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Air temperature and precipitation spatial evaluation in Slovakia using the regularized splain with tension method

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Over the last few years improvement of various GIS applications that involve spatial processing of climatological and meteorological data has been quite noticeable. This upsurge of interest is related directly to the fall in price of 'commercial off-the-shelf' GIS products together with large advances in computer processing ability. GIS methods allow the detailed analysis of spatial patterns of various atmospheric parameters, providing an in depth look into the regularities and variability of weather and climate over time and space. Many climatic parameters, such as air temperature, precipitation and snow cover as well, are strongly dependent on geographical factors such as topography, land use and vegetation height.

The paper presented here deals with spatial evaluation of the air temperature mean and mean precipitation totals within normal period 1961-1990 using GIS 3D interpolation methods. Through the homogenization process the utilized data sets were tested using the quality and quantity control procedures particularly concerning the filling and correction all data gaps and shifts recognized in the long time series within the period 1961-1990.

Nevertheless, the network of climatological as well as rain gauge stations is quite dense in Slovakia it was needed to use additional supporting points (so-called "virtual stations") particularly in the mountainous regions during the pre-processing stage of spatial analysis. In the case of air temperature analysis the regional approach of statistical regression modeling was applied and available in-situ air temperature measurements were supported by the regularly distributed grid points with spatial resolution 10×10 km. In the contrast to the proceeding the precipitation data were advanced with irregular spatial network of "virtual stations". Supplementary data sets represented by grid and virtual points were evaluated using the regional regression function whereby the statistical relation between variables and altitude was investigated within particular region.

Final spatial grids of air temperature mean and precipitation totals were interpolated using 3D module of RST-methos (Regularized Splain with Tension) in GIS GRASS whereby the parameters of tension and smoothing were optimized by means of cross-validation procedure directly integrated in GIS GRASS. Finally, we did a comparison of objective analysis map outputs with manually created maps of monthly temperature and precipitation normal. Moreover we have prepared the maps of air temperature and precipitation normal within 1931-1960 and 1951-1980 periods. Hence the comparison of different normal periods was possible and was carried out using the various numerical inter-layer evaluations (map algebra).