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DEPENDENCE OF SURFACE AIR TEMPERATURE MEASUREMENT ON THERMOMETER'S INSTALLATION HEIGHT

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Air temperature is one of the most measured atmospheric variables which is used for weather and climate monitoring. To achieve the best comparability between weather stations across the globe, the World Meteorological Organization (WMO) specifies common requirements for air temperature measurements in its Guide N. 8 on Instruments and Methods of Observation (GIMO). According to the guide, air temperature should be measured at a specified height between 1.25 and 2 m above ground level. Even though it is mentioned the possibility of large vertical gradients, no references or works are mentioned that have been considered to define the height interval.

To better investigate the measurement comparability in the mentioned range, an experiment, covering more than one year, is running to compare with metrological rigor the measurements associated with different installation heights. The chosen site is on a field covered with natural grass that is regularly maintained. The experimental setup is distant more than 30 m from any obstacles or heat sources, thus reducing possible siting effects. The measurement system consists of 8 traceable Pt100 sensors, shielded by identical artificially ventilated screens and installed at four different heights (1.25 m, 1.5 m, 1.75 m and 2 m) on different poles. Redundant measurements at same heights on different poles are performed to increase the reliability of the system and sort out eventual horizontal air temperature gradients affecting the testing field.

A statistical analysis of the measurements has been performed by studying the distribution of the air temperature differences computed with respect to one of the thermometers at 2 m. Preliminary results highlight two different behaviors: sensors below 2 m are hotter during days, but colder during nights. This reflects the well-known behavior of thermal gradients close to the ground, which in principle should be negligible in the suggested interval of installation. Instead, the study of the diurnal measurements reveals that the medians of the temperature differences are 0.08 °C, 0.10 °C and 0.04 °C at respectively 1.25 m, 1.5 m and 1.75 m from the ground. On the other hand, the differences during nights can reach larger absolute values: -0.3 °C, -0.19 °C and -0.12 °C at respectively 1.25 m, 1.5 m and 1.75 m.

These results point out that significant differences can be observed in air temperature measurements at the installation heights suggested by the GIMO, even when using the same calibrated instruments and exposed to the same environmental conditions. It is therefore crucial to define and promote a standardized installation height to enhance comparability among air thermometers at weather and climatological stations.