PO.ID 174

Fetch effect on sea surface wind speed retrieval from SAR image in coastal waters

Yuko Takeyama*1, Ohsawa Teruo*2, Katsutoshi Kozai*2, Charlotte Bay Hasager*3, Merete Badger*3, Susumu Shimada*1, Tetsuya Kogaki*1
*1 National Institute of Advanced Industrial Science and Technology (AIST), Japan
*2 Kobe University, Japan
*3 Technical University of Denmark, Risø Campus, Denmark

Abstract

The retrieved wind speeds from satellite-borne synthetic aperture radars (SARs) have been validated in various sea areas in previous studies. In coastal waters it has been reported that the SAR retrieved sea surface wind speed has negative biases against in-situ measurements when offshore winds blow. This study discuss the negative bias and a spatial distribution of the negative bias in Japanese coastal waters. In the beginning, it is confirmed that biases indicate negative when the offshore wind (from land to sea) blows except the Shirahama WSM mode though all biases indicate positive when onshore winds (from sea to land) blow. The SAR wind speeds gradually increase from the coastline to offshore when offshore winds blow though the wind speeds do not only increase but also decrease when onshore wind blow. From distributions of correlation coefficients between SAR retrieved wind speeds and in-situ measurements in Hiratsuka, it is found that the coefficient slightly increase from the coastline to offshore when offshore winds blow. The results show the SAR retrieved wind speed is affected by a coastal topography when offshore winds blow. It is also found the SAR retrieved wind speeds located within 10 km off the coastline are lower than in-situ measurements 1 km off the coast because of the coastal topography when offshore winds blow in Hiratsuka.

Introduction

In coastal waters it has been reported that the sea surface wind speed retrieved from SAR images has negative biases against in-situ measurements when an offshore wind blows (toward the ocean). Little is known about a sea surface roughness, which influences sea surface wind speed indirectly in coastal waters. This study discuss the negative biases and a spatial distribution of the negative bias with SAR retrieval wind speeds in Japanese coastal waters.

Data and Methods

The equivalent neutral wind speeds are retrieved from ENVISAT ASAR 177 images observed with IMP, IMM and WSM modes with geophysical model function, CMOD5.N. The neutral wind speeds are corrected with consideration of atmospheric stabilities using air and sea surface temperatures measured in in-situ observation platforms, Hiratsuka and Shirahama.

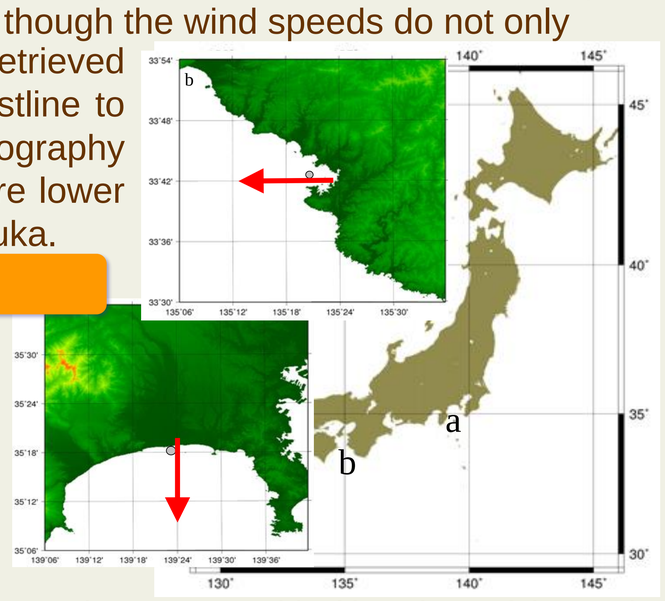


Fig. 1 Geographical locations of the study areas and in-situ platforms.

Results

Table 1 Statistics of SAR retrieved wind speeds against in-situ measured wind speeds.

	Observation mode	Wind direction	Bias (m/s)	RMSE (m/s)	Correlation Coefficient	Number of SAR images
Shirahama	IMP	Offshore	**-1.02**	**2.23**	0.73	43
		Onshore	0.58	1.34	0.86	13
	WSM	Offshore	1.36	2.79	0.55	44
		Onshore	1.63	1.66	0.99	5
Hiratsuka	IMP	Offshore	**-0.54**	**2.00**	0.72	32
		Onshore	0.87	1.96	0.81	4
	IMM	Offshore	**-0.69**	**2.52**	0.40	32
		Onshore	0.07	1.44	0.63	4

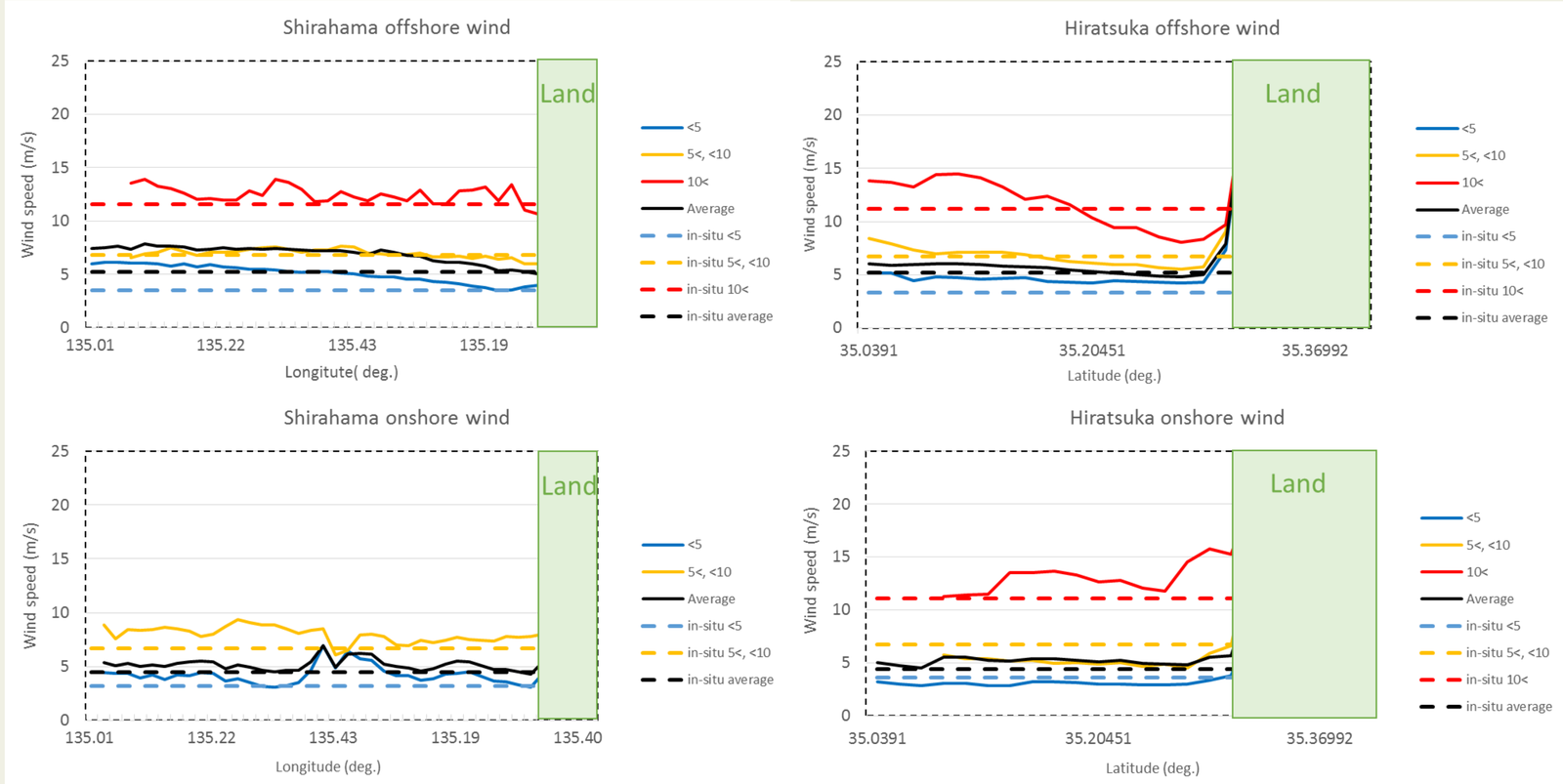
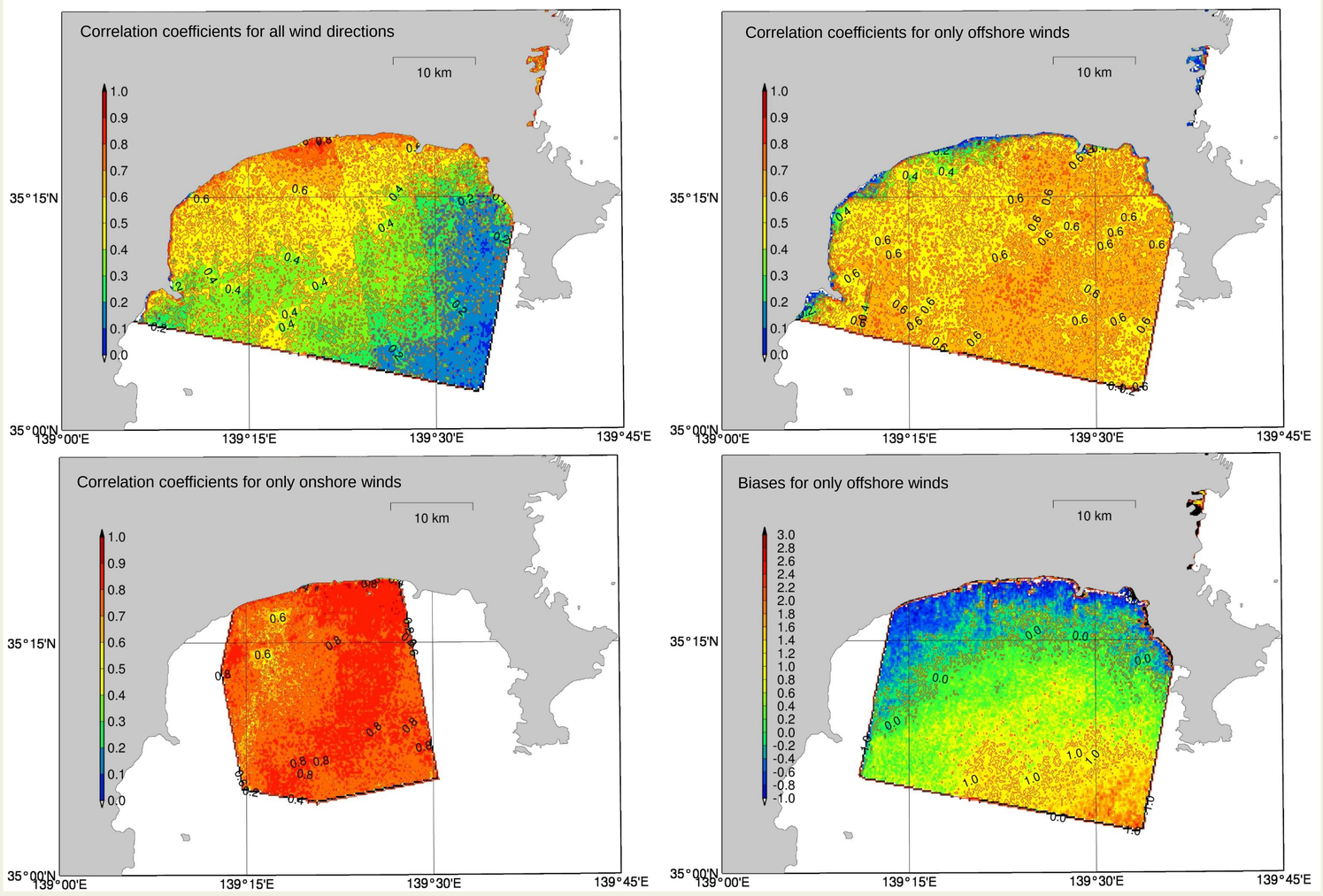


Fig. 2 Spatial variations of the SAR retrieved wind speed from the coastline to offshore in Hiratsuka (right) and Shirahama (left) when offshore winds blow (upper) and onshore wind blows (down).

↓ Fig. 3 Spatial distributions of correlation coefficients between the SAR retrieved wind speed at the platform and those around that (upper left).

↓ Fig. 4 Spatial distributions of correlation coefficients between the in-situ wind speed and SAR retrieved wind speeds for only offshore winds (upper right).



← Fig. 5 Same as Fig.4 but for only onshore winds (down left).

← Fig. 6 Biases of SAR retrieved wind speeds against in-situ wind speeds for only onshore winds (down right).

Conclusion

- Biases of SAR retrieved wind speeds against in-situ measured wind speeds are negative when offshore winds blow except for Shirahama WSM though all biases indicate positive when onshore winds blow.
- The SAR retrieved wind speed gradually increase from the coastline to offshore when offshore winds blow though the tendency is not clear when onshore wind blow.
- Correlation coefficients between in-situ wind measurements and SAR retrieved wind speeds slightly increase from the coastline to offshore when offshore winds blow .
- These results shows that the SAR retrieved wind speed can be affected by the land topography when offshore winds blow.
- The SAR retrieved wind speeds located within 10 km off the coast are lower than in-situ measurements 1 km off the coast because of the land effect when offshore winds blow in Hiratsuka.