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THE IMPORTANCE OF PROPER SITE SELECTION FOR AGROMETEOROLOGICAL TEMPERATURE MEASUREMENTS

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Abstract: *Our research aimed to find out how the measurement site influences the temperature data and thus the agrometeorological information that can be used for precision crop production, such as daily minimum, maximum, mean values (monthly averages). We examined temperature heterogeneity at micro (1-100 m scale) and meso (1-10 km scale) horizontal scales. Temperature data of year 2022, measured by 7 high-precision HOBO Pro v2 U23-002 temperature/humidity data loggers (accuracy: ±0.21°C, resolution: 0.02°C) installed in the close surroundings of a town (Szarvas) in the Hungarian Great Plain were evaluated. Data from Szarvas station of the Hungarian Meteorological Service were also used. The monthly mean temperature on mesoscale was most consistent in November and December, with a maximum difference of only 0.1°C. This also indicates a very high accuracy of our measurements. The largest heterogeneity was found from March to August, with differences typically 0.3-0.4°C. In case of minimum temperature large horizontal heterogeneity was detected (0.2-1.4°C). Microscale variations in maximum temperature were significant in the spring and summer seasons (in monthly averages 0.6-1.2. °C). Based on our results, recommendations were made for the selection of sites for agrometeorological measurements and the positioning of thermometers.*

• Introduction

In standard meteorological practice, air temperature is measured above low vegetation typical for the environment (mostly grass), at a prescribed distance from buildings and artificial surfaces. In case of agrometeorological measurements, when selecting a site for measurements, the purpose of its observations must be decided first, there is a flexibility according to it. The agronomic uses of temperature data are very diverse, due to the complex effects of temperature, accurate temperature information is very important in research work and in crop production practice.

• Material and method

Our measurements aimed to find out how the measurement site influences the temperature data, examined temperature heterogeneity at micro (10 m scale) and meso (1-10 km scale) horizontal scales. Measurements with HOBO Pro v2 U23-002 loggers were set at 7 points in the Szarvas area (*Figure 1*). Also data from the meteorological station of Hungarian Meteorological Service were used. In our study, we evaluated data for the full year of 2022.

Figure 1. Location of temperature measurements in the surroundings of Szarvas, Hungary

In total, 4 out of 8 gauges were located close to each other (50-200 m distance) at site E, but in different micro-environments. The other measuring locations (A, B, C, D) and E1 were at least WMO Class 2 sites to investigate mesoscale variations.

• Results and discussions

The monthly mean temperature at mesoscale (max. distance 8 km) was most homogeneous in November and December, with a maximum difference of only 0.1°C (*Table 1*). This also indicates a very high accuracy of the measurements. From March to August and in October, maximum deviations of 0.3-0.4°C were observed.

Table 1. Monthly (yearly) mean temperature values (°C) at 8 sites in the surroundings of Szarvas (Hungary) in 2022. Values of Δ1 and Δ2 show the largest differences at mesoscale and microscale.

month	A	B	C	D	E1	E2	E3	E4	Δ1	Δ2
1	0.4	0.4	0.3	0.5	0.4	0.4	0.1	0.0	0.18	0.39
2	5.0	4.9	4.9	5.1	4.8	4.9	4.7	4.5	0.26	0.41
3	5.7	5.3	5.4	5.6	5.3	5.4	5.2	5.2	0.36	0.20
4	9.9	9.7	9.8	9.8	9.8	9.9	9.9	9.7	0.28	0.18
5	18.1	17.8	18.0	18.0	17.9	18.0	17.9	17.7	0.37	0.37
6	23.7	23.6	23.4	23.5	23.2	23.3	23.3	23.1	0.43	0.15
7	24.5	24.7	24.3	24.4	24.3	24.4	24.2	24.1	0.36	0.29
8	24.4	24.6	24.2	24.4	24.3	24.4	24.3	24.2	0.38	0.22
9	16.5	16.6	16.4	16.6	16.4	16.5	16.3	16.1	0.16	0.39
10	13.3	12.9	13.1	13.2	13.2	13.3	13.1	13.0	0.34	0.36
11	6.8	6.8	6.8	6.8	6.8	6.8	6.7	6.6	0.09	0.19
12	3.3	3.3	3.2	3.3	3.3	3.4	3.1	3.1	0.14	0.31
year	12.6	12.5	12.5	12.6	12.5	12.6	12.4	12.3	0.28	0.29

The largest spatial differences in monthly averages of daily minimum values ranged from 0.2°C to 1.4°C at mesoscale and typically 0.2-0.7°C at microscale. Microscale variations in maximum temperature were significant in the spring and summer seasons (0.6-1.2°C). At larger scale, generally slightly larger differences were found. It can be stated that the differences due to microenvironment can be larger than between stations in open environments up to 10 km apart. This was found in the winter months of 2022 for minimum temperatures, in February-March and August for maximum temperatures, and in the autumn and winter months for mean temperatures.

• Conclusions

The use of temperature data from the nearest official meteorological station is usually appropriate. If there is a presumed mesoclimatic difference from the area of cultivation, it is advisable to install an own monitoring station.