

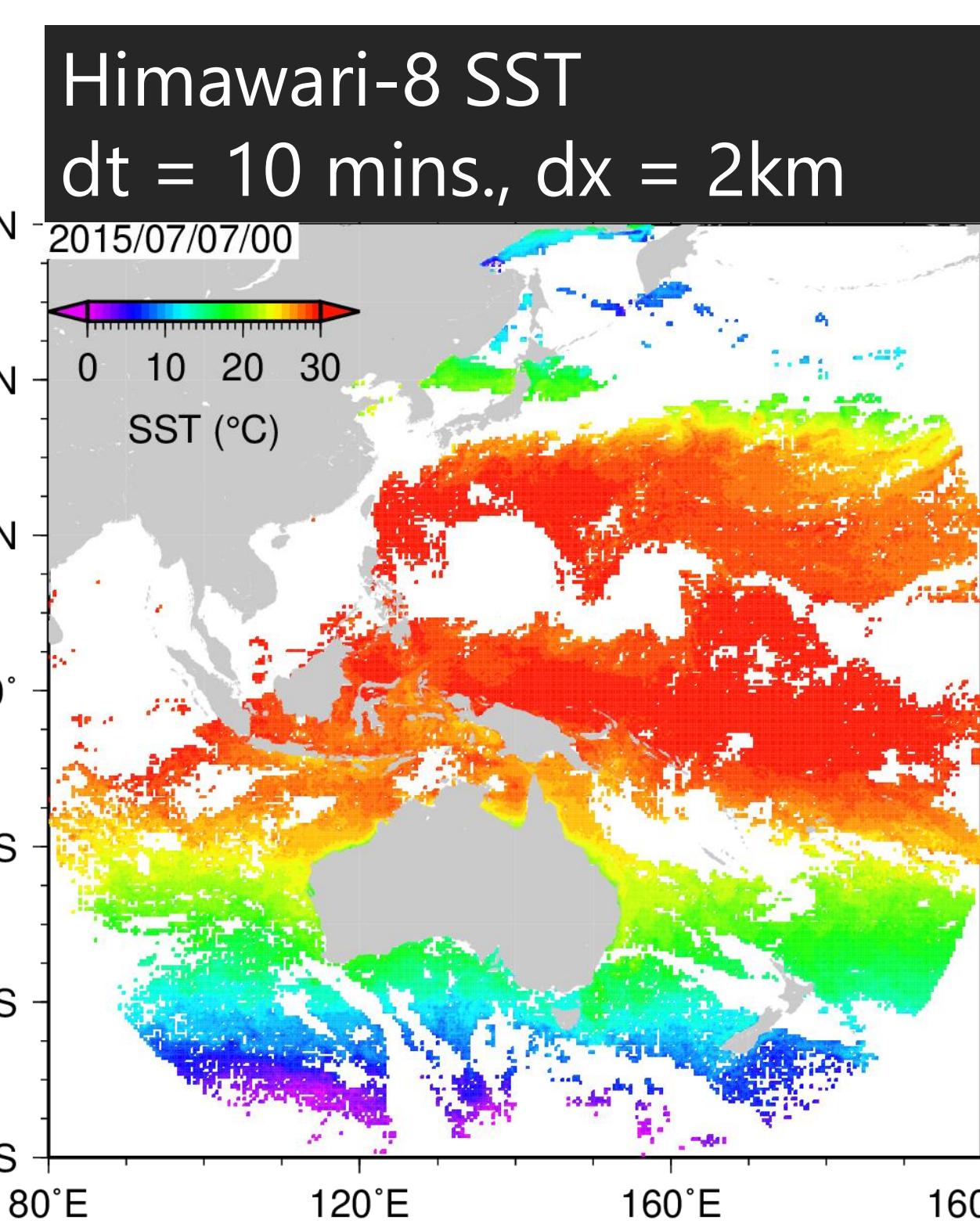
# Development of an ensemble ocean data assimilation system

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## 1 Introduction

- Frequent satellite observations  
(ex. Himawari-8)
- Motivation for frequent data assimilation (DA)
- Challenging topic: Frequent DA
- Analyses with dynamical imbalance
- Initial shocks with high-frequency gravity waves
- Degradation of accuracy



## 2 Motivation

- Explore an optimal setting for frequent DA in an EnKF-based ocean data assimilation system
- Create EnKF-based ocean research analysis datasets
- Compare validation results with existing reanalysis and observational datasets

## 3 EnKF-based ocean data assimilation system

### ■ Regional ocean model

Model: sbPOM v1.0 (Jordi and Wang 2012)

Domain: Western North Pacific & Maritime Continent

Resolution:  $dx=0.25^\circ$  (Sensitivity exps.),  $0.1^\circ$  (LORA), 50  $\sigma$ -layers

### ■ Assimilation

Method: LETKF (Hunt et al. 2007)

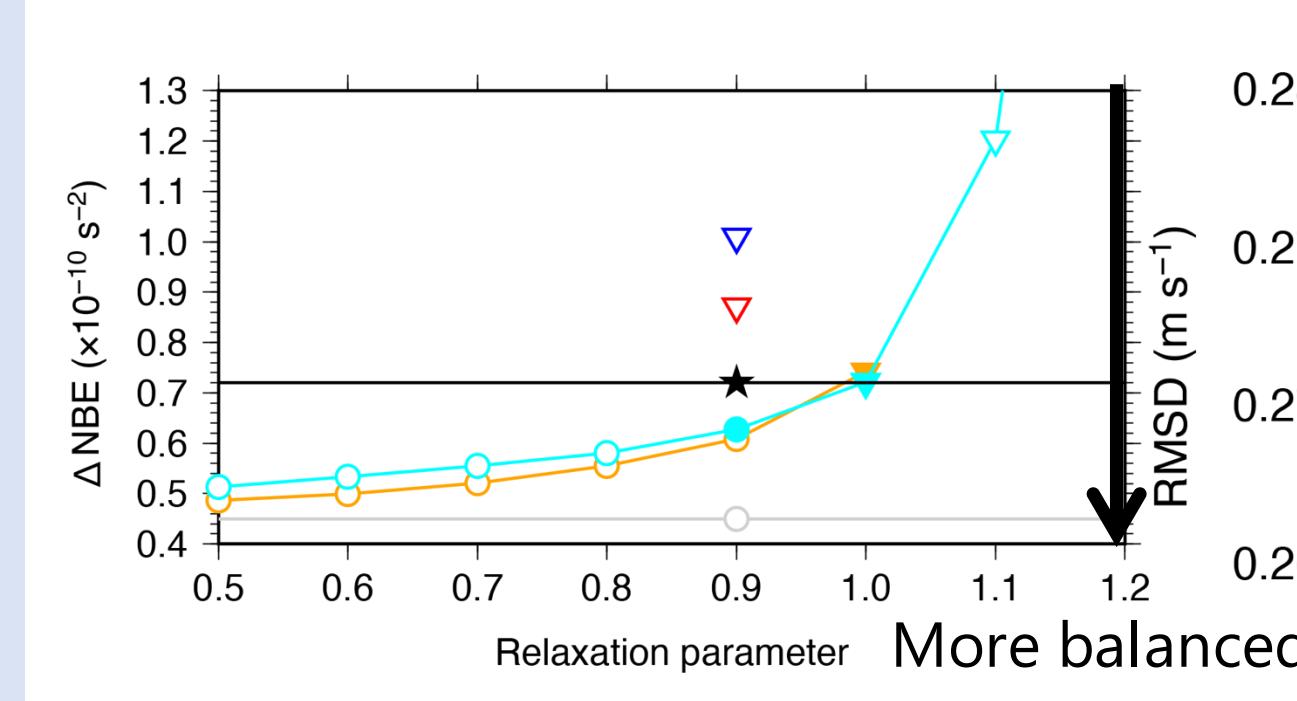
Ensemble size: 128, Assimilation interval: 1 day

Assimilation data: Satellite SST/SSS/SSH and in-situ T/S

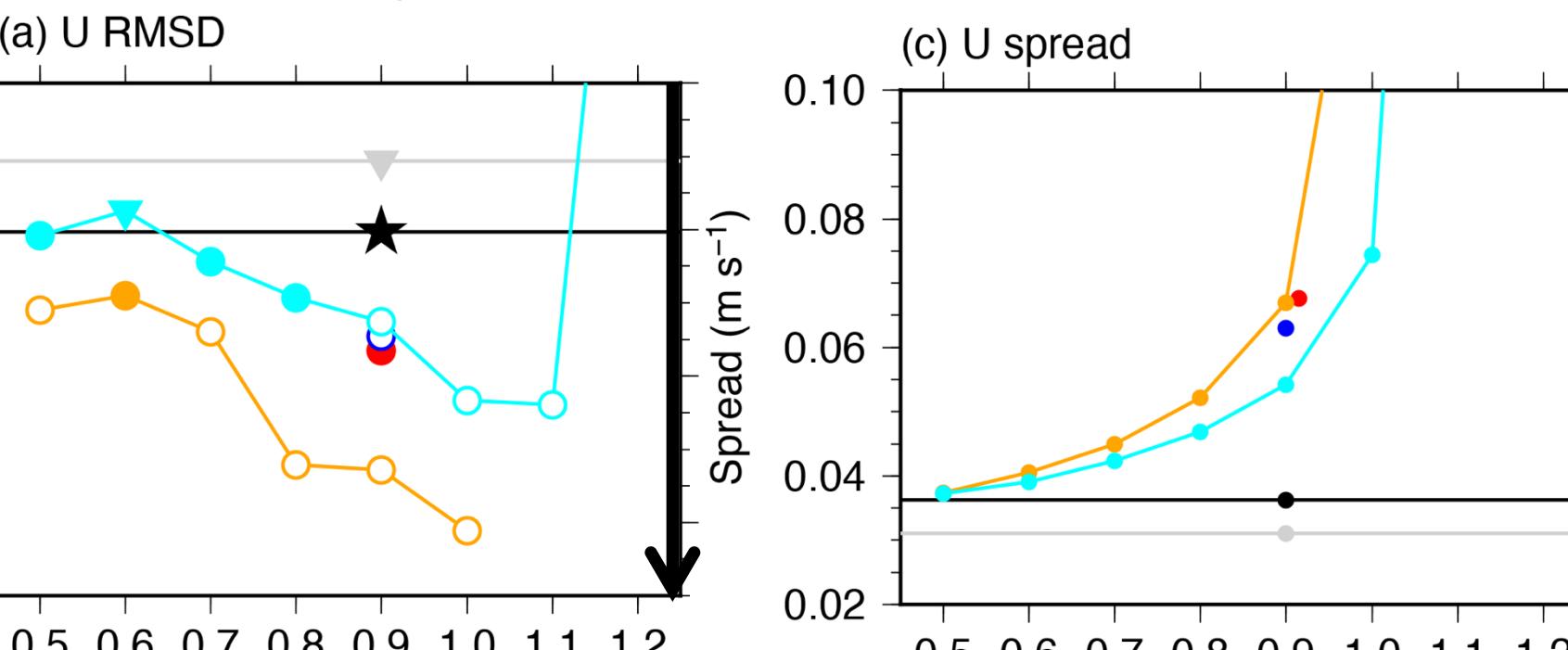
Assimilation period: 2015.07.07 – 2024.01

## 4 Covariance inflation & IAU (Ohishi et al. 2022a)

### ■ Geostrophic balance

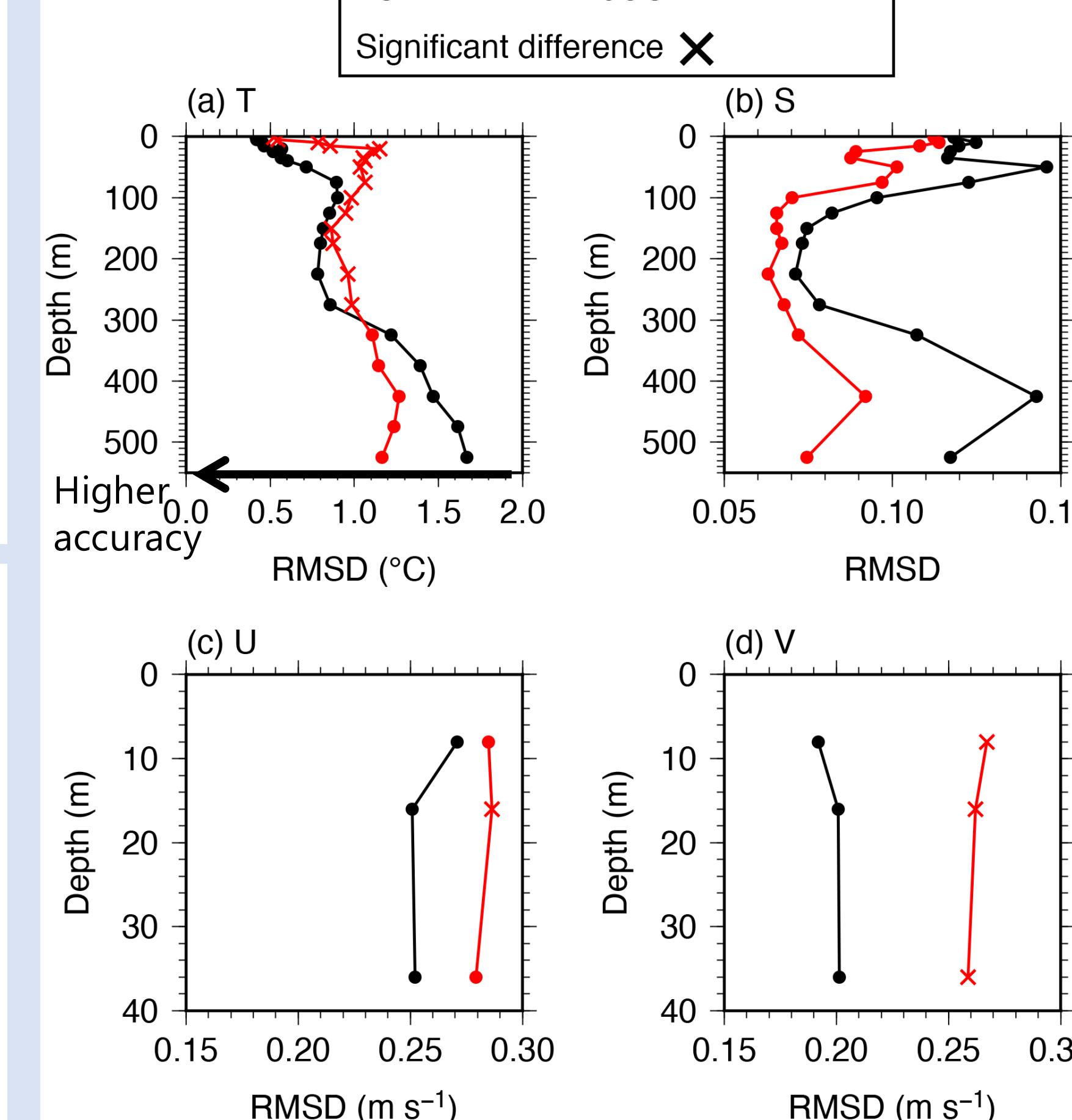


### ■ Accuracy



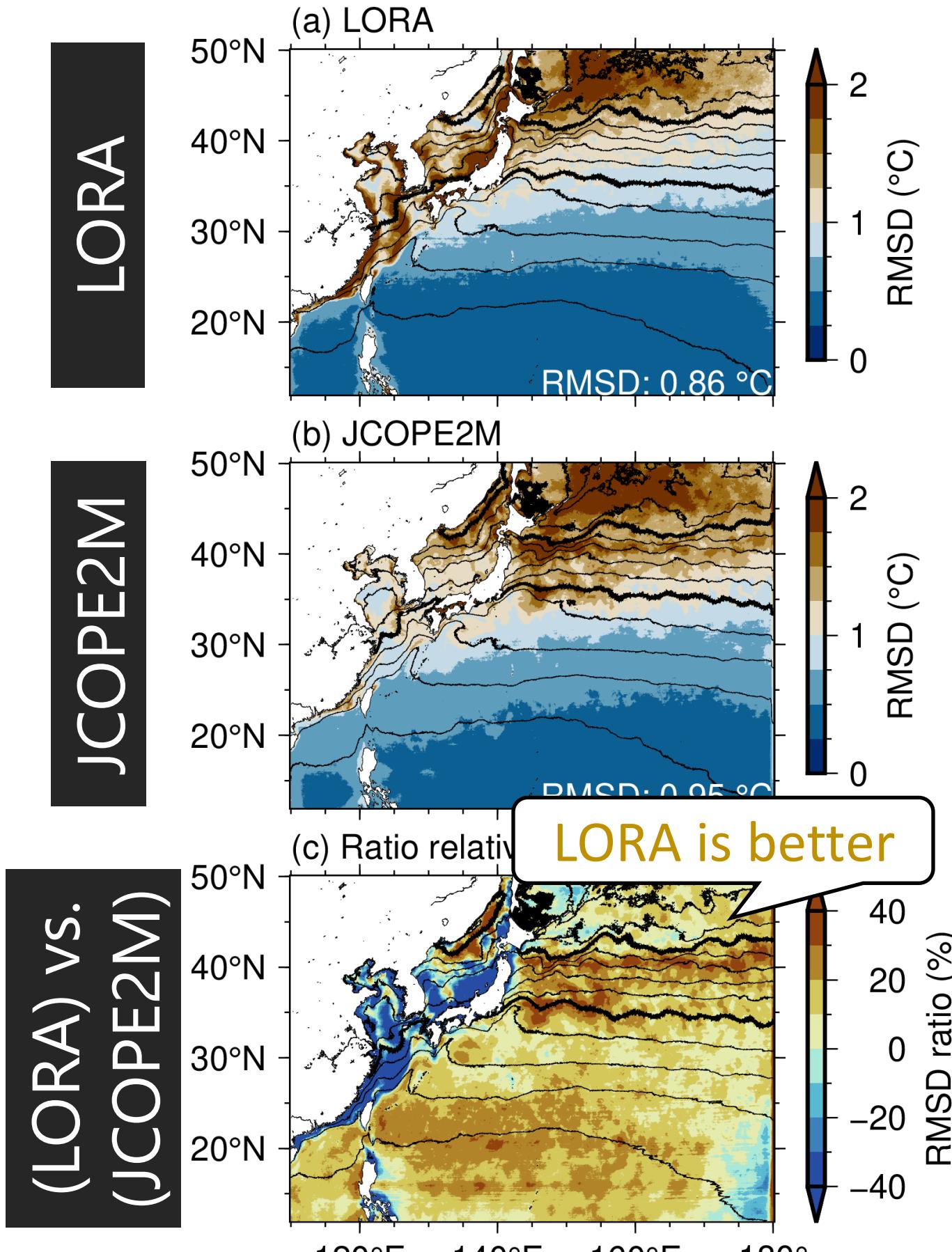
### ■ Ensemble spread

### ■ Accuracy relative to the KEO buoy



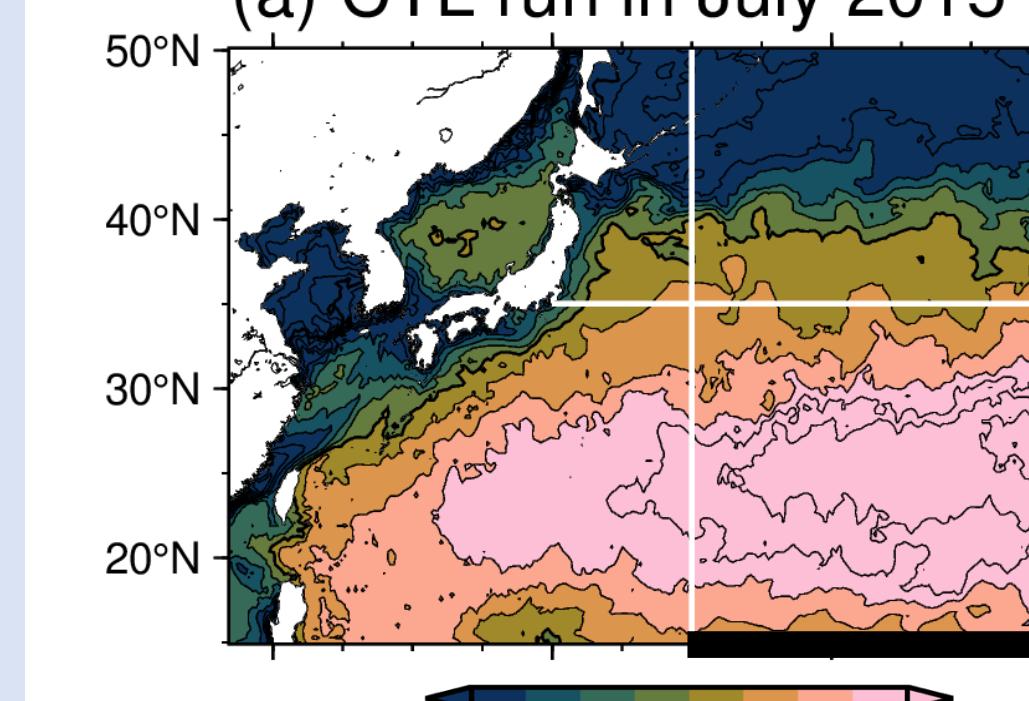
### ■ Accuracy relative to

#### Himawari-8 SST

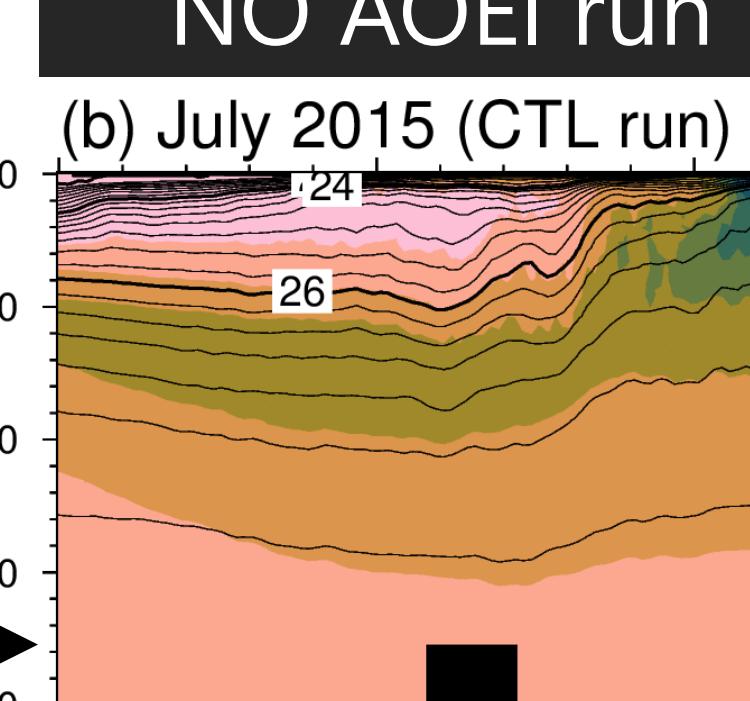


## 5 Adaptive Obs. Error Inflation (AOEI) (Ohishi et al. 2022b)

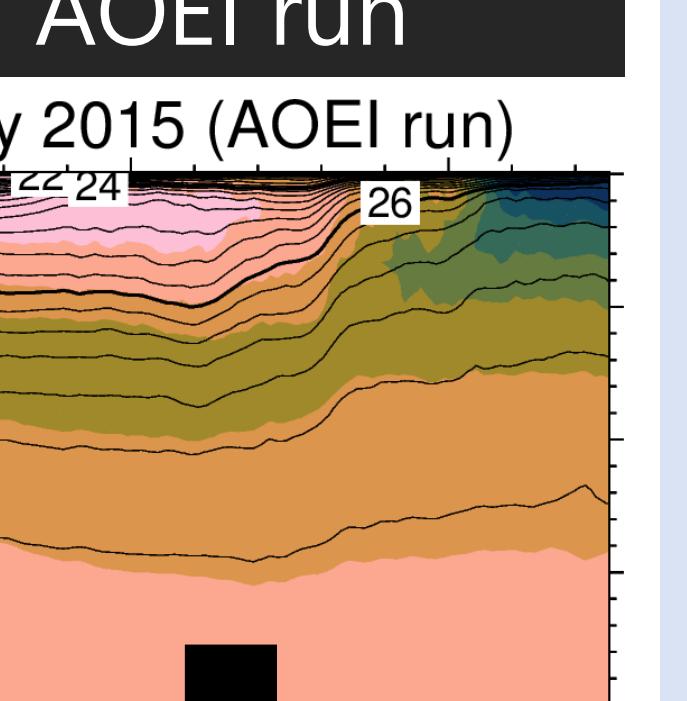
### (a) CTL run in July 2015



### NO AOEI run



### AOEI run



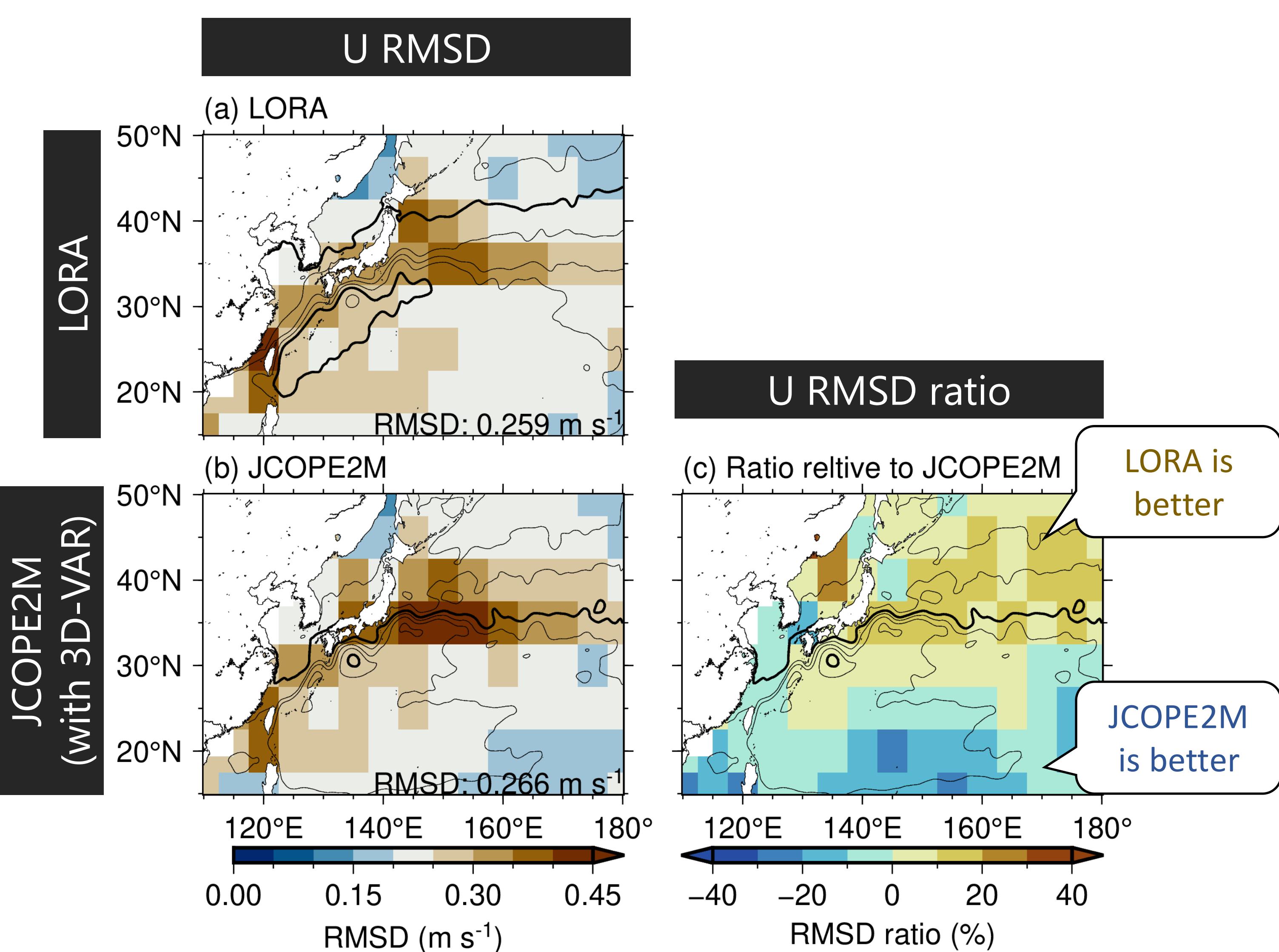
- AOEI is based on innovation statistics
- AOEI improves low-salinity structure

## 6 LORA: LETKF-based Ocean Research Analysis (Ohishi et al. 2023)

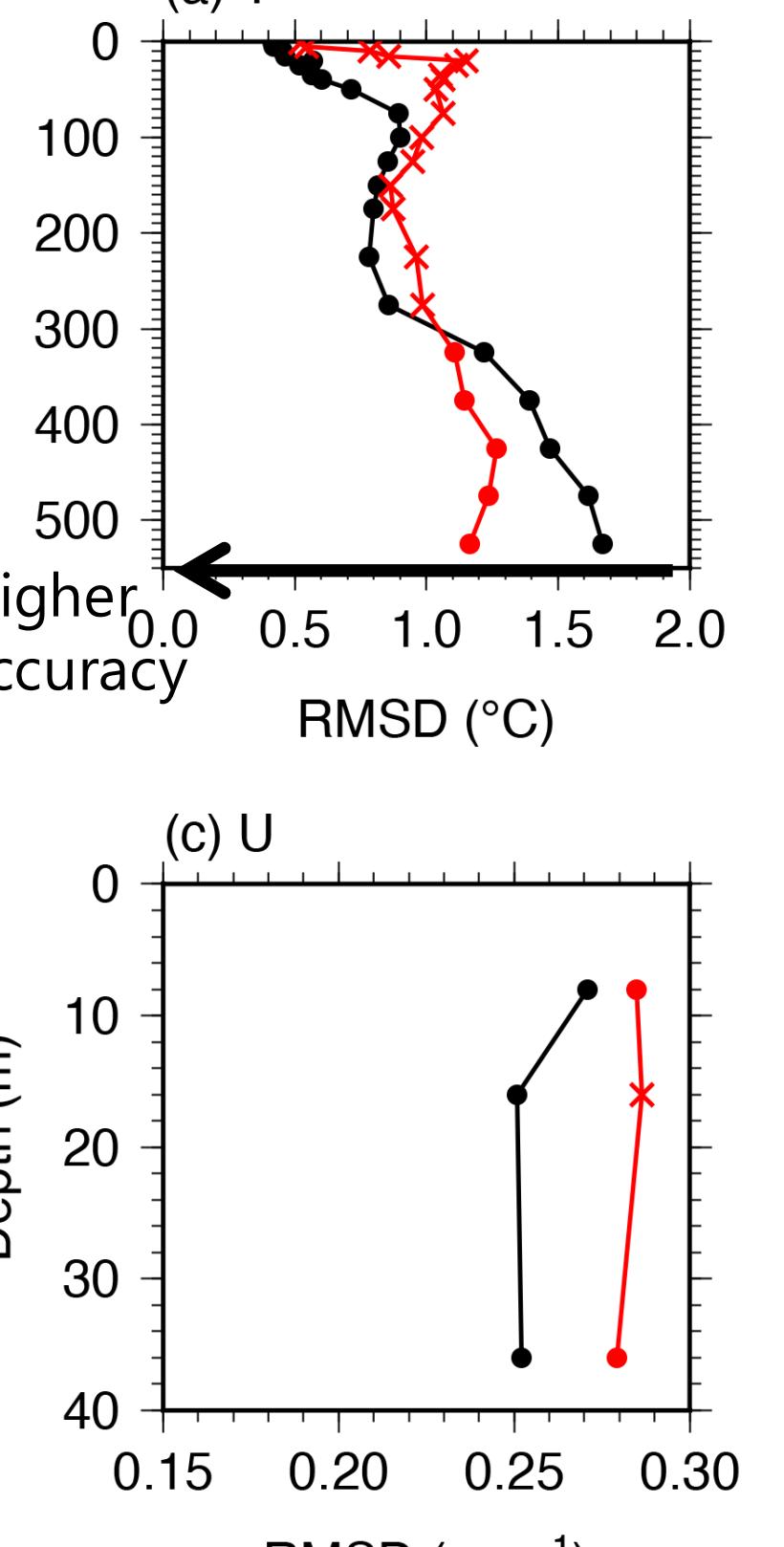
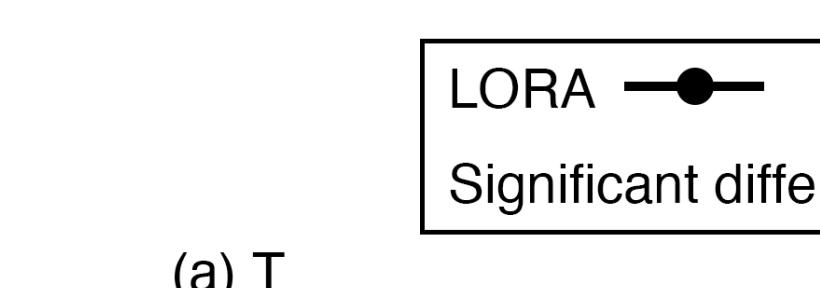
### ■ Outputs

- Daily-mean 3D-ensemble mean and spread
- Daily-mean all ensemble analyses at the sea surface
- Daily-mean mixed layer heat and salinity budget equation terms

### ■ Accuracy of surface horizontal velocity relative to drifter buoys

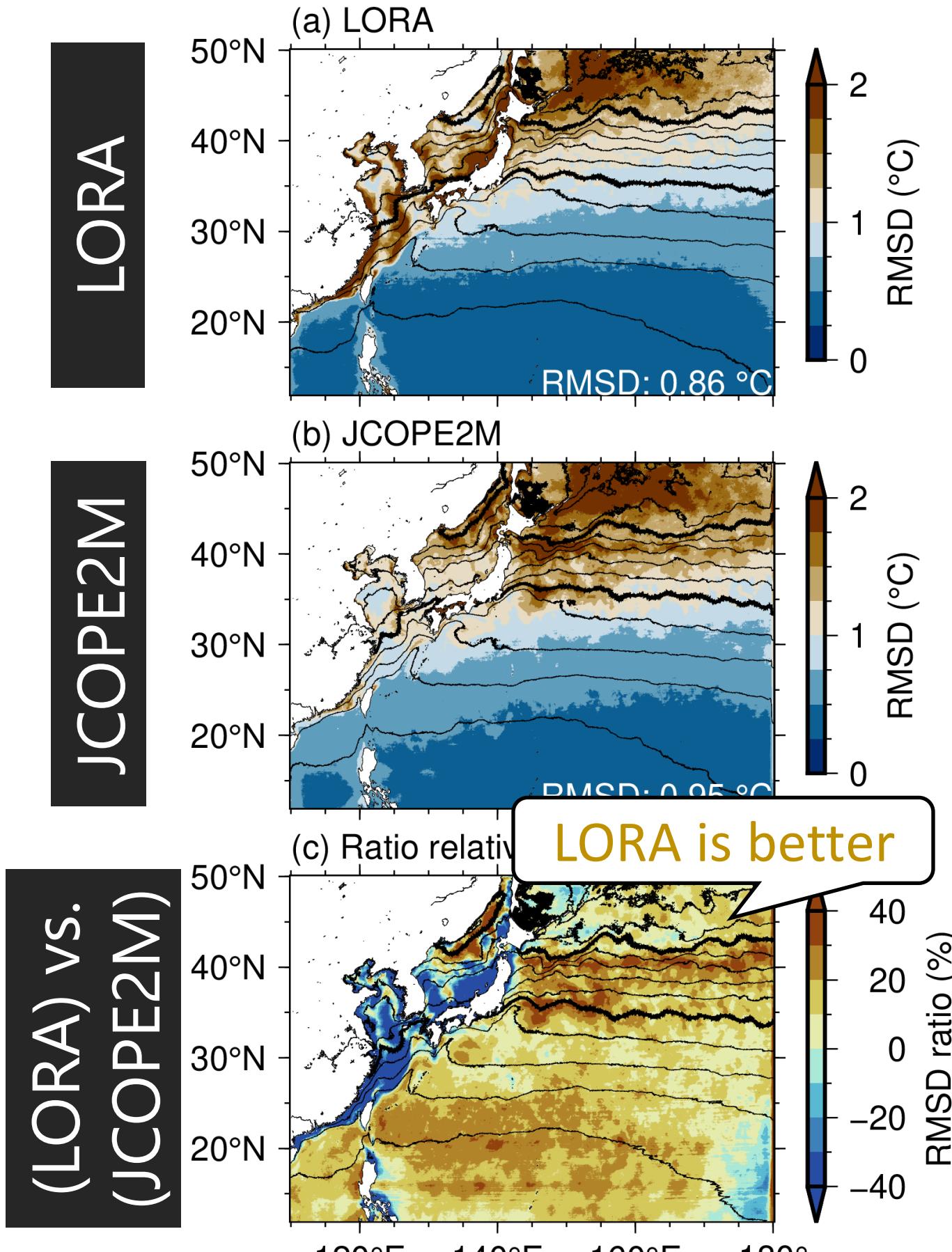


### ■ Accuracy relative to the KEO buoy



### ■ Accuracy relative to

#### Himawari-8 SST



## 7 Summary

- A high-resolution EnKF-based regional ocean data assimilation system was developed for conducting frequent DA.
- The combination of IAU, RTPP, and AOEI is found to be optimal.
- LORA has sufficient accuracy for geoscientific research.
- LORA v1.0 has been released through the JAXA-RIKEN Ocean Analysis website since March 2023 (Ohishi et al. 2024a, b).

### JAXA-RIKEN Ocean Analysis

