Towards a consolidated wind reference for assessing scatterometer high and extreme-force wind capabilities

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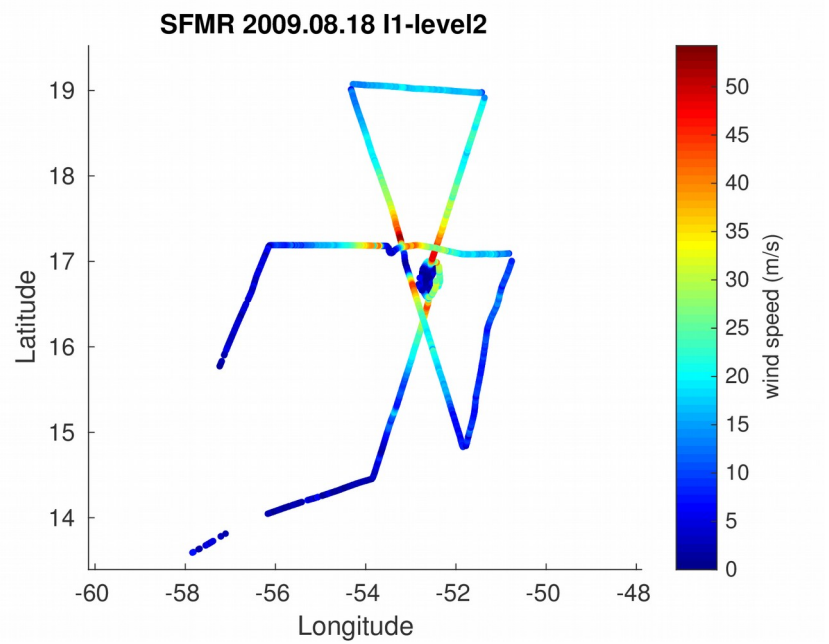
ICM Contribution to CHEFS

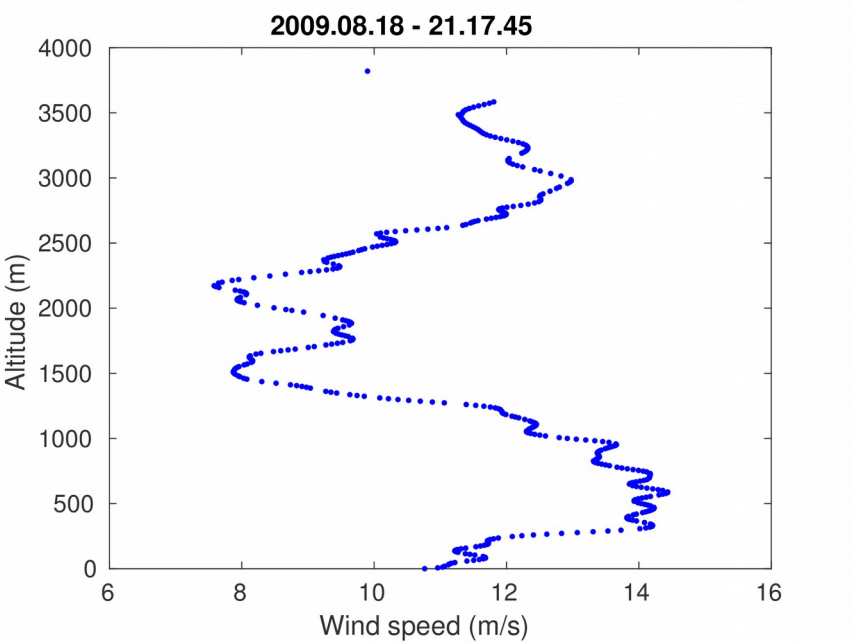
- **Cal/Val of Stepped Frequency Microwave Radiometer (SFMR) using dropsonde**
- **Assess buoy wind reference quality**
- **Reprocessing of ASCAT mission with neutral/stress-equivalent ERA5 winds**
- **Collocation of ASCAT with reference/model data**
- **Analysis of ancillary VV and VH dependencies**

Dropsonde and SFMR



SFMR:

- Nadir-pointing radiometer at C-band.
- The equivalent neutral surface wind speed retrieved by inversion of a Geophysical Model Function.
- Surface wind retrieval are provided in **1-sec sampling** and the **aircraft position** is assigned to each wind retrieval.
- Data availability: from **2008 to 2016**



Dropsondes:

- They provide the wind profile
- The 10m equivalent neutral surface wind speed and direction *empirically derived* by the **WL150 algorithm.**
- Surface wind value consists in an **height-weighted average** of the dropsonde readings available within the lowest **150m-layer** between 10m and 350m. [Sapp et al., 2016; Uhlhorn et al., 2007]

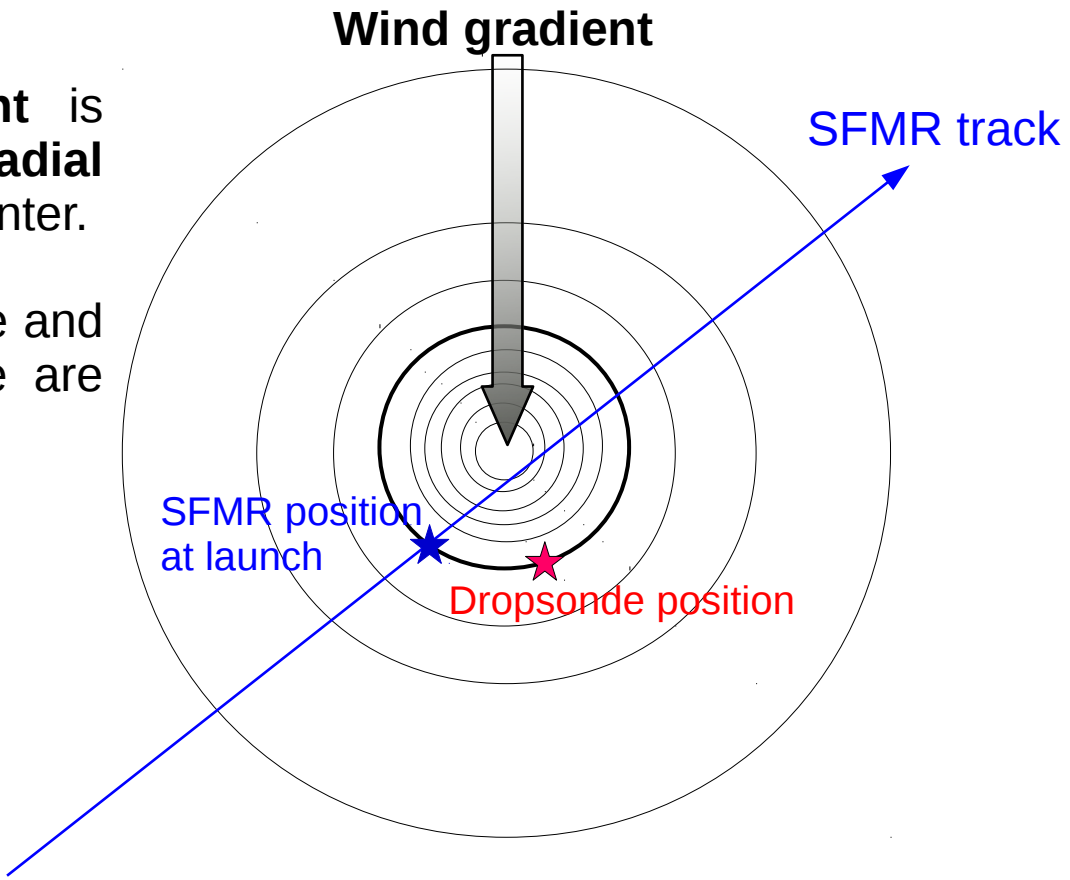
Dropsonde/SFMR Collocation Criteria (1/2)

Using the **dropsonde launch time** → Associating to the dropsonde surface winds the SFMR value at the dropsonde launch time

The dropsonde **displacement** is generally with the **same radial distance** with respect to the center.

We assume that the dropsonde and the SFMR at the launch time are observing the same wind.

[Uhlhorn et al., 2007 and Klotz et al., 2014]



Dropsonde/SFMR Collocation Criteria (2/2)

- **771 available dropsonde measurements** have to be associated to the corresponding flight and SFMR measurement.

- The **flight identifier (ID)** is used

  A) When the ID is available:

  Selected SFMR wind → $\Delta t = |(t_{SFMR} - t_{lauch})| \leq$ **1 sec**

  (if the SFMR wind at launch time is not available)

  B) When the ID is not avalable:

  Selected SFMR wind → $\min(\Delta t) \leq 1$ sec with $\Delta t = |(t_{SFMR} - t_{lauch})|$

  → $\min(\Delta d) \leq 10$ km with $\Delta d = |(d_{SFMR} - d_{lauch})|$

  (if more than one flight at the same day/time)

d_{launch}/t_{lauch}: dropsonde position/time at launch

Subset of conditions

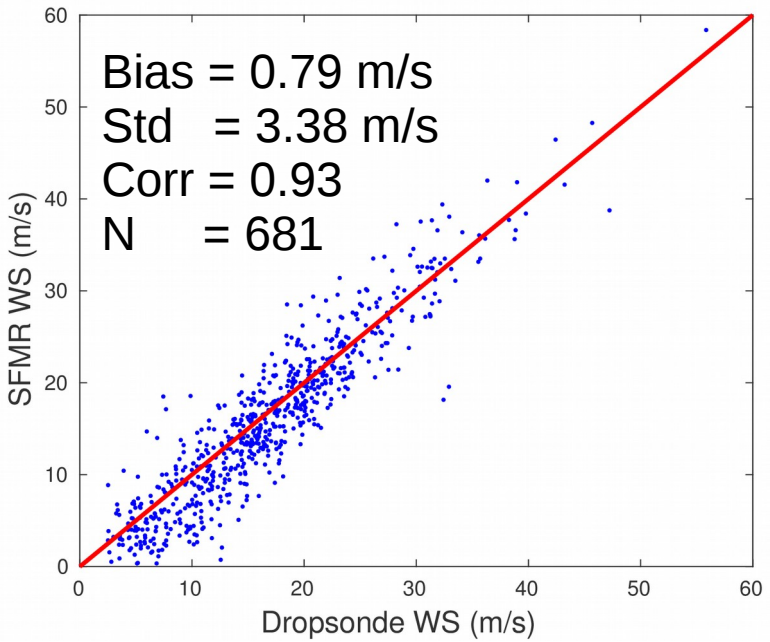
- When the d_{launch} dropsonde position at launch is not available:

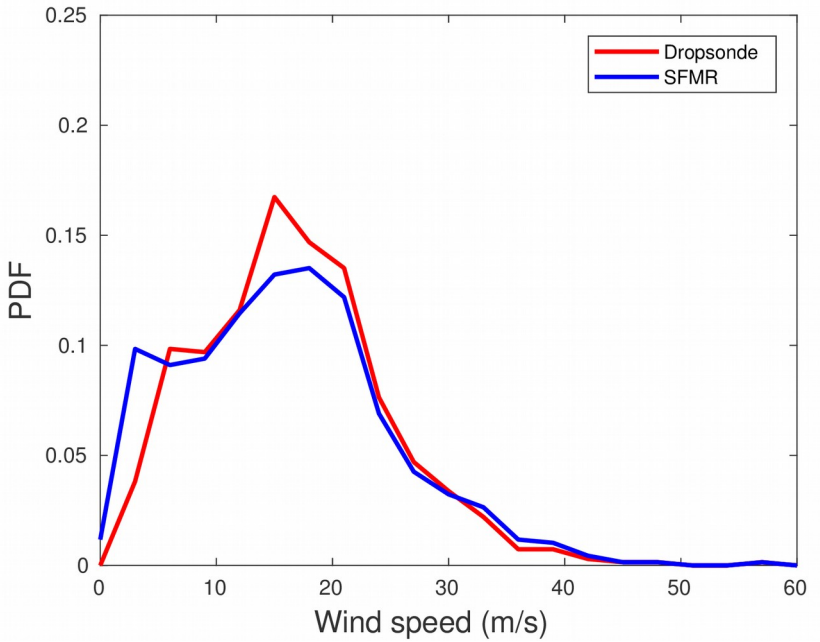
  d_{launch} refers to the first available dropsonde position (generally ≤ 3 sec after launch)

- If the selected SFMR wind is flagged:

  New Selected SFMR wind → $|(t_{SFMR} - t_{sel})| = 1$ sec

Dropsonde/SFMR Statistics (1/2)

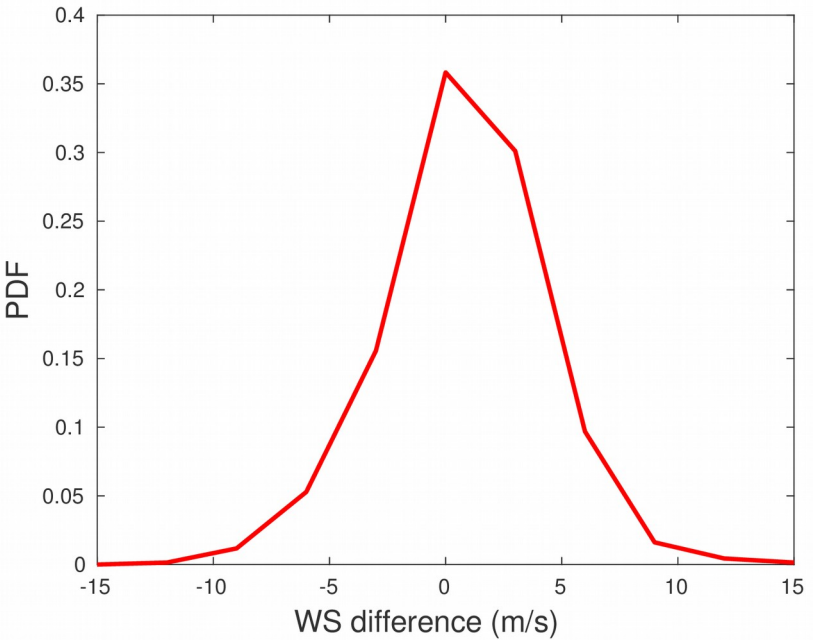




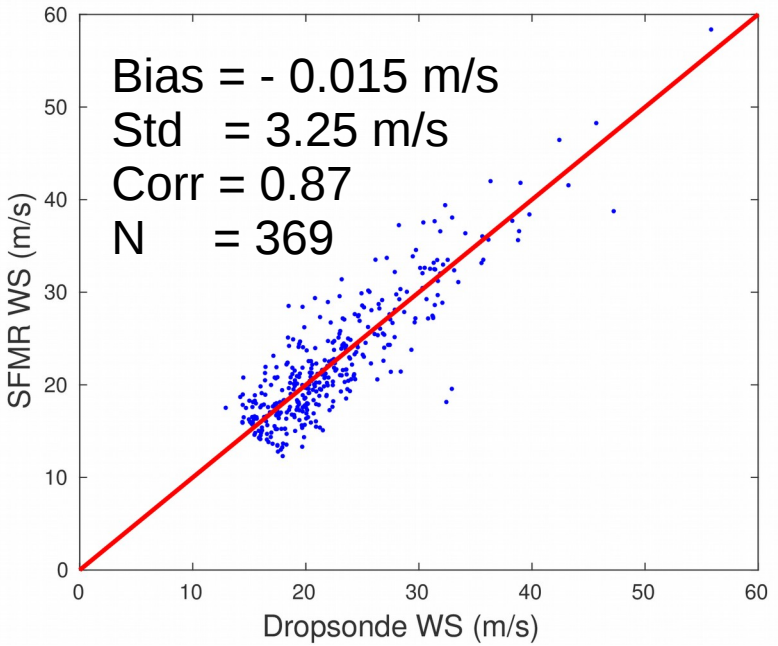
N points decreases:

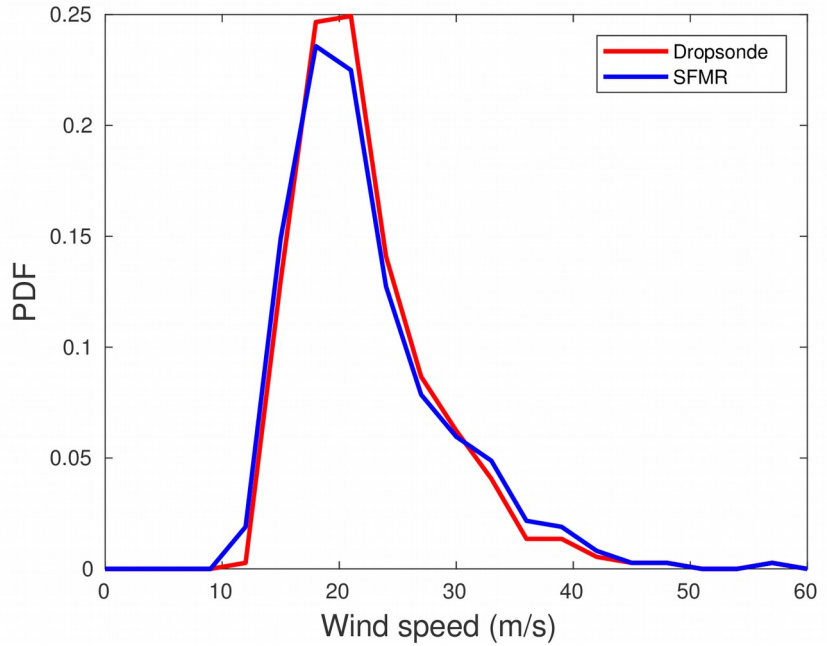
No available SFMR flight for that dropsonde

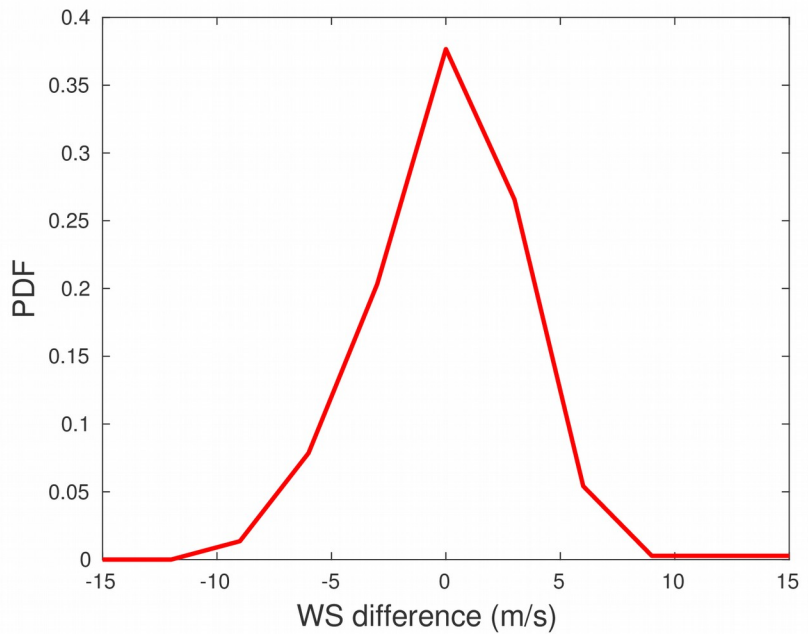
Flagged SFMR measurement even at ±1 sec from the selected



Statistics when avaraged wind > 15 m/s







Conclusions of SFMR/Sonde preliminary analysis

Analyze the SFMR/dropsonde scatter:

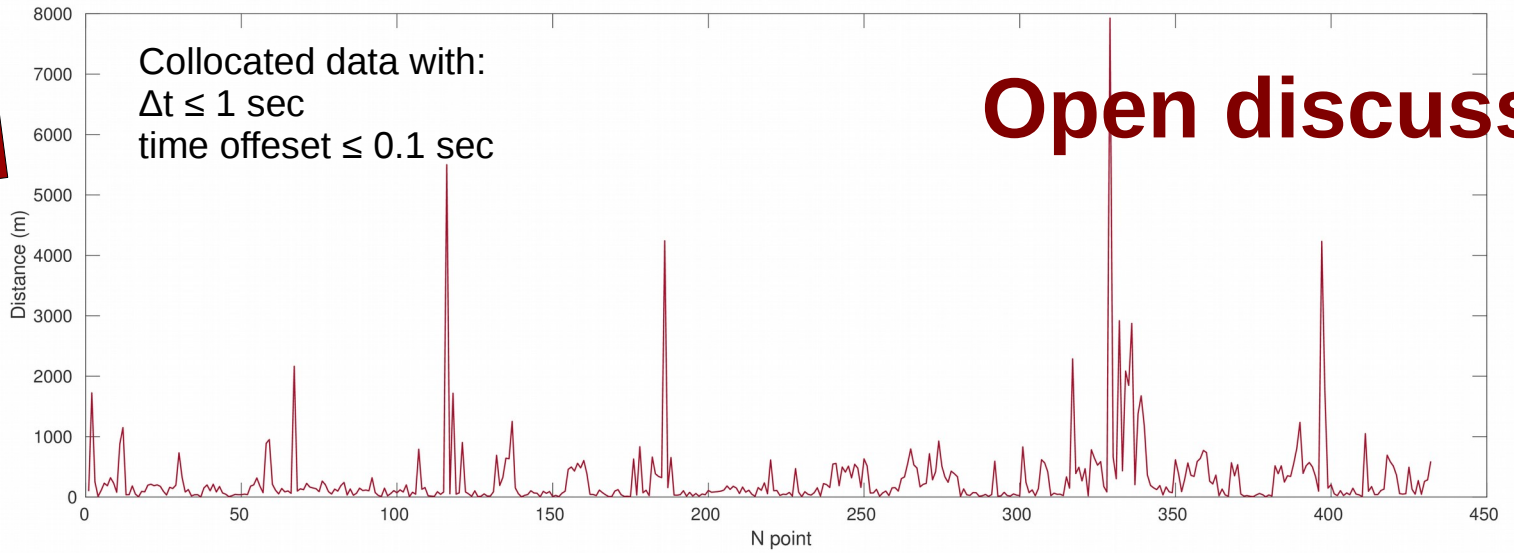
1) Assess the spatial representativeness errors by aggregating SFMR winds at 1s

2) Assess the influence of the WL150 algorithm on surface wind speed estimate error by computing the dropsonde winds from 150m-layer at different mean heights [As suggested by Joe Sapp]

3) Rain contribution?

Ongoing work

Understanding the displacement of the dropsonde position at launch w.r.t. the SFMR position



Open discussion

Buoy data analysis

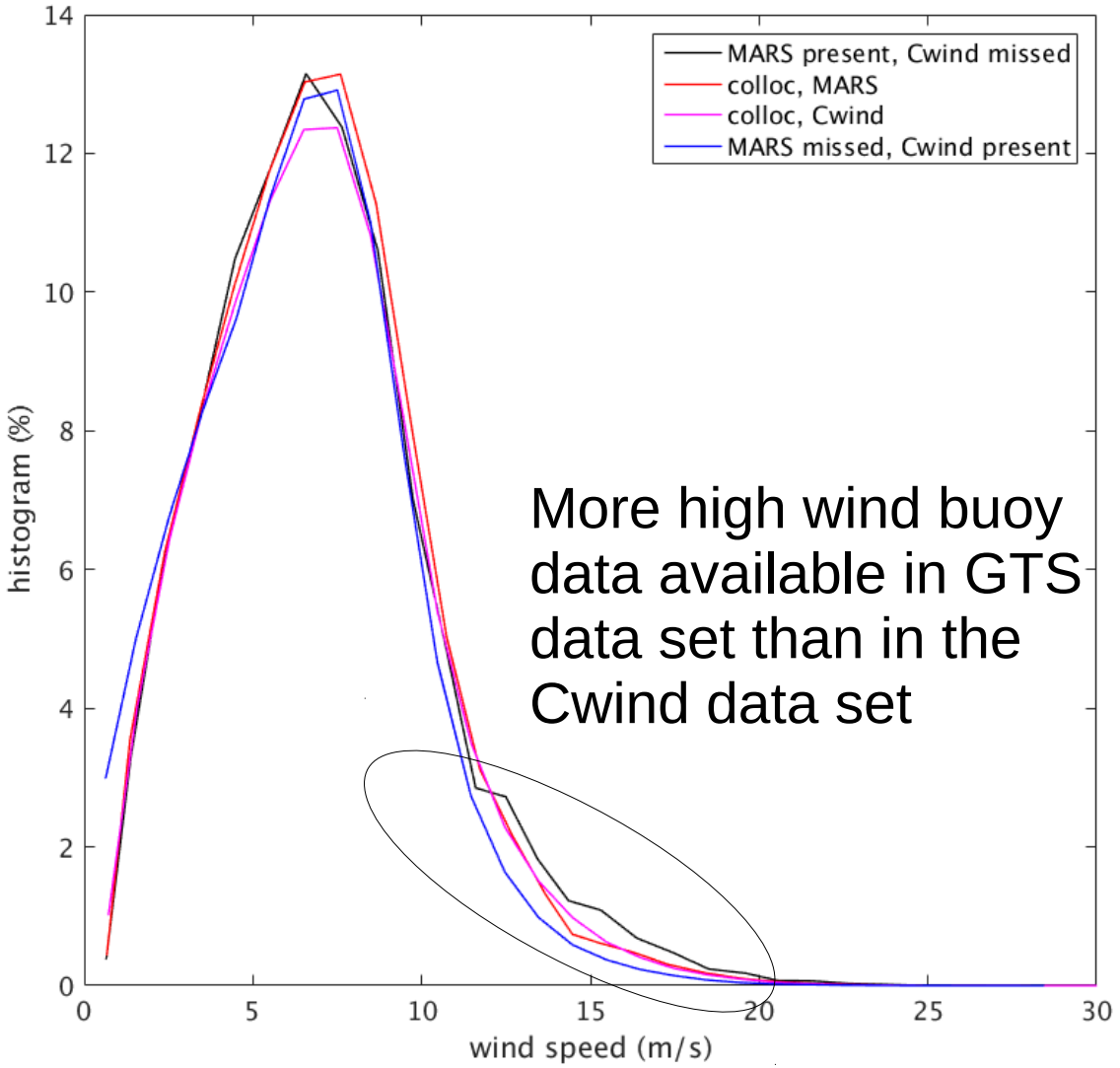
Two sources of buoy data are available to us

1. GTS (Global Telecommunications System) buoy data via ECMWF MARS
2. Continuous buoy winds (Cwind) via below the FTPs

(missing buoys in the north-east Atlantic and British Isles inshore waters)

- NDBC: ftp://data.ndbc.noaa.gov/data/
- TAO/NOPP: ftp://ftp.pmel.noaa.gov/GTMBAdata/OceanSITES/
- TAO/PRIRATA/RAMA/: ftp://taopmelftp@ftp.pmel.noaa.gov/ascii/sites/daily/

Buoy data sources comparison



1. MARS present, c-wind missed : buoy data are not available from the three FTP sites;

2. collocated MARS/C-winds → hourly MARS buoy winds (last 10 min average);

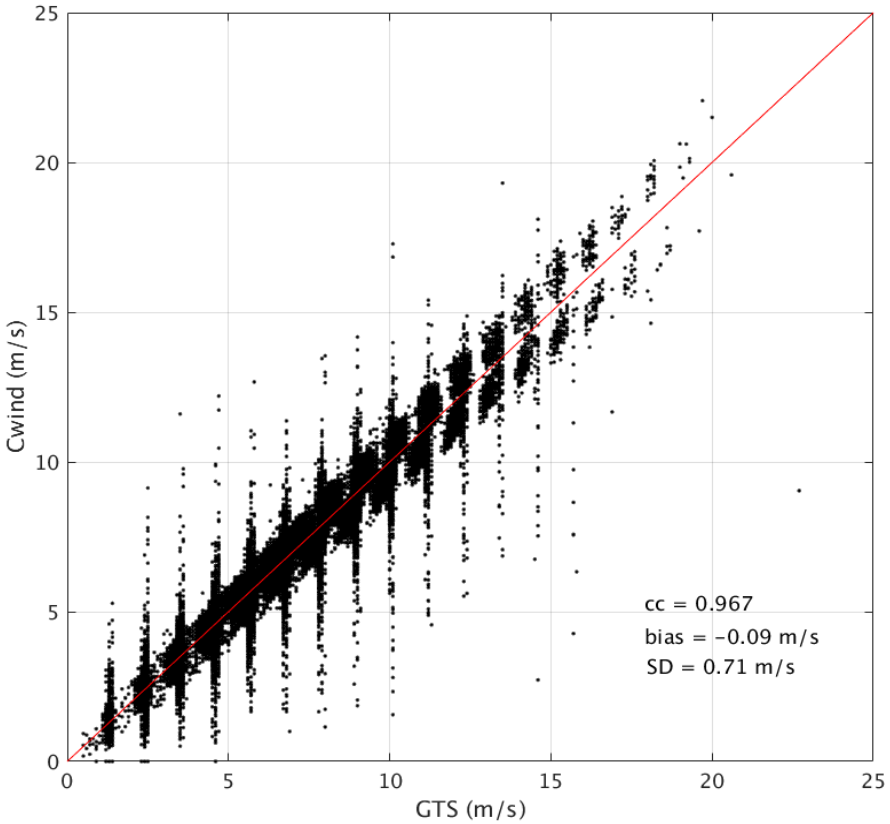
3. collocated MARS/C-winds --> Continuous buoy winds at 00:00, 01:00, ..., 23:00 etc (6 meas/hour).

4. MARS missed, C-wind present: MARS buoy winds are blacklisted (QC flagged).

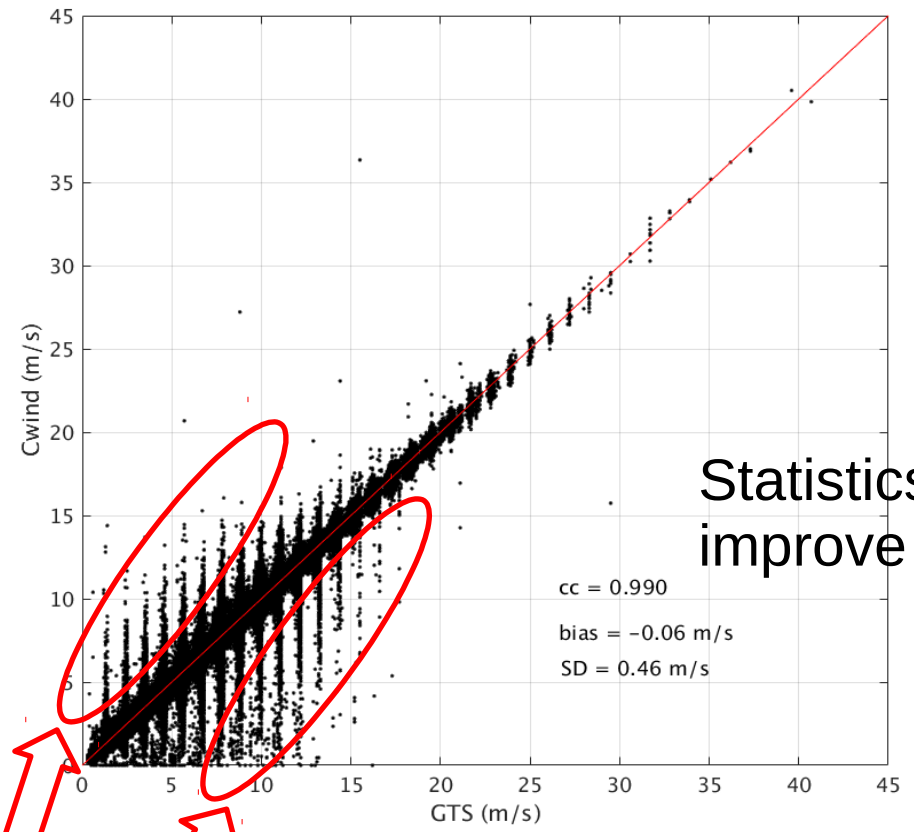
GTS and Cwind buoy data analysis criteria

Collocated GTS and Cwind buoy data are analyzed as follows:

- Period: 2009-2014 (5 years)
- Both are converted to 10-m surface winds using the LKB model;
- 2.4% of data with different anemometer height (AH);
- Temperature sensor height (TsH) is accurately recorded in GTS data set; in the Cwind data set, TsH below 4 m is assigned with fixed value of 3 m (19.7%).



With different AH



With same AH

Statistics improve

Outliers mostly related to the cases with different temperature sensors height (below 4 m)

Conclusions of buoy preliminary analysis

More buoy data are available in GTS (archived in MARS) data set than in the Cwind data set, notably at high winds, particularly for those buoys in the north-east Atlantic and British Isles inshore waters.

- Regarding the collocated GTS and Cwind, one should pay particular attention to the different AH and TsH values in the two data sets. (which one is more accurate? GTS?)
- Cwind bias w.r.t. GTS is negligible