Evaluation and Applications of Ocean Surface Wind Product From Fengyun-3 and Tianmu-1 GNSS-R Constellations

Feixiong Huang[1], Cong Yin[1], Xiaochun Zhai[2], Rongrong Li[3],Lei Li[3]

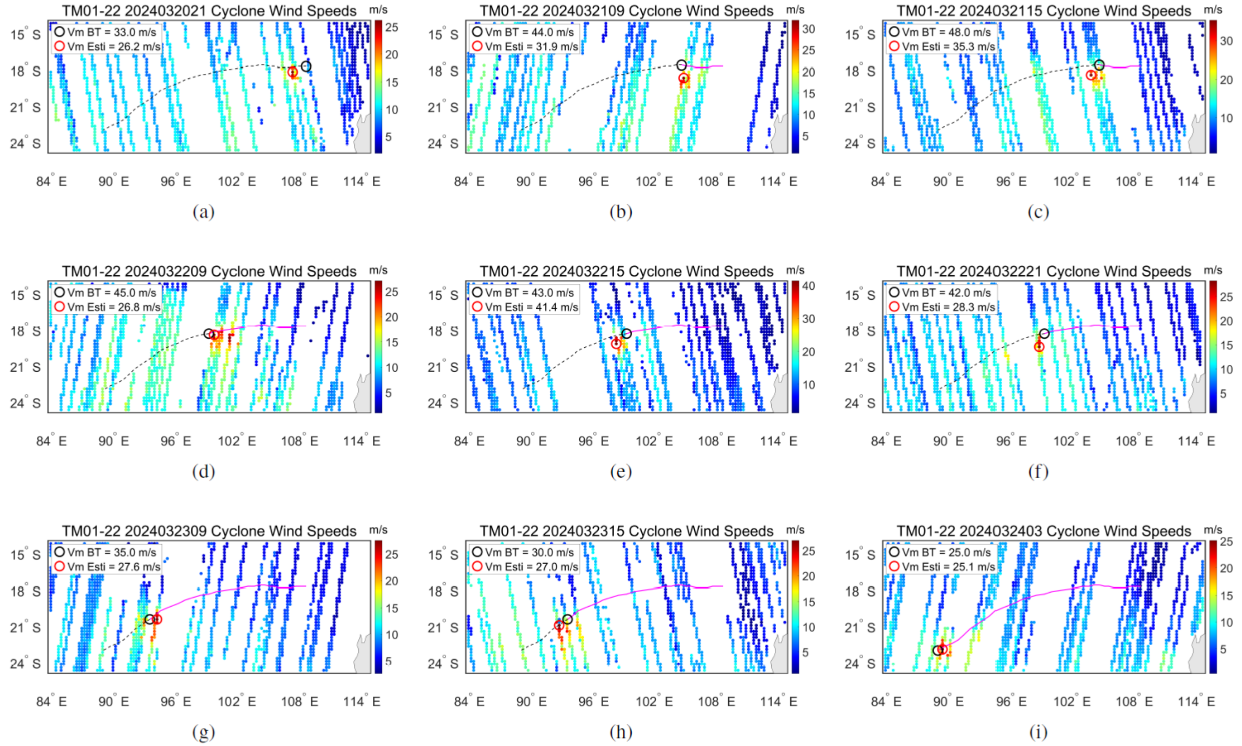
[1]National Space Science Center, Chinese Academy of Sciences
[2]National Satellite Meteorological Center, China Meteorological Administration
[3]Aerospace Tianmu (Chongqing) Satellite Science and Technology Co., Ltd.

GNSS-R Ocean Surface Wind Data (25 satellites):

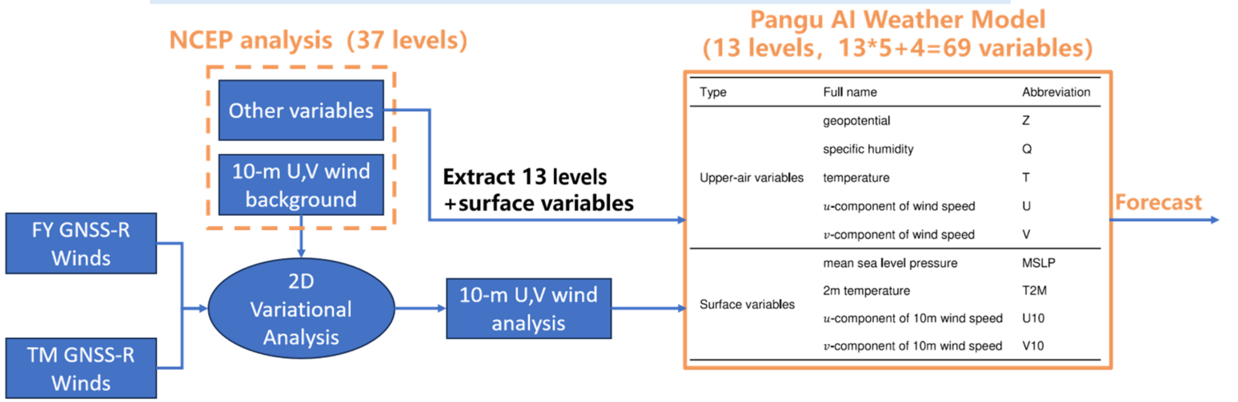
Mission	# Satellites	Launch Year
FY-3E/F/G	3	2021-2023
Tianmu-1	22	2023-2024

high temporal resolution

Application 1: Monitoring the location and intensity of TC Neville in March 2024 by every 6 hour

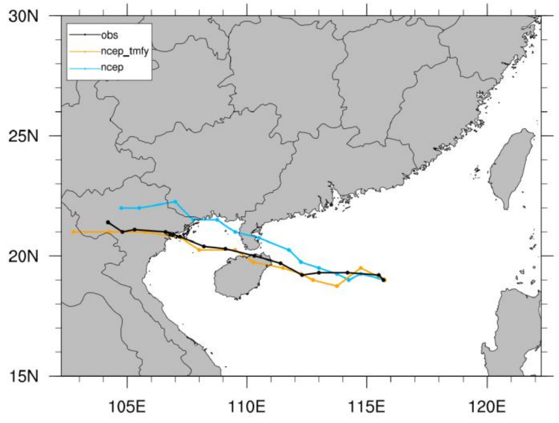


Application 2: Improving TC track forecasting of AI weather models

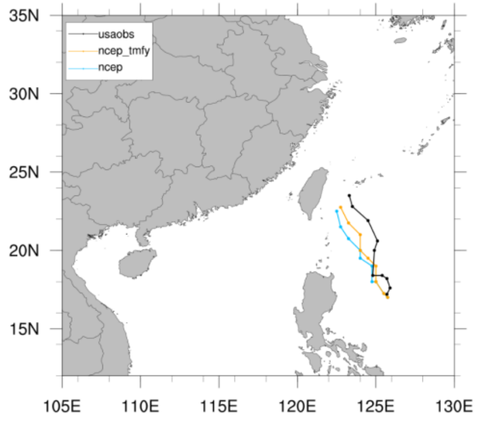


usaobs: TC best track (IBTrACS)
ncep: use NCEP analysis as input
ncep_tmfy: NCEP analysis and GNSS-R winds as input

Typhoon Yagi (20240905 00Z)



Typhoon Gaemi (20240721 18Z)

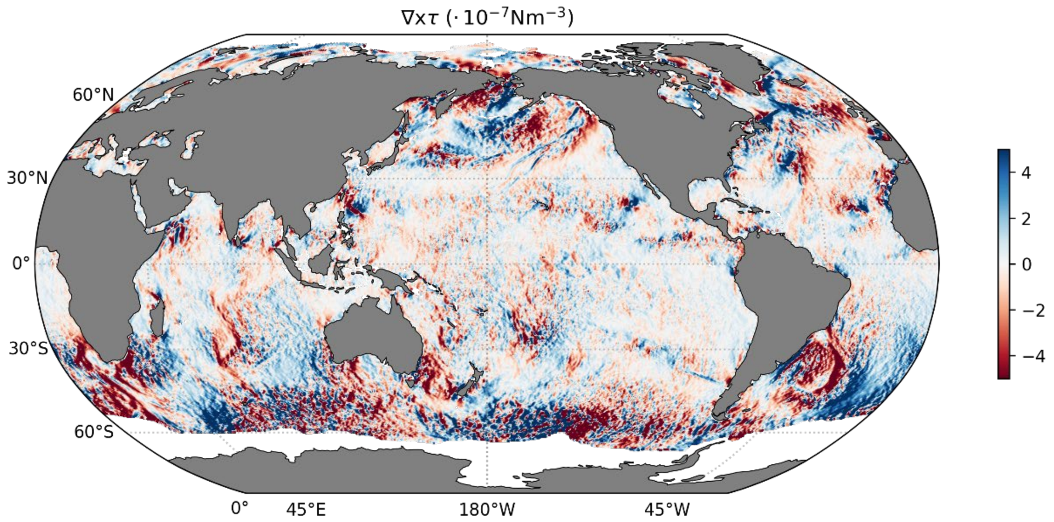


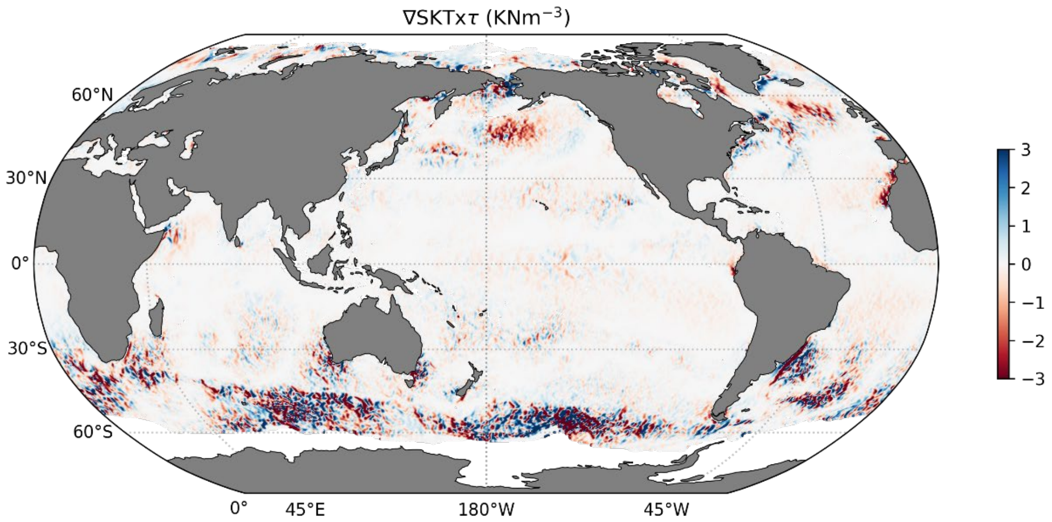
Coupling Atmospheric Dynamics and Ocean with Winds from Satellites

Stavroula Biri, Ad Stoffelen

How can we further reduce systematic model errors on large scale and atmospheric mesoscale?

- Evaluate the missing variance and error variance in NWP model wind fields; attribute these to geophysical processes using physics-informed diagnostics

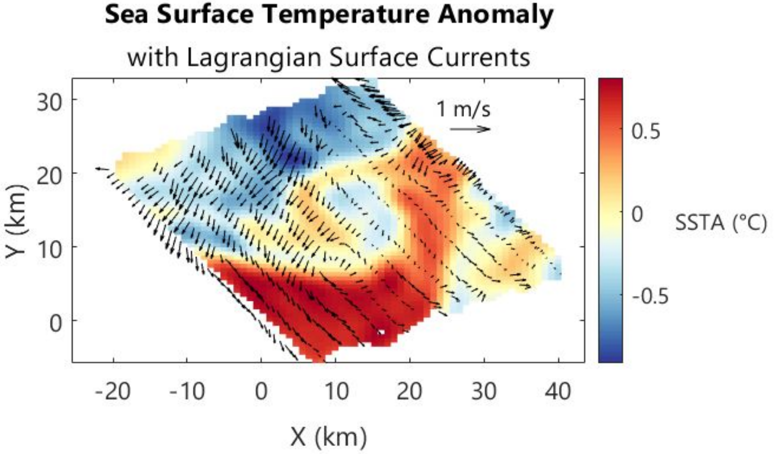




Stokes drift and current coupling at the submesoscale

Kayli Matsuyoshi[1], Luc Lenain[1], Mara Freilich[2], Nick Pizzo[3]
[1]Scripps Institution of Oceanography, University of California, San Diego [2]Brown University
[3]University of Rhode Island, Graduate School of Oceanography

Determining the **role of waves in submesoscale feature evolution** by investigating whether Stokes forces induce, respond to, or are independent of the velocity gradient fields generated.



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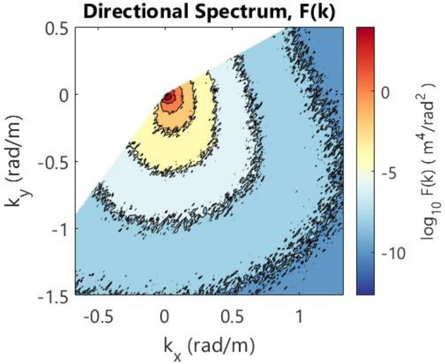
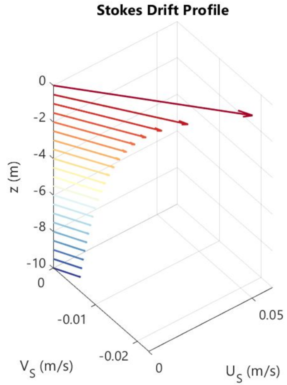


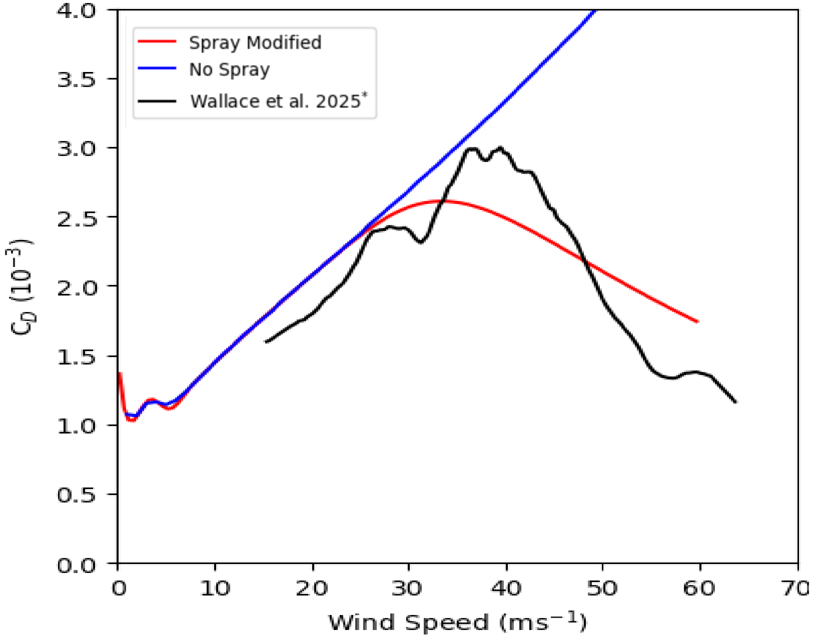


MODELING SPRAY IMPACTS ON WIND SPEED, STRESS, AND DRAG COEFFICIENTS

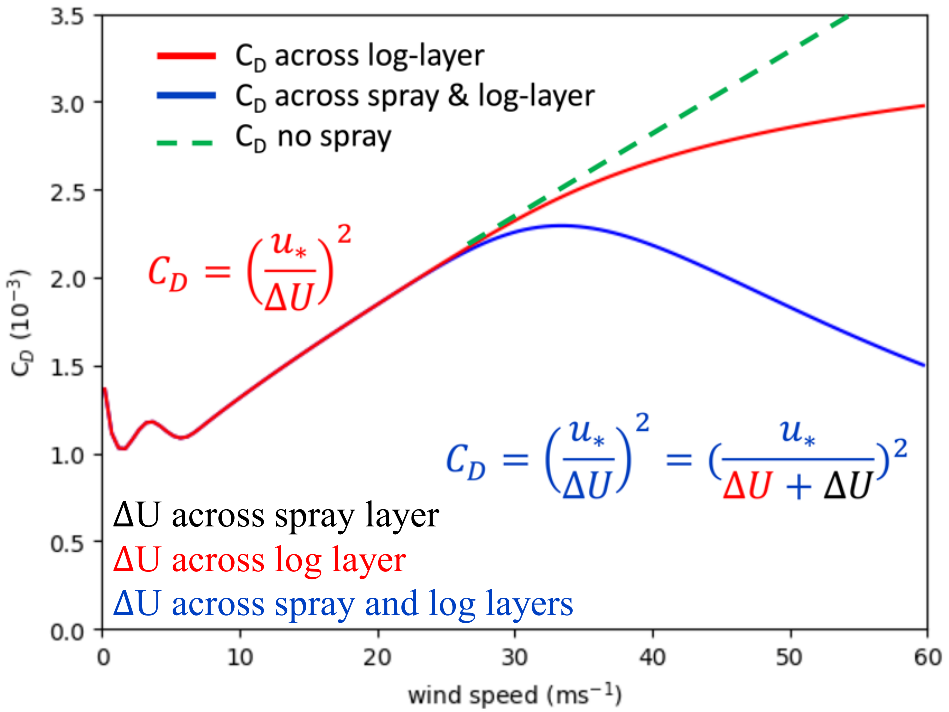
Renee J. Richardson[1,2] and Mark A. Bourassa[1,2]
Florida State University[1], Department of Earth, Ocean and Atmospheric Science, Tallahassee, FL, USA
Center for Ocean-Atmospheric Prediction Studies[2], Tallahassee FL, USA

IOVWST Meeting 2025
Darmstadt, Germany

- Nontraditional boundary layer approach assumes a thin, spray layer being present underneath the constant flux layer
- Under this assumption, C_D is more consistent with observational analyses, however, more processes are at play

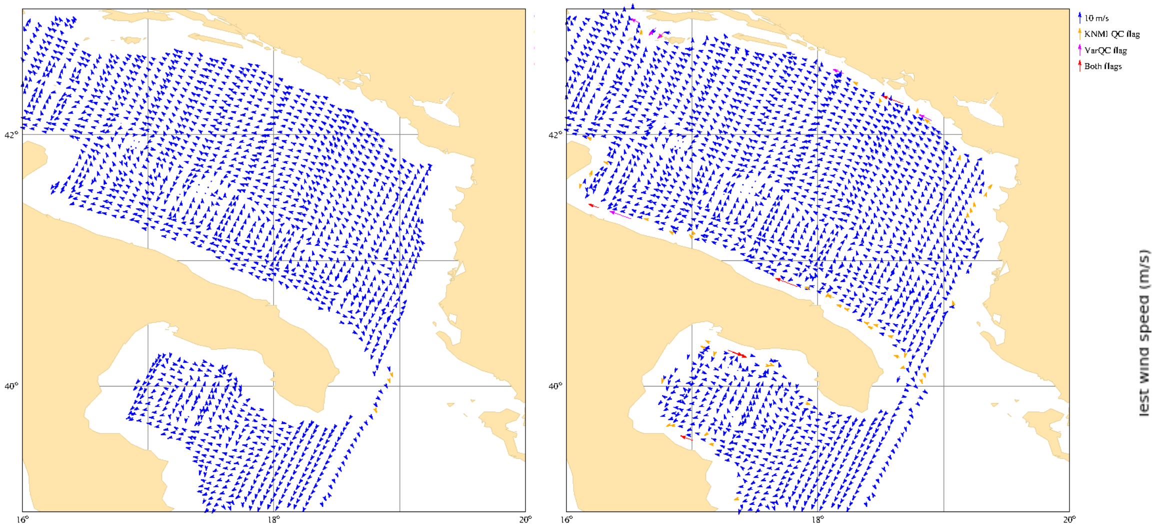


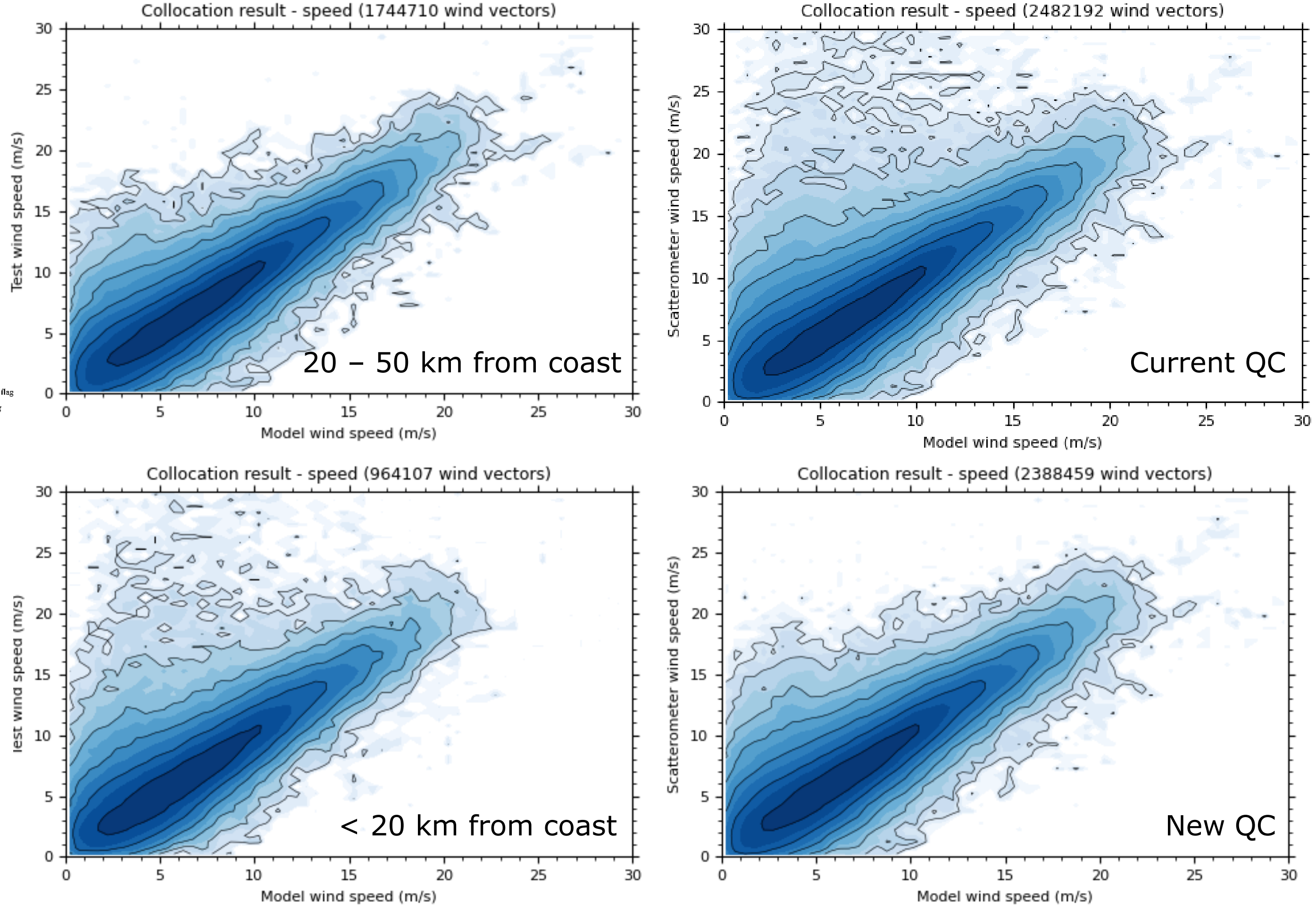
- Total vertical wind shear across the surface layer (ΔU) demonstrate a C_D that is more representative of observations



ASCAT higher resolution winds closer to the coast

- Left column: we have implemented land corrections and coastal retrievals in the 6 km ASCAT wind product
- Mid column: this comes with some unrealistic high wind speeds close to the coast
- Right column: we present some ways forward to improve the situation





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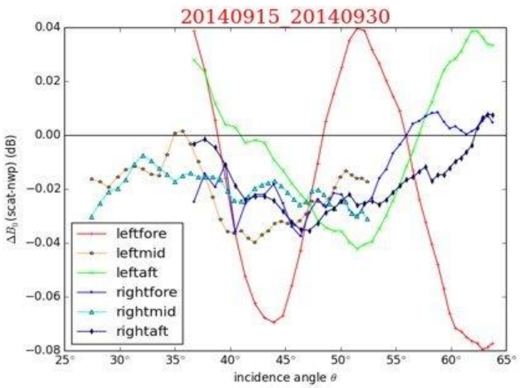
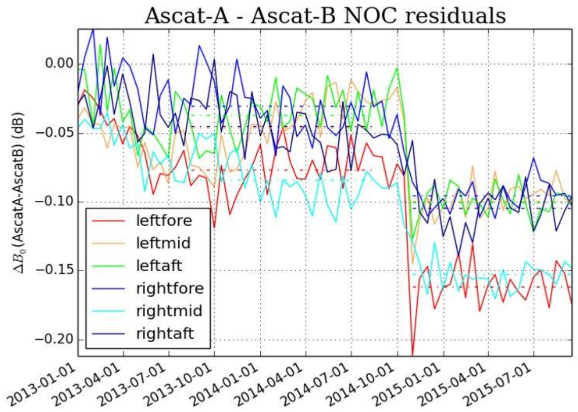
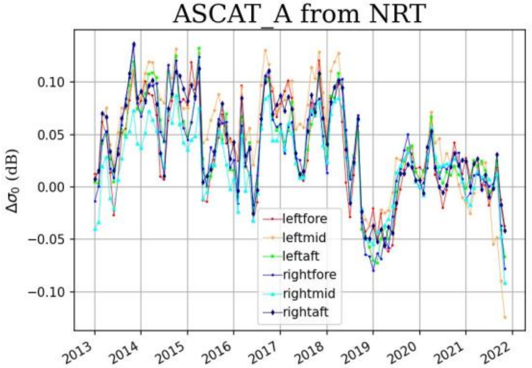
ASCAT-A scatterometer wind product reprocessing

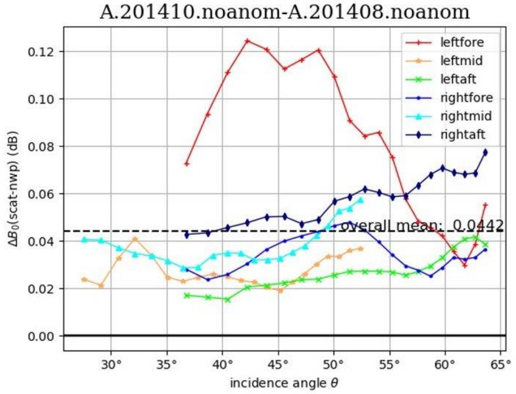
- ASCAT-A scatterometer reprocessing planned with ERA5 stress-equivalent 10 m background winds
- The level1b data has been reprocessed by EUMETSAT
- Instrument anomalies have been re-evaluated

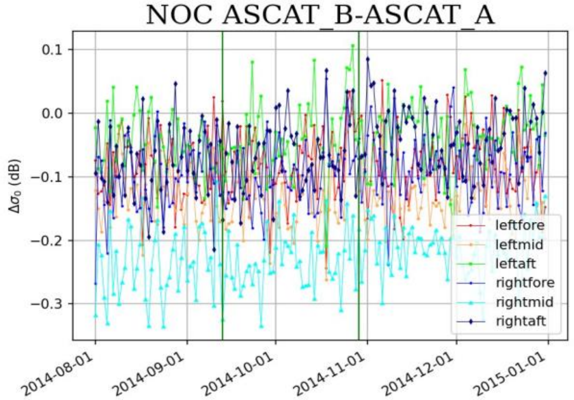


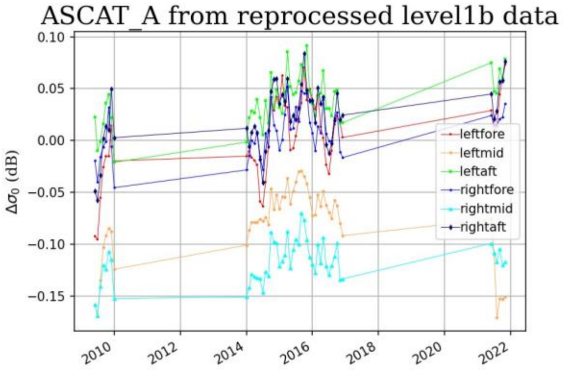




NRT





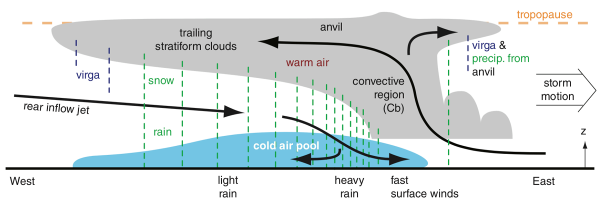


Reprocessed level1b test data

Royal Netherlands Meteorological Institute
Jeroen Verspeek, Ad Stoffelen, Anton Verhoef

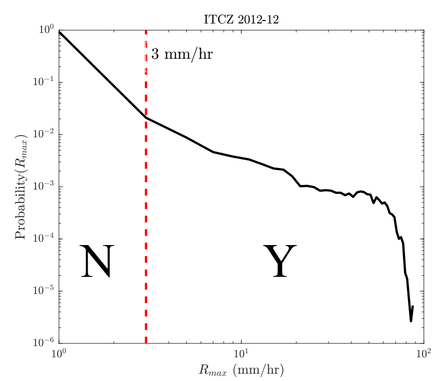
Identifying Tropical Cold Pools with Singularity Exponents

Gregory P King[ATTIC], Marcos Portabella[ICM] and Wenming Lin[NUIST]



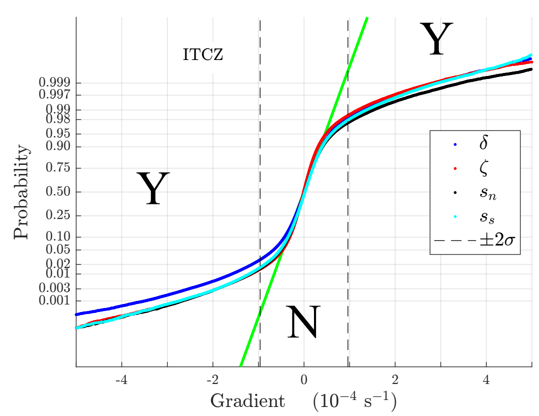
Rain rate extremes

$R_{max} > 3$ **m/hr**



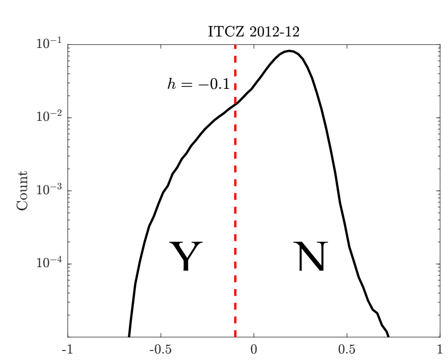
Wind gradients

$$|\nabla \mathbf{u}|_F = \frac{1}{2}\sqrt{\delta^2 + \zeta^2 + s_n^2 + s_s^2}$$



Singularity Exponents

$$|\nabla \mathbf{u}(\mathbf{x})| \sim r^{h(\mathbf{x})}$$



Contingency table for binary variables A and B.
Y $\implies$ exceeds threshold.

		B: Y	B: N
A	Y	n_{11}	n_{12}
	N	n_{21}	n_{22}

$$\text{Odds Ratio} = \frac{n_{11}\, n_{22}}{n_{12}\, n_{21}}$$

Significant correlation when

$$OR(A, B) > 1$$

Case showing spatial locations of $\{n_{11}, n_{12}, n_{21}, n_{22}\}$

Odds Ratio