

Comprehensive studies on sub-mesoscale phenomena; coastal SSHA variations in the Bungo Chanel, Japan, and impacts of assimilating SWOT data in ocean and hydrological models



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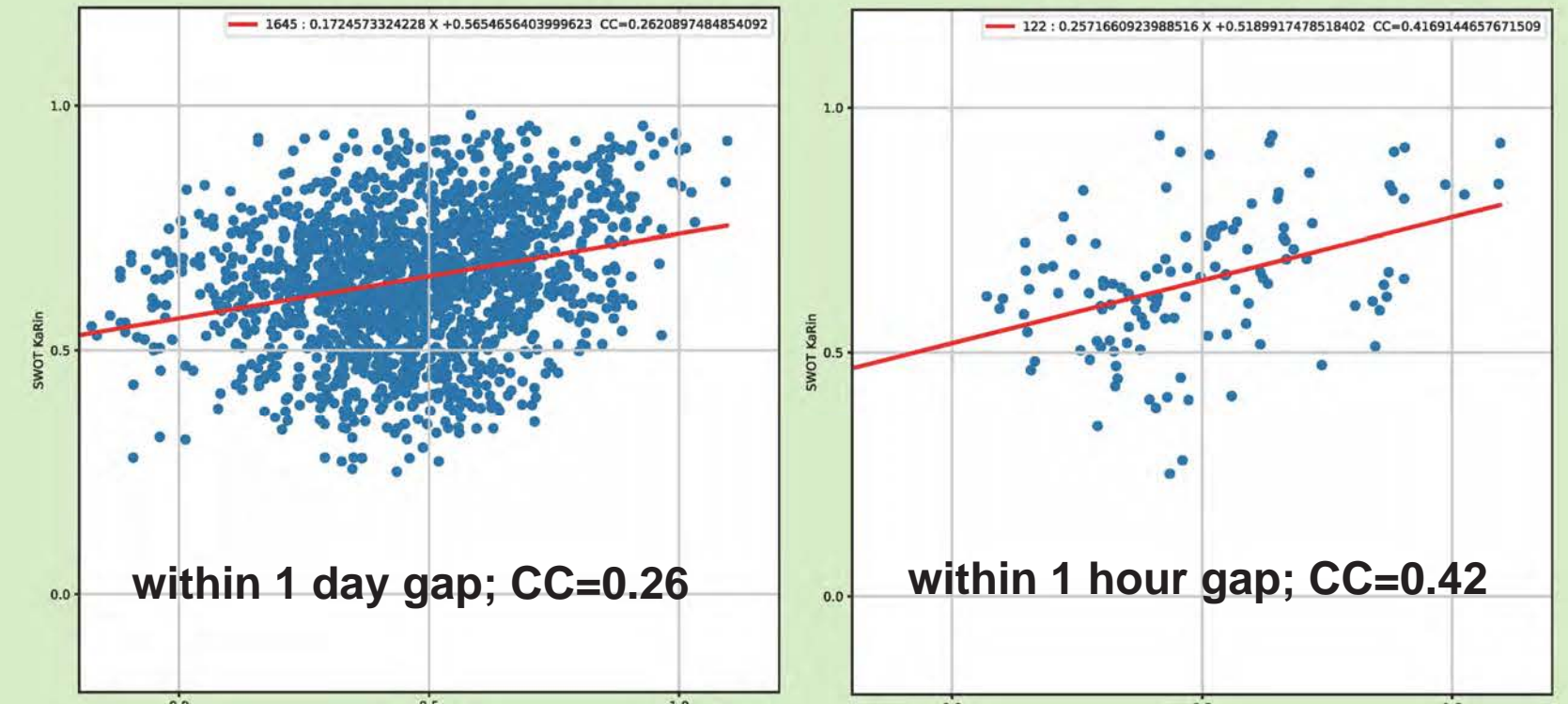
Introduction

Showcase for various SWOT studies in Japan, including;

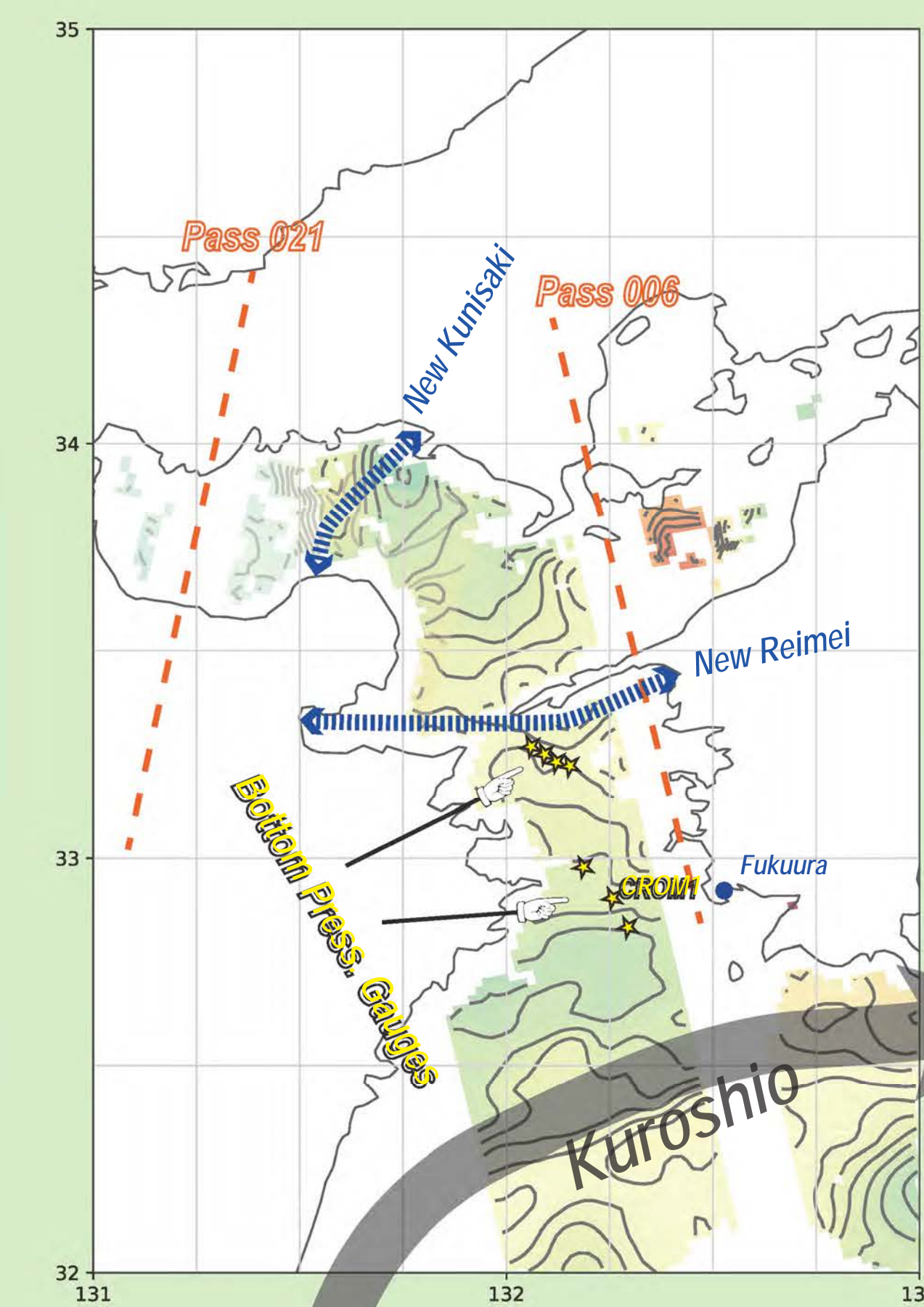
- 🤔 coastal SSH validation in the Bungo Channel, and
- 🤔 assimilating SWOT data to oceanographic or hydrodynamic models.

Coastal SSHA validations in the Bungo Channel

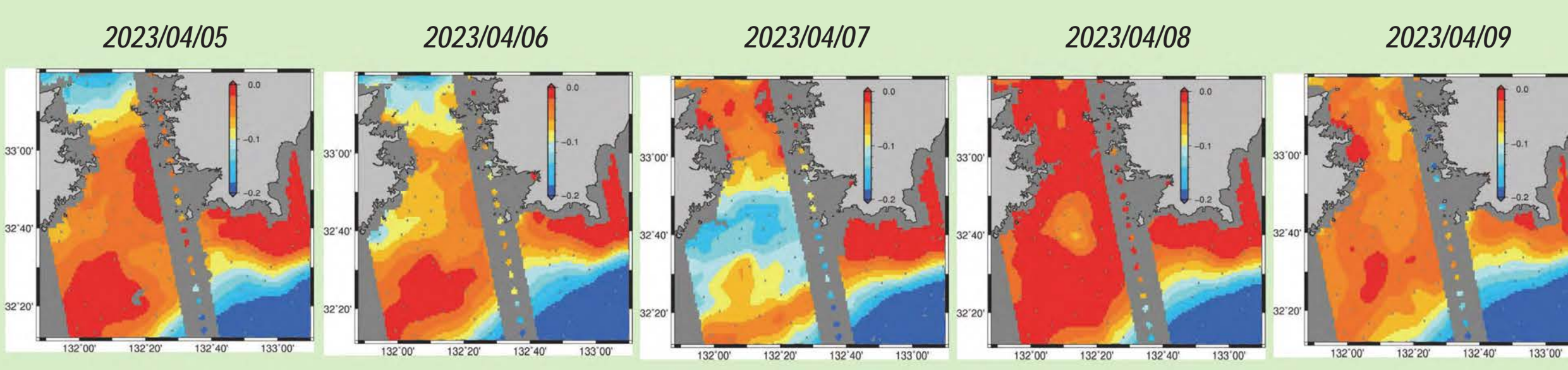
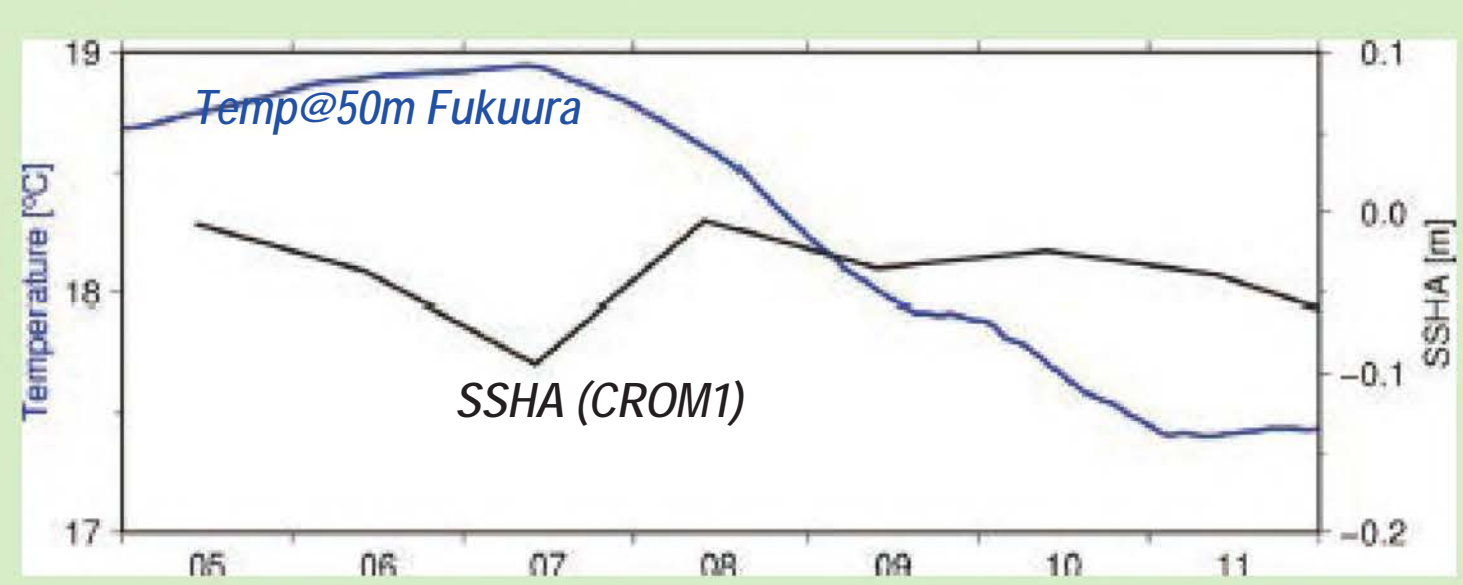
- 🤔 1-day Cal/Val phase SWOT unfiltered SSH data (Level 3, ver 2.01); Passes 006 and 021
- 🤔 GNSS altimeter on ferryboats "New Kunisaki" (2023/3-8) and "New ReiMei", that provide 3-7 round trips in a day
- 🤔 3-month bottom mooring systems with pressure gauges at 7 (4 north +3 south) stations
- 🤔 For details of mooring systems, contact Dr. Morimoto (morimoto.akhiko.cl@ehime-u.ac.jp)



- 🤔 Correlation between SWOT and Ferry SSHs is low (Corr Coef = 0.26)
- 🤔 CC is improved to 0.42 when the temporal gaps are limited to 1 hour
- 🤔 CCs with no spatial and temporal gaps determined from bottom pressure gauges are higher (around 0.6), although not significantly good
- 🤔 In the Bungo Channel, especially in the northern part, tides are so strong and complicated that they would not be precisely corrected in both SWOT and obs data



Level 3 ver. 2.01 unfiltered; on 2023/04/07 at 01(006)/14(021) UTC



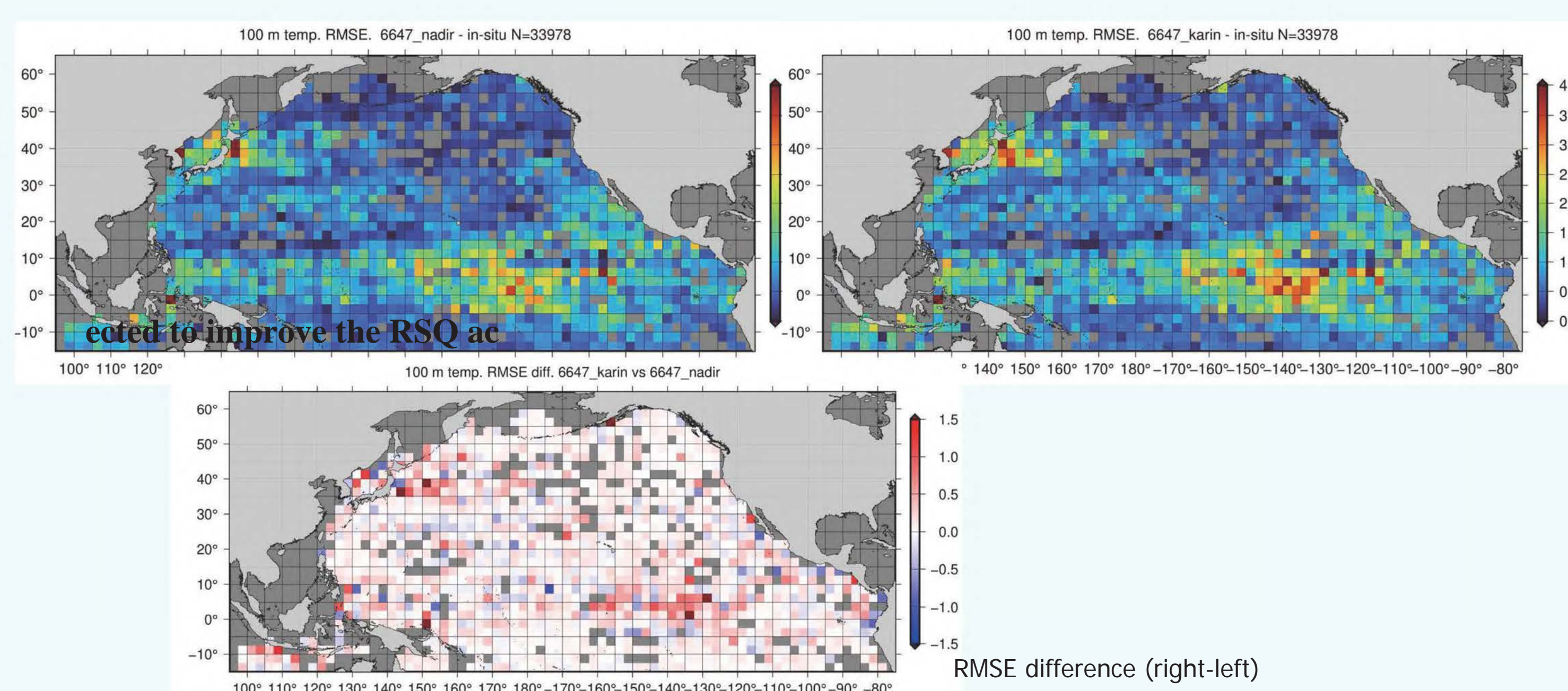
- 🤔 Relatively better RMSD (0.05 m) in the southern mooring systems
- 🤔 Bottom intrusion of cold water is recognized on 2023/04/07 at CROM1 station as a sudden SSHA drop, then coastal 50-m depth temp. at Fukuura decreased
- 🤔 From SWOT time series, lower SSHA seems to be originated from the western side of the Channel (upstream of the Kuroshio)

Assimilating SWOT data



to oceanographic models (1)

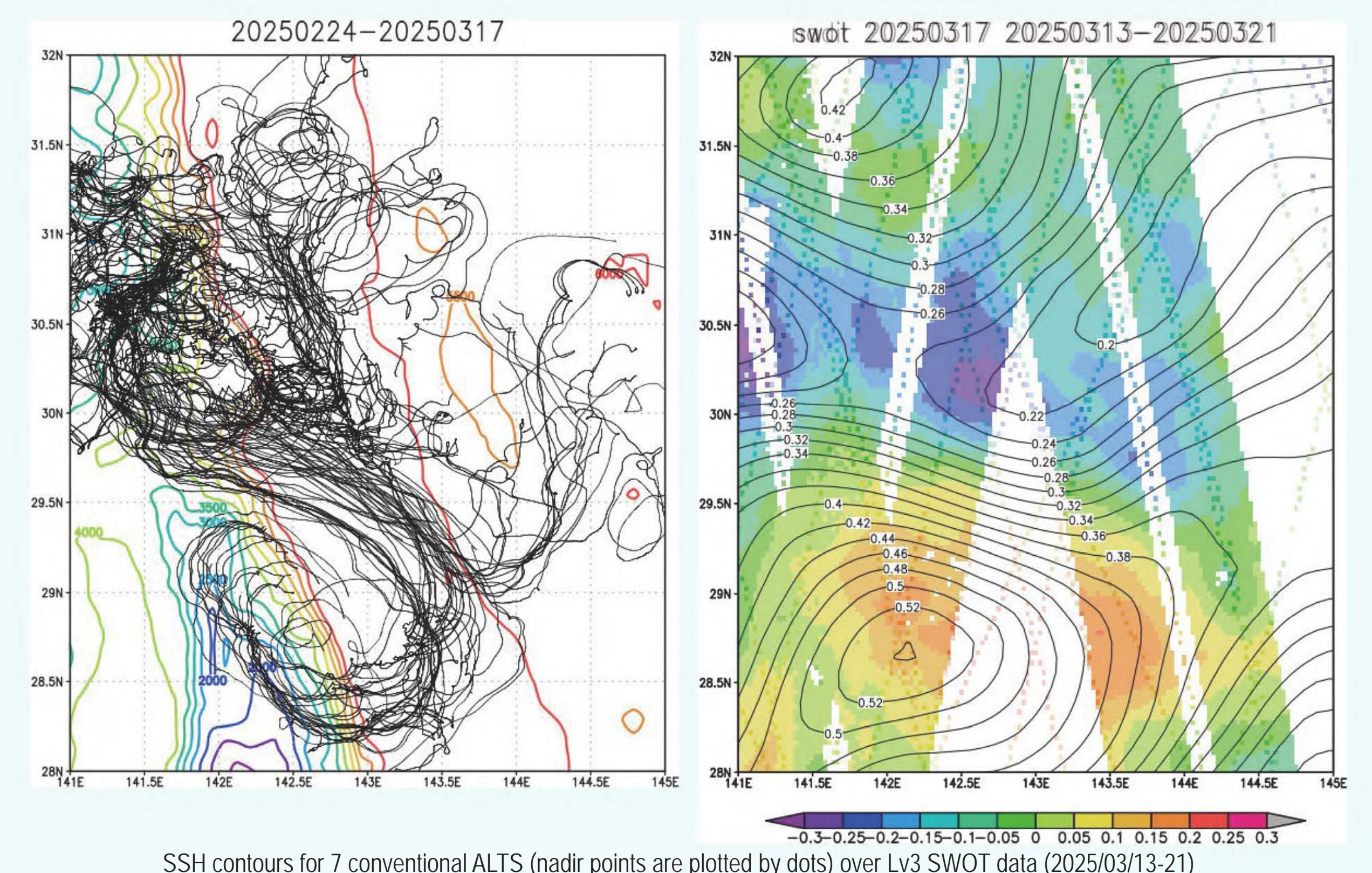
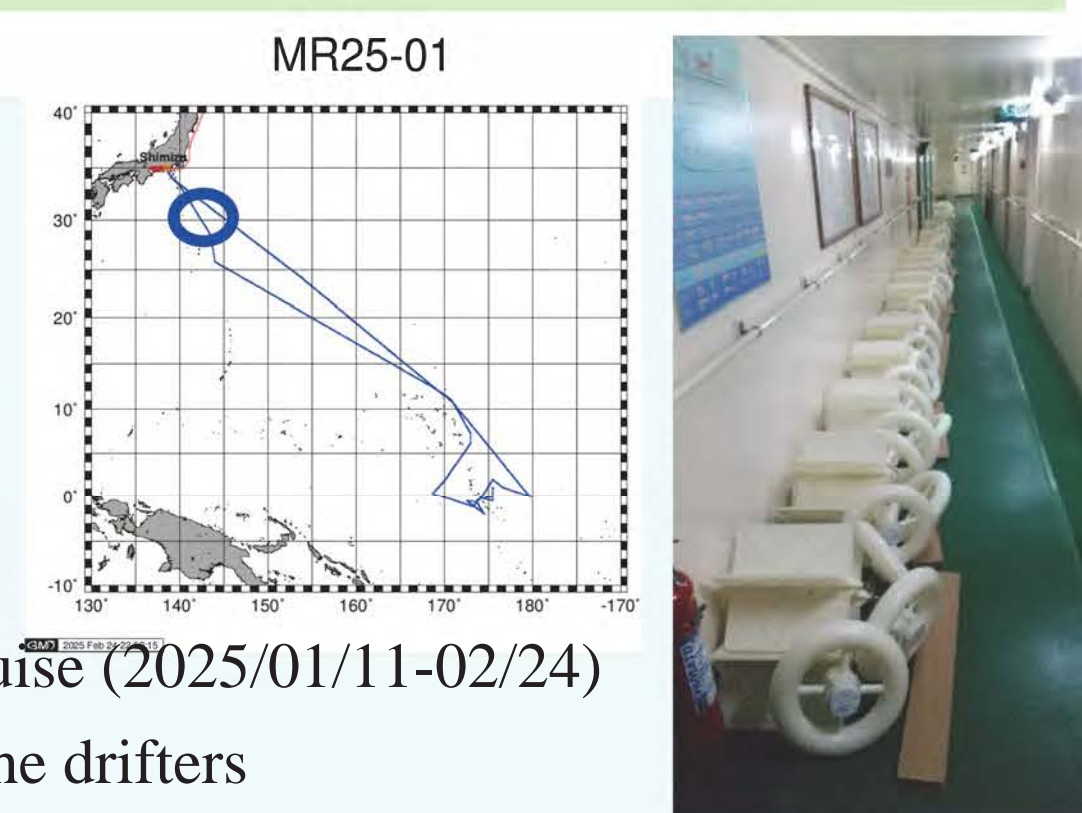
- 🤔 Japan Meteo. Agency (JMA) has a 4DVar assimilation system (MOVE-JPN)
- 🤔 Assimilated results of CMEMS conventional ALTs data (left) and KaRIn data alone (right) are compared with in situ 1000-m depth temperature obs within 2.5-deg grids
- 🤔 SWOT shows larger RMS errors in the Kuroshio Extension and the eastern Equator regions
- 🤔 Because cost functions have been tuned for conventional ALTs, vertical T-S structures for small-scale SWOT data are not precisely represented in the assimilations



🤔 For details, contact Dr. Asai (asai.hiroaki@met.kishou.go.jp) or Dr. Usui (nusui@mri-jma.go.jp)

to oceanographic models (2)

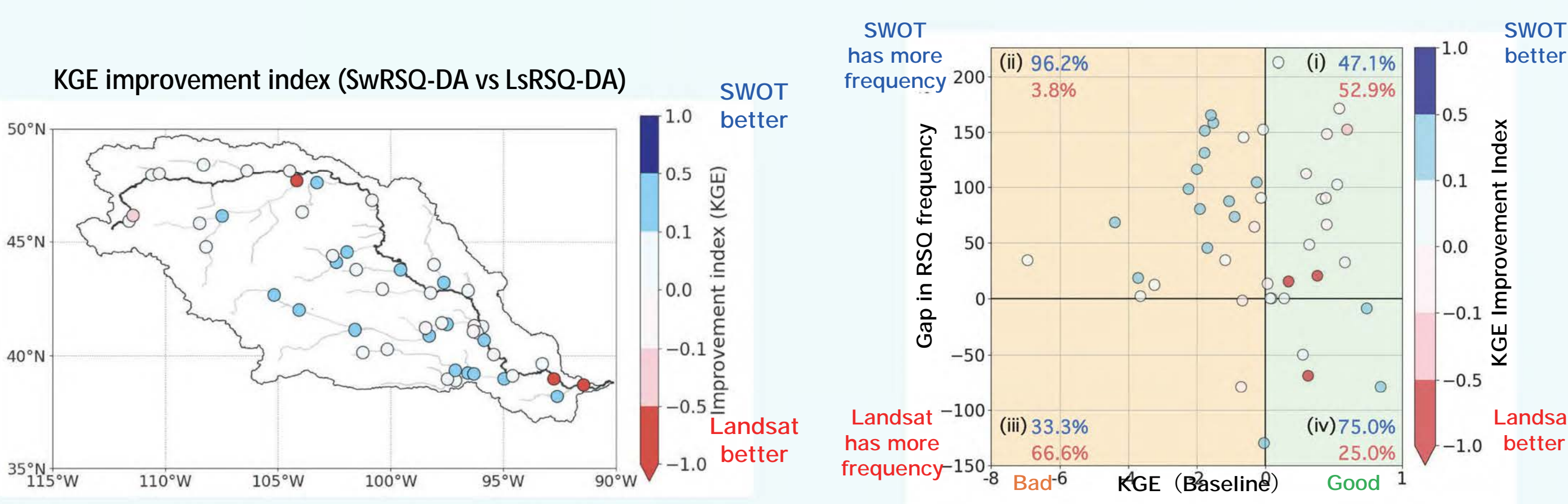
- 🤔 JAMSTEC has deployed 116 CARTE drifters during MR25-01 cruise (2025/01/11-02/24)
- 🤔 Assimilated results are validated by comparing with trajectories of the drifters
- 🤔 For details, contact Dr. Miyazawa (miyazawa@jamstec.go.jp)



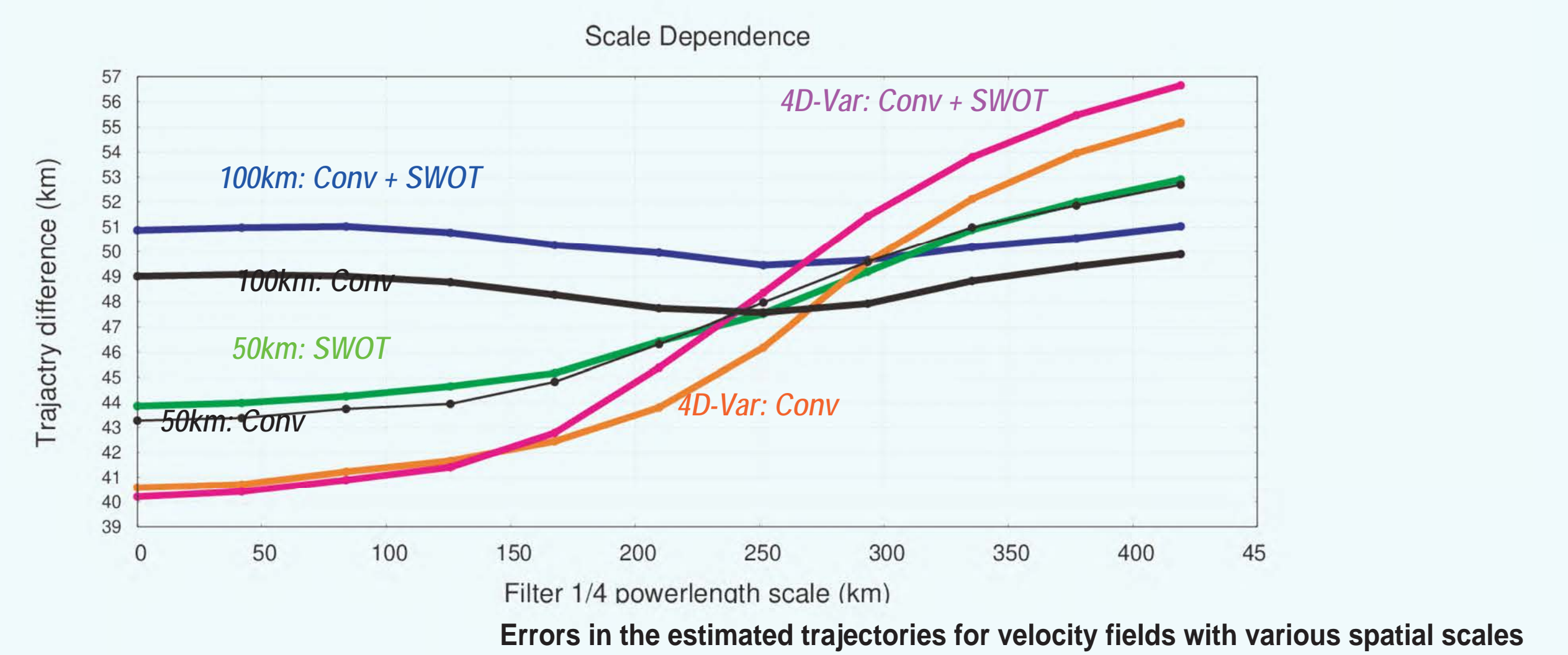
- 🤔 SSH field from 7 conventional ALTs failed to detect the position/size of an eddy around (29N, 142.5E)
- 🤔 SWOT data agree well with trajectories

to hydrodynamic models

- 🤔 Compare SWOT-based river discharge (SwRSQ) and Landsat-based discharge (LsRSQ)
- 🤔 Assimilate them into the H08 model of Missouri River through LET Kalman Filter
- 🤔 SwRSQ is more effective than LsRSQ
- 🤔 Especially, when the number of SWOT observations is greater than Landsat



🤔 For more details, contact Dr. Ishikawa (yishikawa@rainbow.iis.u-tokyo.ac.jp) or Prof. Yamazaki (yamadai@iis.u-tokyo.ac.jp)



- 🤔 However, assimilating Nadir+SWOT becomes worse than Nadir alone
- 🤔 Smaller correlation scales in 3D-Var results in better estimates; 100 km is too large for 7-ALT constellations or SWOT data
- 🤔 4D-Var assimilation provides better comparisons; suggesting temporal variations are not negligible when smaller-scale phenomena are accounted
- 🤔 Adding SWOT provides slightly better results in 4D-Var, but becomes worse when spatial scales are larger than 150 km, which may be related to the width of SWOT data