Data Quality Control for Topographic Mapping Production

Andrea Lopes Iescheck, Rita de Cássia Marques Alves, Manuella Anaís Rodrigues Fagundes, Gabriel de Souza

Federal University of Rio Grande do Sul, Institute of Geoscience, Department of Geodesy. Porto Alegre - RS, Brazil

Extended Abstract

This paper describes a part of a project that aims to perform the spatial data quality control and the evaluation of intermediate and final products generated throughout the topographic mapping of the city of Porto Alegre, State of Rio Grande do Sul, in the south of Brazil. Considering that mapping quality is directly related to the quality of data handled at each stage of cartographic production, methodologies and criteria were defined for each one of the process steps. Quality is a complex issue in the cartographic products analysis, once it comprises a set of qualitative and quantitative parameters.

In Brazil, only the National Map Accuracy Standards (PEC) defines the quality of cartographic products. PEC is an important classification parameter, but it just considers the positional accuracy of the mapped features.

The present study shows the methodology and the results achieved by the quality control of the photogrammetric restitution stage, for planimetric features, at 1:1.000 scale, covering an area of 545 km². The methodology was developed considering the technical specification of the bidding process, the Brazilian cartographic legislation and the international standards related to spatial data quality (ISO).

In order to perform the intended analysis the area was divided into 71 sectors. The set of parameters considered in the quality evaluation were: positional accuracy, completeness, logical consistency, semantic quality and attribute precision.

The criterion adopted for positional accuracy was the horizontal PEC, that sets that 90% of the horizontal coordinates of points in the map when compared to the coordinates of the same points in the ground should not exceed

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0.5 mm x map scale, and limits the RMS errors in 0,3 mm x map scale. The other parameters were analyzed in random samples of 10% of the mapped features, for each sector, with the support of a photogrammetric system. Any nonconformity found in these samples resulted in rejection of the product.

For accuracy evaluation the horizontal coordinates of 180 well-defined points in the map were compared to the coordinates of the corresponding points in the ground. These ground points were determined by a horizontal check survey of higher accuracy. Lack of features (features that should be mapped and were not), features that do not exist (do not appear on the images) and features with incorrect shapes were searched in the completeness analysis. The logical consistency covered the computational representation structure and storage, the topological relationship and the simbology analyses. Description, classification and geographical names were verified on the semantic quality analysis. And the attribute precision considered the correct association of attributes for each feature or set of features.

The results showed that positional accuracy was in accordance with PEC for topographic map class A at 1:1.000 scale. On the other hand, completeness, logical consistency and semantic quality presented an amount of errors that exceeded the maximum number of errors previously defined. Therefore, the products were rejected and sent back to the producer company for correction.

Because of the large number of rejections some adjustments were necessary throughout the control process, concerning the level of acceptance and the sample. So the level of acceptance increased from 0% to 2.5% of nonconformities. The random sample of 10% of mapped features for the sectors that were not analyzed before remained the same. But for the second evaluation of the rejected sectors, the random sample was split into two samples of 5%. One of them with the same sampled features of the first analysis and the other one with different ones.

In conclusion, the methodology and the parameters used were suitable to improve the quality of the products generated in the photogrammetric restitution stage. And the quality control for each stage of the cartographic production process is important since it has an impact on the quality of the final products.