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COMPENSATION OF AN INTEGRATED GEODETIC NETWORK COMPOSED OF GNSS VECTORS FOR TOPO-CADASTRAL WORKS

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Introduction

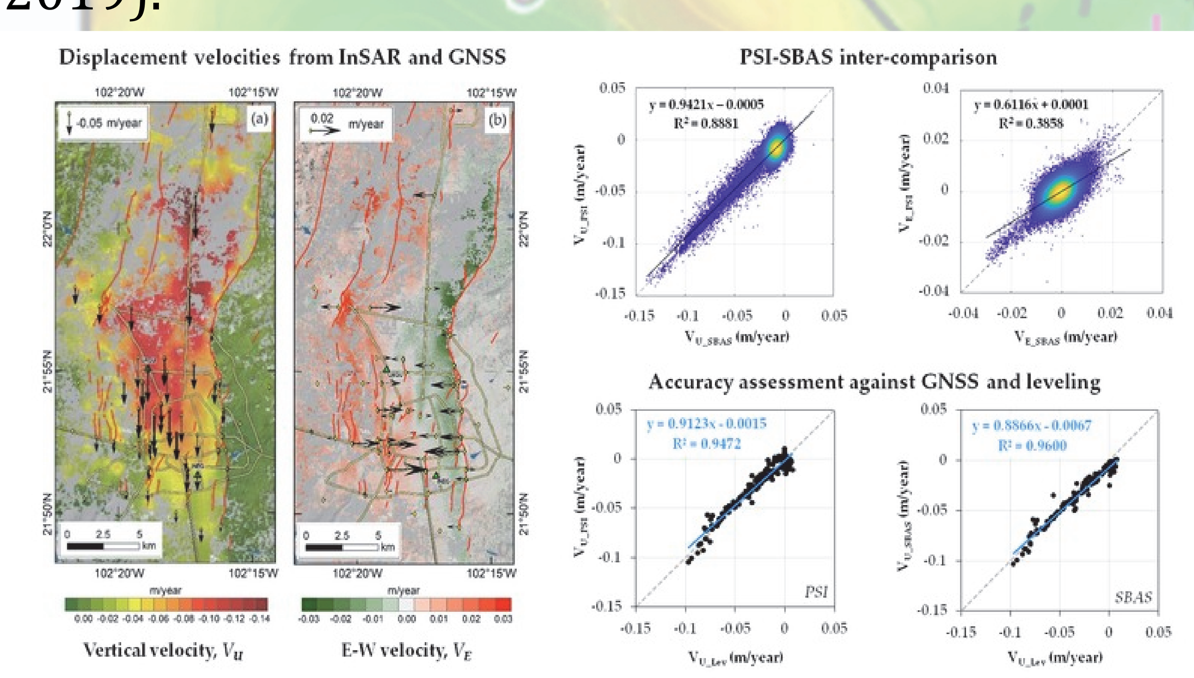
The incorporation of Global Navigation Satellite Systems (GNSS) into geodetic networks has fundamentally altered topo-cadastral practices, furnishing precise positioning and mapping, which are vital for effective land administration. Given that land documentation is becoming increasingly crucial in tackling unrecorded rights and fostering sustainable development, dependable systems are of utmost importance. This is especially pertinent considering UN Sustainable Development Goals (SDGs) target 1.4, which aims to guarantee access to land ownership (Koeva M et al., 2020). The integration of GNSS vectors into a unified network can substantially enhance the accuracy and efficiency of topo-cadastral surveys, responding effectively to both user requirements and governmental aims. In this regard, investigating methodologies like the use of unmanned aerial vehicles (UAVs) for data collection exemplifies innovative solutions to tackling intricate land administration challenges (Danijel Šugar, 2017).

Material and method

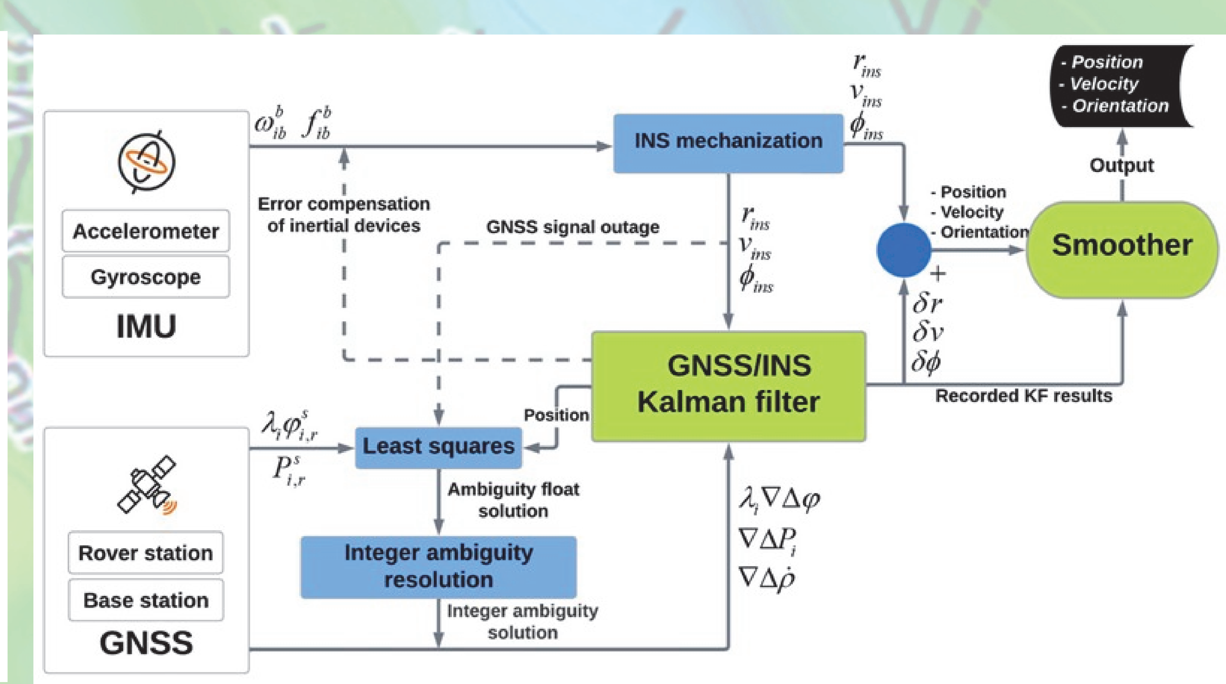
Static and kinematic measurements were done in Berzovia with GNSS equipment from Leica series, an apparatus with multiple applications. It can be used either as reference station, or as rover for both static and kinematic (RTK) measurements. To post-process data from the field (by stationing with GS equipment on concrete landmarks) we acquired RINNEX data from Permanent Stations at 5 sec; together with data from the field, we post-processed and obtained WGS 1984 coordinates for the stationed landmarks. Turning raw data from the ETRS89 system into the STEREO'70 system was done with the TransDatRO Programme; then, we reported points in AutoCAD with the TopoLT Programme and we compared them with RTK values after reading. Data comparison was done between RTK GNSS values, Static GNSS values from post-processing and GNSS Radio.

Result and discussions

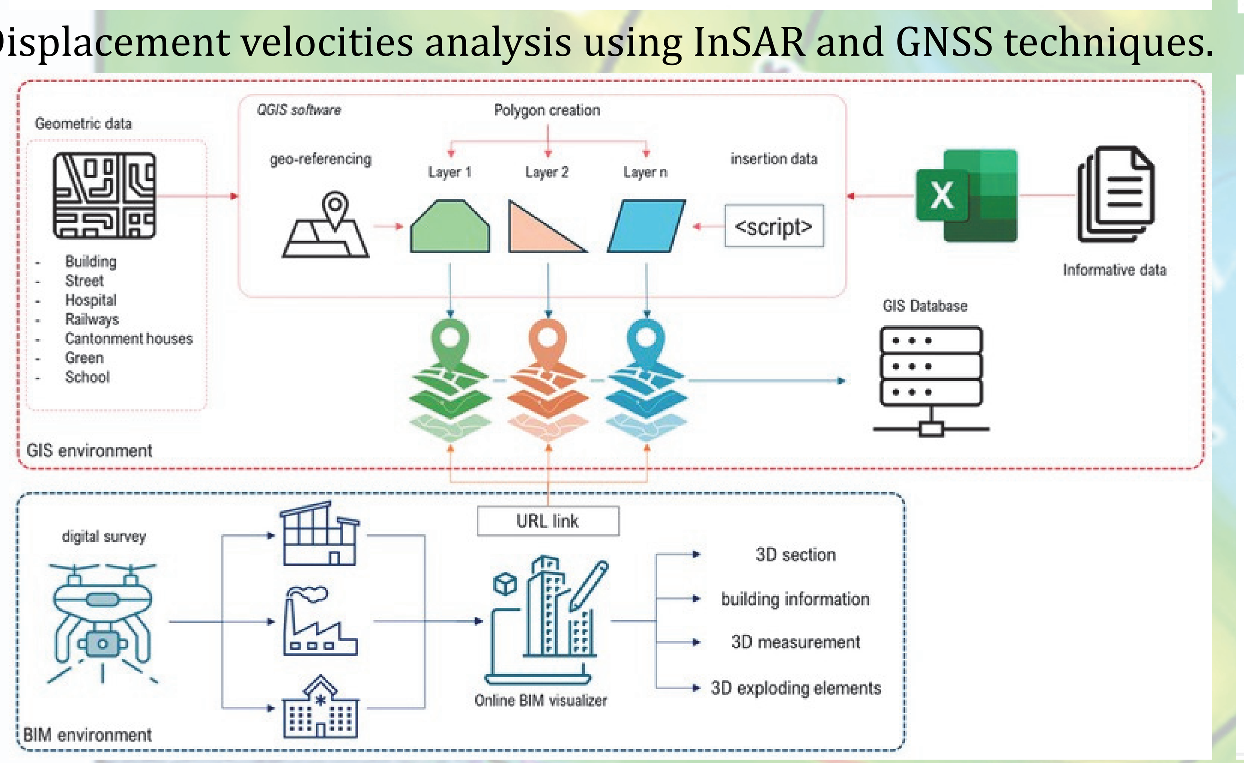
Accuracy and Precision in GNSS Measurements. Within the sphere of Global Navigation Satellite System (GNSS) measurements, both accuracy and precision hold utmost importance for carrying out effective topo-cadastral tasks; these factors exert a direct influence on the trustworthiness of geospatial information. Accurate GNSS readings hinge on the soundness of satellite signals and their ensuing processing, which calls for sophisticated approaches capable of lessening error sources, like atmospheric disruptions and multipath phenomena. As outlined in debates about establishing a definitive cadastre, combining geodetic coordinates with a focus on accuracy assures that property lines are demarcated with the greatest clarity, offering key data on land ownership and entitlements (Brown et al., 2011). Such careful focus on GNSS accuracy not just enhances how efficiently tasks are performed but also turns into noteworthy economic gains, and speeds up how fast infrastructure projects move forward (BĂDESCU et al., 2019).



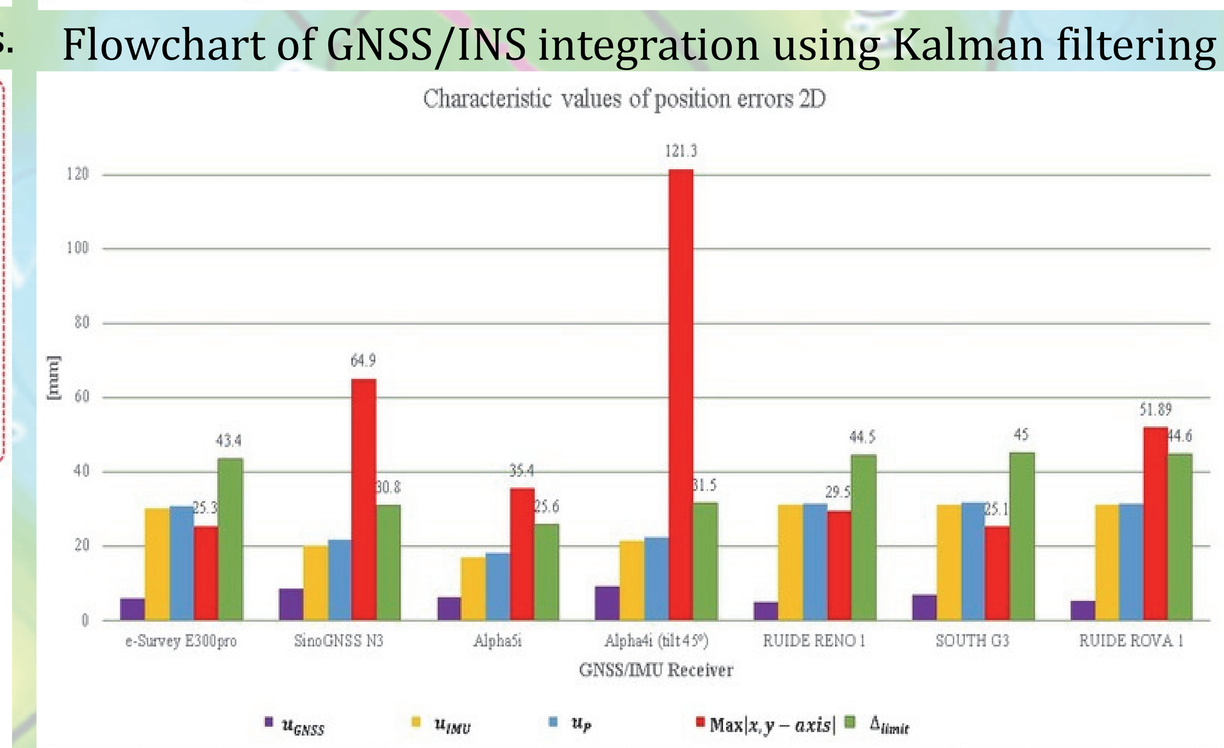
Displacement velocities analysis using InSAR and GNSS techniques.



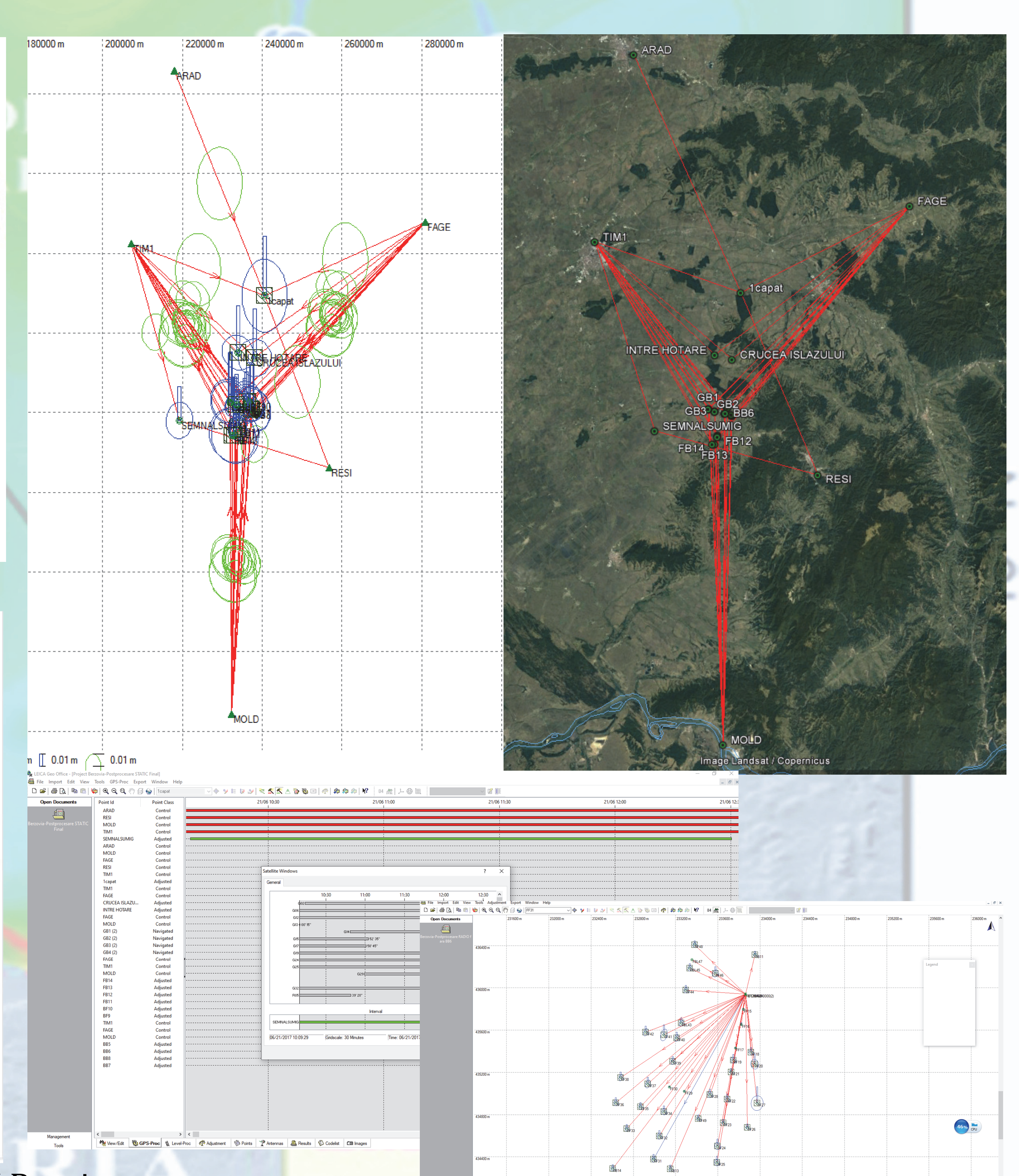
Flowchart of GNSS/INS integration using Kalman filtering



Integration of GIS and BIM workflows for urban planning and data visualization.



Comparison of 2D Position Errors Across GNSS/IMU Receivers



Conclusions

To conclude, the trajectory of topo-cadastral endeavours hinges on the continued harmonisation of sophisticated GNSS technologies and all-encompassing geodetic networks; these will, without a doubt, bolster the exactitude of spatial data acquisition. As underscored by recent investigations, the progression toward more resilient and adaptable systems – those capable of adapting to dynamic geographical attributes – remains vital. The demand for high-definition data, as demonstrated by projects such as (Zahorec P et al., 2021) and (Pail R, 2021), is crucial for both efficacious land administration and urban development initiatives. Moreover, the assimilation of multidimensional data collections, as exemplified in , will notably refine the veracity of cadastral archives, whilst facilitating real-time oversight of land utilisation shifts.

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