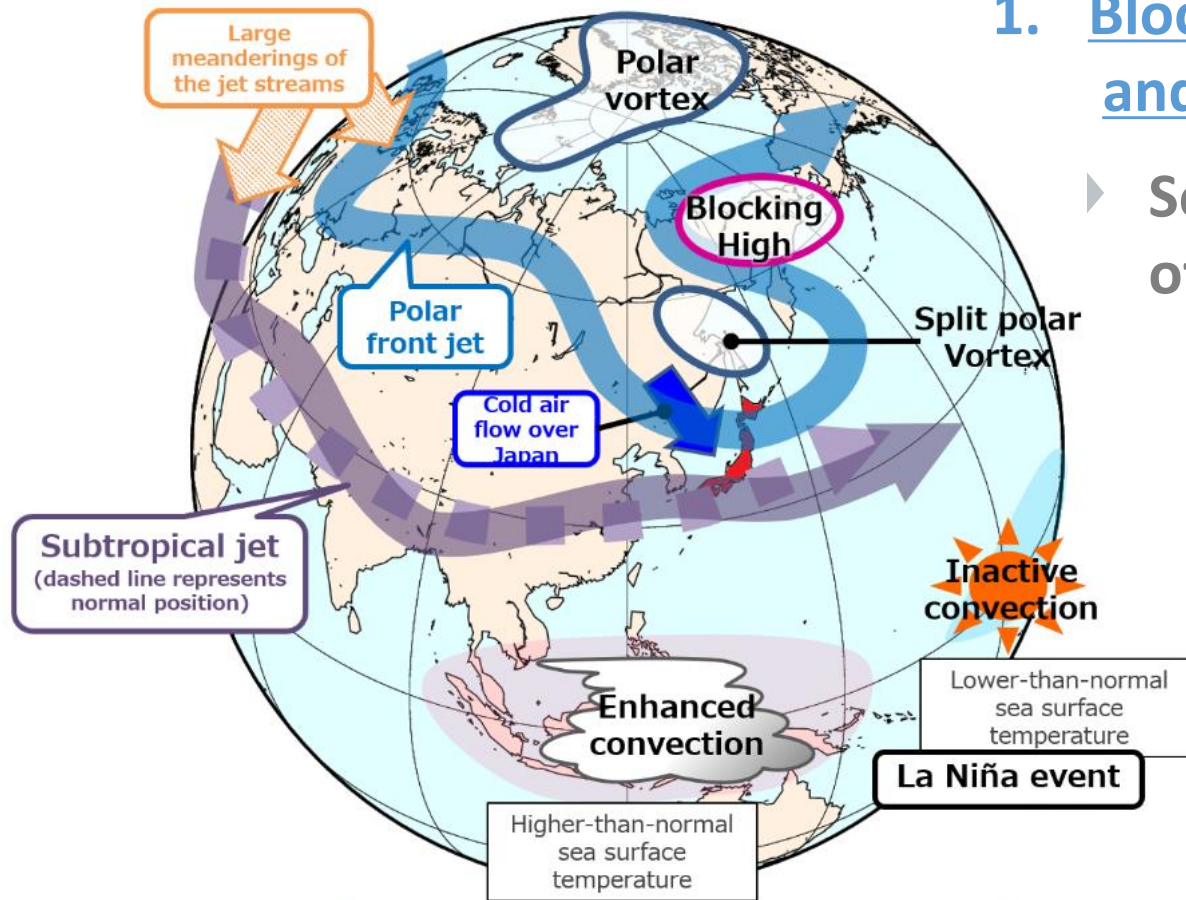
The base period for the normal is 1991-2020.



Ratio of snowfall amount for December 2021 – February 2022 to the climatological normal of winter snowfall amount [%]

The base period for the normal is 1991 – 2020. White dots indicate a ratio of 100%. Locations with amounts of 0 cm or normals less than 3 cm are not shown.

Primary Factors



1. Blocking High and Split Polar Vortex

- Southward shift of the PFJ (Polar front jet)

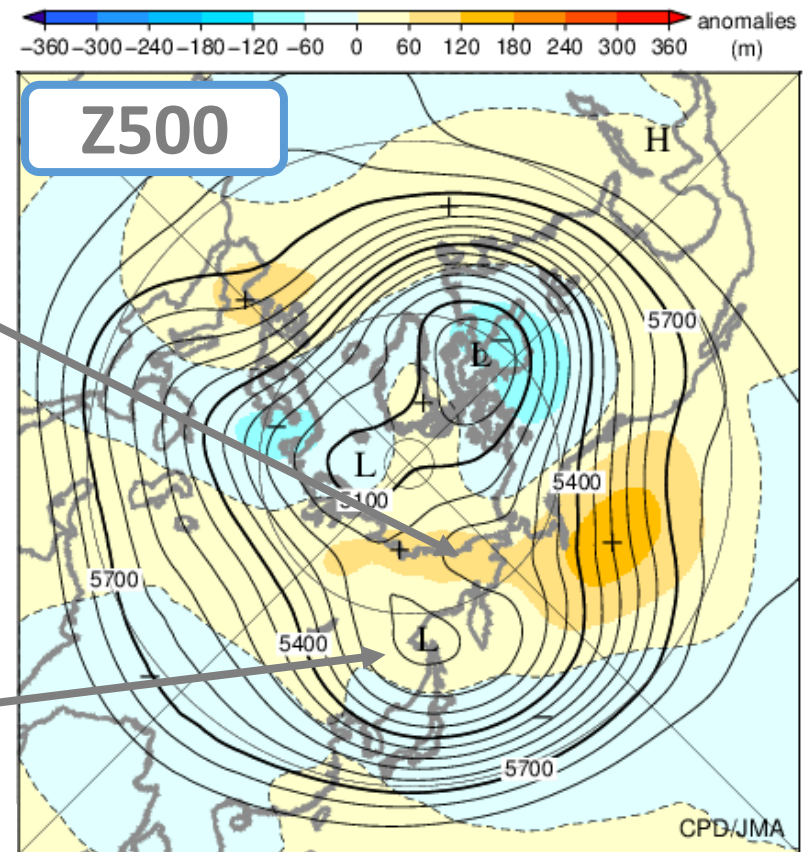
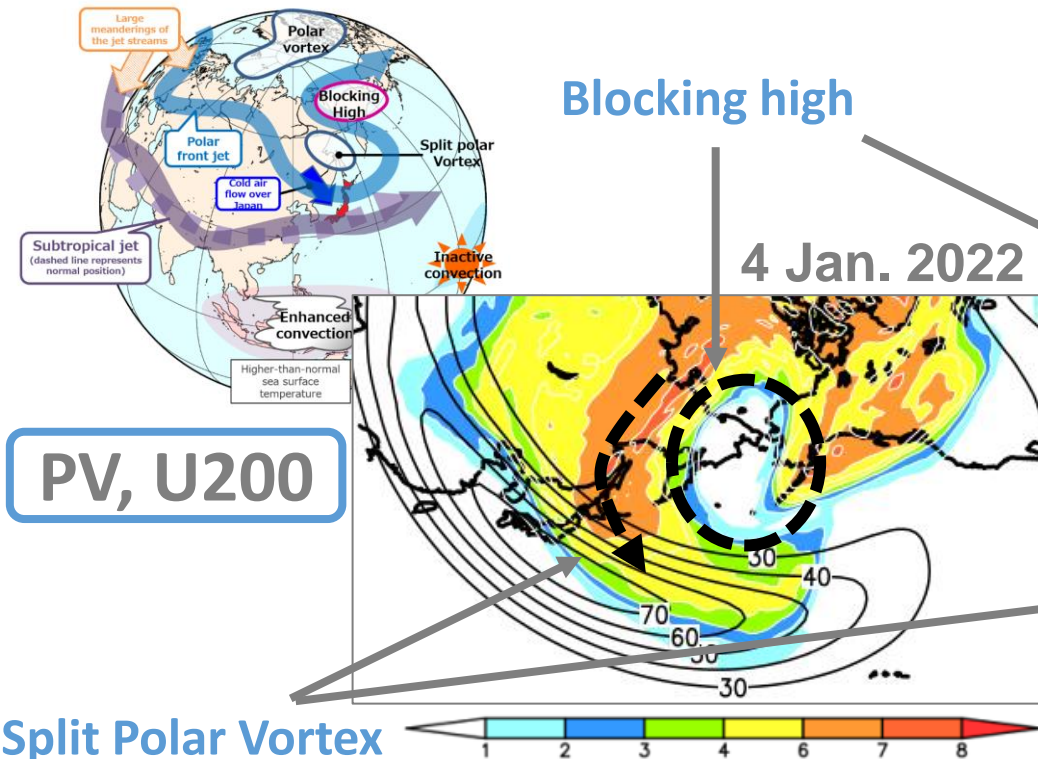
Characteristics of atmospheric circulation from December 2021 to February 2022

2. Enhanced Convective Activity

association with the prevailing La Niña event

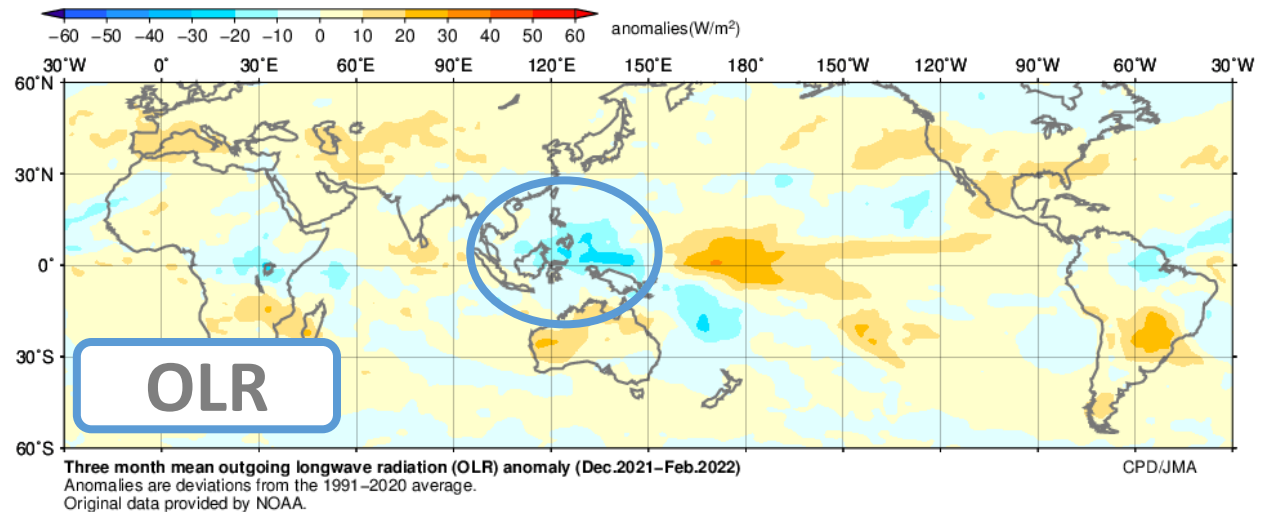
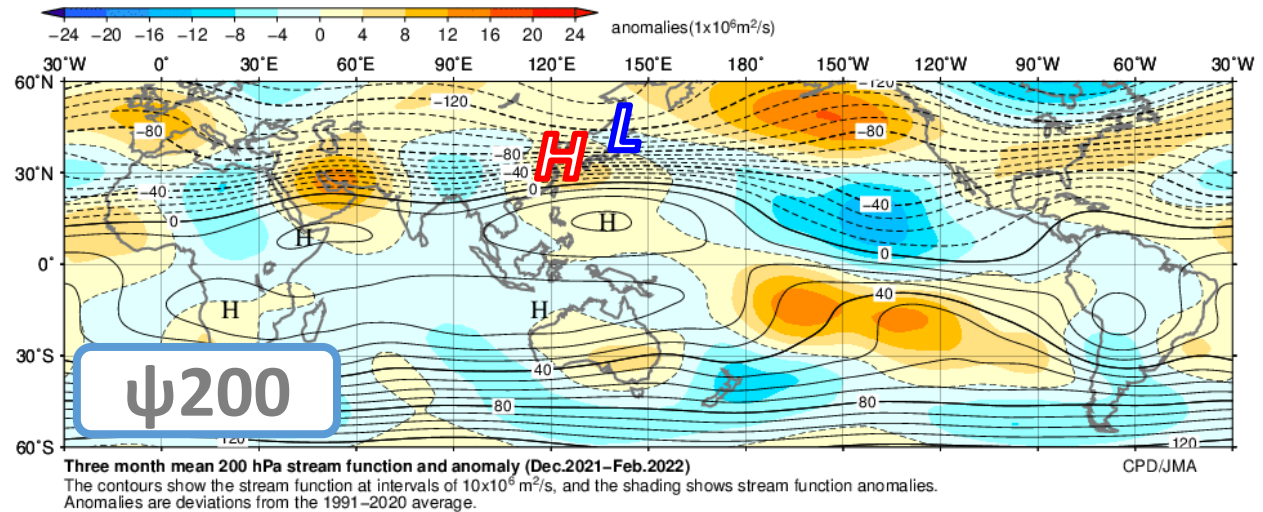
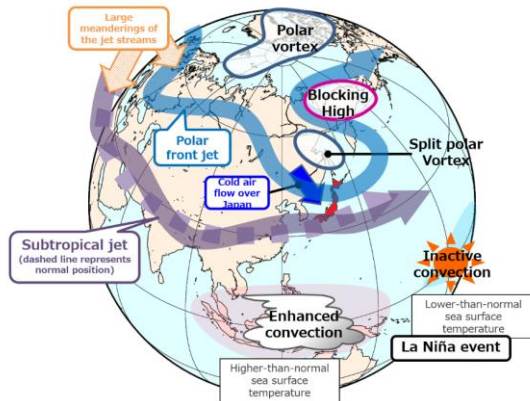
- Southward shift of the STJ (Subtropical jet)

Primary Factors



- ✓ The formation of a **blocking high** over Eastern Siberia in the upper troposphere
- ✓ Along with the blocking high, the tropospheric **polar vortex** over the Arctic region split, with partial movement southward to just north of Japan
- ▶ **Southward shift of the PFJ (Polar front jet)**

Primary Factors



- ✓ **Enhanced convective activity** in the area from the Philippines to eastern Indonesia in association with the prevailing La Niña event
- ✓ Northward shift of STJ to the west of Japan
- **Southward shift of the STJ (Subtropical jet)**

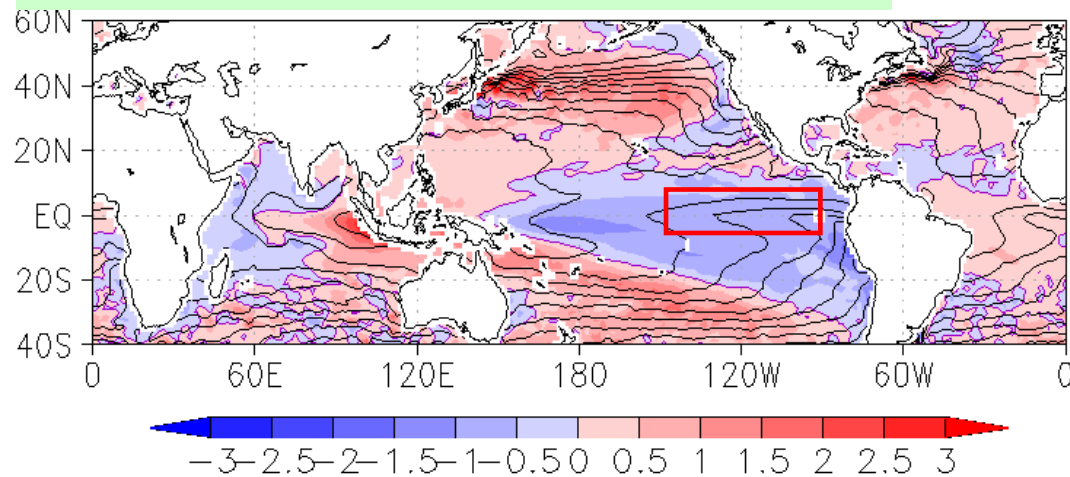
Seasonal outlook for summer 2022 over Japan

Expected conditions in the tropical ocean

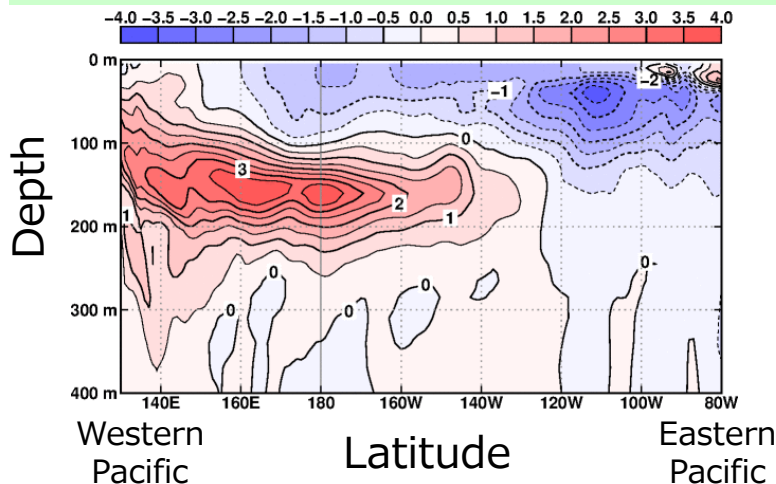
- The ongoing La Niña event is likely cease to meet the definition by the end of summer.
- Despite that, impacts on global circulations are expected to remain through summer.

Predicted SST anomalies for JJA

esbl



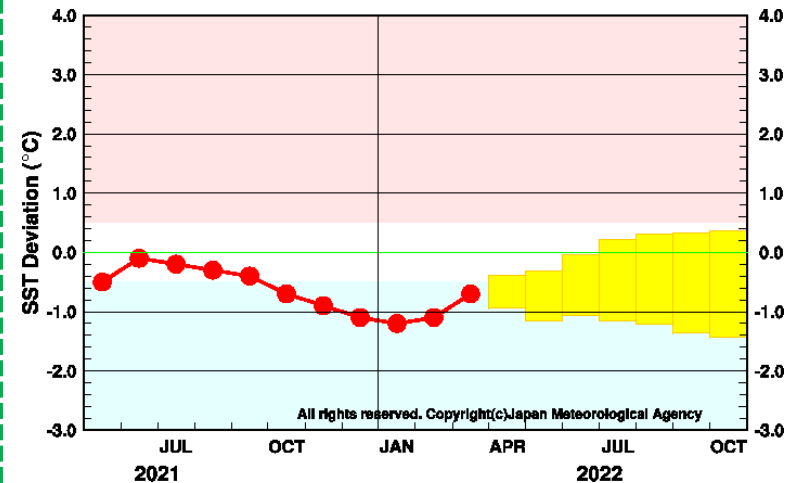
Subsurface water temperature anomaly analysis for early May



<Source>

Monthly El Niño outlook issued on Apr.11

NINO.3 SST deviations



ENSO probability forecasts

YEAR	MONTH	mean period	
2022	FEB	DEC2021-APR2022	100
	MAR	JAN2022-MAY2022	100
	APR	FEB2022-JUN2022	20 80
	MAY	MAR2022-JUL2022	40 60
	JUN	APR2022-AUG2022	70 30
	JUL	MAY2022-SEP2022	70 30
	AUG	JUN2022-OCT2022	70 30

■ El Niño ■ ENSO neutral ■ La Niña

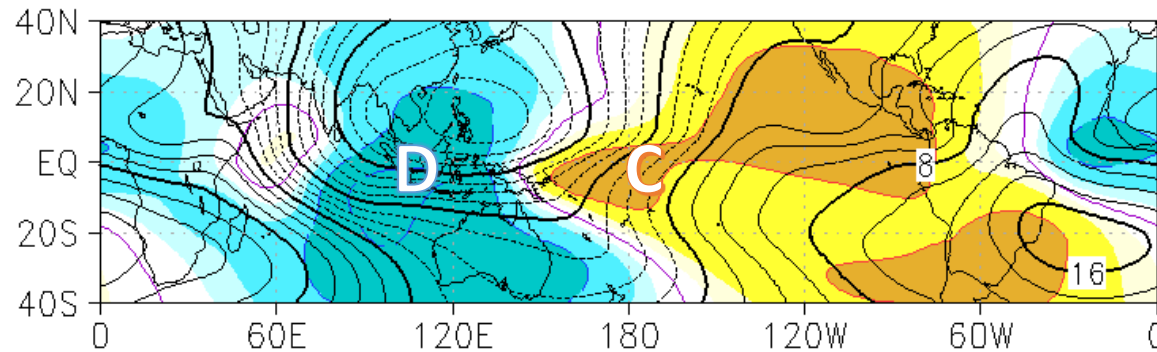
Bars indicate probabilities for 5-month periods centered on FEB to AUG

Upper troposphere circulations

Convection anomalies (velocity potential @200hPa)

from: 2022/6- (m234)

esbl



Responding to SST anomalies, i.e., prolonged La Niña conditions,

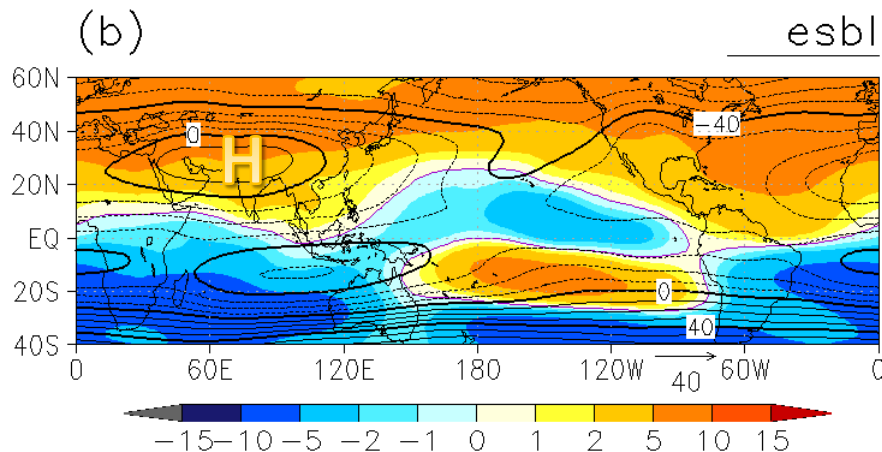
- Enhanced convective activity is predicted over and around the Maritime Continent
- Suppressed convective activity over central to eastern Pacific

Stream function & anomalies @200hPa

init: 2022/04/10/00[1.1]

from: 2022/6- (m234)

esbl



Responding to convection anomalies,

- South Asian Anticyclone (Tibetan High) is predicted to extend northward

Or equivalently,

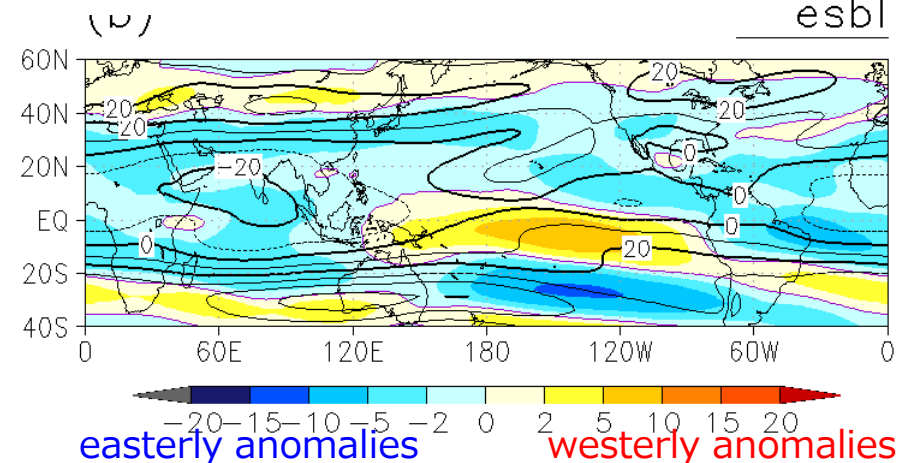
- Subtropical Jet Stream is displaced northward of its normal latitude

Zonal wind anomalies @200hPa

init: 2022/04/10/00[1.1]

from: 2022/6- (m234)

esbl



easterly anomalies

westerly anomalies

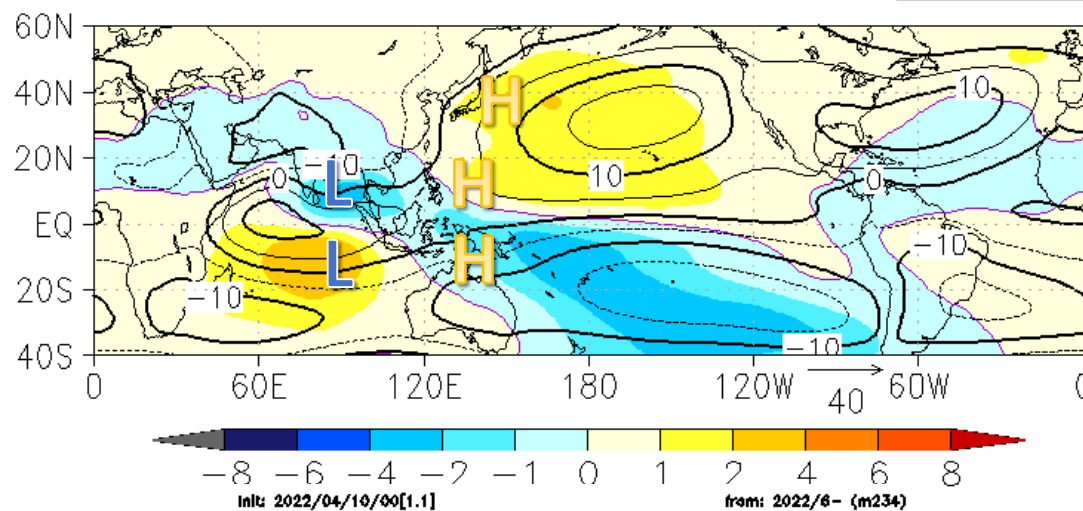
Lower troposphere circulations

Init: 2022/04/10/00[1.1]

from: 2022/6- (m234)

Stream function & anomalies @850hPa

esbl

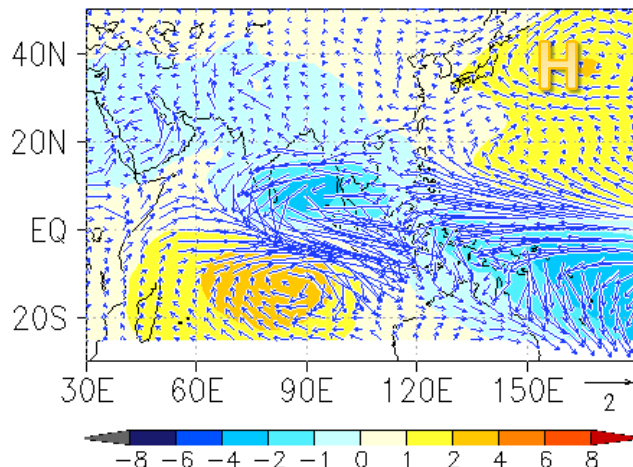


- Responding to convection anomalies,
- "Twin-cyclone" anomaly structure is predicted in the eastern Indian Ocean
 - Anti-cyclonic anomalies are predicted over the tropical Pacific
 - In mid-latitudes, the WNPSH is predicted to extend northward, consistent with the SJS displacement

Init: 2022/04/10/00[1.1]

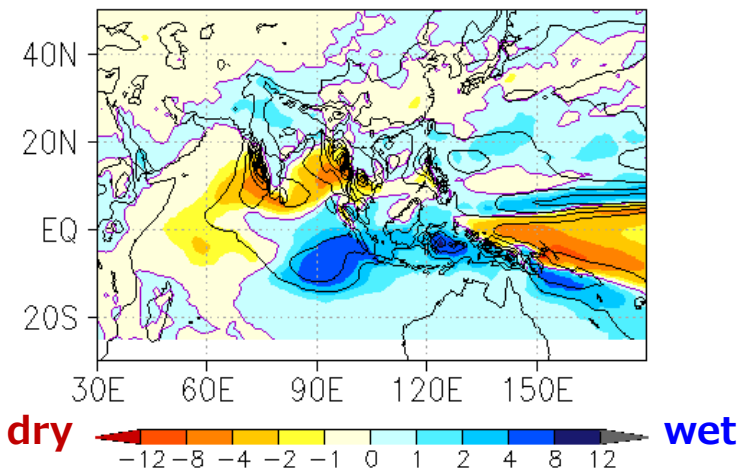
from: 2022/6- (m234)

Wind anomalies @850hPa



- Above-normal warm air inflow associated with enhanced circulation around the WNPSH

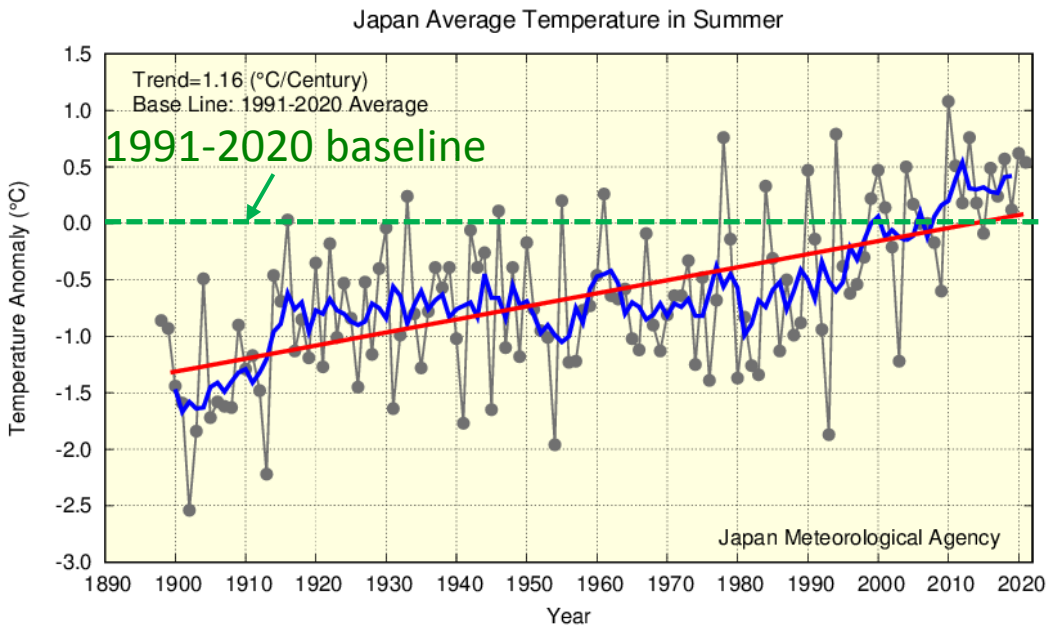
Precipitation anomalies



- Above normal precipitation is predicted for **the northern part** of Asian monsoon region and to the east of the Philippines

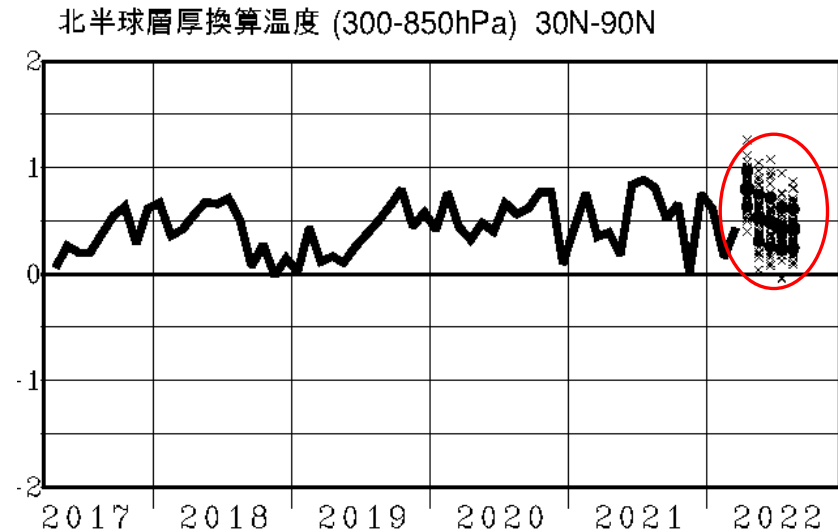
Long-term and large-scale trends

Long-term trend for Japan national surface temperature for summer



- National average temperatures over Japan have been rising at 1.2 °C / century.
- In most of recent summers, temperatures were about 0.5 °C above normal

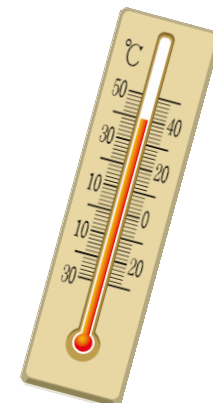
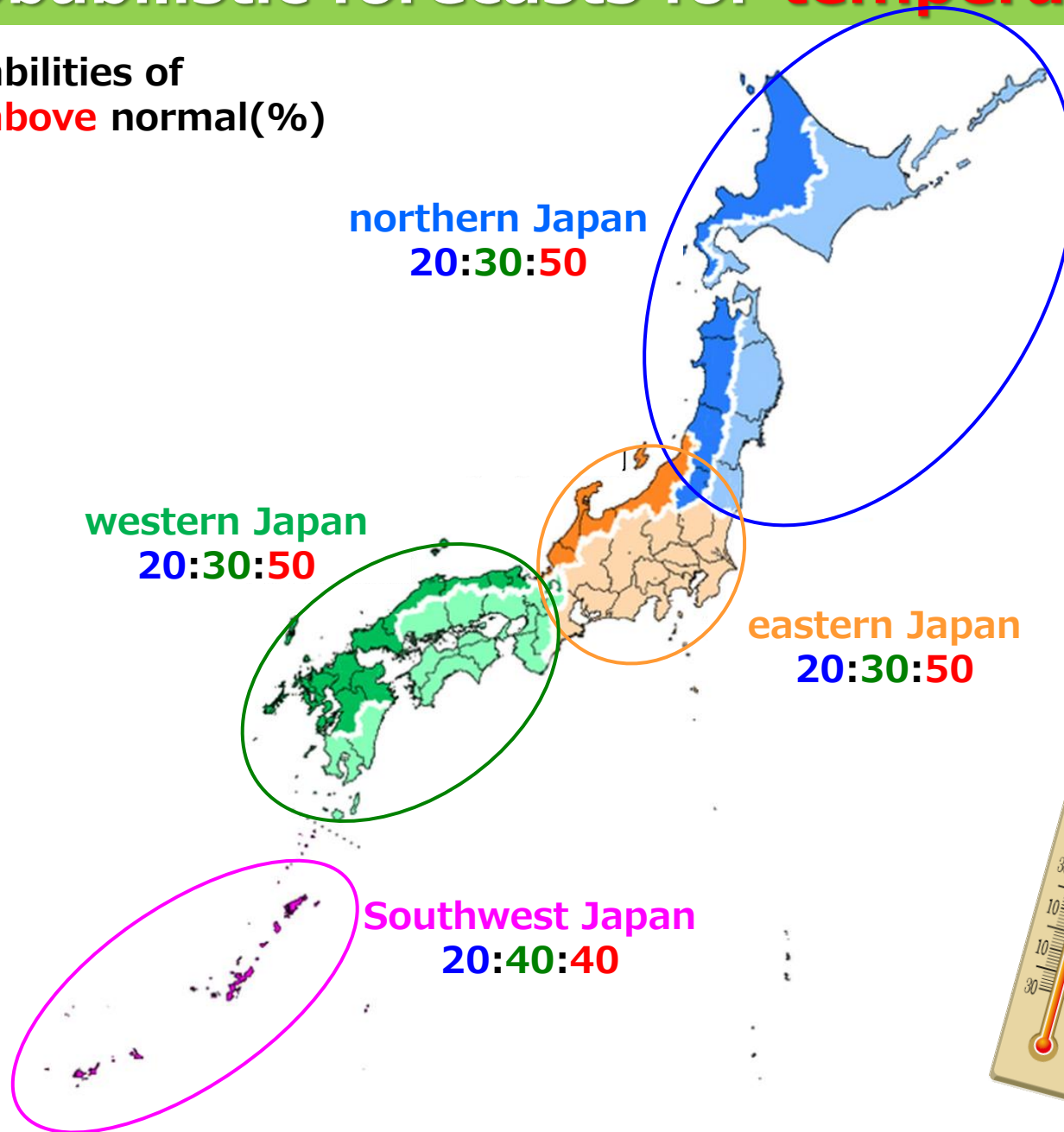
Predicted temperature anomalies for the troposphere of 30-90N



- On large-scale, temperatures are predicted about 0.5 °C above normal for the coming summer

Probabilistic forecasts for **temperature**

Probabilities of
below:**near**:**above** normal(%)



Probabilistic forecasts for precipitation

Probabilities of

below:near:above normal(%)

