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THE PROCESSING FEATURES OF METEOROLOGICAL SERIES BY CLASSICAL METHODS AND USING THE SOFTWARE RCLIMDEX

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Abstract
This article provides information about the methods of processing of meteorological data. Theoretical methods of identifying and eliminating inhomogeneity of climatological series. Also shows the methods checking the data through software RClimDex.

Raw data of meteorological and geophysical observations cannot be directly used to identify climatic features. It's necessary to carry out a climate data processing of the original observations [1]. The theoretical basis of the climate data analysis is mathematical statistics and probability theory.

Meteorological series have a specific features. Over the long-term observation periods often occur changes in the environment (environmental conditions) and in the methods of observation, so the meteorological series have inhomogeneity. Those changes, for example, usually are caused by data processing such as manual keying or data registration mistakes [2] and for changes in the environmental conditions in the surrounding of the weather meteorological stations. The values of meteorological parameters are linked in time and space. These regularities are widely used in the processing of meteorological series. Connectedness of meteorological parameters allowed to develop methods that control the climatic homogeneity, identify gross errors and lead a meteorological series to long periods [2–5].

To identifying and remove inhomogeneity in climatological series, quite simple and enough accurate methods, were developed. These include:

a) the method of visual comparison of the data by years;

b) the method of relevant differences;

c) the method of relevant relations.

The use of a visual comparison of the data by years becomes possible in cases where the natural variability meteorological element less of variability caused by inhomogeneity series. In this case will be clearly distinguishable periods of years with different levels of meteorological elements in the meteorological series.

Identification of inhomogeneity in the series by relevant differences is made possible because for some meteorological elements (e.g. pressure, temperature) difference between their values at two adjacent stations change from year to year, significantly less than the values themselves. If it is in advance known that one of the compared series is homogeneous, the sign of homogeneity of the other series is a sharp change (Fig. 1). A noticeable change in the value of the difference in these conditions suggests that one of the stations systematically fixed the different level of meteorological element (starting from a certain year) compared with the previous period. Since this change of meteorological elements on the another station has not happened, the reason for the change is not a change in the difference between the climatic conditions of the area, but some circumstances leading to the violation of the homogeneity of the series. In order to establish the causes of violations of homogeneity can be used the history of station.

Identification and elimination of inhomogeneity in the series by method of relevant relations applied to those meteorological elements (e.g. rainfall, snow cover), which are characterized by the constancy of the estimated ratio. This means that the ratio of the values of a meteorological element on two adjacent stations will vary slightly from year to year.

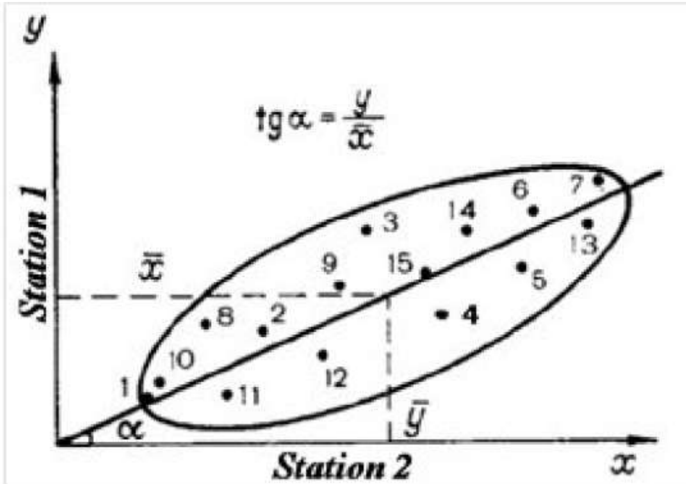

Figure 1. Correlation chart in the case of homogeneous series [1]

The temperature data need to be undergone to a quality control (QC) in order to identify errors and inhomogeneity. The data check is carried out using the software RClimdex [6], which allow to identify data transcription errors, for example, a maximum temperature less than minimum temperature and also identified outliers in daily maximum and minimum temperature.

The QC procedure identifies outliers in daily maximum and minimum temperatures and precipitation amounts. Outliers are daily values that lie outside a particular range, in agreement with Acquaotta et al. [7] and Aguilar et al. [8], is the mean plus or minus 4 times standard deviation of the daily value.

Conrad and Pollack [9] before and Peterson et al. [10] after, explain that we have a homogeneous time series when the variations are due only by variations in climate. Therefore, in order to perform climatic analysis, the daily temperature data are subjected to a homogenization process, the SPLIDHOM method [11, 12]. The test is fully based on non-parametric regression, and relies on cubic smoothing spline. The use of a smoothing parameter set by means of cross-validation allows avoiding over fitting during the estimation process.

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THE ASSESSMENT OF THE RISKS OF GULLY EROSION ACTIVISATION IN URBANIZED AREAS

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Key words: Tomsk, gully erosion, ecological and geomorphological risk

Abstract
On the basis of authors research data the estimation of gully erosion, as factor of geomorphological risk for the urban land of the Tomsk region, was conducted.

Long-time scientific studies of geographers, soil-scientists, geologists, climatologists, hydrologists of Tomsk State University laid the foundation for systematic evaluation of activisation risks of gully-formation in urbanized areas of the western Siberian South-East. The investigations were carried out in sub-taiga zone (pine – small-leaved forests) in the city and suburbs of Tomsk. The total length of gullies (gully-network density) in natural sub-taiga landscape in the West Siberian plain does not exceed 100 m/km^2, and gully density is not more than 10 gully heads /100 km^2.

Territory affected with gullies. The city territory affected with gully erosion significantly exceeds similar figures for natural landscapes. There are more than 80 gullies on Tomsk territory, including those that are backfilled. The most number of all gullies are developed on the third terrace above the flood-plain of the Tom River (see table 1), in deposits of loose alternating sands, sand clays, loams, with max. thickness 25 m.

Table 1
Distribution of gullies in Tomsk over the relief elements*

Geneticically homogeneous surfaces	Quantity of gullies
Interfluvial plain	9
The third terrace above the flood-plain of the Tom River, Q^3_{III}	41
The second terrace above the flood-plain of the Tom River, Q^2_{III}	32
Total	82

* inclusive embedded gullies

The alluvial deposits are covered from the surface with the roof loess like loamy settlements that are easily destroyed when becoming wet. The largest and most active gullies are coincided with these deposits.