



Generation of COMPIRA simulated data

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Introduction

Japan Aerospace Exploration Agency (JAXA) is working on a conceptual study of altimeter mission named Coastal and Ocean measurement Mission with Precise and Innovative Radar Altimeter (COMPIRA), which will carry a wide-swath altimeter named Synthetic aperture radar (SAR) Height Imaging Oceanic Sensor with Advanced Interferometry (SHIOSAI). JAXA has launched a framework called "Coastal forecast core team" to aim at developing coastal forecast system through pre-launch activities toward COMPIRA. Assimilation segment as well as satellite and in situ data provision will play an important role on these activities. As a first step, simulated sea surface heights (SSH) are generated from regional ocean numerical models and the COMPIRA orbit.

COMPIRA orbit configuration

Orbit specifications are designed to be better for operational oceanography including coastal forecast. A spatial grid sampling is 5km and an observation times per revisit period (about 10 days) is 2 to 3 times. (Table 1 and Fig.1) In order to meet both sampling frequency and spatial coverage requirements in mid-latitudes as much as possible, orbit inclination was set relatively low, 51 degrees.

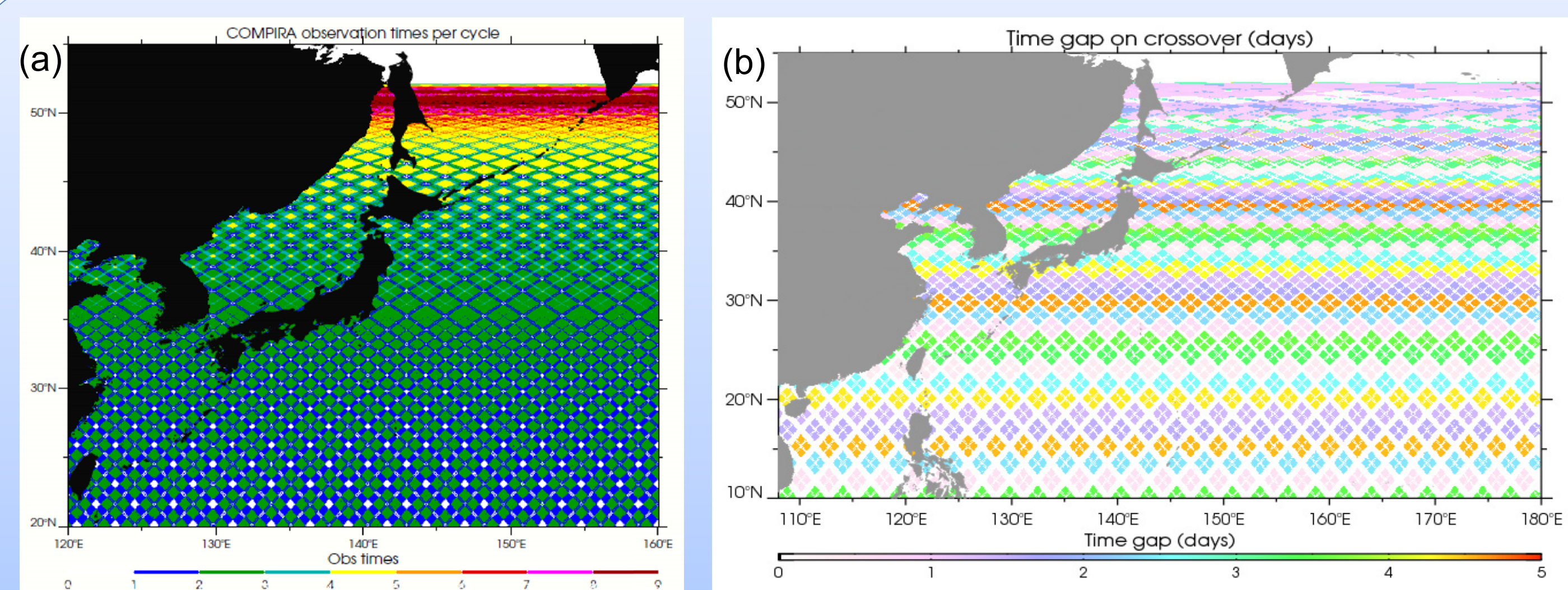


Fig. 1. (a) Observation times per cycle by COMPIRA, and (b) temporal gap between ascending and descending observations on crossover areas.

Table 1. COMPIRA orbit configuration.

Parameters	Revisit time	Inclination	altitude	swath	grid size
	9.8671 days	51 deg.	937 km	80km×2	5km

Generation of COMPIRA simulated data

Simulated sea surface heights (SSH) are generated from regional ocean numerical models and the COMPIRA orbit and error specifications. The several regional model data around Japan were provided by Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Kyushu University, Meteorological Research Institute (MRI). Their specifications are as follows: spatial and temporal grid interval range from 1.5km to 3km, and 30 minutes to 3 hours, respectively. Some models incorporate tidal components.

Table 2. Three segments of coastal forecast team, their role and members.

Area	Grid	Time	Period	Tide	Institute
(a) Around Japan	3km	1 hour	1year	Included	JAMSTEC (Dr. Miyazawa)
(b) Tohoku and south of Hokkaido	1.5km	3 hours	2years	With and without	JAMSTEC (Dr. Ishikawa)
(c) Northwestern Pacific	2km	3 hours	1year	Included	MRI (Dr. Usui)
(d) Japan Sea	1.5km	1hour	4years	Included	Kyushu Univ (Dr. Hirose)

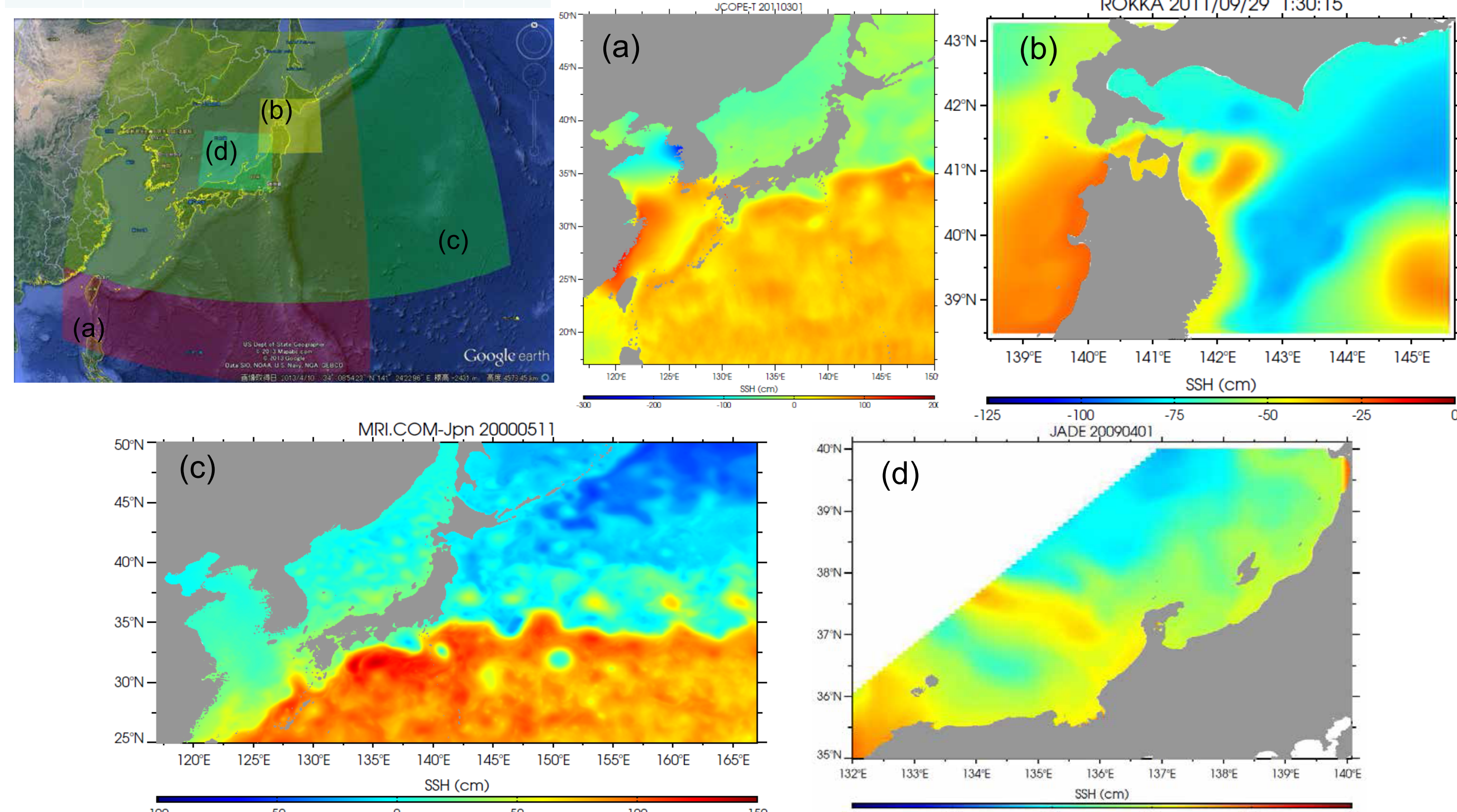


Fig. 2. Examples of SSHs from regional models used to produce simulated SSHs.

Preliminary results

Simulated SSHs : Synergy with SWOT

Fig.3 shows an example of the simulated data produced from the JAMSTEC model (Tohoku and south of Hokkaido). Simulated SSHs are also calculated using SWOT orbit and merged with those from COMPIRA. As an error sources only SAR sensor noises are added in the current simulation (Table 2). By adding SWOT observations, coverage is improved to fill almost all area in 4 days.

Table 2. Parameters applied for simulation.

	Grid size	Swath	noise
COMPIRA	5km	80km	4.2cm
SWOT	1km	60km	1.5cm

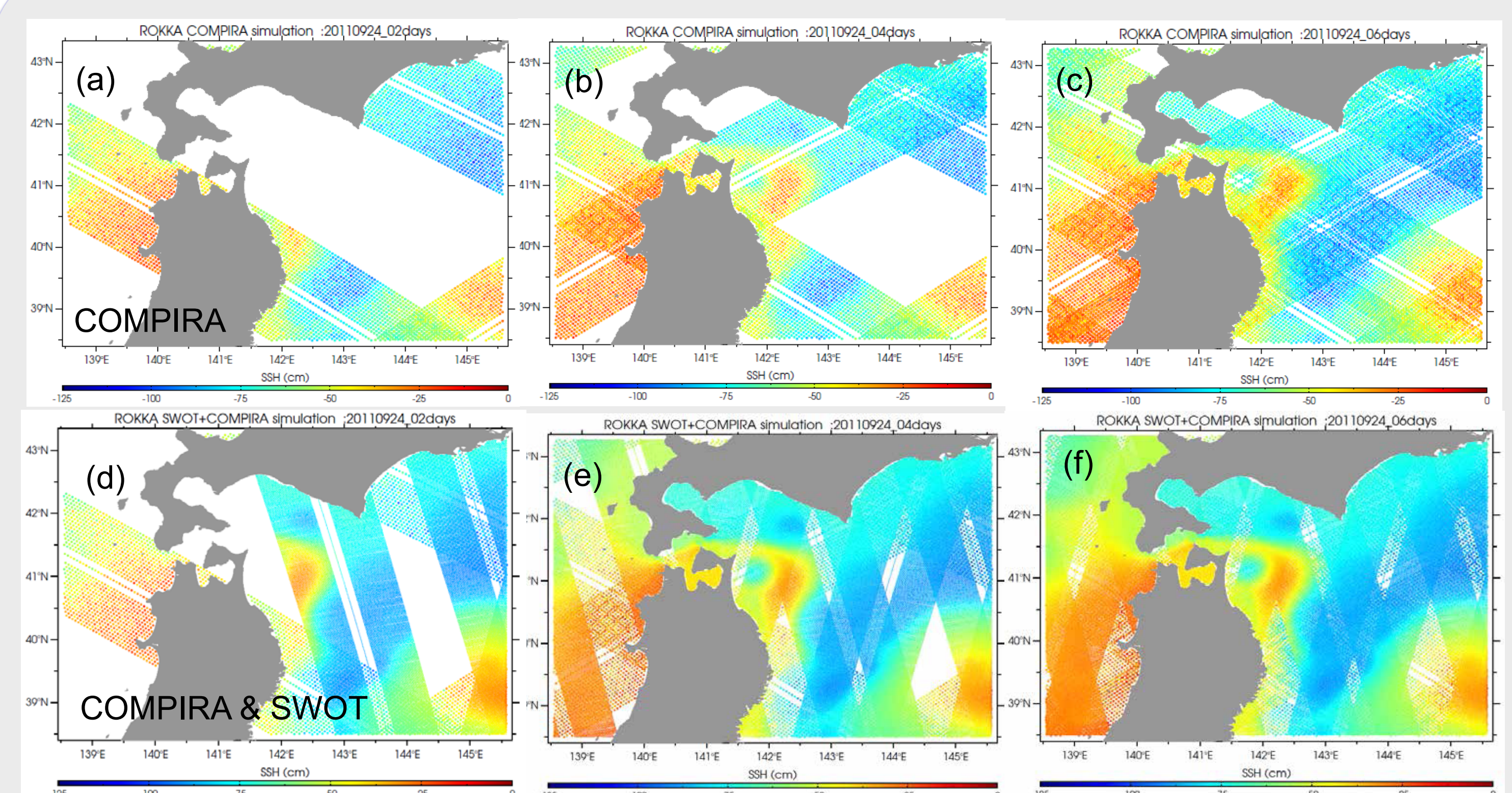


Fig. 3. COMPIRA simulated SSHs accumulated for (a) 2 day, (b) 4 days, and (c) 6days, after 2011/9/24. COMPIRA and SWOT merged ones for (d) 2 day, (e) 4 days, and (f) 6days.

Geostrophic current derivation and comparison with reference current

0.05 deg. gridded SSHs are created from the simulated SSHs by simple averaging with 25km window size and geostrophic currents are then calculated (Fig.4). The SSH-derived currents are then compared with the model surface currents (Fig.5). The results indicate the followings:

- ✓Relatively large COMPIRA noise results in noisy currents which is decreased by adding SWOT
- ✓Temporal averaging contaminates current pattern for rapid phenomena shown in red circles such as Tsugaru warm current and streamers.

As a next step, identical twin experiments using simulation data are planned to include temporal evolution and develop assimilation for coastal areas.

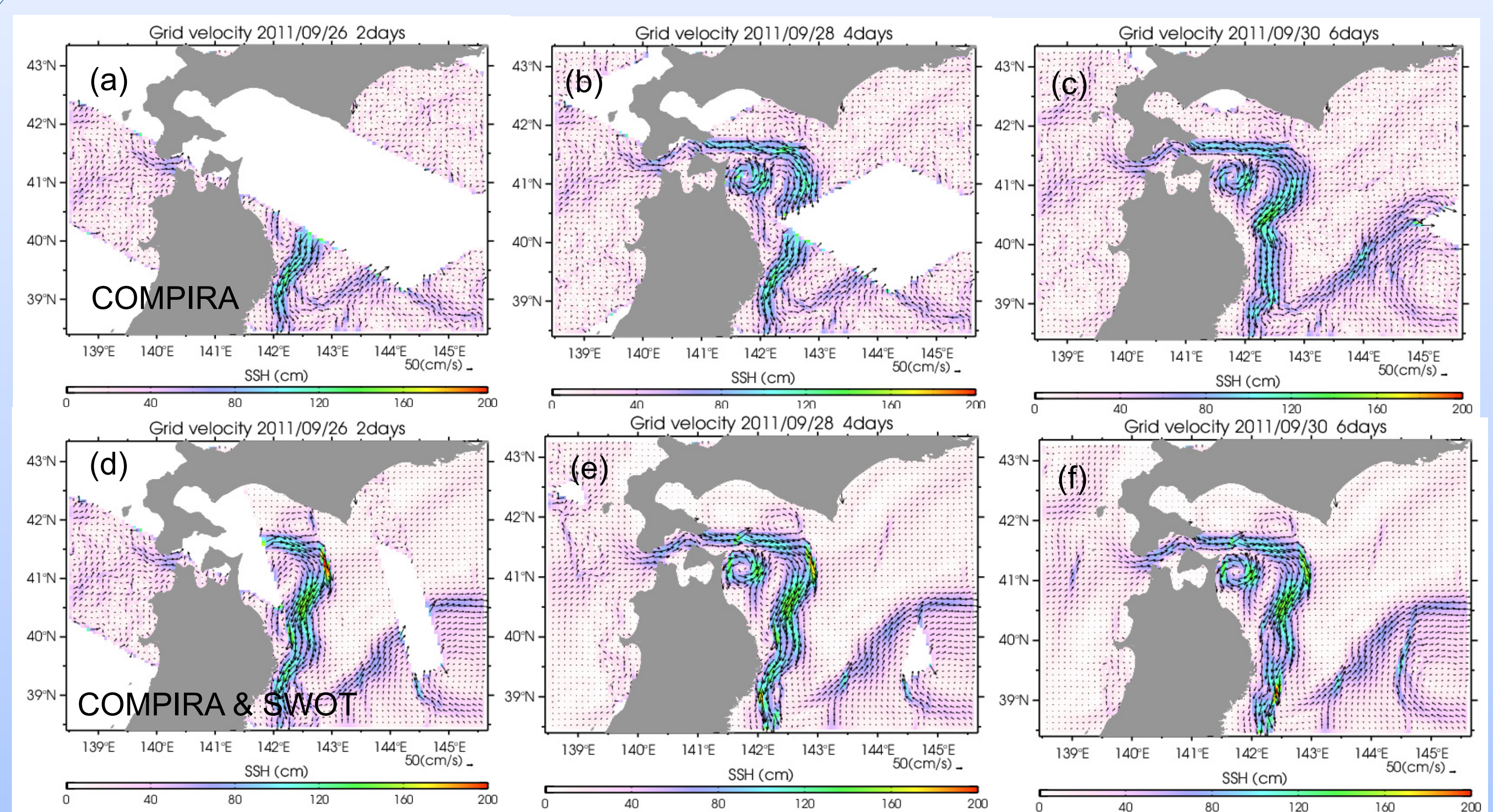


Fig. 4. Geostrophic currents from COMPIRA simulated SSHs for (a) 2 day, (b) 4 days, and (c) 6days, after 2011/9/24. Those from COMPIRA and SWOT merged ones for (d) 2 day, (e) 4 days, and (f) 6days.

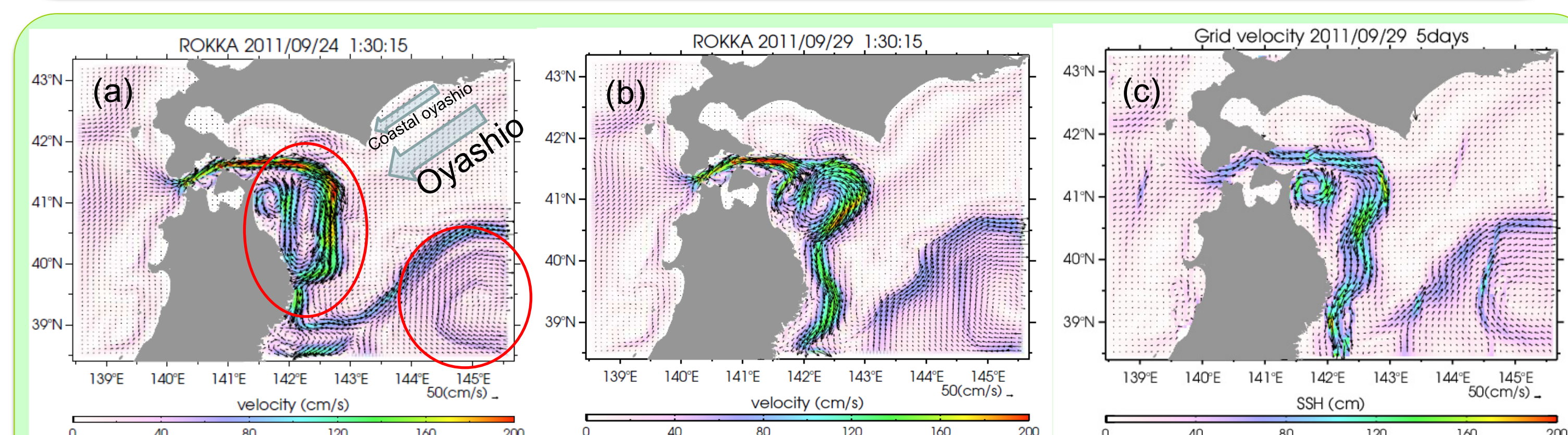


Fig. 5. Model surface currents on (a) 2011/9/24 and (b) 2011/9/29. (c) Geostrophic currents calculated from COMPIRA/SWOT simulated SSHs for 5 days from 2011/9/24 to 9/29.