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Air temperature retrieval from crowd-sourced smartphone battery temperatures for Dutch cities and its application in mesoscale model validation

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Accurate air temperature observations are important for urban meteorology, i.e. to study the urban heat island and adverse effects of high temperatures on human health. Usually, the number of routinely available temperature observations is rather limited. We present a method to derive temperature information for the urban canopy from an alternative source: smartphones. Battery temperature data were collected by users of an Android application for smartphones (opensignal.com). The application automatically sends battery temperature data to a server for storage. A regression model, based on a physical model, is employed to retrieve daily air temperatures from battery temperatures. from a meteorological station of an airport located near the city and from an urban meteorological network in the city. In this study we apply this technique for rural and urban sites in and around Amsterdam (The Netherlands). The evolution of the retrieved air temperatures correspond well with the observations. The mean absolute error of daily air temperatures amounts to 1.4 K, and the bias amounts to 0.4 K. This shows that monitoring air temperatures employing an Android application holds great promise. Finally, we use temperature observations obtained from this technique to validate high resolution WRF mesoscale modeling results over Amsterdam for a warm summer period.