Optimal selection of sea ice motion vector from AMSR2 multichannel data: Increased accuracy by using high resolution 89-GHz data

Eri Yoshizawa (JAXA/EORC),

Koji Shimada (Tokyo University of Marine Science and Technology)

1. Introduction

The use of the high resolution 89-GHz channel data of AMSR2 has an advantage to decrease an uncertainty of sea ice motion vectors (SIMVs) calculated by the maximum cross correlation (MCC) method using brightness temperature imageries. This channel, however, has a higher sensitivity to atmospheric moisture compared with lower frequency channels, resulting in erroneous motion estimates.

In this study, we adopt an algorithm that selects optimal vectors from multichannel data based on filtering processes of such errors (Shimada et al. 2006, Kamoshida and Shimada 2010), and retrieve SIMVs from 89-GHz imageries. The objective of this study is to demonstrate that an accuracy of retrieved SIMVs is increased by using the high resolution 89-GHz data.

2. SIMV retrieval

AMSR2 Brightness temperature data

- 89-, 36, and 18-GHz imageries for horizontal and vertical polarizations

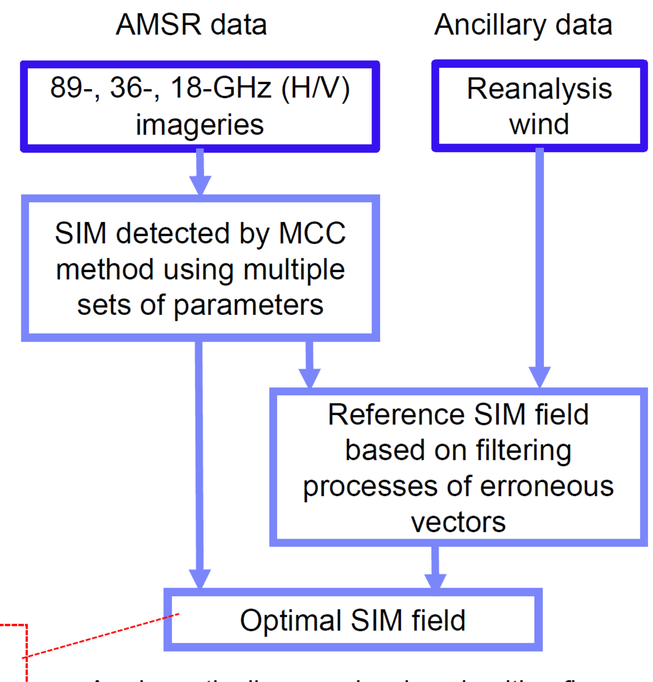
*Imageries with a 5-km resolution are created to take advantage of the high resolution 89-GHz data.

Ancillary data

- AMSR2 sea ice concentration data
- NCEP reanalysis surface wind data

*Sea ice concentration data is used to determine sea ice pixels where retrieving SIMV is processed. The pixels are defined by concentration values more than 15%.

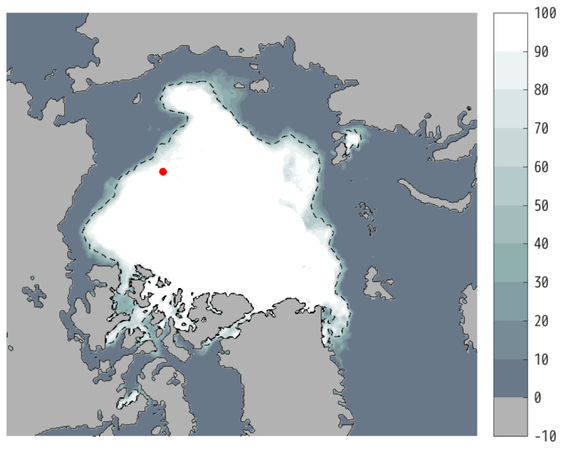
SIMVs (89) are preferentially selected in this study.



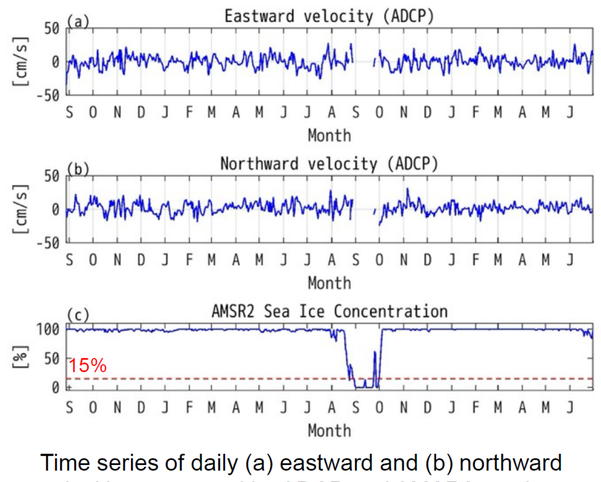
A schematic diagram showing algorithm flow

3. Validation

Retrieved SIMVs are validated using in situ data obtained from the moored Acoustic Doppler Current Profiler (ADCP) at the Chukchi Plateau in the Arctic Ocean.

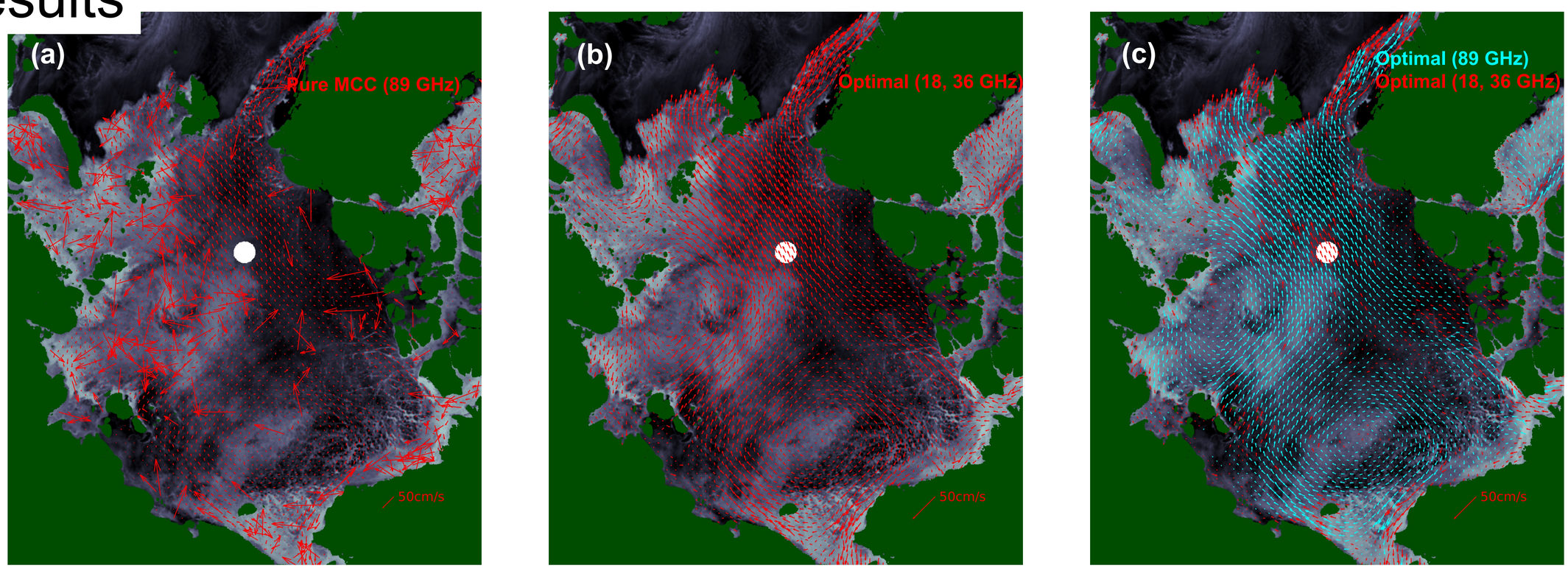


Location of ocean mooring (red circle) with September sea ice concentration in 2013 and 2014.

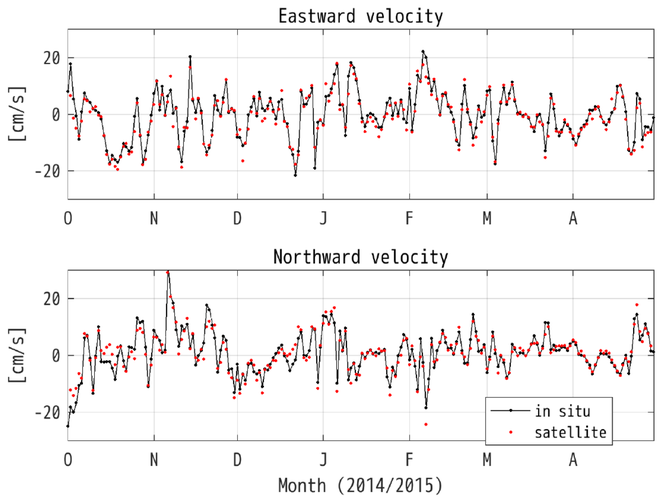


Time series of daily (a) eastward and (b) northward velocities measured by ADCP and AMSR2 sea ice concentration at the mooring location.

4. Results



↑ SIMV fields on December 26th, 2014 provided by (a) detecting MCC peaks from 89-GHz imageries without filtering, (b) selecting optimal vectors using 18- or 36-GHz imageries, and (c) selecting optimal vectors using 89-GHz imageries. In figure (c), vectors from 18- or 36-GHz imageries shown in figure (b) are adopted where those from 89-GHz ones are unavailable as results of filtering. Background imageries are from the horizontally polarized 89-GHz channel. (Yoshizawa and Shimada, *in prep.*)



↑ Time series of moored ADPC data (black) and satellite derived data derived from 89-GHz imageries (red).

↓ Root mean square errors (RMSEs) from comparisons with moored ADCP data (October – April in 2013/2014 – 2014/2015)

v.s. moored ADCP data (N = 426)	**RMSE [cm/s]**	
	Eastward	Northward
Optimal (18, 36 GHz)	2.01	2.30
Optimal (89 GHz)	1.91	2.11

5. Conclusion

- ✓The optimal selection algorithm is used to retrieve SIMVs from AMSR2 89-GHz imageries for winter months.
- ✓Validation results using in situ data in the Arctic Ocean show that an accuracy of SIMVs from the high resolution 89-GHz imageries is increased compared with that from lower frequency imageries.

- Further validations (e.g., for summer months, v.s. buoy data) will be conducted.

Shimada et al. (2006), Pacific Ocean Inflow: influence on catastrophic reduction of sea ice cover in the Arctic Ocean. *Geophys. Res. Lett.*, Vol. 33, L08605, doi:10.1029/2005GL025624.
Kamoshida T, Shimada K (2010) Long term sea ice motion dataset in the Arctic from SMMR, SSM/I and AMSR-E. In: Proceedings of the second international symposium on the Arctic research, Tokyo, Japan, 2010, p 125