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Road siting effect metrological evaluation on near-surface air temperatures

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With the purpose of revising World Meteorological Organization's Commission for Instruments and Methods of Observation (WMO/CIMO) Guide #8 on weather stations siting, and in the framework of EMPIR project ENV58 MeteoMet 2, an experiment to evaluate metrologically the maximum influence of a paved road on 2-m air temperature measurements ("road siting effect") has been designed, installed and run in Italy. It consists of a 100-m long array of seven measurement stations, at increasing distances from a local road, equipped with shielded Pt100 thermometers and ancillary sensors (hygrometers, anemometers, solar radiation meters). Data coming from 1 year of observations, has been analysed for daily climatological metrics, finding that the road mostly effects minimum temperatures, with average values of ~ 0.30±0.18 °C at a distance of 1 m; then, in order to quantify the instrumental effect on the measurement, data was filtered by applying a Generalized Additive Model, selecting only times when the effect is more intense (during nights, in presence of low winds coming from the road), and the road siting effect has been calculated by modelling the maximum temperature differences by using Extreme Values Analysis. The 1-year return value on 10-min measurements is 1.22±0.30 °C at 1 m from the road, with a gradual decline (~ 0.1 °C/m), while an extrapolation to 100-year return level gives a value of 1.71±0.79 °C. Analysis also show the possibility of calculating an asymptotic upper limit to these values, providing there are enough data to lower the associated uncertainties. These results, published in the International Journal of Climatology (Coppa et al 2021, https://doi.org/10.1002/joc.7044) is a first step towards a redefinition of the weather station classification scheme of WMO/CIMO Guide #8, together with building and tree effects experiments which have been run in parallel with the road siting experiment here presented and which will be presented elsewhere. Raw data is also available at Zenodo.org (Coppa et al 2020, https://doi.org/10.5281/ZENODO.4300299)