2024 DRAGON SYMPOSIUM

DRAGON 5 FINAL RESULTS REPORTING

24-26 JUNE 2024

<<COASTAL ZONES AND OCEAN>>



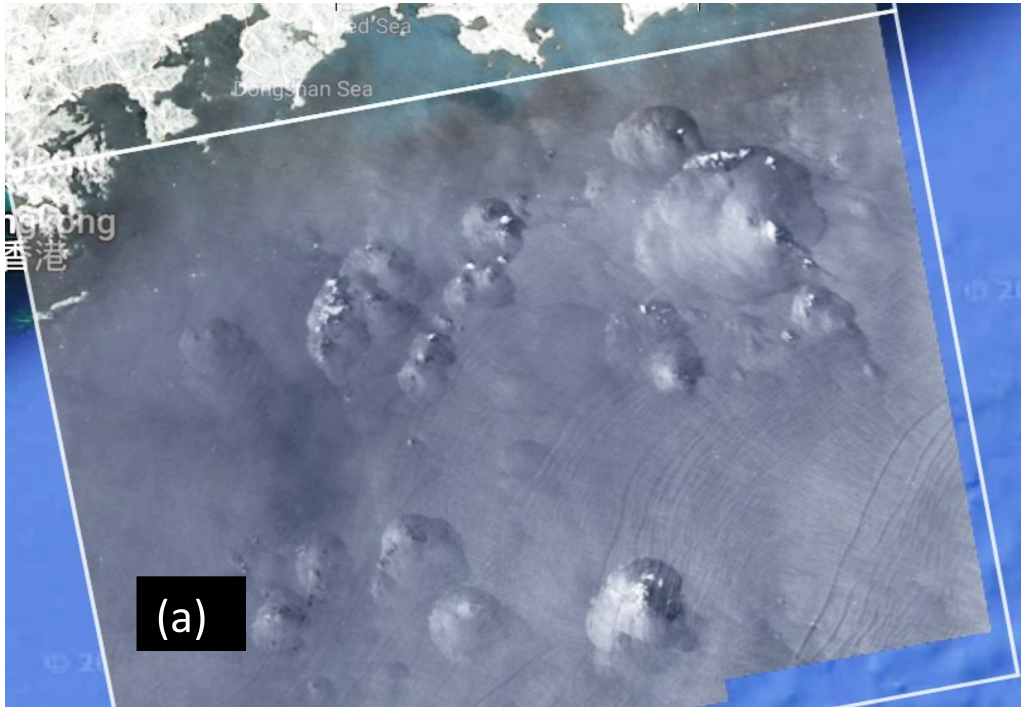
Presentations and projects

Seven projects were presented – collectively involving research by > 60 scientists:

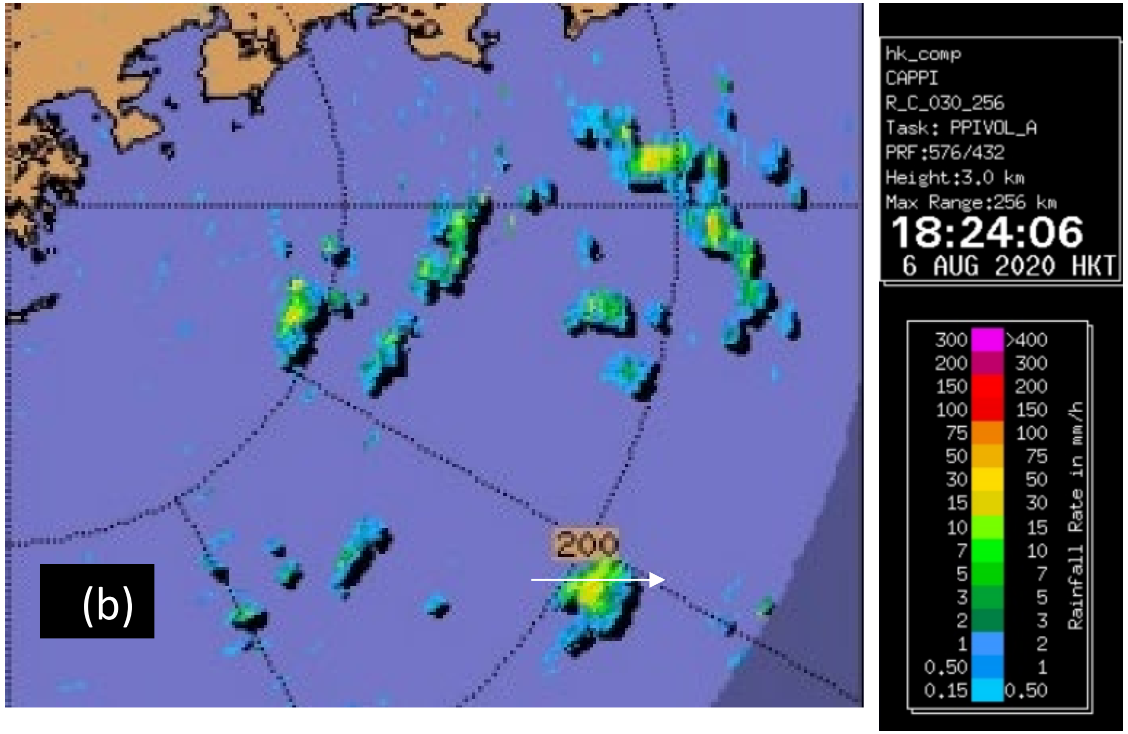
- **Physical Mechanism Causing Strongly Enhanced Radar Backscatter in C-Band SAR Images of Convective Rain over the Ocean (Alpers et al.),**
- **Innovative User-relevant Satellite Products for Coastal and Transitional Waters (Jungsheng et al.)**
- **Monitoring Harsh Coastal Environments And Ocean Surveillance Using Radar Remote Sensing (Nando et al.,**
- **Remote Sensing of Changing Coastal Marine Environments (ReSCCoME) (Li et al,)**
- **Research On Spatiotemporal Expansion Technology Of Ocean Wave Remote Sensing Data Based On Deep Learning (Jungang et al,)**
- **InSAR Experiments for the Analysis of Ground Changes Within the ESA DRAGON V GREENISH Initiative (Pepe et al,)**
- **The Benefit of Artificial Intelligence on Wave Remote Sensing and Assimilation in Operational Wave Models (Aouf et al,)**

Proj. 59373 (Werner Alpers and Zeng Kan)

This image allows an interpretation in terms of the melting layer hypothesis as well as the splash product hypothesis.



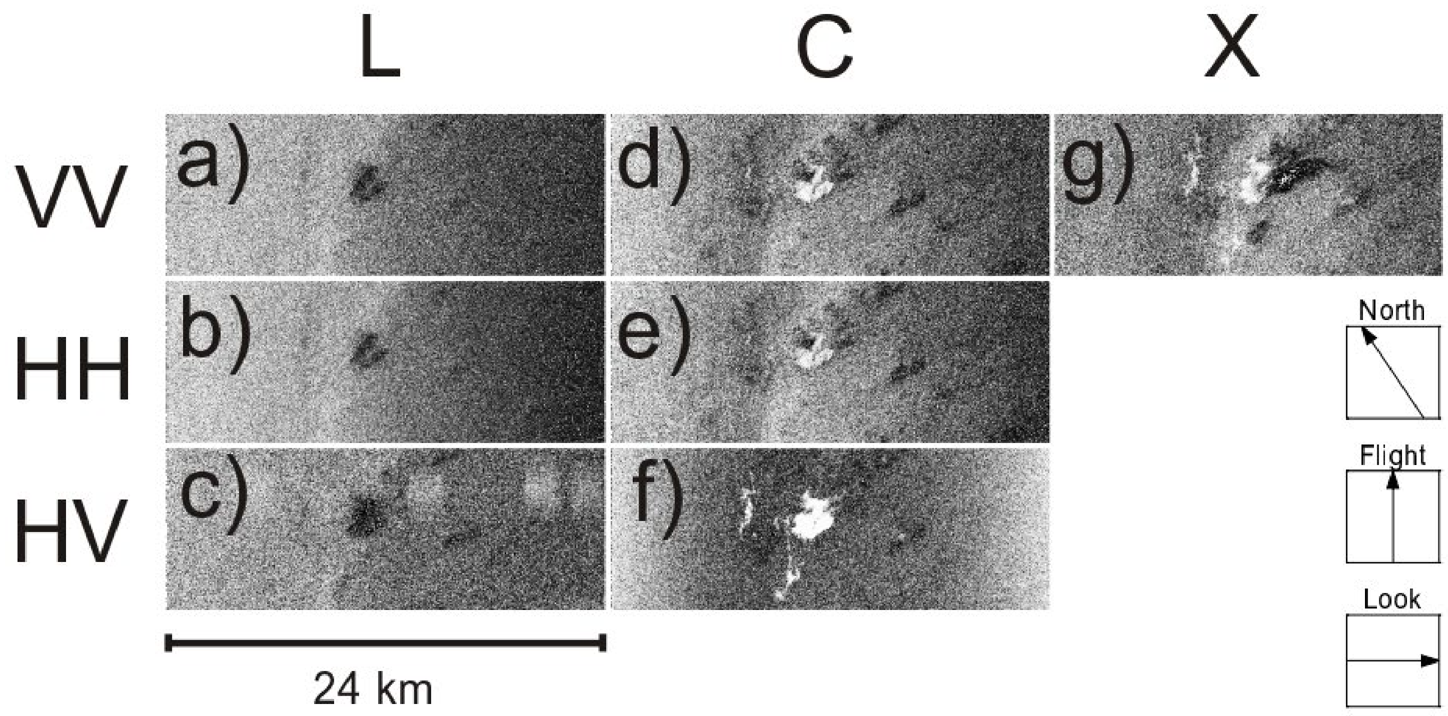
Sentinel-1 SAR image



Hong Kong weather radar image

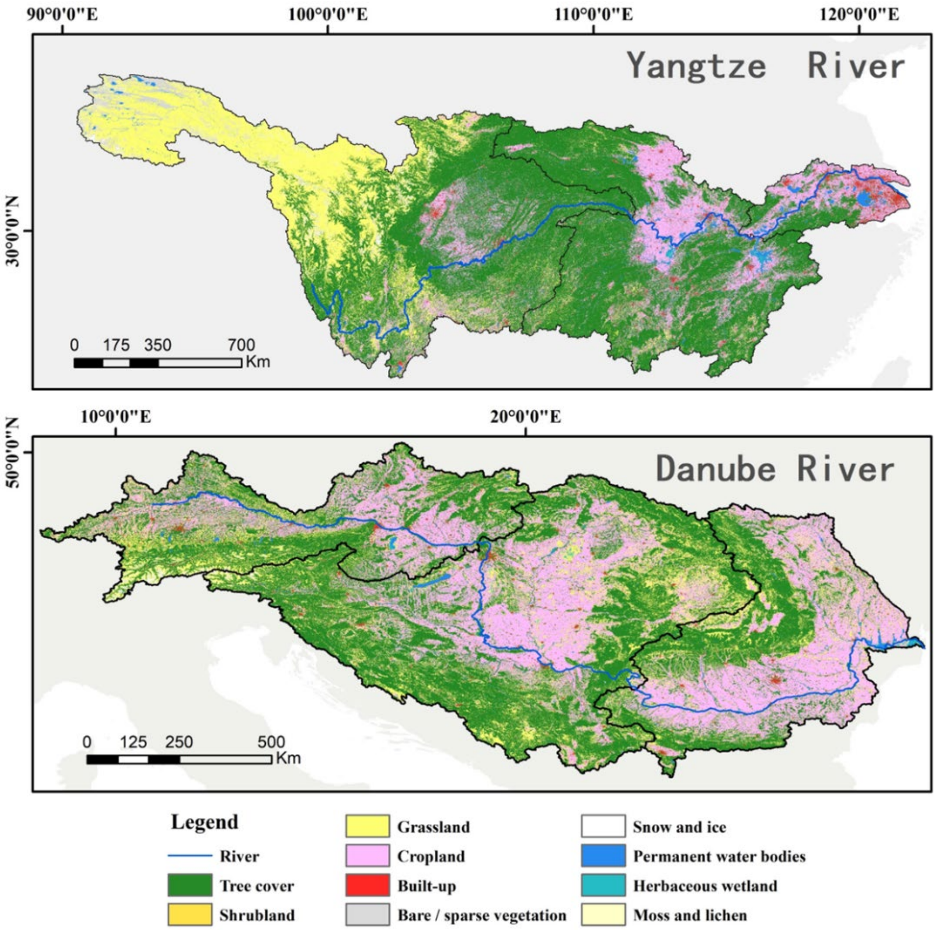
Proj. 59373 (Werner Alpers and Zeng Kan)

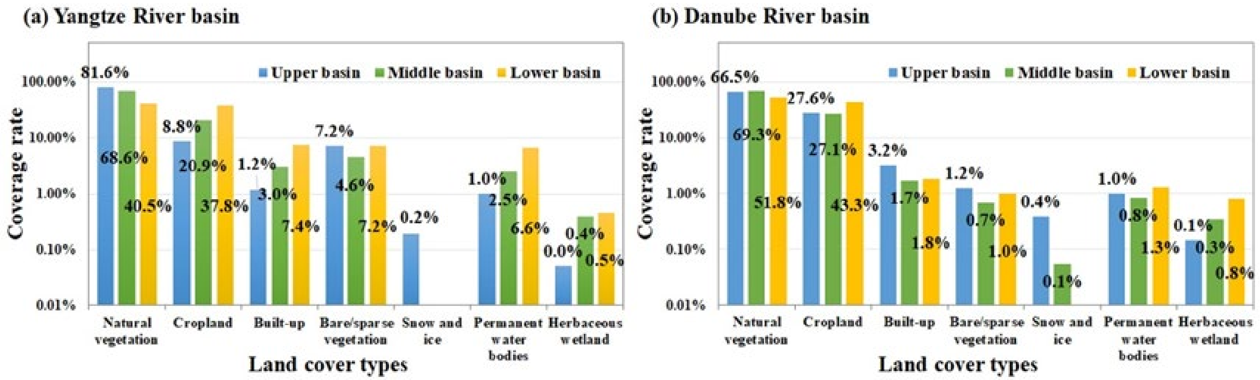
No displacement is visible in the multi-frequency and multi-polarization SAR images a raincell



L-, C-, and X-band SAR images of the same area over the Gulf of Mexico acquired concurrently at multi-frequency and multi-polarization during the SIR-C/X-SAR mission at 08:11 UTC. on 18 April 1994. They show a strong dependence of the radar signature of a rain cell on radar frequency and polarization. Reproduced from Melsheimer et al. (1998).

Environmental factors related to the contrasting patterns of water colour in Yantze and Danube



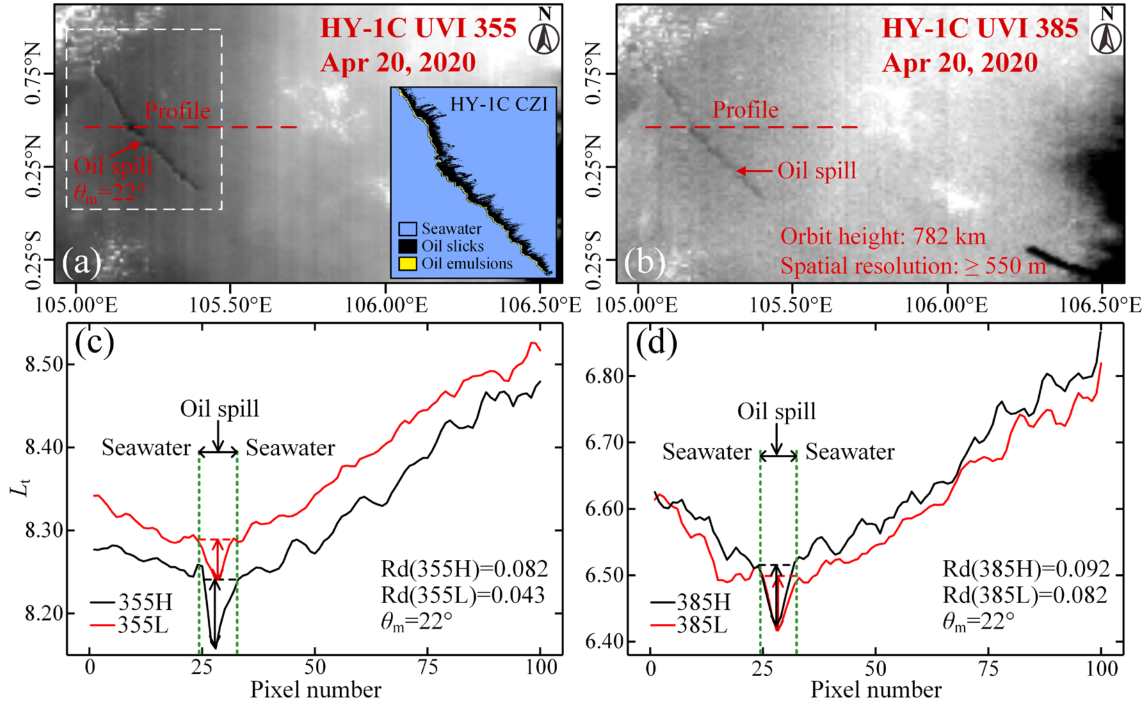


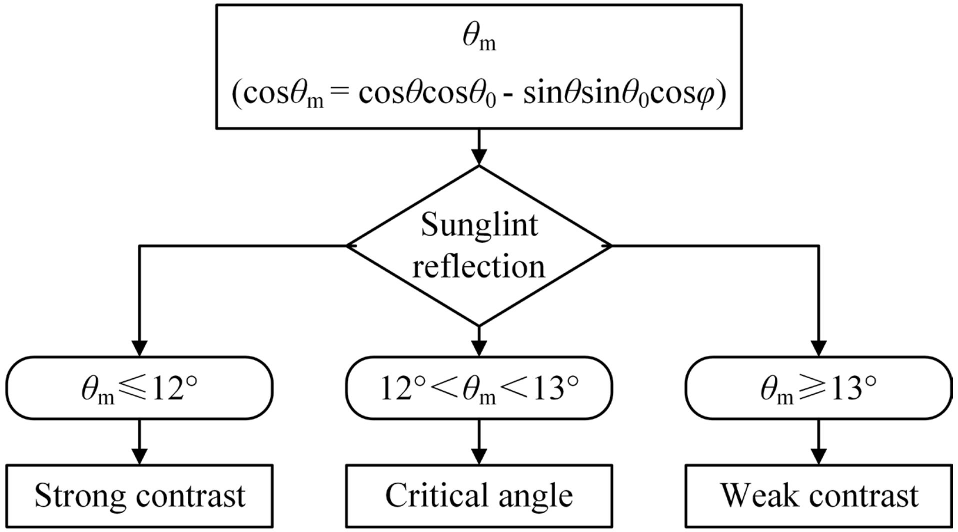
Spatial pattern factors: mainly include dams and hydropower stations along both river systems, and the spatial difference of precipitation.

Seasonal pattern factors: high precipitation and floods during the wet season may disturb the river water.

Proj. 59193 (Junsheng Li, Evangelos Spyrakos)

UV detection of spilled oils in UVI images under sunglint





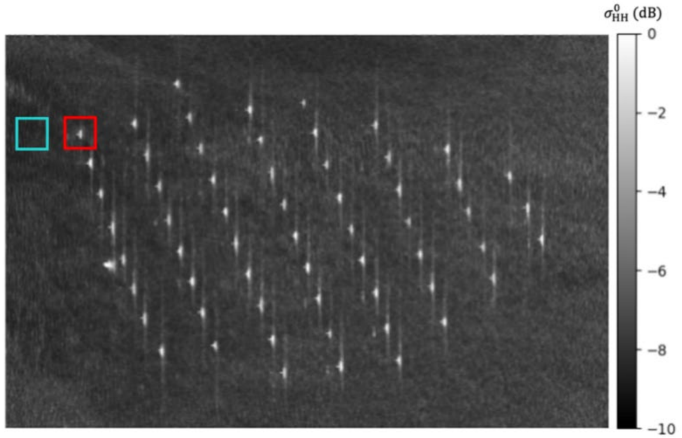
$\cos\theta_m = \cos\theta\cos\theta_0 - \sin\theta\sin\theta_0\cos\varphi$

θ, θ_0 and φ are satellite/solar zenith angle and relative azimuth angle.

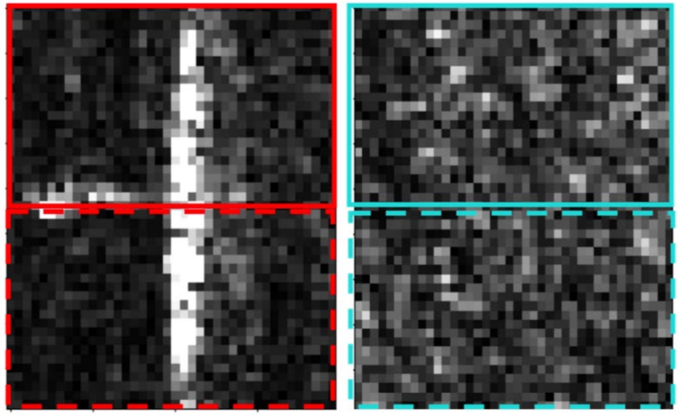
- Oil spills and seawater show negative contrast in UVI images under weak sunglint;
- For spaceborne UV images with low spatial resolution, sunglint reflection determines the image features of spilled oils.

Proj. 57979 (Ferdinando Nunziata, Xiaofeng Yang)

The sensitivity of SAR backscatter to the rotating blade is investigated using PAZ measurements over off-shore wind platforms

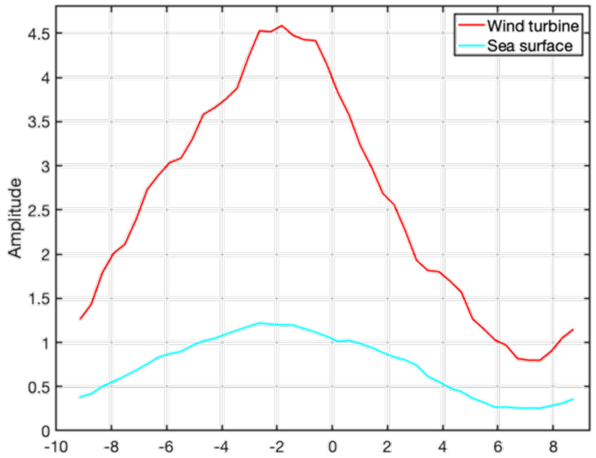


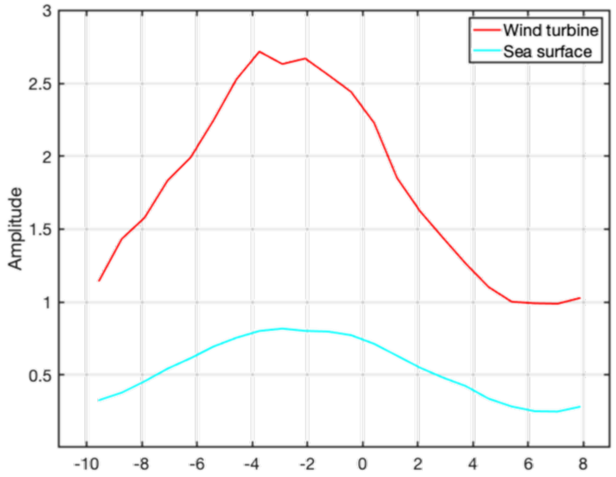
(a)

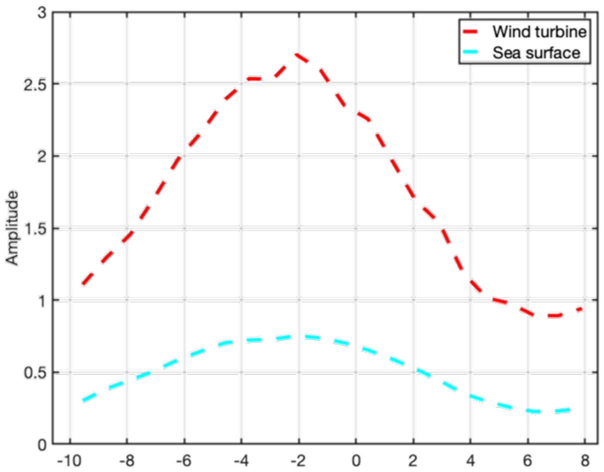


(b)

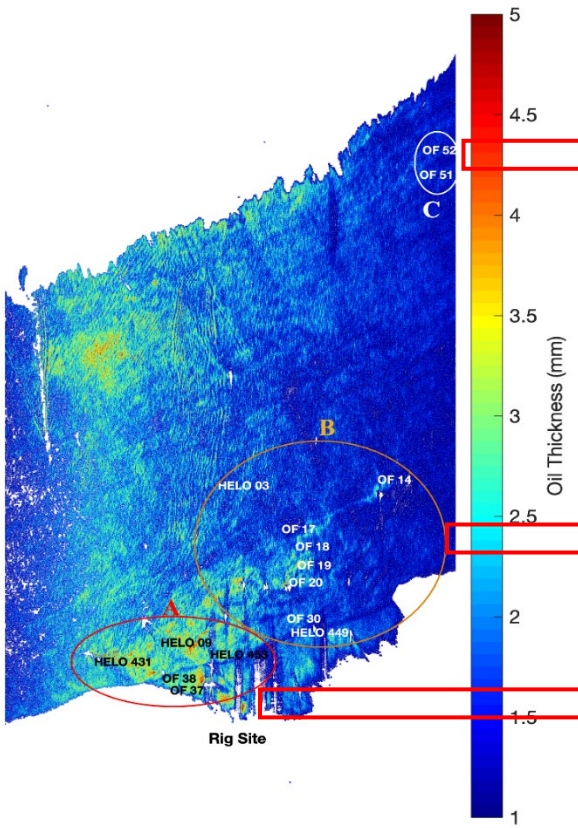
(c)







The AIEM model is used to train NN to retrieve oil thickness and fraction of oil into the water and successfully tested on UAVSAR



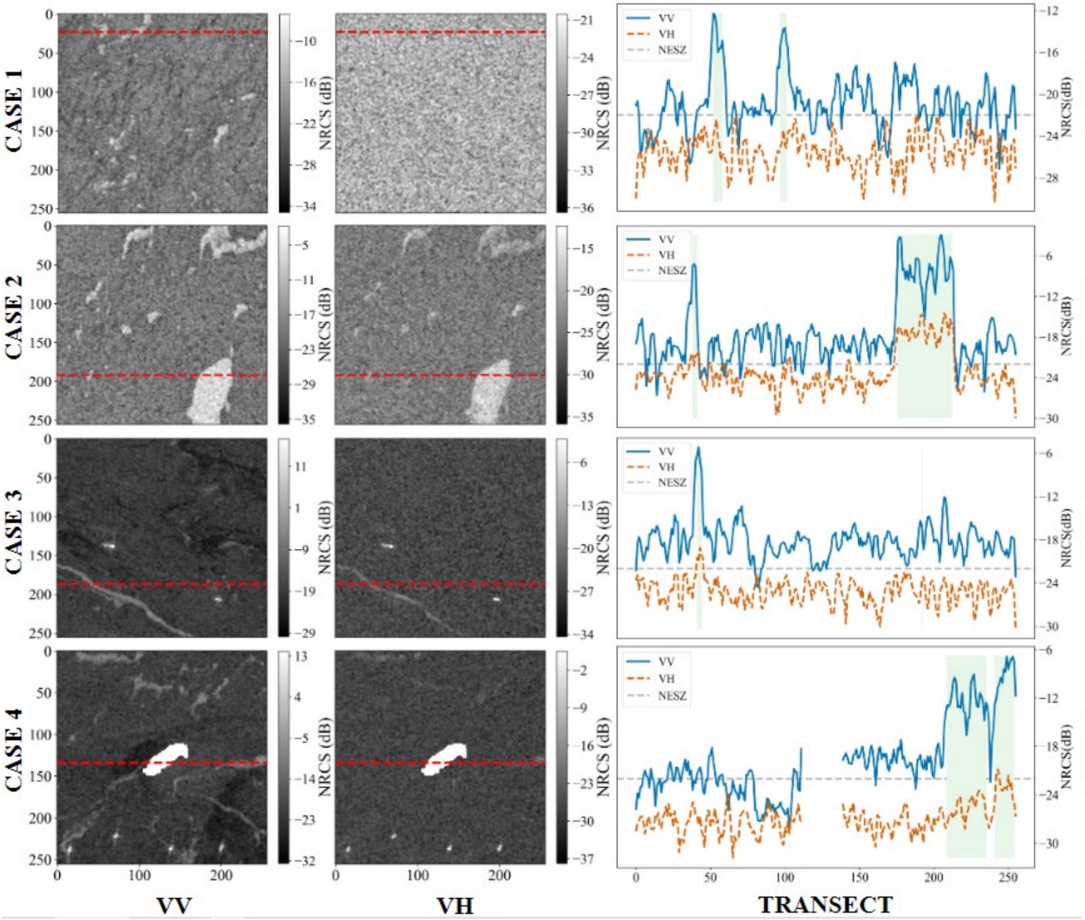
Thin films with thickness of about 1mm

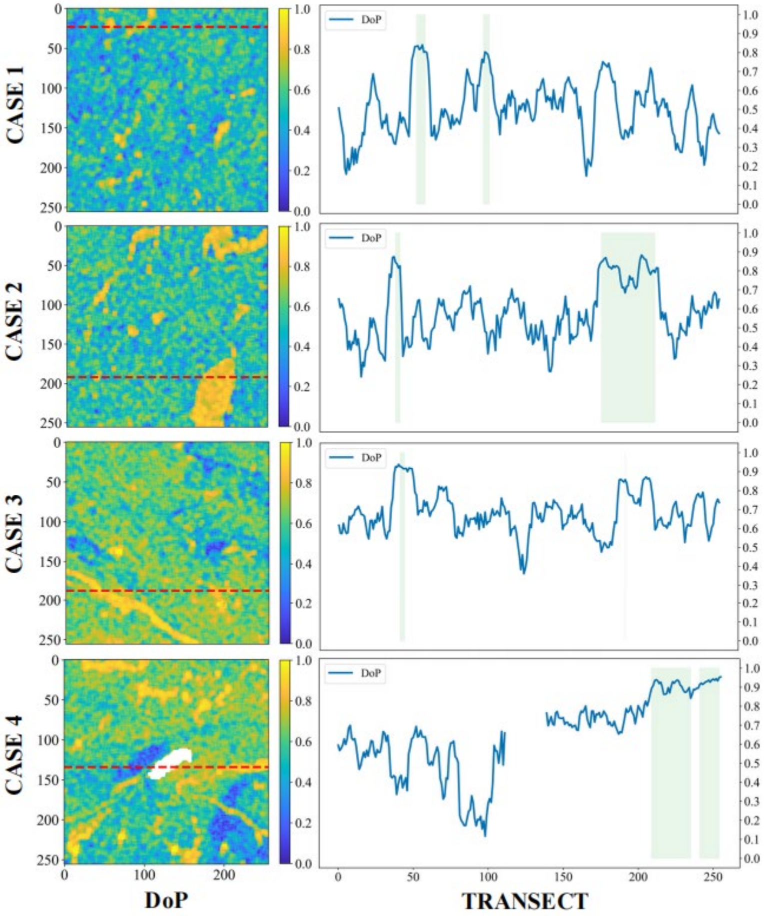
Mixing of emulsified oil and thin films with thickness about 1-3mm

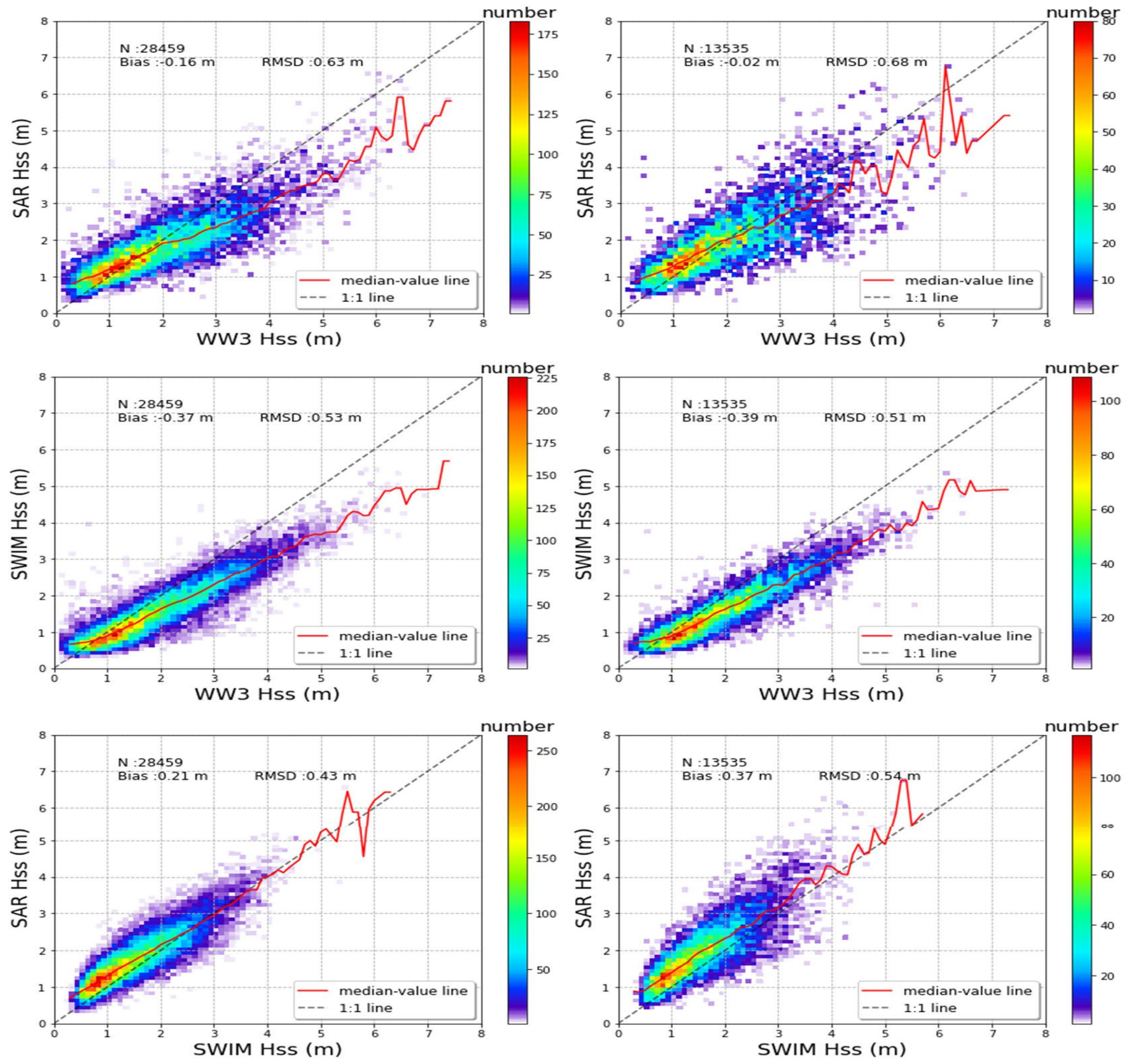
Brown emulsified oil with thickness about 2-4mm

Proj. 57979 (Ferdinando Nunziata, Xiaofeng Yang)

The cross-pol channel over the algae is almost always below NF and, even when it is above NF, is significantly lower than co-pol







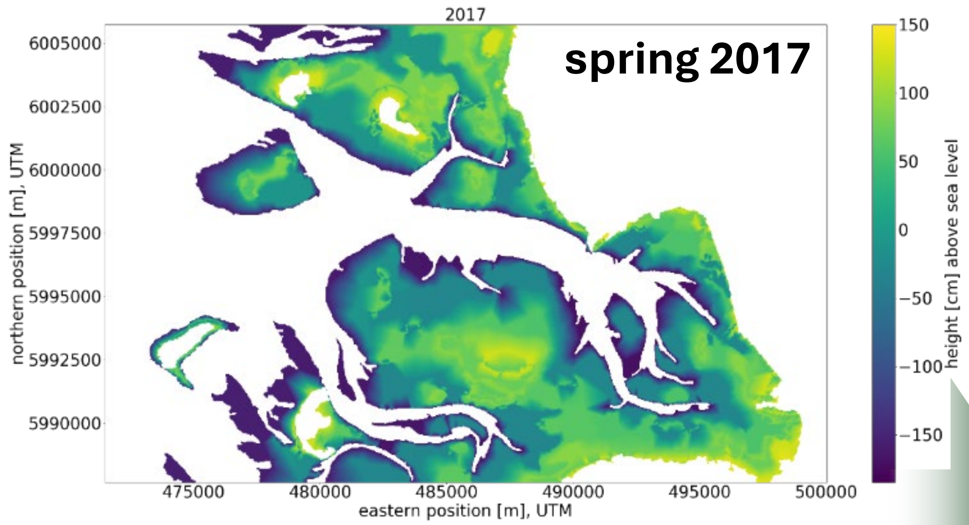
Quantifying Uncertainties in the Partitioned Swell Heights Observed From CFOSAT SWIM and Sentinel-1 SAR via Triple Collocation

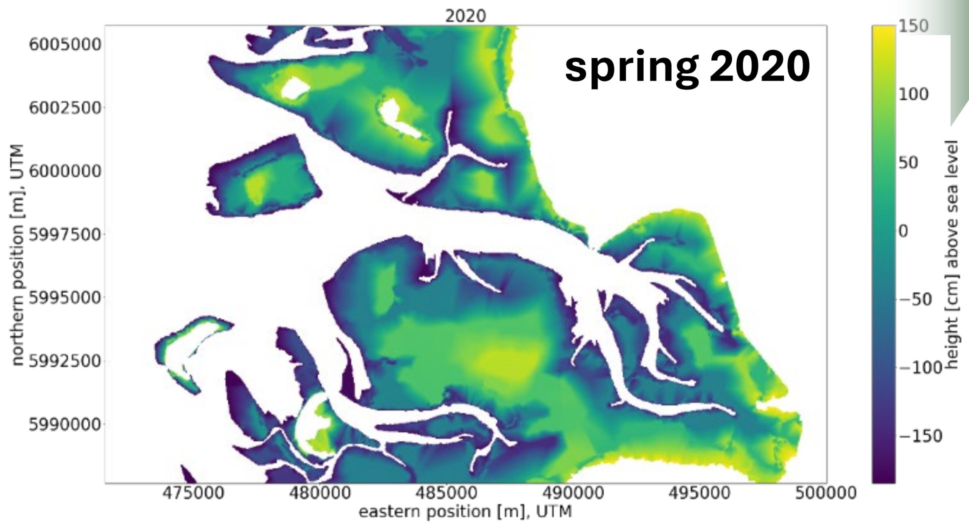
- Quantifying Uncertainties in the Partitioned Swell Heights Observed From CFOSAT SWIM and Sentinel-1 SAR via Triple Collocation.

- CFOSAT has the least uncertainty (0.2-m RMSE, 11% SI, and 11-dB SNR) in terms of Hss

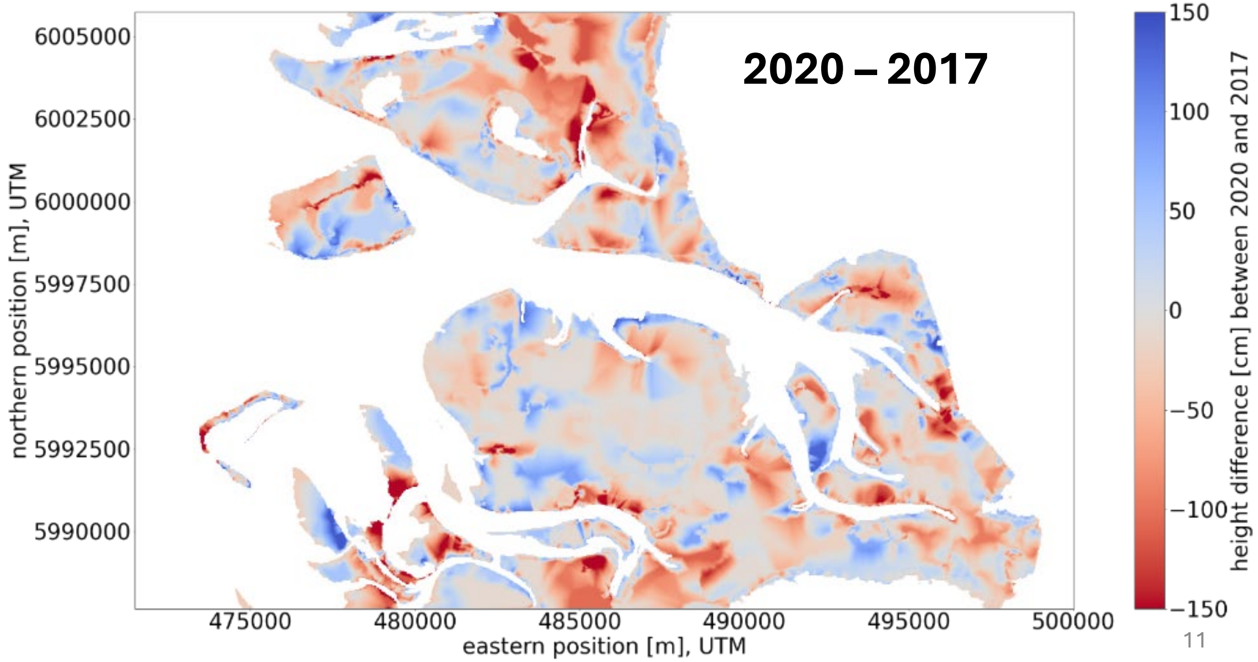
Proj. 57192 (Martin Gade, Xiaoming Li)

Monitor Coastal Erosion and Morphodynamics in Intertidal Areas



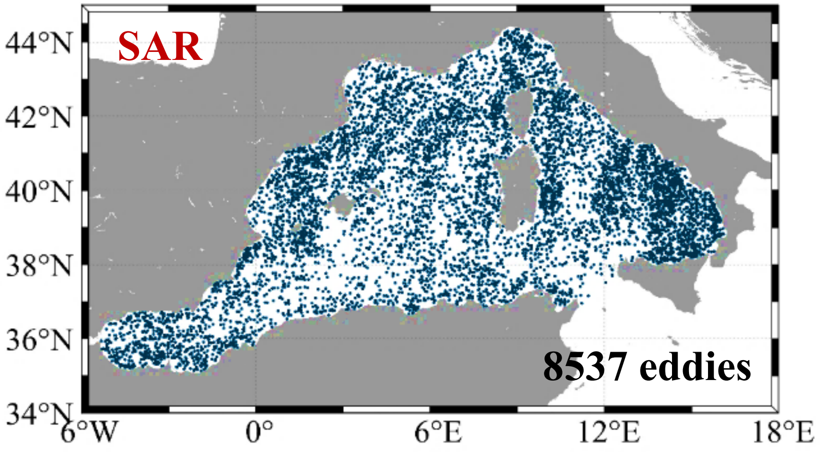


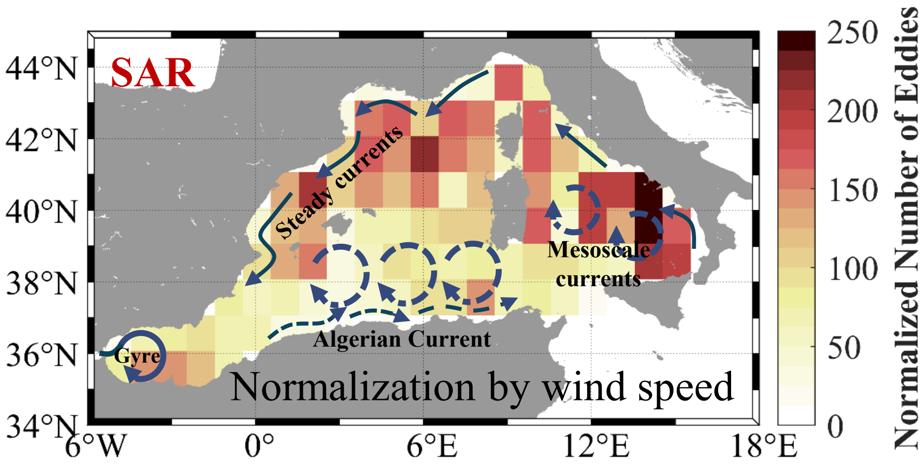
Morphological change

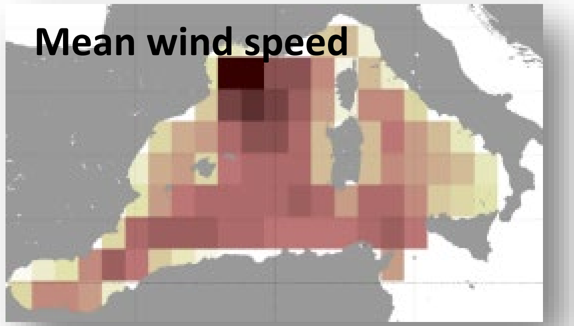


- Accretion
- Erosion

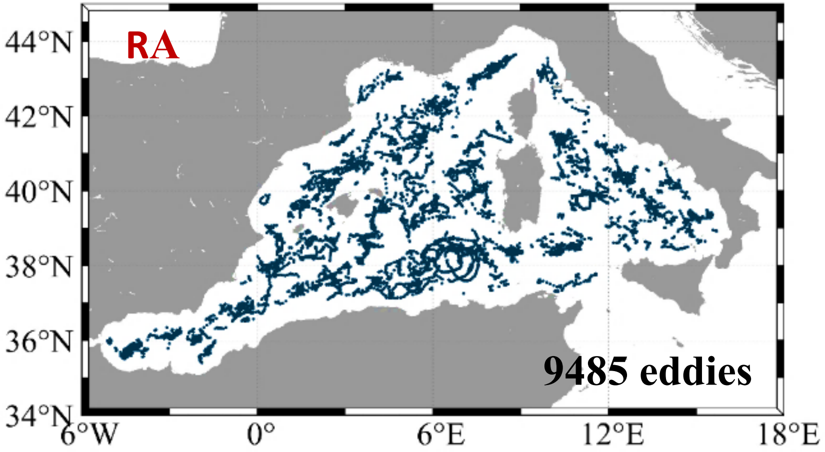
Spatial characteristics of ocean eddies in the Western Med.

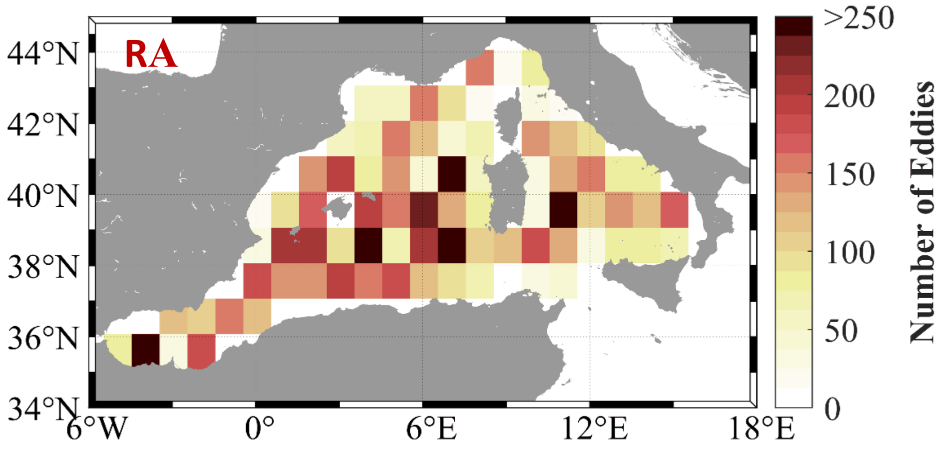


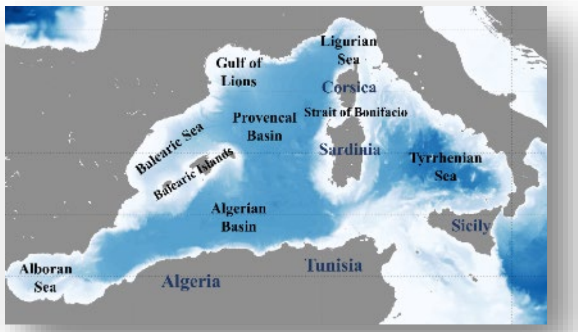




Normalized by $\frac{Mean_{each\_grid}}{Mean_{whole\_sea}}$



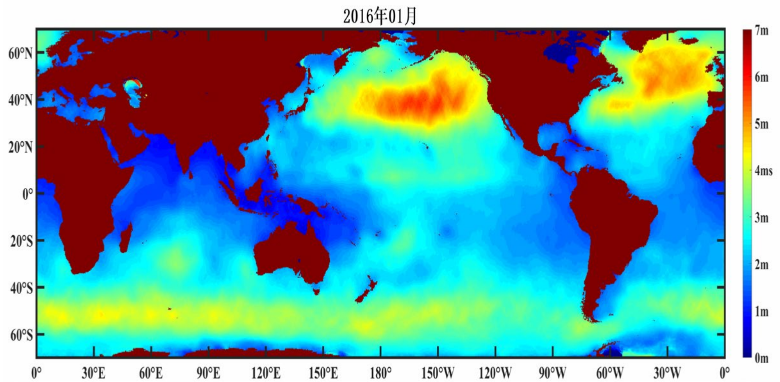




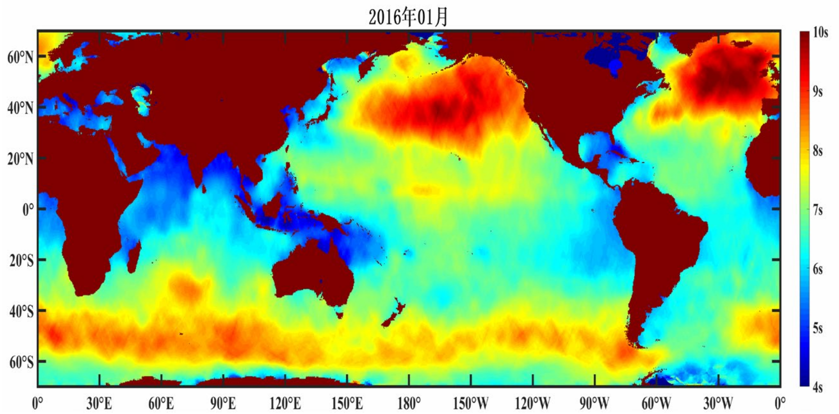
Notable differences in the spatial distributions of ocean eddies detected by SAR and RA.

Proj. 58900 (Ole Andersen, Jungang Yang)

Characteristics analysis of global ocean wave by merging satellites incl HY-2B/C/D RAs

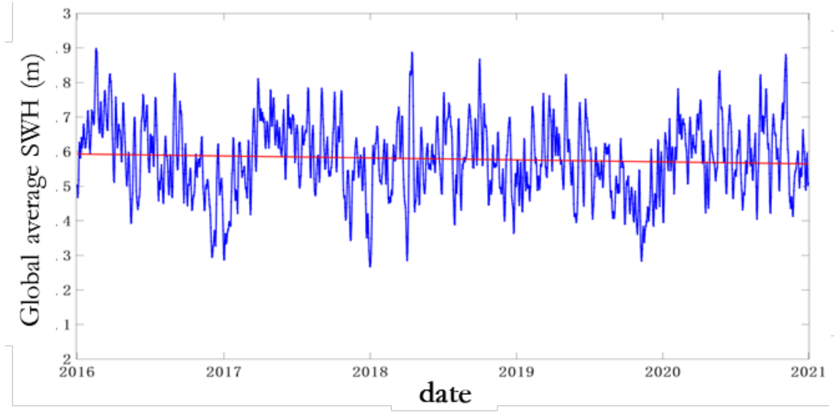


The distribution of global ocean wave monthly SWH

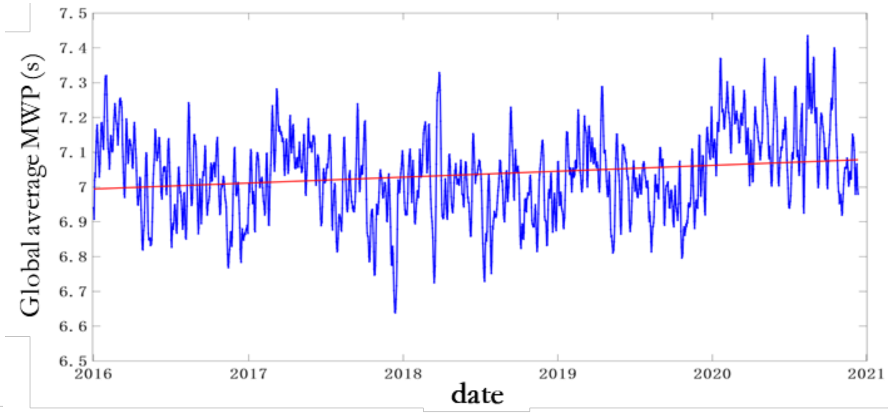


The distribution of global ocean wave monthly MWP

- Three areas of large SWH: the North Atlantic, the North Pacific and the Southern Ocean.
- From winter to summer, SWH decreases and MWP increases.
- From summer to winter, SWH increases and MWP decreases.



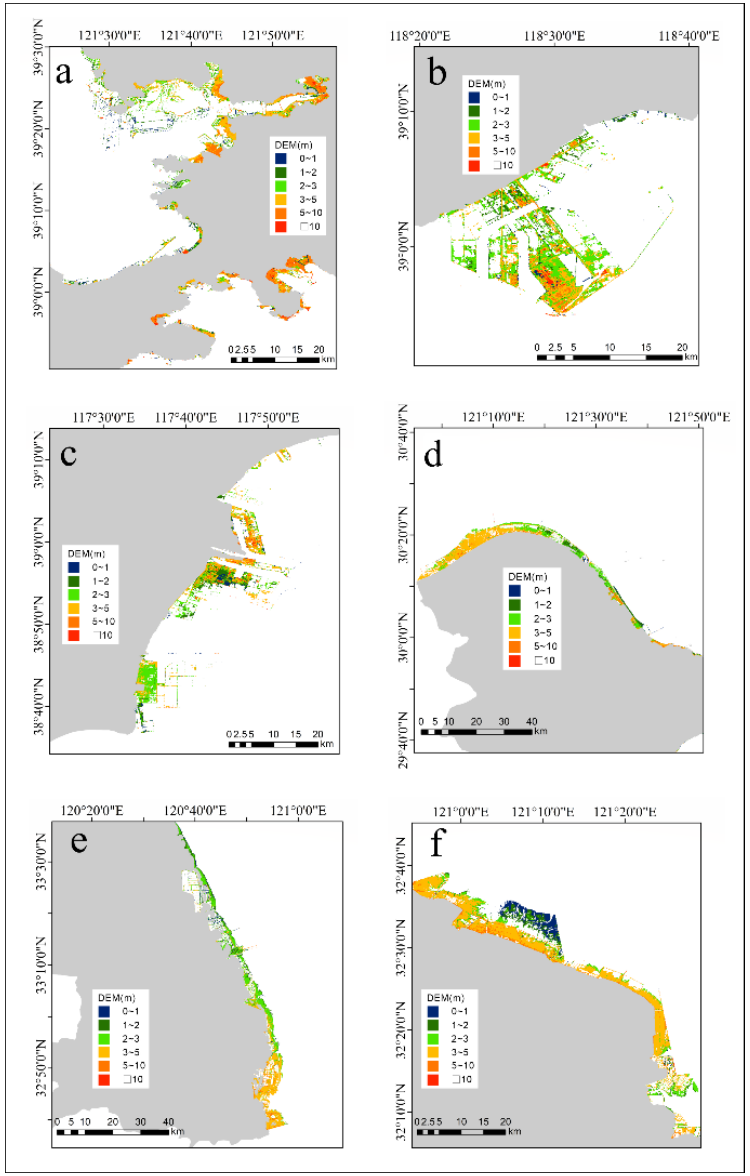
The temporal variations of global ocean wave monthly SWH



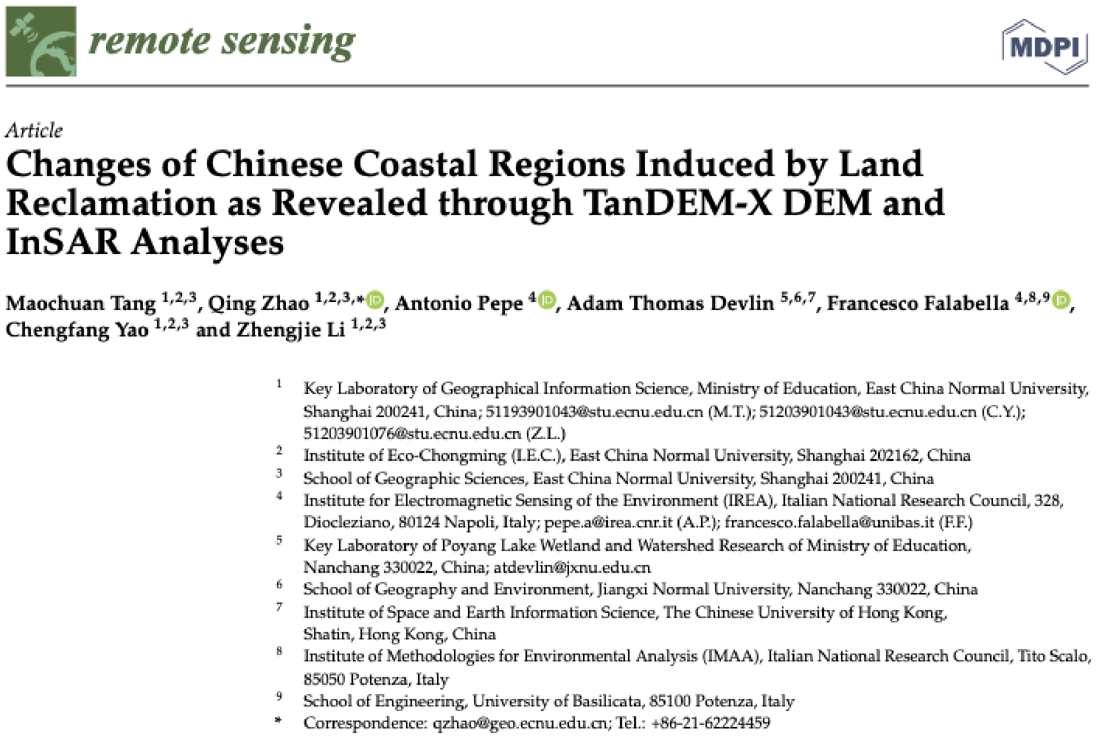
The temporal variations of global ocean wave monthly MWP

- SWH has the decreasing trend with time.
- MWP has the increasing trend with time.

Proj. 58351 (Antonio Pepe, Qing Zhao)



The terrain elevation changes of newly reclaimed land in selected coastal areas, i.e., (a) Dalian, (b) Tangshan, (c) Tianjin, (d) Ningbo, (e) Yancheng, (f) Nantong, obtained by comparing SRTM DEM (2000) and TanDEM-X (2015) (Tang et al. 2022).



remote sensing

MDPI

Article

Changes of Chinese Coastal Regions Induced by Land Reclamation as Revealed through TanDEM-X DEM and InSAR Analyses

Maochuan Tang [1,2,3], Qing Zhao [1,2,3,*], Antonio Pepe [4], Adam Thomas Devlin [5,6,7], Francesco Falabella [4,8,9], Chengfang Yao [1,2,3] and Zhengjie Li [1,2,3]

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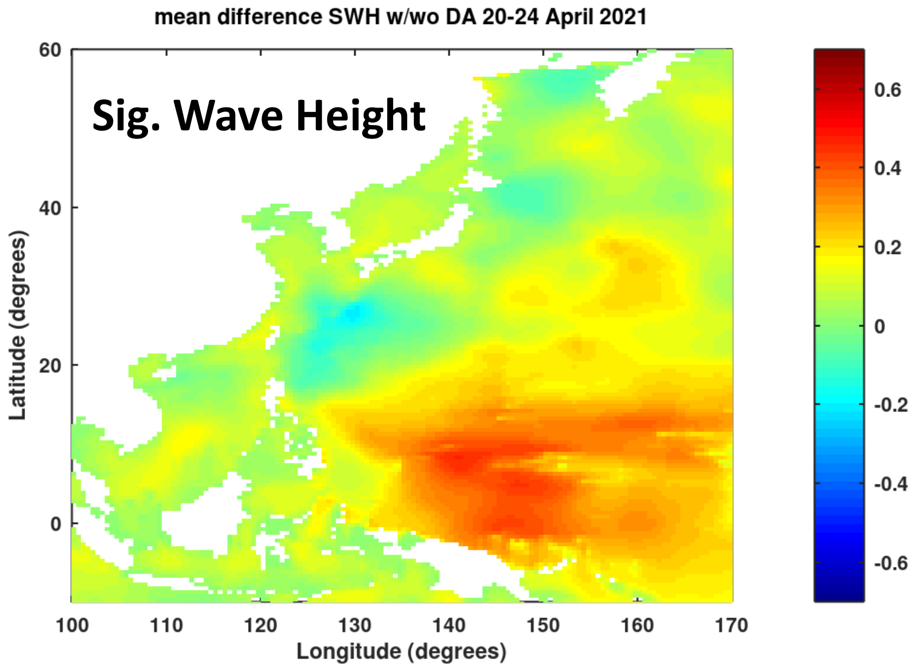
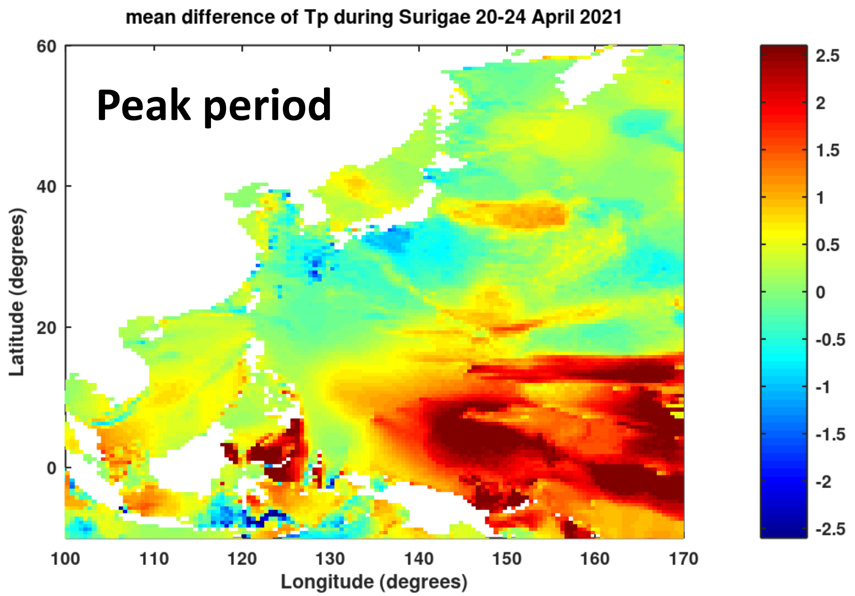
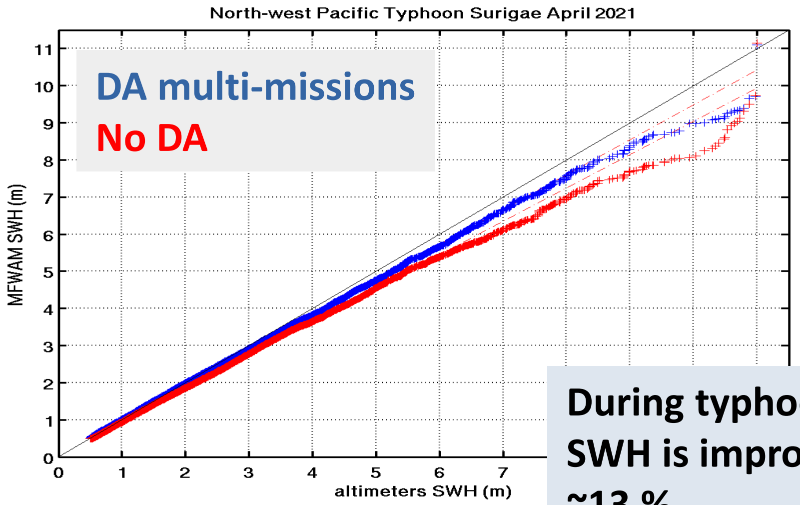
Proj. 59329 (Lotfi Aouf, Jiuke Wang)

The impact of wide swath SWH and directional wave spectra in typhoon Surigae : 20-24 April 2021







Q-Q plot of SWH indicates better PDF of SWH from DA (wide+spec) in Blue line particularly for high waves.

Validation with altimeters (ja3,Saral, S3)

During typhoon SURIGAE SWH is improved by roughly ~13 %

Seed questions: Science & Applications

What are the remaining issues concerning the exploitation of current mission data?

- *EO data are generally available easily, but China should continue to enhance data sharing with European Scientists, and increase capacity construction of data sharing.*
- *Reprocessing of older mission requested.*
- *Consider sharing "higher level" data (ML analyzed)*

What are the new science findings in the domain?

- *The bright patches (high radar backscatter) observed in C-band SAR images over the ocean are caused by surface splash products.*
- *Model-based NN can be successfully used to infer oil thickness in SAR imagery*
- *C-band backscatter from macro-algae is highly polarized*
- *Sub-mesoscale eddies found in SAR images concurring with mesoscale eddies in altimetry*
- *Rogue wave detection and determination of Maximum wave height for dangerous seas*
- *Wide swath significant wave height from scatterometry vs altimetry missions*

Seed questions: Science & Application

What is the general performance and what are the limitations of geophysical parameters retrieval?

- *There is still room for improvements in terms of the understanding of parameter retrieval especially when AI methodologies are used and potential use of physics informed methods.*
- *Lack of validation data (particularly open sea, rash environment) for physical parameters retrieval is a key problem.*

EO data synergy: is there scope for data synergy and if so which EO missions/sensors are required?

- *Synergy of multi-frequency (L, C and X) and multi-polarization (col, dual and quad-) spaceborne SAR data are required.*
- *Enhance synergy and interaction between project and space borne data (wind/waves/SST/SLA etc) .*

Seed questions: New EO Mission Exploitation

Validation : Have the necessary validation data been collected and shared?

- *New in situ campaigns are needed especially in challenging coastal areas, e.g., River mouths, tidal areas, etc.*

What are the new domains where further research is needed?

- *Model-based approaches to help a better comprehension of results achievable using AI is important.*
- *Studies of fine spatial scales (meters) and high temporal scales – particulare in the coastal/estuary environment*
- *Further understanding of the interaction between ocean parameters and processes based on satellite observations.*
- *Uses sea surface observations to investigate subsurface (even deep sea) phenomena.*

What are the synergy between Europe and China new missions to be exploited?

- *Synergy of Chinese CSAR01/02 and Sentinel-1A/1C/1D; HY1C/1D/1E and Sentinel-2; Sentinel-3/6 and HY-2D*

What complementarity in the operational use of the current / future missions (planning, observations, etc.) could be improved to allow better data exploitation?

- *Joint/synergy multiple satellite (e.g., SAR, from ESA and/or third party) for better data exploitation.*