

Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Waterstaat

QUT Queensland University of Technology

Second Wind

Extending the official wind gust records with crowdsourced observations

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[2]Queensland University of Technology

Outline

1. Why wind gusts? (*why this is important*)

2. Previous work with crowdsourced data (*why this is possible*)

3. Second Wind (*what we will actually do*)

Wind gusts are an important warning criteria

Year	Code Orange: *thunderstorms with wind gusts*	Code Orange: *wind gusts*	Total (*all criteria*)
2020	3	1	5
2019	5	1	9
2018	4	3	8

Table 1: *Most weather warnings issued by KNMI are associated with wind gusts.*

Wind gusts are an important warning criteria



Figure 1: Damage from strong winds (Jannes Wiersema, KNMI)

Do official networks have sufficient coverage?

Wind gusts:

- are highly variable in space and over short time scales
- are very easily unobserved by official networks

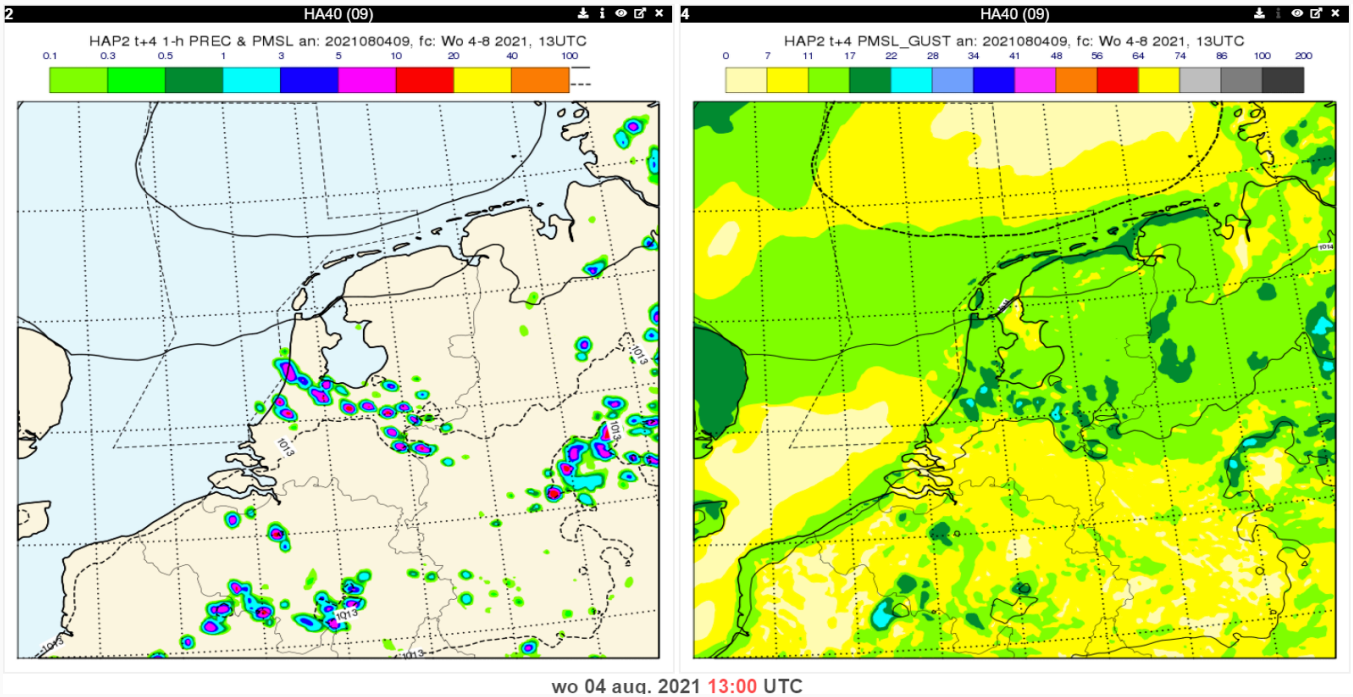


Figure 2: Harmonie-Arome precipitation (left) and wind gusts (right) on a day with thunderstorms in the Netherlands

Huge potential to observe the unobserved

Few official observations and many third-party observations

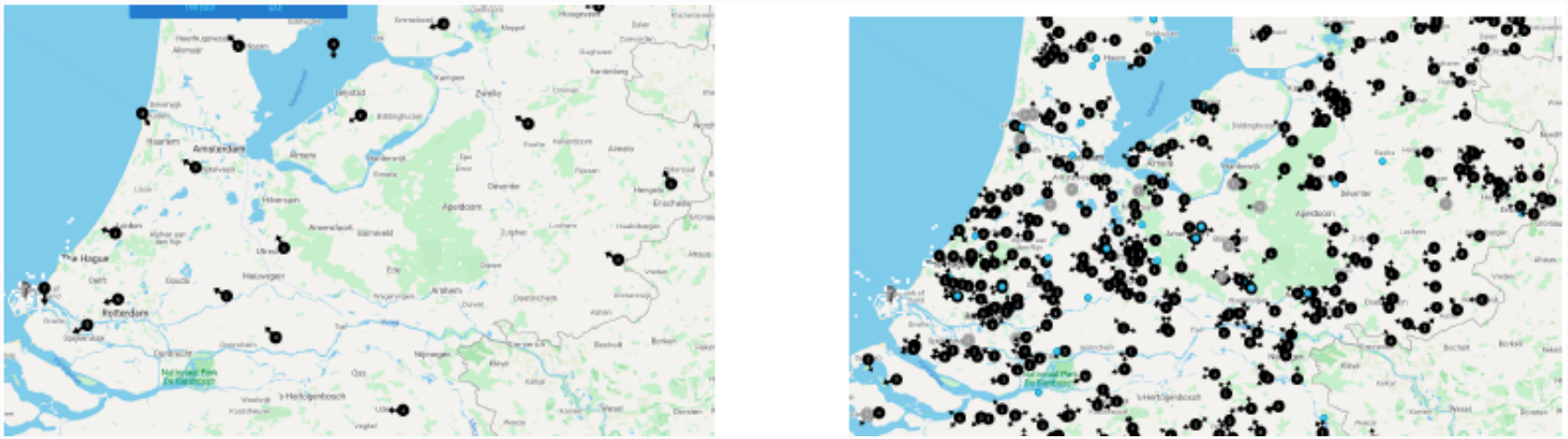


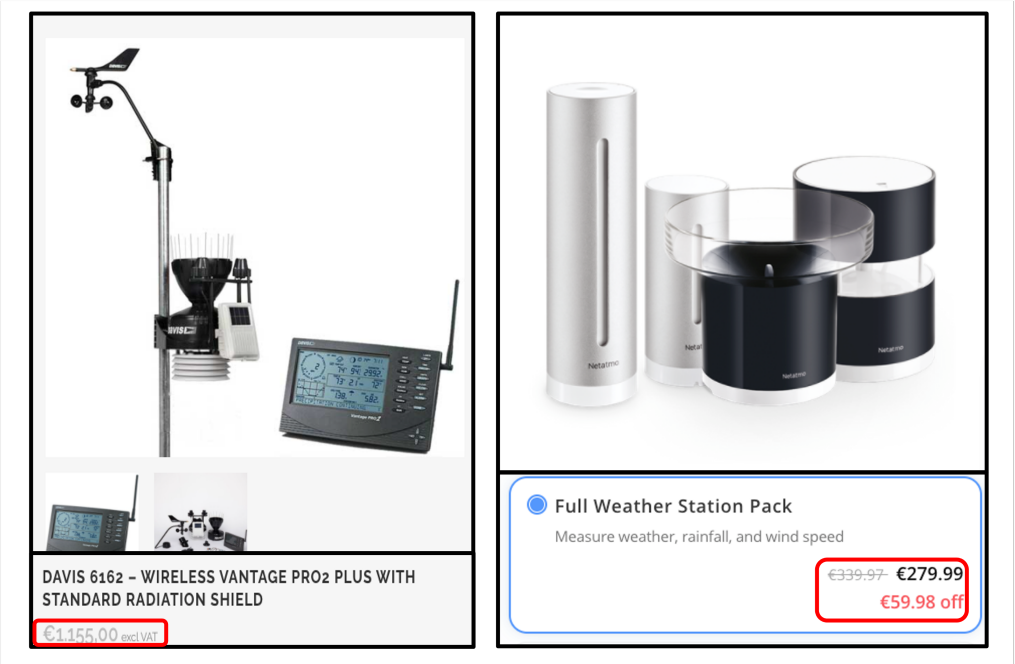
Figure 3: Crowdsourced data (right) can fill gaps between official stations (left).

Weather Observations Website (WOW): https://wow.knmi.nl/

Can we trust any of this data???

Device quality and placement varies in WOW:

An approach that is tailored to individual stations



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Demonstrated value of crowdsourced observations

Temperature, precipitation and wind speed has been examined



The value of crowdsourced wind speed observations

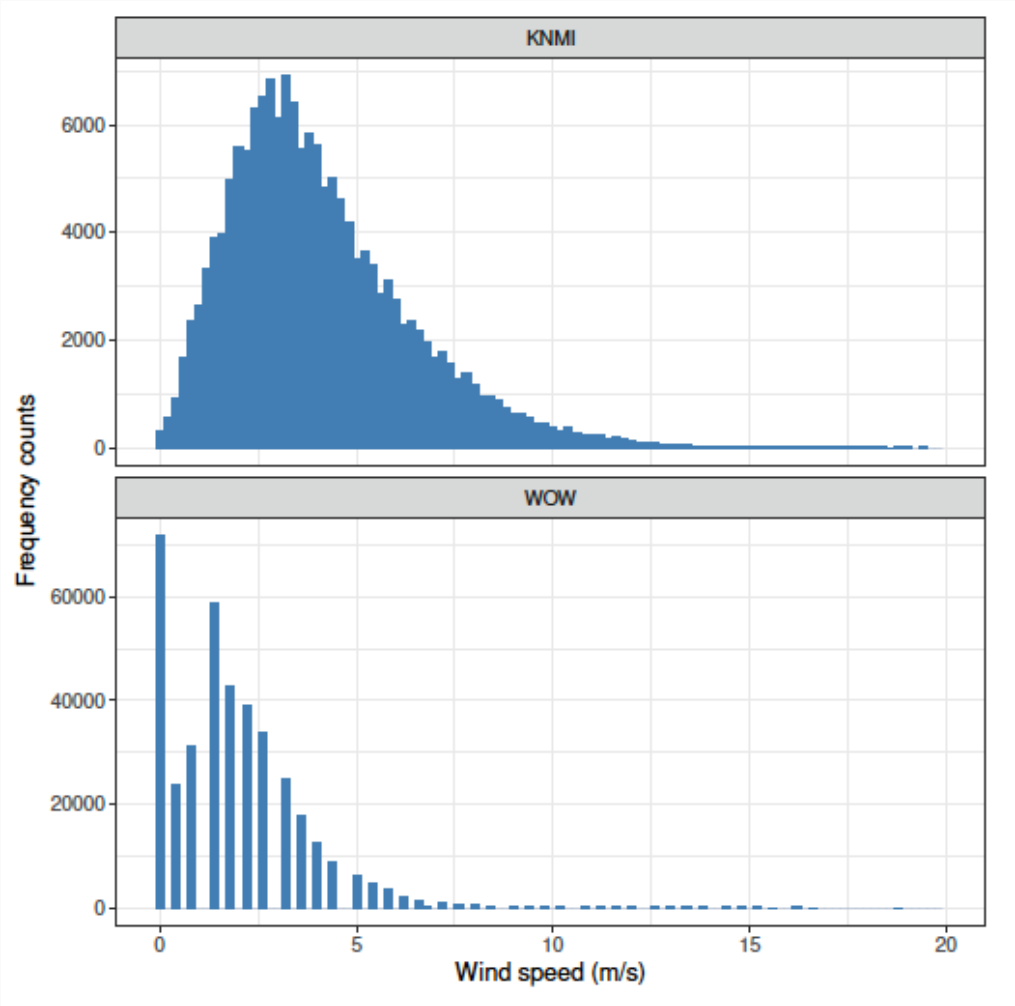
ORIGINAL ARTICLE

Quality control and bias adjustment of crowdsourced wind speed observations

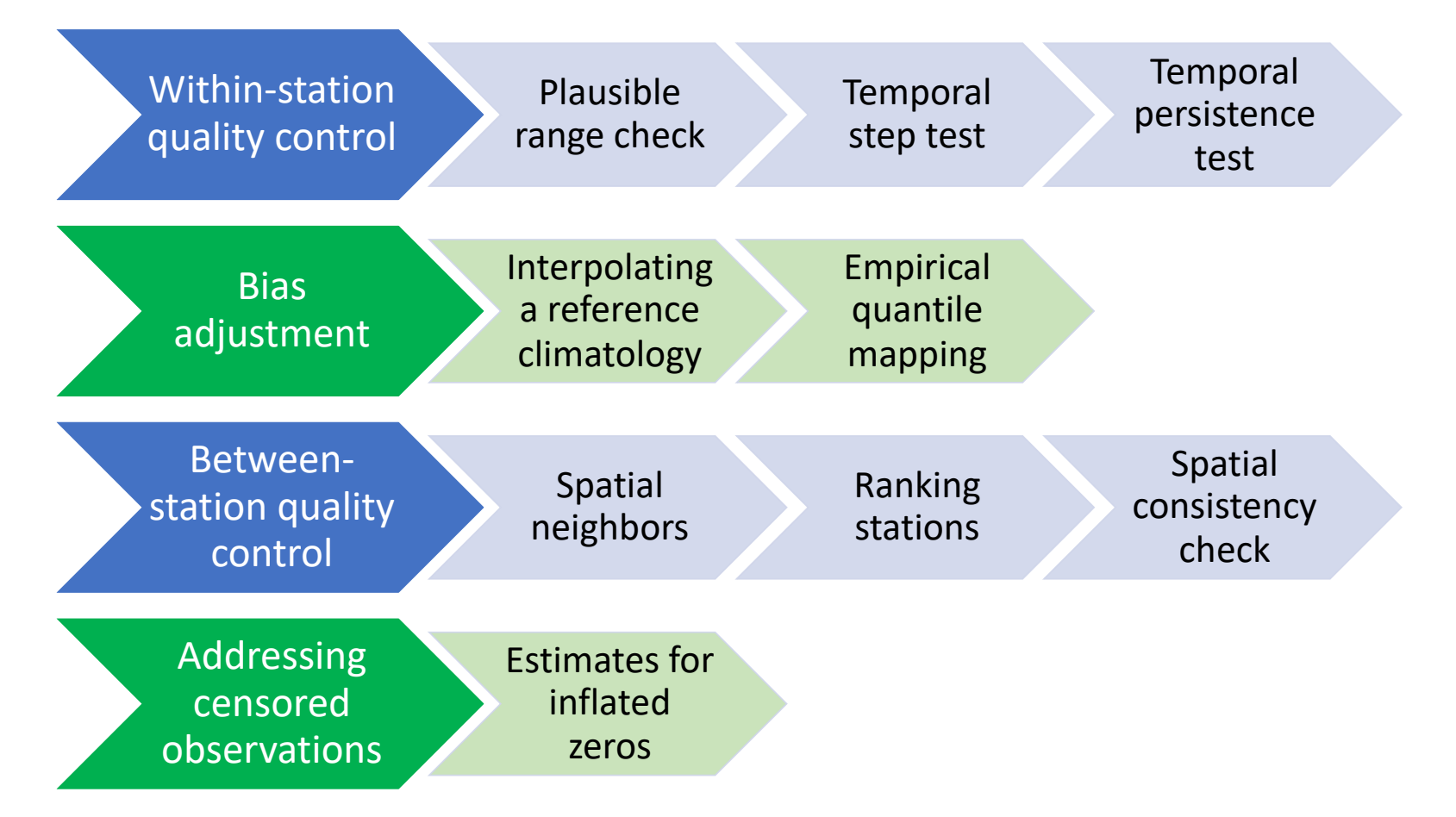
Jieyu Chen[1,2,4] | Kate Saunders[1,3,5] | Kirien Whan[1]

Raw WOW has issues:

1. Bias
2. Zeros
3. Credibility of individual observations



Quality control and bias-adjustment procedure



R-package **QCwind**: https://github.com/jieyu97/QCwind

WOW wind speeds match well with KNMI

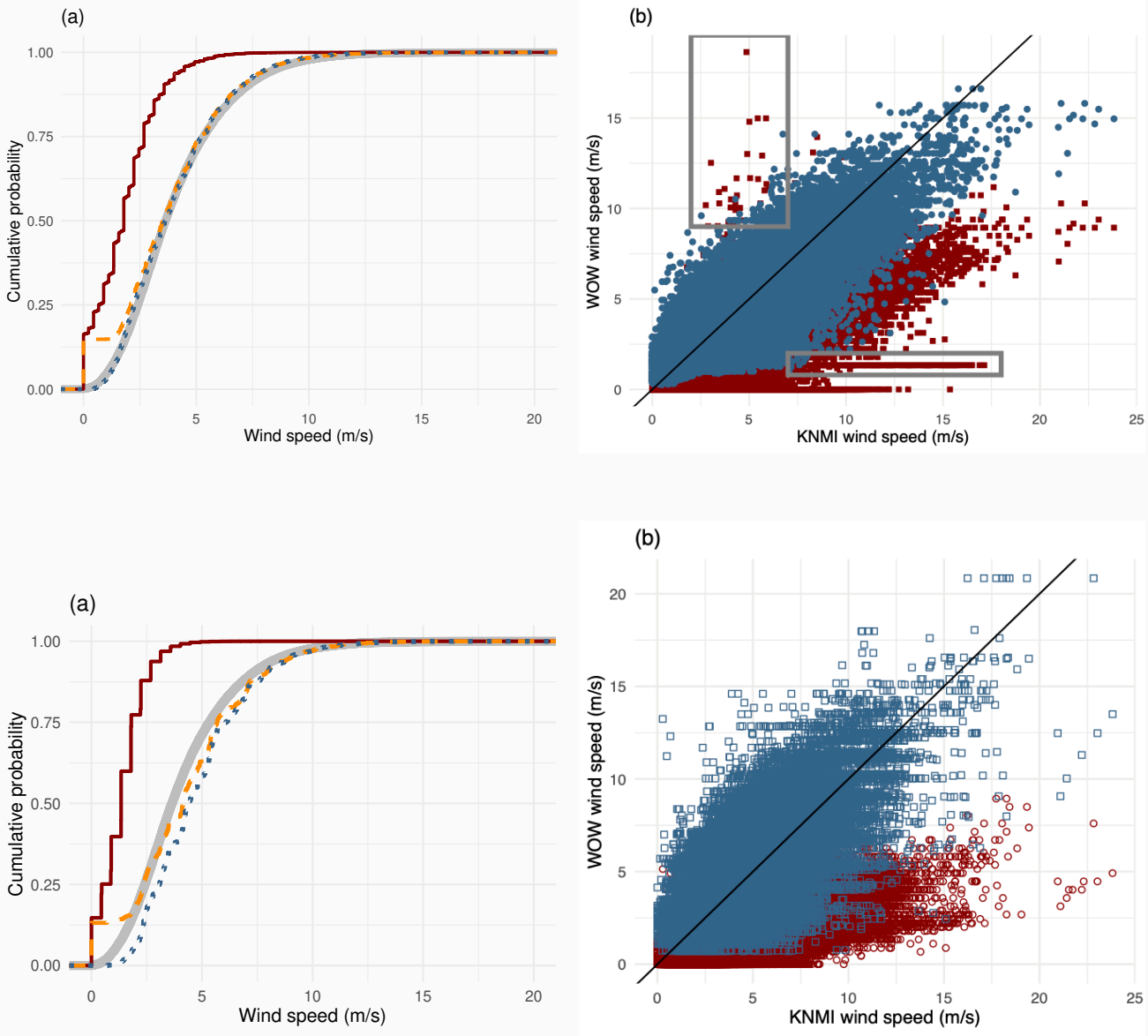


Figure 4: Raw WOW. Bias-adjusted WOW. Final WOW. KNMI

Added value of WOW wind speed

Thunderstorms in the Netherlands: 4th June 2019

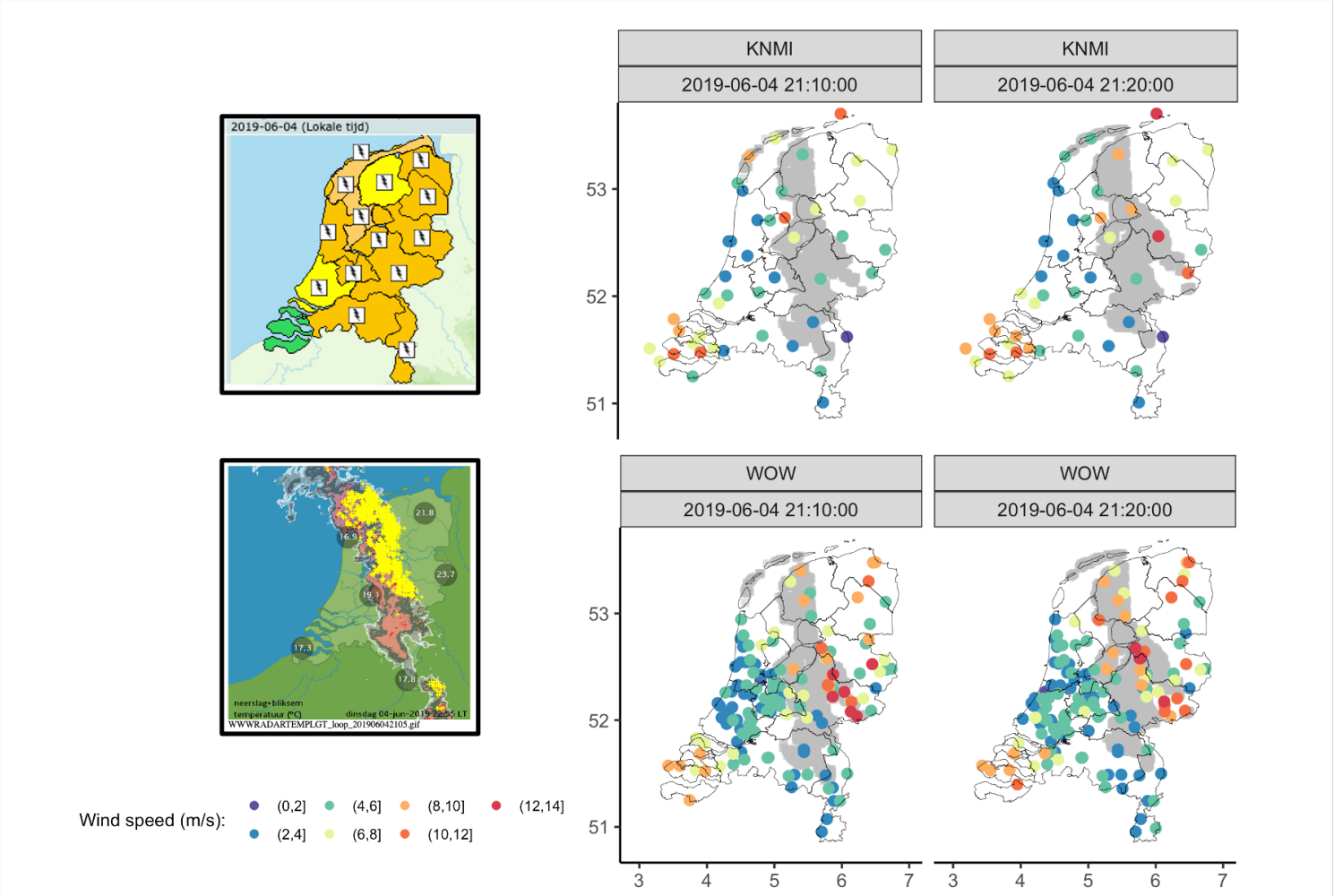
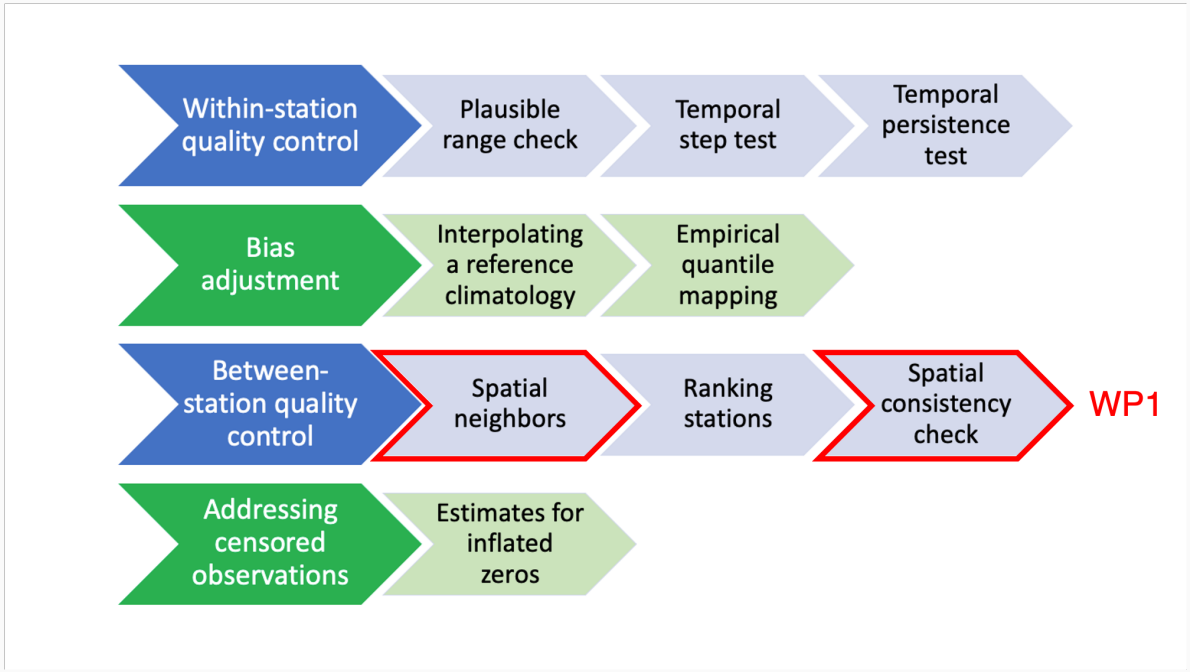


Figure 5: Wind speed observations at KNMI (left) and WOW (right) stations. Grey indicates where there is rain on the radar

Second Wind: Extracting value from crowdsourced wind gust observations

Extend existing QC/BA methods for wind gusts

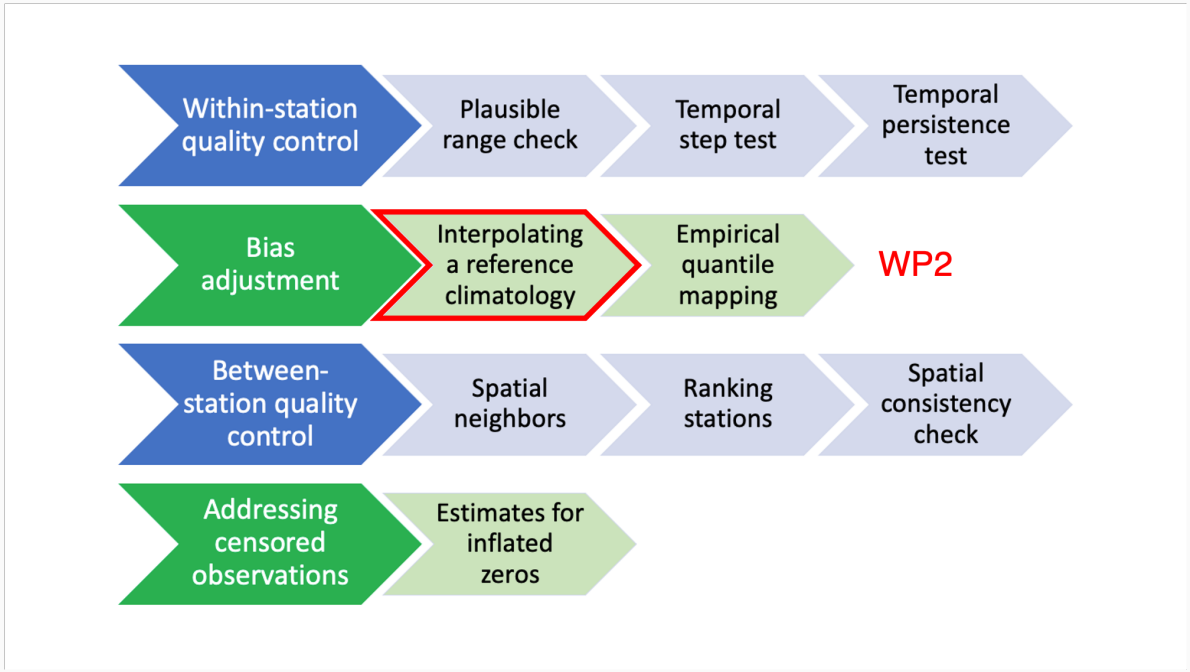
- WP1: Development of statistical methods
- WP2: Improving the reference climatology
- WP3: Development of open-source software



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WP3



WP1: Development of statistical methods



- **Challenge #1: Which neighbours?**
- Improvement: Distance, correlation, distributional characteristics (recent, wind direction, regimes)

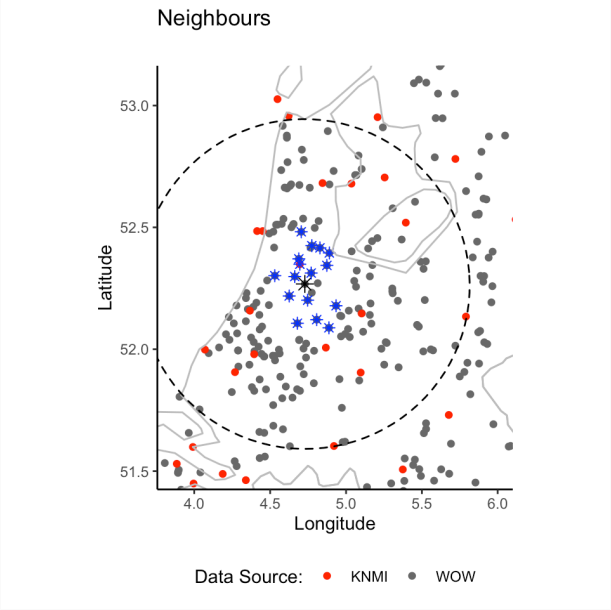


Figure 6: Which neighbours to select?

WP1: Development of statistical methods



- **Challenge #1: Which neighbours?**
- Improvement: Distance, correlation, distributional characteristics (recent, wind direction, regimes)
- **Challenge #2: How to estimate confidence interval?**
- Improvement: Estimation of CIs (non-parametric v parametric, analogues, heavy-tailed distribution, covariates)

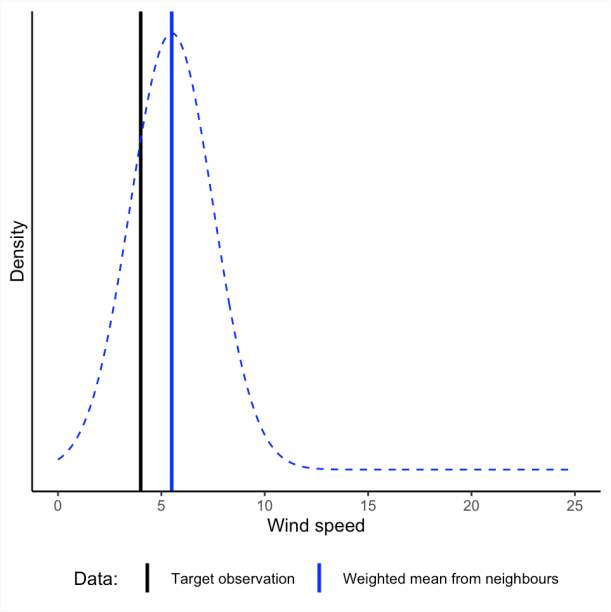
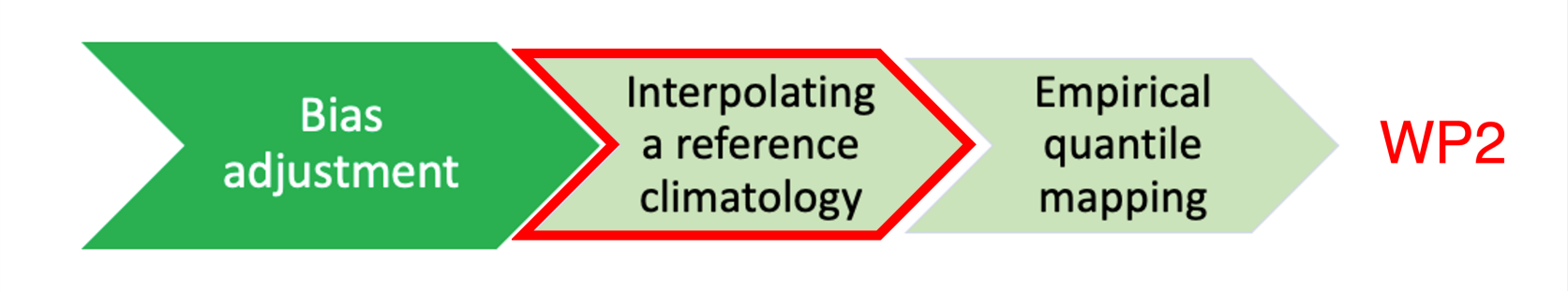


Figure 6: What distribution to estimate CIs?

WP2: Improving the reference climatology



- **Challenge #3: What is the truth?**
- Improvement: surface roughness, high-resolution NWP model, DeepKridging
- Improvement: bias-adjust per wind direction

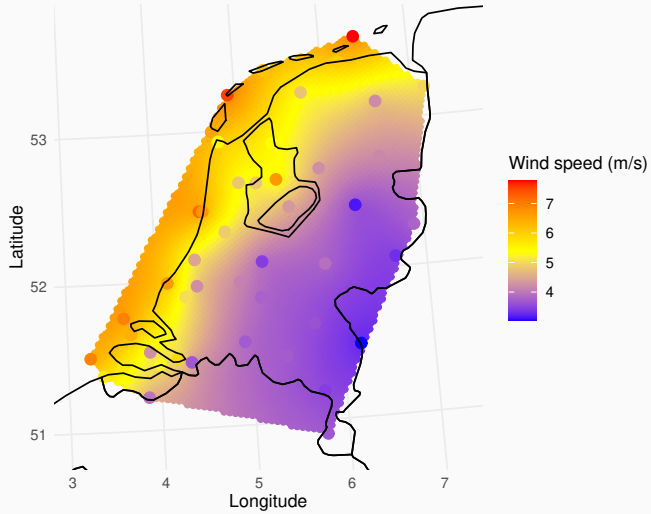


Figure 7: The interpolated climatological 50th percentile

WP3: Development of open-source software



- **Challenge #4: Research to operations**
- Improvement: fast and modular code that runs in real time as new stations drop in and out
- **Challenge #5: Transferable code**
- Improvement: open-source and well documented code that can be run by end-users

Joint project with QUT and KNMI

KNMI:

- 6-month project with a masters student
- internally funded

QUT:

- 1.5 year project with a masters student
- match any funding from the Harry Otten prize



Conclusions

- Fill gaps in the official network
- Make quality crowdsourced wind gust observations available to forecasters
- Benefits for warnings, monitoring, extremes, post-processing

