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and Water Management

HY-2B and HY-2C winds and services from the OSI SAF

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Outline

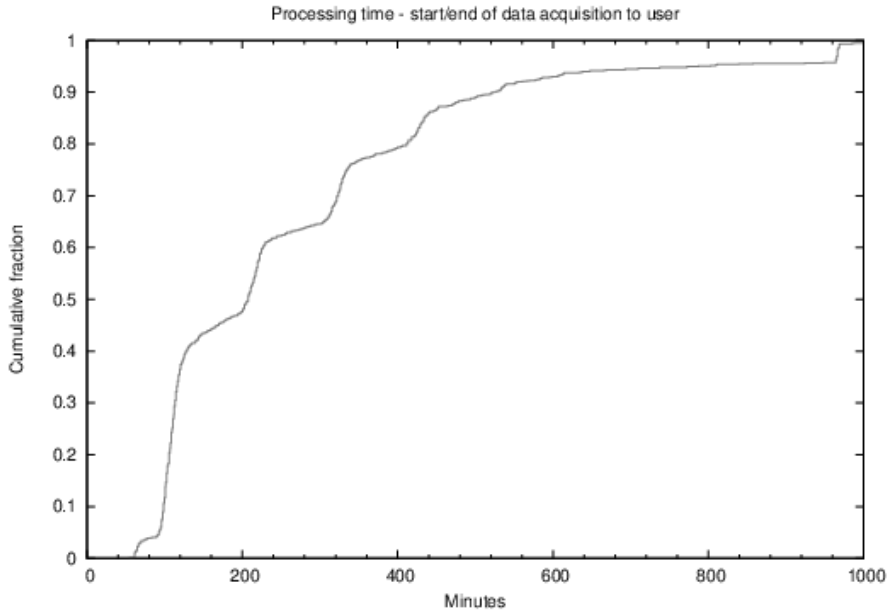
- Introduction
- Data reception and timeliness
- Wind processing, coverage and data distribution
- Comparisons with Numerical Weather Prediction and buoy winds
- Outlook
- Conclusions

Introduction

- Haiyang 2B (HY-2B) was launched on 25 October 2018 in a sun-synchronous orbit with a local time of descending node at 6:00
- Haiyang 2C (HY-2C) was launched on 21 September 2020 in a drifting orbit with 66° inclination (providing winds between 73°S and 73°N)
- Both satellites carry a Ku-band pencil beam scatterometer similar to SeaWinds and OSCAT
- Both satellites are operated by the Chinese National Satellite Ocean Application Service (NSOAS)
- We are very grateful for receiving the data following agreements between EUMETSAT and NSOAS

HY-2B data reception and timeliness

- KNMI receives Level 1b data in near-real time through a EUMETCast terrestrial link from EUMETSAT
- Data are processed in near-real time since 28 January 2019
- Each day 5-7 orbits are received through a polar ground station in Sodankylä, Finland; this is set-up with EUMETSAT and NSOAS and it significantly enhances the timeliness
- 90% of the data is received within 9 hours (compare this graph with the HY-2C one on the next slide)
- The HY-2B local time of Equator crossing of the polar orbit is 6:00 (vs. ASCAT 9:30 and ScatSat-1 8:45)



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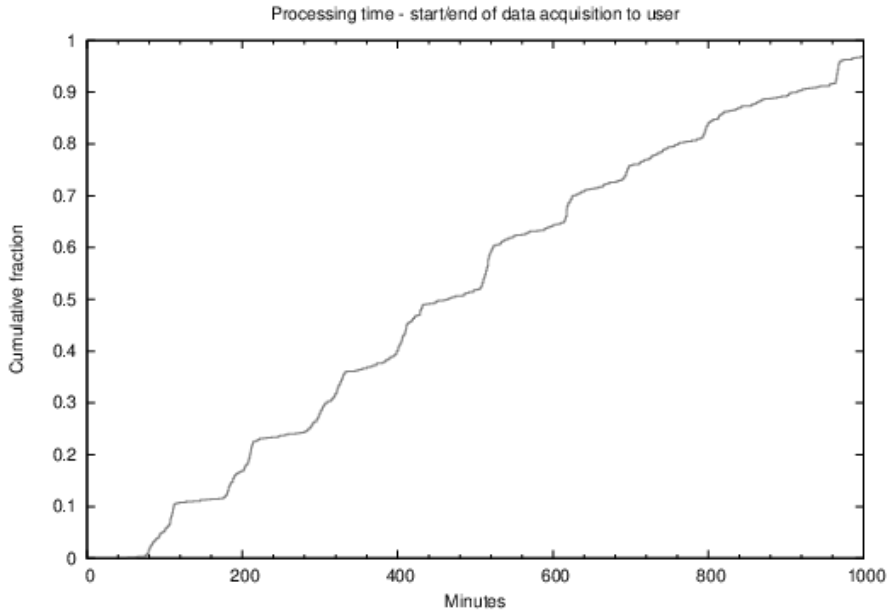
HY-2C data reception and timeliness

- KNMI receives Level 1b data from NSOAS in near-real time through an FTP link
- Data are processed in near-real time since 12 November 2020
- No polar ground stations are used and the timeliness varies between 1.5h and 17h
- 90% of the data is received after 15 hours



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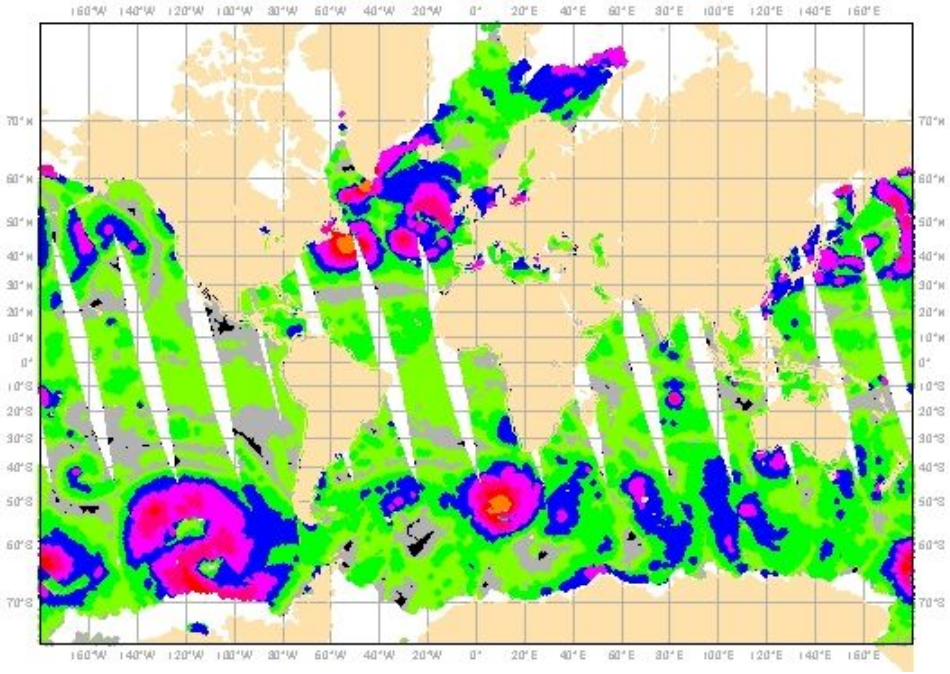
Wind processing

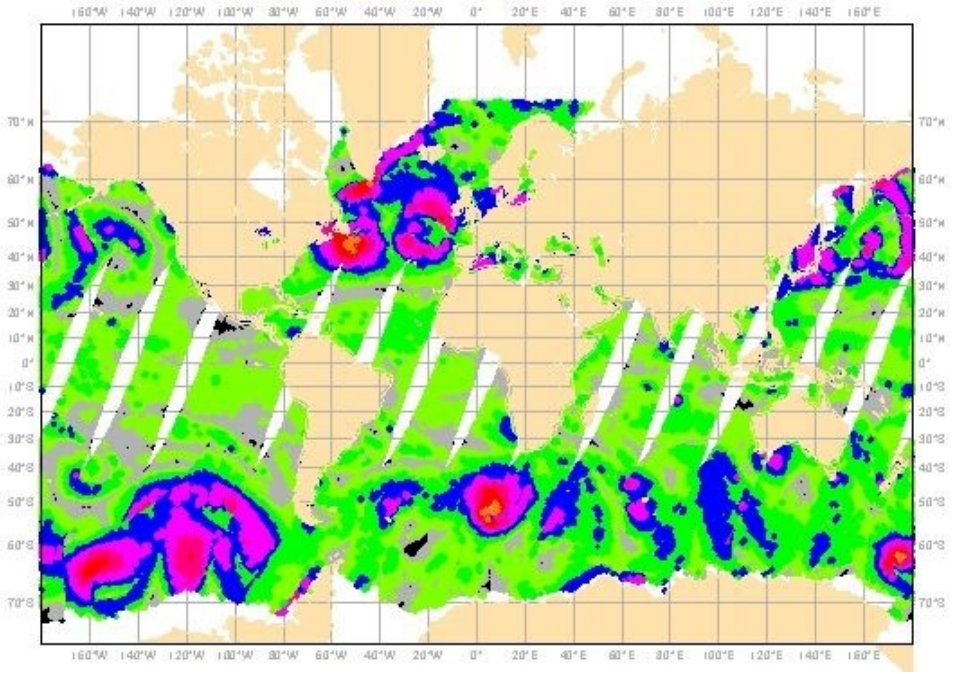
- Level 2 wind products are created with 25 km and 50 km swath grid spacing
- The processing algorithms for the wind processing are to a great extent based on the algorithms as developed in the OSI SAF and NWP SAF for earlier Ku-band scatterometers, and have been improved in close cooperation with colleagues from China
- The OSI SAF Pencil Beam Wind Processor (PenWP) is used
- Fixed HH and VV backscatter corrections are applied to obtain wind speed biases vs. ECMWF as low as possible
- The NSCAT4DS Geophysical Model Function is used which is derived from NSCAT4 with improved wind speed response and direction modulation
- Backscatter values are corrected for Sea Surface Temperature (SST), the correction is a function of polarization, wind speed, SST, and incidence angle

Verhoef et al., IOVWST 2021

Data coverage

- HY-2B has the ‘classic’ pole-to-pole coverage (left) whereas HY-2C covers latitudes between 73°S and 73°N (right) and varying local overpass times – both plots show ascending passes over 1 day





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Data distribution

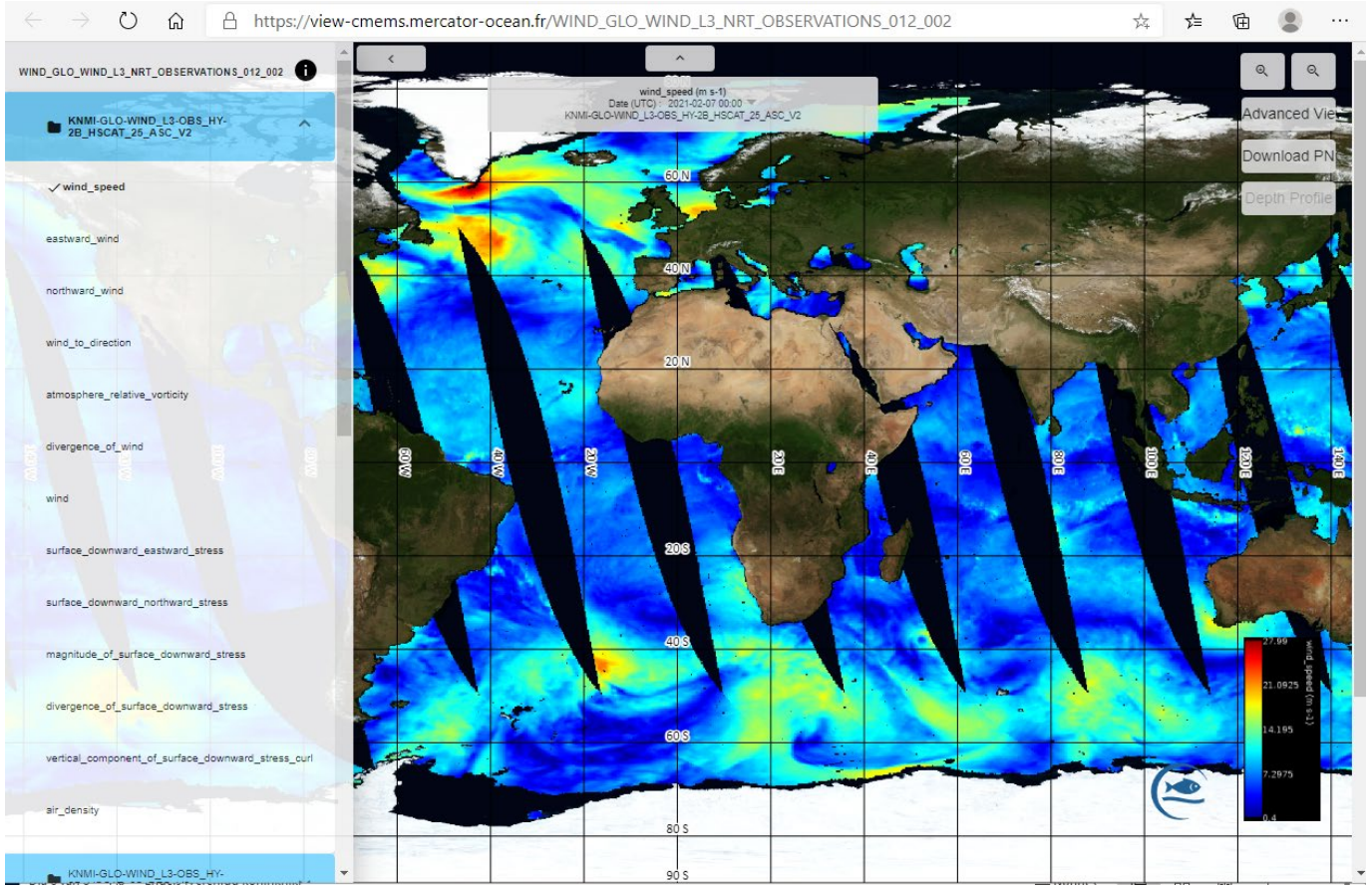
- The data are processed into OSI SAF level 2 swath wind products which are available on a restricted FTP server
- The level 2 data are available now for European meteorological services and members of the HY-2B/C cal/val project following agreements between EUMETSAT and NSOAS
- The winds are visualised on the OSI SAF winds website at KNMI: https://scatterometer.knmi.nl/
- The HY-2B winds are available as daily gridded level 3 data to the general public in the Copernicus Marine Environment Monitoring Service (CMEMS) https://marine.copernicus.eu/about-us/about-producers/wind-tac/

EUMETSAT OSI SAF OCEAN AND SEA ICE

COPERNICUS · MARINE ENVIRONMENT MONITORING SERVICE · CMEMS SEA SURFACE WIND TAC · Contract 80-CMEMS TAC WIND · Until 31 March 2021

CMEMS data preview

- HY-2B winds and related parameters like wind stress, curl, divergence on a regular lat/lon grid (0.25° or 0.50°) are available for download or preview
- The data are organized in daily files, separate for ascending and descending passes
- HY-2C will follow later



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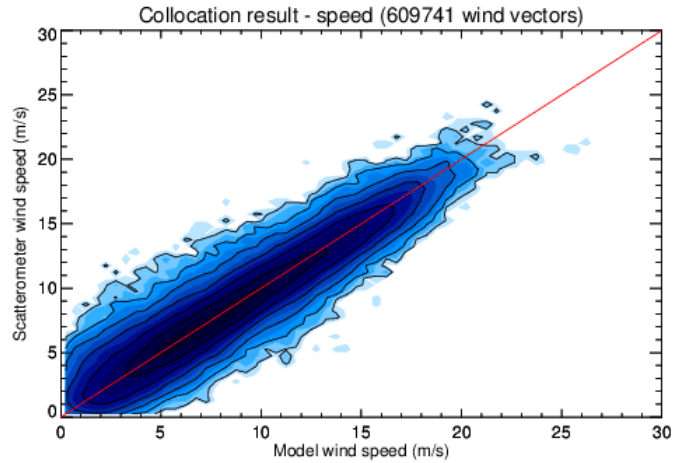
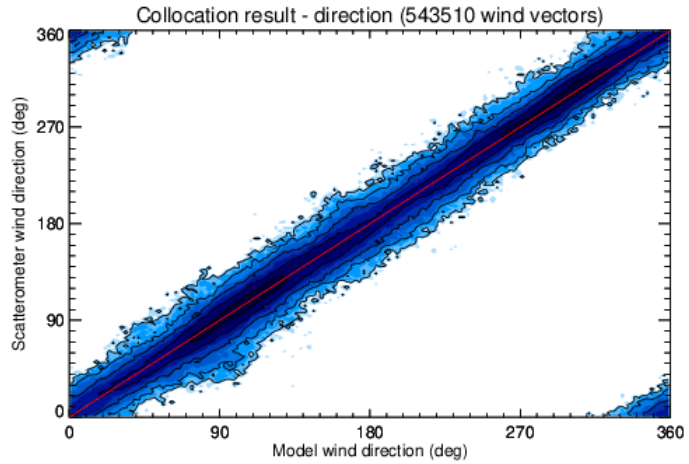
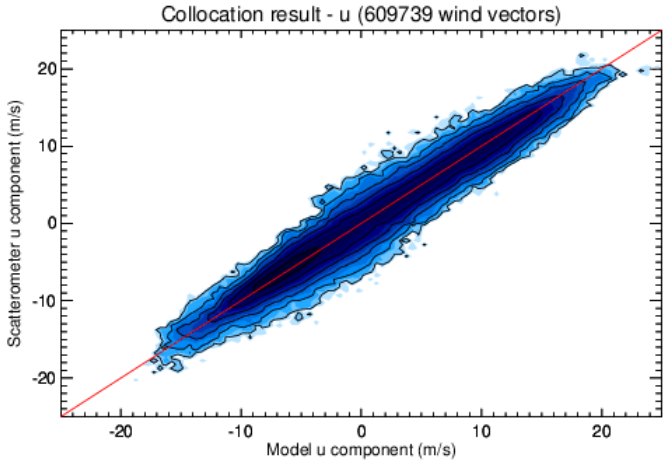
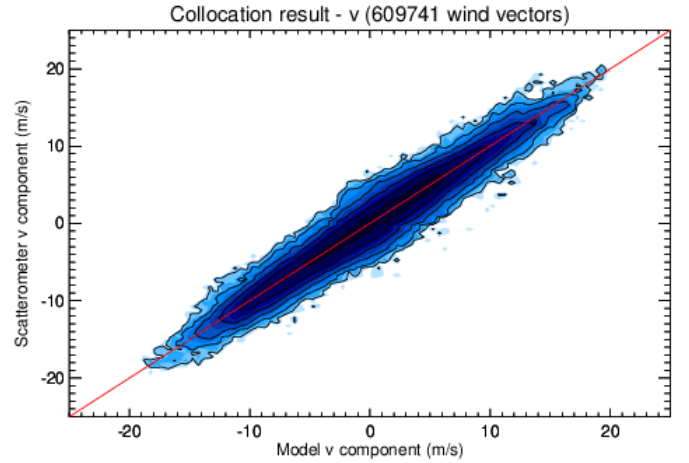
Scatterometer winds compared to ECMWF

- The contour plots show the HY-2 speed, direction, u, and v component vs. ECMWF operational stress equivalent forecast winds
- The plots for HY-2B look very similar
- The results look very good, comparable to those from other Ku-band instruments









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Scatterometer winds compared to ECMWF

- The table shows biases and standard deviations of three scatterometers vs. ECMWF stress-equivalent forecast winds
- All numbers are from the same date (12 October 2020) and in all cases the NSCAT4DS geophysical model function and SST backscatter corrections were used
- The wind products of the three instruments show comparable performance
- HY-2C has a different latitude distribution of the observations due to its orbit characteristics, this may influence the statistics slightly

	HY-2B	HY-2C	ScatSat-1
Wind speed bias	0.07	-0.01	-0.12
Stdev *u*	1.13	1.18	1.16
Stdev *v*	1.08	1.15	1.10
Stdev wind dir	8.80	9.83	9.28

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Scatterometer winds compared to buoys

- The table shows biases and standard deviations of three scatterometers vs. winds from moored buoys
- All numbers are from the same period (June – November 2020)
- No buoy collocations are available yet for HY-2C
- HY-2B seems to perform slightly better than ScatSat-1, however for ScatSat-1 the older NSCAT4 GMF was used instead of NSCAT4DS and no SST corrections were applied, this probably has a detrimental effect on the standard deviations

	HY-2B	HY-2C	ScatSat-1
Wind speed bias	-0.18	N/A	-0.20
Stdev *u*	1.51	N/A	1.60
Stdev *v*	1.52	N/A	1.61
Stdev wind dir	16.65	N/A	18.85

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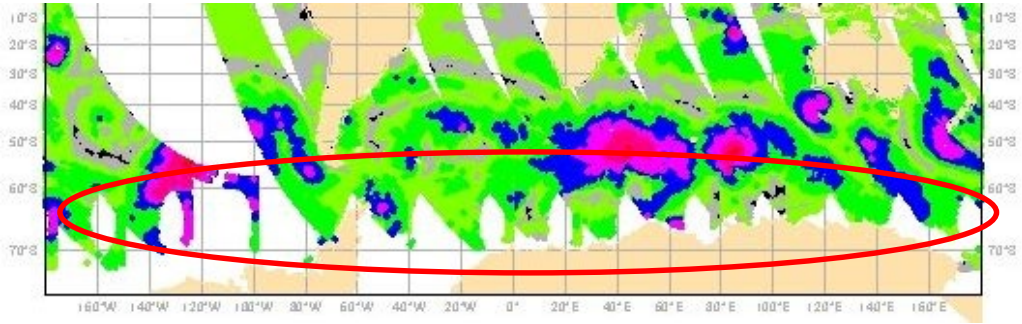
Conclusions

- HY-2B and HY-2C winds are regularly processed at KNMI in near-real time, the data quality is very good, comparable to similar Ku-band instruments
- The timeliness varies between ~1.5 and ~17 hours, as expected for a data downlink twice per day, for HY-2B it is better thanks to the use of a polar ground station
- Near-real time ocean and weather users would benefit much from the winds if they were available in a timelier fashion, cf. WMO requirements of 1-3 hours https://www.wmo-sat.info/oscar/variables/view/wind_vector_near_surface
- HY-2B/C winds generated in the OSI SAF show very good statistics as compared to ECMWF and buoy winds
- The HY-2C satellite orbit is, contrary to most other scatterometer missions, not sun-synchronous; this will provide regular collocations with all other instruments currently in orbit

Outlook

- HY-2C winds will be added to the multi platform product viewer on the OSI SAF winds website: https://scatterometer.knmi.nl/tile_prod/
- There are some missing winds in the HY-2C products at the end/start of new orbits, probably due to a shortcoming in the processor at KNMI, this will be further investigated



- The HY-2C orbit is not sun-synchronous, this opens the opportunity to compare the winds to other C-band and Ku-band instruments
- We plan to further validate the winds and move to an operational product status in the OSI SAF

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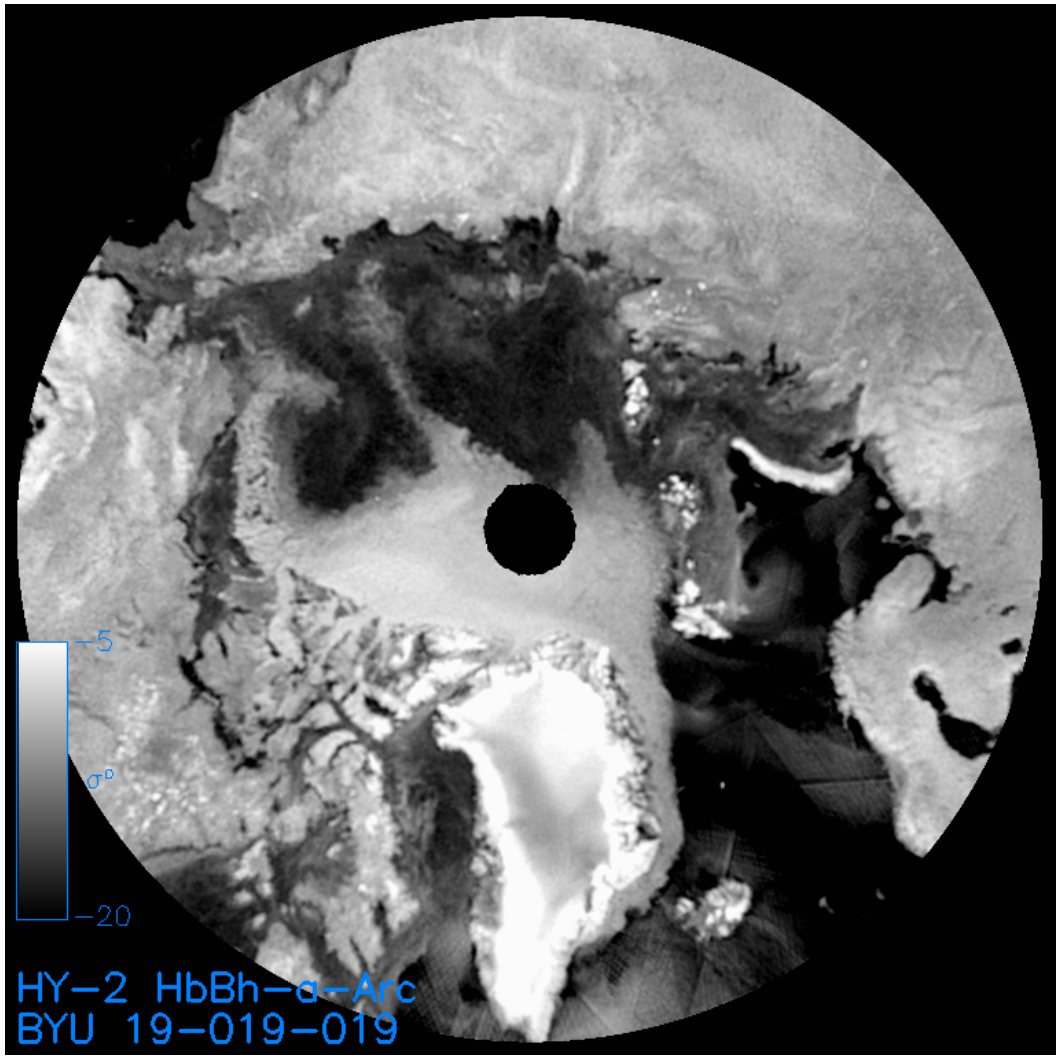
Outlook

- David Long has kindly provided software for enhanced resolution processing of HY-2B and HY-2C sigma0 data using the Scatterometer Image Reconstruction (SIR) algorithm
- This software generates backscatter images on a 4.45 km grid
- We are evaluating the software and assess its usability to enhance ice and wind processing



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