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Physics-Based Correction of Inhomogeneities in Temperature Series: Model Transferability Testing and Comparison to Statistical Approaches

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For the correction of inhomogeneities in sub-daily temperature series, Auchmann and Brönnimann (2012) developed a physics-based model for one specific type of break, i.e. the transition from a Wild screen to a Stevenson screen at one specific station in Basel, Switzerland. The model is based solely on physical considerations, no relationships of the covariates to the differences between the parallel measurements have been investigated. The physics–based model requires detailed information on the screen geometry, the location, and includes a variety of covariates in the model. The model is mainly based on correcting the radiation error, including a modification by ambient wind.

In this study we test the application of the model to another station, Zurich, experiencing the same type of transition. Furthermore we compare the performance of the physics based correction to purely statistical correction approaches (constant correction, correcting for annual cycle using spline). In Zurich the Wild screen was replaced in 1954 by the Stevenson screen, from 1954-1960 parallel temperature measurements in both screens were taken, which will be used to assess the performance of the applied corrections.

For Zurich the required model input is available (i.e. three times daily observations of wind, cloud cover, pressure and humidity measurements, local times of sunset and sunrise). However, a large number of stations do not measure these additional input data required for the model, which hampers the transferability and applicability of the model to other stations. Hence, we test possible simplifications and generalizations of the model to make it more easily applicable to stations with the same type of inhomogeneity.

In a last step we test whether other types of transitions (e.g., from a Stevenson screen to an automated weather system) can be corrected using the principle of a physics-based approach.