

LETKF-based Ocean Research Analysis (LORA) in the Western North Pacific and Maritime Continent regions

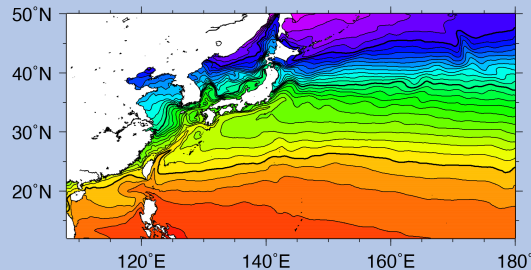
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1: RIKEN, 2: JAXA

Introduction

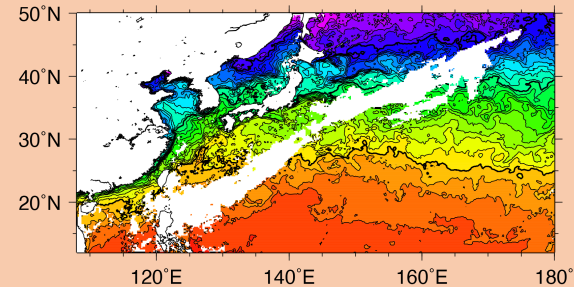
Introduction – Data Assimilation –

Simulation



3D homogeneous grid,
but less accurate

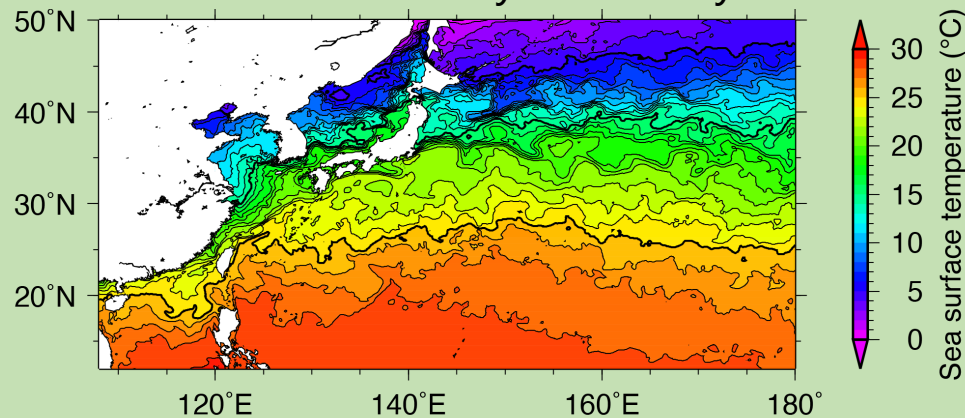
Satellite observation



More accurate,
but inhomogeneous and noisy

Data Assimilation

Optimal combination of ocean simulation and obs.
with statistical methods and dynamical systems theory



More accurate datasets without missing values

1. Introduction – Existing ocean reanalysis datasets –

■ Global reanalysis datasets

3D-VAR	4D-VAR	KF	EnKF
5 datasets	2	2	PEODAS

DA interval: 5 day
Not available at present

■ High-resolution regional reanalysis datasets

3D-VAR	4D-VAR	KF	EnKF
FRA-JCOPE2 (JAMSTEC)	FORA-WNP30 (MRI & JAMSTEC)	DREAMS (Kyushu Univ.)	TOPAZ4 North of 65°N

DA interval: 7 day

(c.f. Balmaseda et al. 2015; Martin et al. 2015)

*3 (4)**D-VAR**: 3 (4) Dimensional VARiational data assimilation

***KF**: Kalman Filter ***EnKF**: Ensemble Kalman Filter

- Not frequent assimilation in both EnKF-based systems
- No EnKF-based reanalysis datasets around the Pacific region

1. Introduction – Motivation –

■ Ohishi et al. in prep

- Construct an EnKF-based ocean data assimilation system
to assimilate satellite and in-situ observations
at a frequent interval of 1 day
- Explore an optimal setting for frequent data assimilation
→ Most suitable schemes: RTPP ($\alpha=0.8-0.9$)+IAU+AOEI
 - *RTPP: Relaxation-to-prior perturbation (Zhang et al. 2004)
 - *IAU: Incremental Analysis Update (Bloom et al. 1996)
 - *AOEI: Adaptive Observation Error Inflation (Minamide and Zhang 2017)

■ Motivation

- Create EnKF-based ocean research analysis datasets
in the Western North Pacific (WNP) and Maritime Continent (MC) regions
- Evaluate accuracy of the analysis datasets

Datasets

2. Datasets

■ LORA

Model: sbPOM (Jordi and Wang 2011)

Domain: **Western North Pacific (WNP)**

Maritime Continent (MC)

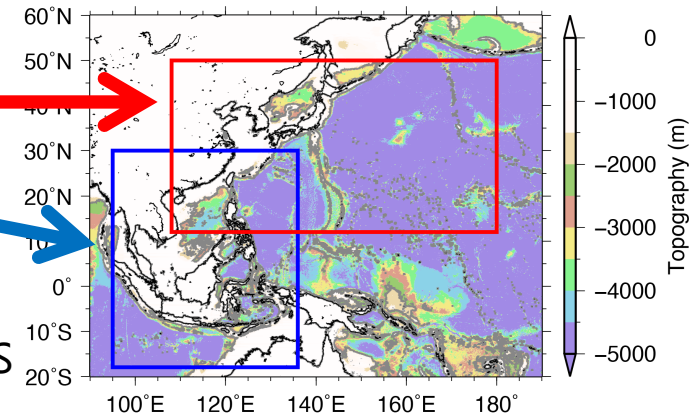
Resolution: $0.1^\circ \times 50$ σ -layers

Data assimilation: LETKF (Hunt et al. 2007)

Assimilation interval: **1 day**, Ensemble size: 100

Assimilation data: Satellite SST/**SSS**/SSHA, in-situ T/S

Assimilation period: 2015.07.07 – 2019.12.31



■ JCOPE2M (Miyazawa et al. 2017)

Model: POM (Mellor 2002)

Domain: Northwestern Pacific [108° – 180° E, 10.5° – 62° N]

Resolution: $1/12^\circ \times 46$ σ -layers

Data assimilation: Multi-scale 3D-VAR

Assimilation interval: **2 days**

Assimilation data: Satellite SST/SSHA, in-situ T/S, **Biologging surface flow/T**

Assimilation period: 2015.08.01 (JCOPE2) – Present

■ **Observational** SSH dataset: AVISO (Ducet et al. 2000)

Domain: Global

Resolution: 0.25°

Data assimilation: Optimal Interpolation

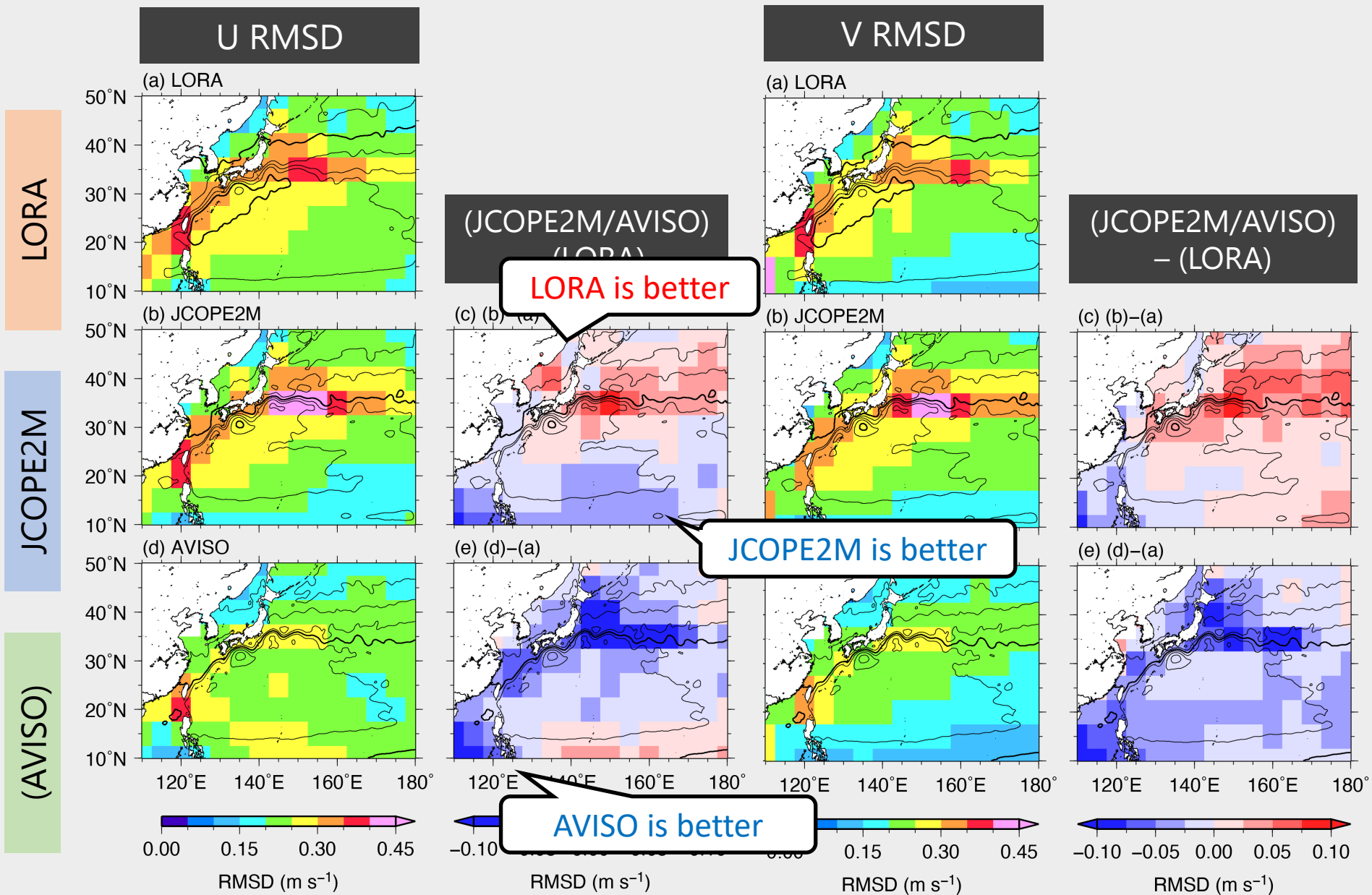
Assimilation interval: 1 day

Assimilated data: Satellite SSHA + MDOT (Maximenko et al. 2009)

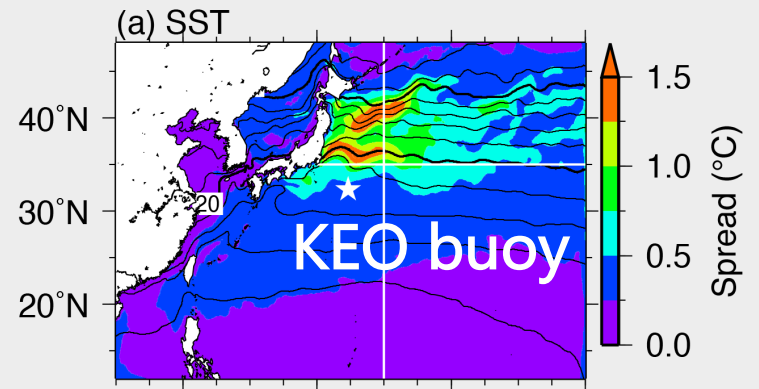
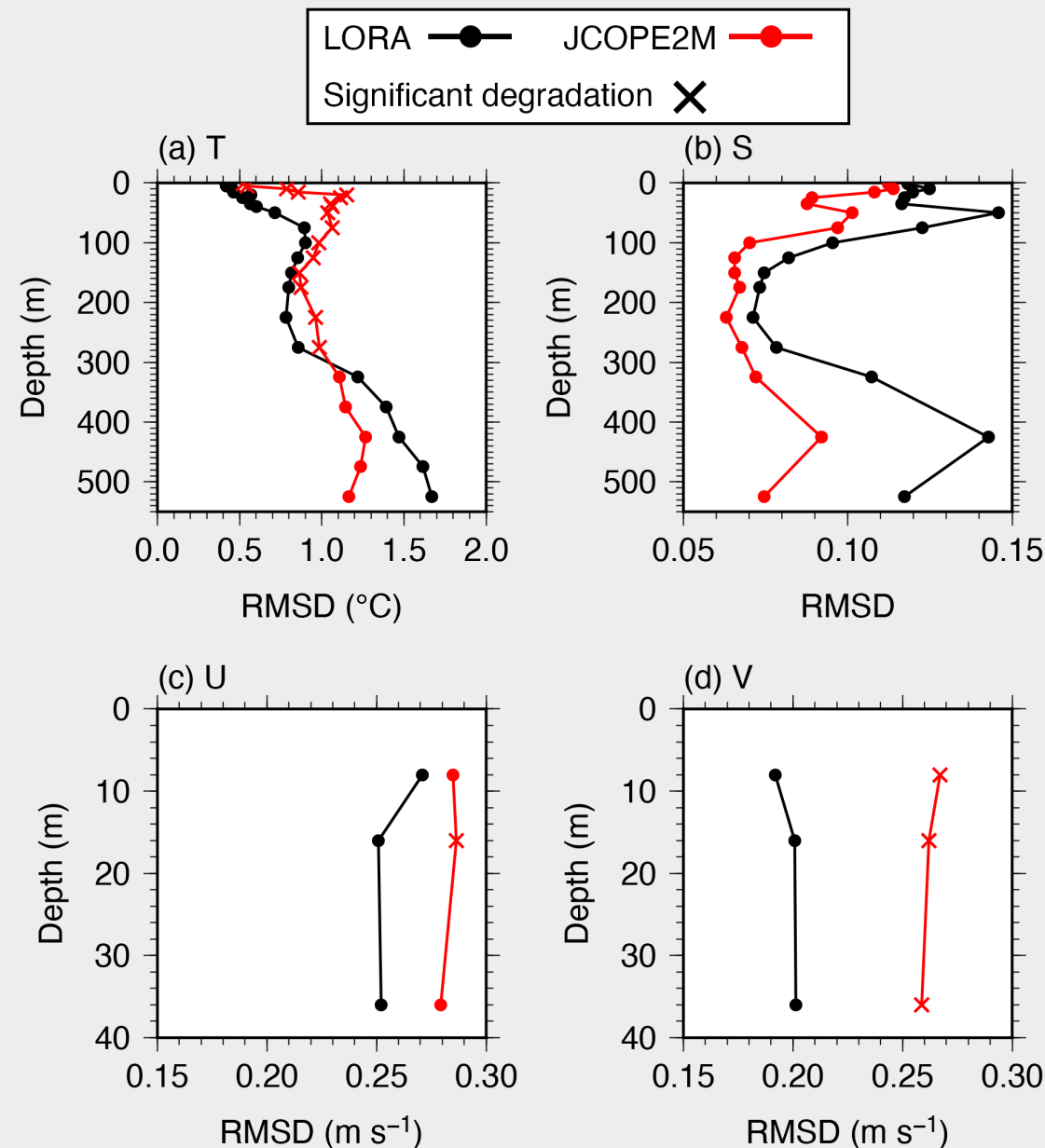
Results of LORA-WNP

- RMSD vs. drifter buoy
- RMSD vs. KEO buoy

3. Result – vs. Drifter buoy –



3. Result – vs. KEO buoy –



■ T

0–300 m: LORA is better

300 m–: JCOPE2M is better*

■ S

JCOPE2M is better*

■ U, V

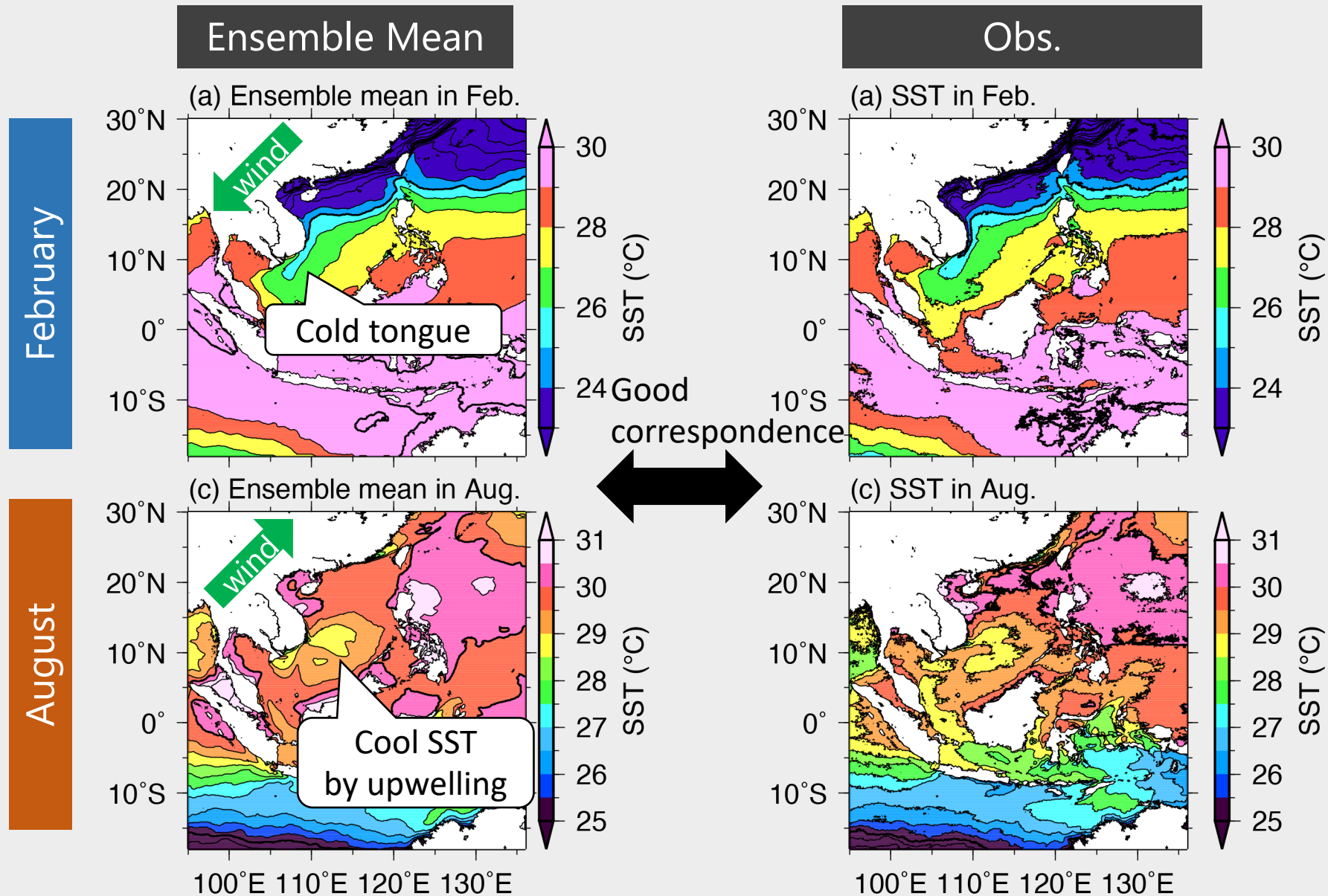
LORA is better

(*No significant)

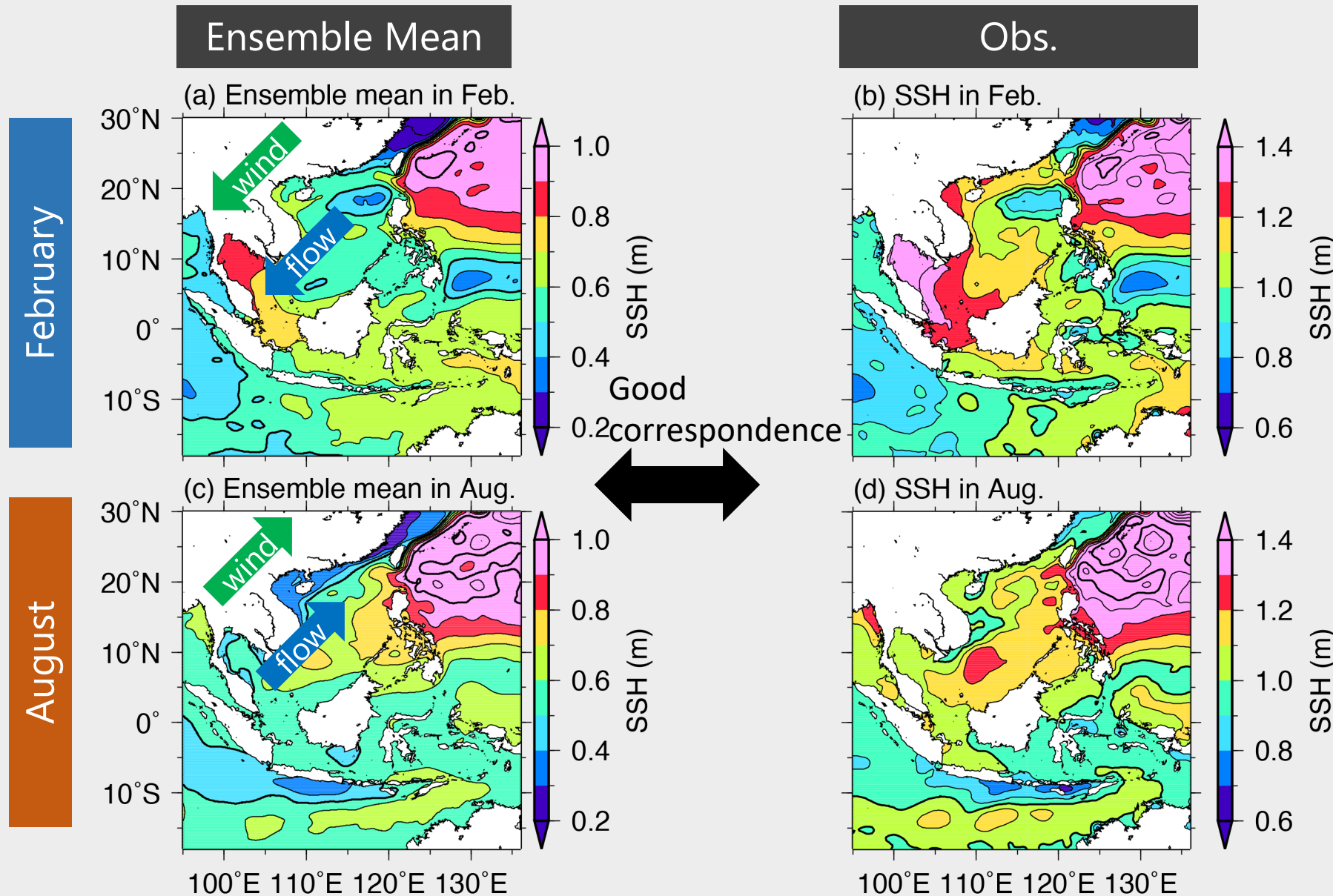
Results of LORA-MC

- SST and SSH climatology
- RMSD vs. drifter buoy

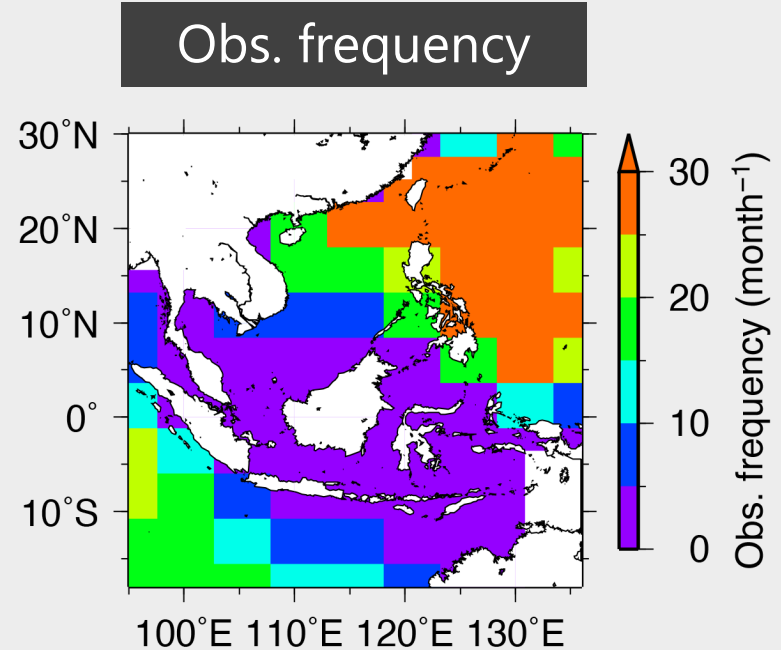
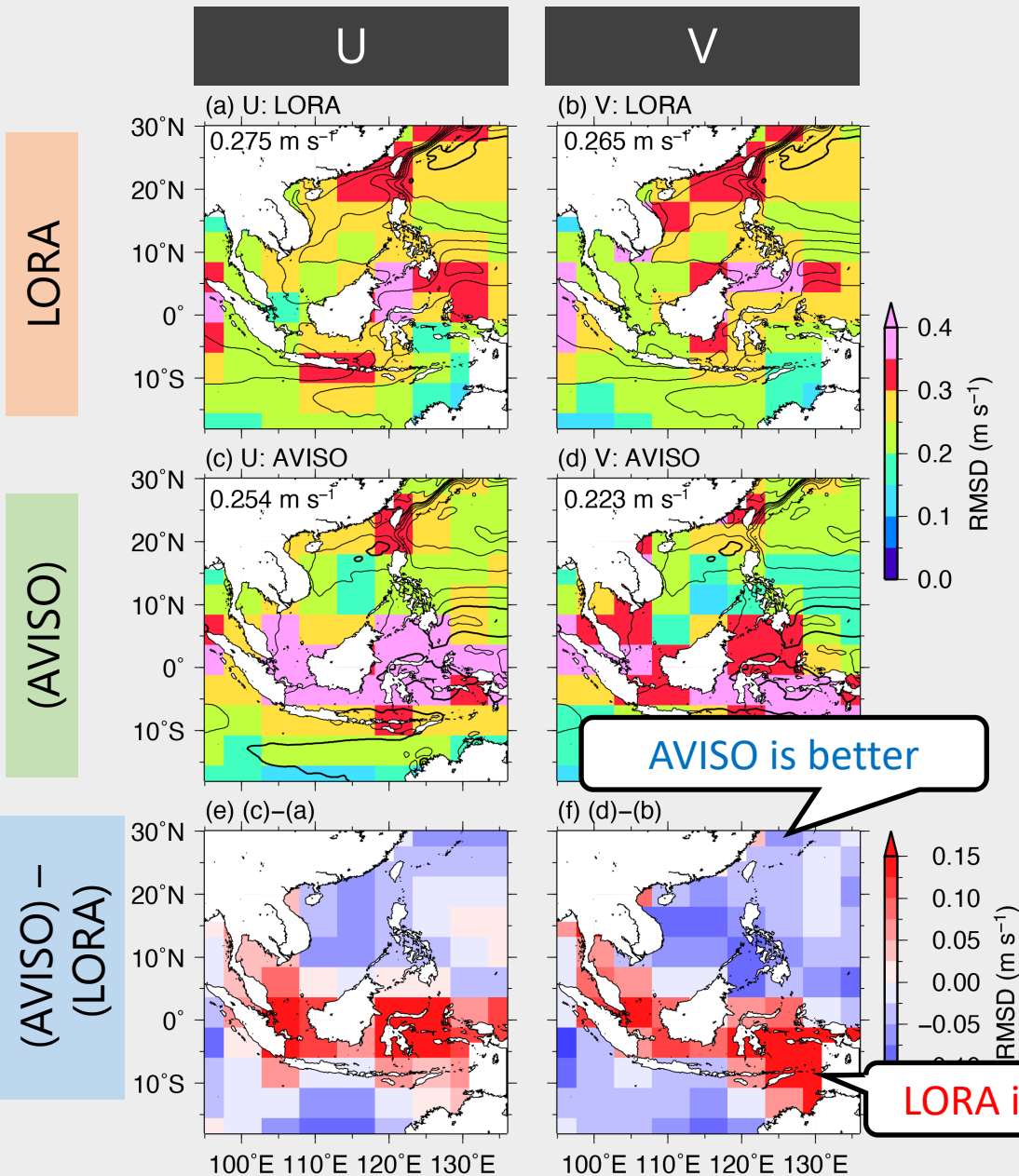
4. Result – SST –



4. Result – SSH –



4. Result – vs. Drifter buoy –



- LORA is better around regions with few obs.
- AVISO is better around regions with sufficient obs.

Summary

Summary

We have constructed LETKF-based ocean research analysis (LORA)
in the Western North Pacific (WNP), Maritime Continent (MC) regions.

■ LORA-WNP

→ LORA has same or better accuracy in almost variables compared with JCOPE2M.

- Surface flow from drifter buoys: AVISO > LORA > JCOPE2M
- T, S, U, V from the KEO buoy

T: LORA > JCOPE2M, S: JCOPE2M $\geq$ LORA, and U & V: LORA $\geq$ JCOPE2M

■ LORA-MC

- SST and SSH fields: Good correspondence with observations
- Surface flow from drifter buoys

Open ocean: AVISO > LORA

Coastal region: LORA > AVISO

If you are interested in the LORA,
please contact me.

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