Bulletin of Geophysics and Oceanography Vol. XX, n. X, pp. XXX-XXX; Xxxxx 20xx
DOI 10.4430/bgo00514

The new reference gravity network in Italy

R. Barzaghi[1], G. Berrino[2], B. Betti[1], A. Borghi[3], D. Carbone[4], D. Carrion[1], D. Contrafatto[4], A. Facello[5], F. Fuso[6], A. Germak[5], F. Greco[4], A. Mazzoni[6], A. Messina[4], F. Migliaccio[1], L.T. Mirabella[4], A. Prato[5], G. Ricciardi[2], F. Riguzzi[7], L. Rossi[1], F. Vespe[8] and A. Vitti[9]

[1] *DICA-Politecnico di Milano, Milano, Italy*
[2] *Istituto Nazionale di Geofisica e Vulcanologia - Osservatorio Vesuviano, Napoli, Italy*
[3] *Istituto Nazionale di Geofisica e Vulcanologia, sezione di Bologna, Bologna, Italy*
[4] *Istituto Nazionale di Geofisica e Vulcanologia - Osservatorio Etneo, Catania, Italy*
[5] *INRiM, Torino, Italy*
[6] *DICEA, Università La Sapienza, Roma, Italy*
[7] *Istituto Nazionale di Geofisica e Vulcanologia, sezione di ONT, Roma, Italy*
[8] *ASI, Centro di Geodesia Spaziale, Matera, Italy*
[9] *DICAM, Università degli Studi, Trento, Italy*

(Received: 12 June 2025; accepted: 8 November 2025; published online: 13 February 2026)

ABSTRACT The Italian area is affected by on-going deformations and/or mass transfers, both of geophysical and human origin, which act on very different temporal scales and significantly modify the gravity field over time. The current Italian gravity database contains gravimetric measurements taken on land and sea by various research institutions and services. Data were acquired at very different epochs, with different instruments, some now obsolete and mostly lacking inter-comparison, and also with non-uniform operational procedures of data acquisition and analysis. Thus, these data are not homogeneous and do not represent an updated image of the Italian gravity field. This paper shows the main steps followed towards the realisation of a new reference network for absolute gravity in the Italian area. The choices are in line with the resolutions approved by the International Association of Geodesy during its 2015 general assembly. The goal is to update the existing absolute gravity network by adding gravity stations according to the new standards so as to align this infrastructure to the highest level of precision and accuracy. Based on this, an overall revision of the Italian gravity database will be possible, thus, leading to a better estimate of the gravity potential.

Key words: reference gravity networks, Italian area, gravity measurements, vertical gravity gradient, network positioning.

1. Introduction

A modern zero-order gravimetric network (G0) is being realised in Italy based on absolute gravity measurements, thanks to funding provided by the projects “Pianeta Dinamico” (INGV, 2019-2023) and research programs of significant national interest (PRIN - *Progetti di ricerca di Rilevante Interesse Nazionale,* 2020) (MUR – Italian Ministry of University and Research, 2022-2025).

The necessity to create a new network arises from the following: 1) the need to align various gravimetric networks (recent and historical) into a single reference frame, including older

© 2026 - The Author(s)

measurements available in Italy, currently referring to the International Gravity Standardization Net 1971 (IGSN71) standard (Morelli *et al.*, 1974), which does not adhere to present scientific and technical requirements; 2) the availability of new high precision absolute measurements and the need to align them to the new international standards proposed in 2015 by the International Association of Geodesy (IAG; IAG Resolution 2 at the IAG/IUGG General Assembly in Prague, 2015: https://office.iag-aig.org/doc/5d7b8fd9d31dc.pdf); 3) the need to define an updated gravity reference network in Italy (selected absolute gravity points) to be used as reference for the relative measurements, and 4) the existence of intense geodynamic and anthropic processes producing temporal variations in gravity due to various phenomena of mass variations (volcanoes, earthquakes, hydrology, etc.), which affect the entire Italian peninsula (e.g. Riguzzi and Doglioni, 2020 and references therein). Further technical and scientific implications also concern the advancements related to metrology and gravity measurement with atomic interferometry (Ménoret *et al.*, 2018; Zhu *et al.*, 2021; Antoni-Micollier *et al.*, 2022; Zhong *et al.*, 2022; Richard, *et al.*, 2024).

The absolute gravity reference system, officially adopted by the scientific community to this day, is the IGSN71 standard established by IAG and implemented in Italy through the IGSN71-ITALIA standard (Morelli *et al.*, 1974). It consists in stations located along the Hannover-Catania calibration line, integrated with stations in Rome, Milan, and Trieste, the Bologna-Ferrara calibration line, and eight sites of a pre-existing network (RFI55). The Italian network was framed in the first order world gravity network composed of 50 stations equipped with pendulums and absolute gravimeters spread in different continents; the gravimetric connections were complete with relative gravimeters. A detailed description of the state of the art of gravimetry in Italy to this day is reported in Berrino (2020).

2. The reference gravity network design

A census of the still existing absolute gravity sites in 2017 has brought to light that from 1976 to 2011, 44 sites have been measured with different aims (volcanic monitoring, geophysical prospecting, and calibrations). Therefore, most of the G0 network stations are new; all are located indoor to ensure power and protection from outdoor conditions, with absolute gravimeters operating in all the surveys during the late afternoon and night, to reduce noise caused by human activity.

Based on this selection, an initial set of 30 stations has been defined over the peninsular part of Italy and the two main islands of Sicily (Fortunato *et al.*, 2020; Greco *et al.*, 2021, 2024) and Sardinia (Fig. 1). The Global Geodetic Observing System (GGOS) core station of Matera [the "Giuseppe Colombo" Centre for Space Geodesy of the Italian Space Agency (ASI)] is one of the network points required in the documents of the GGOS-Bureau of Networks and Observations (https://ggos.org/about/org/bureau/). Matera will provide the link between the Italian national absolute gravity network and the GGOS of IAG, following the international standards. The Sicilian network was first realised with five stations (Catania, Centuripe, Milazzo, Palermo, and Noto) connected to the reference stations of the International Earth Rotation and Reference Systems Service providing the geocentric Cartesian components of the baselines between the new gravimetric point and the reference benchmarks of Very Long Baseline Interferometry and Global Navigation Satellite System (GNSS) NOT1 (Greco *et al.*, 2024).

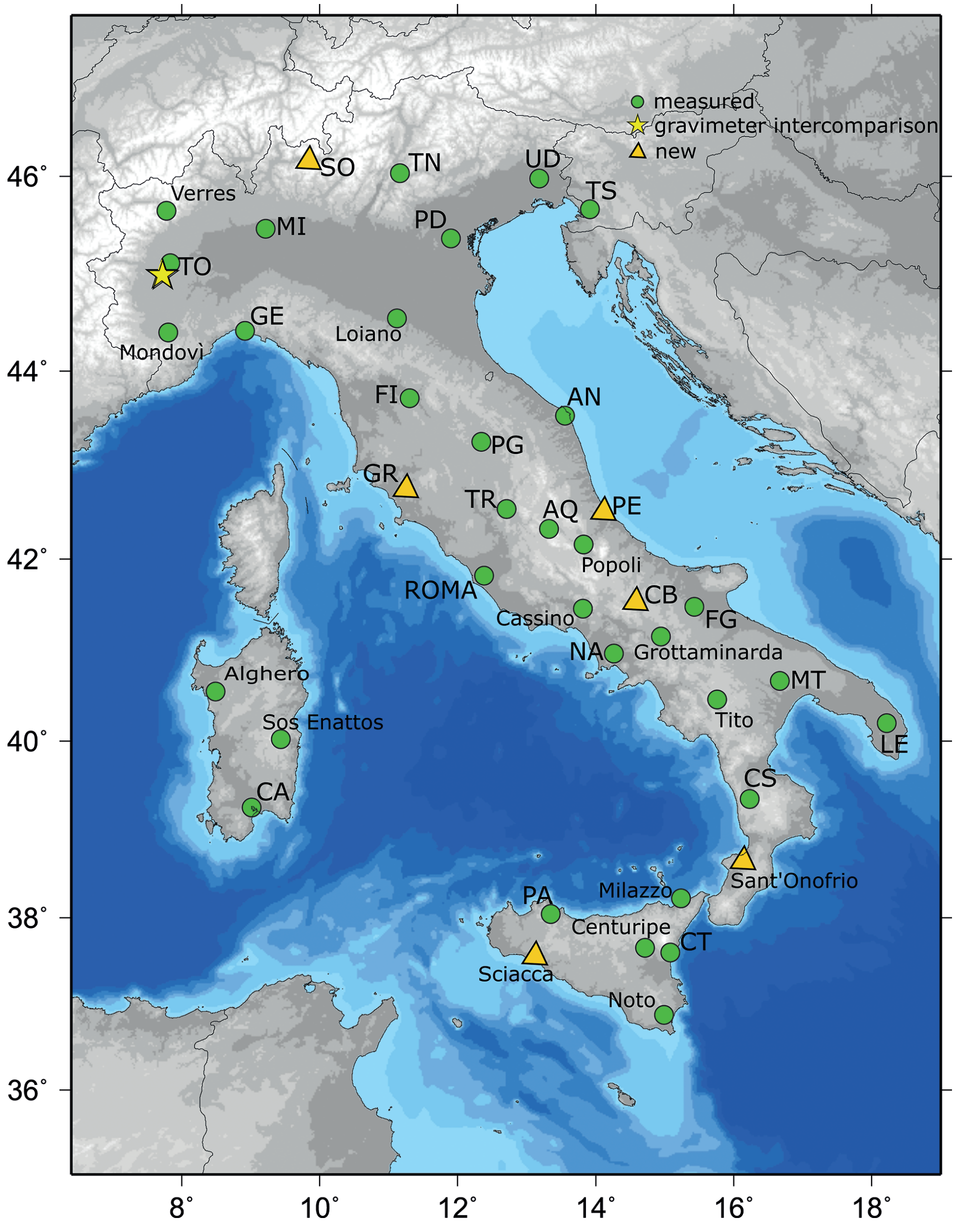


Fig. 1 - The new absolute gravity network G0: measured stations (green dots); Italian site at the INRIM in Turin (TO) of gravimeter intercomparison (yellow star); stations still to be measured (yellow triangles).

3. Gravimetric surveys

The measurements were carried out using three absolute gravimeters (Fig. 2): two Micro-g LaCoste FG5 [the first (#238) owned by Eni S.P.A. and on loan for use to the Etna Observatory of the Italian National Institute of Geophysics and Volcanology (INGV-OE); the second (#218) owned by ASI, Matera] and one IMGC-02 [developed and maintained by the Italian National Metrology Institute (INRiM) (D'Agostino *et al.*, 2008)]. The FG5 gravimeters are based on the principle of free-fall measurement using laser interferometry with an atomic clock providing an ultraaccurate time reference for measuring the time of free-fall, whereas the IMGC-02 gravimeter is based on laser interferometry to measure the symmetrical free rising and falling motion of a test mass in the gravity field. The IMGC-02 serves as the national reference of absolute gravimeters.

Fig. 2 - The absolute ballistic gravimeters used in the frame of the project: FG5#238 (on the left) and IMGC-02 (on the right).

FG5 has a vibration isolation system able to minimise the influence of external vibrations and environmental noise on the measurement as well as a control and data processing unit to manage the experiment and the collected data. FG5#238 operated in all the surveys during the late afternoon and night, to reduce the noise caused by human activity. The measurements were planned into sets, with about 50 to 100 drops per set. During the sessions, multiple drop sets (generally of about 12 hours) were carried out, thus, achieving very high accuracy with final standard uncertainties of about 2-3 µGal. The FG5 reference height measure is about 1.21 m, a value which can be slightly variable (within 2-5 mm) from one installation to the other, due to the level setup of the gravimeter.

IMGC-02 uses the symmetric method in which the body is launched upwards in a vacuum launch chamber (approximately 0.1 Pa), recording its space-time trajectory during its ascent and descent motion: during the flight (of the order of 0.2 m), a very large number of equidistant positions (stations) are located. The measurement method consists in measuring the time intervals that the body requires to travel the distances between two successive stations. The time taken by the body to travel these distances is measured by means of a counter with a resolution of the order of 100 ps. A rubidium atomic clock provides sufficient stability to serve as a time standard for this counter. The set of these data pairs (i.e. distances always constant, and times taken to travel them) are processed by solving the equation of motion with a polynomial equation (in first approximation of second degree) with the least square method. For each launch, the *g* value is obtained as one of the coefficients of the interpolating equation. This value refers to a point located below the top of the trajectory at a distance equal to approximately 1/6 of the useful length of the trajectory itself (approximately 0.48 m from the ground). During the sessions (generally overnight), the values of the standard deviation of the regression coefficients are examined for each launch. The normality condition with the $\chi 2$ test is verified and a Chauvenet exclusion test to eliminate those observations clearly affected by irregularities in the trajectory or by the concomitance with microseisms is applied in order to calculate the average value of *g* only on the launches with a regular course.

For both instruments, the observations have been reduced for the known effects (e.g. polar motion, solid Earth's tides, oceanic loading, atmospheric pressure, self-attraction, and diffraction). The influence of the atmospheric mass variations at each station has been corrected using the barometric admittance factor of -0.3 μGal/hPa and the difference between the measured and the nominal atmospheric pressure, depending on the elevation of the station. Outliers beyond the 3σ range have been computed and rejected during the acquisition stage. The corrected *g* values are associated to a statistical uncertainty given by the standard deviations of the absolute gravity values obtained for each set (σ_{set}) divided by the square root of the number of sets, N_{set}:

$$\delta_{stat} = \sigma_{set}/\sqrt{N_{set}}. \qquad (1)$$

In order to ensure measurement traceability, as required by the international standards on gravity measurements (Marti *et al.*, 2014; Vinnichenko and Germak, 2017; Facello *et al.*, 2025), the absolute gravimeters used in the measurements participated in international and national comparison campaigns, as follows:

- Last Key Comparisons of IMGC-02 and FG5#238: Regional Key Comparison EURAMET.M.G-K3, 2018 (Falk *et al.*, 2020) and EURAMET.M.G-K2.2023 (Wziontek *et al.*, 2025) at the Geodetic Observatory in Wettzell (Germany);
- Last Key Comparison of FG5#238 and FG5#218: International Key Comparison CCM.G-K2.2023, (Newell *et al.*, 2024) organised in 2023 at the Table Mountain Geophysical Observatory (TMGO) in Boulder, Colorado, USA;
- Inter-comparison between FG5#218/IMCG-02 and FG5#238/IMGC-02: Inter-comparison sessions at INRiM at two different dates (Session A, November 2023, for FG5#218/IMCG-02 and Session B, January 2024, for FG5#238/IMCG-02).

Absolute gravity measurements have been supplemented with the direct measurements of the local value of the vertical gravity gradient (VGG), in order to reduce to the ground reference level the absolute values measured by different instruments at varying heights and avoid the use of standard free-air VGG of 0.3086 mGal/m. Moreover, at each station, an associated outdoor gravity point is measured, with respect to the absolute point, by relative gravity observations and materialised in accessible positions in order to facilitate the link to the G0 reference point by other users.

4. Positioning surveys

The gravity field campaigns have been assisted by topographic survey campaigns, enabling centimetric georeferencing of the gravity stations within the European Terrestrial Reference Frame 2000 (ETRF2000) (2008.0), the official reference frame in Italy.

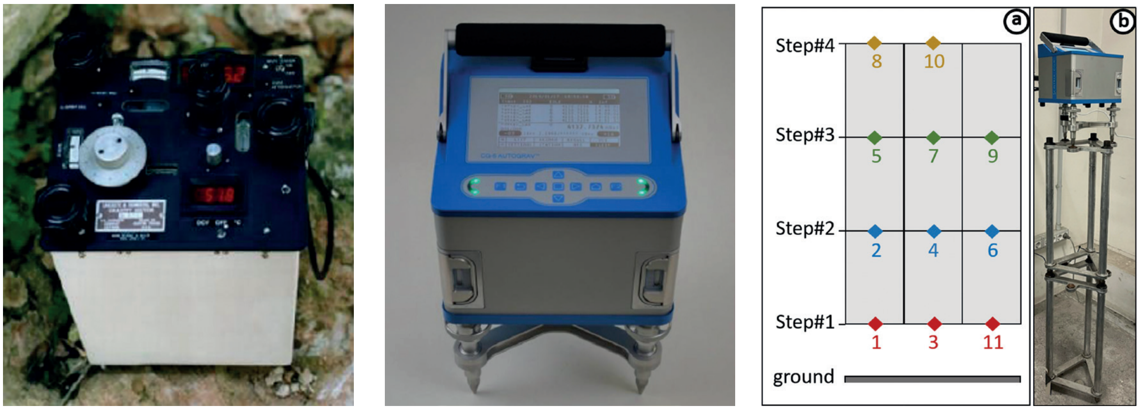


Fig. 3 - The relative gravimeters used in the frame of the project: LaCoste & Romberg, model D (left); Scintrex CG-6 (middle) both employed to measure the VGG and the gravity difference from the absolute to the auxiliary outdoor point; example of measurement scheme and tripod frame employed to measure the VGG at the absolute stations (right).

For most gravity stations, the surveying scheme that has been adopted for referencing the G0 points is based on the integration of GNSS observations and three-dimensional (3D) total station local survey. Outside each G0 station, a GNSS campaign, was performed on at least two points. Starting from these GNSS points, 3D closed loop traverse schemes were, then, adopted to survey the G0 points located inside buildings. In particular sites (for example Catania, Noto, Palermo, and Rome), GNSS permanent stations were included in the traverse scheme in order to improve the robustness of the surveys.

The associated gravity points outside buildings were also included as points of these 3D traverse schemes.

Collected GNSS observations have been processed in the precise point positioning approach using final products (i.e. precise satellite orbits and clocks) in order to estimate precise coordinates of the GNSS points in the current realisation of the International Terrestrial Reference System (ITRS) in which final products are provided (ITRF2020).

Station coordinates were finally obtained by rigorous least square adjustment of the GNSS/traverse surveys. In this way, G0 station points (both the main and the associated ones) were referred to the current realisation of the ITRS.

Since the Italian official reference frame is ETRF2000 realised by the Italian National Dynamic Network [*Rete Dinamica Nazionale*] (IGMI, n.d.), coordinates in the ETRF2000 were also computed using the official transform parameters published by the Reference Frame Sub-Commission for Europe (EPN Central Bureau, n.d.).

As an example, the surveying scheme of the INGV-Catania station is presented in Fig. 4. The measurements were carried out by surveying two GNSS sites located in the courtyard of the INGV-OE building (200 and 300 in Fig. 4) and, subsequently, by measuring the distances and angles between these sites and the gravimetric site CAT located downstairs indoor the laboratory with the total station (100). The survey has also been connected to the permanent GNSS stations of EIIV operating on the rooftop terrace of the INGV-OE.

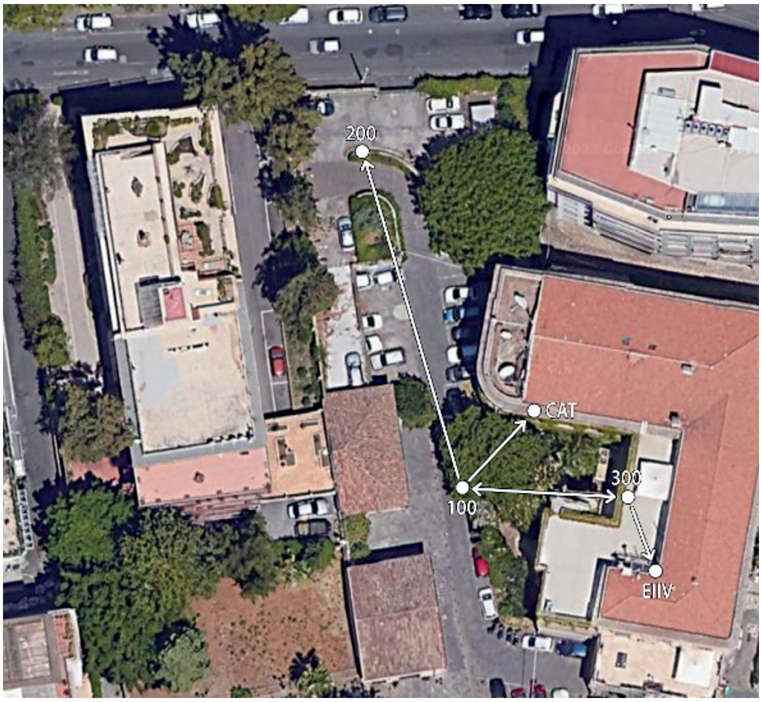


Fig. 4 - The survey scheme of the INGV-Catania G0 station (CAT), EIIV is the permanent GNSS station; 100, 200 and 300 are the auxiliary points to measure the coordinates of the gravity station.

5. Site descriptions

In order to provide all the useful details of the site characteristics and accessibility to other users, datasheets containing the information on the site name, measurements with uncertainties, survey epoch, and instruments used have been prepared. Furthermore, a description of the site, the contact person, the map to reach the location and some pictures are also reported. For example, the datasheet of the IIM-Genova station is given in the Appendix.

6. Comments and conclusions

The collected data will be validated and reduced following the internationally accepted standards and ultimately will be published through a dedicated web page of the project. These data will also be submitted to the absolute gravity database maintained by the Bureau Gravimétrique International/Bundesamt fuer Kartographie und Geodaesie where the absolute gravity data that will contribute to the new global absolute gravity reference system are collected.

The average standard uncertainties obtained after the absolute gravimetric surveys are within 2-4 µGal at instrumental height; those obtained from relative gravity surveys are 2-6 µGal/m (VGG) and 2-6 µGal (auxiliary points). The average uncertainties achieved after the positioning measurements are about 3 cm in height and 1 cm in planimetric coordinates.

The new National Reference Gravity Network represents a modern reference system in Italy, aligned with European and international standards, to support all scientific and technological activities in the fields of geodesy and geophysics. This system would make it possible to: i) harmonise all gravimetric and elevation data of different origins already available across the Italian territory, leading to the revision of the current national gravimetric/altimetric database;

ii) homogenise Bouguer anomaly maps on all scales; iii) reference all new gravimetric surveys conducted on the Italian territory, on different scales and for different purposes, to a single system; iv) reprocess all available gravimetric data in order to calculate the important lithospheric structure represented by the Moho.

The newly measured absolute gravity values will also be important for estimating gravity field temporal variations at stations where previous absolute gravity values are available. As an example, the INRiM stations in Turin can be cited. The actual measured value at ground level is 980534318.2±8.9 mGal (9 January 2024), while the previous value was 980534337.9±8.7 mGal (2-28 November 2005).

In addition, the observed VGG values provide important information on the Italian gravity field. The VGG values measured over 22 G0 stations, range between -385.5 mGal/m and -233.0 mGal/m showing a significant variability.

Ultimately, this new infrastructure will supplement the Italian fiducial gravimetric network of 10 stations equipped with superconducting and absolute gravimeters in continuous (or quasi-continuous) recording. At present under construction, the network will enable the determination of the temporal variations of the long-term and long-wavelength gravity field in the Italian area..

Acknowledgments. This work was funded by the Pianeta Dinamico (Dynamic Planet) project (INGV) and the PRIN 2020 project, "Establishing the absolute gravity and physical height systems in Italy" (Italian Ministry of University and Research - MUR). A draft of this paper was presented as oral communication at the 43rd National Conference of the GNGTS, Geophysics for the Future of the Planet (Bologna, 11-14 February 2025). This project came to light thanks to the fundamental support of Carlo Doglioni, Fernando Sansò, and Mattia Crespi, whom we wish to acknowledge.

REFERENCES

Antoni-Micollier L., Carbone D., Ménoret V., Lautier-Gaud J., King T., Greco F., Messina A., Contrafatto D. and Desruelle B.; 2022: *Detecting volcano-related underground mass changes with a quantum gravimeter*. Geophys. Res. Lett., 49, e2022GL097814, doi: 10.1029/2022GL097814.

Berrino G.; 2020: *The state of the art of gravimetry in Italy*. Atti Accad. Naz. Lincei Cl. Sci. Fis. Mat. Nat. Rend., 31, S35-S48, doi: 10.1007/s12210-020-00924-8.

D'Agostino G., Desogus S., Germak A., Origlia C., Quagliotti D., Berrino G., Corrado G., D'Errico V. and Ricciardi G.; 2008: *The new IMGC-02 transportable absolute gravimeter: measurement apparatus and applications in geophysics and volcanology*. Ann. Geophys., 51, 39-49, doi: 10.4401/ag-3038.

EPN Central Bureau; n.d.: *EUREF Permanent GNSS Network.* http://www.epncb.oma.be (accessed: November 2025).

Facello A., Germak A., Prato A., Greco F., Samperi L., Contrafatto D., Berrino G., Riguzzi F., Barzaghi R. and Mazzoni A.; 2025: *Metrological traceability for the absolute gravity Italian network.* Measurement: Sensors, 38, 101389, doi: 10.1016/j.measen.2024.101389.

Falk R., Pálinkáš V., Wziontek H., Rülke A., Val'ko M., Ullrich C., Butta H., Kostelecký J., Bilker-Koivula M., Näränen J., Prato A., Mazzoleni F., Kirbaş C., Coşkun F.G., Van Camp M., Castelein S., Bernard J.D., Lothhammer A., Schilling M., Timmen L., Iacovone D., Nettis G., Greco F., Messina A., Reudink R., Petrini M., Dykowski P., Sękowski M., Janák J., Papčo J., Engfeldt A. and Steffen H.; 2020: *Final report of EURAMET.M.G-K3 regional comparison of absolute gravimeters*. Metrol., 57, 07019, doi: 10.1088/0026-1394/57/1A/07019.

Fortunato M., Mazzoni A., Berrino G., Greco F., Riguzzi F. and Sonnessa A.; 2020: *Indoor height determination of the new absolute gravimetric station of L'Aquila*. Ann. Geophys., 63, GD662, doi: 10.4401/ag-8473.

Greco F., Riguzzi F. and Berrino G.; 2021: *Insights into seismogenetic areas in central Italy from combined absolute gravity and GNSS measurements*. Remote Sens., 13, 4649, doi: 10.3390/rs13224649.

Greco F., Berrino G., Riguzzi F., Mazzoni A., Amendola M., Carbone D., Contrafatto D., Dardanelli G., Lo Brutto M., Messina A., Mirabella L., Ricciardi G. and Samperi L.; 2024: *The first absolute gravity and height reference network in Sicily*. Sci. Data, 11, 357, doi: 10.1038/s41597-024-03177-4.

IGMI; n.d.: *National Dynamic network* [*Rete dinamica nazionale – RDN*]. Italian Military Geographic Institute, http://www.igmi.org/en/direzione-geodetica/progetto-rdn-rete-dinamica-nazionale (accessed: November 2025).

Marti U., Richard P., Germak A., Vitushkin L., Pálinkáš V. and Wilmes H.; 2014: *CCM-IAG strategy for metrology in absolute gravimetry: role of CCM and IAG*. pp. 1-8, <metrica.inrim.it/handle/11696/72211?mode=complete>.

Ménoret V., Vermeulen P., Le Moigne N., Sylvain B., Bouyer P., Landragin A. and Desruelle B.; 2018: *Gravity measurements below 10^{-9} g with a transportable absolute quantum gravimeter*. Sci. Rep, 8, 12300, doi: 10.1038/s41598-018-30608-1.

Morelli C., Gantar C., Honkasalo T., McConnell R.K., Tanner J.G., Szabo B., Uotila U. and Whalen C.T.; 1974: *The International Gravity Standardization Net 1971, (I.G.S.N.71).* Bureau Central de l'Association Internationale de Geodesie, Paris, France, 194 pp., <https://apps.dtic.mil/sti/tr/pdf/ADA006203.pdf>.

Newell D., Ullrich C., Butta H., Andrade de Sousa M., Quaresma D., Green R., Parks H., Liard J., Wang Q., Feng J., Hsieh W.-C., Kostelecký J., Pálinkás V., Bilker-Koivula M., Näränen J., Rothleitner C., Konrad J., Telada S., Kayukawa Y., Choi I.-M., Chung J.-W., Esparza-Ramirez A., Aljuwayr A., Alotaibi H., Mametja T., Kirbaş C. and Seifert F.; 2024: *CCM.G-K2.2023: CIPM key comparison of absolute gravimeters*. Metrol., 61, 07009, doi: 10.1088/0026-1394/61/1A/07009.

Richard J., Antoni-Micollier L., Vermeulen P., Arnal M., Gautier R., Janvier C., Ménoret V., Majek C., Desruelle B. and Rosenbusch P.; 2024: *Absolute quantum gravimeter for field applications*. In: Proc. European Geosciences Union, General Assembly 2024 (EGU 24), Vienna, Austria, 3560, doi: 10.5194/egusphere-egu24-3560.

Riguzzi F. and Doglioni C.; 2020: *Gravity and crustal dynamics in Italy*. Rend. Lincei Sci. Fis. Mat. Nat., 31, 49-58, doi: 10.1007/s12210-020-00881-2.

Vinnichenko A. and Germak A.; 2017: *Comparisons of absolute gravimeters (COOMET.M.G-S1)*. Metrol., 54, 07010, doi: 10.1088/0026-1394/54/1A/07010.

Wziontek H., Pálinkáš V., Antokoletz E.D., Müller J., Vaľko M., Kostelecký J., Koivula M.B., Näränen J., Merlet S., Bernard J.D., Rothleitner C., Konrad J., Prato A., Facello A., Germak A., Baumann H., Reich M., Gebauer A., Lothhammer A., Brachmann E., Iacovone D., Nettis G., Greco F., Messina A., Contrafatto D., Reudink R., Dykowski P., Cieselski A., Janák J., Papčo J. and Engfeldt A.; 2025: *Final Report on key comparison EURAMET.M.G-K2.2023 of absolute gravimeters*. Metrol., 62, 07022, doi: 10.1088/0026-1394/62/1A/07022.

Zhong J., Tang B., Chen X. and Zhou L.; 2022: *Quantum gravimetry going toward real applications*. The Innov., 3, 100230, doi: 10.1016/j.xinn.2022.100230.

Zhu D., Gao S., Zhu X., Wu B., Cheng B. and Lin Q.; 2021: *Progress of quantum gravimeter applied in the fields of Earth science*. Adv. Earth Sci., 36, 480-489, doi: 10.11867/j.issn.1001-8166.2021.034.

Corresponding author: Federica Riguzzi
Istituto Nazionale di Geofisica e Vulcanologia
Via di Vigna Murata 605, 00143 Roma, Italy
Phone: +39 06 51860266; e-mail: federica.riguzzi@ingv.it

Appendix: The datasheet of the IIM-Genova station

Absolute gravity point (P0) at IIM-Genova Passo dell'Osservatorio 4, Genova Lat = 44.41937113° N Long = 8.92134757° E H = 92.827 m h = 137.827 m				
Date Time UTC (from÷to) P (hPa)	**Meter and Actual measurement height (m)**	**Number of total drops**	***g at Actual measured height (µGal)**	**g at ground (µGal)**
24-25 February 2024 18:10 ÷ 09:38 998.90	IMGC-02 (INRiM) 0.4906	2316	980543168.2 ± 11.0	980543308.3 ± 11.1
Gradient: -285.5 ± 2.7 (µGal/m) – from 15 measurements, on 27 June 2024 with instrument LCR-G737.				

*g value at the actual measurement height, including all corrections (e.g. diffraction, self-attraction), with gradient se to zero.

Associated gravity point (P1) at IIM-Genova Passo dell'Osservatorio 4, Genova Lat = 44.41911306° N Long = 8.92165224° E H = 75.417 m h = 120.416 m			
Date Time UTC (from÷to) P (hPa)	**Instrument**	**Observed difference P1 - P0 (µGal)**	**g at ground (µGal)**
27 June 2024 13:37 ÷ 15:01 1002.15	LCR-G737	3935.4 ± 1.2	980547243.7 ± 11.1

Point cordinates are given in ETRF2000(2008.0) at the same time of the gravity measurement; orthometric heights are computed using ITALGEO05.

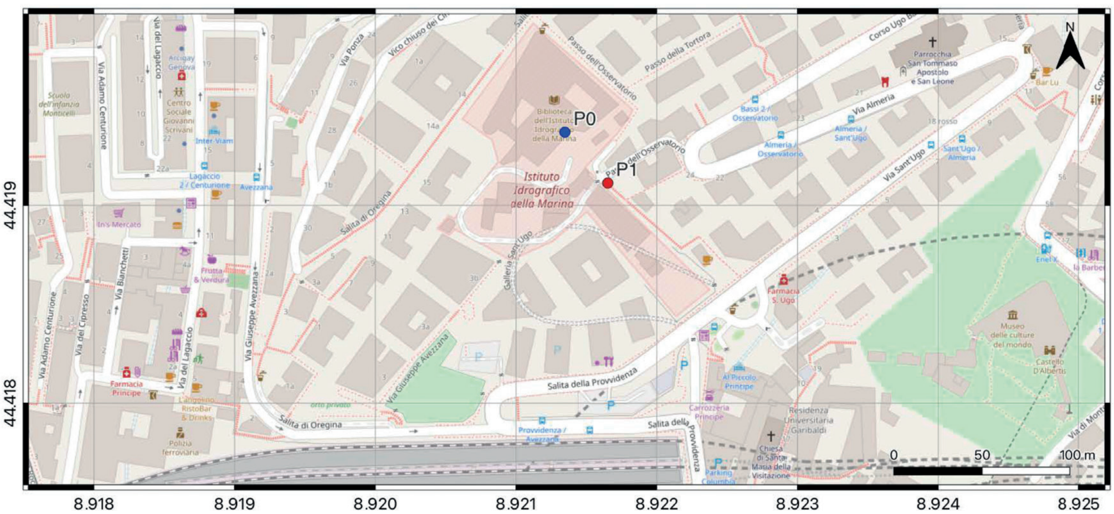
Coordinates are given with an accuracy better than 3 cm. The position is jointly surveyed by total station and GNSS.

Contacts and location

Luca Repetti (luca_repetti@marina.difesa.it)

The absolute gravity point is inside the military base and in order to access it you should contact the person listed above. The associated point is on the left side before the entrance gate of the military base.

Map



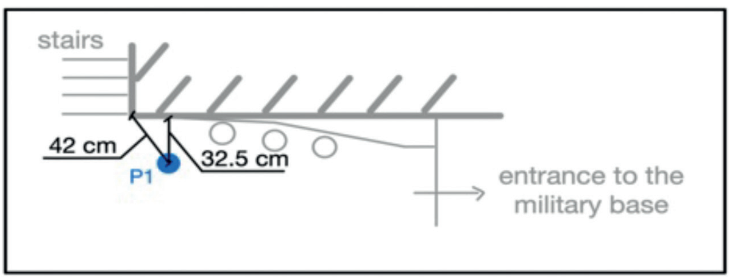
The basemap is from OpenStreetMap WMS.

Pictures of PO

Absolute gravity observations.

Gravity gradient observations.

Pictures of P1



Surveyed by:

absolute gravity	INRiM
relative gravity and gradient	Politecnico di Milano (DICA)
positioning survey	Politecnico di Milano (DICA)