EUREF Symposium 2026 — June 23-25, ENSA Paris-Val de Seine, Paris

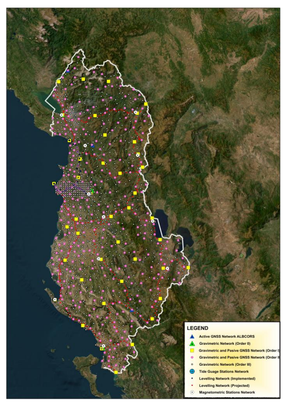
ASIG — Autoriteti Shtetëror për Informacionin Gjeohapësinor

Modern Geodetic Reference Frame of Albania

Phd.Qirko Kristaq, Msc.Balliu Oltjon, Msc. Kasneci Luçiano, Msc.Qershija Endri, Msc. Peka Eljon, Msc.Dylber Peposhi.
State Authority for Geospatial Information

Introduction

The State Authority for Geospatial Information (ASIG) is responsible for the establishment and maintenance of the Albanian Geodetic Reference Frame (AGRF). The AGRF includes the National GNSS Network, the National Gravimetric Network, the National Tide Gauge Network, the National Magneto metric Network, and the National Levelling Network.
Since 2018, ASIG has been working to modernize Albania's geodetic infrastructure according to European standards and reference systems such as ETRS89, EVRS, and IGRS.
A major goal of this work is the development of a high-resolution gravimetric geoid and the establishment of a new national vertical reference system.
Significant progress has been achieved in the development of the Albanian gravimetric network, including the implementation of the third gravimetric orders.
In parallel, ASIG is cooperating with the EUREF Working Group to estimate the velocities of 27 Albanian CORS stations and contribute to the European Dense Velocity Model.



This poster presents the current status of the Albanian Geodetic Reference Frame, recent developments in the national GNSS and gravimetric networks, and the ongoing work toward a modern vertical reference system based on a gravimetric geoid.

State Levelling Network

Designed - Project of State Levelling Network

- 4 polygons
- Leveling lines will follow the main routes in Albania
- The lines will be extended up to the main border points of Albania
- Existing BMs (ALB86) will be included in the new network of levelling
- Levelling lines length: ≈ 1441.324 Km, Benchmarks: : ≈ 430 BMs
- high cost, time consuming

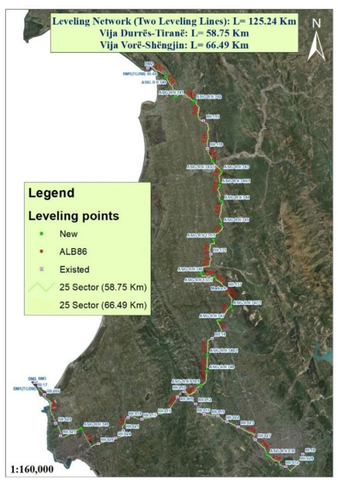
Implemented

- Two Levelling Lines and linking of the Tide Gauge stations in Durrës and Shëngjin.
- Durres-Tirana: 26 sectors, 26 benchmarks, L = 58.75 Km.
- Vore-Shengjin: 26 sectors, 25 benchmarks, L = 66.49 Km.
- Method: Precise Levelling of First-class:
- Δhsek mm ≤ 1mm × √S(Km) and T ≤ 1mm × √S(Km).
- Instrument: Sokkia SDL1X (0.2mm/km) and 2 Staff invar RBA-Code, BIS30A

Future Activities

- Linking two additional tide gauge stations in Orikum and Saranda.
- Linking with neighboring countries (Kosovo, Montenegro, North Macedonia, Greece)
- Linking with UELN (EVRS/EVRF2019) -United European Leveling Network





State Tide Guage Stations Network

Tide Guage Network

- 4 Tide Gauge stations (located: Shengjin, Durres, Orikum, Saranda)
- Working and collecting data since February 2018
- Control Center – Hydromet Cloud (located in ASIG) - which enables collecting, processing, and sharing of data for all users.
- Micro-networks (3 points BMs) - near each tide gauge.
- Measured: GNSS & Levelling according to first class criteria between BMs
- Purpose: Monitoring the MSL and determining a vertical ground movement
- Main Purpose: Determine the local equipotential surface of the geoid (W0j) (Zero Height Surface)



State Gravimetric Network

Designed

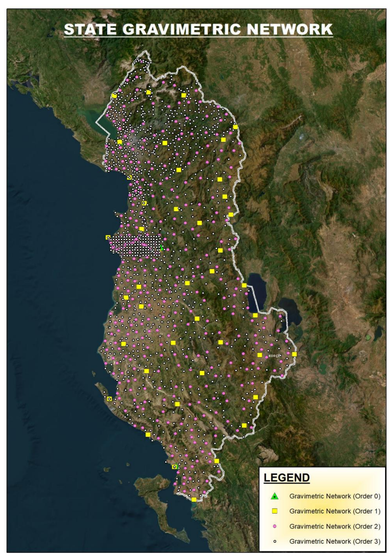
- 4 Order Gravimetric Networks
- Purpose: Calculation of the precise local gravimetric geoid with an accuracy of 2-3 cm
- Based: Terrestrial gravimetric measurements

Implemented

- 0th Order: 3 absolute points, FG5/242, Accuracy ~ 2.4-2.7 μ Gal , 2015
- 1st Order: 42 points, ~33-55 km apart, 2-CG5, Accuracy ~10 μ Gal , 2018
- 2nd Order: 338 points, ~5-10 km apart, 1-CG5, Accuracy ~20 μ Gal , 2023
- 3rd Order: 934 points, ~3-7 km apart, 1-CG5, Accuracy ~30 μ Gal , 2024, Phase I
- Geodetic Instruments: FG5/242, CG5, Receives GNSS
- Method: Gravity (absolute, profile and star), GNSS (Static and RTK)
- Accuracy of GNSS: Position & Hight : < 0.02 m

Next Steps (2026–2027)

- **3rd Order Gravimetric Network (Phase II)**
- Station spacing: 2 × 2 km in flat areas and 5 × 5 km in rural and mountainous areas
- Target accuracy: 30 μGal
- Estimated number of stations: ~915 points
- Monumentation: Points will not be permanently marked; locations will be identified using spray paint marks only



Objective: To densify the Albanian gravimetric network and provide improved gravity data for the computation of a high-resolution gravimetric geoid and the realization of the new national vertical reference system.

Albania Geoid 2024

Gravimetric data

- Land Gravity: Albania and Greece
- GGM: EGM08 (EIGEN6c4 & XGM2019)
- Satellite altimetry: DIU & SIO
- DTM: Lidar 2015-ASIG & SRTM

Methodology for geoid determination

- Technique: RCR (remove-compute-restore)
- Residual terrain: RTM - two approaches were used (spectral and classical)
- Methods: 1DFFT/2DFFT and LSC

Final geoid model

- Gravimetric Geoid (2DFTT)
- Hybrid Geoid (2DFTT)

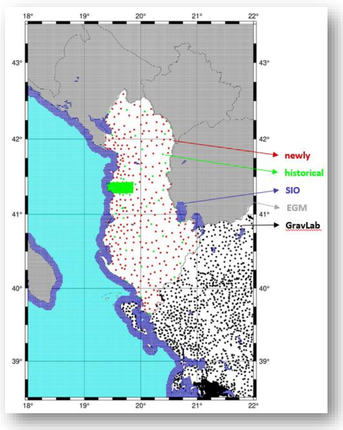
Assessment

- 225 points (GNSS/H_MSL) of old Datum (ALB86) : **Std.dev. 13.1 cm**
- 50 points (BMs) new levelling lines based to MSL of the tide gauge (TG) in Durrës: **Std. dev. of relative differences: 6 cm**

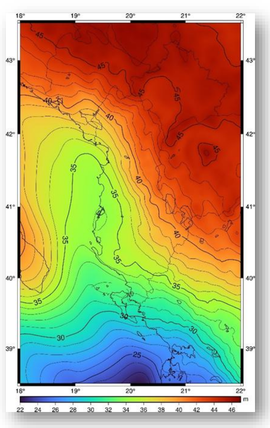
Validation (parametric fit)

- 225 point (GNSS/H_MSL) of old Datum (ALB86) : Std 11.1 cm
- *Hybrid Geoid (2DFTT) : referred to the MSL of the Durres TG station is the new vertical datum of Durres MSL. (shift to fit:↑ -20.23 cm or -0.02971 m2/s2)*

Gravity Database



2DFTT Gravimetric Geoid



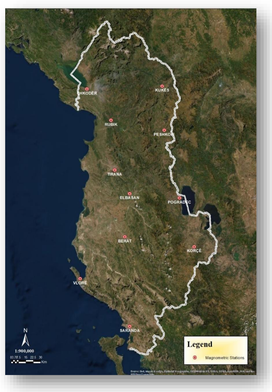
State Magnetometric Stations Network

Magnetometric Stacions Network

- Contain: 11"Repeat Stations":
- The network will serve to:
  1. **Magnetic declination D**
  2. **Magnetic inclination I**
- Magnetometric measurements: were carried out in 1997, 2002, 2007, 2011, 2015 and the last measurement campaign finished in 2018 from ASIG
- Magnetic declination is essential for aligning maps and magnetic sensors.

Future Activity

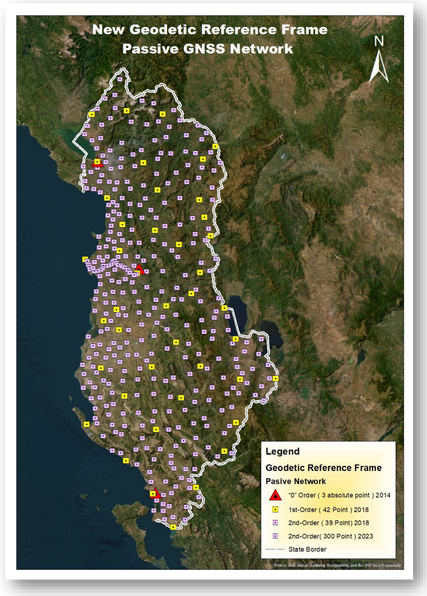
•Development of magnetic maps for Albania.



State GNSS Network

Passive GNSS Network

- 1st Order Passive GNSS Network: 42 points
- 2nd Order Passive GNSS Network: 338 points
- These points are common with the points of other First and Second Order Networks includes in Geodetic Reference Frame of Albania
- These points are uniformly distributed across the territory of Albania, forming a Unique Geodetic Base (G.R.F of Albania).
- Unique Geodetic Base (G.R.F of Albania) enables:
  - Stability control of Active GNSS Network – ALBCORS
  - Maintenance of the European coordinate reference system (ETRS89)
  - Geodetic control within the territory of Albania





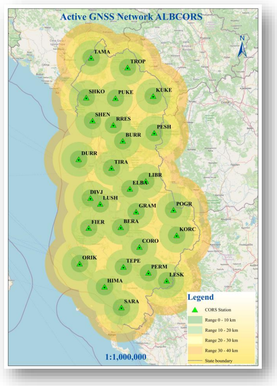




ALBCORS Network

Active GNSS Network

- 27 CORS stations : "21 Pillar type and 6 Roof Type"
- 27 CORS stations : KOLIDA (SOUTH S9; STHCR3-G3)
- Based on the European Terrestrial Reference System/ Frame (ETRS89/GRS80)
- Coordinate are fixed in ETRF2000 (epoch 2014.177)- Geocentric Static Datum
- Control Centre - GNSMART (Geo ++)
- Two main services: RTK (2-3cm,2D-3D) & PP (1cm, 3D)
- Currently, 300 users working with ALBCORS







Ongoing Activity

- ASIG works with the EUREF Working Group to calculate the velocities of 27 Albanian CORS stations and support the European Dense Velocity Model.

Future Activities

- Bernese GNSS Software training for two specialists.
- Inclusion of 1–2 Albanian stations in the EUREF Permanent Network (EPN).

Conclusion

- The establishment of a modern vertical reference frame based on a precise national gravimetric geoid enables the transformation of GNSS-derived ellipsoidal heights into accurate and consistent physical (orthometric) heights across Albania.
- Regional and international cooperation in gravity, levelling, and geodetic infrastructure is essential for improving geoid modelling, ensuring data consistency, and strengthening the connection with neighbouring countries and European reference systems.
- Sustained technical support and capacity building in GNSS, gravity, geoid determination, and levelling are necessary for the realization, maintenance, and modernization of the Albanian Geodetic Reference Frame and its integration into the European Vertical Reference System (EVRS) and the International Height Reference System (IHRS)

Contact Information

State Authority for Geospatial Information
Street "Papa Gjon Pali II", Nd. 2, H. 3
Tiranë
Albania
1010

Tel: +355 4 223 6762
Email: info@asig.gov.al
Web: www.asig.gov.al