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# Development of an OSI Software Package for Gravitational Field Mapping Data Processing

Sampietro D[1,2], Capponi M[1], Merlo R[3], Terruzzi M[3], Koivisto E[4] and Gaya Pique L[4]

[1]Geomatics Research & Development srl, Italy - [2] Istituto Nazionale di Geofisica e Vulcanologia, Italy - [3] DkR srl, Italy - [4] CTBTO Preparatory Commission

## INTRODUCTION AND MAIN RESULTS

Gravitational field mapping (GRV) can support CTBTO On-Site Inspections by revealing anomalies linked to underground nuclear explosions. Since these signals can be very small, accurate processing is essential.

We developed a Python package with a user-friendly interface that, by applying all needed corrections, can help the inspection team to obtain and visualize reliable corrected gravity data.

SnT 2025 CTBT: SCIENCE AND TECHNOLOGY CONFERENCE
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## Introduction

Gravitational field mapping (GRV) is one of the techniques available to CTBTO On-Site Inspections (OSI) to search for evidence of underground nuclear tests. Gravity anomalies generated by cavities, collapse zones, or petrophysical changes can be extremely small and easily masked by instrumental or environmental effects. Therefore, accurate data processing is essential, including instrumental corrections, time-variable as well as external factors corrections.

In this framework, we developed a Python software package, based on open-source libraries, that integrates the full correction chain into a simple and intuitive graphical interface. The tool allows import of raw data from gravimeters, with focus on the Scintrex CG6 recently acquired by the CTBTO, application of all instrumental, temporal, and external factors corrections, and visualization of results in different formats.

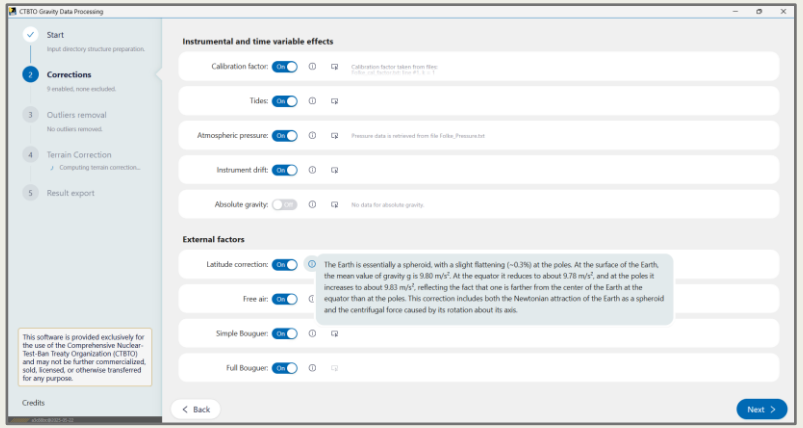
The main goal is to provide the inspection team with a user-friendly solution delivering reliable and comparable gravity values, thus enhancing the detection of anomalies that, combined with other geophysical methods used within an On-Site Inspection, can contribute to the identification of underground nuclear tests.



## Method

The software applies the full set of standard gravity corrections to ensure reliable gravity field data:

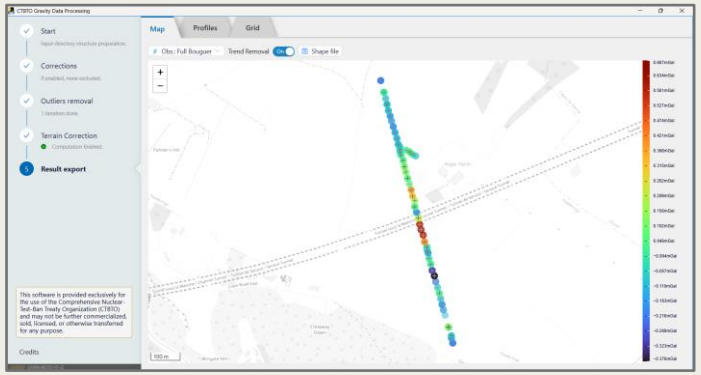
- Instrumental corrections: calibration factor, instrumental drift and absolute gravity;
- Time variable corrections: tidal and atmospheric pressure effects;
- External factors corrections: latitude, free-air and simple and full Bouguer reductions.



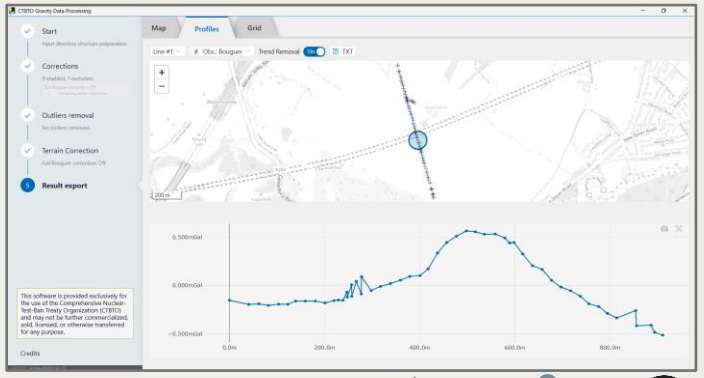

Outlier removal is supported through statistical tests on variance, tilt, and a chi-square approach, ensuring data robustness. Terrain effects are addressed by an innovative and efficient multi-resolution prism-based algorithm, balancing accuracy with computational speed.

## Results

The developed software enables the visualization and export of gravity data on maps, profiles, and grids.




An example is the gravimetric profile view, where all observations (from raw to corrected data) are displayed along survey lines, allowing the inspection team to clearly identify local anomalies.



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## Additional material