

PRESS RELEASE

MEASURING AIR TEMPERATURE: HARDER THAN YOU MIGHT THINK

An article published in the Journal “Nature Physics” by INRiM Researchers summarizes the technical and scientific difficulties in providing accurate measurements of atmospheric temperature

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Air temperature is the main quantity used to evaluate climate change.

Warnings issued by IPCC are based on 1.5 or 2 °C temperature rise scenarios with respect to pre-industrial era: atmospheric temperature has been commonly measured for more than one century in order to compute meteorological or climatological models.

These measurements are performed using thermometers that, starting from mercury-in-glass instruments, have now evolved into highly sophisticated electronic systems.

Despite the apparent and almost familiar ease of this measurement, given the presence of thermometers in our homes and cars, the operation is far from trivial. Measurements are influenced by a wide range of external factors: solar radiation, presence of wind, interactions between sensor and environment, its degree of protection from rain, snow or condensation, the very position of the sensors itself.

To make things worse, currently there is no definition of air temperature in terms of its water vapour content, its composition, or pressure. Concurrently, these difficulties lead to the fact that no standard procedures are available for the calibration of thermometers in air.

Metrology, as the science which deals with improving measurement methods and capabilities, puts forward study initiatives and solutions to this underestimated problem.

In a paper published on *Nature Physics*, researchers from the National Metrology Institute of Italy (INRiM) speak about the challenges that air temperature measurements pose to the scientific community, presenting European and global research projects that deal with improving calibration and measurement methods, as well as uncertainties due to external factors, in order to maximize quality and comparability of the measurements.

Andrea Merlone, Research Director of INRiM, explains that «climate change studies are based on the so-called “annual or monthly anomalies”, relative variations in air temperature compared to reference periods. This method allows us to observe global warming in a very specific way and it confirms the value of climate scientists' work. Metrology is now aiming to give further support to air temperature measurements to capture trends more quickly, more accurately, more absolutely and with a greater measurement sensitivity. Data generated from stations from very different locations, from the poles to the Mount Everest, from the desert to marine sites will be more comparable. We are approaching temperature values that could trigger worrying scenarios: all the scientific disciplines must make their knowledge available towards this global priority. Metrology came out of the laboratories and went to the field to solve an underestimated problem "that we didn't even think we had"».

KEY INFORMATION

Who: National Metrology Institute of Italy (INRiM).

What: Merlone A., Coppa G., Musacchio C., *The air temperature conundrum*, Nature Physics (2024).

Research link: [DOI: 10.1038/s41567-024-02428-w](https://doi.org/10.1038/s41567-024-02428-w)

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