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Artificial changes in Estonian monthly air temperatures: break detection and homogenization with HOMER Software

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The focus is on 5 different temperature parameters: the Estonian monthly mean temperature (Tmean), monthly absolute maxima (absMAX), monthly absolute minima (absMIN), monthly mean maxima (avgMAX) and monthly mean minima (avgMIN) temperature. The air temperature data is tested and homogenized by applying HOMER software (HOMogenizatonsoftwarE in R). HOMER is an interactive semi-automatic method: constructed exploiting of other homogenization methods, i.e. PRODIGE, ACMANT, CLIMATOL and joint-segmentation method 'cghseg'. HOMER is software for homogenizing essential climate variables at monthly and annual time scales. Almost whole observation network in Estonia is about 22 stations, in this study is analysed all 22 station with the series 1961-2018 and 10 stations with longer series 1925-2018. So far, no homogeneity adjustments have been done for climate data in Estonia for the whole network. Efforts have been primarily focused on trying to assess only one station e.g. Tartu station long-term temperature data or e.g. Tallinn long-term temperature data. Although there are the Standard Normal Homogeneity test (SNHT) results from monthly mean temperature series from the period of 1946-1998 (23 stations) and period of 1891-1998 (only Tartu station) indicates that the data of most stations in Estonia are homogeneous: SNHT for the 23 stations demonstrates that the temperature series at 11 stations are entirely homogeneous and at the other 12 stations, the main cause of inhomogeneity is relocation of the station. Now, it is of interest to examine the period after year of 1998. The metadata for new period 1998-2018 contains changes in instruments (automation) in all stations and new changes in station location in some stations. It is challenging to find inhomogeneities and to adjust potential biases for temperature series in a whole network, especially to find out and understand inhomogeneities over less-studied stations not only over the well-studied stations as Tallinn and Tartu. The objective of this presentation is to give an overview of non-climatological errors in Estonian temperature series and to explain the reasons of errors with station metadata. The following three questions are addressed in this presentation:

• How many stations are affected by non-climatological errors?
• Is there differences in behaviour of same artificial change in same station on specific temperature parameter (Tmean, absMAX, absMIN, avgMIN and avgMIN)?
• What is the size of the amplitudes (positive or negative bias) of the potential errors?

Finally, all five temperature parameters for each station is corrected by HOMER (using ANOVA).
The homogenisation results are compared with raw data and explained briefly.