



# Current Status and Future Plan of JMA's Global and Seasonal Ensemble Prediction Systems

YAMADA Takashi

World Meteorological Center of Tokyo

# Outline

## ■ Global Ensemble Prediction System (Global EPS)

- On 30<sup>th</sup> March 2021, JMA enhanced the ensemble size of the Global EPS used for the forecasts shorter than 1-month, at the same time as the other improvements such as enhancement of vertical resolution from 100 to 128 levels and improvements in singular vector (SV)-based initial perturbations.
- JMA plans to enhance the horizontal resolution of the Global EPS around March 2022.

## ■ Seasonal Ensemble Prediction System (Seasonal EPS)

- JMA plans to upgrade the Seasonal EPS used for the forecasts longer than 1-month around February 2022.
- JMA also plans to upgrade the Re-analysis System used for re-forecasts for the both EPSs prior to upgrade of Seasonal EPS.

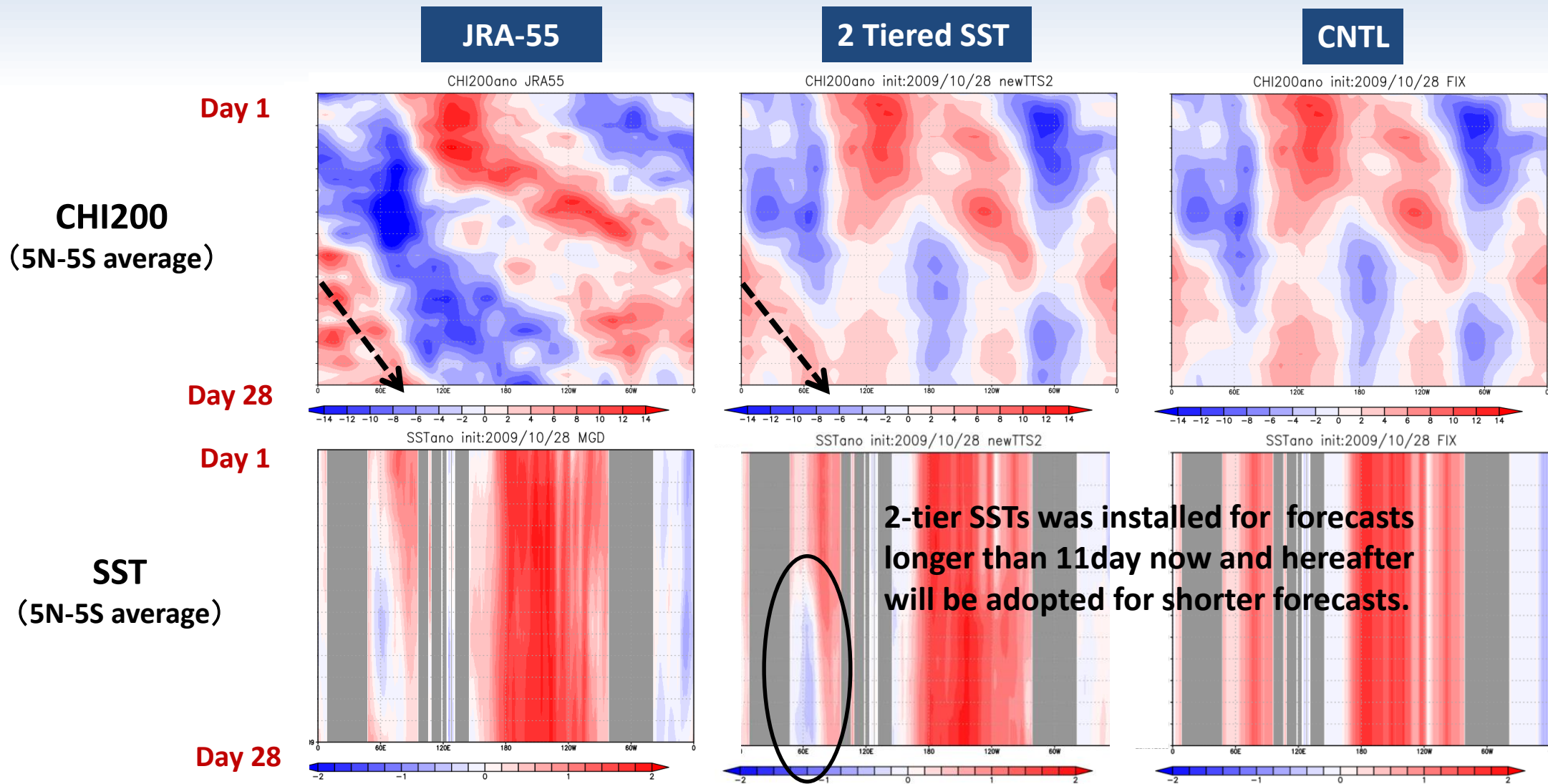
# JMA's Global Ensemble Prediction System

Model	GEPS22XX (Next Model planned in March 2022)	GEPS2103 (Current Model since March 2021)
Horizontal Resolution	<b>For 18 day forecasts</b> <b>TQ479 (approx. 27km)</b> <b>For forecasts longer than 18 day</b> <b>TQ319 (approx. 40km)</b>	For 18 day forecasts TL479 (approx. 40km) For forecasts longer than 18 day TL319 (approx. 55km)
Vertical Layers	128 levels (up to 0.01hPa)	128 levels (up to 0.01hPa)
Initial Condition for Forecast	Atmosphere : Global Analysis Land : Offline Land Analysis	Atmosphere : Global Analysis Land : Offline Land Analysis
SST Condition	Prescribed SST perturbation and <b>enhanced 2-tier SST using SSTs predicted by the next Seasonal EPS</b>	Prescribed SST perturbation and 2-tier SST using SSTs predicted by the Seasonal EPS
Sea Ice Condition	Prescribed Sea Ice distribution	Prescribed Sea Ice distribution
Forecast Range	34 days	34 days
Number of Ensemble	( see the table of the next slide )	( see the table of the next slide )
Re-forecast	24 initials x 13 members x <b>30 years (1991-2020)</b>	24 initials x 13 members x 40years (1981-2020)
Initial Condition for Re-forecast	<b>JRA-3Q</b>	JRA-55

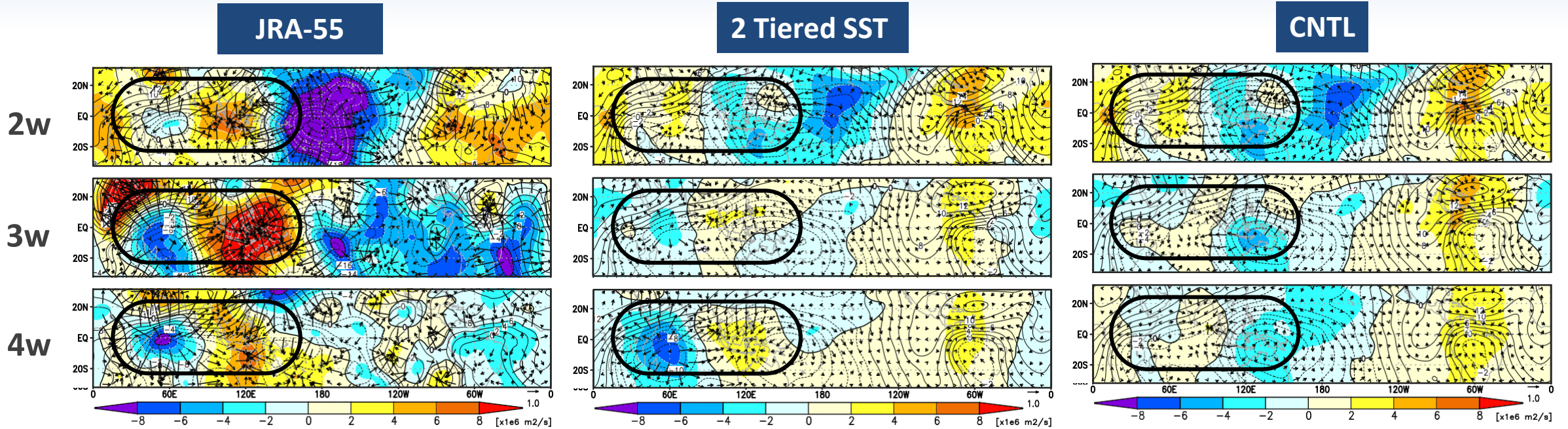
# JMA's Global Ensemble Prediction System

Forecast Range		GEPS22XX (Next Model planned in March 2022)	GEPS2103 (Current Model since March 2021)	GEPS2003 (Previous Model)
Typhoon Forecast Up to 132 hour	Number of Ensemble	<b>51</b>		27
	Initial Time (UTC)		06, 18	06, 18
11 day Forecast Up to 264 hour	Number of Ensemble	<b>51</b>		27
	Initial Time (UTC)		00, 12	00, 12
11 to 18 day Forecast Up to 432 hour	Number of Ensemble	<b>51</b>		13
	Initial Time (UTC)		<b>12</b>	00, 12
18 to 34 day Forecast Up to 816 hour (Run only on Tue. Wed.)	Number of Ensemble	<b>25</b>		13 (11 for 00 Tue.)
	Initial Time (UTC)		<b>12</b>	00, 12

# Effect of 2-tier SSTs (installed in Mar. 2020)



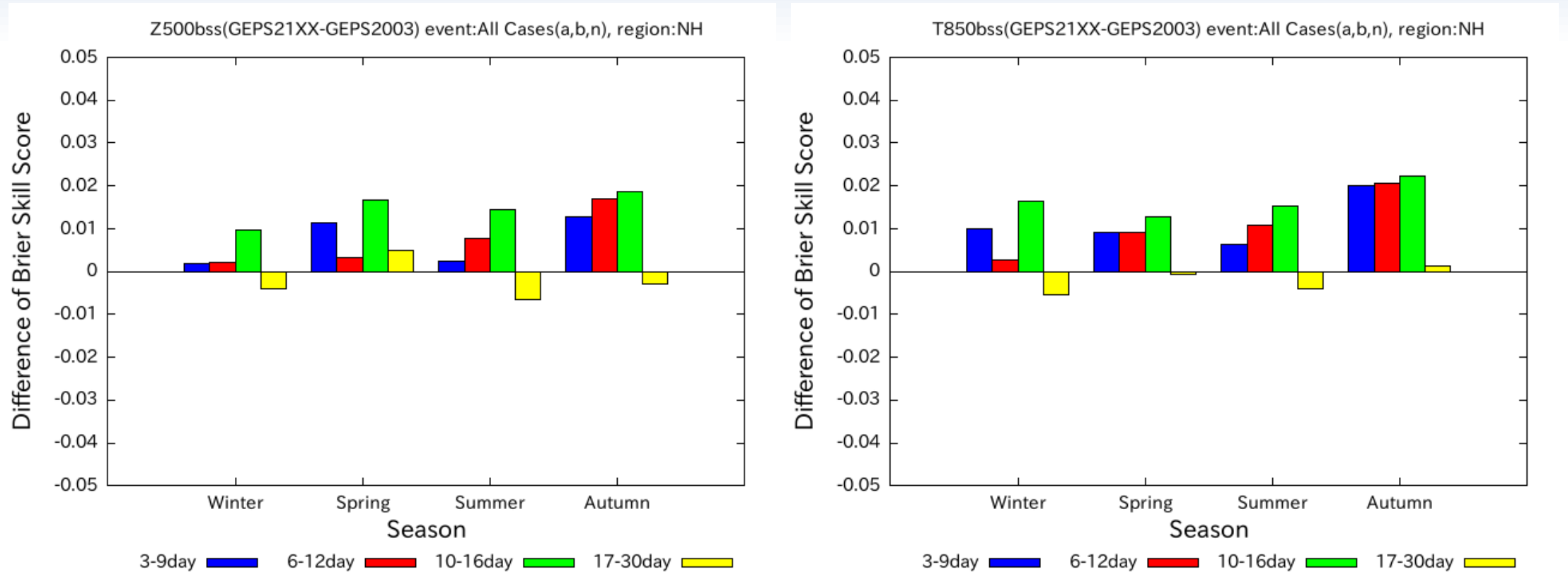
# Effect of 2-tier SSTs (installed in Mar. 2020)



Velocity Potential at 200hPa

**2-tier SST improved velocity potential error at 200hPa for 3-4 week forecast.**

# Effect of enhancement of ensemble member (installed in Mar. 2021)



**Brier Skill Score for 1-2 week probabilistic forecast has been improved by enhancement of ensemble size.**

# JMA's Seasonal Ensemble Prediction System

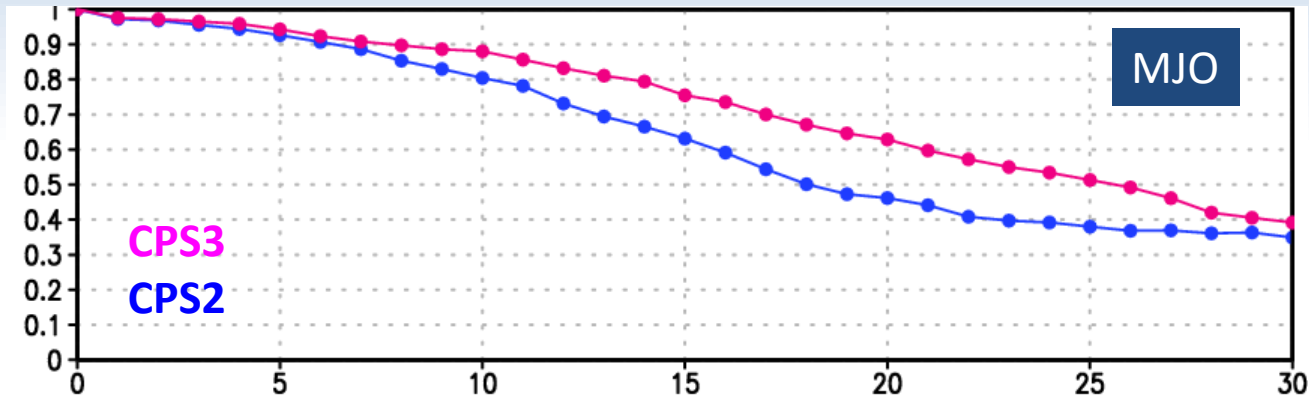
Model	JMA/MRI-CPS3 (Next Model planned in February 2022)	JMA/MRI-CPS2 (Current Model since June 2015)
Horizontal Resolution	Atmosphere: <b>TL319 (approx. 55km)</b> Ocean: <b>0.25 ° (lon) × 0.25 ° (lat)</b>	Atmosphere: TL159 (approx. 110km) Ocean: 1.0 ° (lon) × 0.5-0.3 ° (lat)
Vertical Layers	Atmosphere: <b>100 levels (up to 0.01hPa)</b> Ocean: <b>60 levels</b>	Atmosphere: 60 levels (up to 0.1hPa) Ocean: 52 levels and Bottom Boundary Layer
Initial Condition for Forecast	Atmosphere: <b>Global Analysis</b> Land: <b>Offline Land Analysis (*)</b> Ocean: <b>4DVAR(coarse res)</b> <b>+ IAU(eddy permitting res), daily (*)</b> Sea Ice: <b>3DVAR, daily (*)</b> <b>* Same forcing as atmosphere</b>	Atmosphere: JRA-55 Land: JRA-55 Ocean: 3DVAR at 5-day interval (*) Sea Ice: Climatology  * JRA-55 forcing
Forecast Range	240 days	240 days
Number of Ensemble	<b>5 members per an initial</b> <b>(51 members with 11-initial LAF)</b>	13 members per an initial (51 members with 4-initial LAF)
Frequency of Forecast	<b>Every day</b>	Every 5 days
Re-forecast	24 initials x 5 members x 30 years <b>(1991-2020)</b>	24 initials x 5 members x 41years <b>(1979-2019)</b>
Initial Condition for Re-forecast	Atmosphere: <b>JRA-3Q</b> Ocean: <b>4DVAR (JRA-3Q Forcing)</b>	Atmosphere: JRA-55 Ocean: 3DVAR (JRA-55 forcing)



# JMA's Re-analysis System

Reanalysis System	JRA-3Q (Next Re-analysis planned in Late 2021)	JRA-55 (Current Reanalysis since 2012)
Analysis Period	1947 - present	1958 - present
Data Assimilation System	Based on the operational analysis system as of December 2018.	Based on the operational analysis system as of December 2009.
Horizontal Resolution	TL479L100 (approx. 40 km)	TL319L60 (approx. 55 km)
Vertical Layers	100 levels (up to 0.01hPa)	60 levels (up to 0.1 hPa)
Satellite brightness temperature	RTTOV-10.2	RTTOV-9.3
SST and Sea-ice	COBE-SST2 before 1985 (1.0° x1.0° ) MGD-SST from 1985 onward (0.25° x0.25° using satellite data)	COBE-SST (1.0° x1.0° )
Ozone	MRI-CCM2 (TL159L64)	Climate Value in and before 1978 MRI-CCM1 in and after 1979 (T42L68)

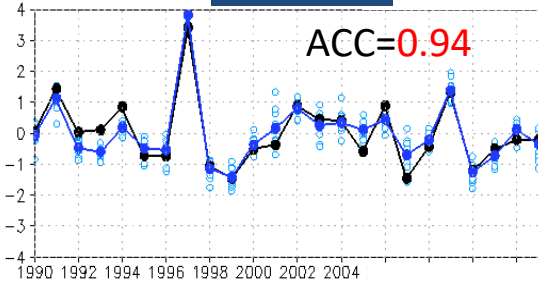
# Performance of JMA's new seasonal EPS



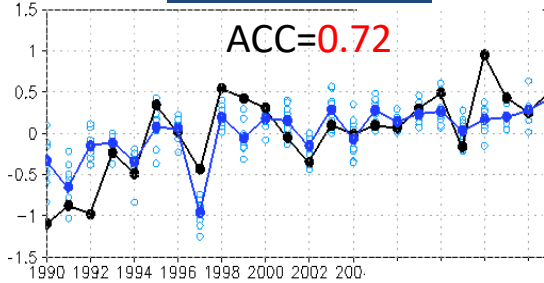
Based on the trial version of hindcast, some important scores for seasonal forecast was improved.

CPS3

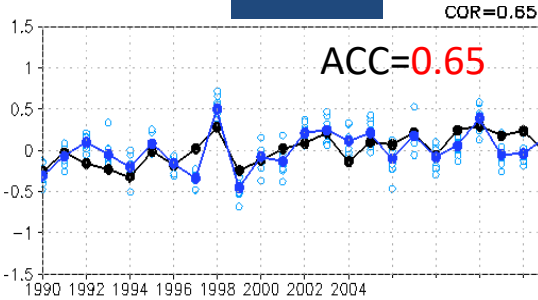
NINO.3



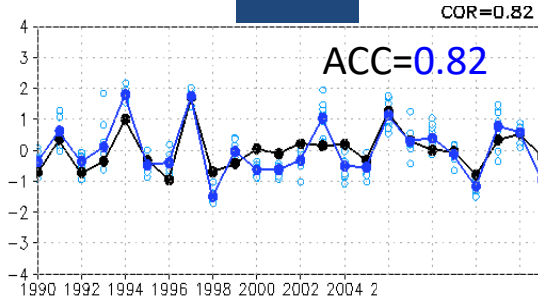
NINO.WEST



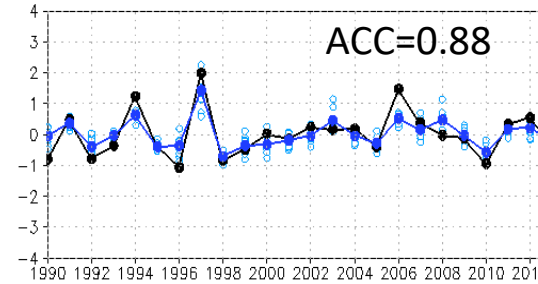
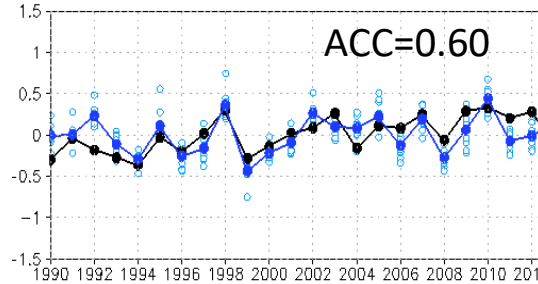
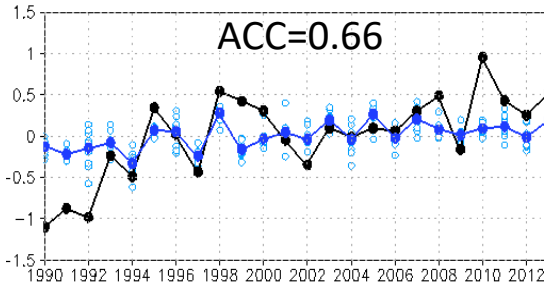
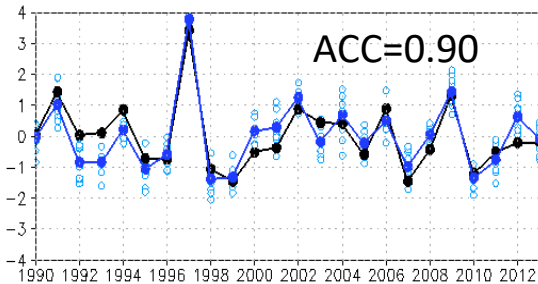
IOBW



DMI

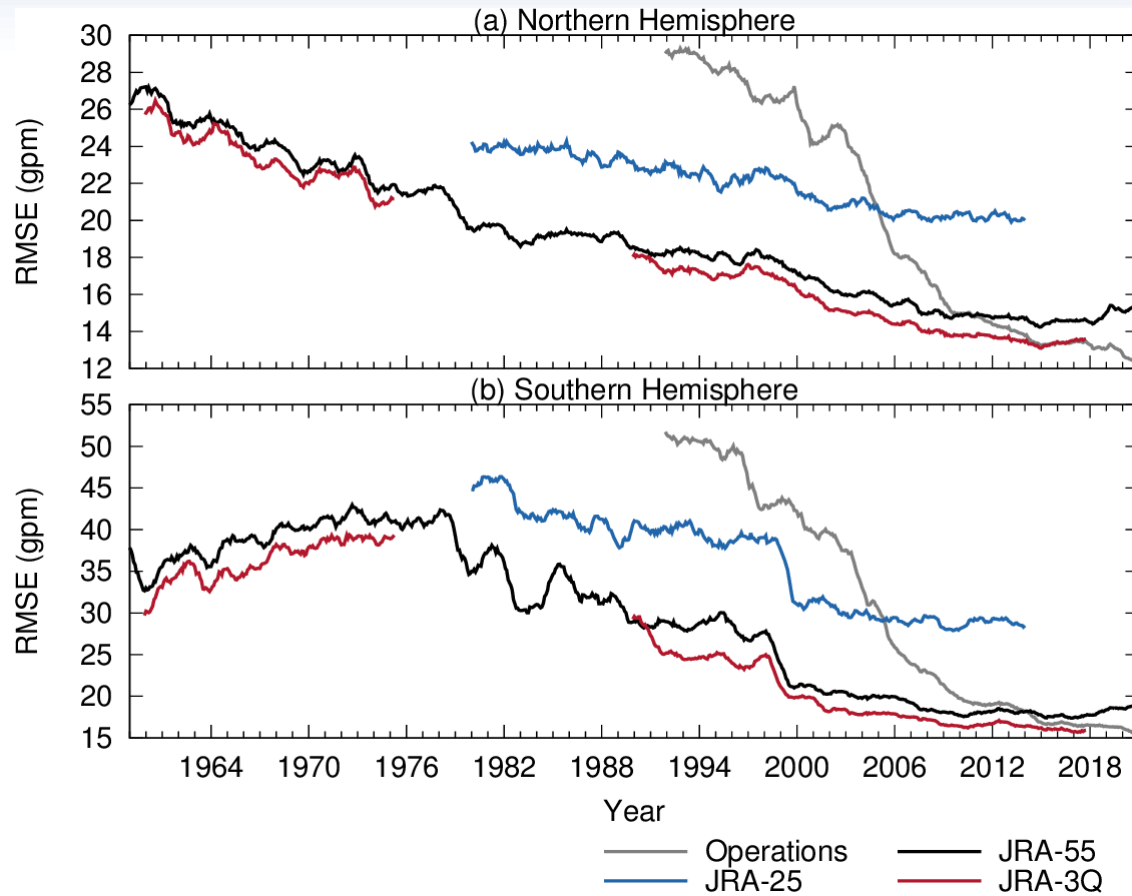


CPS2

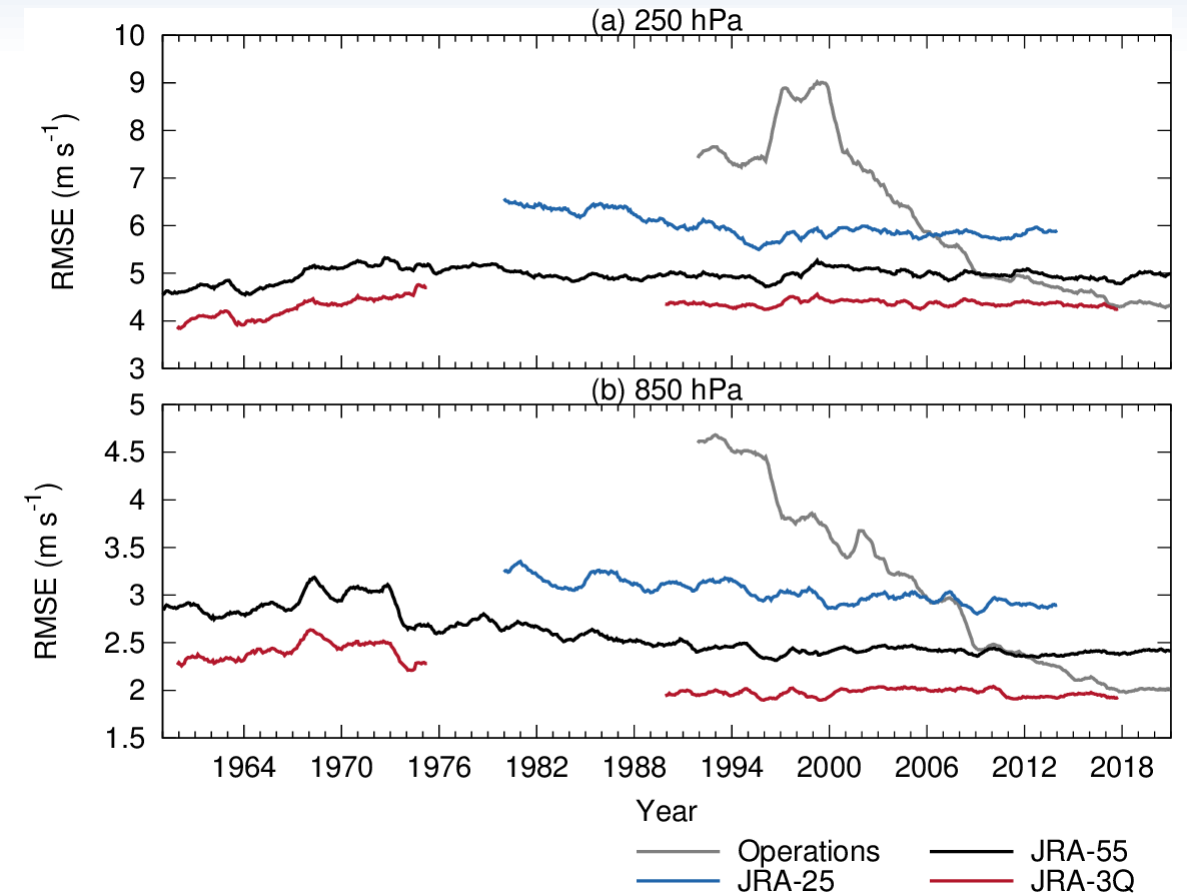


# Performance of Re-analysis

## 2-day forecast scores from analysis data



Geopotential Height at 500hPa



Wind vector in the tropics

# Summary and Information

- JMA plans to provide the gridded data of the new Global EPS , the new Seasonal EPS and the new re-analysis (JRA-3Q) by 2022.
- These data will be available through the following routes.

