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DIGITAL TERRAIN MODELING BASED ON LiDAR AND SRTM DATA AND EVALUATION OF MORPHOMETRIC PARAMETERS IN GIS ENVIRONMENT

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Introduction

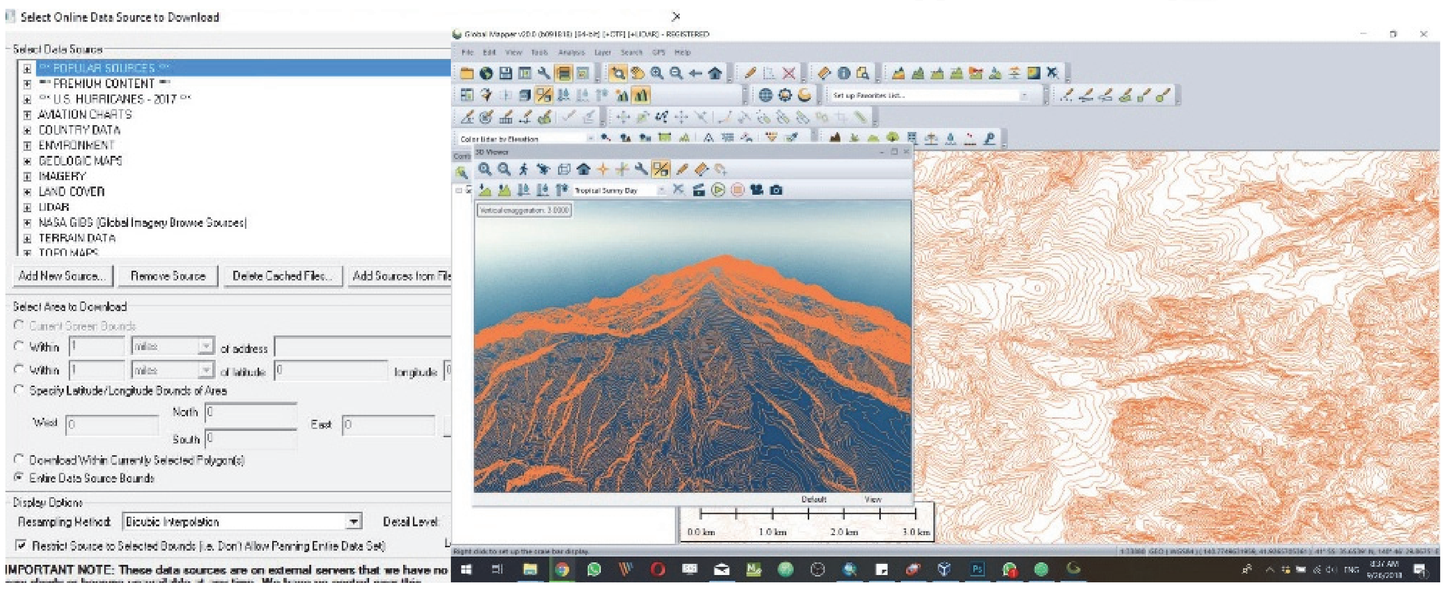
The paper presents a modern approach to digital terrain modeling by using and integrating altimetric data from LiDAR and SRTM sources, processed and analyzed in the GIS environment. The study is based on real data, supplemented with information obtained from global digital elevation models, used to generate a digital terrain model (DTM). The data used included SRTM models and LiDAR datasets, supplemented with field measurements using GNSS and total station technology, for the purpose of positional validation and correction. Data processing was performed using GIS applications, in particular Global Mapper, which allowed for data integration, filtering and interpolation, as well as the generation of three-dimensional models. The methodology adopted included the generation of point clouds, the creation of a digital terrain model using interpolation methods (TIN), as well as the derivation of morphometric parameters, such as slope, longitudinal and transverse profiles and altimetric variations.

Material and method

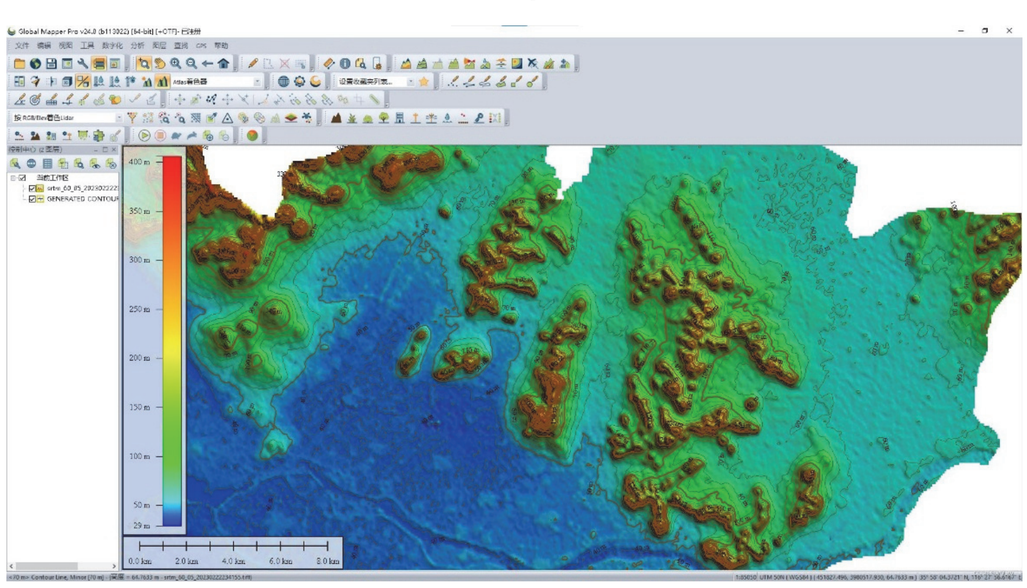
LiDAR data were used to obtain a detailed model of the land surface, which is characterized by high resolution and superior accuracy. SRTM data were used to complete and extend the analysis, which offers extensive spatial coverage, being suitable for regional-scale analyses [4], [5]. For the purpose of validation and positional correction, field measurements using GNSS and total station technology were used, which allowed the accuracy of the altimetry data to be verified [6]. Data processing was performed using the Global Mapper application, which allowed the import, reprojection and integration of data from different sources. The data were reprojected into the national Stereographic 1970 coordinate system, using the parameters specific to the Dealul Piscului 1970 datum. Subsequently, digital terrain models were generated using TIN and GRID [7].

Result and discussions

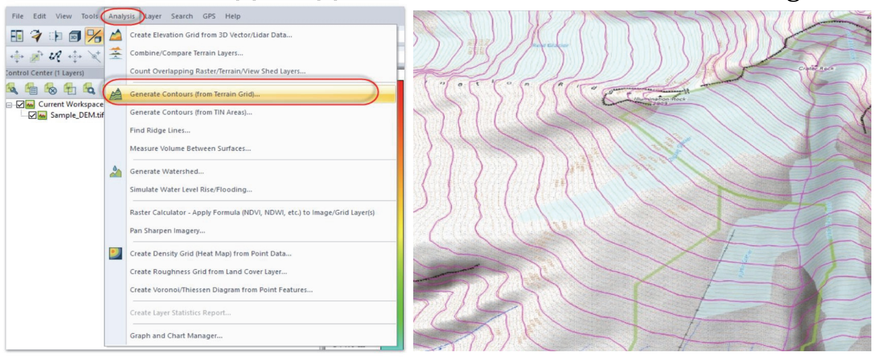
The results obtained from the processing of altimetry data revealed significant differences between digital terrain models generated from LiDAR, SRTM and ASTER data. Comparative analysis is possible from the point of view of the graphic representation (curve of the level, 3D models), which also has a higher value numeric value. Models based on the data of LiDAR also have a low level of detail, allowing identification of a variety of microreliefs in an tropical element. The level curves generated from these data are uniform and precise, faithfully reflecting the real terrain configuration. In addition, different altimetry calculations based on the LiDAR date and time can be achieved in the future. The ASTER GDEM models showed higher surface variability, being affected by noise and local errors. The contour lines generated from these data are less uniform, and in some cases discontinuities or artificial variations in the relief appear. These aspects limit the use of ASTER data in detailed analyses.



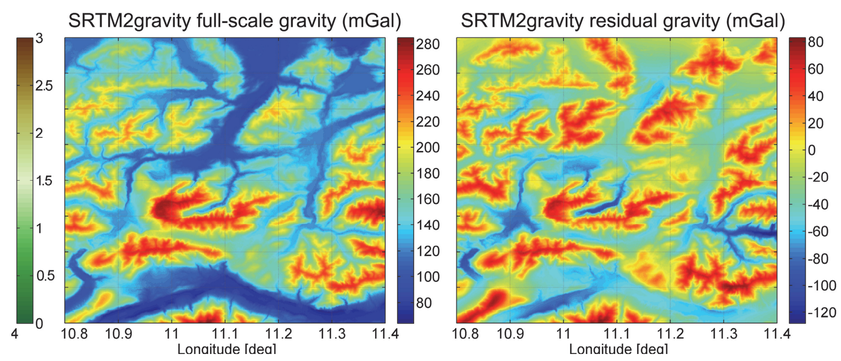
Global Mapper application interface used for accessing and integrating SRTM and ASTER data



Longitudinal terrain profile obtained from the analyzed digital models



Digital terrain model and contour lines generated based on SRTM and ASTER data



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Conclusions

The integration of data from multiple sources in the GIS environment allows obtaining reliable digital terrain models that are adaptable to different types of applications. The choice of data source must be made according to the purpose of the analysis, requiring a compromise between accuracy, resolution and data availability.

Based on the results obtained, the integrated use of several altimetry data sources is recommended, as well as their validation by field measurements (GNSS or total station), to increase the accuracy of the digital models. For future research, it is proposed to extend the comparative analyses to other global digital models, as well as their evaluation under various geomorphological conditions.

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