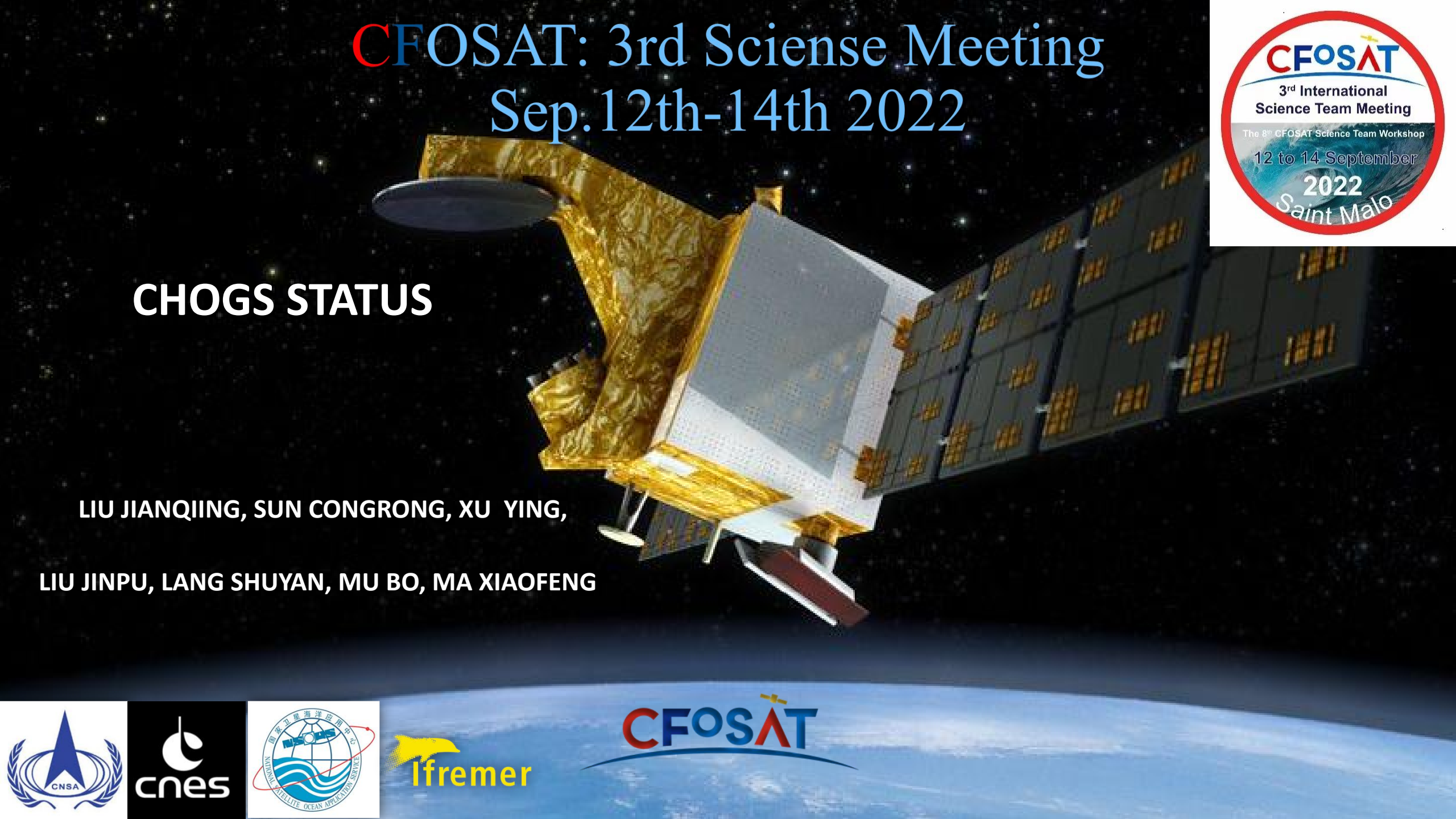
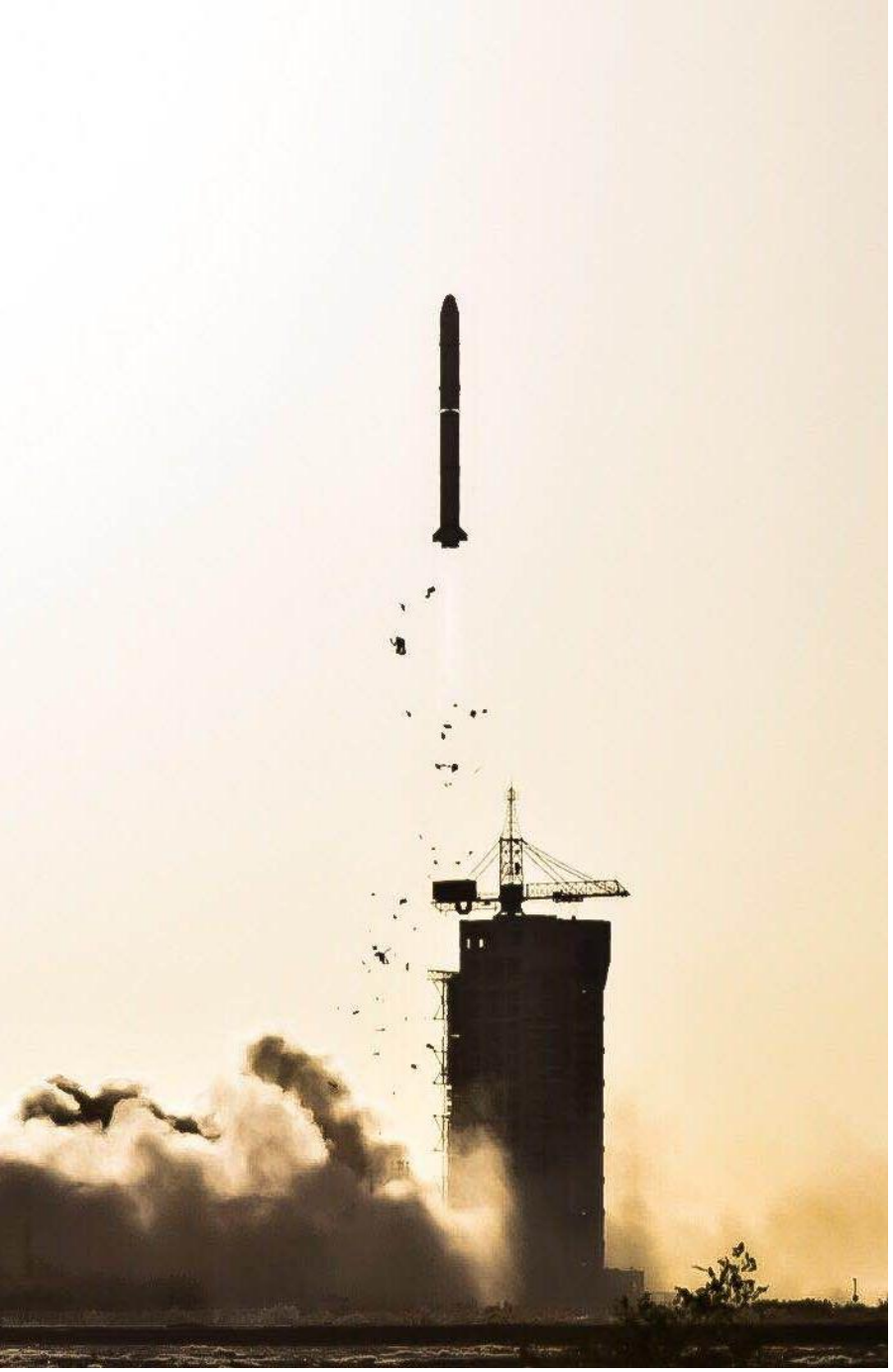
CFOSAT: 3rd Sciense Meeting
Sep.12th-14th 2022



CHOGS STATUS

LIU JIANQIING, SUN CONGRONG, XU YING,

LIU JINPU, LANG SHUYAN, MU BO, MA XIAOFENG

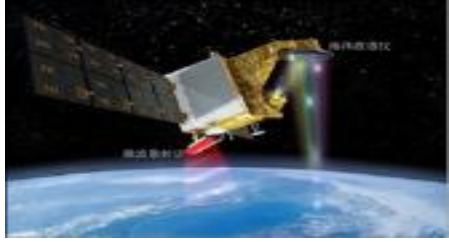


Topics

- **CFMC Operation**
  - Satellite platform monitor
  - Payload TC upload
  - TM and L0B data transferred to CNES
  - Chinese Ground station status
  - Products Distribution
- **Current SCAT Product & Application**
  - SCAT data processing software(V3.3)
  - SCAT product status
  - Some SCAT application
- **Recent SWIM Application**
- **SCAT Long-term Validation result**
- **Conclusion**

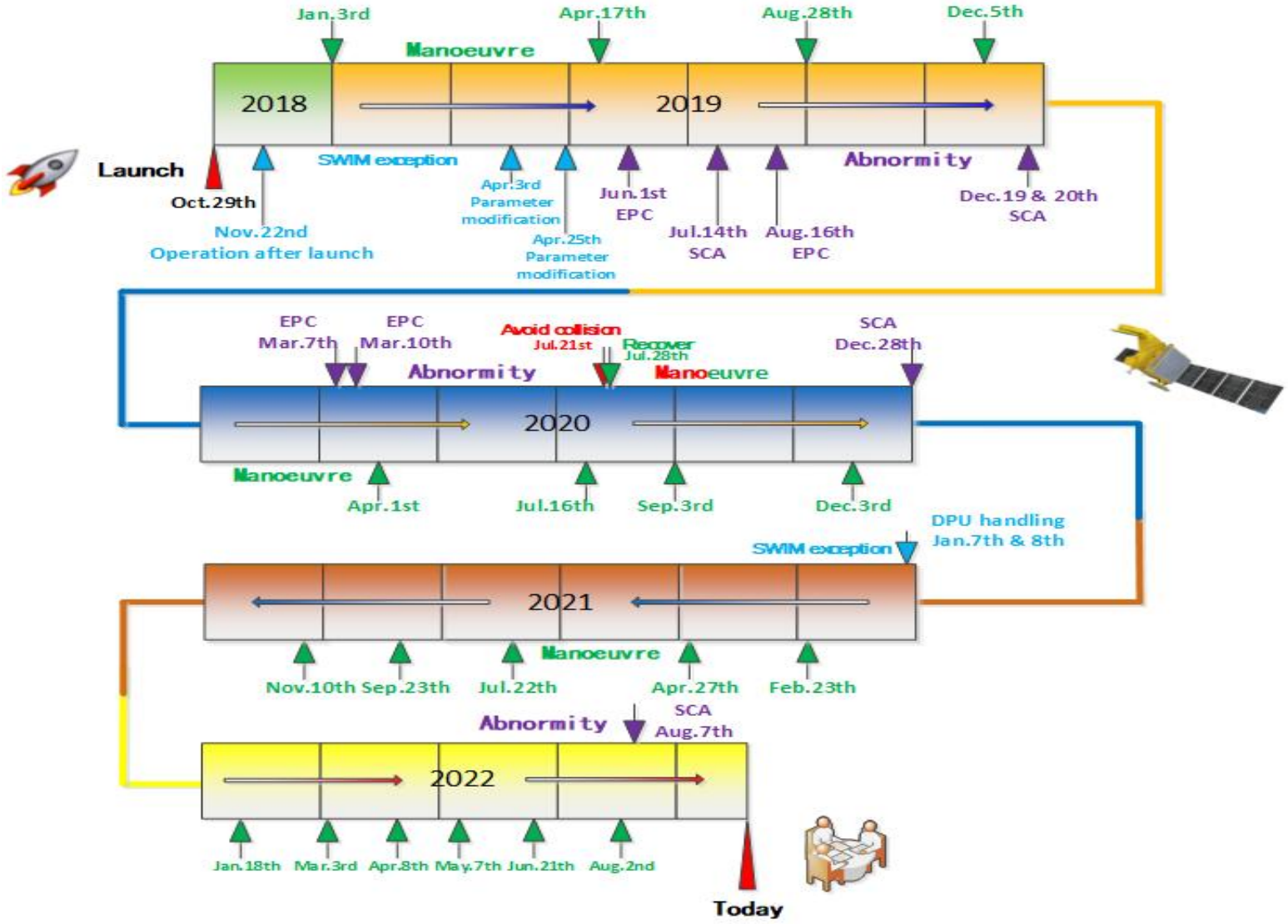
CFMC OPERATION

CFMC operation : Satellite platform monitor

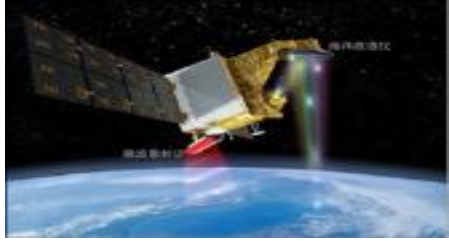


From launch,
SCAT operation 8 times
SWIM operation 4 times
Platform manoeuvre 21 times
Avoid collision one time

2022, until Sep.7, Platform manoeuvre 6 times



CFMC operation : Payload TC upload

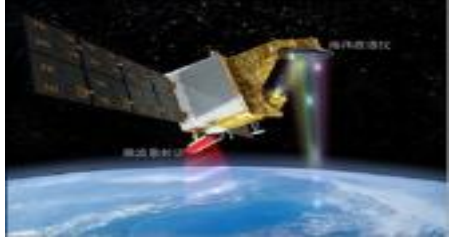


From satellite launch to Sep.7, 2022: NSOAS upload 414(↑75) times TC, including downlink plan(24957 orbit number), platform and payload operation.

	Downlink (number)	Downlink/day (number)	Downlink (minutes)	Downlink/day (minutes)
NSOAS	4439 (↑982)	4	55086 (↑7830)	45
CNES	20518 (↑3915)	15	41036 (↑7830)	31

Legend: ↑ increment until Sep.7 this year

CFMC Operation: Products Distribution

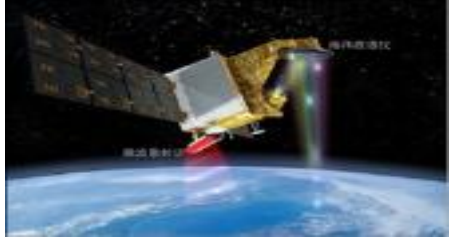


OSDDS users

- from launch to Sep.7, 2022

Item	Value
Users	343(↑131)
Countries	6 (↑2)
Amount of data distributed	195TB(↑148)

Legend: ↑ increment in 2022



CFMC operation : TM and L0B data transferred to CNES

From launch to Sep.7, 2022

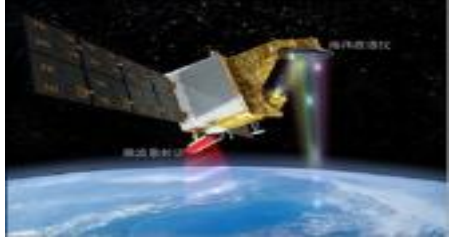
783 times TM parameters transferred to CNES

54(↑19) times demand from CNES and 144.8GB（↑31.7） data transferred to CNES

Data type	Number of file	volume in GB (compressed)
SCAT L0B	234 (↑59)	29.5 (↑7.4)
SWIM L0B	283 (↑74)	115.3 (↑24.3)
total	517	144.8

- *CNES and NSOAS exchange L0B while GS have problems at data acquisition*

Legend: ↑ increment in 2022



Chinese Ground station status

- From launch to Sep.7, 2022
- CHGS(Beijing, Sanya and Mudanjiang) ingest 5750 orbits and 36.9TB org data.

Year	Number of ingesting orbit	volume
2018	377	1.2TB
2019	1437	8.4TB
2020	1475	12.6TB
2021	1479	8.4TB
2022/09/07	982	6.3TB
total	5750	36.9TB

CURRENT SCAT PRODUCT & APPLICATION

SCAT Status: Wind products(L2)

Input :

- ✓ SCAT L1B data processed at NSOAS
- ✓ Ancillary data (ECMWF forecast winds, OSI SAF ice edge)

Version:

1.0 → 2.0 (2019.3) → 3.0 (2020.4) → 3.2 (2021.3) → 3.3 (2021.12)

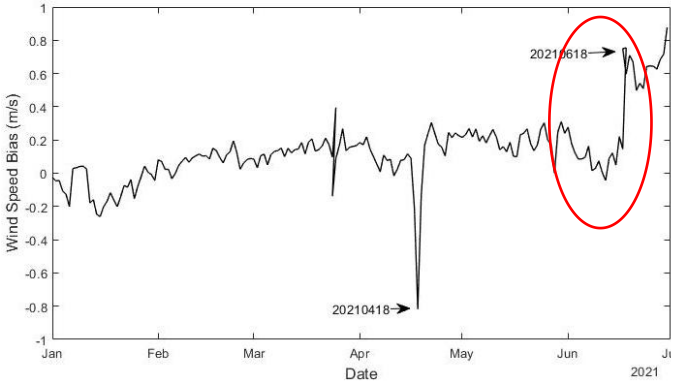
- ☐ Operational product

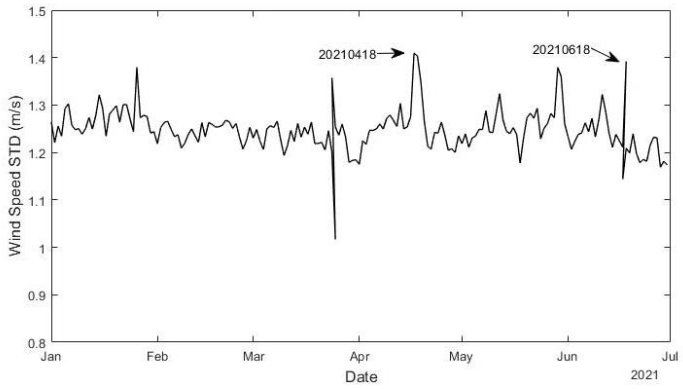
- CFO_EXPR_SCA_C_L2B_OR_YYYYMMDDTHHMMSS_xxxxx_250_VV_owv
- CFO_EXPR_SCA_C_L2B_OR_YYYYMMDDTHHMMSS_xxxxx_coa_VV_owv
- V3.3 reprocessing product(L2A,L2B) is ready to distribute (on NSOAS FTP server,2019.1.1-2022.6.30)

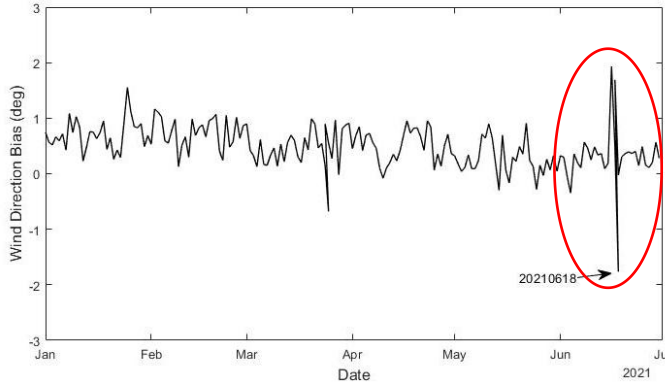
SCAT L1 IPF V3.3

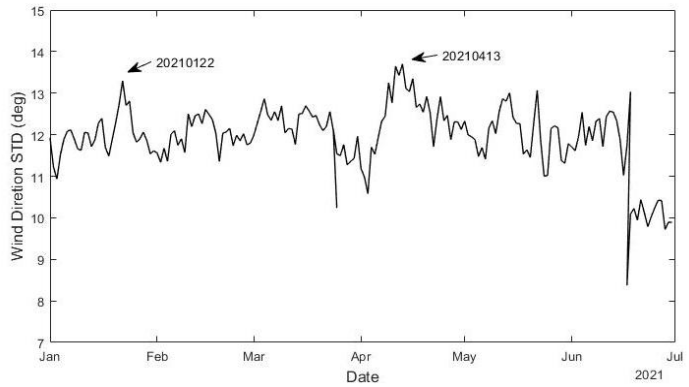
	V3.2	Debugging	V3.3
L1A	The operation is basically normal	Routine check and maintenance of program code	**Update memory management and variable allocation to improve the software robustness.**
L1B	the quality of wind speed becomes worse after June 17, 2021.	The change of satellite orbit influence the temperatures of SCAT, and causes the fluctuation of signals.	**Noise calibration adaptive algorithm is updated in V3.3.** **Fixed 1 bug in V3.2 for data processing between 600-1200 frames.**

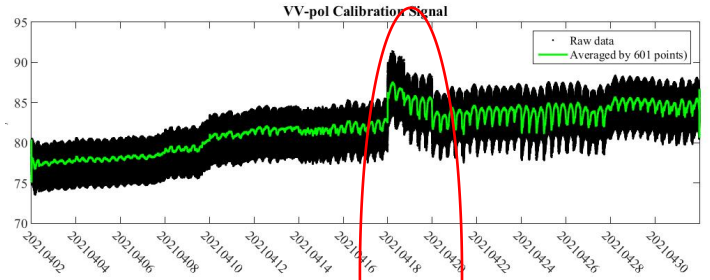
L1B IPF V3.2 vs. V3.3



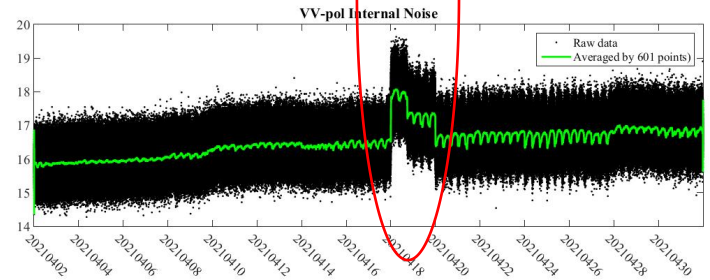




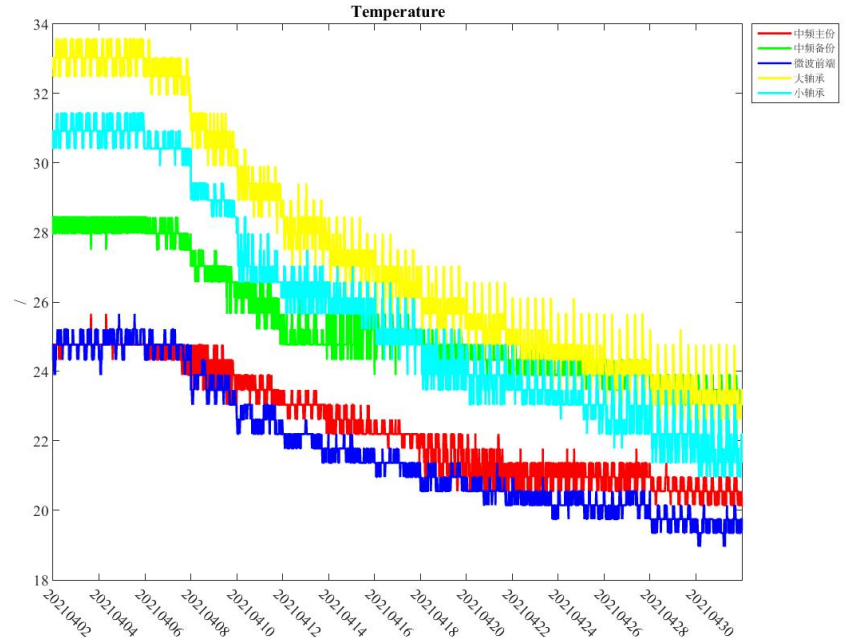




Internal calibration signal



Intenal noise signal

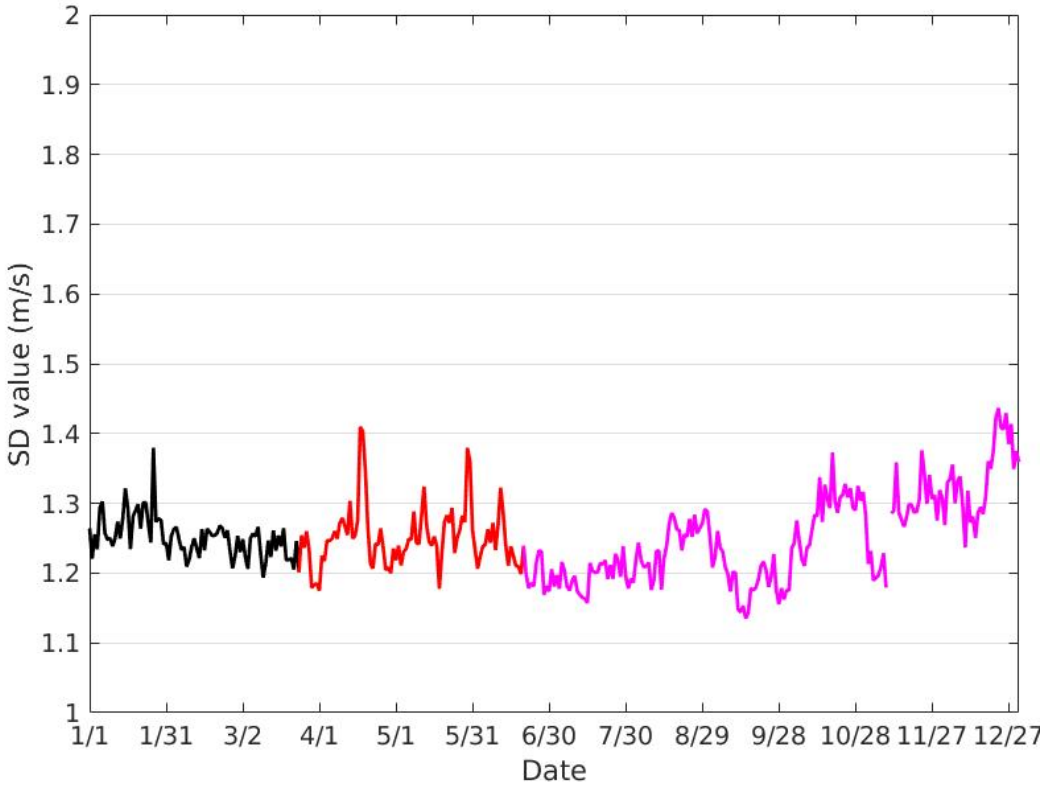


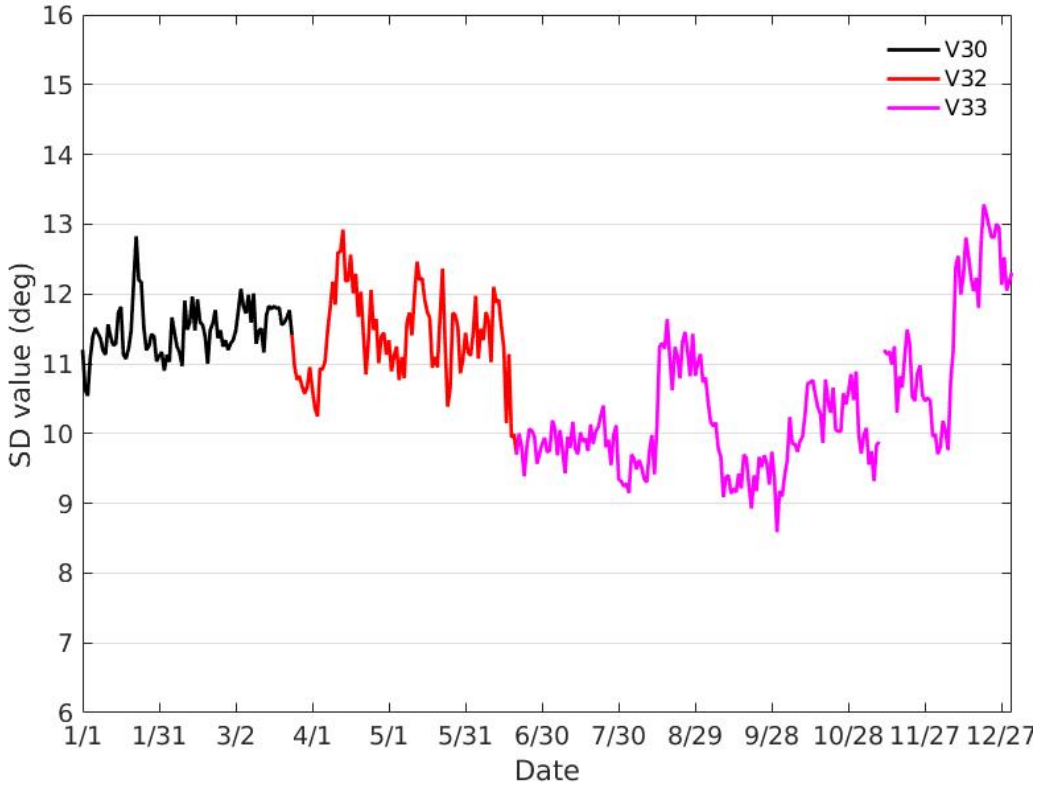
SCAT L2 IPF V3.3

	V3.0	Debugging	V3.2/V3.3
1.	Numerical ocean calibration (NOC)	Update the LUTs of MLE normalization, QC threshold, VV /HH calibration coefficients	**Update calibration coefficient**

CSCAT Status: Evolution (daily monitoring)

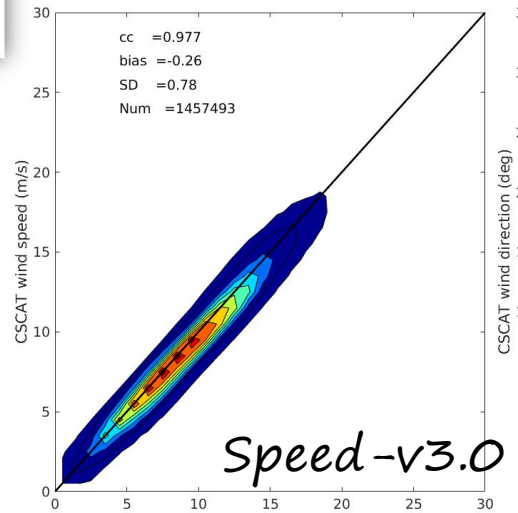
Data: Jan 1st – Dec. 31, 2021

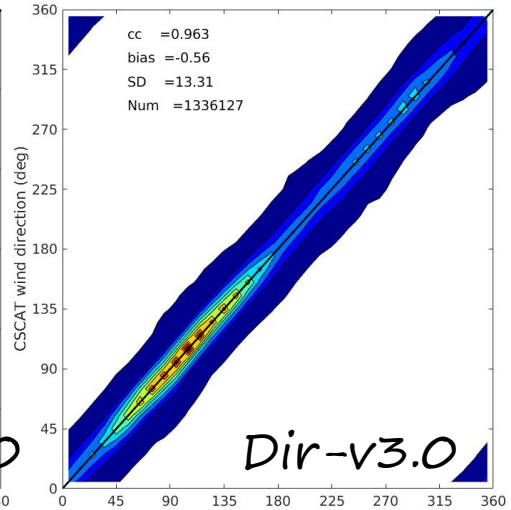


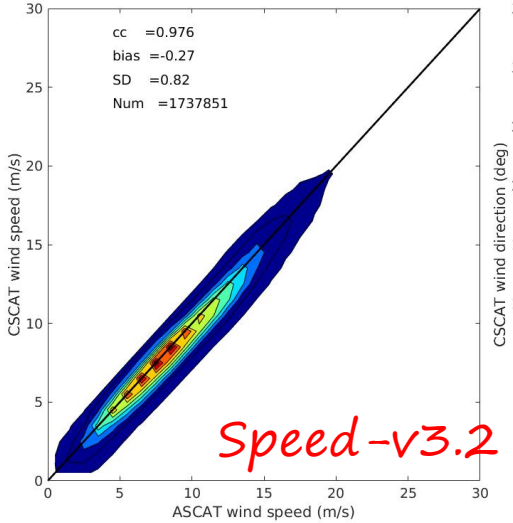


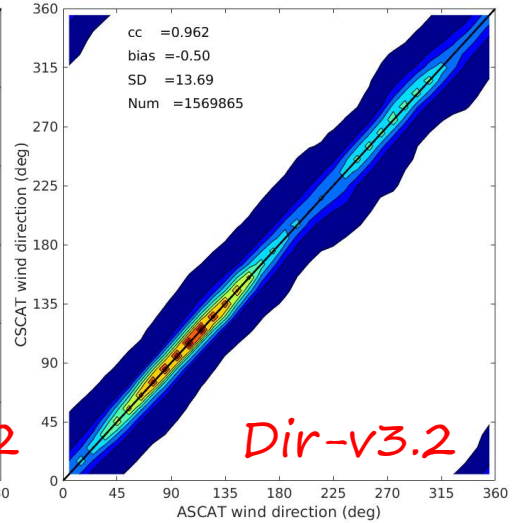
SD values of SCAT wind speed (a) and direction (b) w.r.t. ECMWF

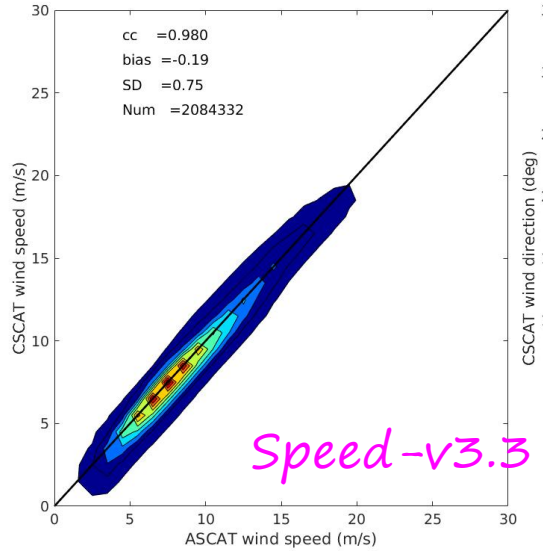
CSCAT VS ASCAT

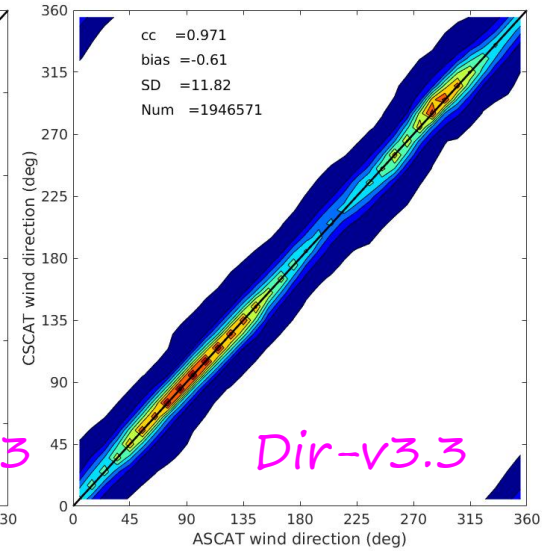








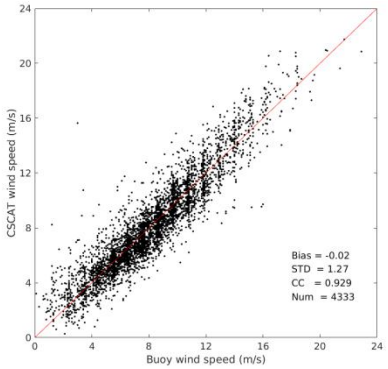




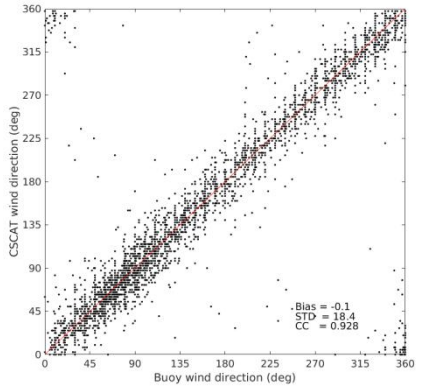
CSCAT VS ASCAT

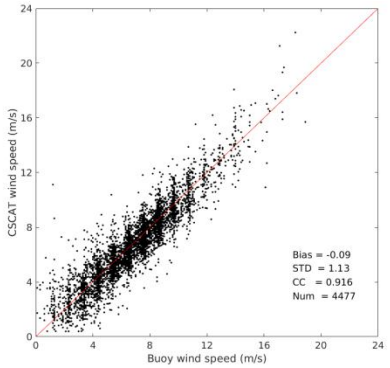
	Speed SD	Dir SD
V3.0	0.78 m/s	13.3°
V3.2	0.82 m/s	13.7°
V3.3	0.75 m/s	11.8°

CSCAT VS BUOYS (WIND SPEED)

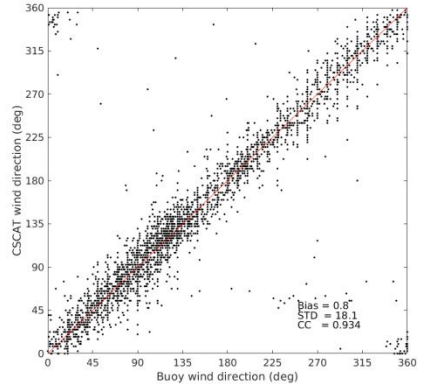


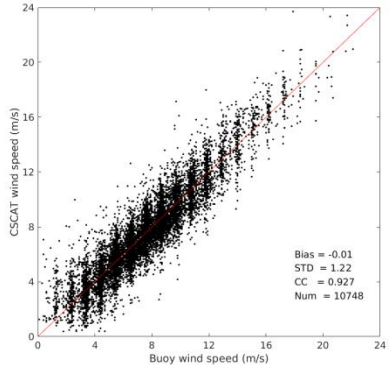
V3.0



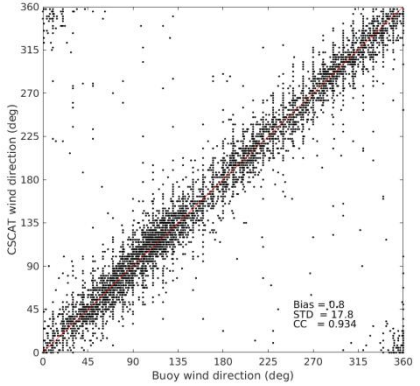


V3.2





V3.3



	Speed SD
V3.0	1.27 m/s
V3.2	1.13 m/s
V3.3	1.22 m/s

	Direction SD
V3.0	18.4°
V3.2	18.1°
V3.3	17.8°

Evaluation wind product quality

（SCAT antenna failure during 2022.8.7-8.25, after antenna re-work ,data analyzing results show the product is consistent, long term analyzing is under-going）

Table The wind vector validation results using NCEP data before and after antenna failure on 08-Aug-2022

phase	Date range	Wind speed （m/s）			Wind direction (deg)			Num
		bias	RMS	corr_coef	bias	RMS	corr_coef	
before	T0 (July)	0.03	1.12	0.92	0.07	13.08	0.99	9199585
after	T1 (25-Aug to 27-Aug)	-0.04	1.10	0.93	-0.19	12.88	0.99	826455
	T2 (28-Aug to 30-Aug)	-0.08	1.10	0.92	-0.19	12.96	0.99	1005230
	T3 (31-Aug to 02-Sep)	-0.14	1.08	0.92	-0.17	13.06	0.99	960687

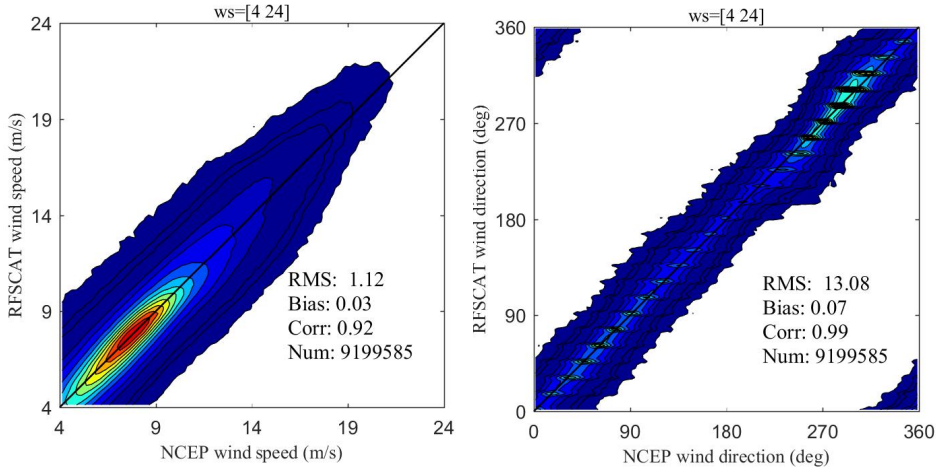


Fig.1 results for T0

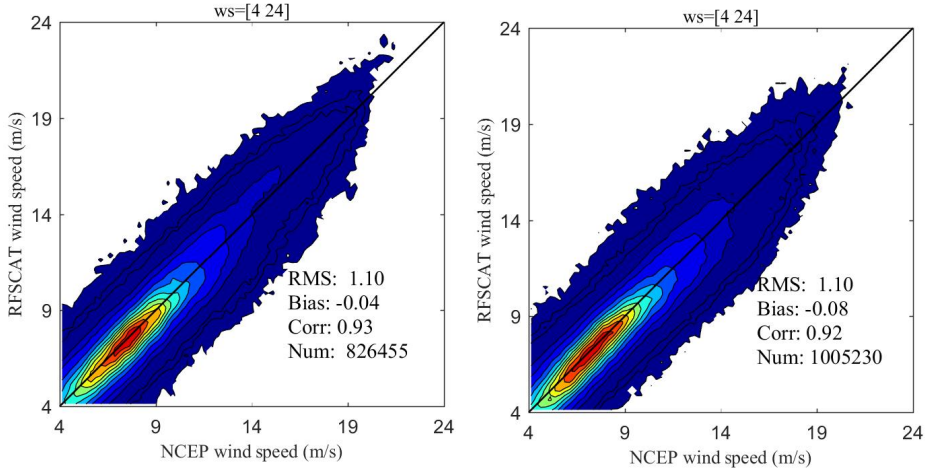


Fig.2 wind speed results for T1 and T2

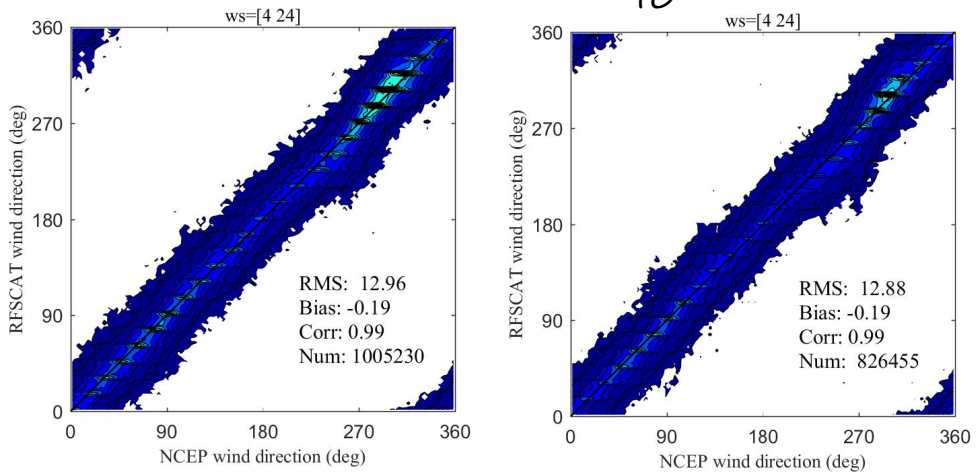
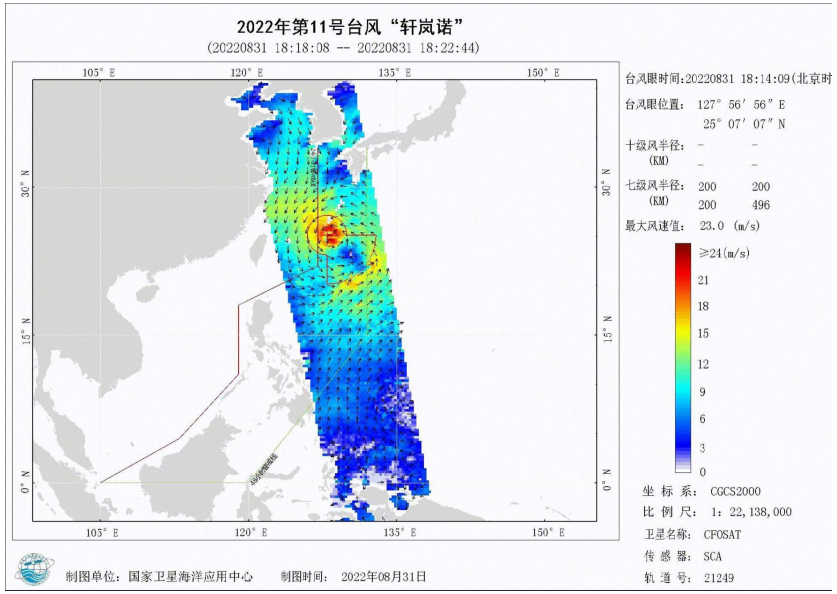
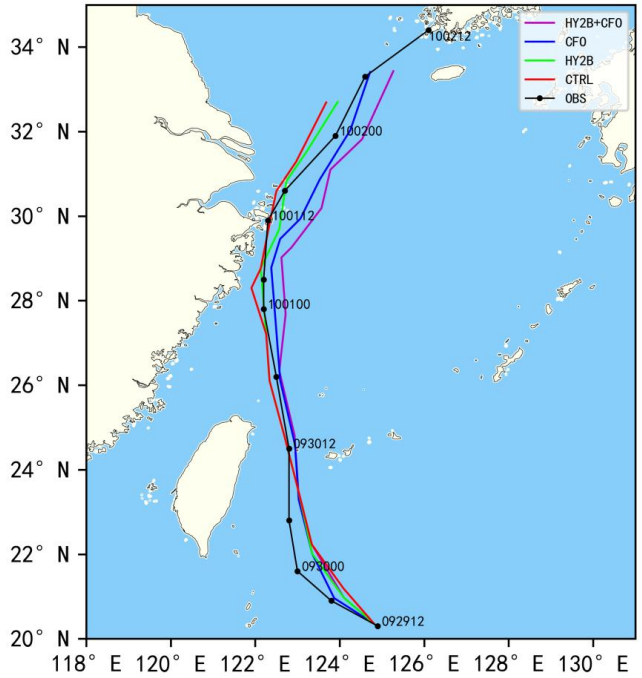
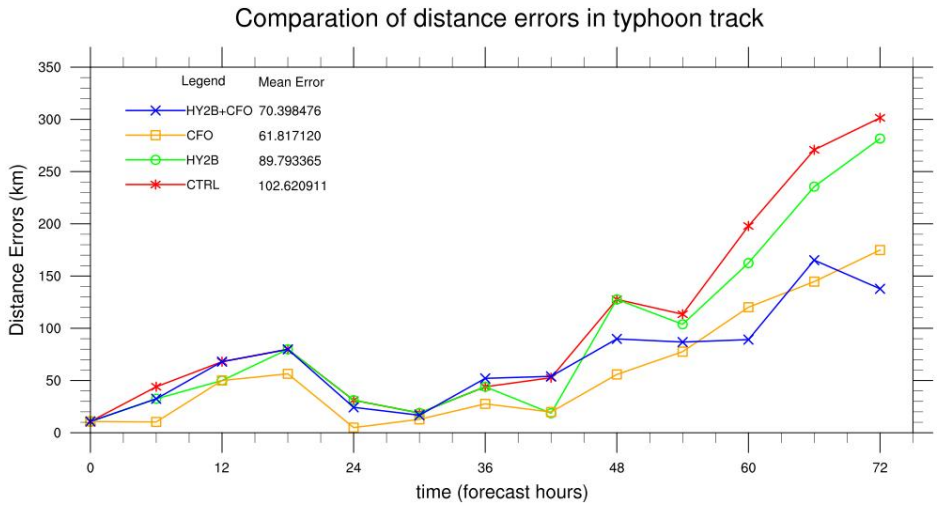


Fig.3 wind direction results for T1 and T2

CFOSAT SCAT can provide sea wind monitoring service, especailly typhoon



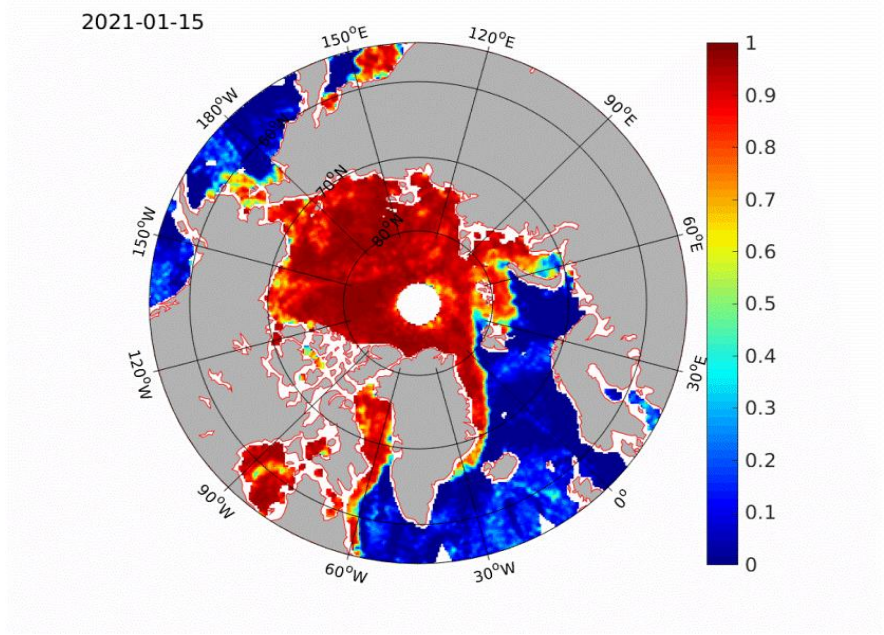


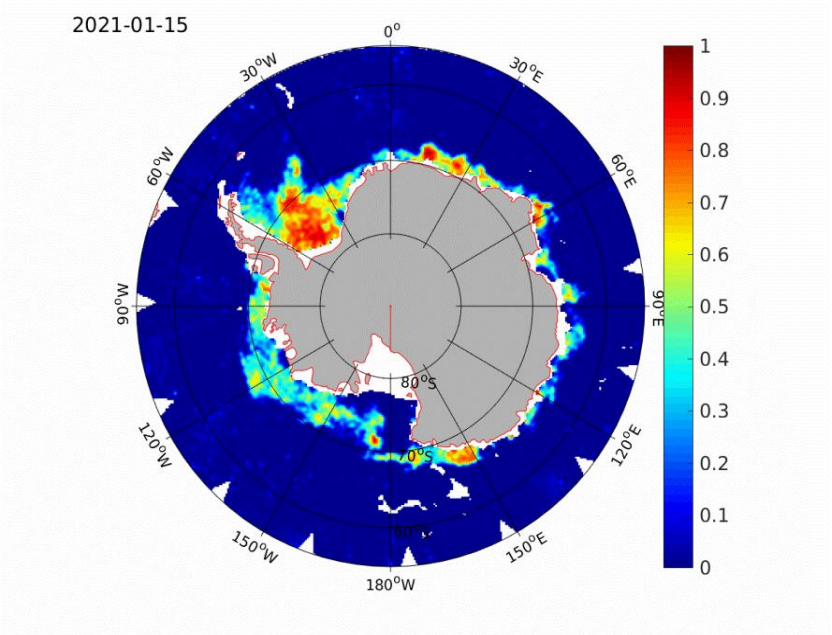


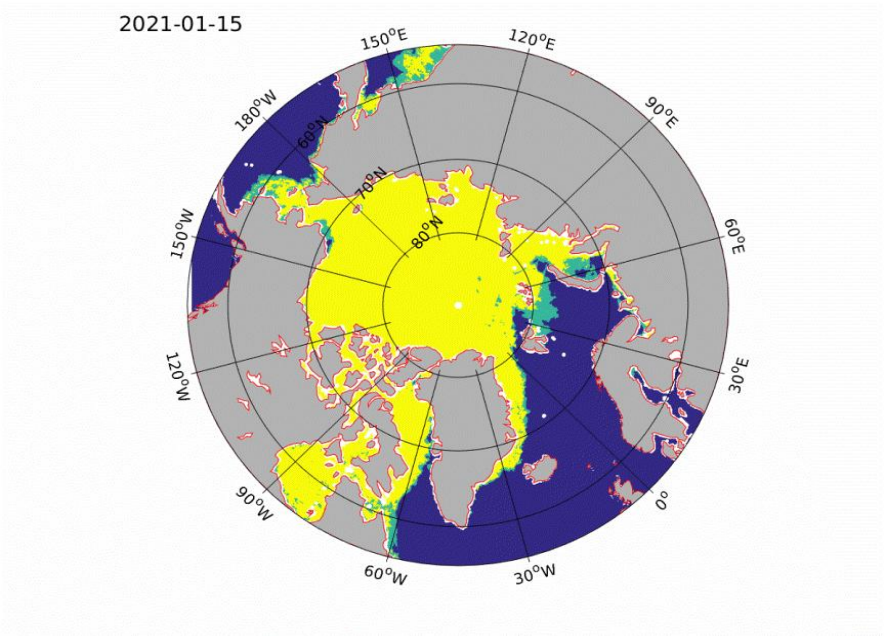
Left: recent typhoon monitoring (2022,Aug.31), typhoon eye position and the maxmium wind speed.

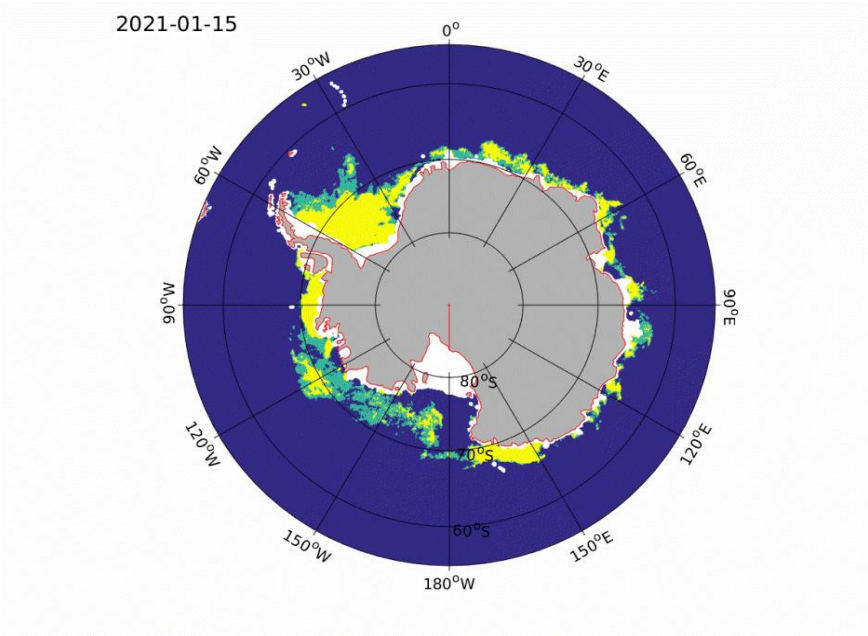
Middle and right: Assimilation of Winds for Typhoon, using SCAT data.

SCAT Polar Seaice Monitoring (operationl products on NOSAS)





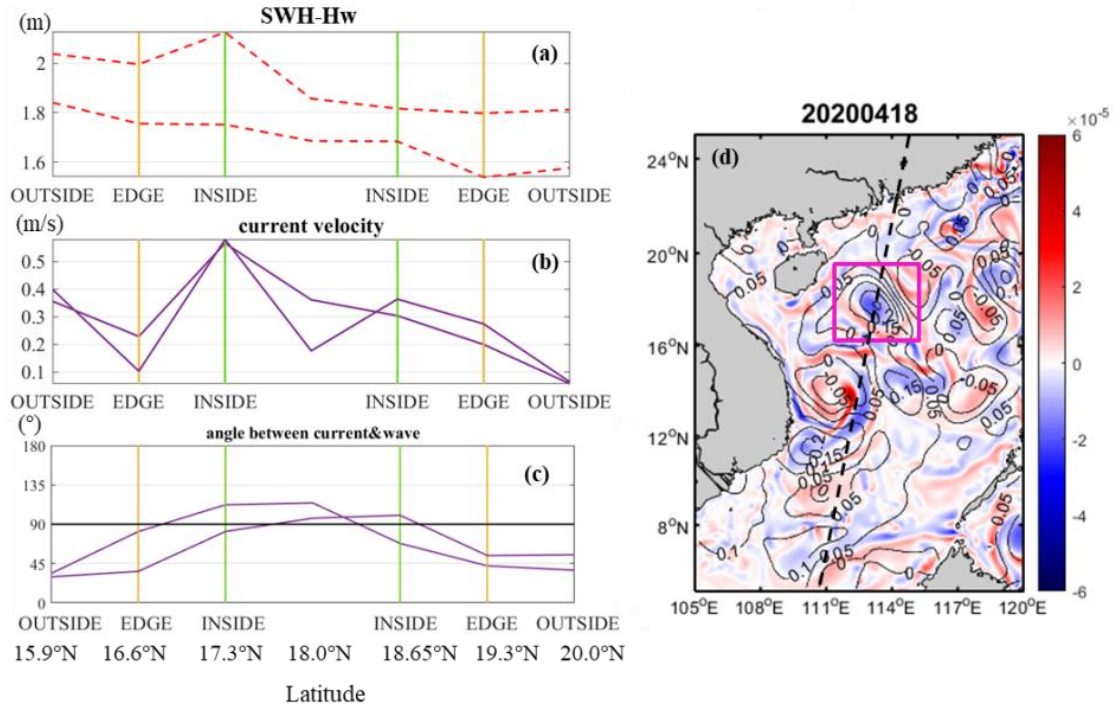




RECENT SWIM APPLICATION

Modulation effects of mesoscale eddies on sea surface wave fields in the South China Sea derived from wave spectrometer onboard China-France Ocean Satellite

TAN Keyi et al, revised in JGR

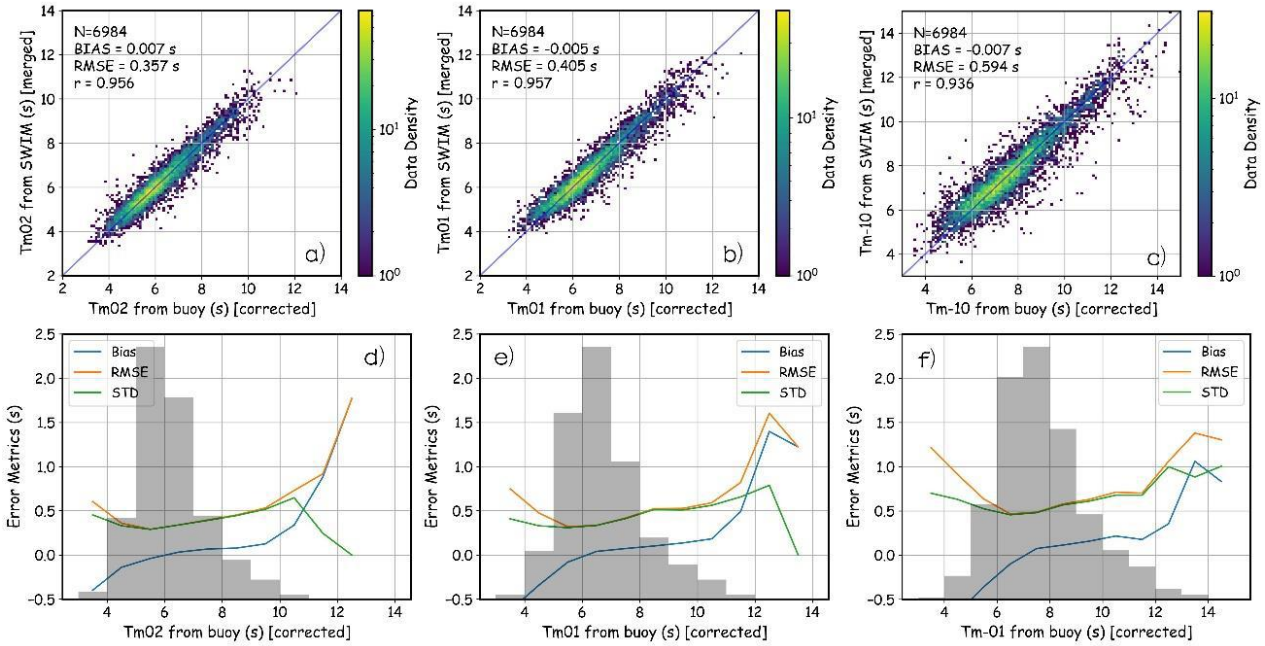


Variation of wind-eliminating SWH, surface current velocity and angle between current and wave directions across warm eddy

- Using the SWIM, examine modulation effects of mesoscale eddies on sea surface wave fields in the South China Sea (SCS) .
- The wave energy analysis indicates that the deformation term of eddy current is a dominant term affecting SWH at the eddy edge.
- The model results show the wave parameter variations crossing the eddy are close to that interpreted by from the SWIM data.

Accurate Mean Wave Period from SWIM Instrument On-Board CFOSAT

JIANG Haoyu et al, submitted to RSE

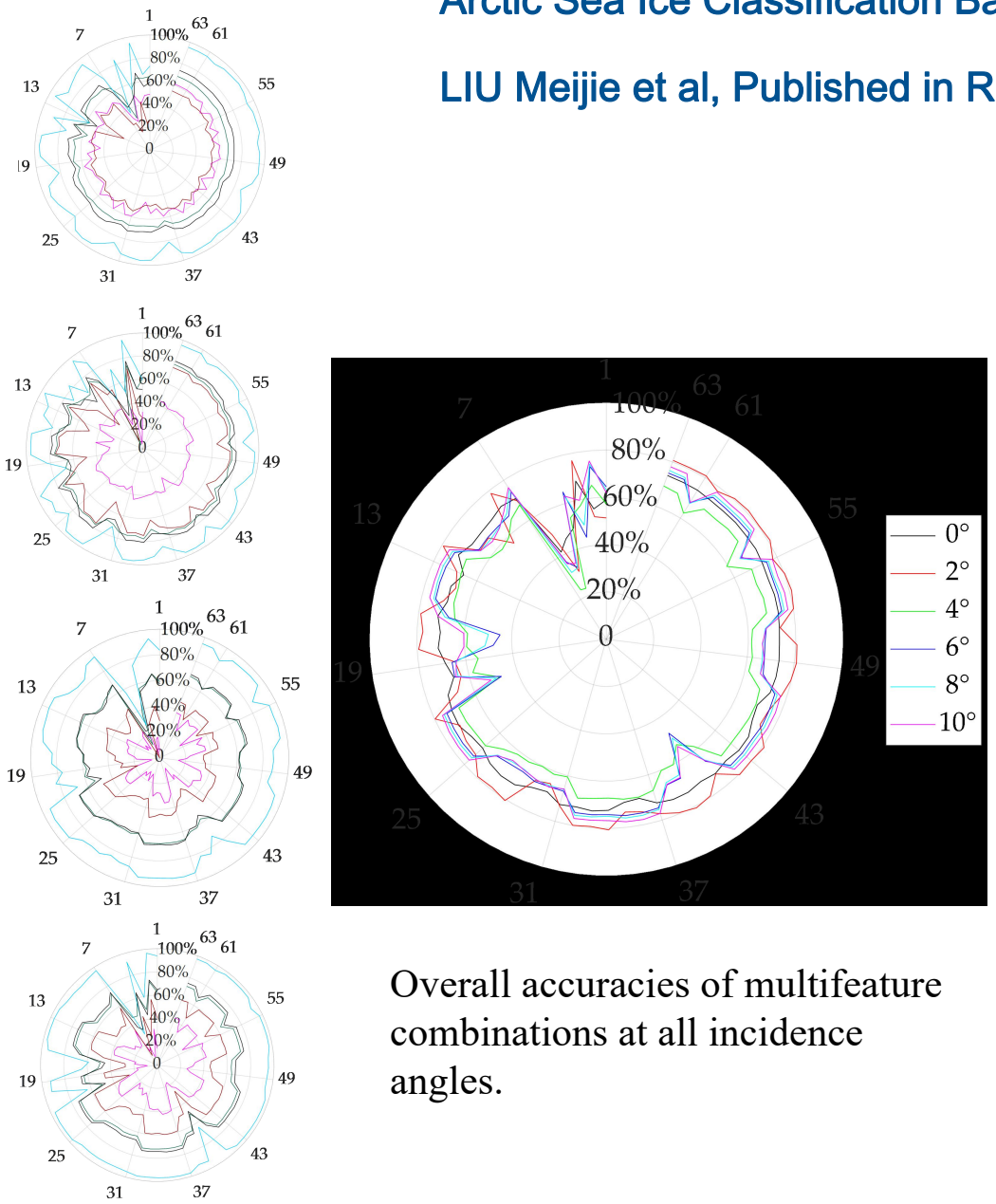


Comparison of the SWIM MWPs from the ANN merged retrieval model against buoy measured MWPs

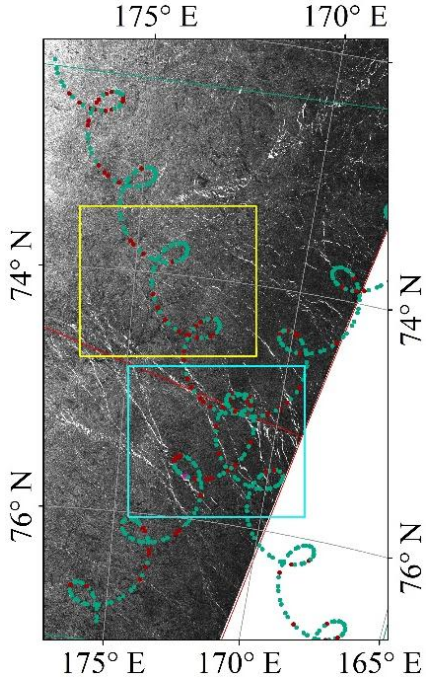
- A merged MWP retrieval model combining the nadir U10-SWH and the MWP from the spectrum of SWIM using an artificial neural network.
- Accuracy for MWP retrievals (RMSEs of ~0.36 s for zero up-crossing periods, 38 ~0.41 s for mean periods, and ~0.60 s for energy periods), demonstrating the usefulness of SWIM in the studies of ocean waves.

Arctic Sea Ice Classification Based on CFOSAT SWIM Data at Multiple Small Incidence Angles

LIU Meijie et al, Published in Remote sensing



Overall accuracies of multifeature combinations at all incidence angles.



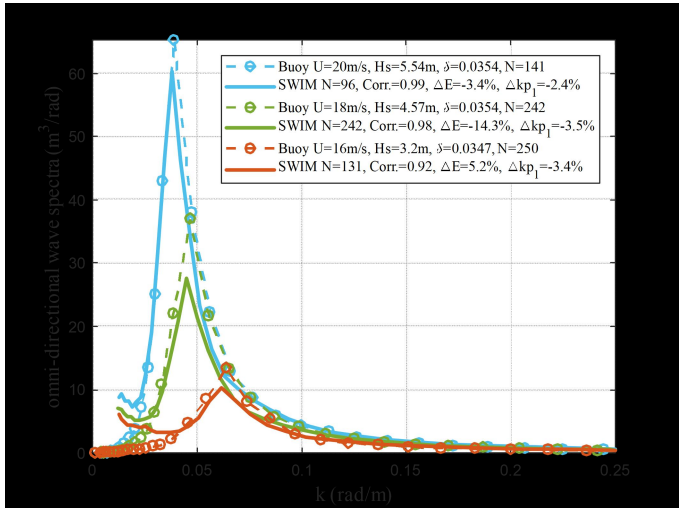
Classification results in Sentinel-1 SAR images of FYI

- Ice classification using six waveform features of SWIM echo data in the Arctic.
- Compared with sea ice charts, the overall accuracy is up to 81% using the optimal classifier and a multi-feature combination at 2°.
- Multi feature combinations with the KNN method are effective in sea ice classification using SWIM data.

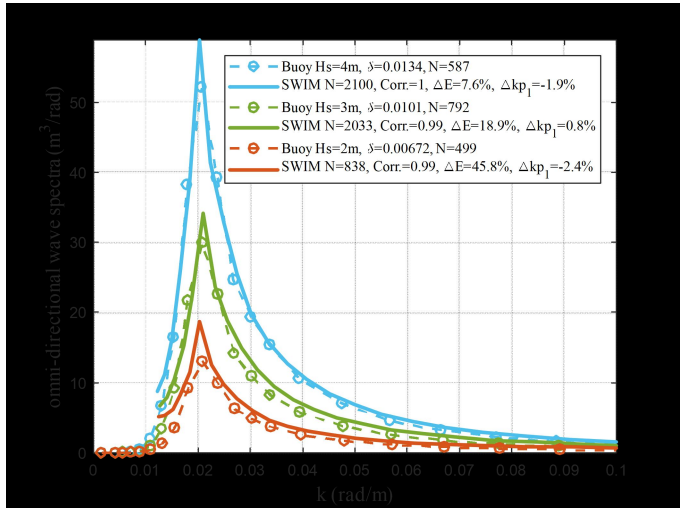
Statistical comparison of ocean wave directional spectra

derived from SWIM/CFOSAT satellite observations and from buoy observations

XU Ying et al, summited to TGRS



developing wind wave



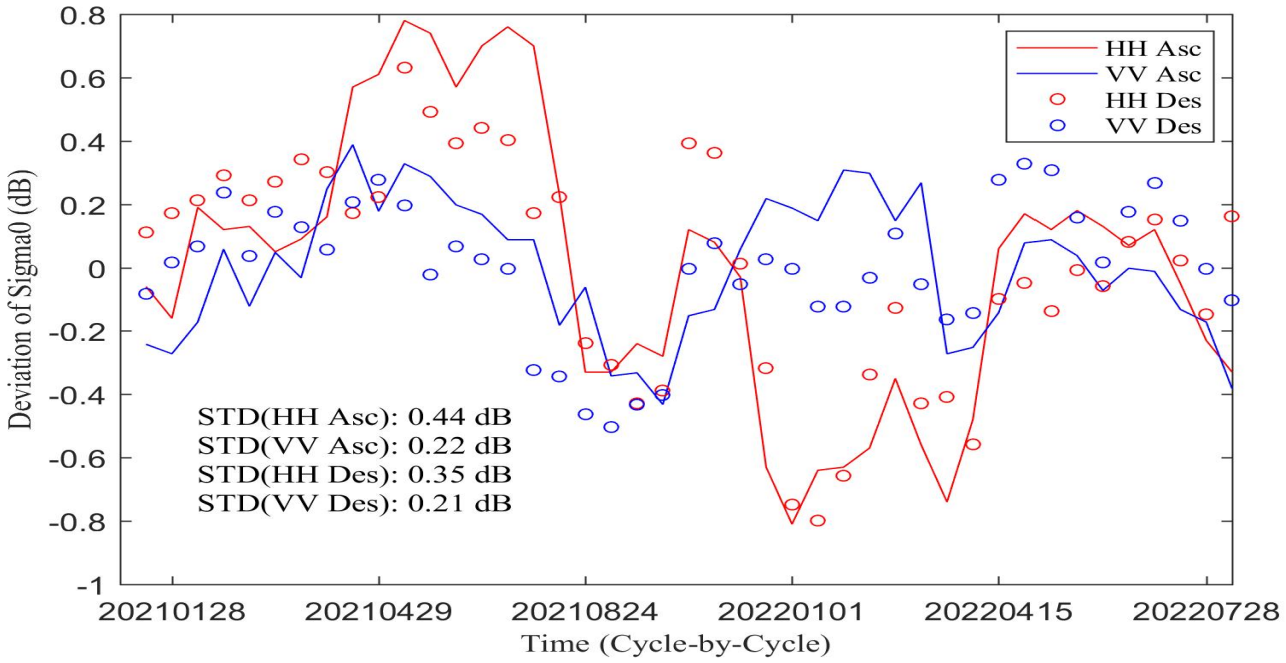
swell

- A new comparison method of SWIM and buoy observations including omni spectrum and directional function at peak wave number, in different classes of sea-state.
- Under medium and high sea conditions, 8 ° and 10 °SWIM spectra have a high consistency with buoy observations.
- Under low sea conditions, bias between SWIM and buoy observation mainly due to parasitic peak, non-linear surfboard effect and a slight underestimation of speckle noise spectral density.

SCAT LONG-TERM VALIDATION RESULT

SCAT LONG-TERM VALIDATION RESULT

The long-term sigma0 was monitored by analyzing the measurements over Amazon rainforest from Jan-2021 to Jul-2022. The below figure shows the deviation sigma0 by subtracting the mean sigma0.

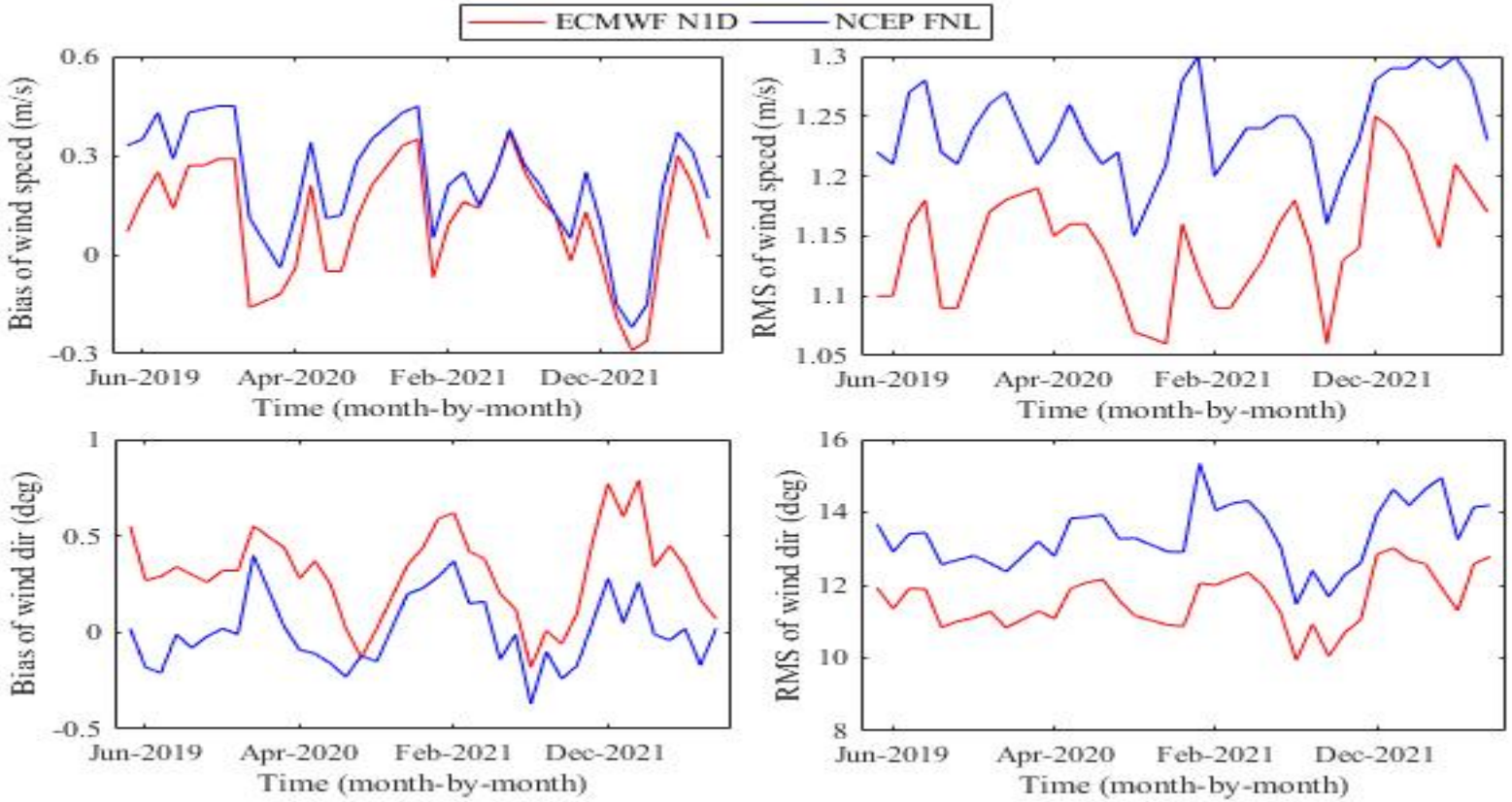


The long-term sigma0 is stable.

The stability of VV-pol is better than HH-pol.

SCAT LONG-TERM VALIDATION RESULT

The long-term validation results per month are show in below four pictures. The quality of wind speed and direction is stable from Jun-2019 to Jul-2022.



The results indicate that the performance requirements （2m/s for wind speed RMS and 20° for wind direction RMS have been met.）
The long-term measurements are stable.

Conclusions

CHOGS STATUS

Since the beginning of life , the current status of the Satellite, of the Payload (SCAT, SWIM, DTS), of the Ground Segments provided by NSOAS and CNES are OK. The mission lifetime pass almost 4 years and hope to be 1-2 years more.

The mission objectives is achieved, documents, products and application show the suitability of the Satellite, of the Payload, of the Ground Segments.

Data distribution increased in the passing years and planned to delivery via WMO GTS.

谢谢！Thank you ! Merci !