

# 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)

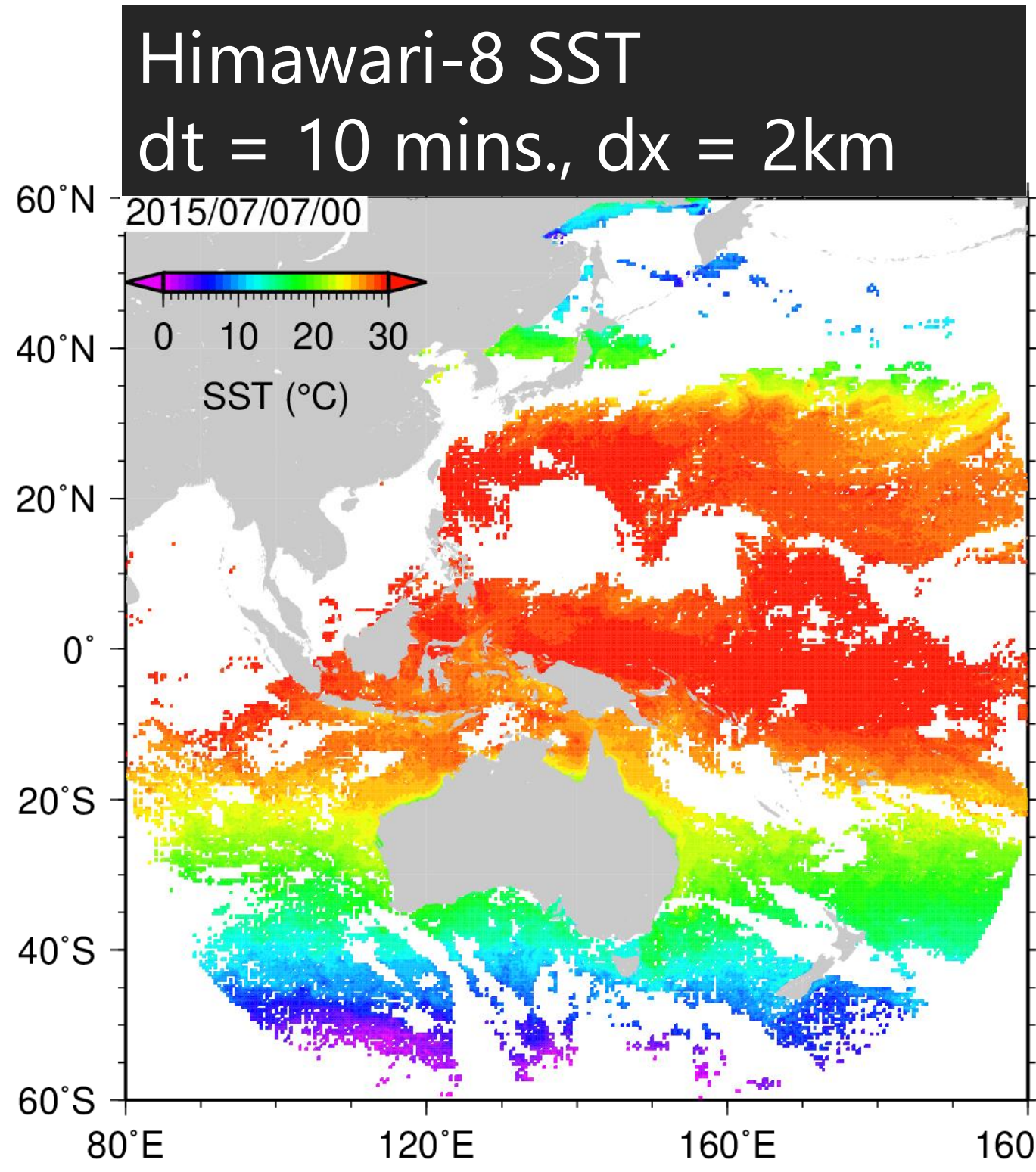
### Challenging topic: Frequent DA

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° (Sensitivity exps.), 0.1° (LORA), 50  $\sigma$ -layers

### Assimilation

Method: LETKF (Hunt et al. 2007)

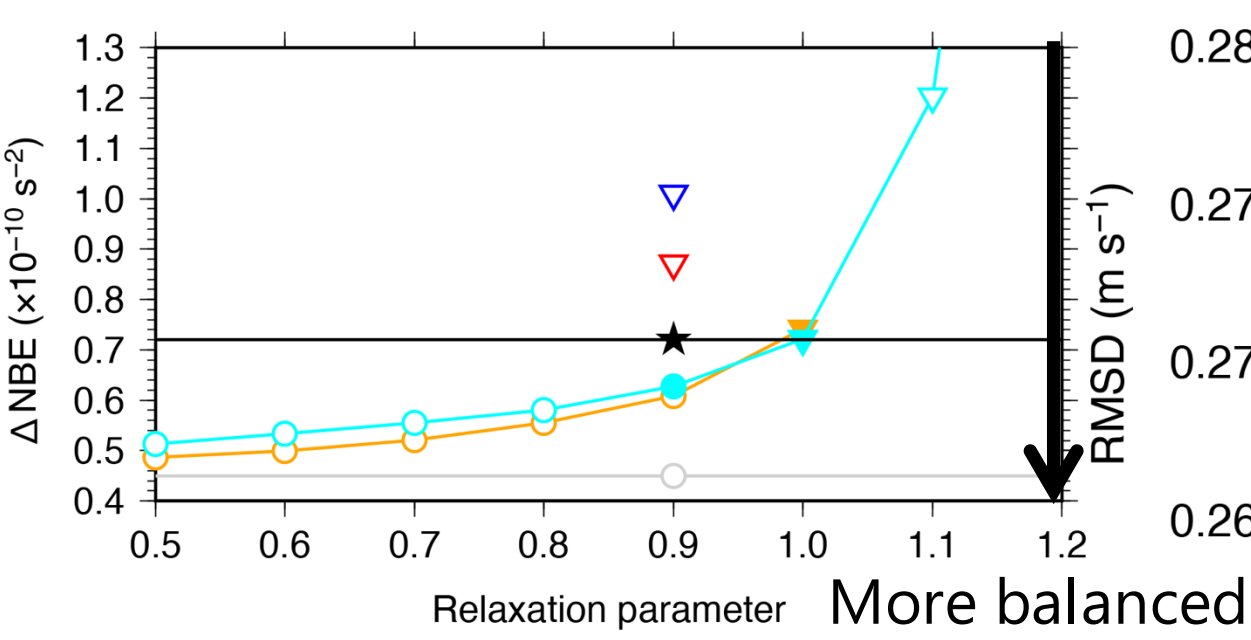
Ensemble size: 128, Assimilation interval: **1 day**

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

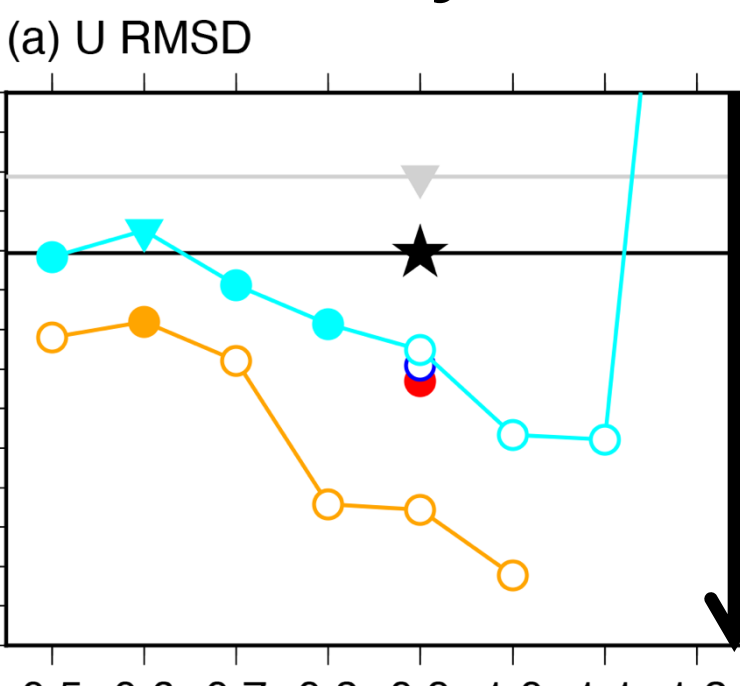
Assimilation period: 2015.07.07 – 2024.01

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

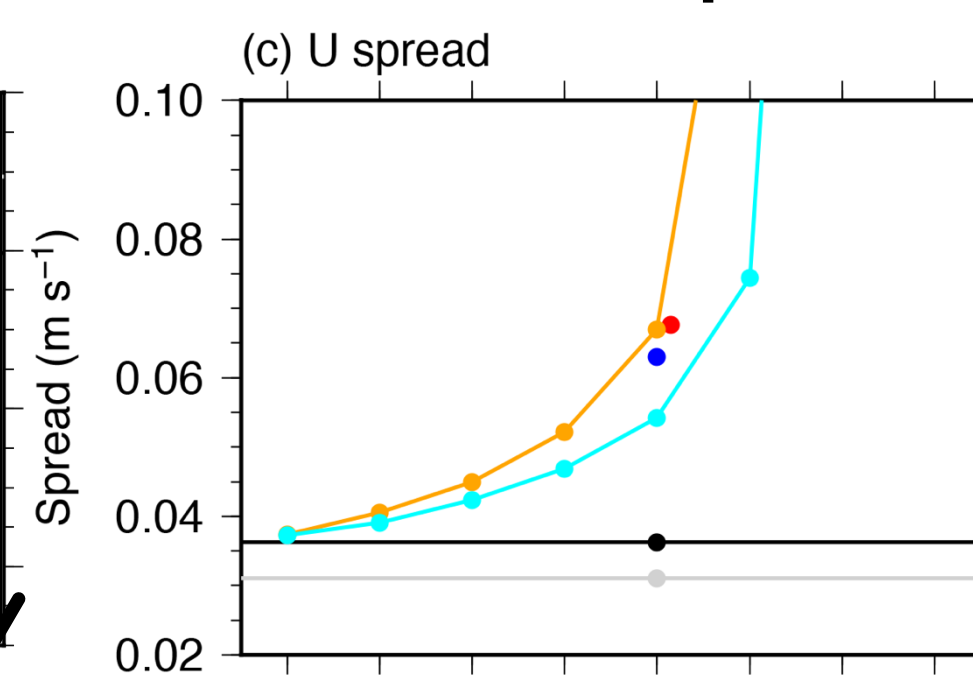
### Geostrophic balance



### Accuracy

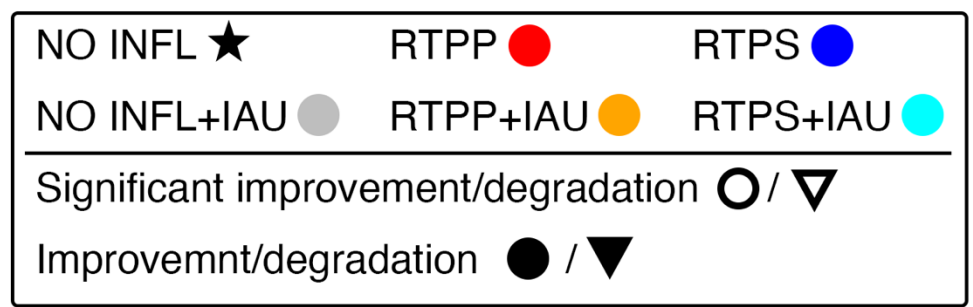


### Ensemble spread

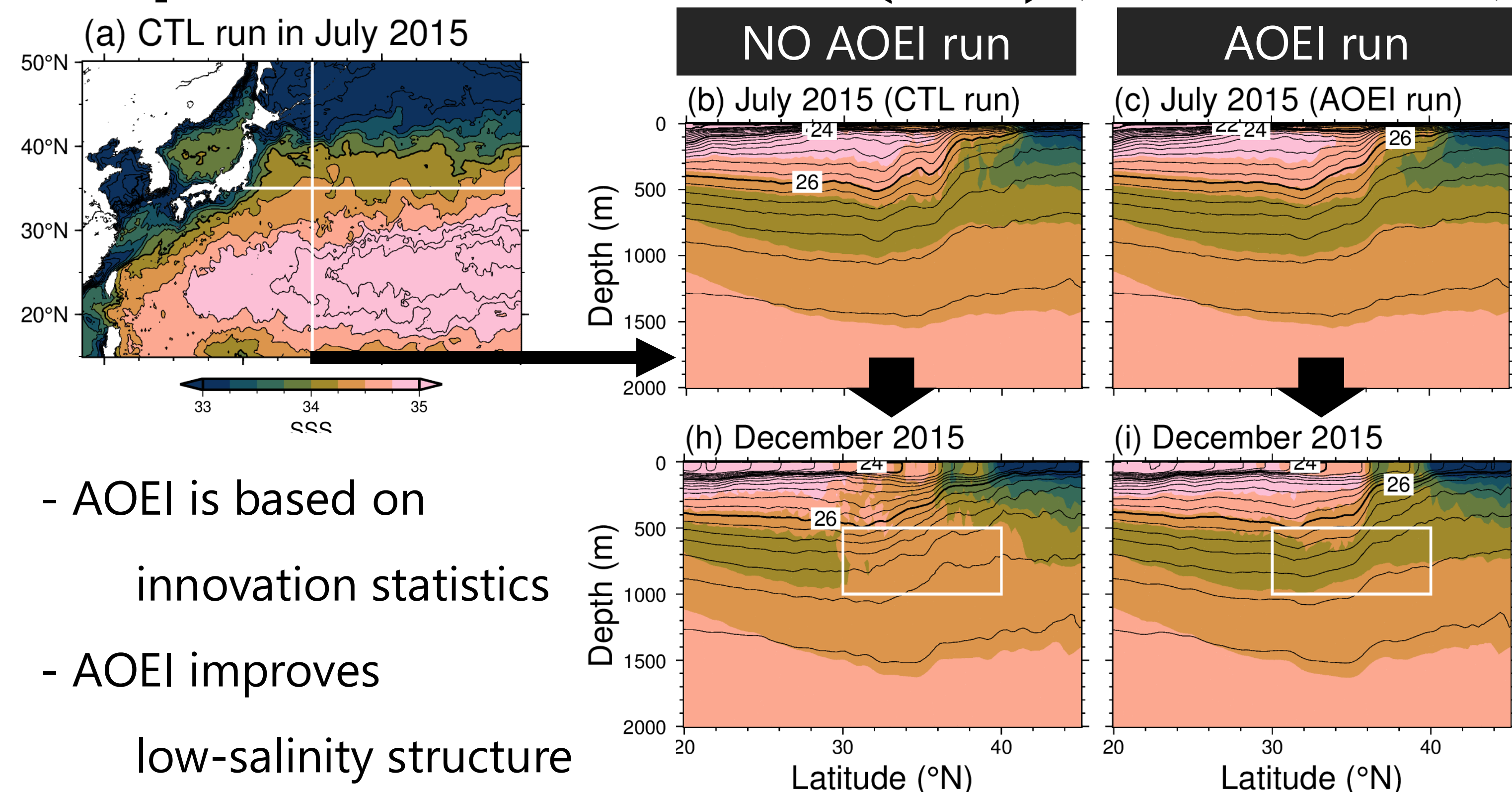


Combination of RTPP ( $\alpha = 0.8-0.9$ ) and IAU

→ Better balance and accuracy



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



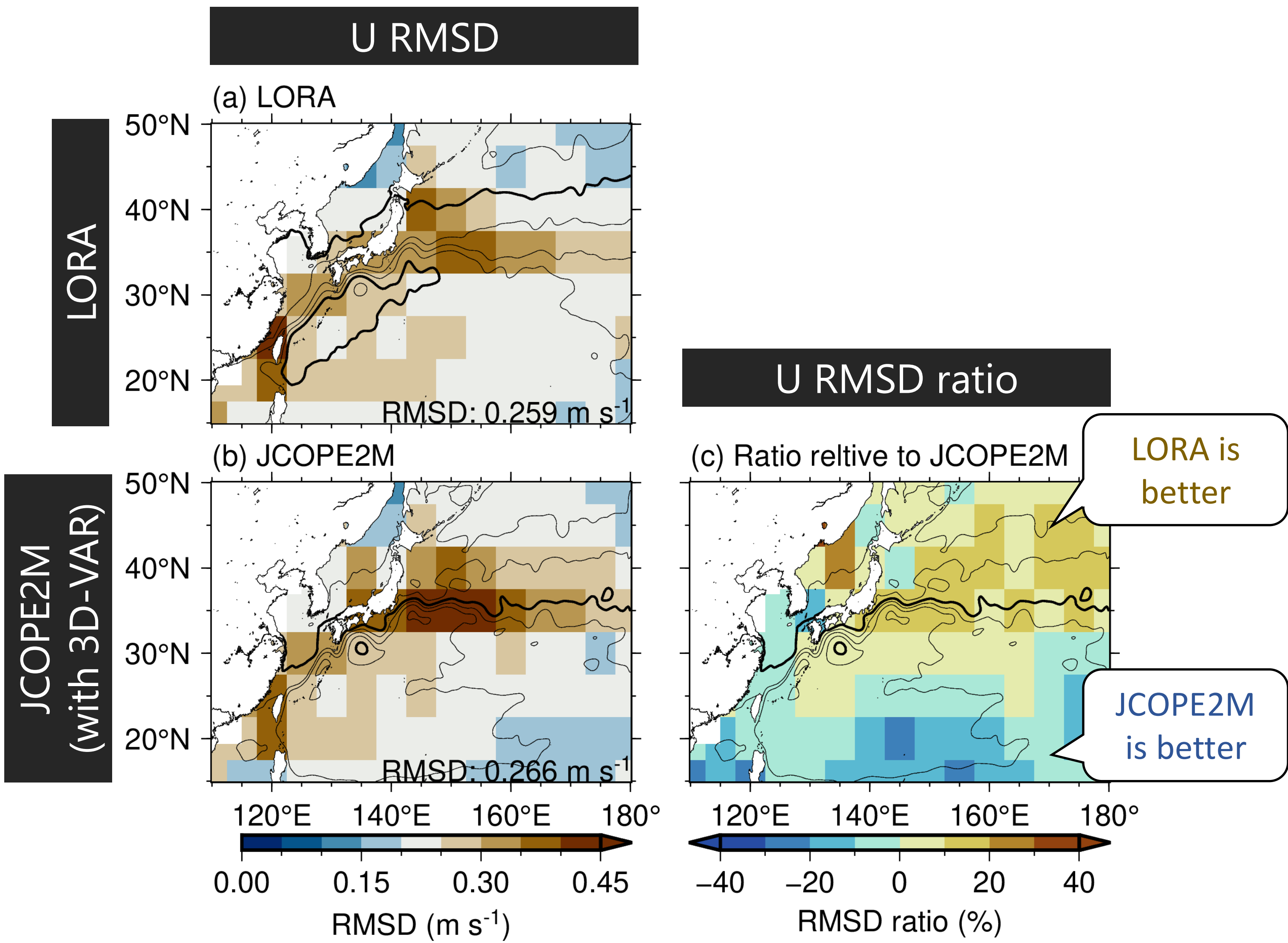
- AOEI is based on innovation statistics
- AOEI improves low-salinity structure

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

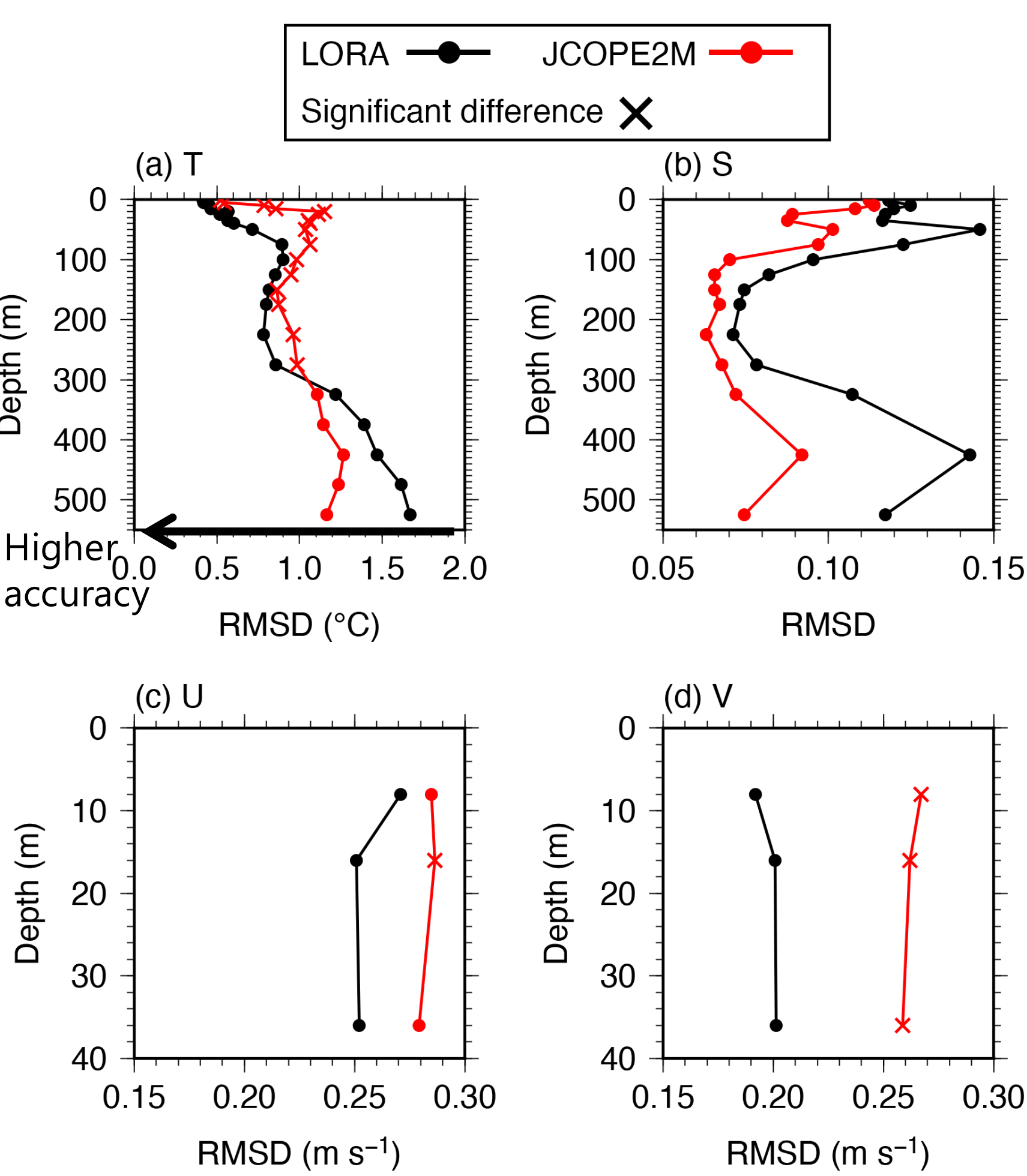
### Outputs

- 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

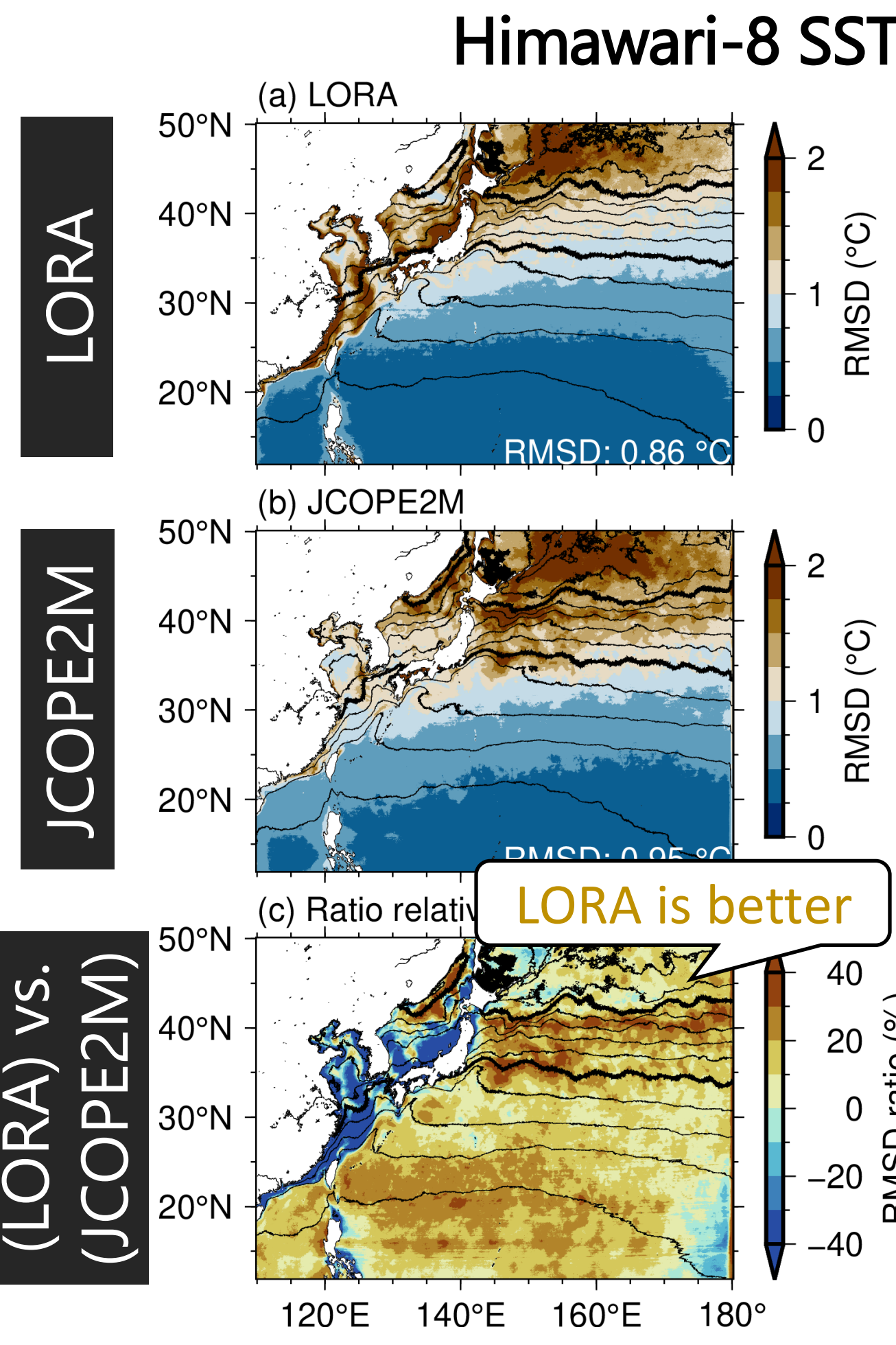
### Accuracy of surface horizontal velocity relative to drifter buoys



### 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

