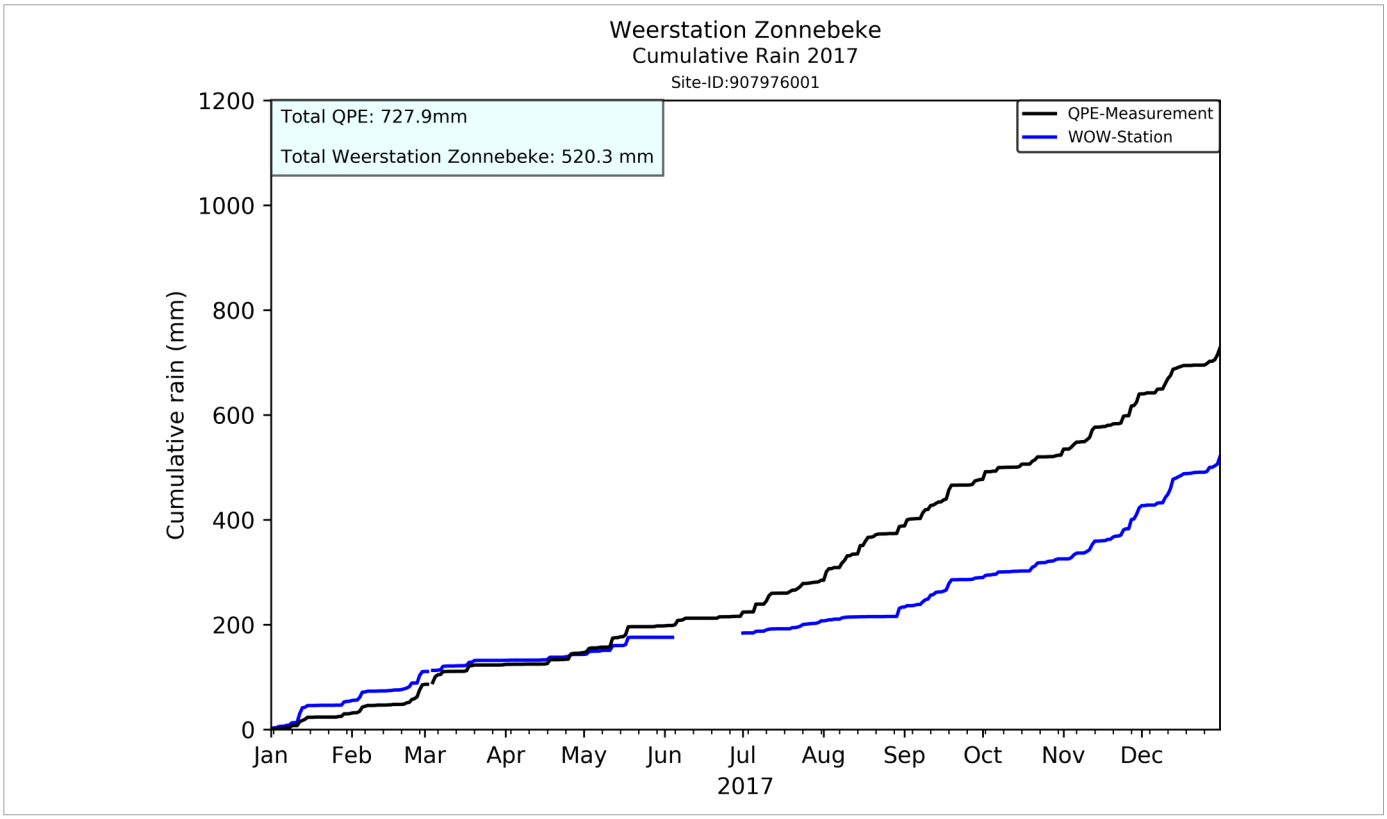
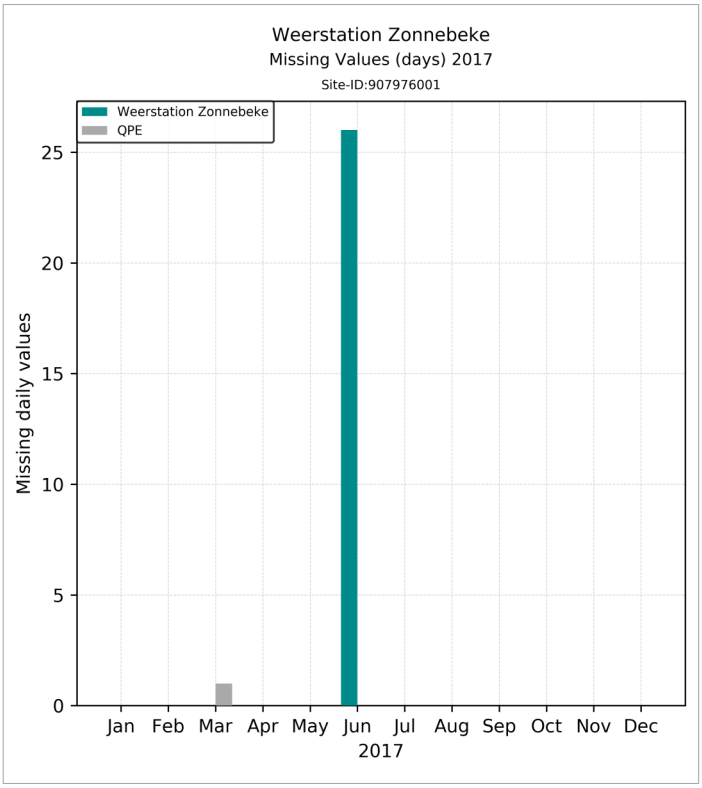
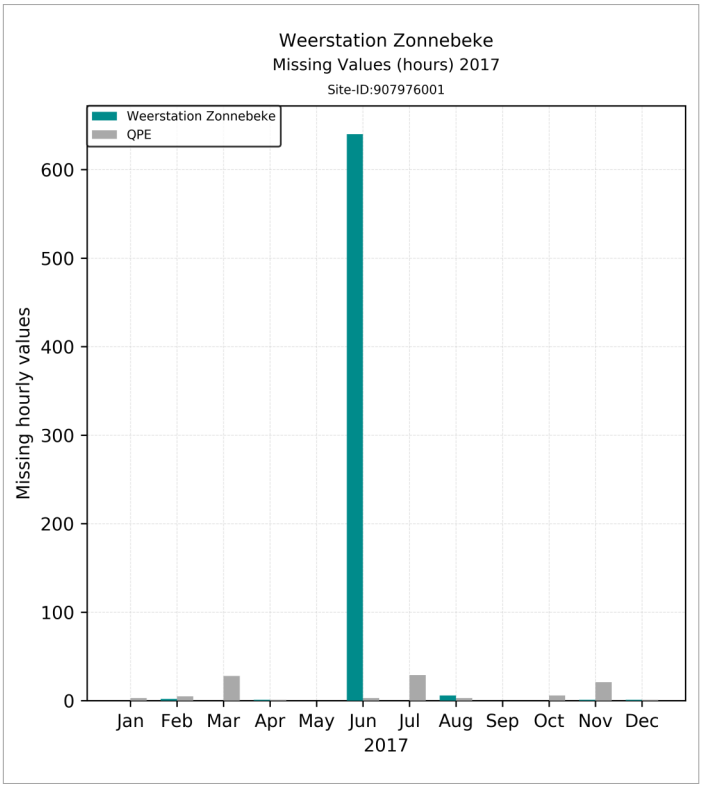
- **Cumulative rain:** The accumulated rainfall over the whole year of the WOW station (blue line) and the QPE (black line).

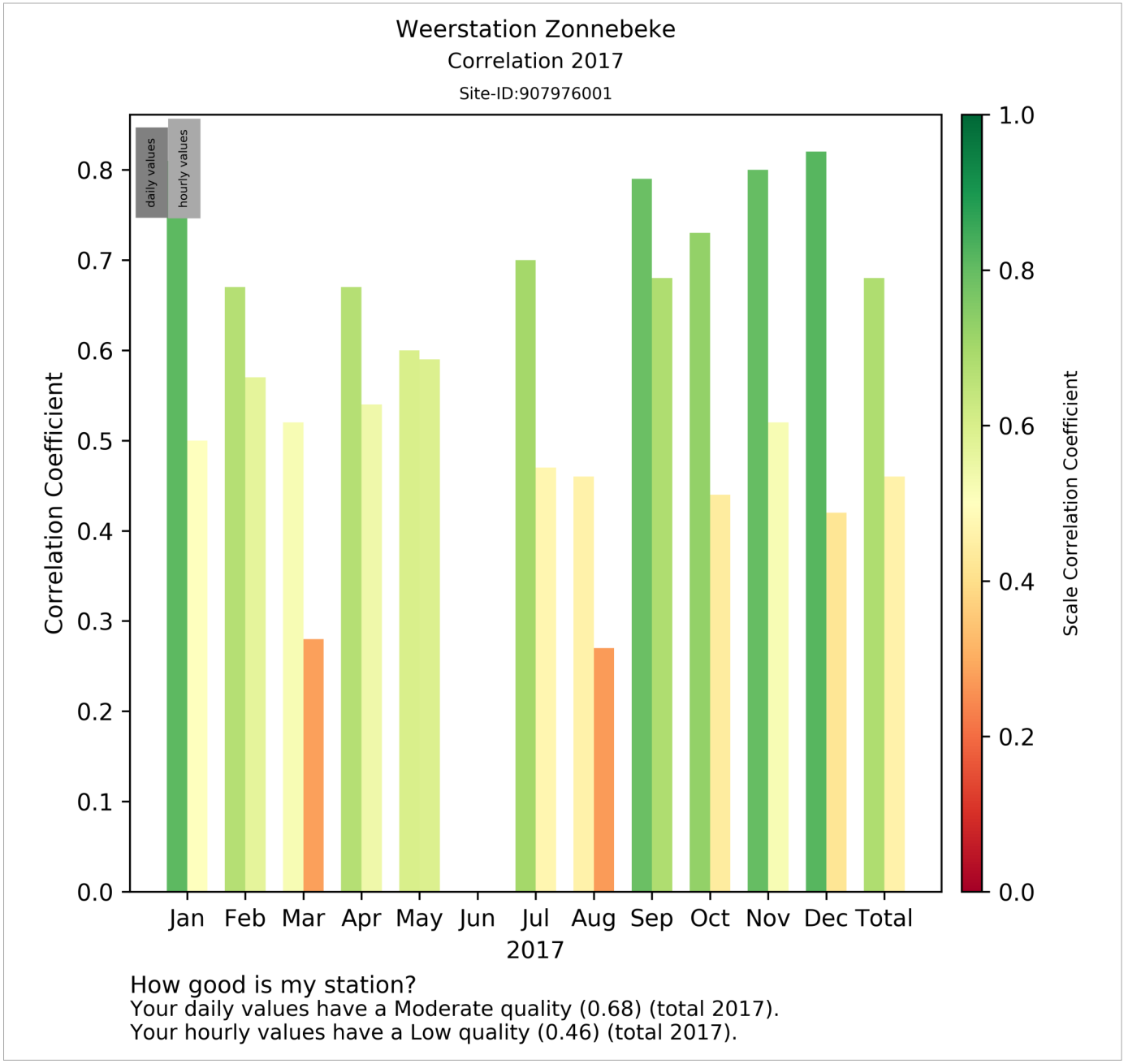


- **Overview of missing values:** The exact amount of daily and hourly values which were missing each month in the WOW or the QPE data are here presented.





Correlation[1] result (based on Spearman-Rank-Correlation)**:** The daily and hourly WOW data was correlated by each month and the whole year with the related QPE. The result of a correlation analysis is a correlation coefficient which ranges from **0** (no correlation) to **1** (perfect correlation). Be aware that a perfect correlation cannot be expected due to several influences and challenges in measuring precipitation.



Correlation Coefficient	Interpretation
0.9 – 1.0	Very good quality
0.7 – 0.9	Good quality
0.7 – 0.5	Moderate quality
0.5 – 0.3	Low quality
0.3 – 0.0	Very low quality

Based on the "Rule of Thumb" for the interpretation of the correlation coefficient (Hinkle (1982))

[1]Correlation describes statistically a connection or relationship between two variables (here WOW- & QPE-value).

A research was carried out to investigate the quality of data derived from WOW-stations. Hourly and daily WOW data was compared to a merged-radar-gauge product called QPE over a one-year period (2017). A statistical correlation analysis was applied on hours and days where both WOW station and QPE recorded more than 0.1 mm of rain.

What is QPE?

QPE (quantitative precipitation estimates) is an estimate from radar and rain gauge data. In this research three radars and two rain gauge networks are used to develop the QPE product. Two Belgian radars (Radar of Jabbeke and Wideumont) and one French radar (Radar of Avesnois) are involved. The used rain gauge networks are the SPW network with 90 telemetric stations operated and maintained by the hydrological service of the Walloon Region and the VMM network with 43 stations operated by the Flemish Environmental Agency.

The radar and rain gauge data are merged with a mean field bias correction. In this merging method the radar estimates are assumed to be affected by a uniform multiplicative error and can be adjusted by the median of the ratio of radar and gauge. The QPE data represents a cartesian grid of 1x1 kilometre and accumulates the fallen precipitation over one hour.

For the correlation analysis the precipitation data of the exact WOW-station-location was extracted from the QPE.

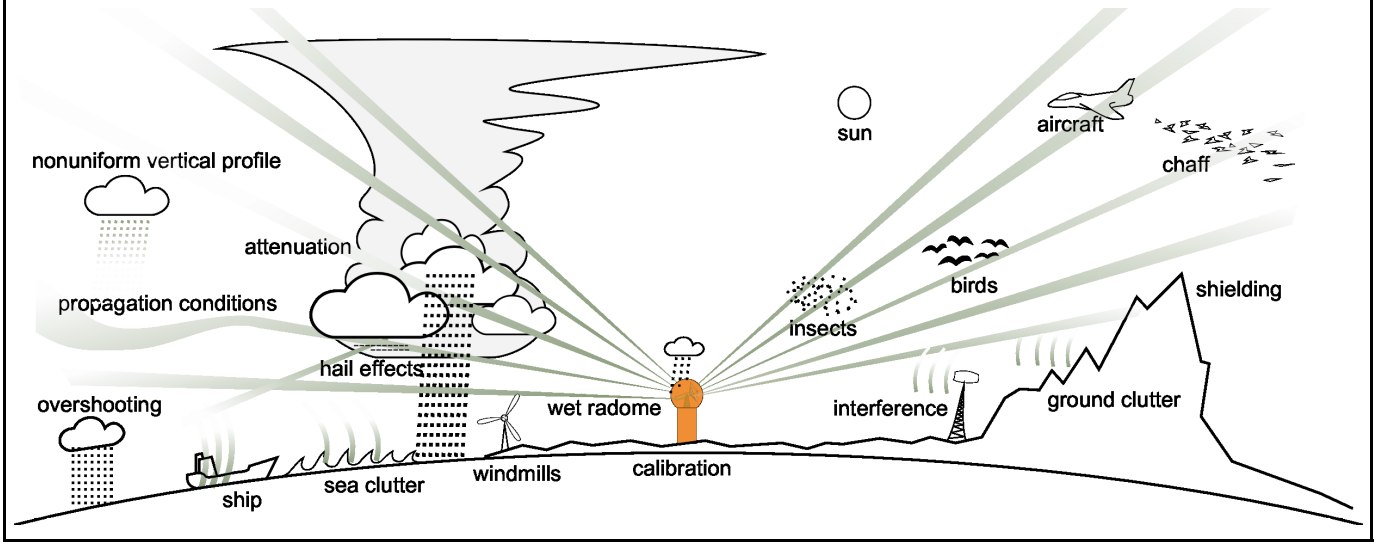
Influence factors:

Precipitation is challenging to measure due to many influence factors – measurement errors and seasonal variations and impacts. Here are named the major ones:

Measurement errors: Rain Gauge

- *Calibration issues* (sensor drift or pollution)
- *Design flaw* (i.e. can result in inaccurate readings)
- *Communication, up-and downloading and software errors*
- *Metadata issues* (incomplete then difficult to interpret)
- *Outsplash* due to too shallow container walls
- *Levelling issues* due to outside impulses
- *Evaporation losses* during high temperatures
- *Wind* can cause turbulences that deviate the precipitation
- *Challenges with tipping bucket:* only tips when full: impact especially on hourly data

Measurement errors: Radar



Seasonal variations and impacts

Winter:

- *Stratiform precipitation* (lower in troposphere: might be located under the radar beam
- Occurrence of *snow*: wrong estimate (radar), overfreezing (rain gauge), higher risk of wind deviation

Summer:

- *Convective precipitation* (more scattered): very local
- Occurrence of *hail:* radar overestimation, outsplash
- *High temperatures*: evaporation

Spring/Autumn:

- Occurrence of *inversion* (fog): overestimation of radar due to ground clutter