

Weather differentiation between urban and rural

In which way does weather in cities differ from the countryside and how is this differentiation caused?



Teun Heijne, Jerom Haring and Rafaël van der Wal

Het Heerenlanden

Mister Van den Berg

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1. Introduction

1.1 Background

Urbanization is a process which has been going on for centuries. Urbanization describes the population shift from rural areas to urban areas. Not only does this have great effect on demography, job availability and traffic but also on the landscape. Urban areas become more and more populated. These people need housing which is equivalent to the increasement of buildings people make. In the rural areas, people leave and new buildings are built but at a far lower rate than in these urban areas. These results create consequences on both demography and landscape. The differences in landscape have never been bigger.

1.2 Objective/ purpose

The objective to this research is to find out whether differences in temperature and weather conditions exists. And if so, what are these differences? To come to a research and conclusion, measurements must be done. These measurements take place in a relatively big city (Gorinchem) and a small village where not much is done to change the landscape. These measurements will be compared and conclusions will be made. Reasoning behind possible strange results should be justified with reasoning and conclusions.

1.3 Hypothesis

We did some research in order to form a hypothesis. We looked in the phenomenon of the Urban Heat Islands. The Urban Heat Islands (UHI) effect is the phenomenon that the temperature in the city is on average higher than the temperature in the surrounding countryside. This effect is caused by multiple factors: pollution, modification of physical and chemical properties of the atmosphere, and the appliance of roads and buildings which reflect heat instead of take up heat like a field.

The UHI contributes to the enhanced global warming, which is a growing nearly untreated thread. That is why this effect is so important to be treated.

We will expect the temperature in the city to be higher than on the countryside. This is due to the done research about urban heat islands which states that the city has a higher temperature than on the countryside. Also, we expect the windspeed differs, as the buildings block the wind, while on the countryside the wind can flow freely without interruption of buildings. We expect the humidity level and precipitation rate to be the same in the city and rural area.

2. Research questions

When discussing the differences between weather in countryside and in the urban areas a few questions came to the mind. These questions have become the research questions and are as follows:

What's the difference in *precipitation rates* in cities and in the countryside?

What's the difference in *temperature* for cities and in the countryside?

What's the difference in *humidity* in cities and in the countryside?

What's the difference in *windspeed* in cities and in the countryside?

The main research question is different and is as follows:

In which way does weather in cities differ from the countryside and how is this differentiation caused?

3. Materials and method

In order to provide a sufficient report, procedures must be followed and materials should be used to do measurements. The measurements are split up in different segments. One type of measurements was done by our self in both Gorinchem and Leerbreek. The device used was provided by the father of Jerom Haring. The other type of measurements was based on a variety of sources. The reason behind this is to create structure and multiplicity in our report. These sources showed different numbers every time. Based on the most reliable source, we did the measurements and noted everything down with relevance to the report. In the first type of measurement a complicated protocol was used. This protocol is as following: the person in charge of the device must put the device on the ground for three minutes. This restriction is used to make sure that the device would not be influenced by the surrounding in which it was transported in any way. Exactly after the three minutes, the person in charge should make three to ten pictures of the numbers displayed on the screen. These numbers made it easier for the person in charge to note down the numbers and to have evidence of any disputable measurements. These pictures guiding as evidence were sent to the other members. The other members would check if everything was done the way it is supposed to be and answered with permission. In this way, it is impossible to make mistakes in the measurement process. This protocol was used every time measurements were done outside to guarantee right measurements.

4. Date summary

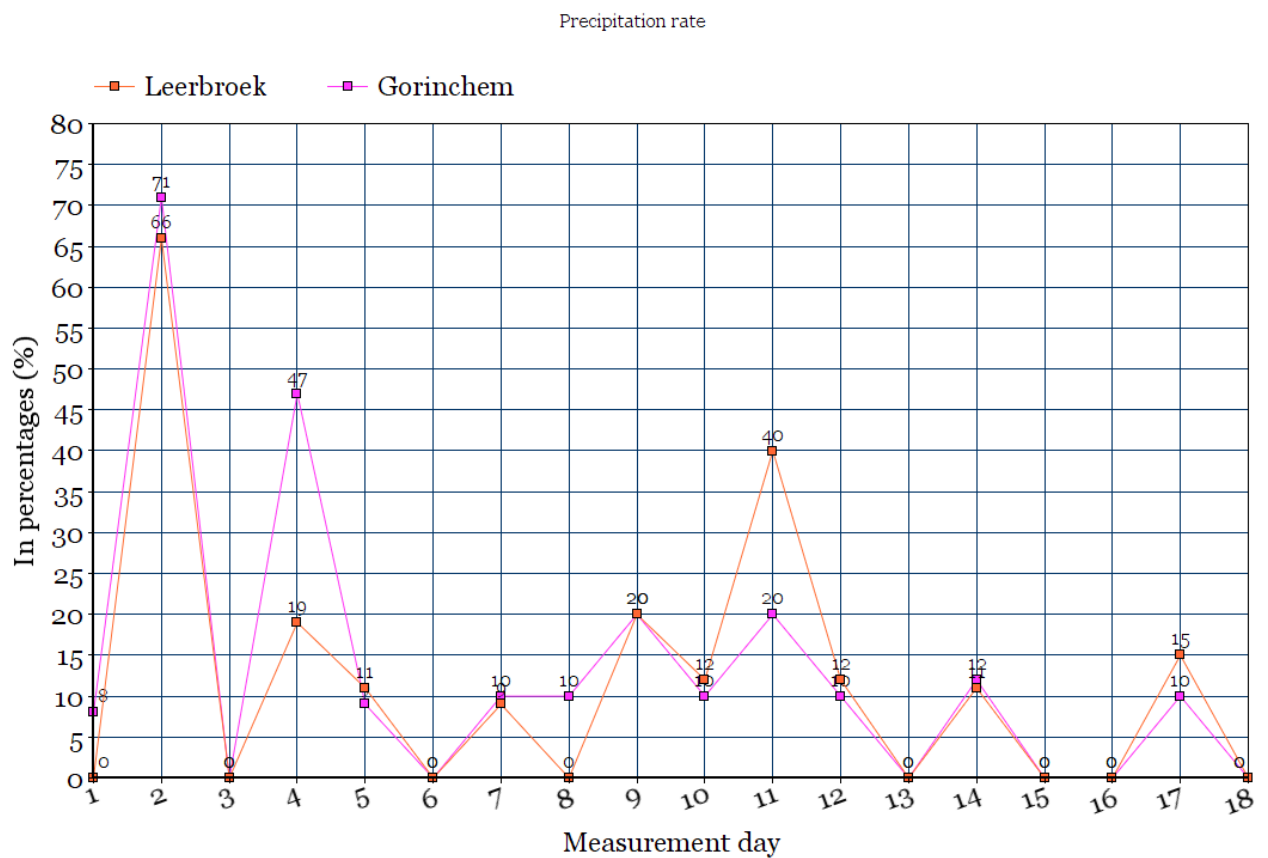
Measurements have been taken on:

1. 22-2-2019
2. 23-2-2019
3. 24-2-2019

4. 27-2-2019
5. 28-2-2019
6. 29-2-2019
7. 13-3-2019
8. 19-3-2019
9. 20-3-2019
10. 21-3-2019
11. 22-3-2019
12. 23-3-2019
13. 24-3-2019
14. 25-3-2019
15. 26-3-2019
16. 27-3-2019
17. 2-4-2019
18. 10-4-2019

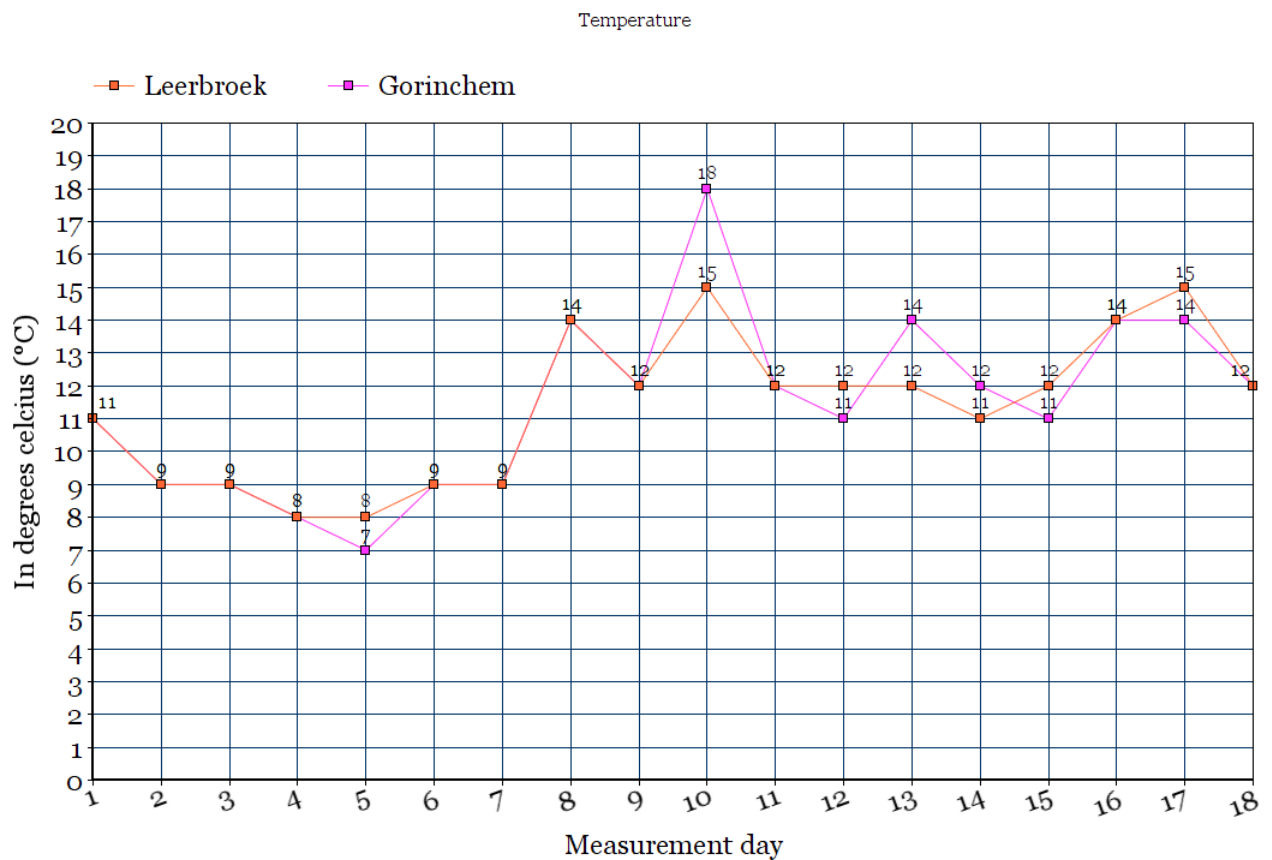
5. Data and analysis

5.1 Precipitation rate



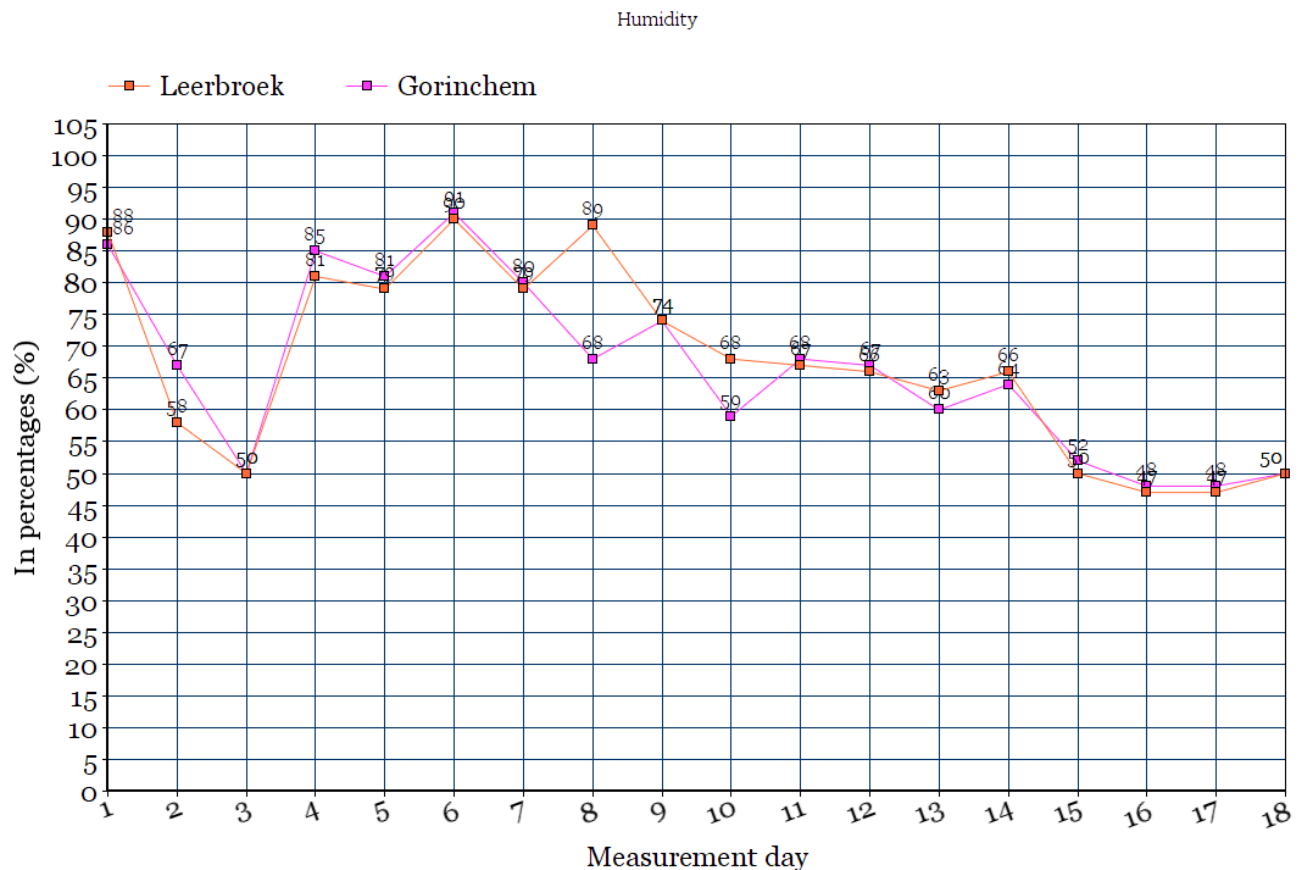
The precipitation rates in Gorinchem and Leerbroek are very similar. Precipitation rate could be influenced by the distance to the sea, but in this case that doesn't influence the results, because both are almost at the same distance away from the sea. Altitude, the height of the place, and latitude also don't change the results, because they are (almost) the same. However, if you look very closely you can see that in the first measurement period (22-2-2019 -> 20-3-2019) you can clearly see that the precipitation rate was higher in Gorinchem than in Leerbroek, except from 28-2-2019. After this period, the precipitation rate in Leerbroek was often higher than the precipitation rate in Gorinchem. These results could be a coincidence, but it could also be caused by the different periods during the year. These different periods could cause a different weather and result in precipitation. This could be possible, because different places have different periods, but it is probably also because they are located close to each other.

5.2 Temperature



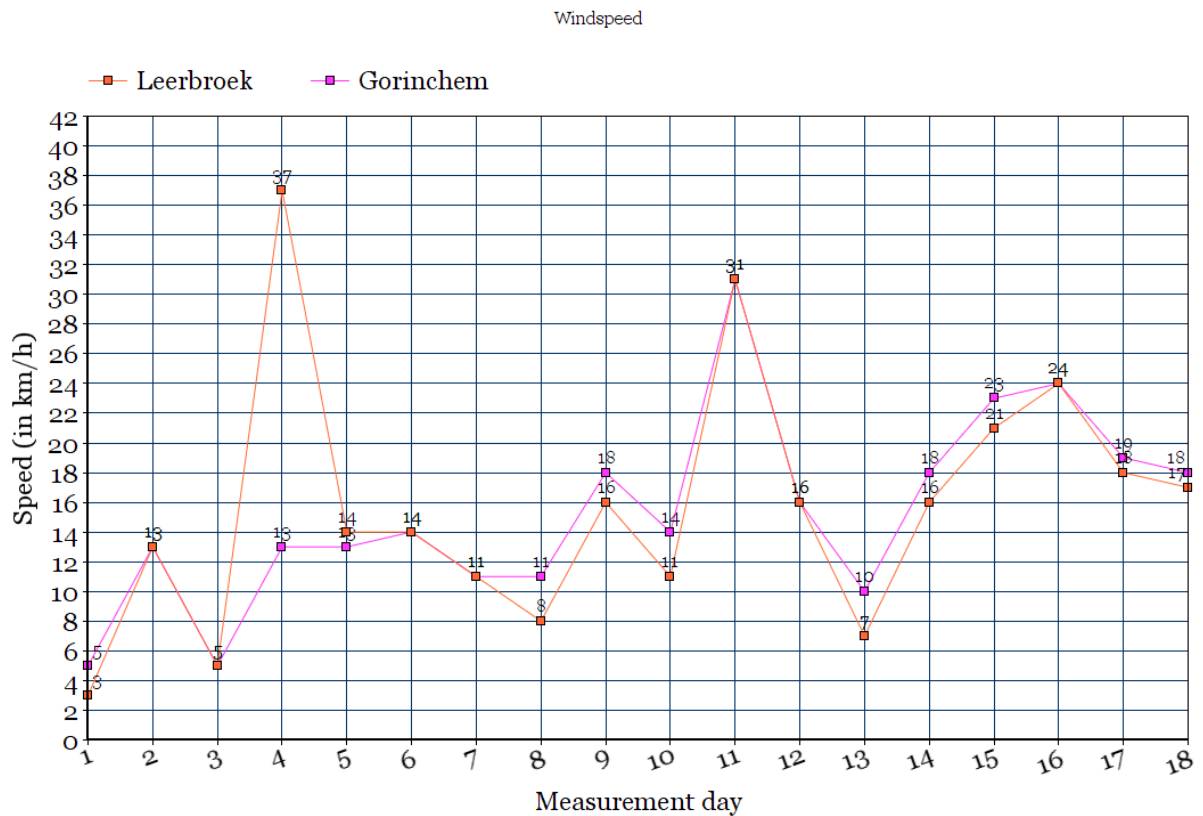
When looking at the temperature, the temperature in the urban area (Gorinchem) is bumpier, while the temperature in Leerbroek is more constant. This is also an effect of the Urban Heat Islands. Also, the urban area tends to have higher temperatures than the rural area. This is again an effect of the UHI. But mostly the temperature is the same in both areas. This however is coincidence as the areas are located close to each other.

5.3 Humidity



The graphs of Gorinchem and Leerbroek show approximately comparable results. On average, both places measure the same amount of precipitation. Outliers show up on the second, eighth and tenth day. These outliers might be caused by external factors. One of them is that Gorinchem is stationed next to river Merwede which has effect on the humidity. The biggest factor to humidity is air temperature. Due to the air temperature being approximately the same, the small gaps between the results are explained. Overall, the differences between countryside and urban areas regarding humidity are minimal.

5.4 Windspeed



Both windspeeds are close to each other. However, most of the time the windspeed in Gorinchem is slightly higher. This slight difference might be caused by a measurement error or an undiscovered phenomenon. One thing that could be seen is that on the fourth measurement date (27-2-2019) a very high peak is existent in the Leerbroek measurement but not in the Gorinchem measurement. 27 February was a very windy day, so the measurement picked this up in Leerbroek, however not in Gorinchem. This is a result of the buildings blocking the wind from reaching the measurement gear.

6. Conclusion

At the start of the research, we expected the precipitation rates to be like each other. In fact, the rates differ more from each other than we predicted. This precipitation rates differed most in the first few measuring days. Peaks in as well Gorinchem as Leerbroek made outcomes differ from the predictions. These rates are normally influenced by distance to sea, but it did influence the results due to the sea being in a range which did not bring effect on both places. Nor altitude nor latitude brought differences. Therefore, we were off from the predictions, but we were not far off.

The temperature in the urban areas was to be expected higher than in the countryside. Temperatures were not in particular higher, but differences were spotted. The temperature in the countryside (Leerbroek) was more constant and less bumpy. Gorinchem also noted down higher temperatures. Overall, the temperature was affected in a way and differences showed up between the countryside and the rural areas.

The humidity level was expected to not differ from each other. And so it did. The humidity graph shows a big amount of differences, but these differences are that small that they are not seen as strange discoveries. The biggest factor on humidity is the air temperature. Because the temperature graph shows it did not have much effect on the differences in both places, it neither had big influence on the humidity level. All in all, the humidity level shows some minor differences, but does not play a big role in this research.

The windspeed was expected to differ the most out of all measurements taken. The windspeed did show differences between both places. On the fourth day, this difference was really shown. Windspeed is of course affected by the freedom it must blow. In the countryside, less buildings are built which would mean the windspeed would reach higher levels. These effects do pop up in the graph but not such a big way we expect. The windspeed did show differences and proved the theory in which the landscape influences the windspeed.

All in all, differences are spotted in the graphs between both places. The reasoning behind this has to do with factors which only occur in one place. For example, the river Merwede which plays a role in the humidity and the amount of buildings placed which influences the windspeed. Measurements of Gorinchem show less windspeed, same humidity, a higher temperature and less precipitation. The results are minimal, but prove difference between countryside and urban area.

7. Discussion

During the PO we did have some difficulties. First, we could've gotten so much more data than we do now and the planning of measuring the data wasn't very clear and structured. We also had some technical difficulties which caused us to have difficulties with measuring.

We also think that it would have been more wisely to choose two places that are located further away from each other, to have clearer differences in weather and to have better results.

Last, we did, we think, have nice end results and we were very enthusiastic about doing research, which made it less boring to do the PO.

8. Acknowledgements

We would like to thank Jerom's father for borrowing the measurement equipment and mister Van de Berg for all his help.

9. References/Bibliography

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