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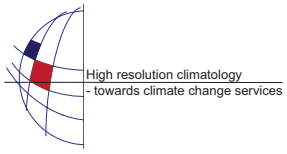

Analysis of extreme precipitation in different time intervals using moving precipitation totals

T. Tammets (1) and J. Jaagus (2)

(1) Estonian Meteorological and Hydrological Institute, Tallinn, Estonia (jaak.jaagus@ut.ee), (2) University of Tartu, Geography, Tartu, Estonia (jaak.jaagus@ut.ee)

Abstract. The objective of this study is to present an alternative method for analysing precipitation extremes – droughts and floods. Precipitation regime is usually characterized using the mean, maximum and minimum of monthly or annual precipitation totals. More exactly, moisture conditions of an object in the environment could be described if we examine precipitation totals of an undivided period of time, characteristic to this object, preceding the situation under observation. Duration of this period depends on the object under examination (crop, building, ground water resource etc.). To represent the extreme values of precipitation at different time intervals (lasting from one day to 360 days or from one month to 5-10 years), we propose to build relationships that connect precipitation extremes with the number of days or months of the observed interval. For this purpose, we calculate the moving totals of precipitation through the daily (monthly) precipitation time series without breaking time into months or years.

$Mathematically, based on a sequence a_1, a_2, \ldots, a_i, \ldots, a_N, the sequence of moving totals over subsequent n terms s_i^{(n)} (i=n, n+1, \ldots N) is expressed as:$

$$s_i^{(n)} = \sum_{j=i-n+1}^{i} a_j \quad ,$$

where N is the total number of days or months in the precipitation time series and n is the number of days (months) through which the moving total is calculated. If we choose the maximal and minimal moving totals of precipitation in the time series with the step of one day (or month) for each interval, we get the relationship between the observed extreme values (minimum and maximum) of precipitation in the observed interval (y-axis) and the number of successive days (months) in this interval n (x-axis). It is also possible to find such relationships between the percentiles, quartiles or other statistical characteristics of precipitation and n. The presented extreme precipitation curves, calculated through the statistically reliable long time series, could characterise climate resources in an area. Using this method, it is also possible to find periods when precipitation has been lower or higher than the given threshold t. This method is applied for climatological analysis of extreme precipitation and droughts influencing the agricultural production in Estonia.