

# Enhanced-resolution AMSR2 sea ice concentration products for operational use



Thomas Greenwald<sup>1</sup>, Yinghui Liu<sup>2</sup>, J. Scott Stewart<sup>3</sup>, Mary J. Brodzik<sup>3</sup>, and Walter N. Meier<sup>3</sup>

<sup>1</sup>Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin-Madison, WI (Contact: tomg@ssec.wisc.edu)

<sup>2</sup>Advanced Satellite Products Branch NOAA/NESDIS/STAR/CoRP, University of Wisconsin-Madison, WI

<sup>3</sup>National Snow and Ice Data Center (NSIDC), CIRES/University of Colorado

## WHY ARE AMSR2 OBSERVATIONS OF SEA ICE IMPORTANT?

- Unlike optical sensors, the Advanced Microwave Scanning Radiometer-2 (AMSR2) can observe sea ice through most clouds.
- In operations, these observations are needed to fill gaps in space and time when high-resolution Synthetic Aperture Radar (SAR) imagery are unavailable, and to provide a more expansive view of sea ice in the Arctic.

## GOALS

- Summarize how forecasters and ice analysts at the Alaska Sea Ice Program (ASIP) and the US National Ice Center (USNIC) are using new enhanced AMSR2 sea ice concentration (SIC) products in the Arctic.
- Evaluate the accuracy of these products against high-resolution Landsat imagery.

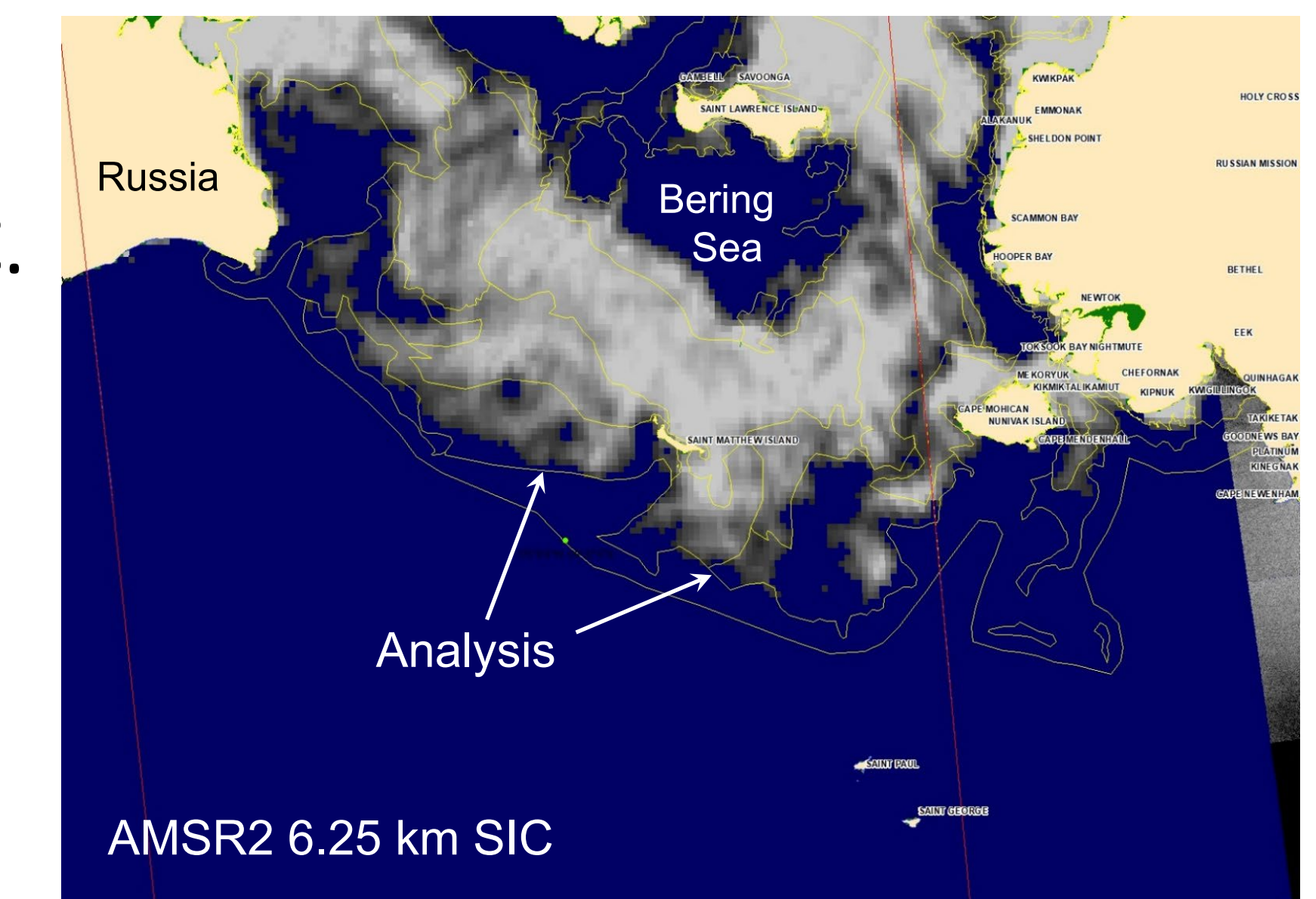
## METHODS

- Enhanced-resolution AMSR2 imagery is produced via a proven signal processing method (Long and Brodzik 2016) using multiple overlapping field-of-views. Daily swath data are projected onto equal area EASE-Grid 2.0 for morning/evening composites.
- **SIC product generation:** Used 6.25 km gridded brightness temperatures and the “Bootstrap” algorithm with inputs of 18/23 GHz data and upscaled 36 GHz data (Meier et al. 2017).
- **Validation:** We handpicked 5 Landsat data (50 m resolution) clear sky scenes for the comparisons. Sea ice concentration was retrieved from Landsat visible (0.64  $\mu\text{m}$ ) reflectance data using the method of Liu et al. (2016).

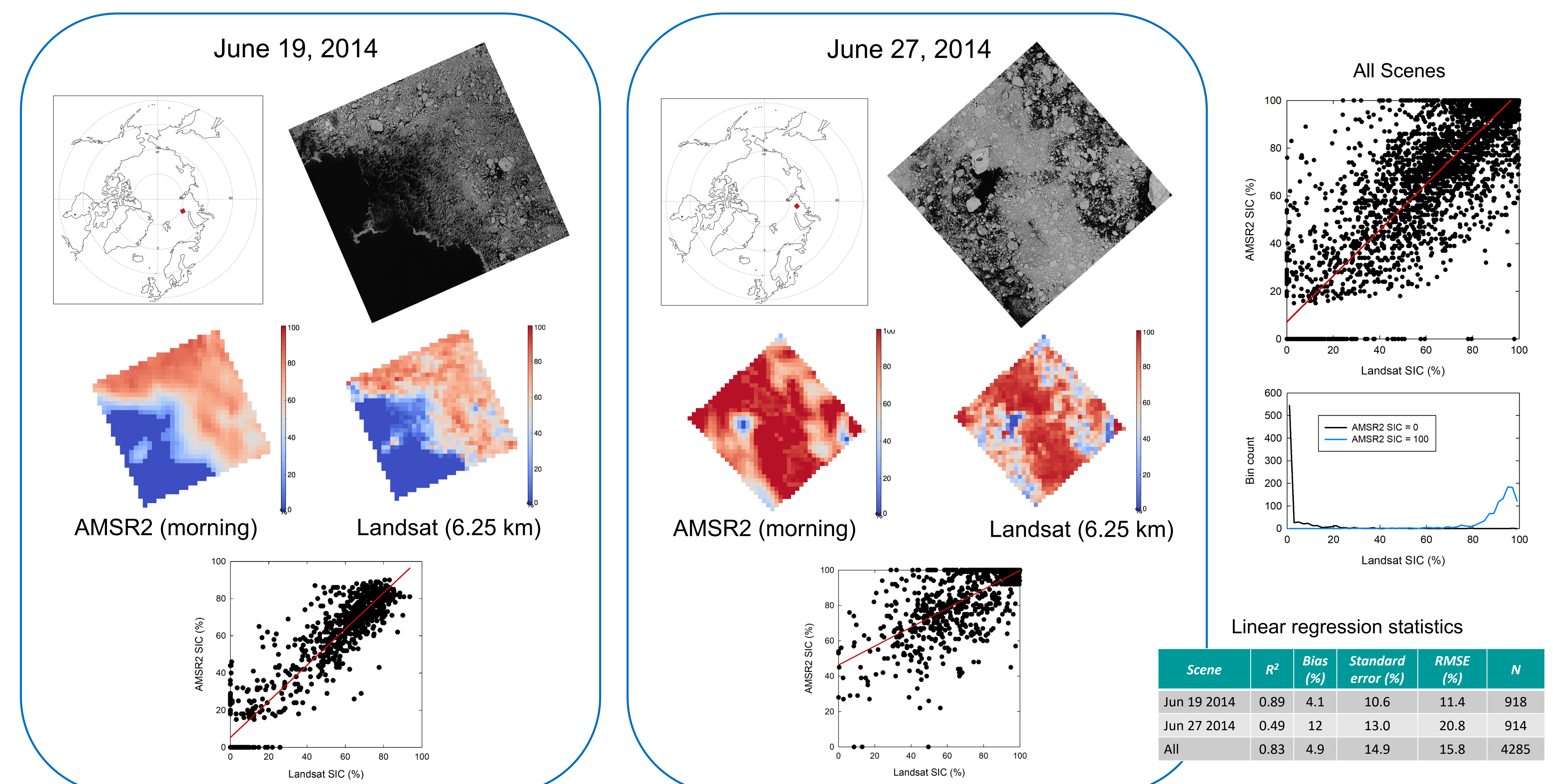
STANDARD RESOLUTION		ENHANCED RESOLUTION	
AU product		rSIR product	
AMSR2 Frequency	Native Sensor Footprint	Standard Gridded Resolution	rSIR Enhanced Resolution
18.7 GHz	22 x 14 km	12.5 km	6.25 km
36.5 GHz	12 x 7 km	12.5 km	3.125 km
89.0 GHz	5 x 3 km	6.25 km	3.125 km

## PRODUCT USE IN OPERATIONS

- For over a year, our JPSS Proving Ground and Risk Reduction (PGRR) project has provided enhanced resolution (3.125 km) AMSR2 imagery to forecasters and ice analysts at ASIP and USNIC.
- Like the enhanced AMSR2 imagery, the new enhanced (6.25 km) SIC products are used by ASIP forecasters to fill gaps in SAR imagery and when extensive cloud cover occurs.
- These products are also used to independently track the ice edge and marginal ice zone (MIZ) with a degree of confidence not achieved with the standard AMSR2 sea ice concentration.



## VALIDATION RESULTS



## CONCLUSIONS

- Forecasters are using the new products to fill gaps in imagery and for tracking the ice edge and MIZ.
- A limited initial validation of the new products showed overall high correlation with Landsat SIC. However, in one case the AMSR2 SIC estimates were biased somewhat higher.
- Our plans are to expand the validation, as well as compare to the NOAA legacy AMSR2 SIC products.

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## References

- Liu, Y., J. Key, and R. Mahoney. 2016, doi:10.3390/rs8060523.  
 Long, D. G. and M. J. Brodzik. 2016, doi:10.1109/TGRS.2015.2505677.  
 Meier, W. N., J. S. Stewart, Y. Liu, J. Key, J. A. Miller. 2017, doi:10.1109/JSTARS.2017.2693120.