

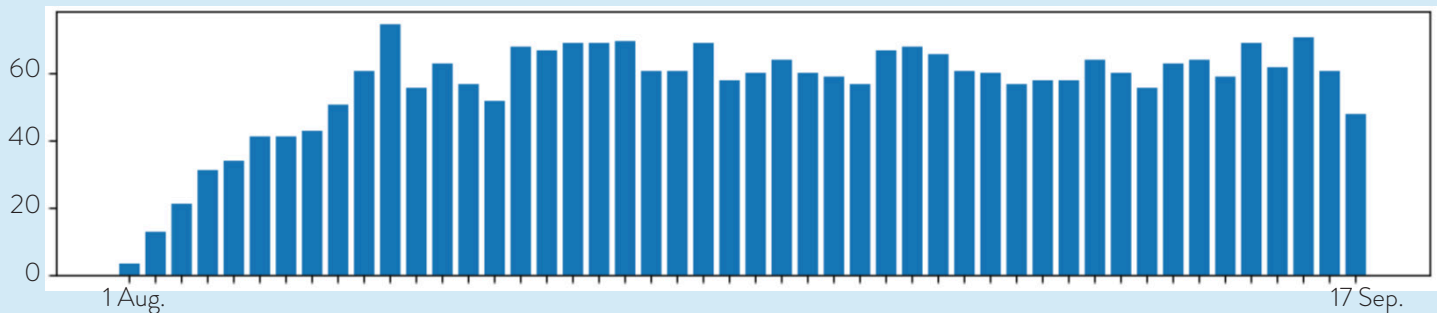
# DELFT MEASURES RAIN RESULTS

NOVEMBER 2021

Last summer, 90 residents of Delft participated in Delft Measures Rain (DMR) 2021. They all received the rain gauge that can be seen in the photo on the right. In total, the participants gathered 5128 measurements. Last year, 1991 measurements were taken. So this is a big improvement! This info-graphic shows the main results. We looked at the number of measurements per day and we made a comparison between the manual DMR measurements, KNMI meters and automatic rain gauges. We also investigated the distribution of rainfall within Delft. Does one area get more rain than another? Above all, we would like to thank all participants for their good measurement work and their contribution to the research!

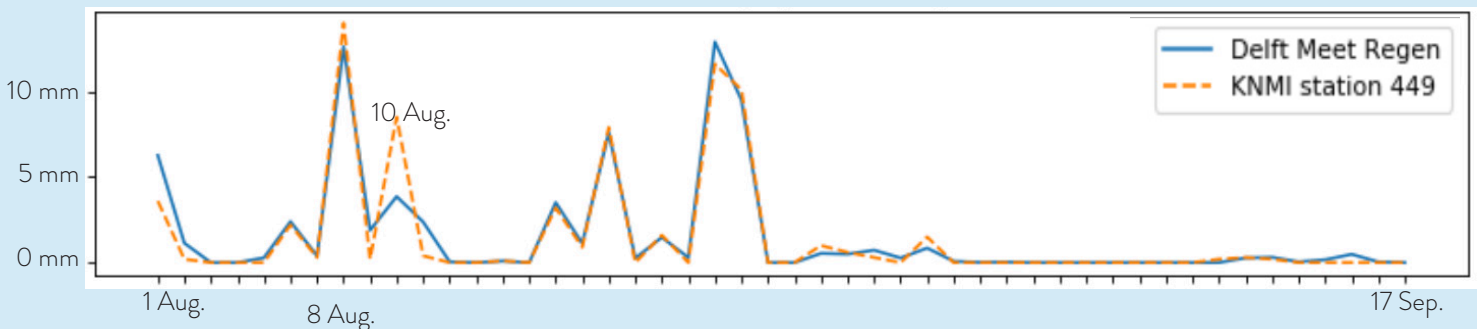


## NUMBER OF MEASUREMENTS PER DAY



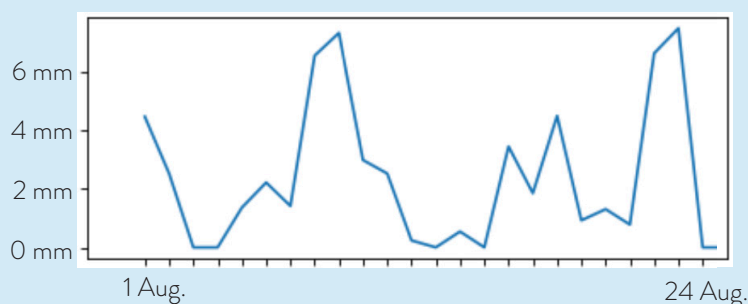
The graph above shows the daily amount of DMR measurements we received over the first one and a half month. You can see that at the beginning, participants needed some time to finish their setup. But after a week or so the average quickly rose to about 60 measurements per day. Measurements continued until the end of October but not all measurements have been processed yet. In the graphs below and above, 2708 measuring points are incorporated.

## AVERAGE DAILY RAINFALL



The blue line in the graph above represents the daily average of all DMR readings. The orange line is the official measurement for Delft from the KNMI rain gauge. In general the KNMI and DMR data correspond very well. It is striking that the KNMI measured a slightly higher peak on August 8 with a difference of 1.38 mm. On August 10, the difference between the peaks was 4.64 mm.

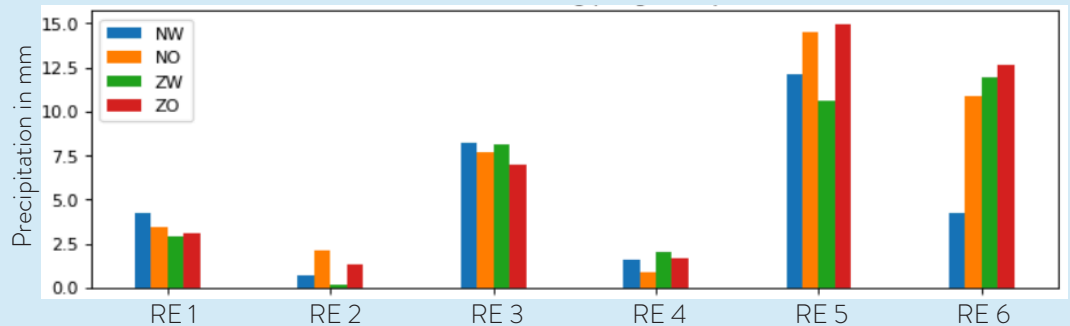
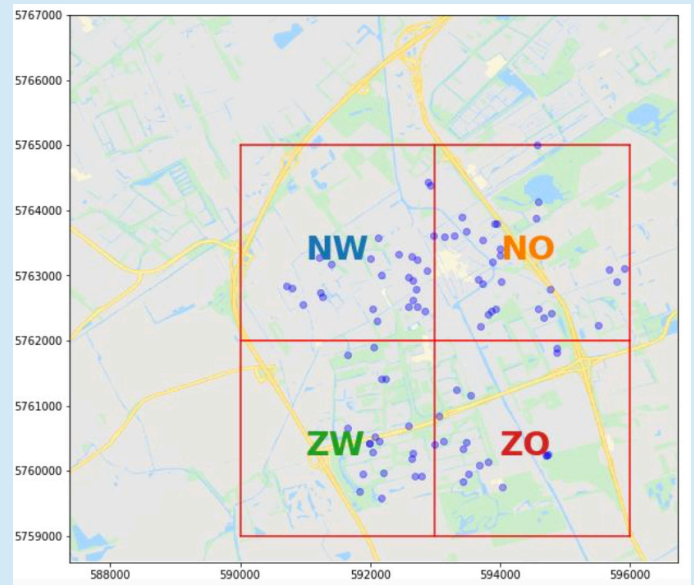
## STANDAARD AFWIJING VAN DE DMR METINGEN



Another noticeable fact is, although it is also expected, that the standard deviation of the DMR measurements seems to increase on days with higher rainfall. The standard deviation provides insight into the differences between the individual DMR measurements. In this case, a high standard deviation can mean two things: with more rain, the local differences within Delft are larger/more clear, or that with more rain, reading errors by participants become larger.

## SPREAD OF RAINFALL WITHIN DELFT

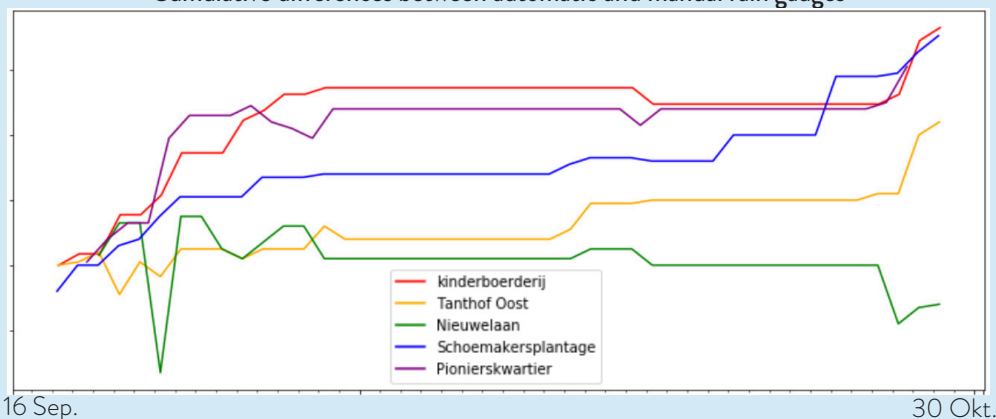
To research the spread and the differences of rainfall within Delft, the area is split into four measurements areas. This is visualised in the map on the right. Every measurement area spans 9 square kilometres. In the graph below the map, the average rainfall in these areas is compared for 6 rainfall events (REs). It becomes clear that there is indeed a difference in the amount of precipitation per rainfall event. This can be up to a few millimetres. However, it can also be seen that during different rainfall events, other areas receive the most rain. In line with this, a further analysis has shown that no pattern can be discovered. This means that there is not an area that, for example, always receives more rain than the rest. During DMR, the ZW area had the most precipitation. We also compared this to last years outcome. During the 2020 measurements, the NW area received the most rain.



## COMPARISON BETWEEN MANUAL AND AUTOMATIC RAIN GAUGES

In addition to the normal manual rain gauge, a number of measurement locations did also receive an automatic rain gauge. This one can be seen in the image to the left. These automatic meters are connected to the WOW-NL network. This is a network of the KNMI containing automatic sensors, which are managed by citizens. The graph below shows the cumulative difference between the manual rain gauge and the automatic weather station for each location. The biggest differences can be seen for the kinderboerderij and for the Pionierskwartier. At the end of August these have reached a difference of about 4 to 6 mm and at the end of September a difference of more than 7 mm. The locations where the manual rain gauge differed the least from the automatic rain gauges, were Tanthof Oost and Nieuwelaan. At Tanthof East the difference is about 1 mm at the end of August and more than 4 mm at the end of September. At Nieuwelaan, the graph remains around 0 mm, which makes it seem as if the difference between the manual rain gauge and the

Cumulative differences between automatic and manual rain gauges



automatic rain gauge is very small. However, this is not necessarily the case. The differences are sometimes positive (manual rain gauge measures less than automatic rain gauge) and sometimes negative (manual rain gauge measures more than automatic rain gauge), so the difference at the end of August happens to be just over 0 mm. Differences between the manual measurements can be due to evaporation, measuring errors or buildings and trees that may interfere with the measurement.

Still, when the manual and automatic meters are compared one by one, it is noticeable that despite small differences, the measured rainfall follows a very similar pattern. This kind of manual measurements could therefore be a good extension of the WOW-NL network as it gives a good picture of the rain that has taken place.