



# Operational Use of ASCAT Coastal Winds in JMA Mesoscale NWP System

Shin KOYAMATSU

Numerical Prediction Division,  
Japan Meteorological Agency (JMA)

IOVWST Meeting @ The Westin Portland Harborview

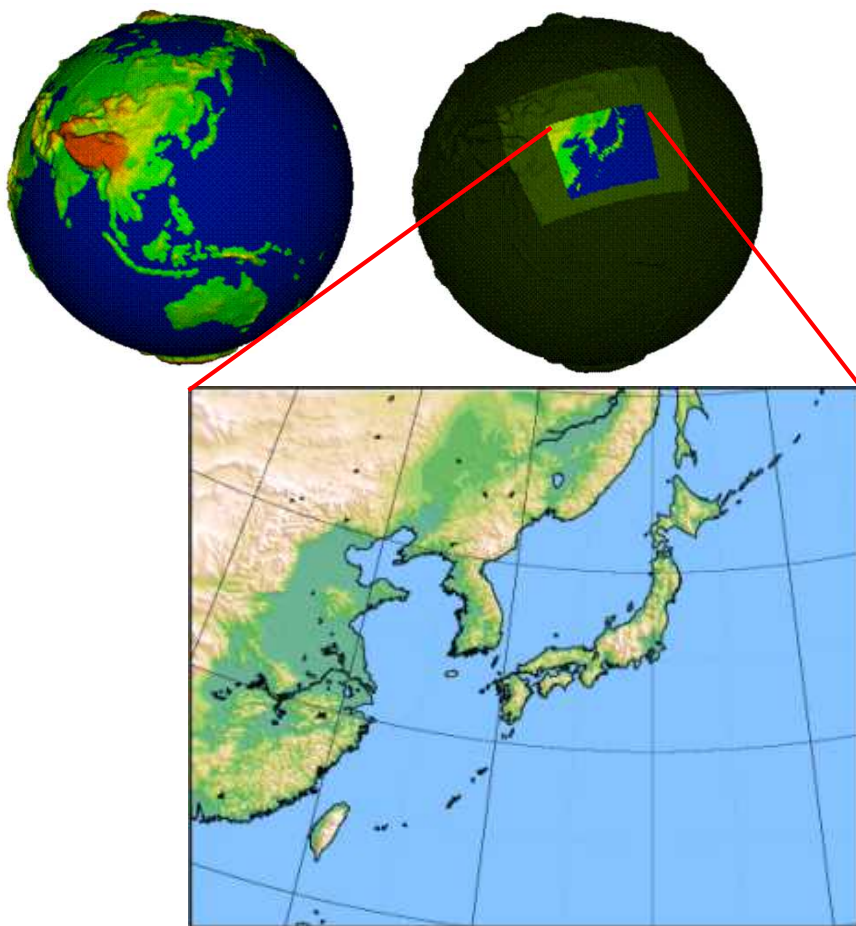
8:45-9:00 May 31 2019

# Brief Summary

- The JMA began assimilation of **ASCAT coastal wind data** in place of 25 km wind data into its mesoscale NWP system on March 26 2019.
- Expected effects of ASCAT coastal winds:
  - **Fill coverage gaps** of sea surface winds
  - **Increase the number of data** used in assimilation
- In this presentation, the impacts of ASCAT coastal wind data assimilation in the JMA mesoscale NWP system are shown.

# JMA Mesoscale NWP System

- JMA mesoscale model covers Japan and surrounding areas



## Mesoscale Model (MSM)

Purposes	Weather warnings/advisories Very short-range forecasts of precipitation Aviation forecasts
Grid size	5 km / 817 x 661
Vertical levels / Top	76 levels / 21.8 km
Forecast range	51 hours (00, 12 UTC) 39 hours (03, 06, 09, 15, 18, 21 UTC)

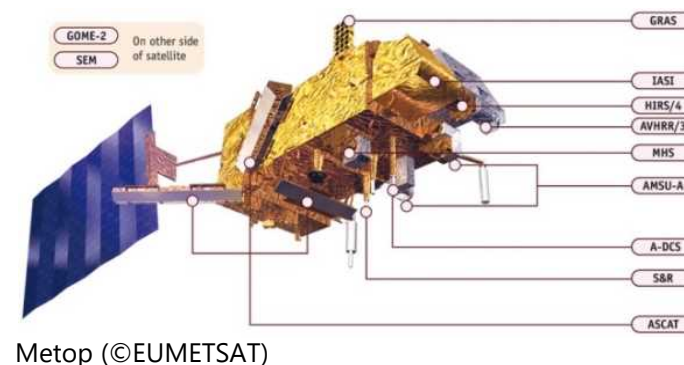
## Analysis System

Data assimilation method		4D-VAR
Outer	Grid size	5 km / 817 x 661
	Vertical levels / Top	48 levels / 21.8 km
	Integral time	20 sec
Inner	Grid size	15 km / 273 x 221
	Vertical levels / Top	38 levels / 22.1 km
	Integral time	40 sec
Analysis times		00, 03, 06, ..., 21 UTC
Time window		3 hours
Data Cut-off Time		50 min

# Use of Scatterometer in JMA Mesoscale Analysis

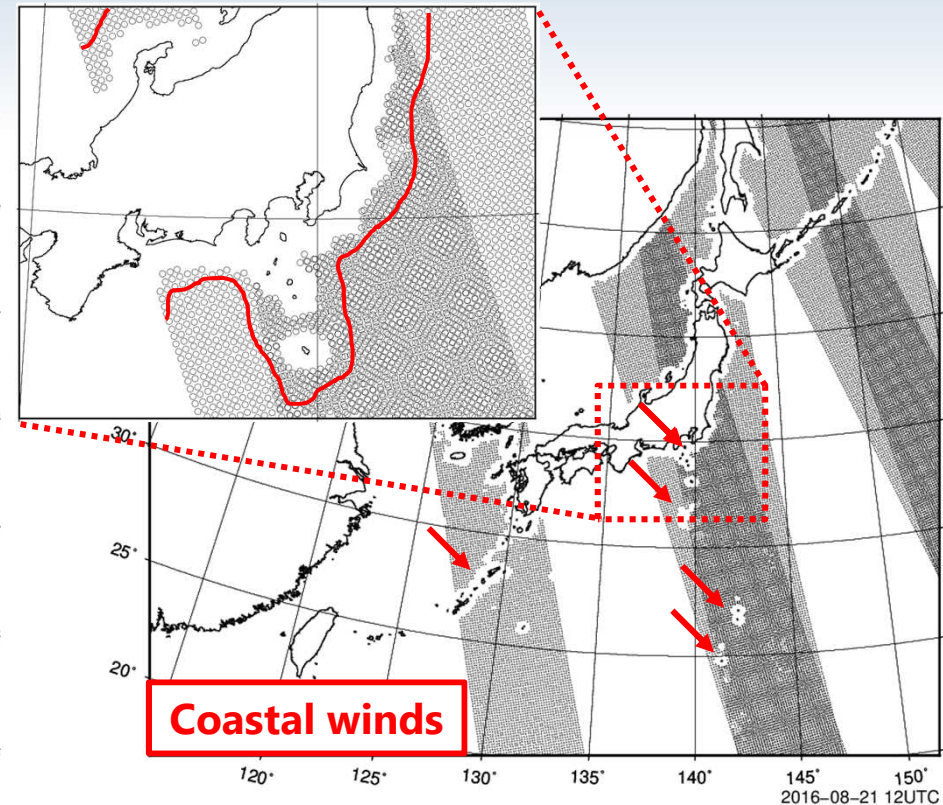
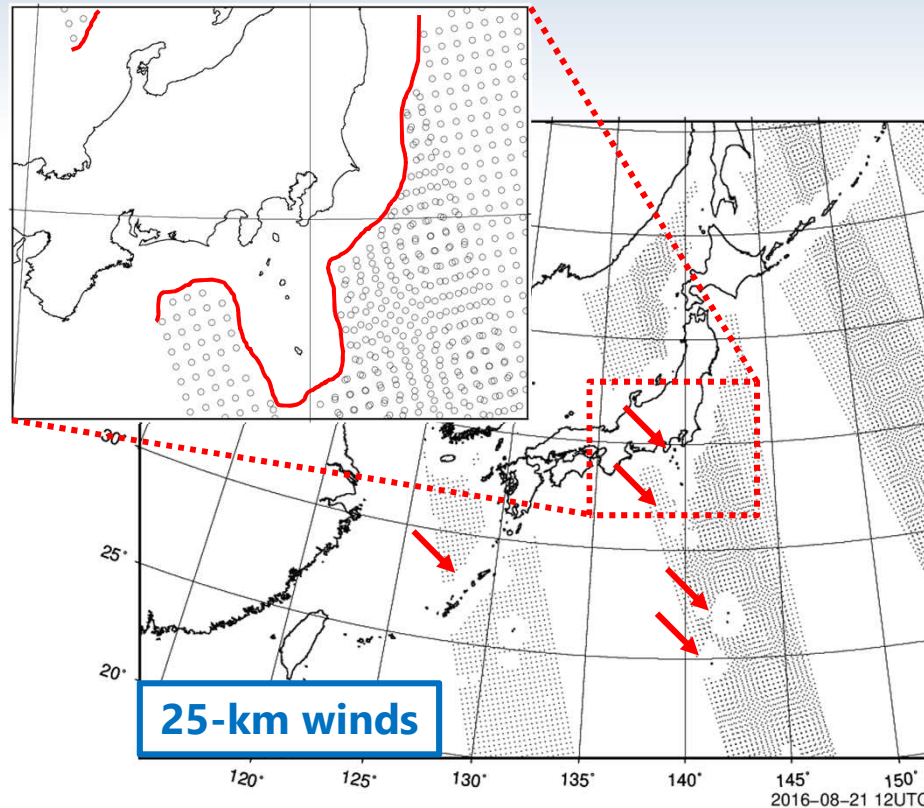
Scatterometer	ASCAT on Metop-A/B
Operational since	December 2015
Product	OSI-SAF Level 2 BUFR <b>25-km</b> equivalent-neutral wind product by KNMI
Observation error	3.0 m/s
Wind speed range	0-25 m/s
Crosstrack cell used	All nodes
Bias correction	None

- ASCAT wind data obtained with **25 km cell spacing** had been used in the JMA mesoscale NWP system since December 2015.





# ASCAT Coastal Wind Data



- ASCAT coastal winds are available off the **coast of main islands of Japan** and **around small islands**, where ASCAT 25-km winds are unavailable.
- **Improvement of analysis fields** is expected by the increase in the number of available data due to the expansion of data coverage.

# Setup of Data Assimilation Experiments

- Purpose
  - To investigate **impacts of ASCAT coastal wind data** on the JMA mesoscale NWP system.
- Configuration
  - Two experiments for comparison
    - **25KM**: with ASCAT **25 km winds**
    - **COAST**: with ASCAT **coastal winds**
- Period
  - **Summer**: 27 Jun. 2016 to 30 Aug. 2016 (65 days)
  - **Winter**: 11 Dec. 2016 to 15 Jan. 2017 (36 days)

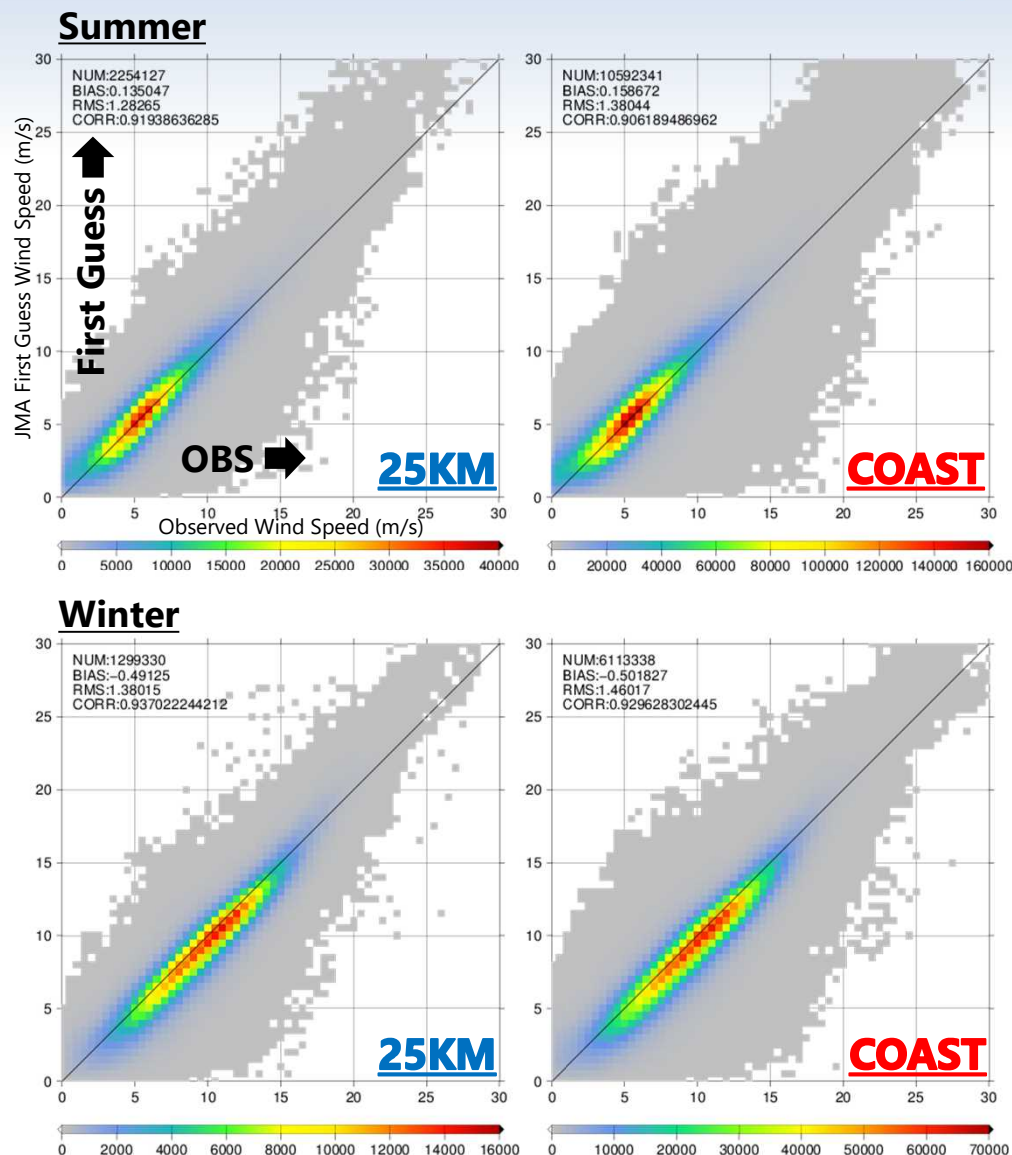
Analysis experiments are started at five days before Forecast experiments as a spin-up period.

# Pre-Analysis Procedure

- Pre-analysis procedures in JMA mesoscale analysis were applied in both 25KM and COAST.

Step	Description
Flag check	Rain, Land/Sea, Sea ice, etc.
Value check	Reject unexpected values.
Ambiguity removal	Select winds close to JMA first guess by median filter after nudging.
Wind speed check	Reject winds with a speed above 25.0 m/s.
Gross error check	Reject winds with large $ O-B $ or $ O-B/B $ in speed.
	Reject wind groups* with large $ O-B $ or $ O-B/B $ in direction. (*grouped if neighboring winds are similar)
Data Thinning	0.5 degree $\times$ 0.5 degree box.

# Data Comparison



**COAST** has a good quality enough to replace **25KM**.

- The larger Std. Dev. of O-B in COAST implies that COAST has captured smaller scale phenomenon.
- Similar characteristics are confirmed for each data set.

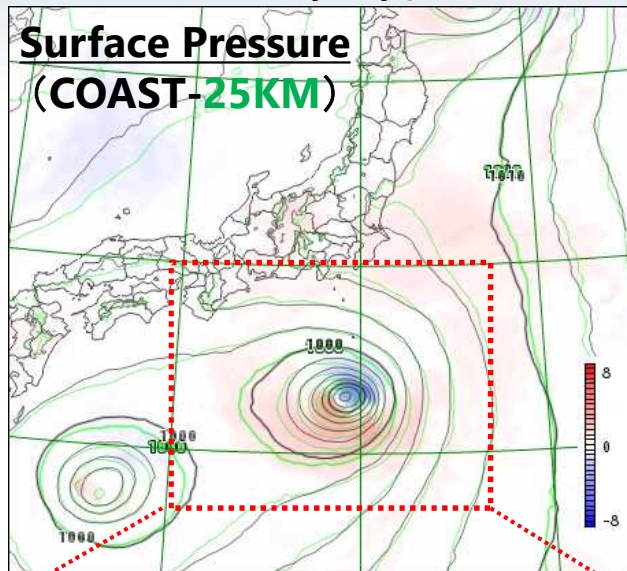
O-B in Summer	25KM	COAST
Data count	2,254,127	10,592,341
Mean (m/s)	-0.14	-0.16
Std. Dev. (m/s)	1.27	1.37

O-B in Winter	25KM	COAST
Data count	1,299,330	6,113,338
Mean (m/s)	0.49	0.50
Std. Dev. (m/s)	1.29	1.37

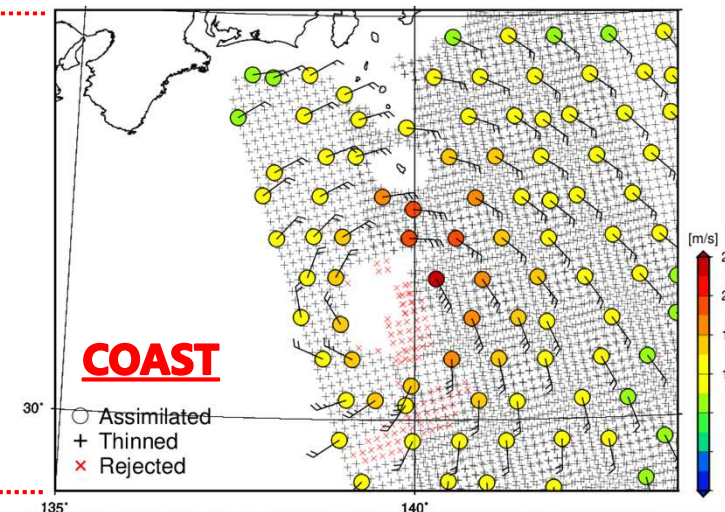
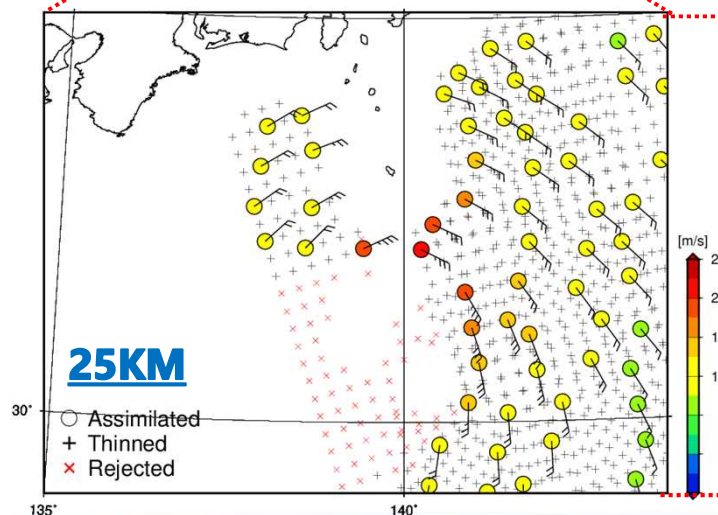


# Impact on Analysis Field

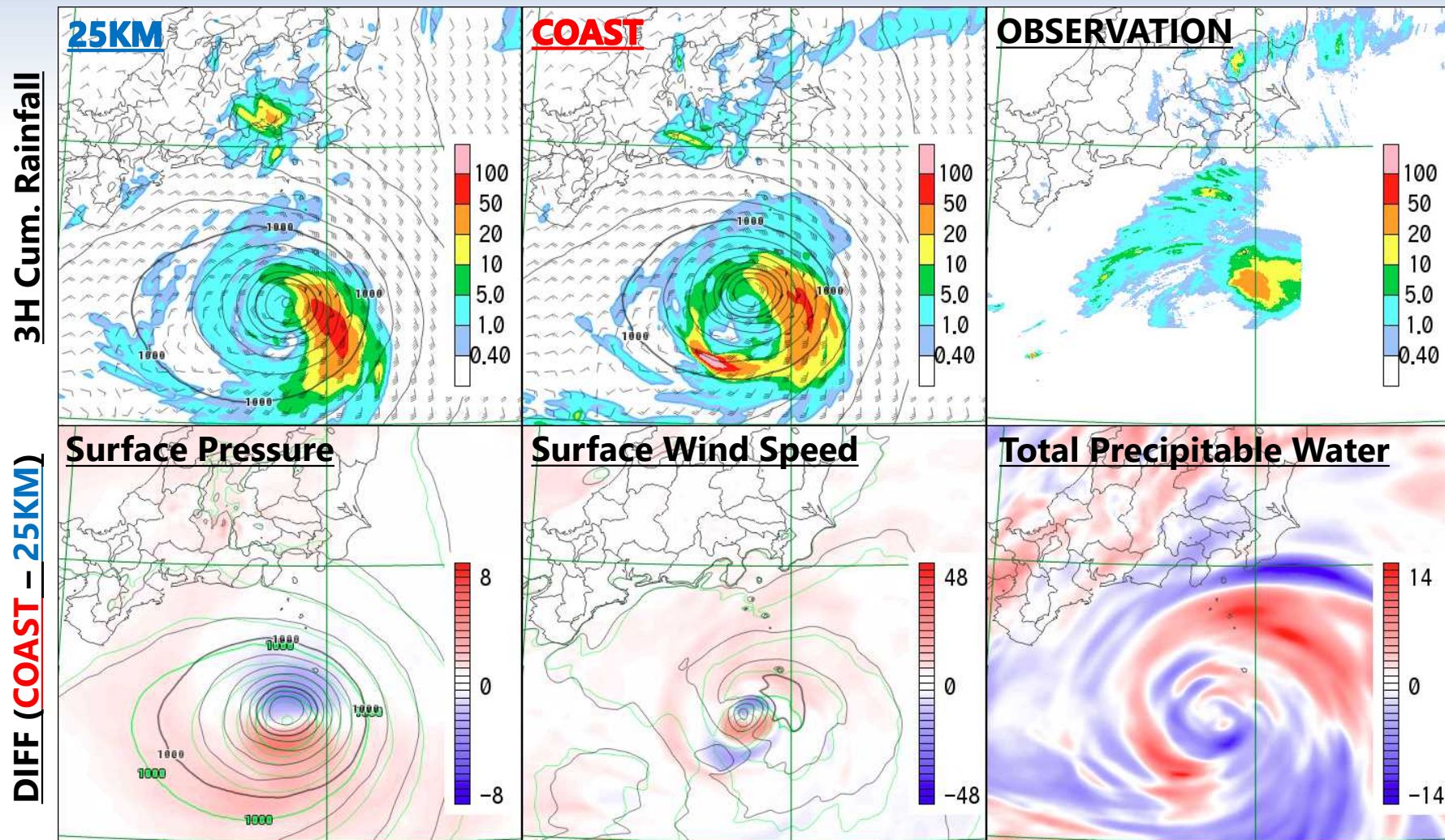
A case study: Typhoon Mindulle (2016) at 12 UTC on August 21



- Typhoon position is changed toward northeast in analysis field.
- Increase of available data in **COAST**:
  - Off coast of Japan main island
  - Around small islands
  - Area rejected by QC in **25KM**
- Increase of assimilated data contributes to the change of typhoon position.



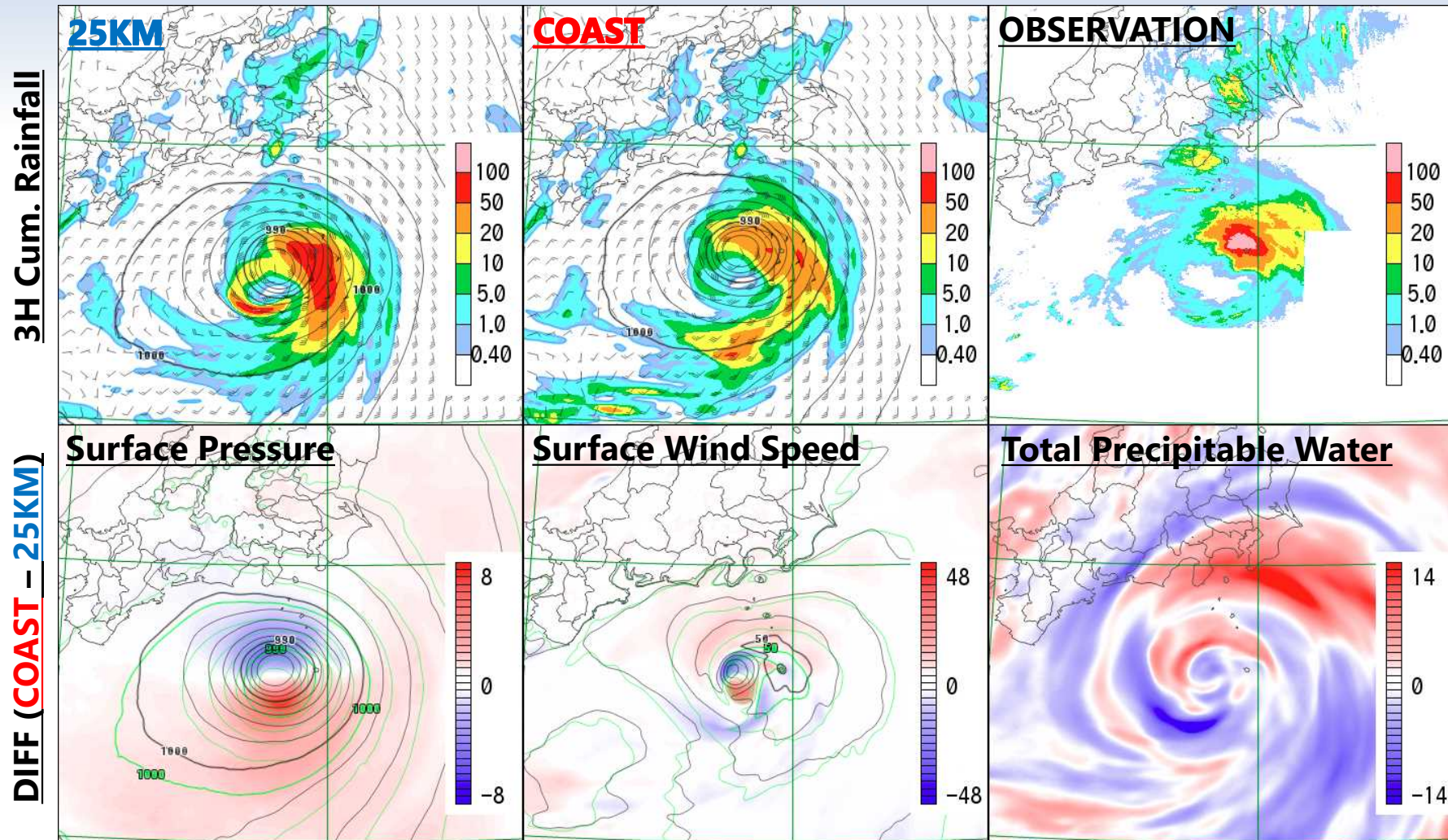
# 3-hour Forecast



- According to the modification of the analysis field, the prediction of typhoon position is also changed northward.

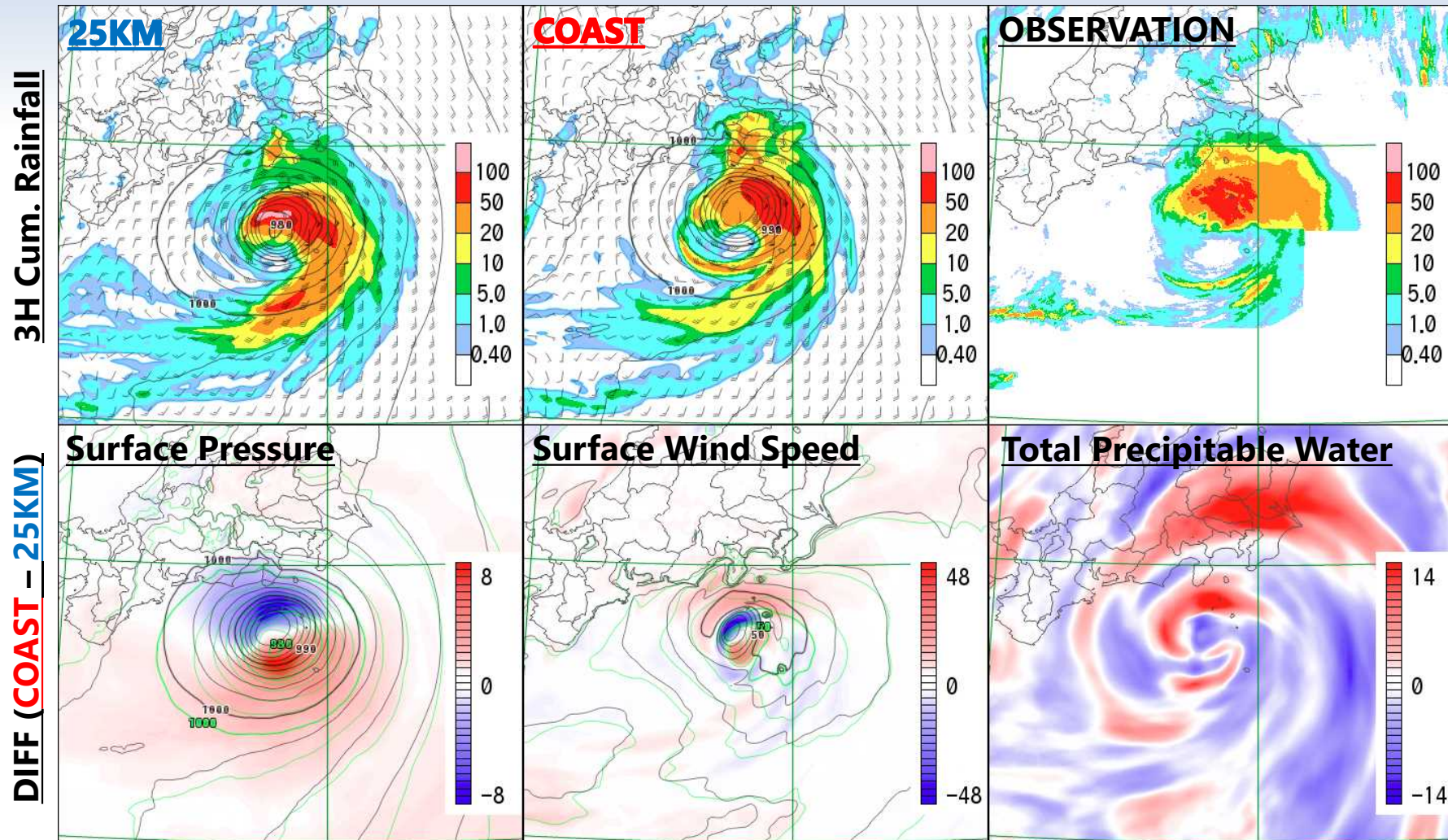


# 6-hour Forecast



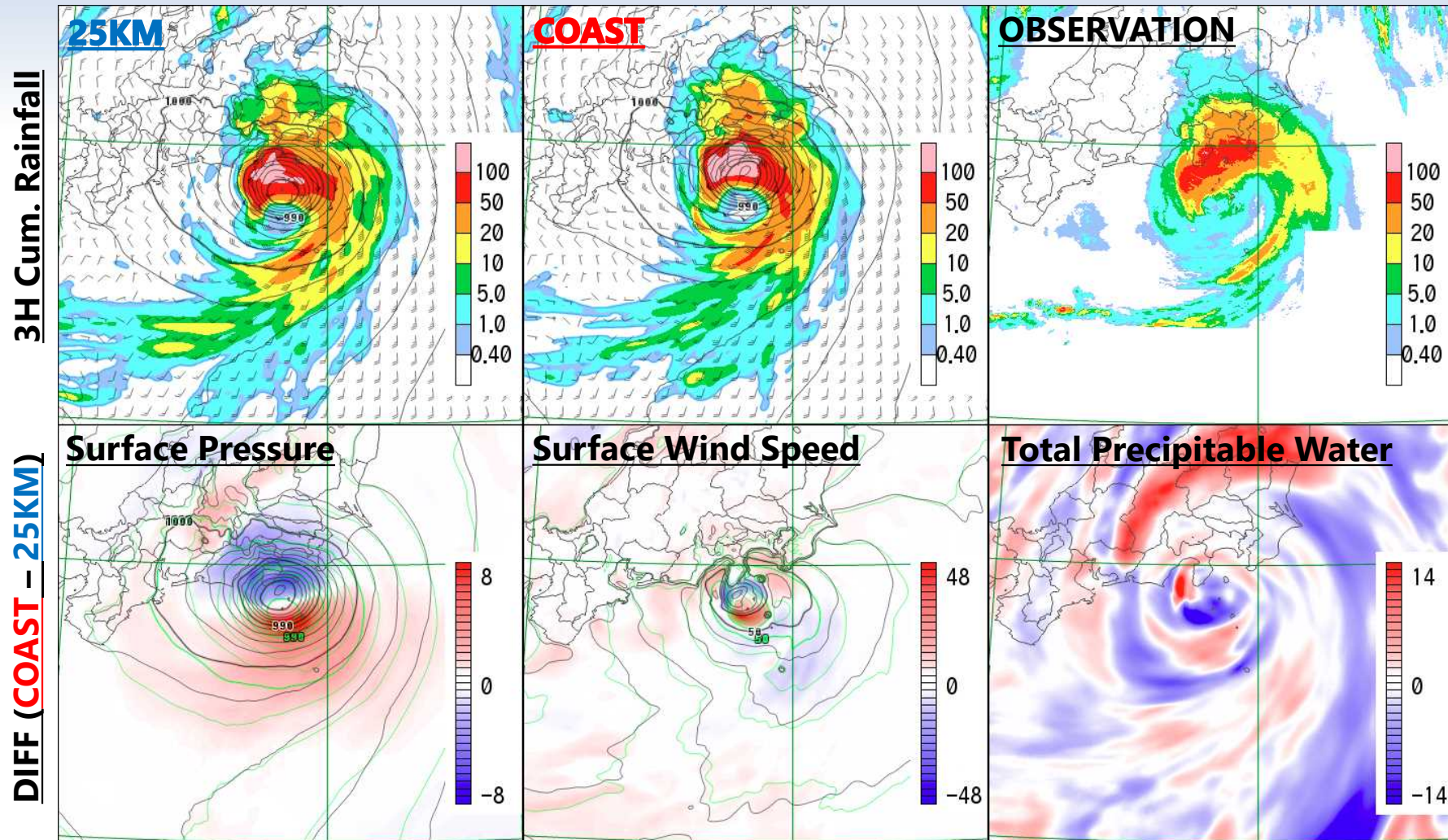


# 9-hour Forecast



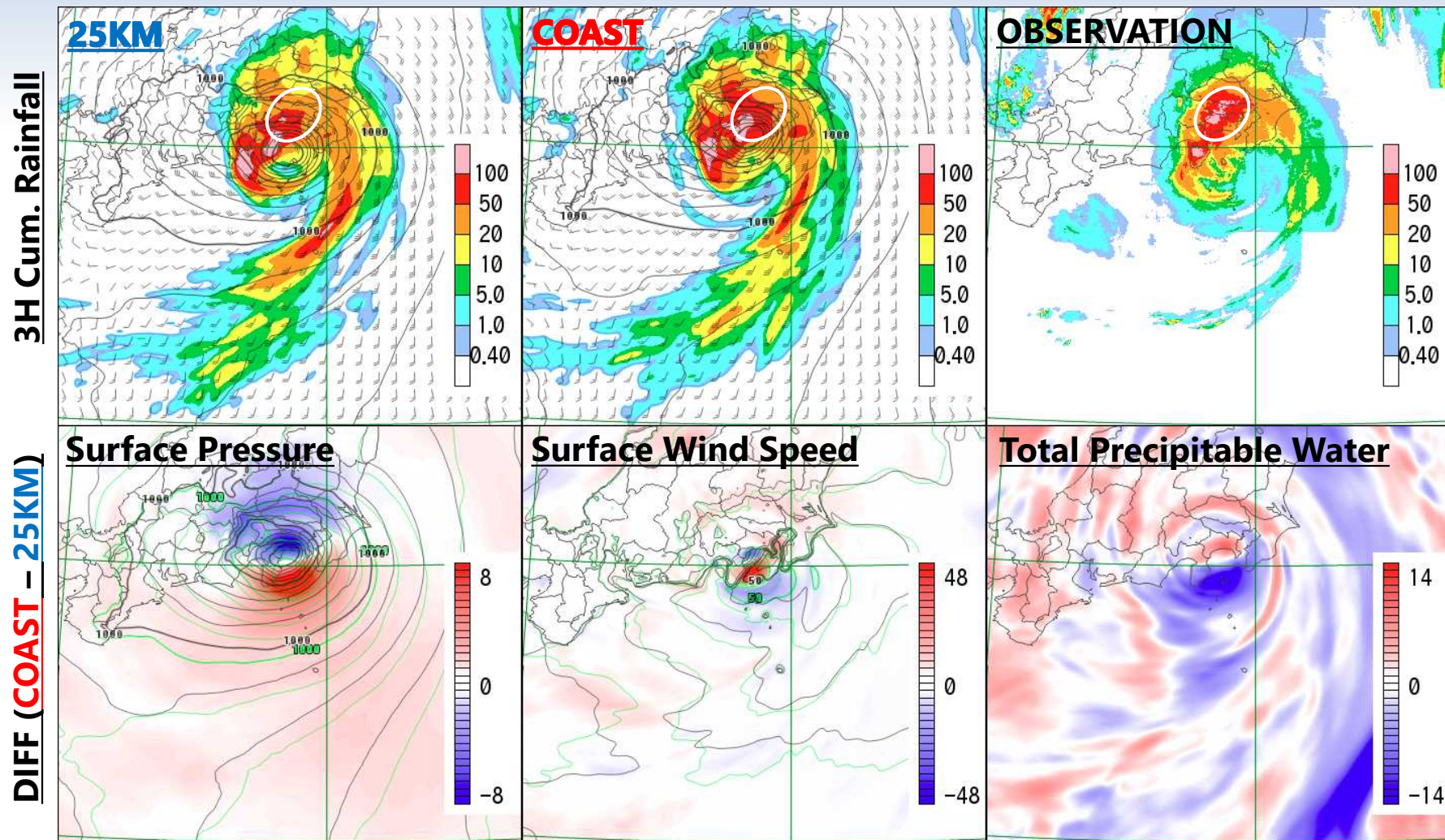


# 12-hour Forecast





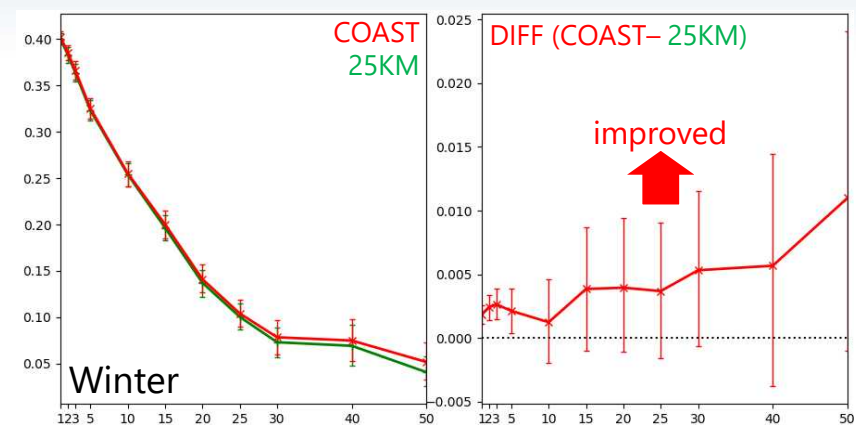
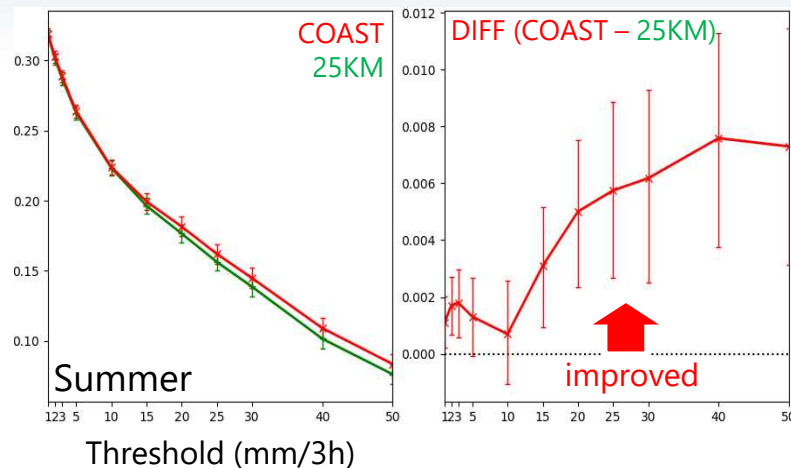
# 15-hour Forecast



- The distribution of precipitation is also shifted northward, and the prediction of heavy rain is improved.

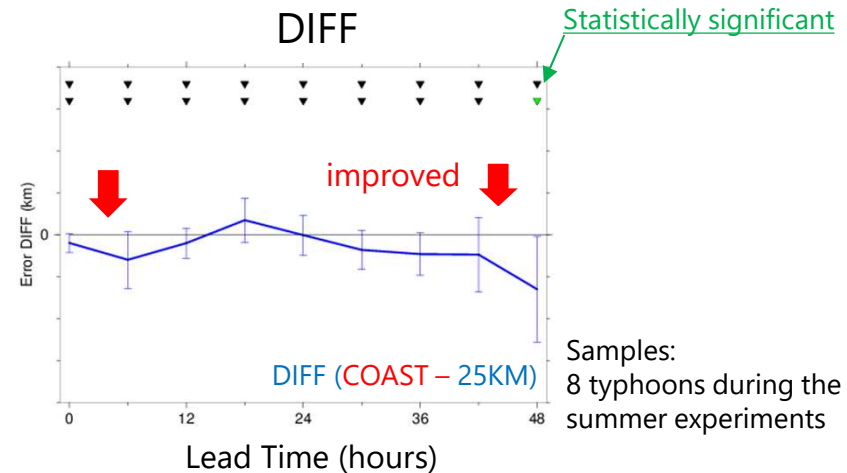
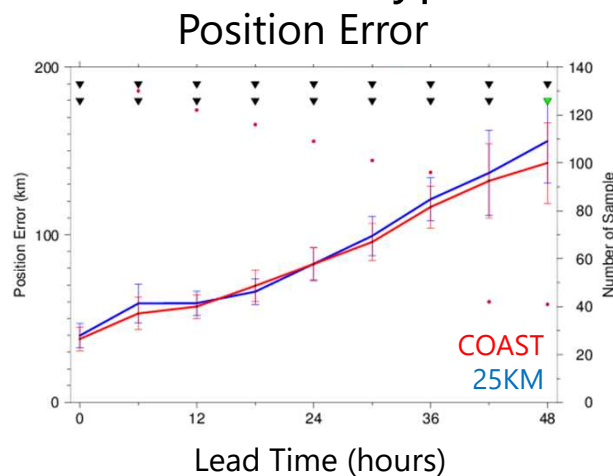
# Precipitation and Typhoon Statistics

## Equitable Threat Scores (ETSs)



Against Radar/Raingauge-Analyzed Precipitation  
Grid size for verification: 20 km x 20 km

## Typhoon Position Errors



# Summary

- The use of ASCAT coastal winds in JMA mesoscale NWP system brought:
  - Increase of data coverage and data number used in the assimilation
  - Positive impact on a typhoon
  - Improvements on precipitation forecast scores and position errors of typhoon prediction
- Based on these results, the JMA began the assimilation of ASCAT coastal wind data into its mesoscale NWP system on March 26 2019.





Thank You for Your Attention!!