Remote Sensing Systems
www.remss.com

RSS Updates on Satellite Wind Processing and Validation

Lucrezia Ricciardulli, Thomas Meissner, Andrew Manaster*, Richard Lindsley, Carl Mears, Katherine Wentz

Remote Sensing Systems, Santa Rosa, CA, USA

**** Now at .....***

Updates on:

1) **Paper on TAO spurious wind bias**
2) **Implementation of new AMSR2 TC-wind algorithm for rain mitigation**
3) **RFI impact on wind measurements**

This study is supported by NASA OVWST

Update 1: TAO buoys

TAO Buoys spurious wind bias since mid-2020

Identification of a spurious jump in the TAO buoy winds using satellite observations

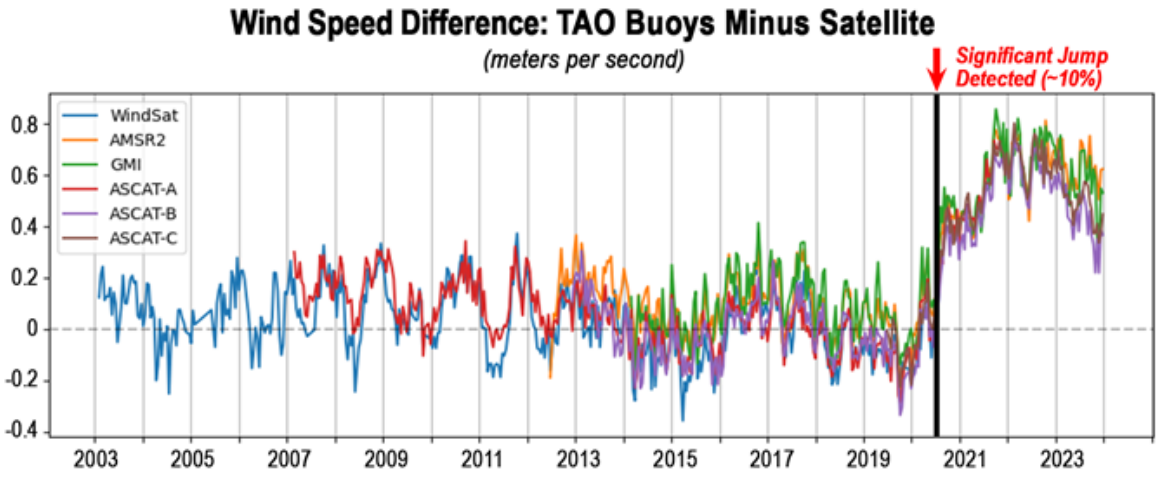
PI: L. Ricciardulli, *Remote Sensing Systems*

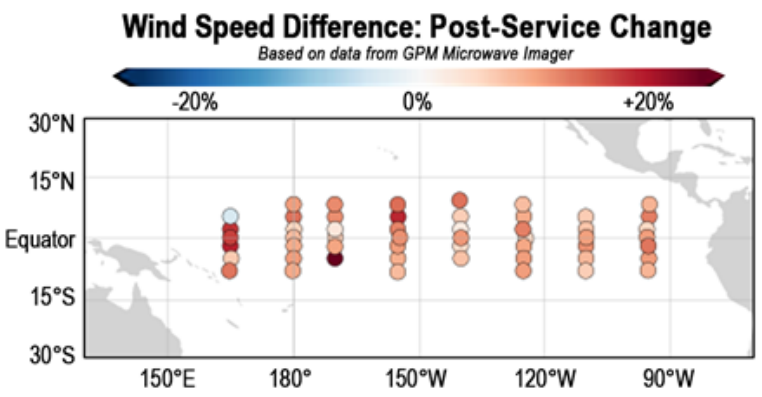
Remote Sensing Systems
www.remss.com

Thank you for your feedback at IOVWST 2024.

Results were summarized at NASA HQ ⇨

The paper is published on BAMS ⇨





The jump was identified in all TAO buoys after they were serviced since mid-2020. The exact source of this change is still under investigation at National Data Buoy Center.

The Tropical Atmosphere Ocean (TAO) array is a system of 55 moored buoys in the tropical Pacific Ocean designed to monitor variability and investigate El Niño Southern Oscillation (ENSO) events.

Using wind retrievals from multiple cross-calibrated microwave satellites, we have identified a significant spurious change of 0.5-0.8 m/s (~10%) in the ocean surface wind from the TAO buoy array since mid-2020, impacting the global scientific community.

Other arrays (i.e., PIRATA, RAMA) are not affected. The resulting inconsistency between the calibration of the TAO versus the other buoy arrays undermines the use of global buoy data as ground truth, such as for satellite calibration.

These findings reinforce the value of global efforts from several groups in creating stable and accurate satellite ocean wind Climate Data Records able to detect changes as little as 0.1 m/s when averaged in space and time (Wentz et al. 2017).

Stability of the integrated satellite-buoy system is key for international ocean observation programs, climate variability studies, and data assimilation.

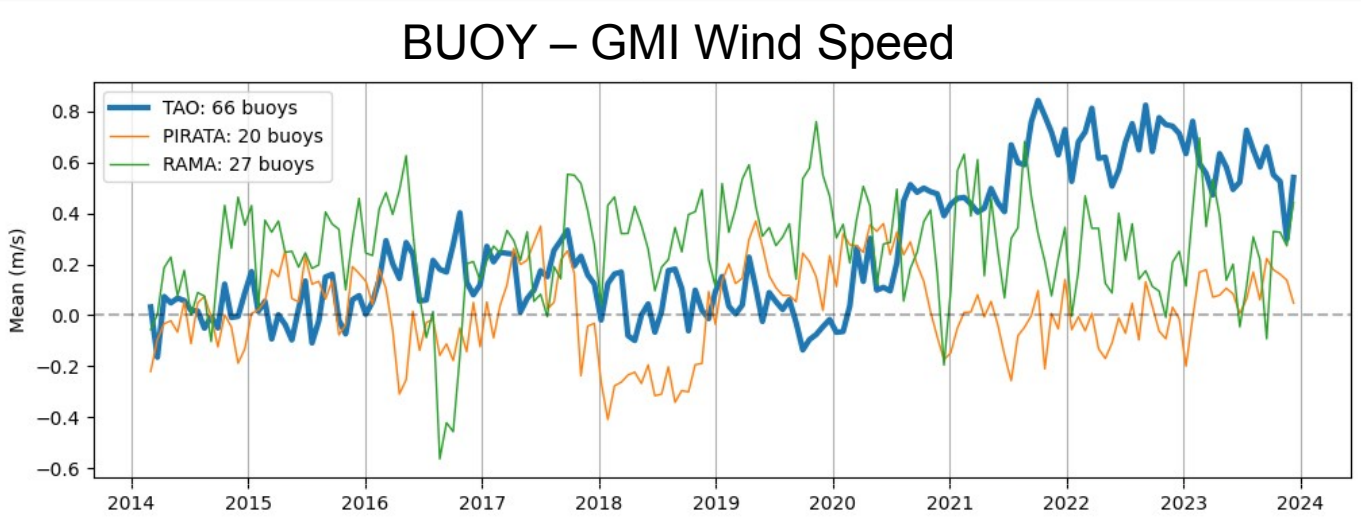
Ricciardulli, L., Manaster, A. and Lindsley, R.: Investigation of a calibration change in the ocean surface wind measurements from the TAO buoy array. *Bulletin of the American Meteorological Society*. Early Online Release, 7 January 2025, DOI 10.1175/BAMS-D-24-0072.1.

Impact on Users

Do not use or adjust TAO winds after 2020 for:

- Satellite calibration/validation
- Verification of other observationally-based method (i.e. Saildrones, merged wind datasets, etc..)
- Climate Data Record
- Data assimilation in NWP: reject, or adjust (reduce by ~10%)
- Surface Heat Fluxes: dataset development or verification
- Tropical climate variability analyses need to account for spurious signal

Misalignment with other buoy arrays



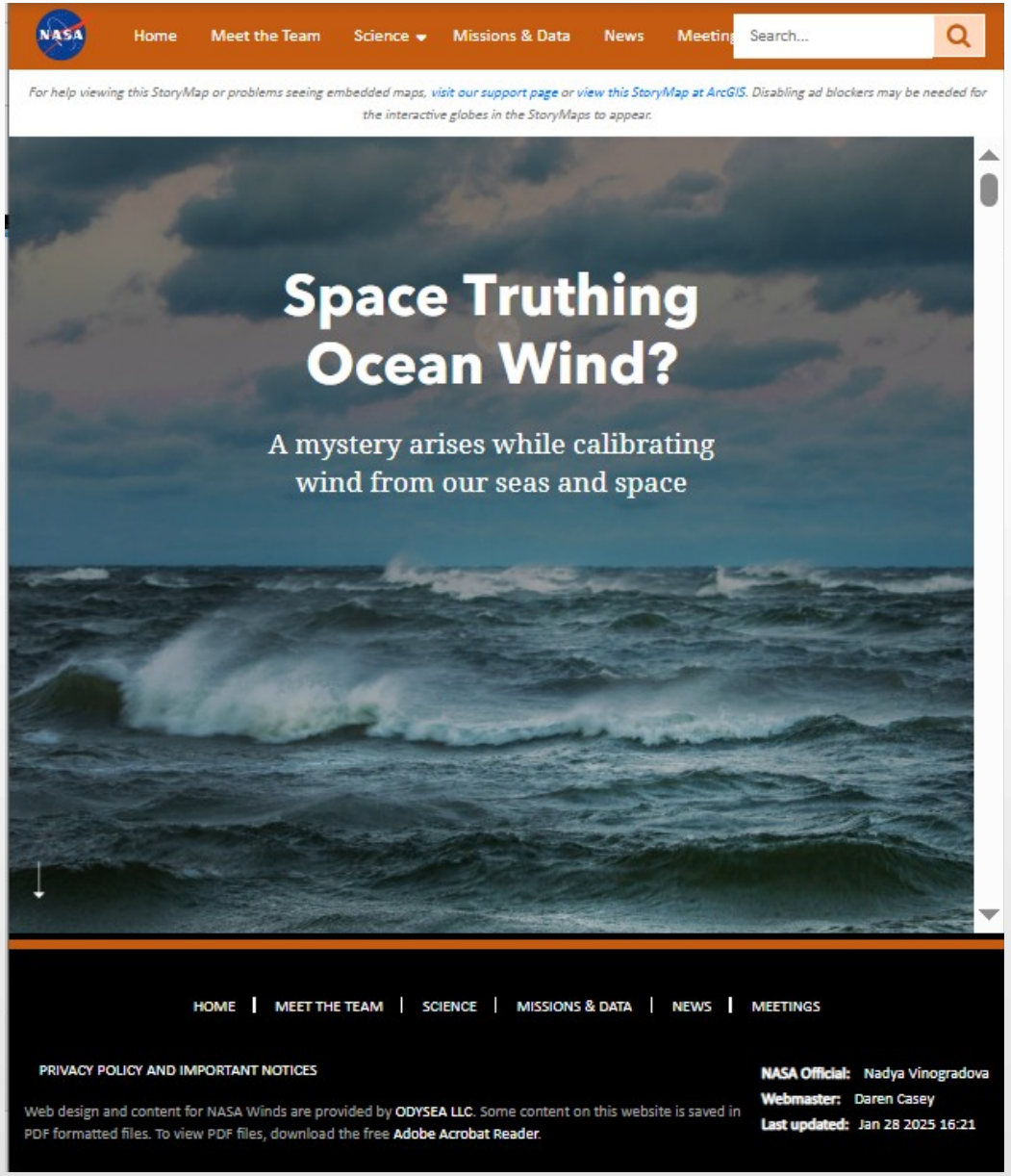
Any significant change in the calibration of the ground truth needs to be coordinated with the global scientific community.

StoryMap

This StoryMap by Annette deCharon presents an engaging story on ocean wind measurements from buoy and satellites; how they are used for satellite calibration; the discovery of the TAO spurious bias, and its impact.

Thank you Annette!

https://nasawinds.org/storymaps/space_truthing.htm



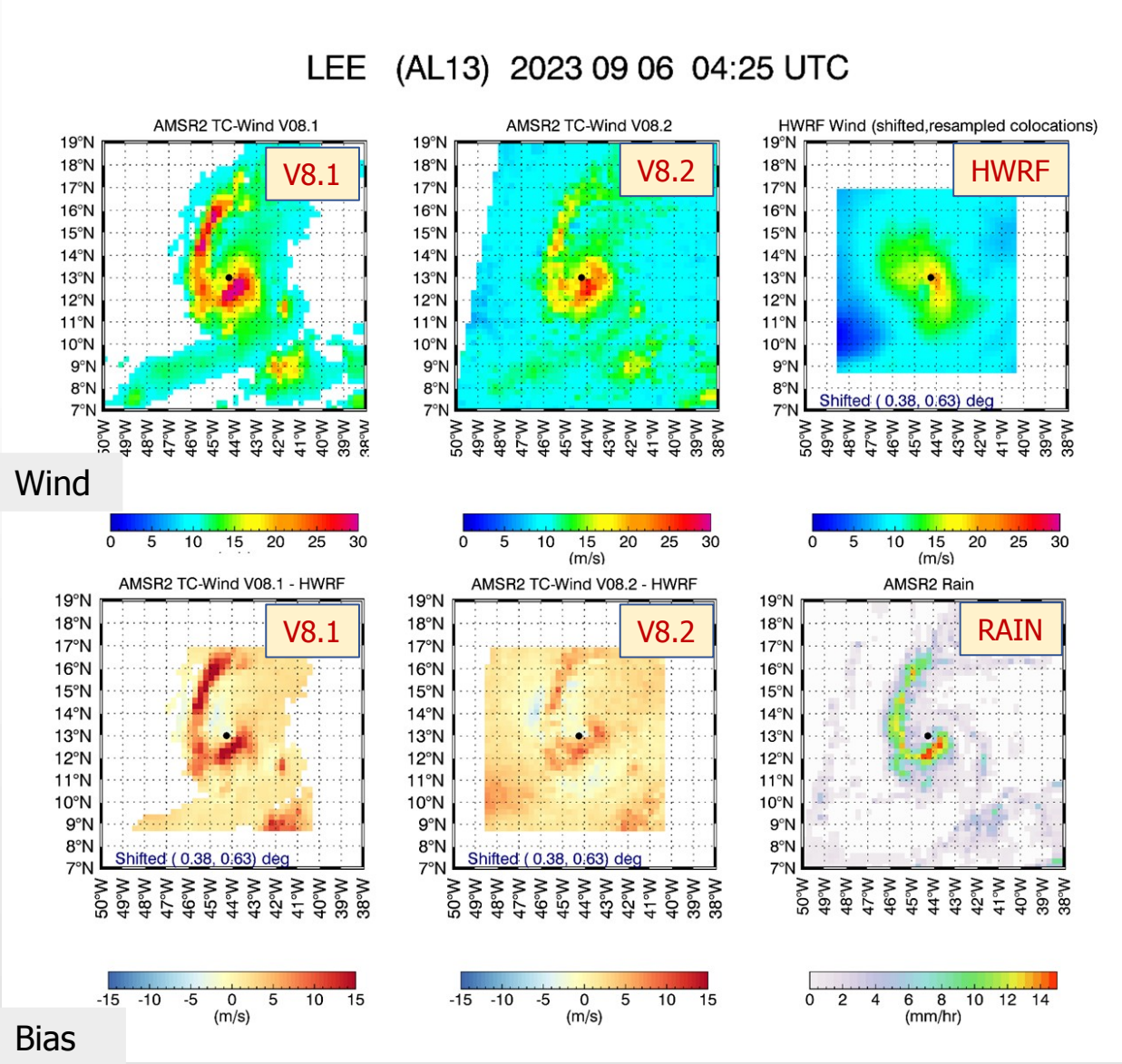
Update 2: AMSR2 new wind algorithm

New AMSR2 TC-wind algorithm to mitigate rain/ice impact

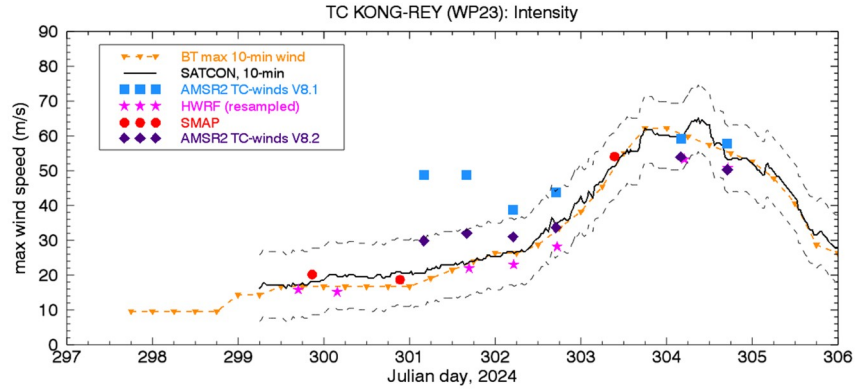
- AMSR2 TC-winds V8.1: We had found cases of significant wind bias (> 10 m/s) in TC core winds and rain bands due to residual spurious rain/ice signal, more common in storm's early stage and below 30 m/s, often in areas with unusually cold 89 GHz (see IOVWST 2024)

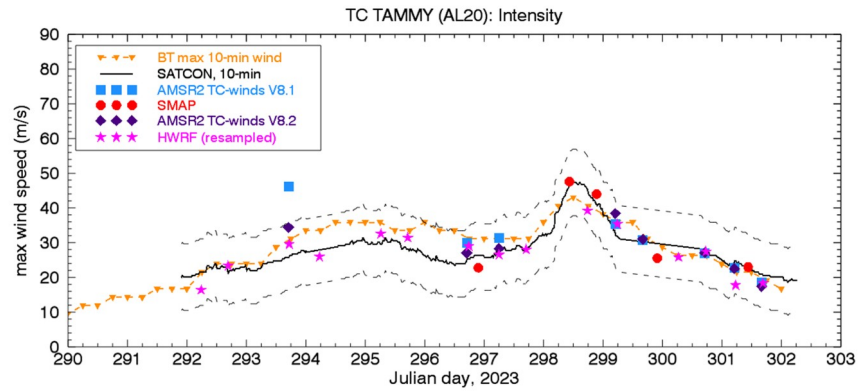
TC-winds V8.2

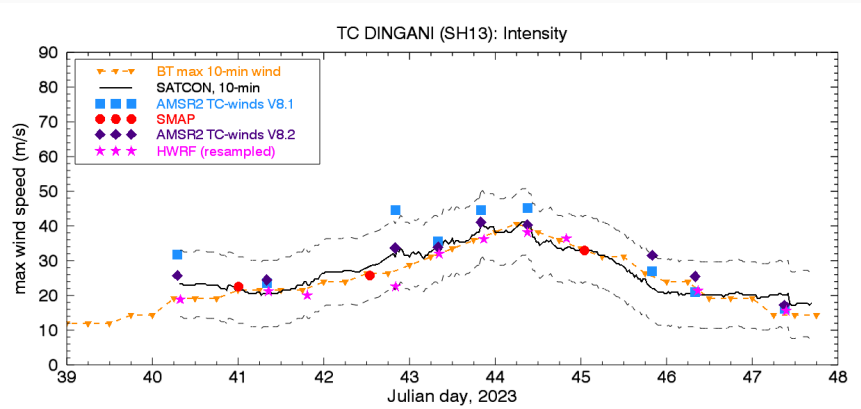
- We retrained the AMSR2 all-weather wind algorithm including all channels, 6-89 GHz.
- Processing of AMSR2 TC-Winds V8.2 was implemented in NRT in November 2024.

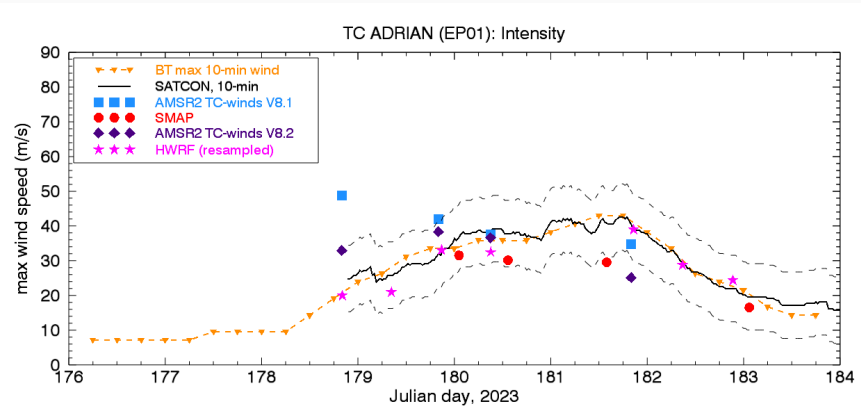


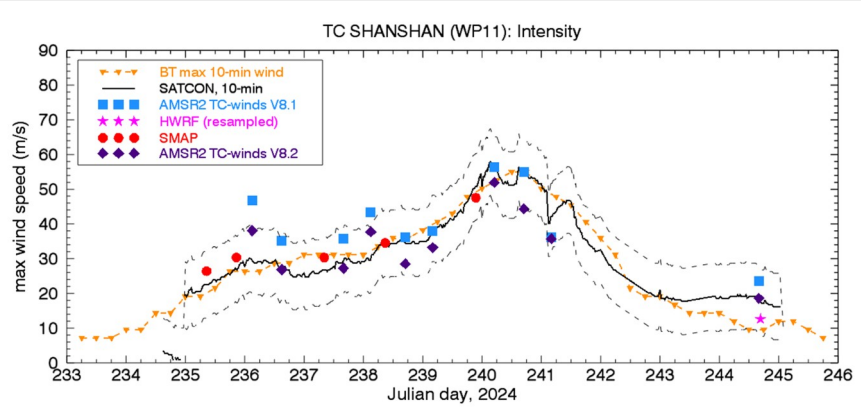
Examples of bias reduction with AMSR2 TC-Winds V8.2

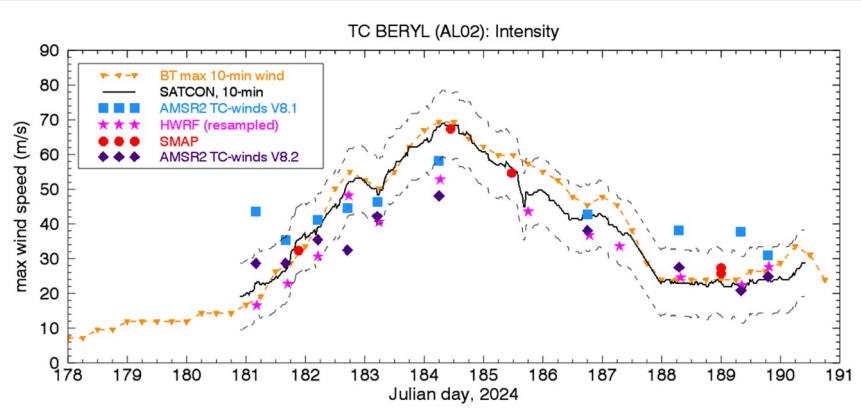












Update 3: Increasing RFI at 1-10 GHz

Recent RFI in SMAP

Recent persistent RFI in SMAP

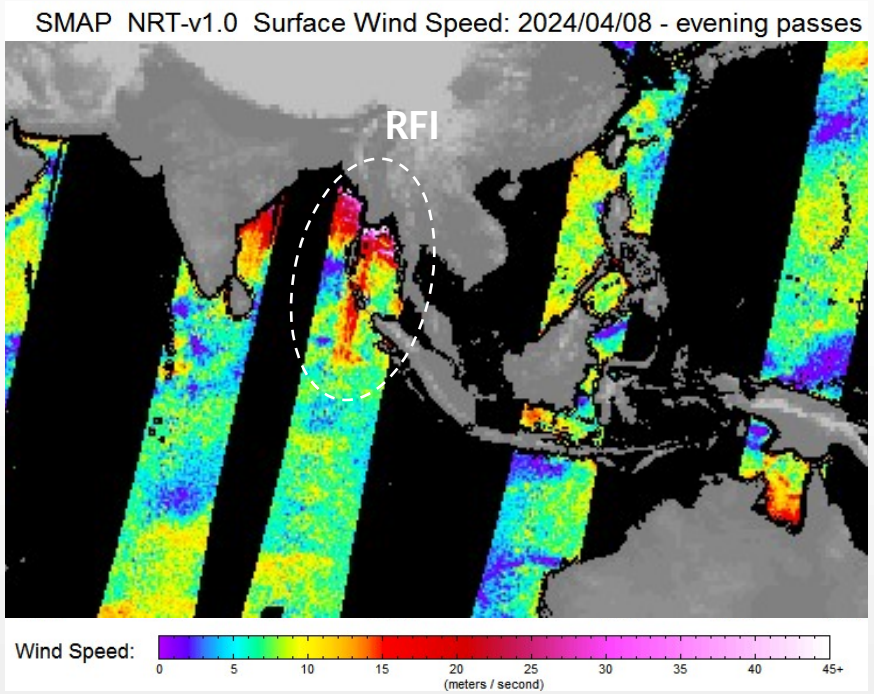
- New L-band (1.4 GHz) RFI in Bay of Bengal

Since Dec 2023, both asc/desc ☐ land/ship based

- Very large positive bias
- Additional occasional RFI near Taiwan and Mediterranean

☐ Automated detection (flag) is complicated, under development;

☐ Easier option to mask region



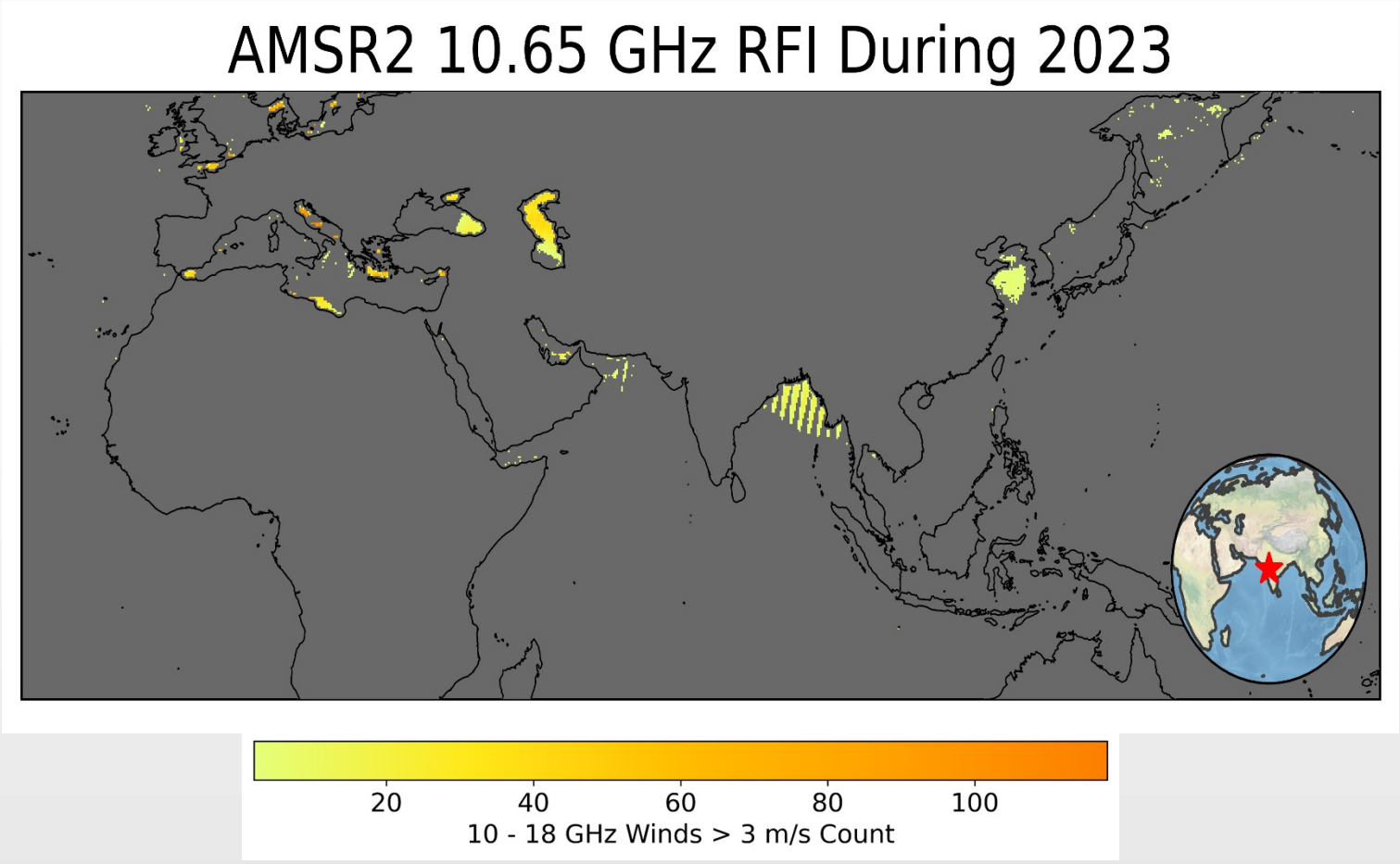
RFI 10 GHz, Descending passes

Occasional RFI in AMSR2

- New RFI source in C-band (6-7 GHz) and (10 GHz) in Bay of Bengal
- Descending passes (1:30 am)
- Not yet flagged
- Other RFI over global coastal waters at 10 GHz is filtered
- Location changes over time, frequent updates in RFI filter

The figure shows regions with large differences of two wind products, one using 18 GHz and above, the other including 10 GHz:

Wind (10)- Wind(18) > 3 m/s

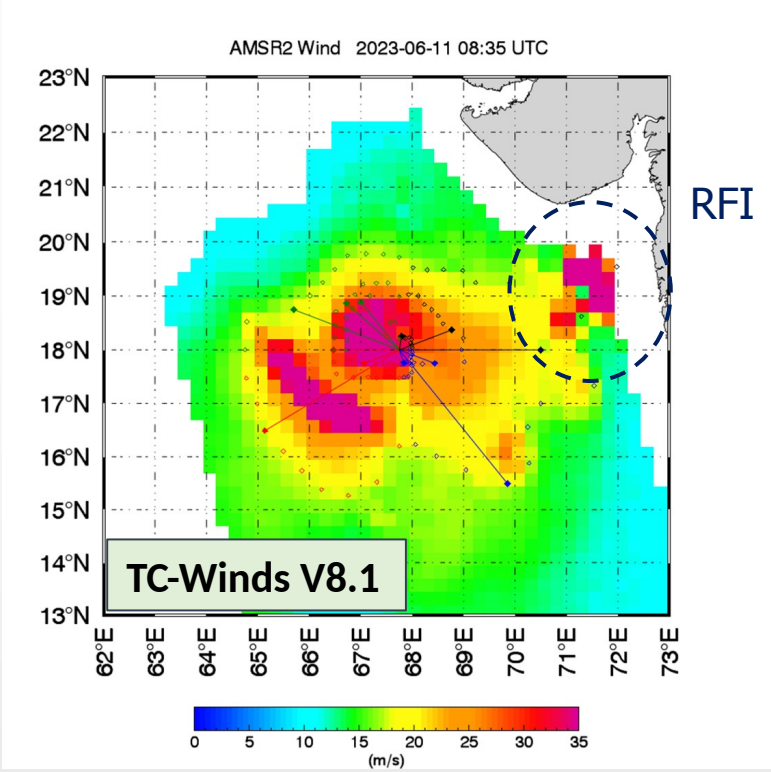


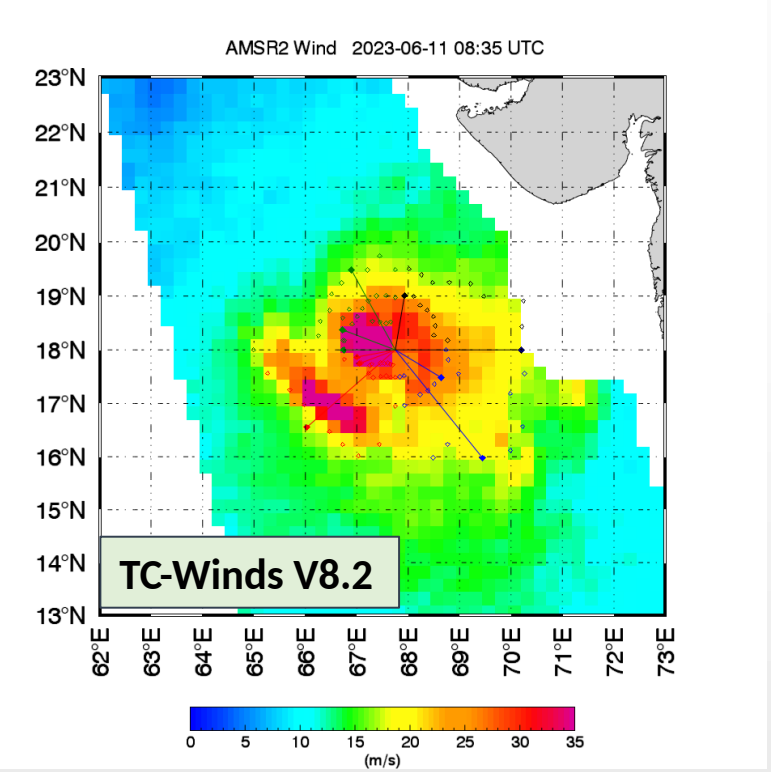
Incidence of cases for which wind (10)-wind(18) > 3 m/s over one year

AMSR2 RFI 6-7 GHZ

BIPARJOY (IO02)
06-11-2023 08 UTC

- New RFI in 6-7 GHz channels was detected often in Bay of Bengal and Arabian sea; stationary/land based (asc/desc)
- Additional RFI flag was implemented in TC-winds V8.2





if TB(6 or 7 GHz) –TB(10 GHz) > 0.1 K
then skip retrieval