

Comparison of ASCAT and SWOT Wind Speeds Near Sea Ice

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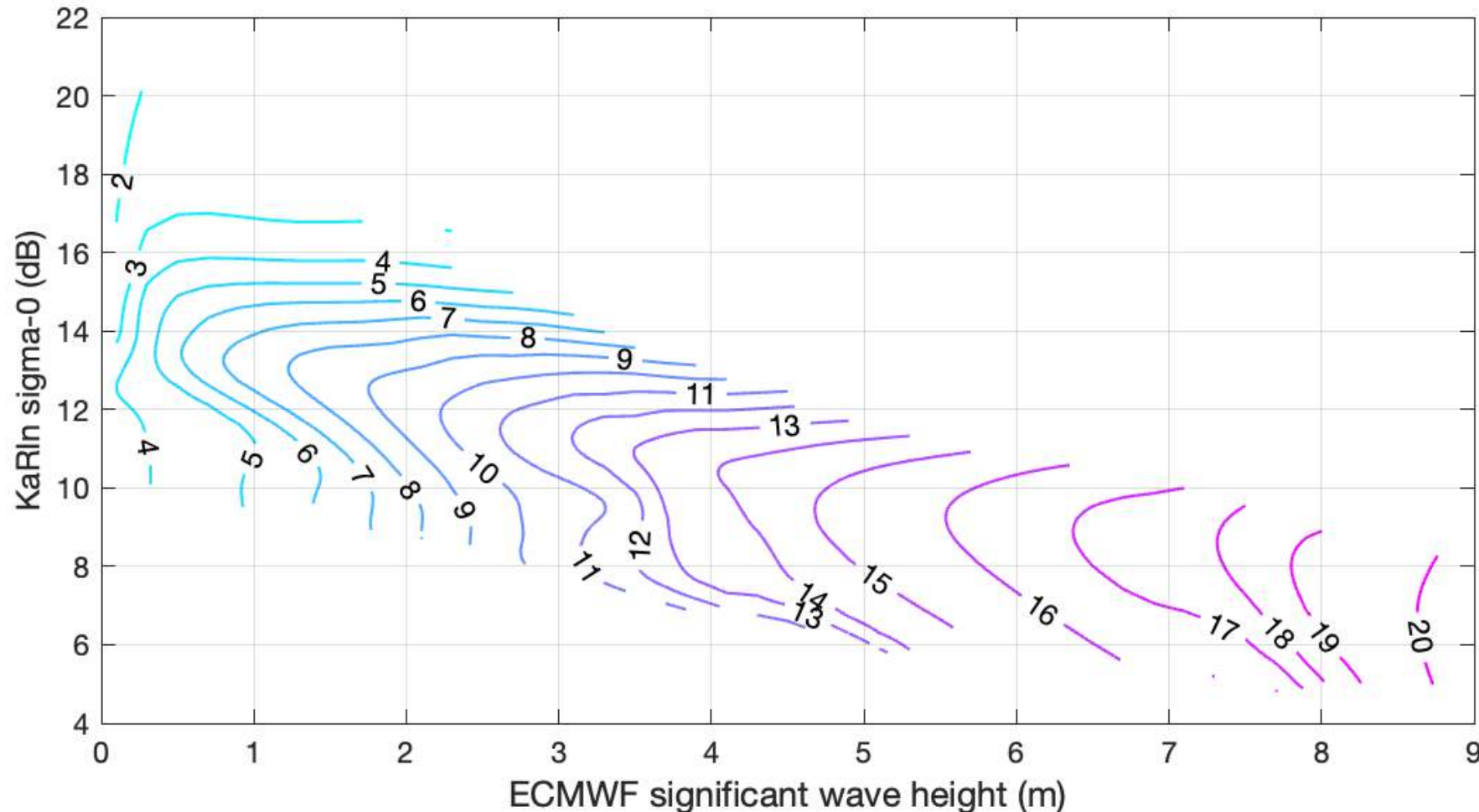
Sponsor Acknowledgment

- *The research described here was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*

Plan: Develop a multi-decadal multi-sensor ocean surface wind climate data record near the sea ice edge

- Step 1: Retrieve 2-km resolution wind speeds and ice concentration map from SWOT.
- Step 2: Compare SWOT winds and QC to ASCAT data and use to improve ASCAT QC and wind accuracy near ice edge.
- Step 3: Compare ASCAT winds and QC to QuikSCAT and ScatSAT data and use to improve QuikSCAT and ScatSAT quality control near ice edge

Developed SWOT KaRIn wind retrieval using ASCAT and ECMWF as ground truth



Inputs to wind retrieval are

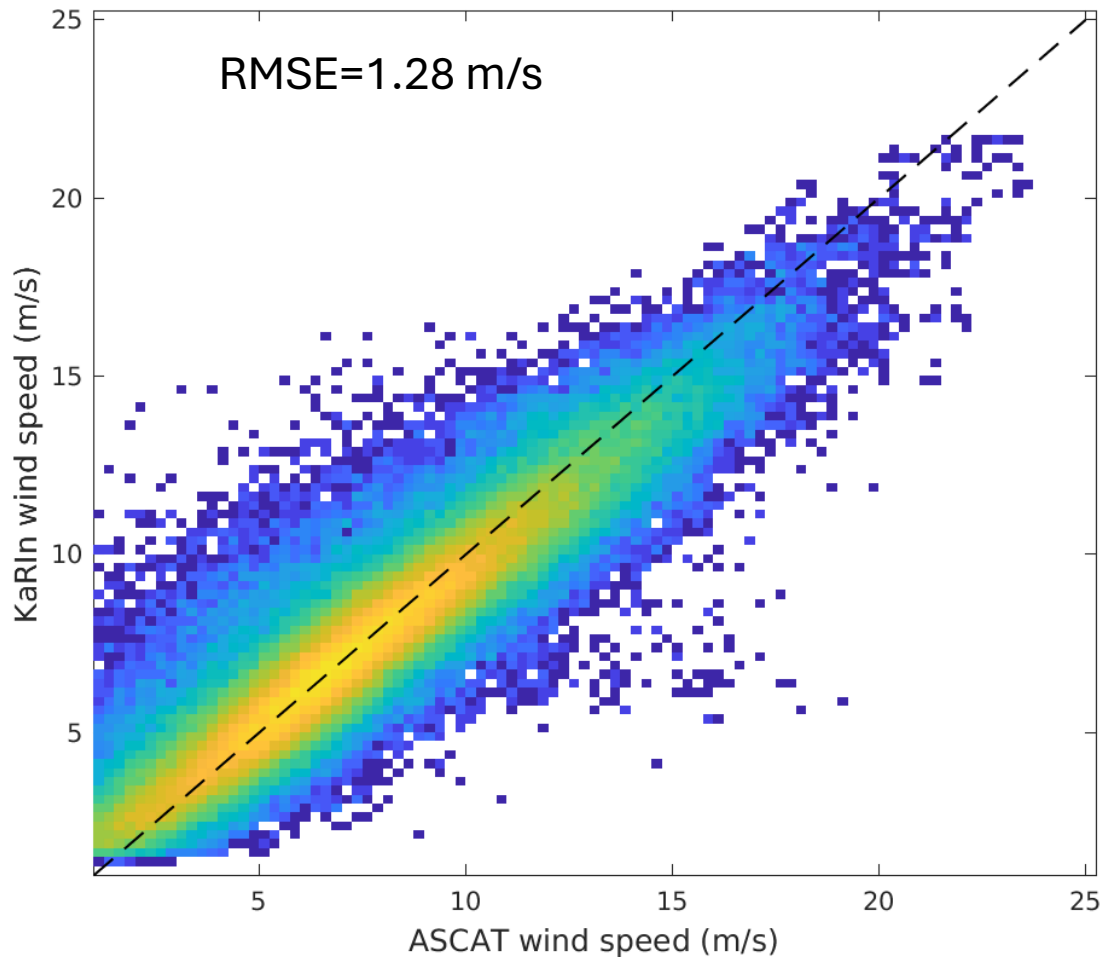
- sigma-0,
- incidence angle
- SWH (ECMWF)

Plot is a cut of the 3-D model function at incidence angle = 2.5 degrees.

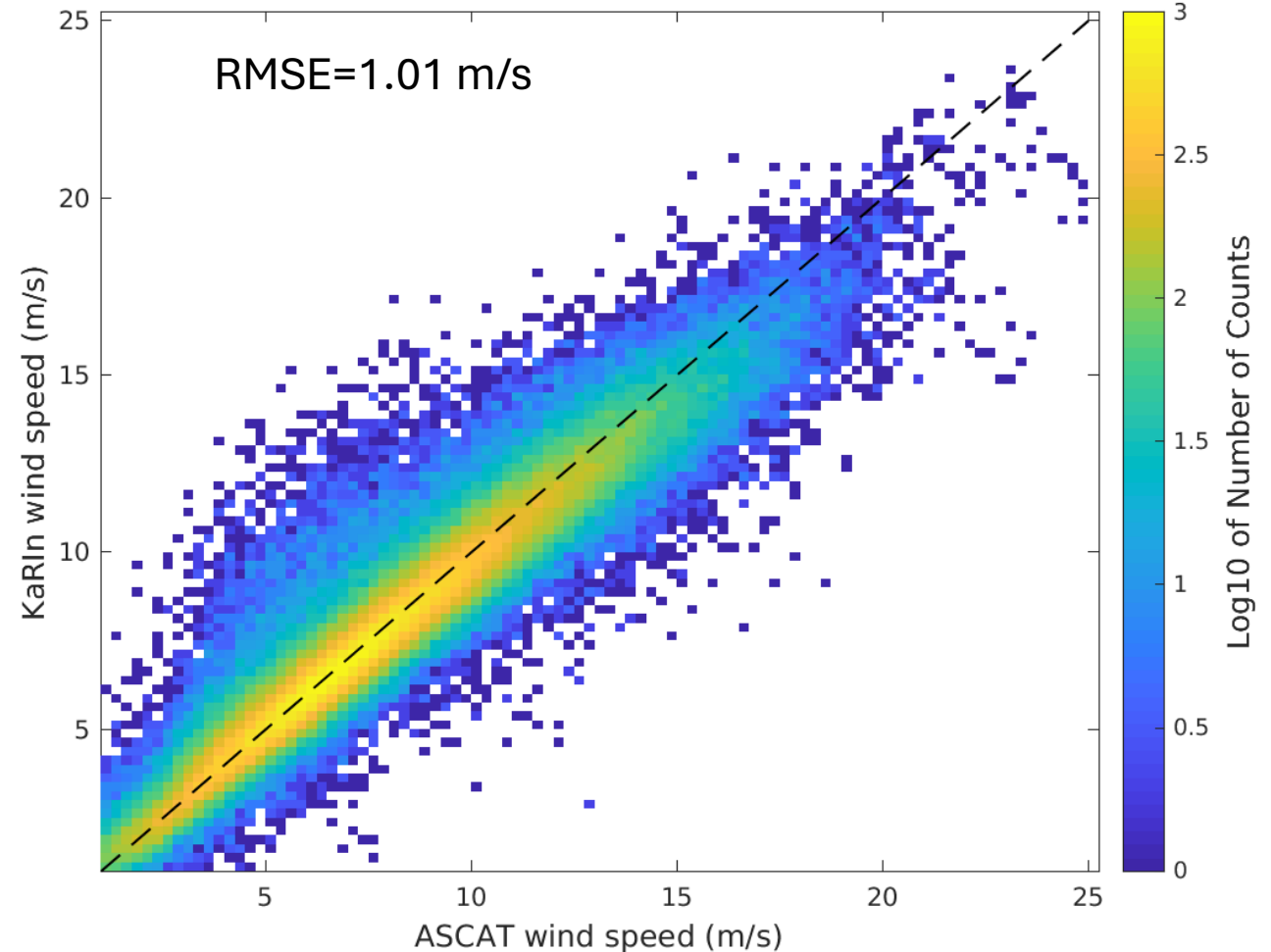
GMF is a lookup table produced using an empirical function approximation method using ECMWF winds as training output.

Developed SWOT KaRIn wind retrieval using ASCAT and ECMWF as ground truth

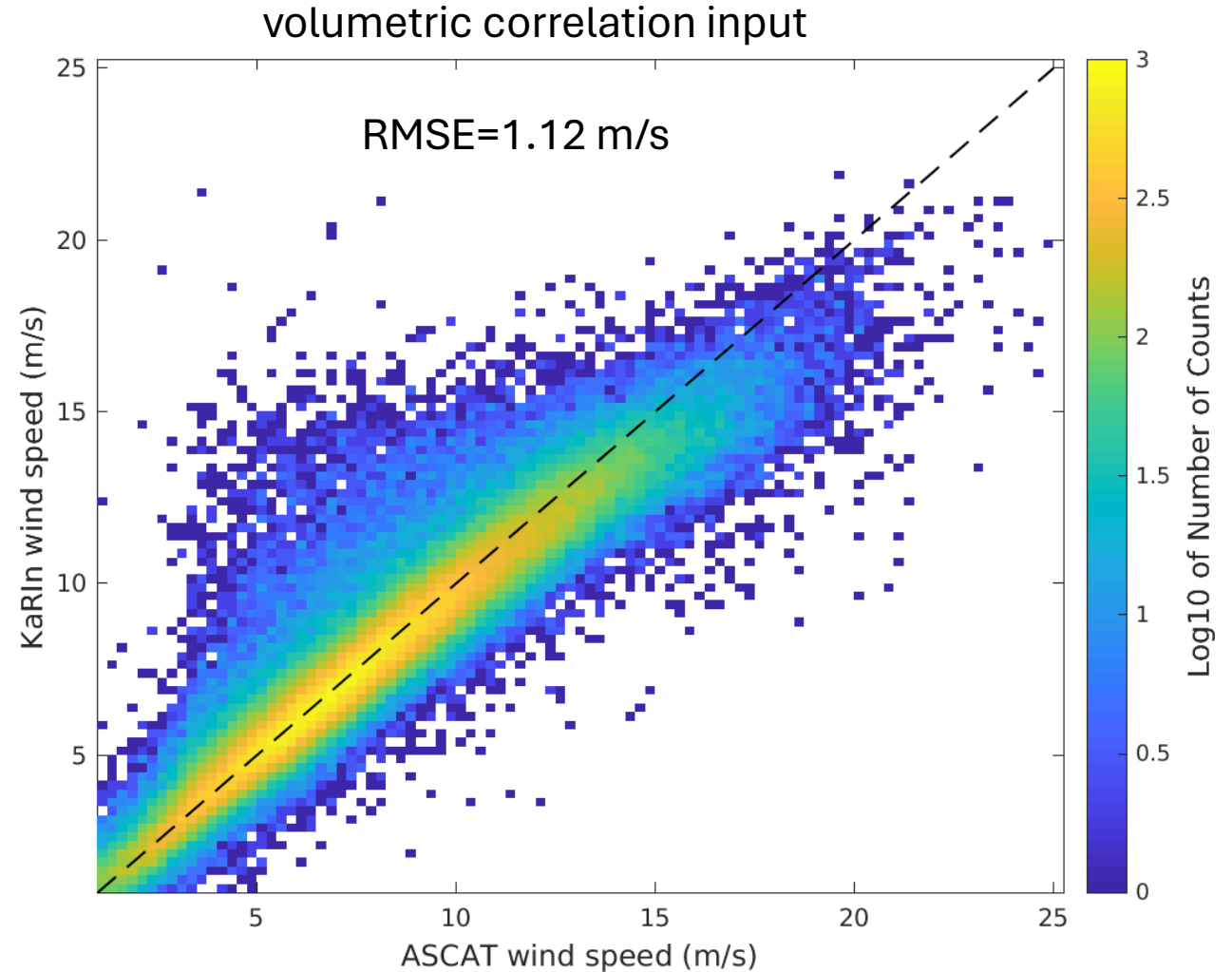
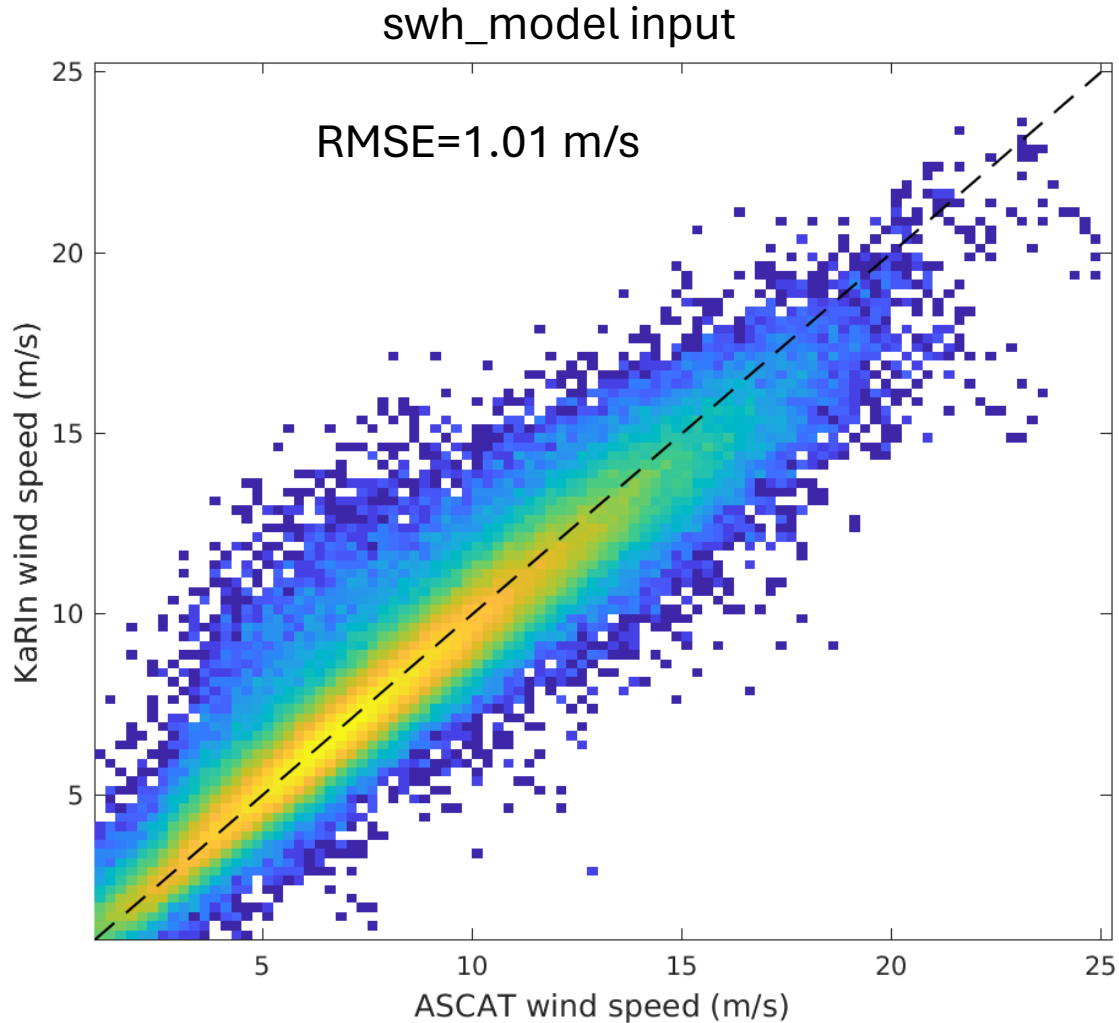
Current GMF, ASCAT within 30 min, GOOD SSHA2



Retrained GMF, ASCAT within 30 min, GOOD SSHA2



Developed SWOT KaRIn wind retrieval using ASCAT as ground truth, *volumetric correlation instead of model SWH*



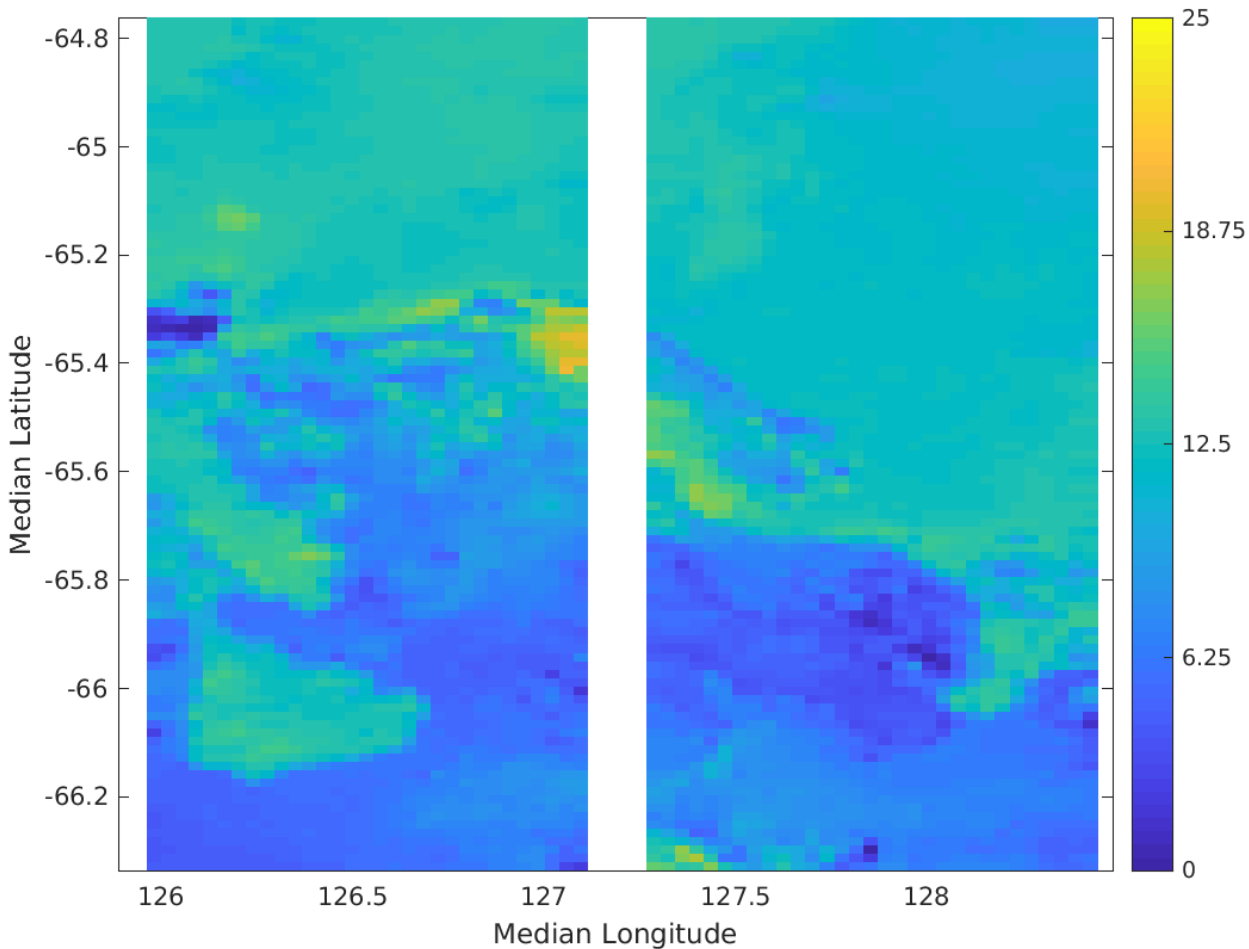
A note on SWOT KaRIn coregistered images

- All geographic images in this presentation are in SWOT swath coordinates with the y-axis being along track and the x-axis across track.
 - SWOT InSAR data is missing in the middle of the x-axis (nadir) for this reason.
- To give a general idea where the data is on the ground
 - Y-axis is labeled with median latitude for each along track position
 - X-axis is labeled with median longitude for each cross track position
- Along track extent of each image was determined by centered a 200-km window on the southernmost ***valid*** co-registered ASCAT wind pixel.

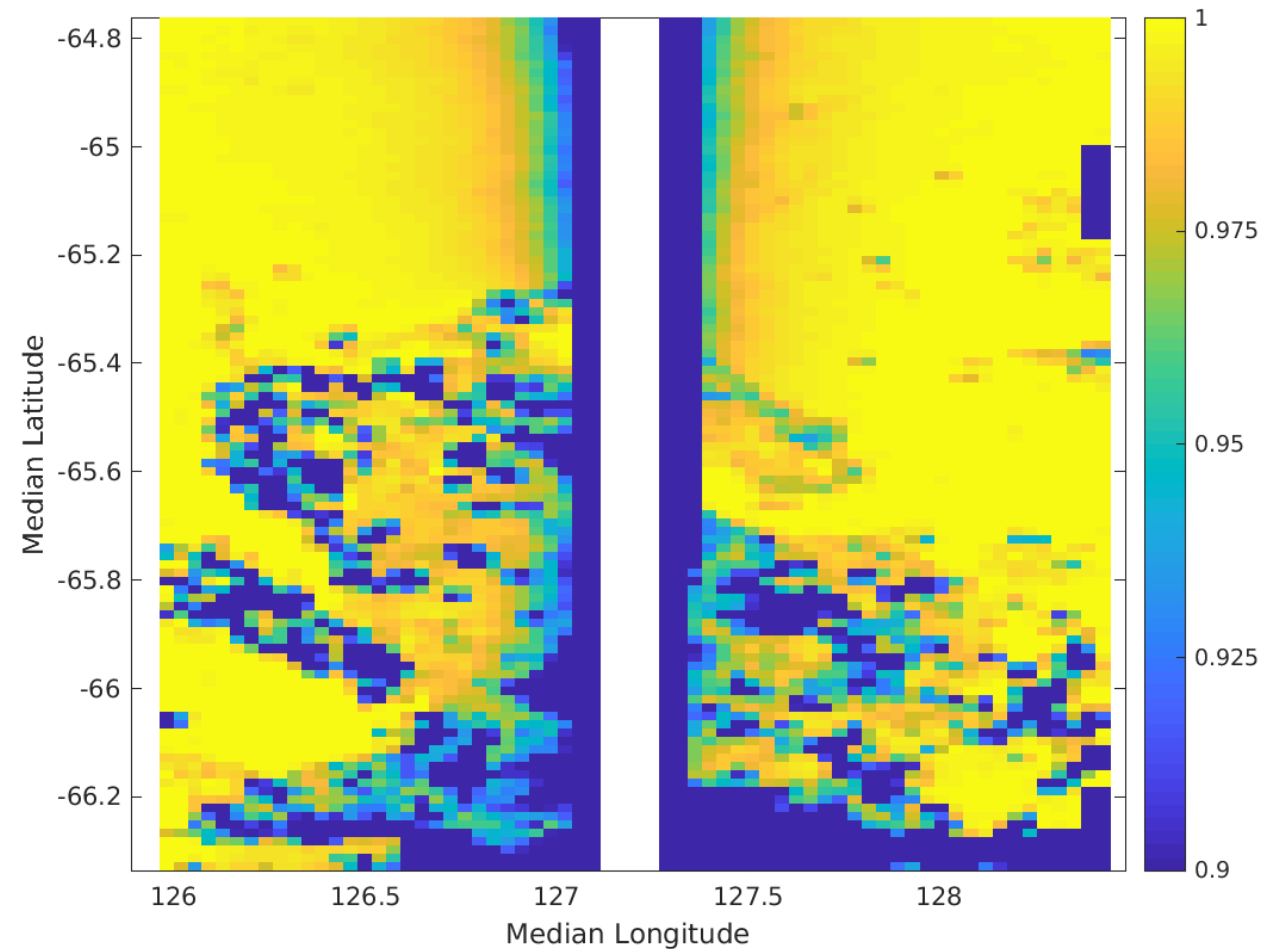
SWOT KaRIn backscatter and volumetric correlation near ice

Cycle 479, Pass 019, April 3, 2023

Backscatter in dB



Volumetric Correlation



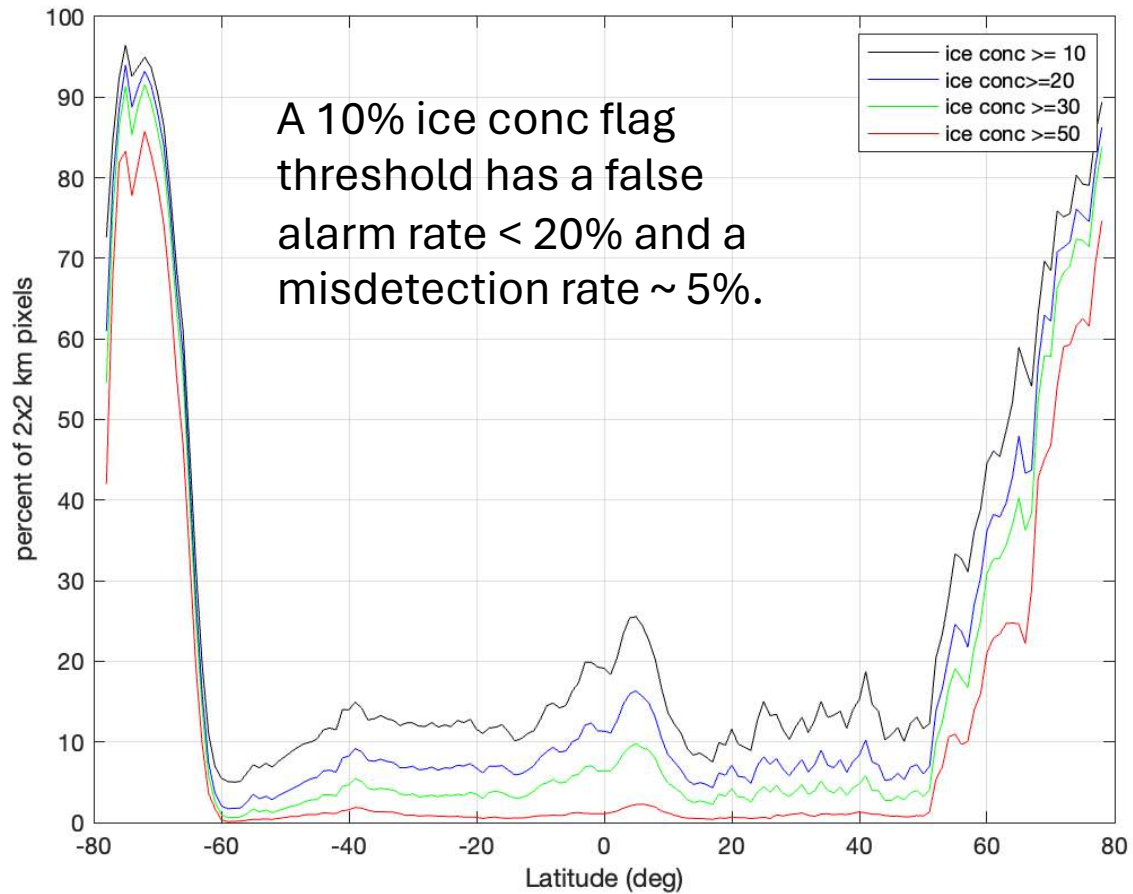
SWOT KaRIn 2 x2 km sea ice concentration estimate

RMS diff from ECMWF is 12.42 %

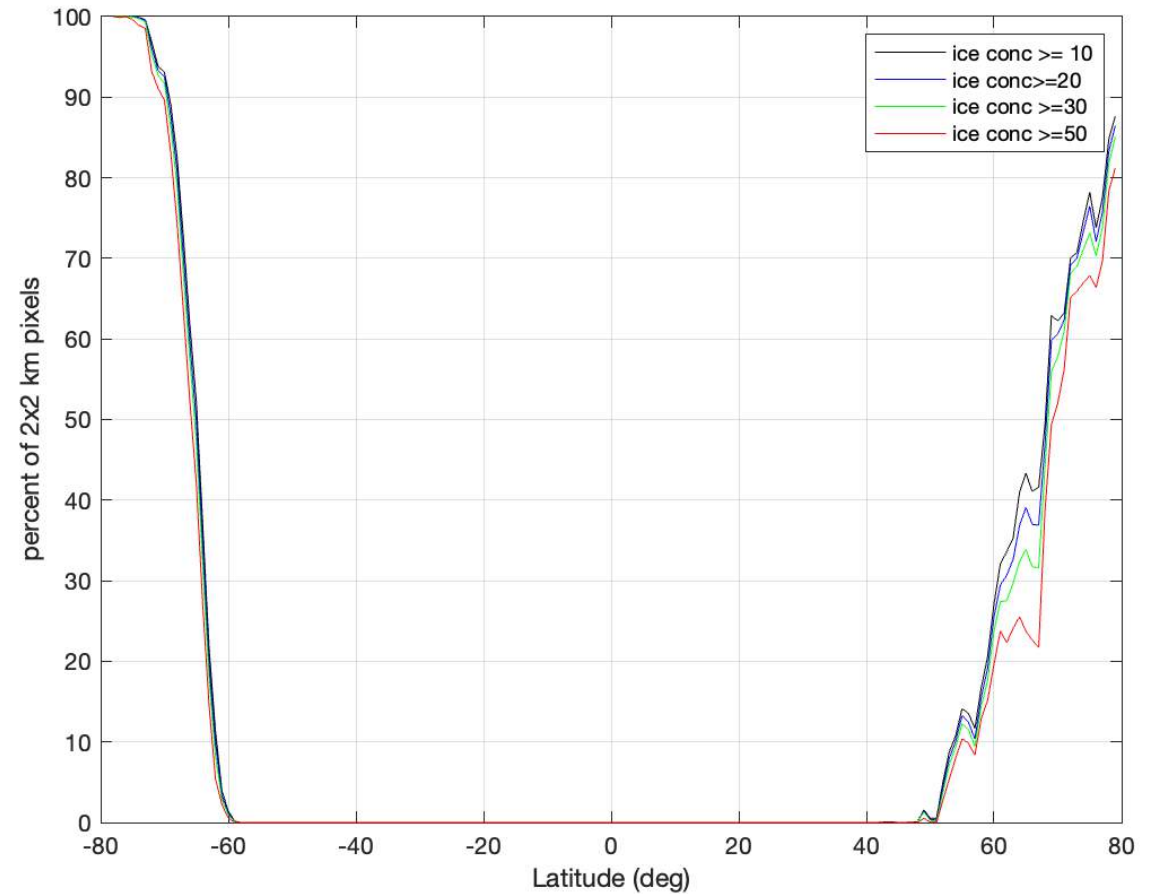
- Trained a neural network to map
- From:
 - Volumetric correlation
 - Sigma-0
 - Incidence angle
 - 3x3 variance of volumetric correlation
 - 3x3 variance of sigma-0
- To:
 - ECMWF ice concentration (much lower resolution)

Compare SWOT and ECMWF KaRIn sea ice concentration by latitude to determine of flagging threshold

SWOT

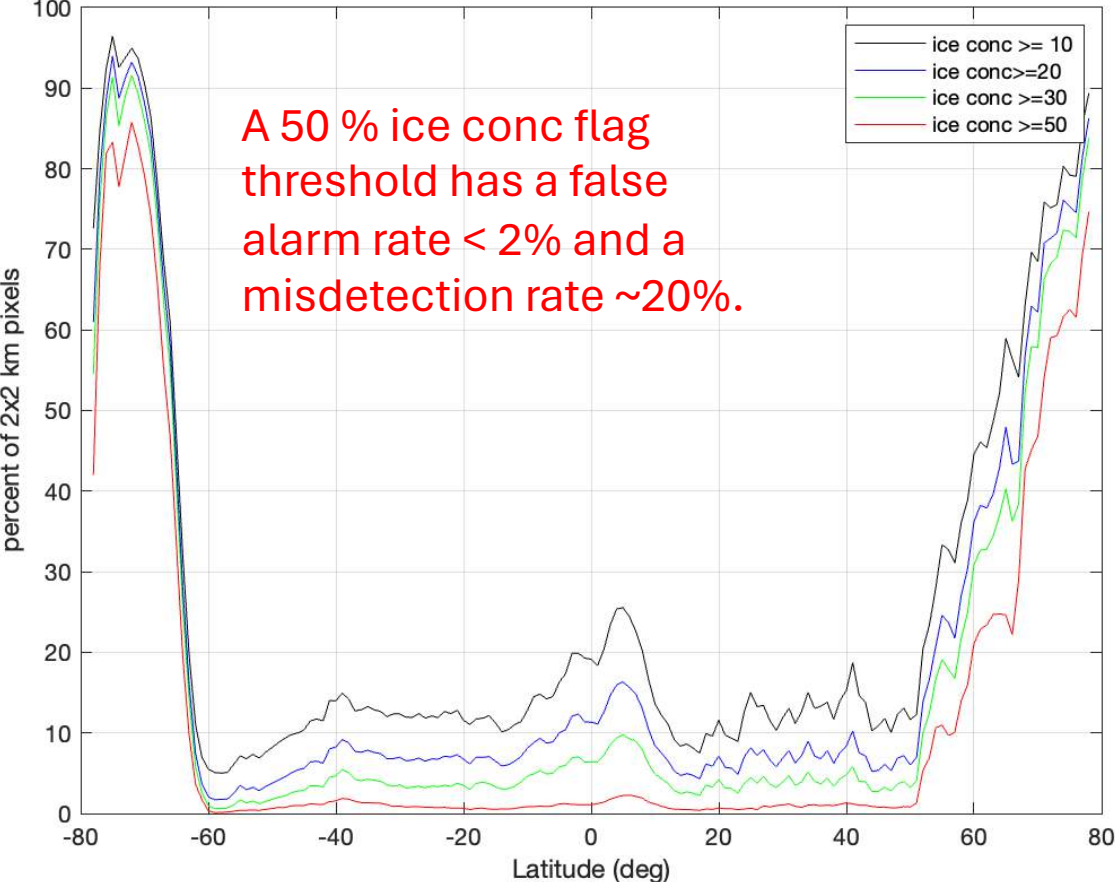


ECMWF

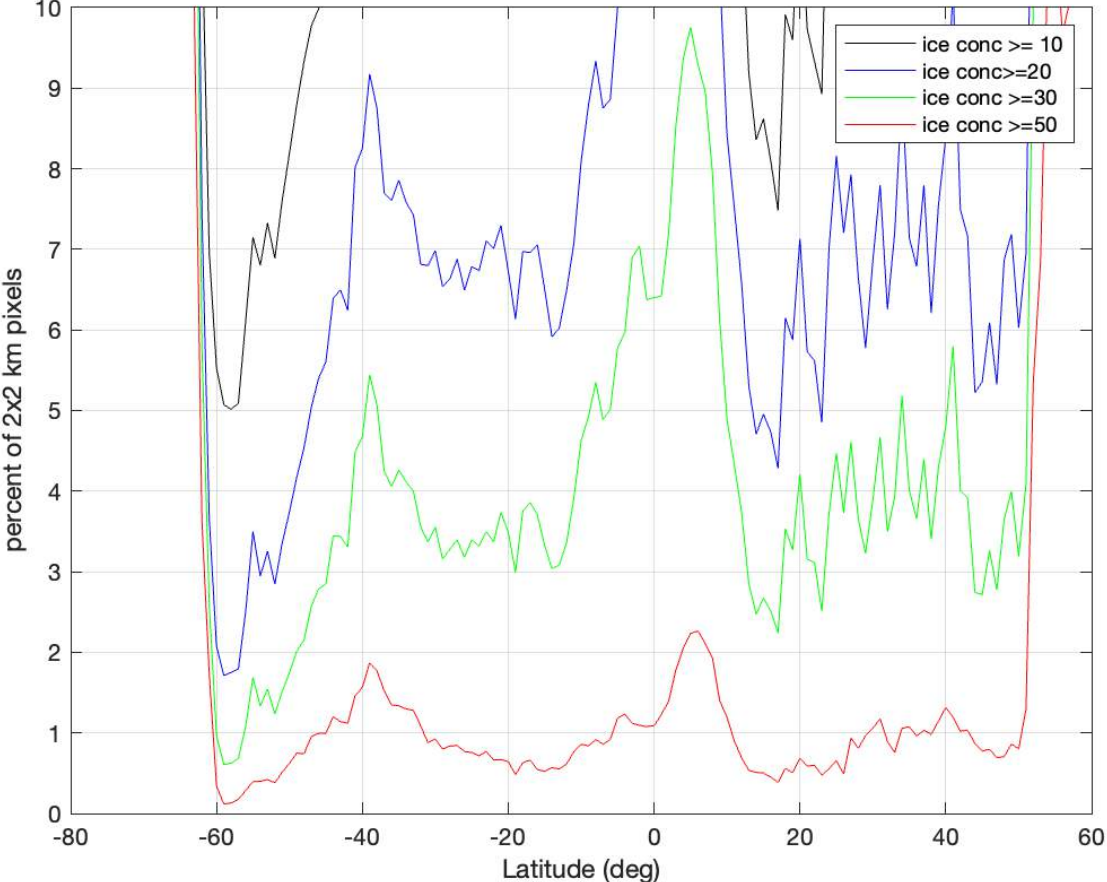


Compare SWOT and ECMWF KaRIn sea ice concentration by latitude to determine of flagging threshold

Percentage flagged vs latitude



Zoomed in to show false alarm rate for 50% threshold

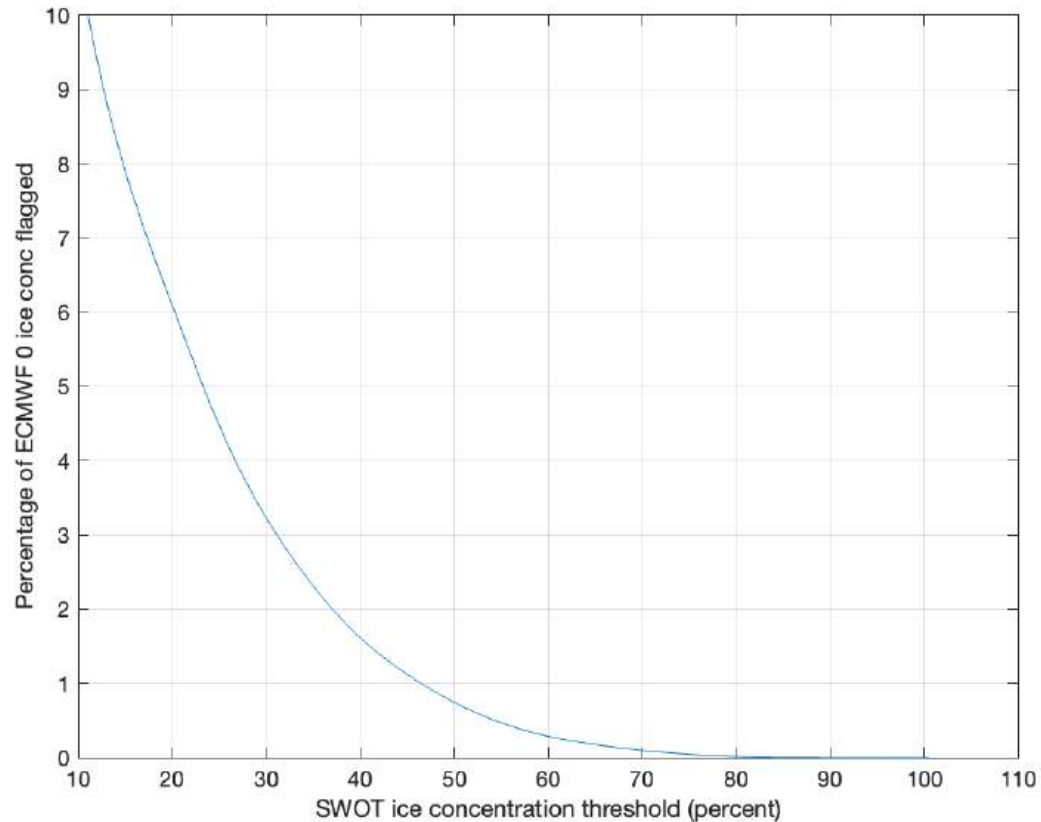


Alternative way to compute false alarm and missed detection rate:

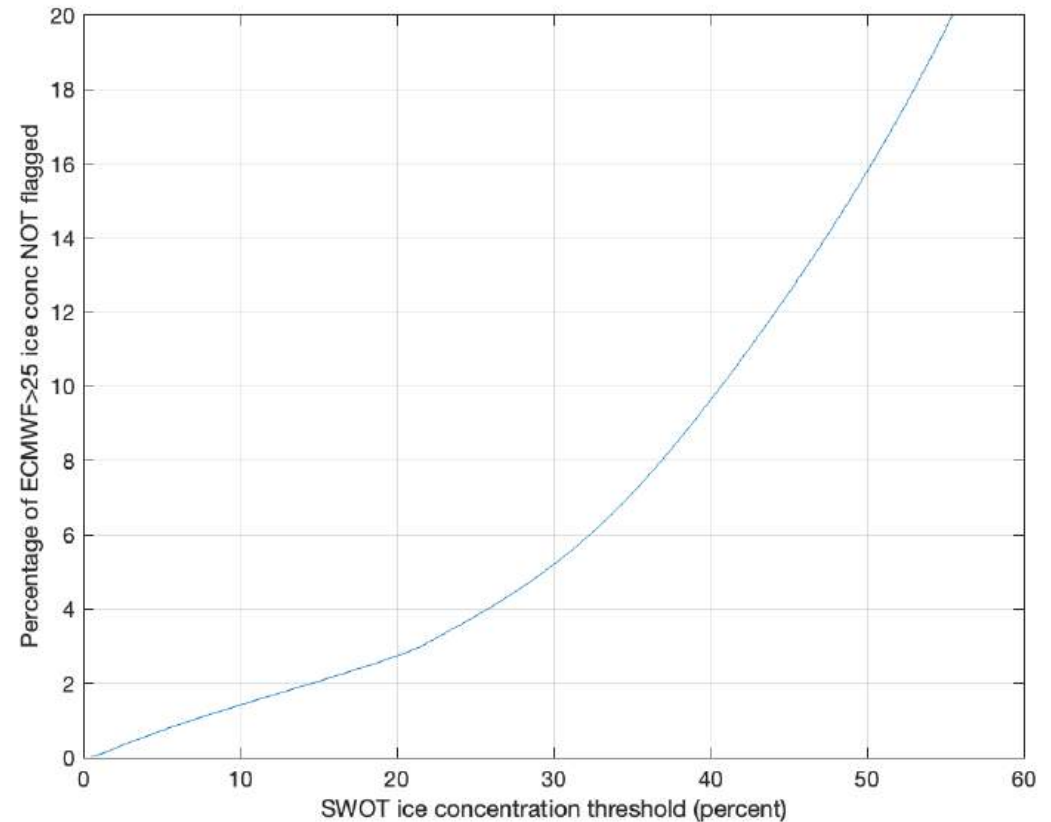
FA=Percentage of ECMWF ice conc=0 data flagged

MD=Percentage of ECMWF ice conc > 25% not flagged

False alarm vs SWOT ice conc threshold

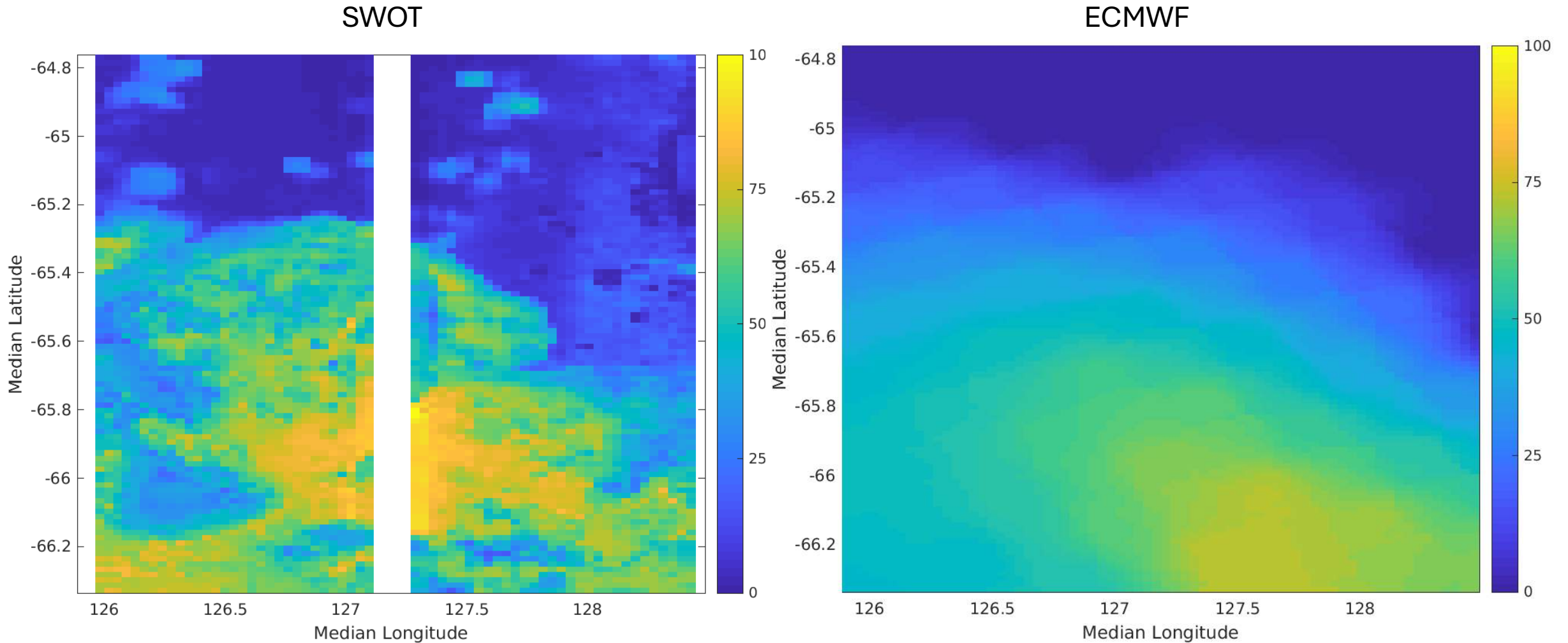


Missed detection vs SWOT ice conc threshold



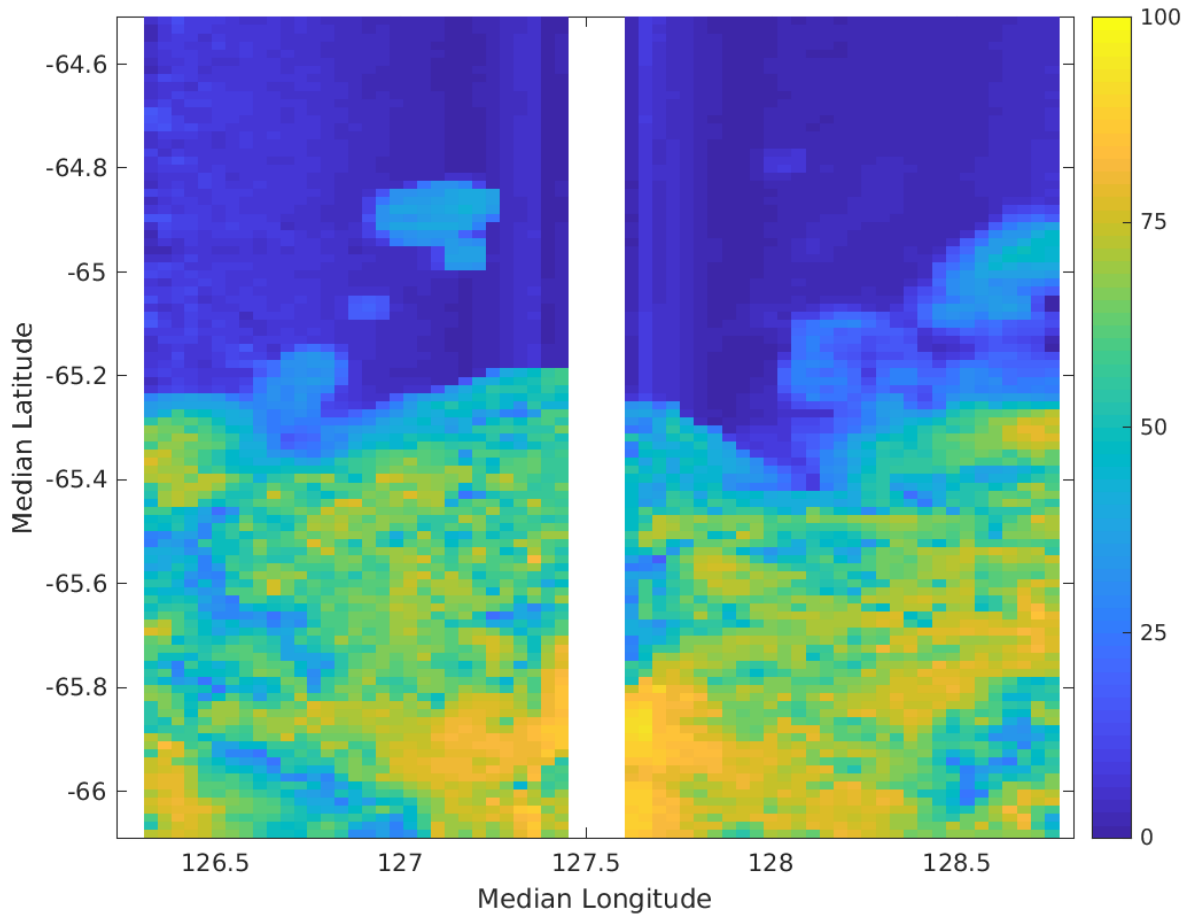
SWOT KaRIn and ECMWF Ice concentration

Cycle 479, Pass 019, April 3, 2023

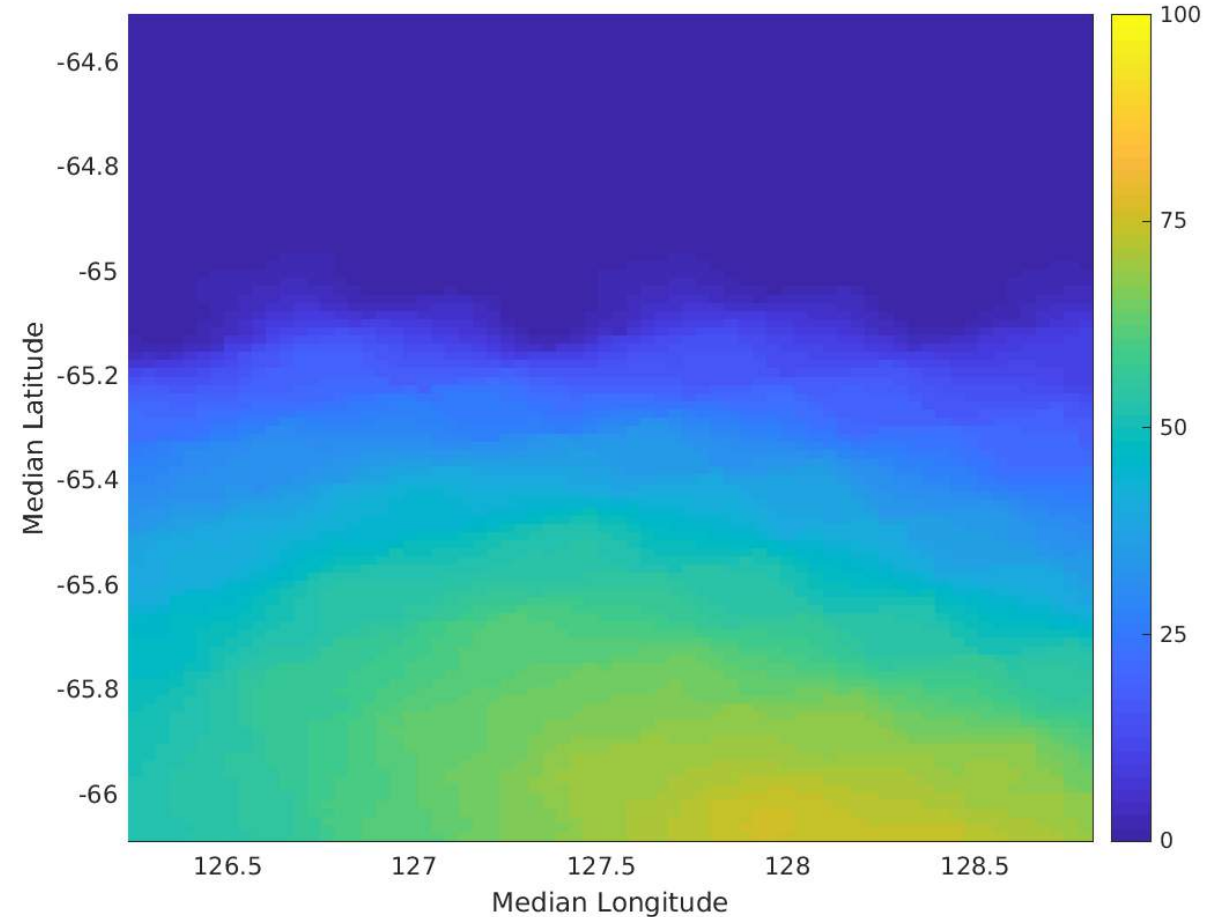


SWOT KaRIn and ECMWF Ice concentration Cycle 480, Pass 019, April 4, 2023

SWOT



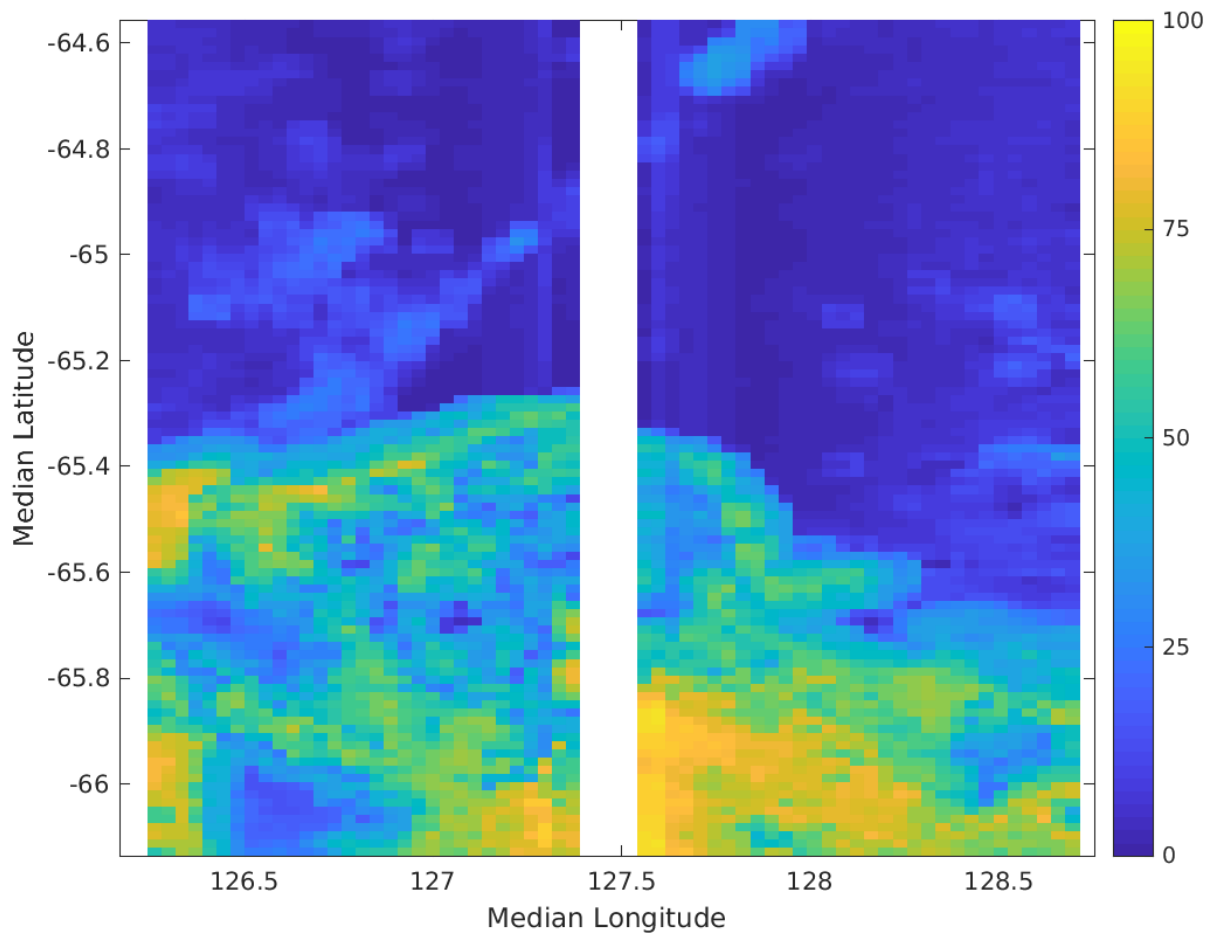
ECMWF



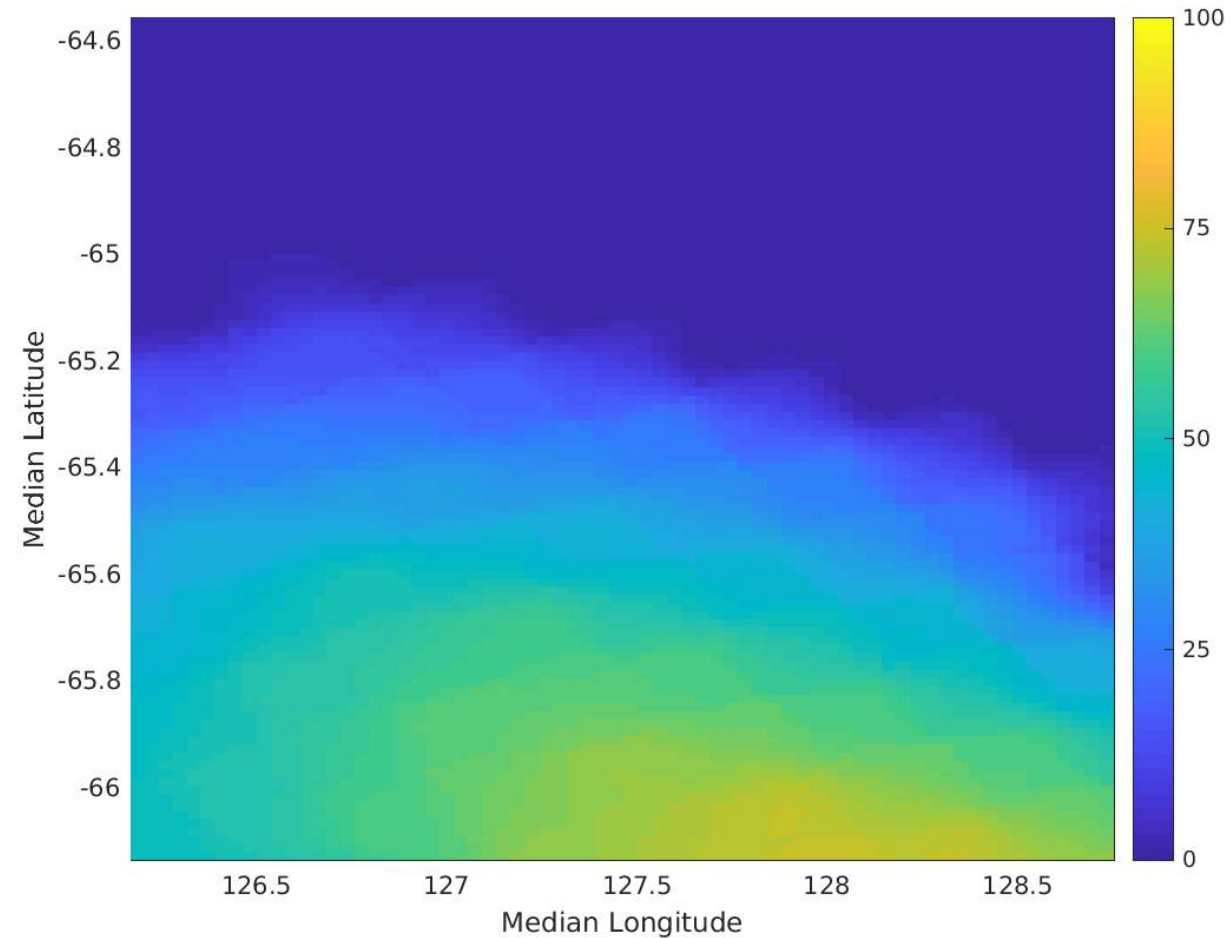
SWOT KaRIn and ECMWF Ice concentration

Cycle 481, Pass 019, April 5, 2023

SWOT



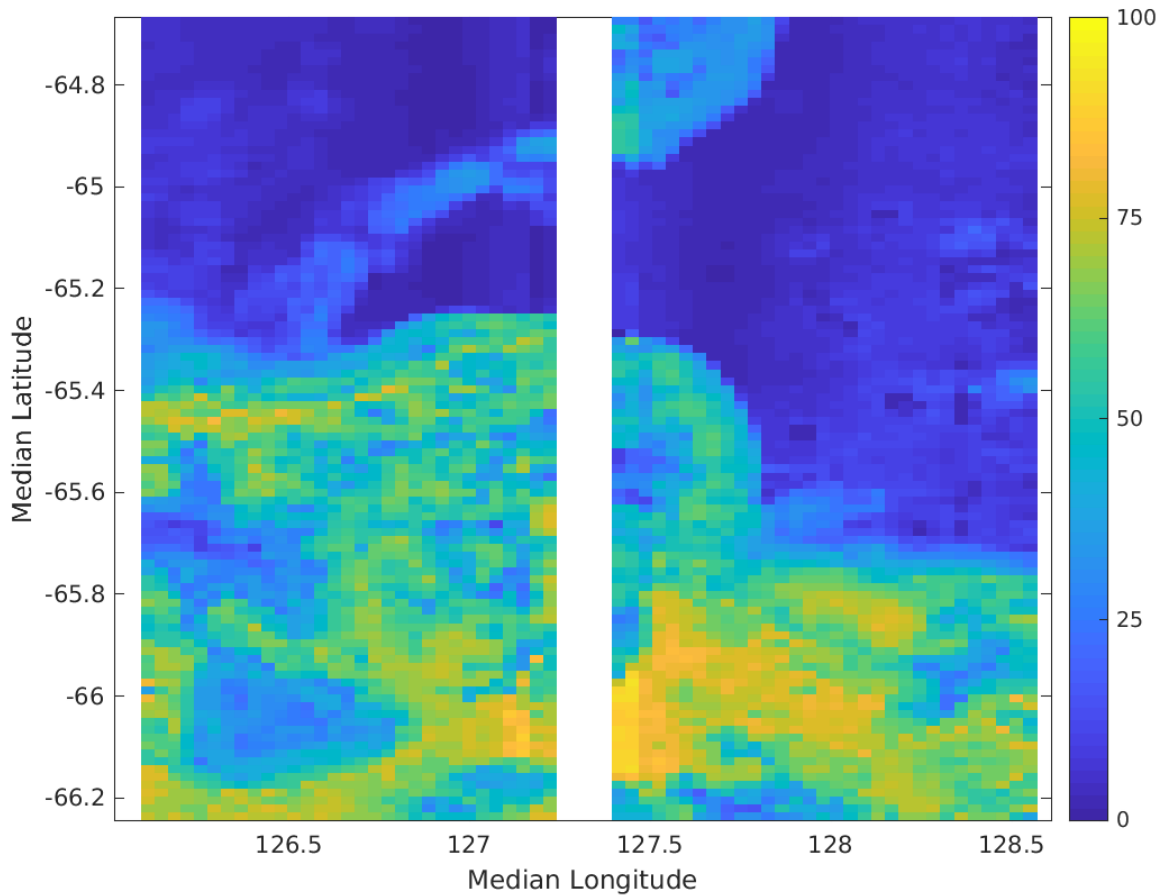
ECMWF



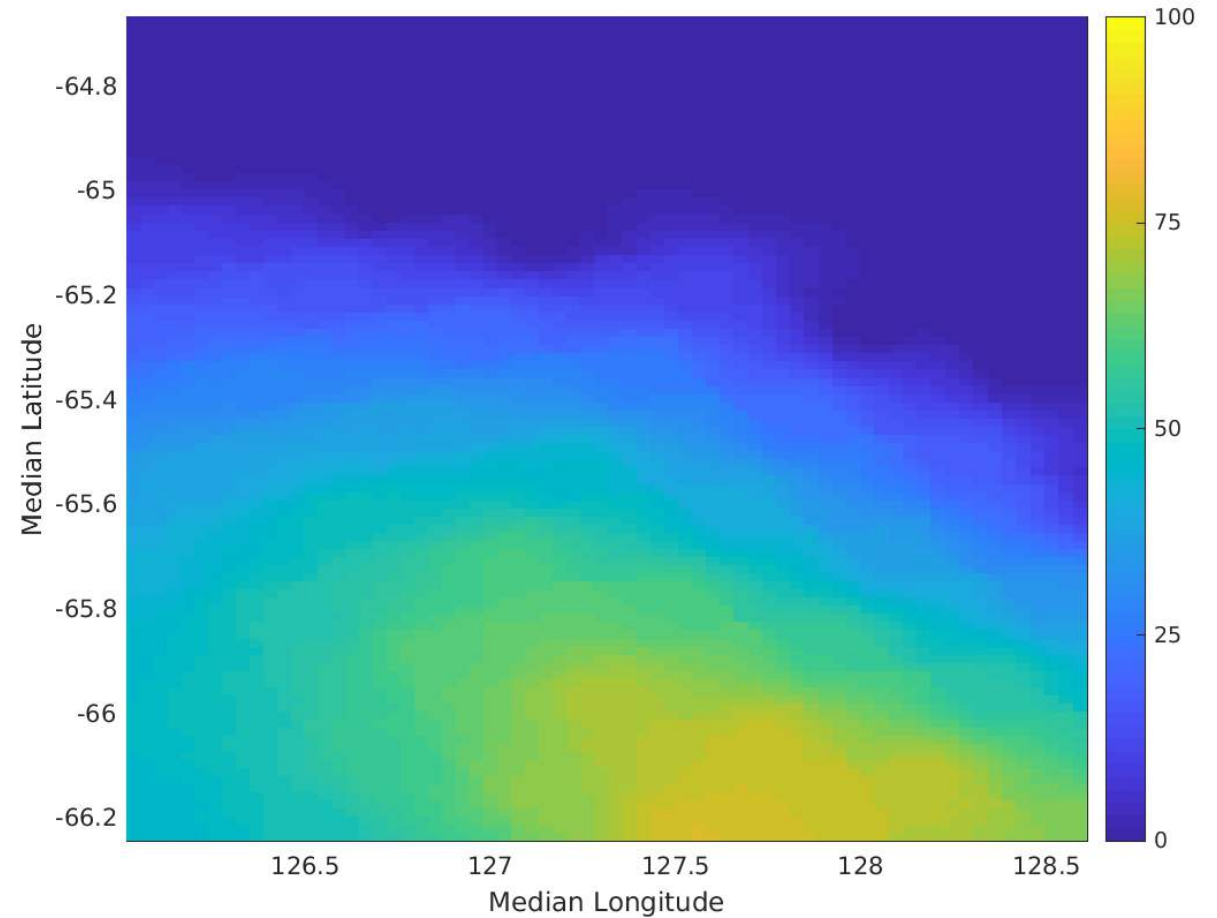
SWOT KaRIn and ECMWF Ice concentration

Cycle 482, Pass 019, April 6, 2023

SWOT



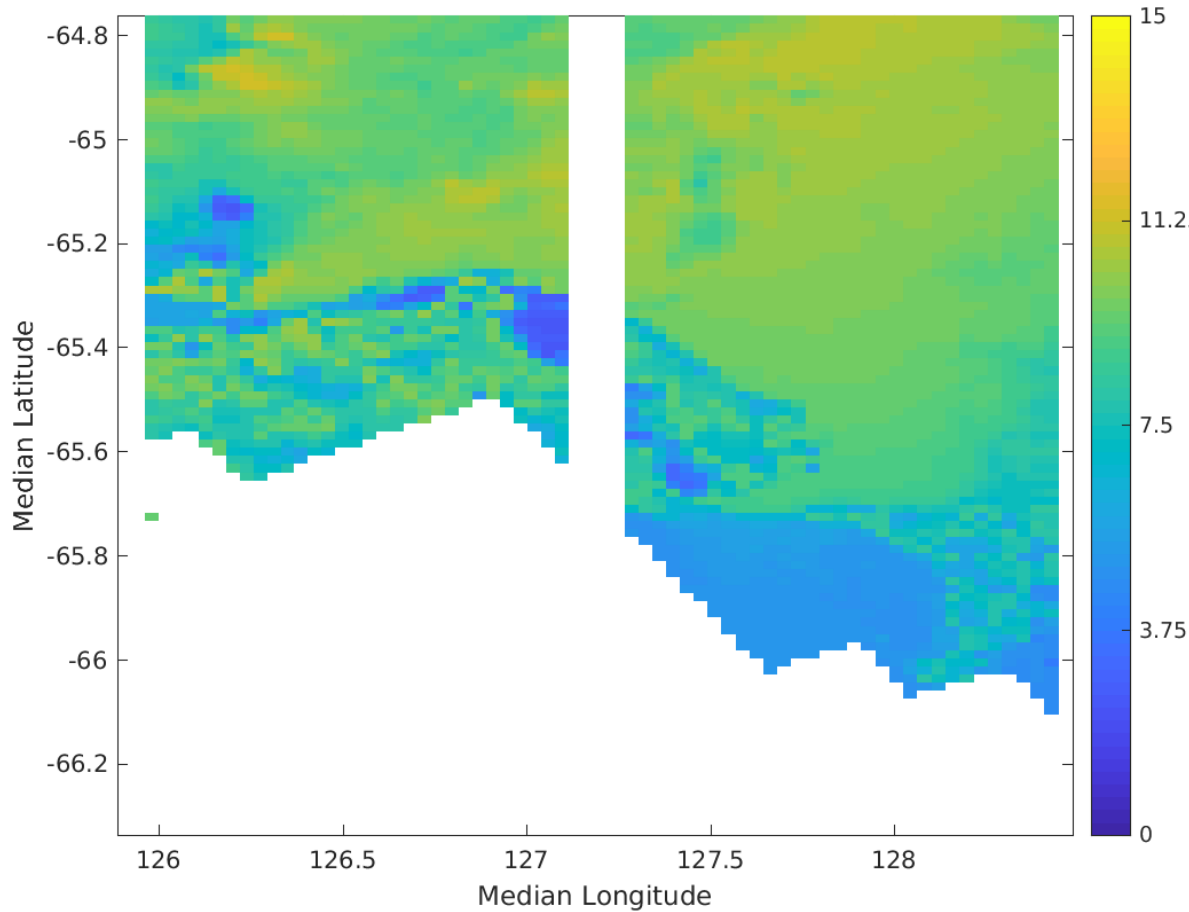
ECMWF



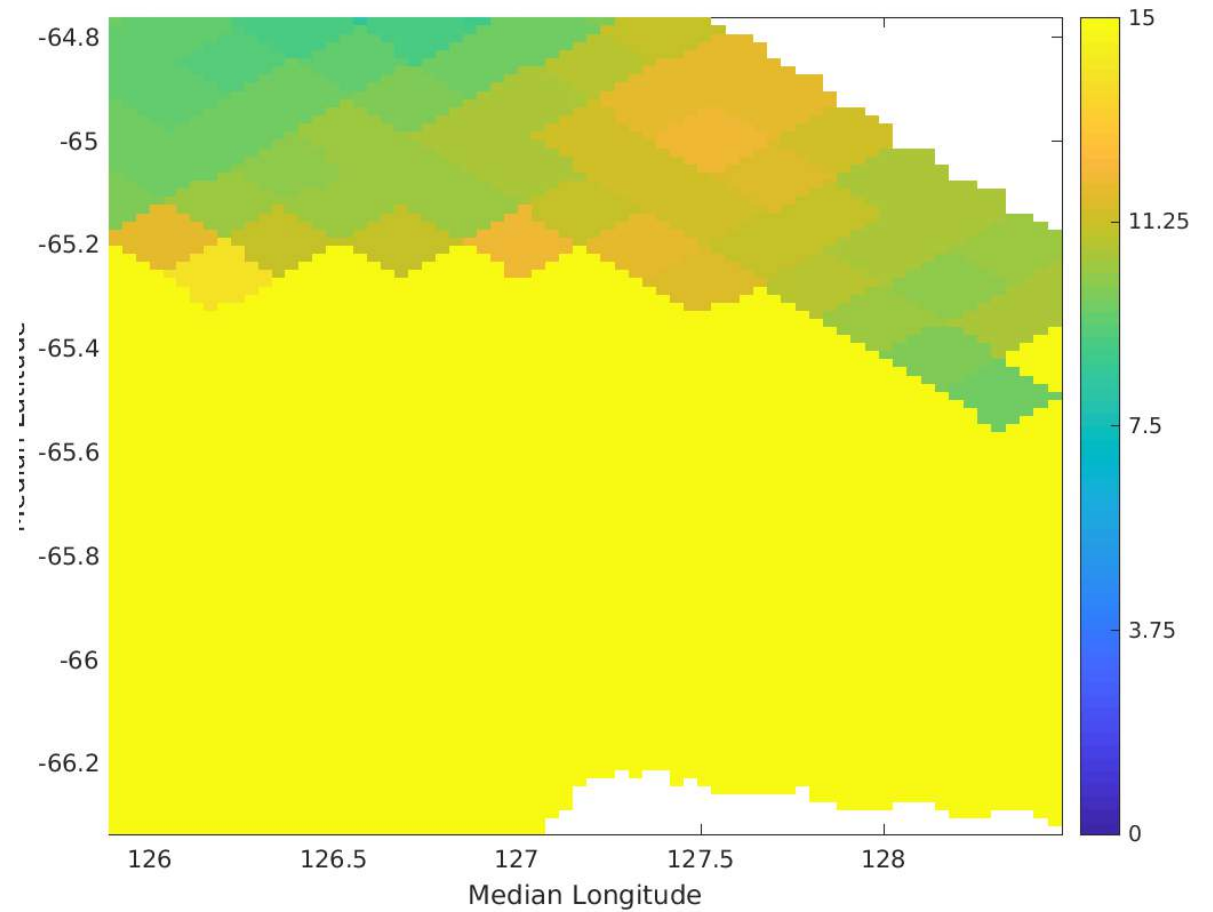
SWOT KaRIn and ASCAT Wind Speed (m/s)

Cycle 479, Pass 019, April 3, 2023

SWOT

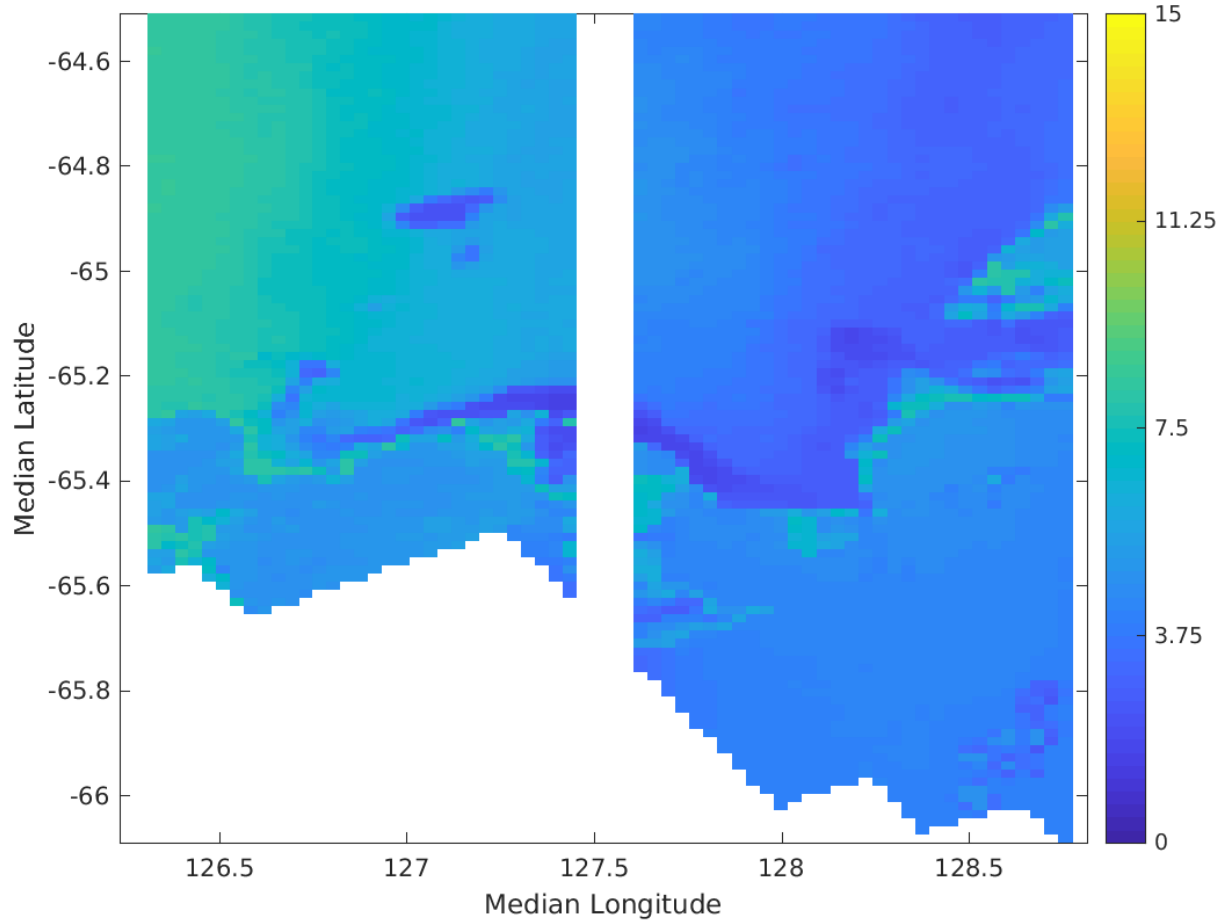


ASCAT

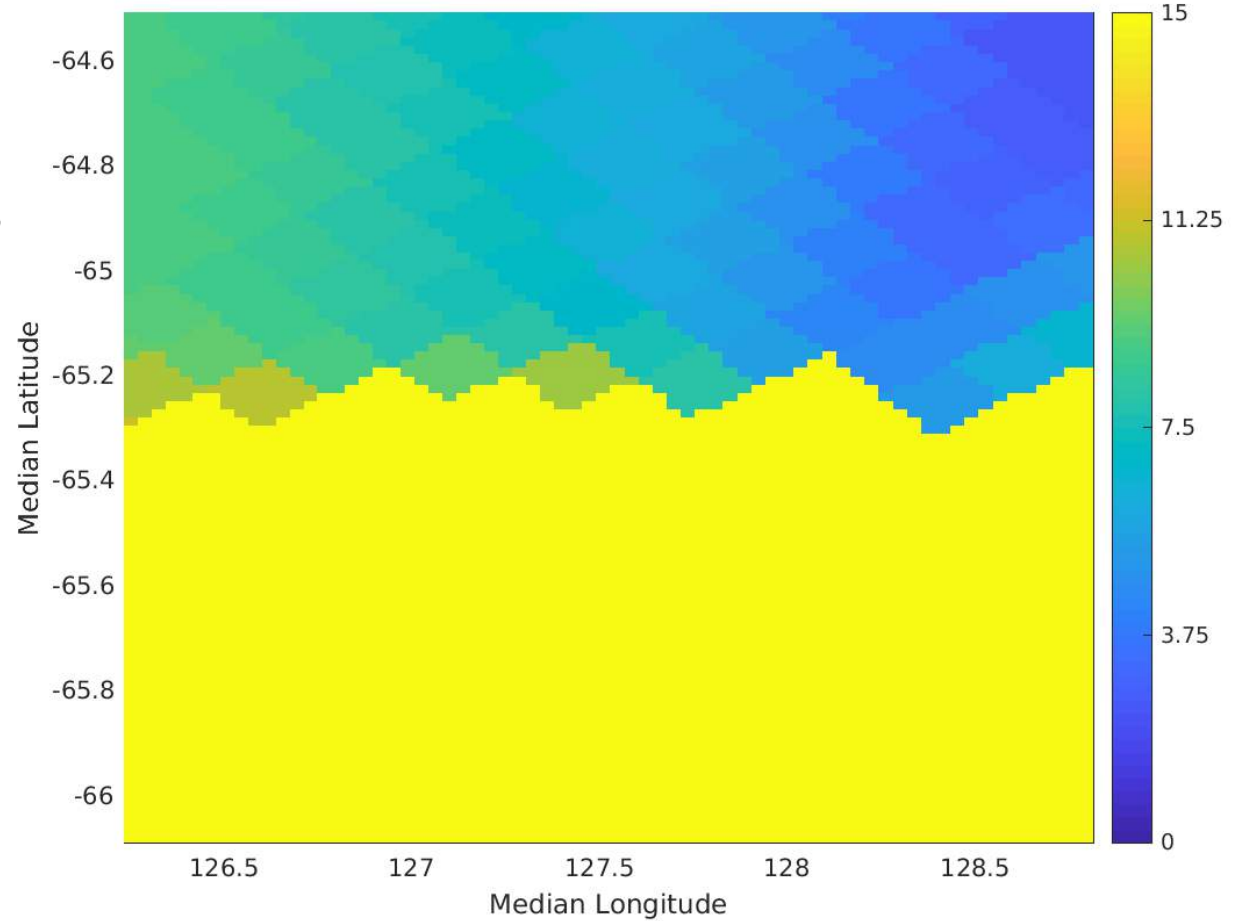


SWOT KaRIn and ASCAT Wind Speed (m/s) Cycle 480, Pass 019, April 4, 2023

SWOT

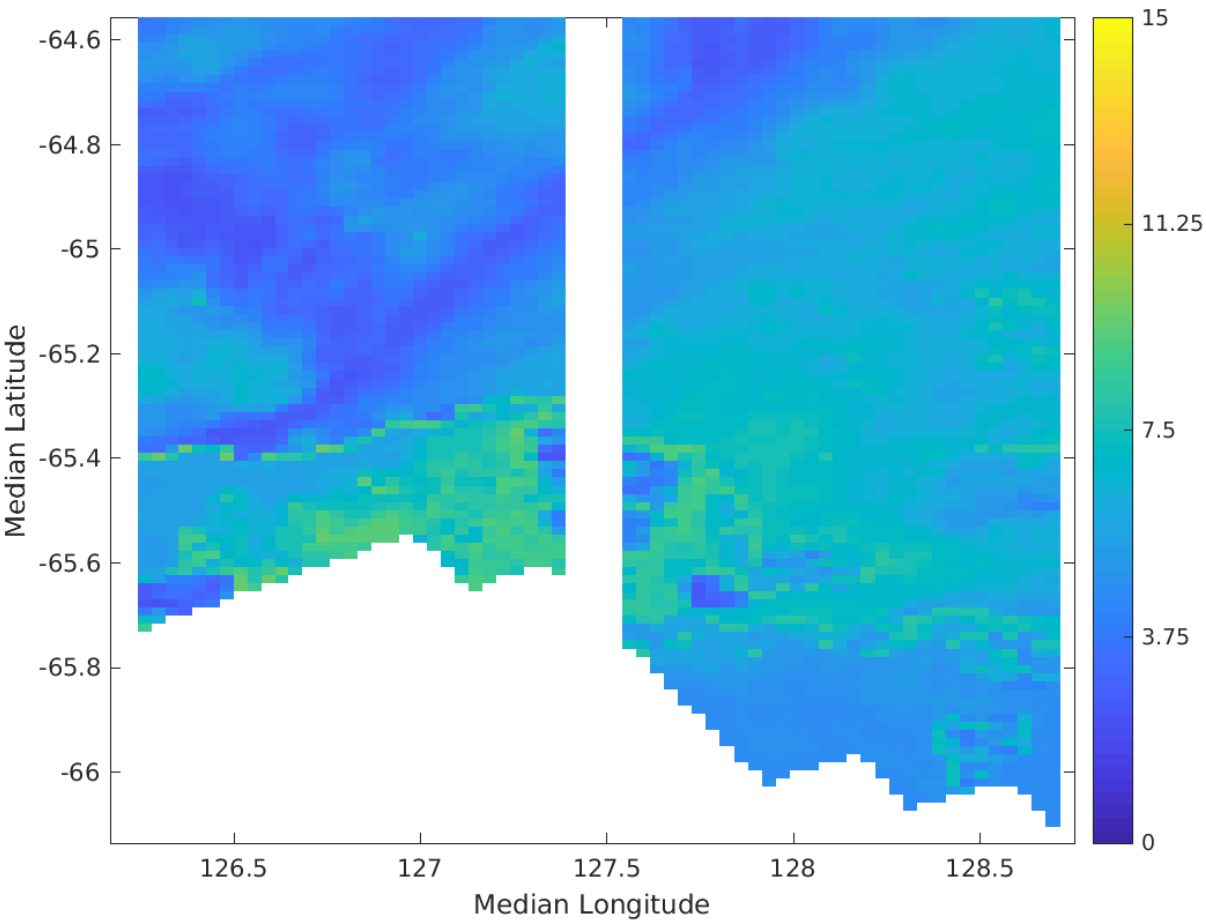


ASCAT

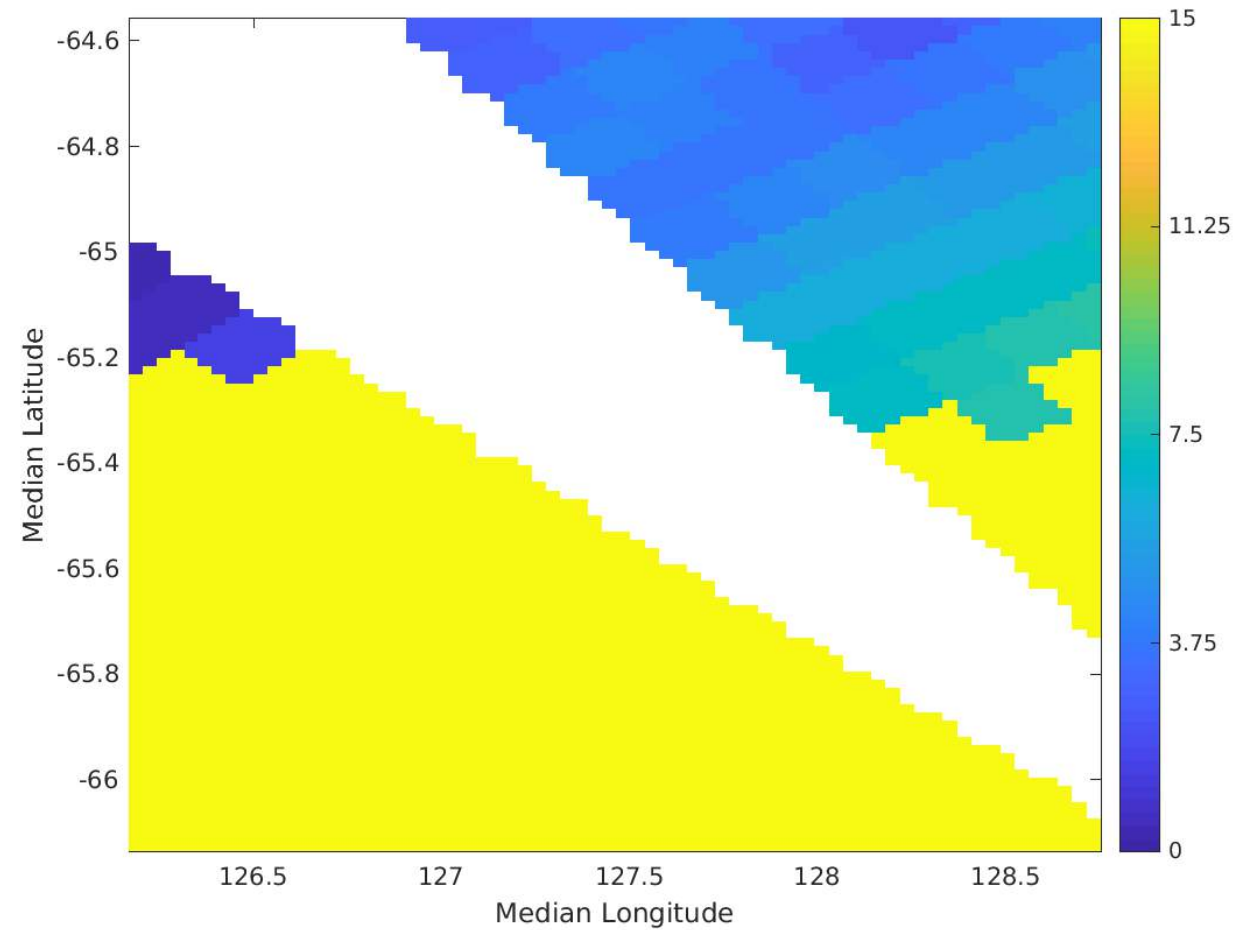


SWOT KaRIn and ASCAT Wind Speed Cycle 481, Pass 019, April 5, 2023

SWOT

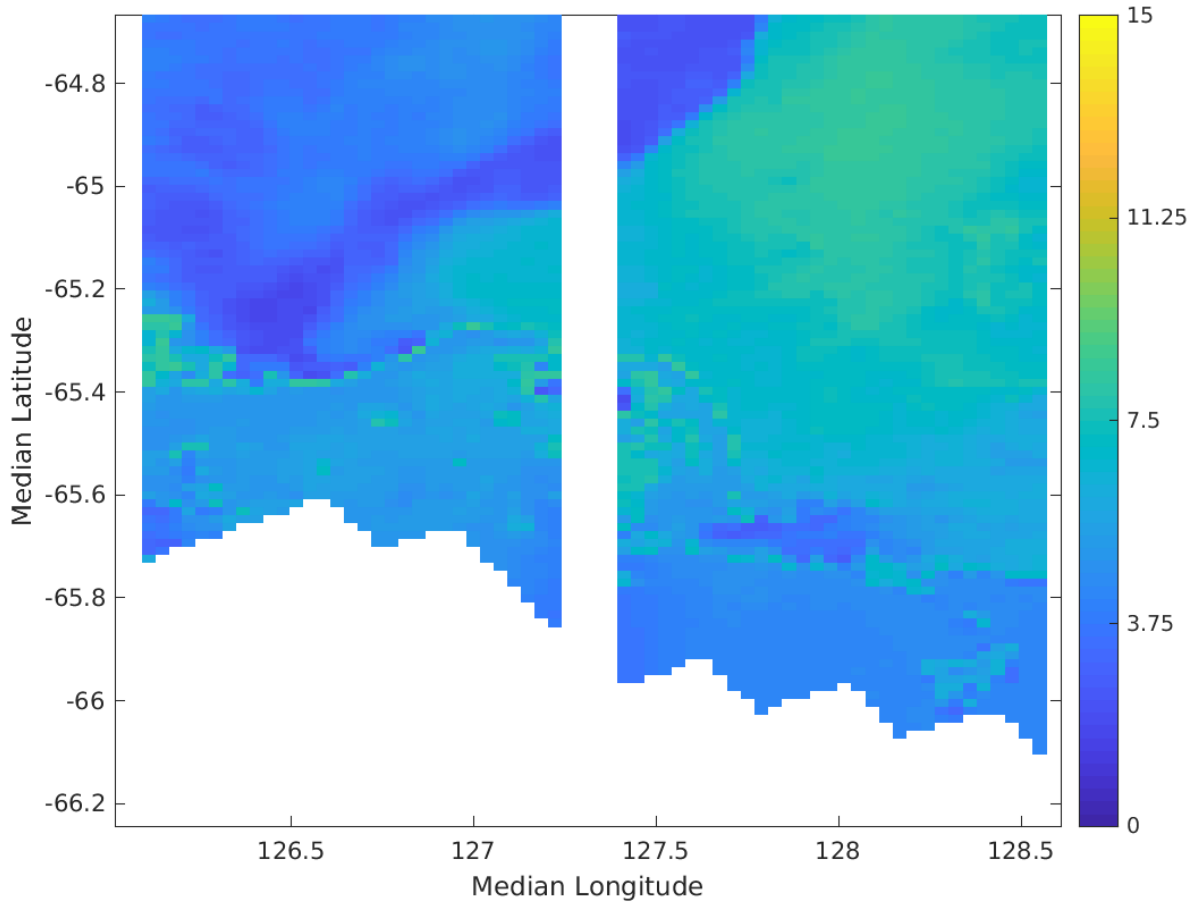


ASCAT

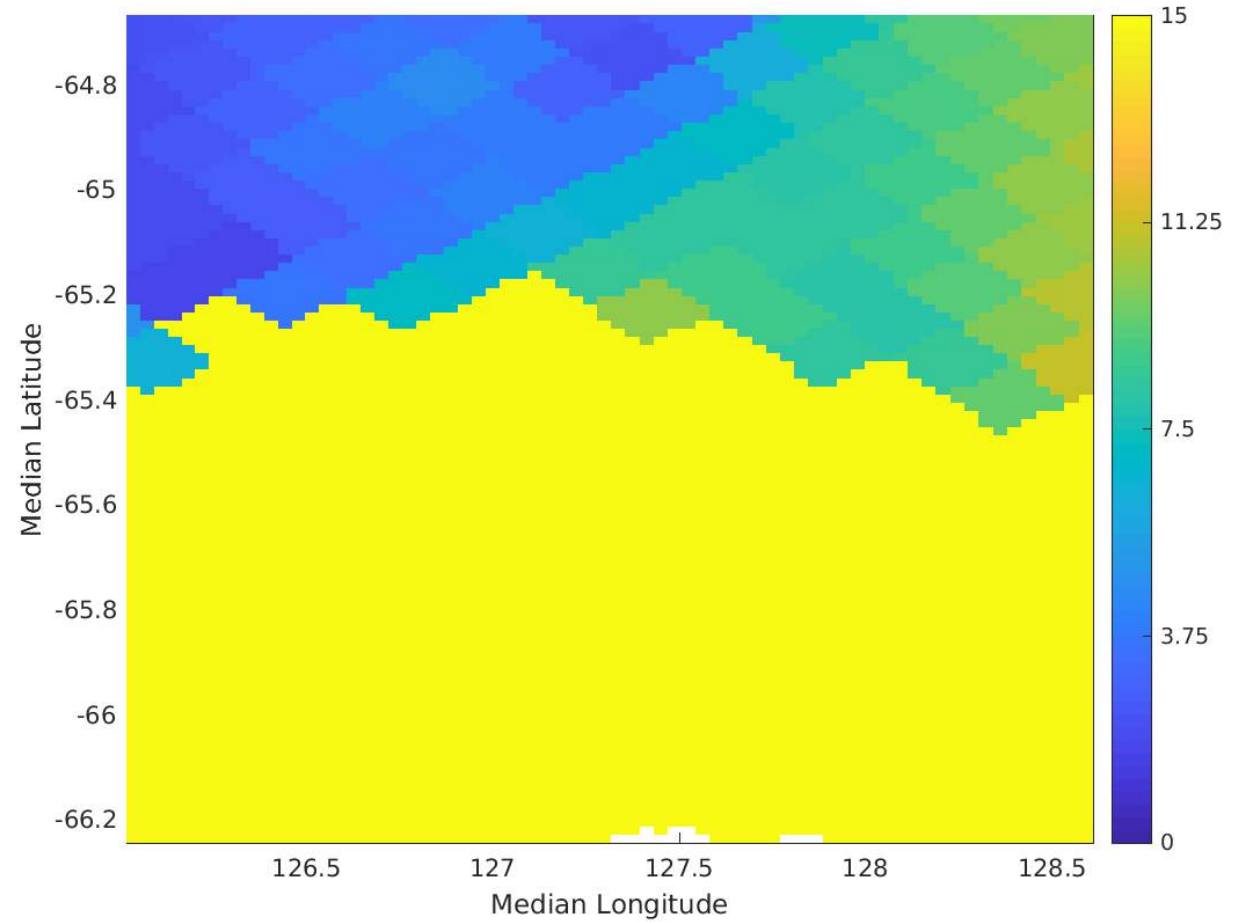


SWOT KaRIn and ASCAT Wind Speed Cycle 482, Pass 019, April 6, 2023

SWOT



ASCAT



Conclusions and future work

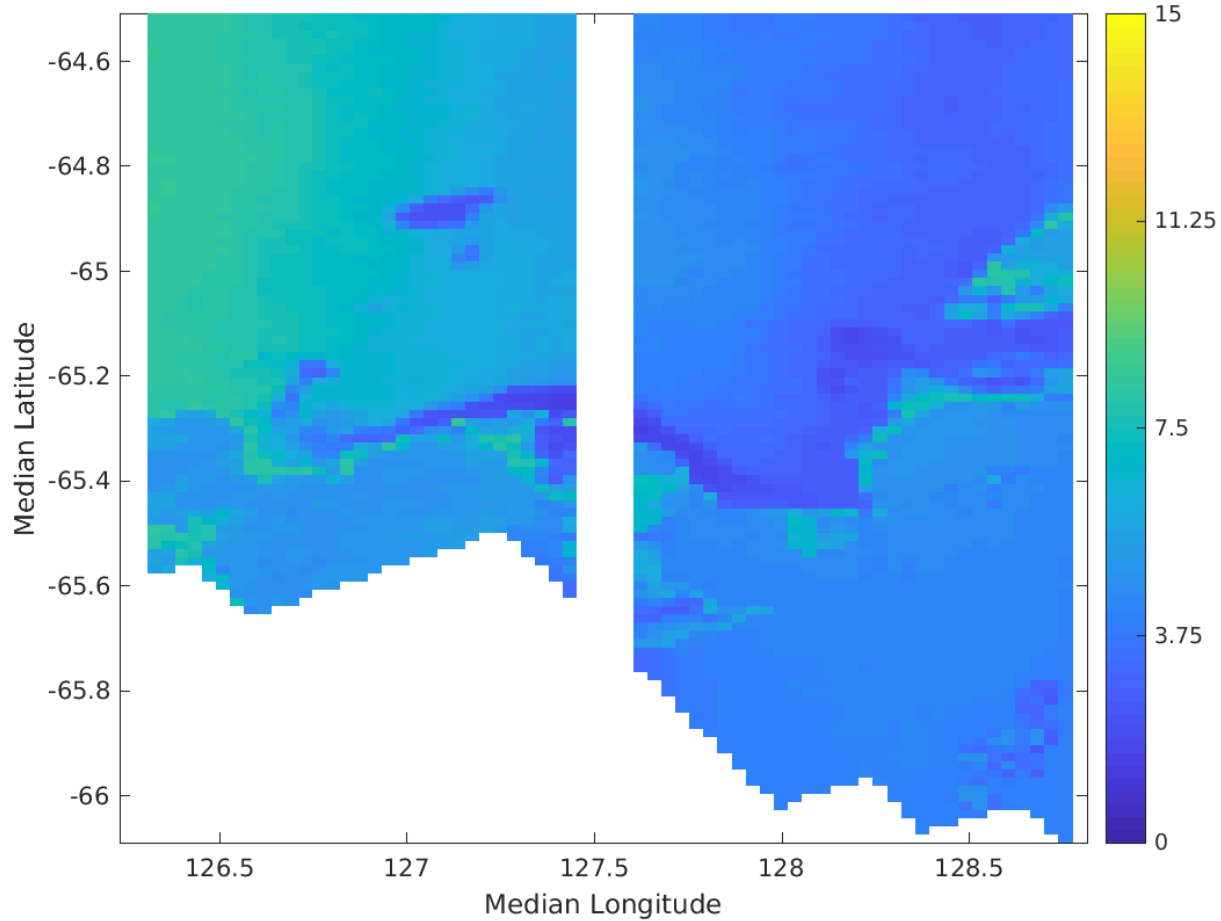
- Developed a 2-km ice flag from SWOT data
 - Definite sea-ice (SWOT ice conc > 50%, ~1% false alarm rate),
 - Possible sea-ice (SWOT ice conc 10-50%)
 - Definite ice-free (SWOT ice conc < 10%), missed detection rate = ~ 1.5%.
- Next steps are:
 - Develop SWOT near sea-ice winds products using newly developed flag as quality control.
 - Compare SWOT winds and QC to ASCAT data and use to improve ASCAT QC and wind accuracy near ice edge.
 - Compare ASCAT winds and QC to QuikSCAT and ScatSAT data and use to improve QuikSCAT and ScatSAT quality control near ice edge

Backup Slides

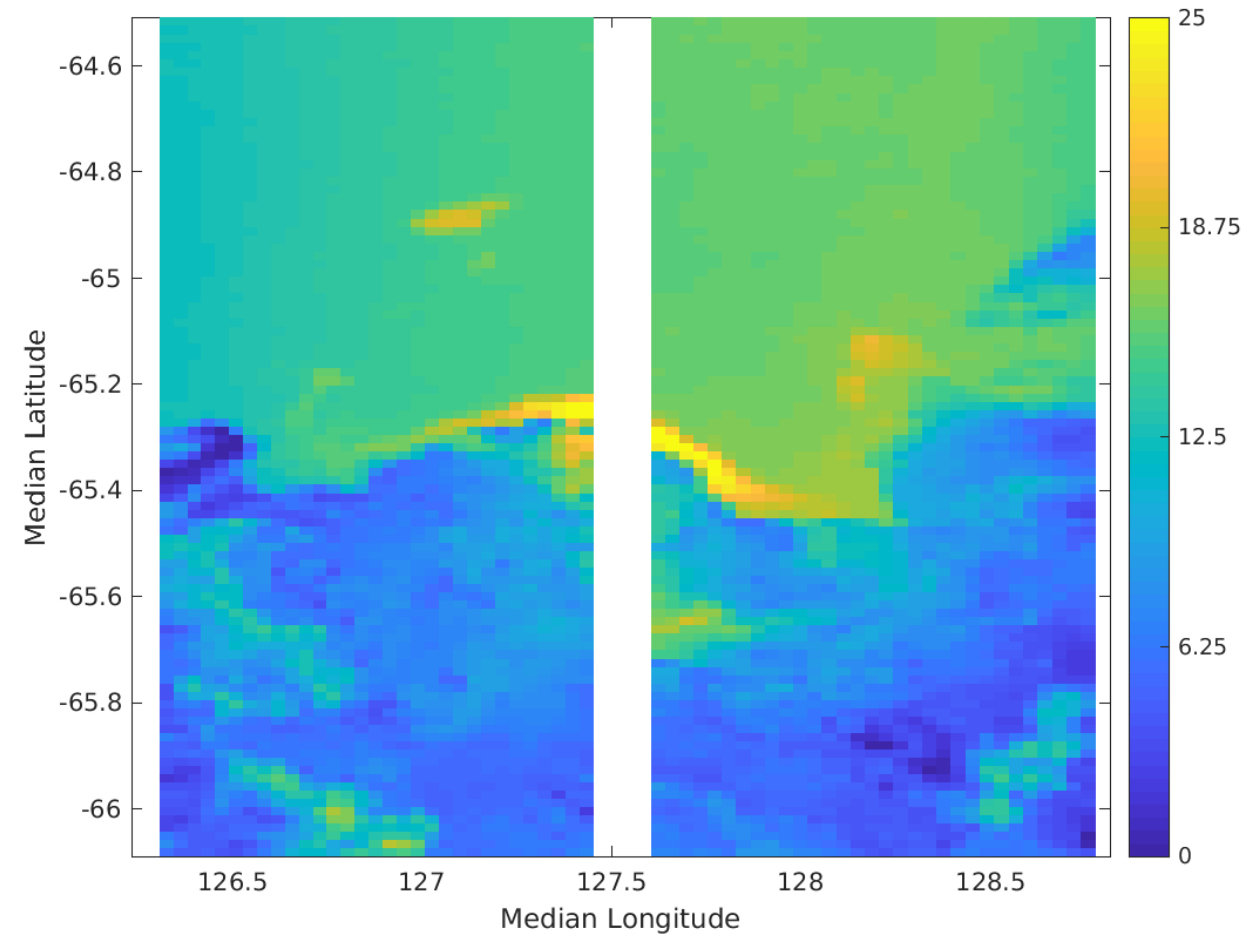
SWOT Wind Speed (m/s) and Sigma-0 (dB)

Cycle 480, Pass 019, April 4, 2023

Wind Speed (m/s)



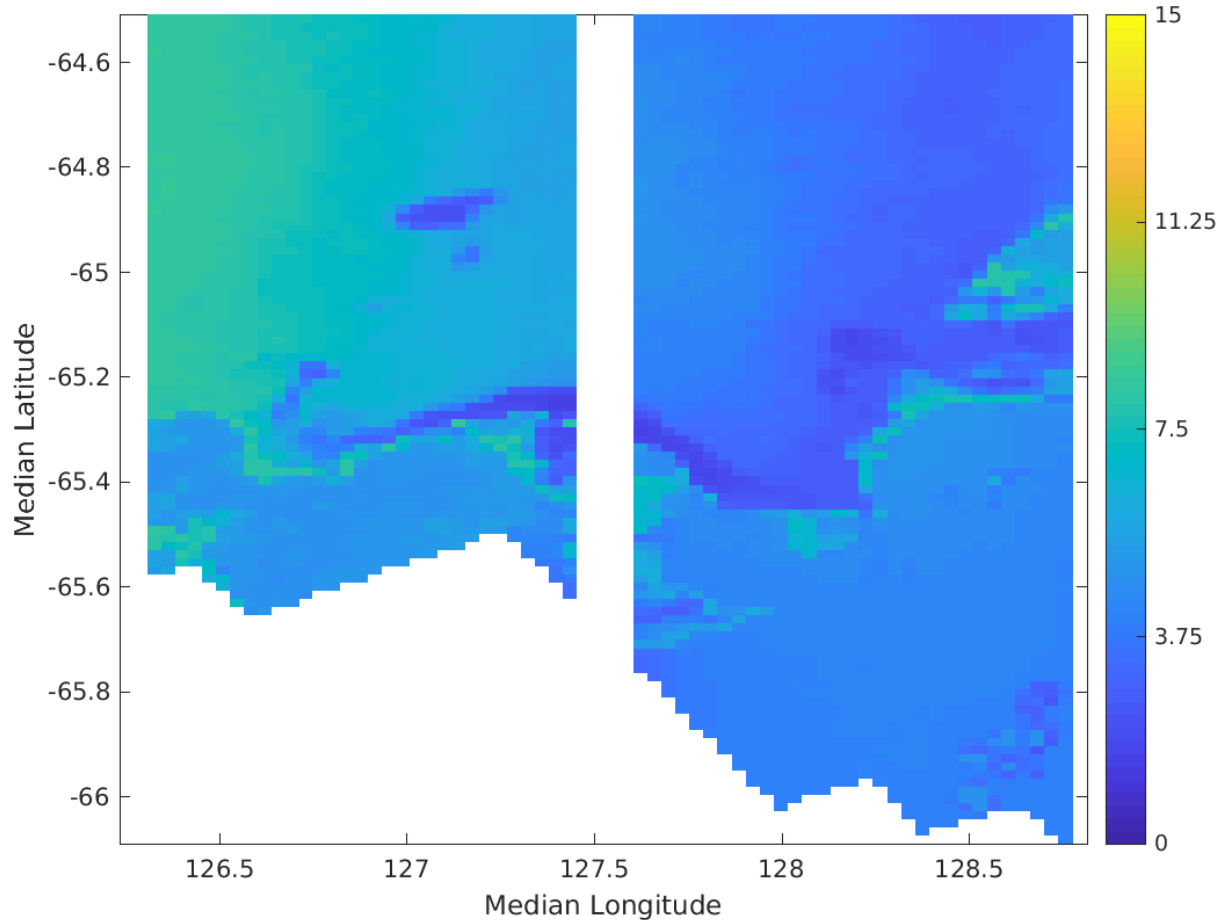
Sigma-0 (dB)



SWOT Wind Speed (m/s) and Volumetric Correlation

Cycle 480, Pass 019, April 4, 2023

Wind Speed (m/s)



Volumetric Correlation

