

## **CARTOMETRIC ANALYSIS AND GEOREFERENCING OF SPECIAL (1:75 000) AND GENERAL (1:200 000) SCALE SHEETS OF THE THIRD MILITARY SURVEY**

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The 1:75,000 scale Special Map (SM75) and 1:200 000 (GM200) series of the Third Military survey is analysed in this text. Geographic coordinates of the sheet corners are computed from the sheet number codes, as well as their grid coordinates in the modern Křovák Projection and Czech and Slovak national grid called S-JTSK. Distortions caused by paper drying and shrinkage were analysed and a mathematical algorithm is given to compute their effects. This analysis also verified the usefulness and practical adaptability of the shrinkage correction method to obtain more precisely rectified map sheets for GIS applications.

The Third Military Survey of the Czech Countries

The historical Third Military Survey, concerning the territory of the Czech Crown, was carried out in the Austria-Hungarian Empire in the period of 1870-1883. The survey was carried out in decimal scale of 1:25,000 and resulted in topographic sections. Numeric base for the survey was a network of trigonometric stations in the coordinate systems of Gusterberg and St. Stephen transformed into the polyedric projection. The maps of the 3rd Military Survey survived the end of the Austro-Hungarian Empire in 1918 thanks to their importance and became the state map series in Austria, Hungary and Czechoslovakia.

The new Czechoslovak Military Geographic Institute of Prague (founded in 1919) took over these map sheets from the Austrian Military Geographic Institute for the territory of Bohemia, Moravia, Silesia, Slovakia and Subcarpathian Ruthenia. Altogether 699 topographic sections, 189 sheets of the special map and 33 sheets of the general map all of them in the form of printing documents, i.e. copper printing plates.

Especially the SM75 series enjoyed a great popularity and was produced in several thematic series.

Elimination of distortions in the SM75 map by Helmert transformation

We made an experiment to substitute of the original polyedric projection of the SM75 maps by the Křovák Projection within the Czech Republic. According to the results, this is possible and advantageous. The meridians and parallels will be theoretically represented as common curves. As far as meridians are concerned they will be represented as concave curves with respect to meridian  $42^{\circ} 30'$  which also represents X axis in the S-JTSK system. Considering the dimensions of the map sheets we can presume that the west and east section lines represented by meridians are straight lines without any loss in map accuracy.

Final Analysis of map distortion for the State Map Series SM75 of the Czech Republic

The distortion (shrinkage) of the selected map sheet 3953 Praha (Fig. 4) is 3.3 mm in the horizontal direction and on the contrary, in the vertical direction the map got longer by 0.4 mm. Helmert transformation used on the raster coordinates influenced directly by the shrinkage determined a mean square error of the set of identical points.

If the shrinkage of the map is eliminated beforehand by calculation by calculating the absolute or relative shrinkage value of the map sheets then after a repeated application of Helmert transformation, the correlation field of  $m_y$  and  $m_x$  deviations becomes flatly spread.

This conclusion proves that even the relatively old maps as the SM75 and GM200 sheets are, printed mostly on paper of an inferior quality, can be successfully converted into a scanned and rectified raster image by removing the total influence of the scanning errors. Errors of manual interactive digitization of map sheet corners and errors due to non-homogenous shrinkage may be eliminated by procedure described in this contribution.