symposium EUREF Paris 2026

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Galileo and EGNOS Performance Monitoring - Contributions from National Mapping Agencies

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The Galileo and EGNOS Monitoring of Performances by Member States" (GEMOP) is a project funded by the European Union Agency for the Space Programme" (EUSPA) through the Call Support for Galileo/EGNOS Performance Monitoring Activities" (EUSPA/GRANT/03/2021). The GEMOP consortium consists of 27 partners from 15 European countries. The basic idea behind the call is to perform independent monitoring and assessment of Galileo and EGNOS services and to support the Galileo Reference Centre" (GRC).
The main tasks of GEMOP are:

- GNSS data provision from permanent GNSS stations in various formats
- GNSS and SBAS Signal in Space (SiS) monitoring
- Campaign-based performance investigation
- perform independent monitoring and assessment of EGNOS services provision
- provision of processed data, e.g. reference orbits, biases and clocks, ionosphere and troposphere products including determination of the accuracy of the processed data
- independent validation through, e.g., SLR, large aperture antennas

Most of the activities have to be reflected in the generation of dedicated Key Performance Indicators (KPIs) and/or Figures of Merit (FOMs).
The majority of the GEMOP partners are universities and other research institutes but some partners are coming from National Mapping Agencies (NMAs). From the large variety of data, reports, results and products this presentation is focussing on contributions coming from NMAs in Finland and The Netherlands that are generating specific FOMs from dense national networks.

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The Galileo High Accuracy Service (HAS): Performance Assessment within the GEMOP Initiative

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The Galileo High Accuracy Service (HAS) provides global, decimeter-level (20/40 cm for the Horizontal/Vertical components respectively) absolute positioning for standalone receivers using Precise Point Positioning (PPP). Corrections for satellite orbits, clocks, and signal biases are broadcast via the Galileo E6B signal (1278.75 MHz) and a dedicated NTRIP caster (Internet Data Distribution, IDD). This study presents one of the several performance analysis conducted under the GEMOP project (Galileo and EGNOS Monitoring Of Performances), a EUSPA-funded initiative establishing an independent monitoring network that consists of 4 sites located in Europe within Work Package G3.2 -a joint effort by NMA, GOP, CNES, NLR, and UPAD- specifically evaluates HAS various performance targets.
Following the initial service declaration in January 2023, the Minimum Performance Levels (MPLs) are defined as: 1) Clocks: for both Galileo and GPS the 95% percentile MPLs of at least 0.12 m and 0.15 m, respectively and B) For the Galileo and GPS 3D corrected orbits, the required MPL is of 0.20 m and at 0.33 m respectively.
According to our results, despite minor system-level deviations, service-level positioning remains robust. Daily kinematic PPP tests using combined Galileo/GPS solutions fulfilled the strict MPL thresholds for Horizontal (0.15 m) and Vertical (0.20 m) Position Errors for the combined GPS and Galileo solutions across the network (0.25/0.30 m for the Horizontal/Vertical for the Galileo only solution); the errors are computed using the IGS/EPN solutions and static daily PPP solutions with integer ambiguity resolution using Bernese v5.4 as the reference values. In general, Galileo and GPS and Galileo-only solutions met the MPLs . These results confirm that HAS corrections are highly effective and meet the required geodetic performance targets.

*Speaker

GRF Europe - Bridging Regional Geodetic Expertise and Global Geodesy Governance

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The Community of Interest on Geodetic Reference Frames (GRF Europe), established under UN-GGIM Europe in 2023, serves as a coordination mechanism linking the rich European geodetic landscape to the global geodesy governance framework. This contribution presents the recent activities and strategic direction of GRF Europe in support of UN-GGIM Europe, the UN Global Geodetic Centre of Excellence (UN-GGCE) and the UN-GGIM Subcommittee on Geodesy.

Operating on the principle of complementarity with established bodies, GRF Europe focuses on three areas: raising awareness of geodetic infrastructure needs across governmental levels, providing informed navigation of the complex European institutional landscape, and building a regional contact network spanning more than 35 countries. Recent achievements include engagement with supranational bodies on the geodetic supply chain, support for frequency protection of geodetic VLBI observations, and linking users with geodetic experts on requests related to coordinate reference systems.

GRF Europe advocates for sustained investment in geodetic infrastructure by translating global policy frameworks into regionally and nationally relevant arguments. This contribution outlines how this approach contributes to securing the long-term sustainability of the geodetic supply chain and its critical role in underpinning positioning, navigation, and timing services across Europe.

*Speaker

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Collaborations and sustainability

Report from IGS Workshop

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From June 1st to 5th, 2026, the IGS workshop takes place in Santiago de Chile. The first part has a symposium format with oral and poster presentations. The second part is held as a workshop where the IGS products committees, pilot projects, and working groups are discussing the current status in their field and future developments.
Some of the points discussed at the IGS workshop will or may have an impact on the activities of EUREF. The report will compile highlights from the IGS workshop with a dedicated focus on the topics, decisions, and developments that seem to be relevant for EUREF.

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EPOS-GNSS products and consistency between the different solutions

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In the frame of the European Plate Observing System, the Thematic Core Service GNSS data and products distributes GNSS solutions computed by different processing centers, with different processing strategies. Two internally consistent automated solutions are provided and include all EPOS stations: INGV delivers a solution in double difference computed with GAMIT, UGA delivers a solution computed in Precise Point Positioning with GIPSY-X. Two other solutions computed in the frame of EUREF are also distributed: ROB computes a combined solution that includes the sites from the European Permanent Network, and SGO computes a densified solution. This talk aims at presenting these different products and services, and at providing a quantified comparison between the latest version of these products. The analysis is conducted on _˜400 sites common to the three solutions currently available in IGb20, both on position time series and on secular velocities, shows that the three latest solutions are generally very consistent.

*Speaker

Activities of the EUREF Governing Board

Report on the Activities of the EUREF Governing Board

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The IAG Sub-Commission 1.3a for Europe, EUREF, is a joint effort of research organizations and National Mapping and Cartographic Agencies. Its main goal is the definition, realization and maintenance of the European Reference Frames (realizations of the European Terrestrial Reference System (ETRS89) and the European Vertical Reference System (EVRS)). The EUREF key infrastructures are the EUREF Permanent Network (EPN) and the United European Levelling Network (UELN). Within EUREF's flat structure the EUREF activities are coordinated by the EUREF Governing Board (GB). The EUREF GB oversees and discusses EUREF activities and policy. The GB meets three times a year, with a minimum of one meeting in-person. Since the last EUREF symposium 2025 in Covilhã, the GB had several digital and one extended in-person meetings. The main activities and progress of the GB within this period are summarized in this presentation. More details about EUREF can be found at http://www.euref.eu/. This presentation gives an overview about the main topics which were discussed in the EUREF GB during the past twelve months.

*Speaker

Current Status of the EUREF Permanent Network and Progress on EUREF Resolutions

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The EUREF Permanent Network (EPN) provides the GNSS reference stations essential for accessing and maintaining the European Terrestrial Reference Frame. For users, it is crucial to identify, at any given epoch, which EPN stations are performing according to expectations so they can be reliably used as reference stations during data analysis.

To support this, the EPN Central Bureau (CB) continuously monitors station performance, focusing on data availability, metadata correctness, and data quality. This presentation provides an update on the current status of the EPN, highlighting major developments since the 2025 EUREF Symposium, including improvements in monitoring, data services, and station management.

It also outlines the progress made by the EUREF community in implementing resolutions adopted at previous symposia, which define the strategic priorities guiding the development and operation of the EPN and its data infrastructure.

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EPN Analysis Centres Coordinator Report

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The EPN Analysis Centres Coordinator (ACC) combines and analyses GNSS position solutions provided by the 17 EPN Analysis Centres (AC). The combined solutions computed by the ACC are used for the creation of the EPN cumulative solution, and also serve for the EPN station position monitoring. The report presents the activities of the EPN ACC during the last year, and outlines the status of AC and combined operational solutions. In years 2022-2025, the EPN Repro3 project was conducted which aimed at reanalysis of EPN GNSS data from 1996 to the present using a consistent methodology. In August 2025 the ACC finished the analysis of 12 EPN AC Repro3 solutions and the creation of EPN daily and weekly combined solutions. The results from the Repro3 project will be also presented in the report.

*Speaker

Report of the EPN Troposphere Coordinator

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The EPN Troposphere Coordinator (TC) combines and analyses GNSS troposphere solutions provided by the EPN Analysis Centres (ACs) in addition to the coordinate solutions. The report presents the activities of the EPN TC during the last year, and outlines the status of the combined (final and rapid) operational solutions. In 2022, the EPN Repro3 project began which aims at analyzing all EPN data from 1996 to the Novembre 2022 using a consistent methodology. This report presents also the status of Repro3 tropospheric combined solution.

*Speaker

Enhancement of the EUREF reference frame solution thanks to the EPN-Repro3

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The EUREF Permanent Network (EPN) provides access to the European Terrestrial Reference System 89 (ETRS89), the standard high-precision GNSS coordinate system in Europe. To maintain it, EUREF regularly publishes updated coordinates and velocities of EPN stations. Each update of this reference frame solution is provided together with a station classification to help users identify its most reliable reference stations. In 2025, the EPN Analysis Centers and Analysis Center Coordinator completed a third reprocessing of the EPN, providing input to compute a new EUREF reference frame solution which was released early 2026. This presentation describes the results, quality assessment of the solution and the associated station classification.

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EPN Densification: status and challenges after repro3

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EPN Densification as a collaborative activity of 30 national GNSS Analysis Centres is aiming at the generation of a pan-European combined station position and velocity product based on long term processing of the national permanent GNSS networks. The last product release was published in 2023 including data of 15 years and expressed in igs14 reference frame. The results are published in the https://epnd.sgo-penc.hu web portal.

Then a global to national scale reprocessing started to deliver products in the igs2020 frame with updated modeling capabilities. Now it is far completed on global (IGS) to continental (EPN) scales and also in most of the national networks. However still at some countries the work is not yet completed or even not yet started.

As the combination strategy of EPND assumes the availability of all inputs therefore new solution since 2023 could not be generated. The SINEX evaluations, data filtering for the available input is up to date, the network specific combinations had been done and show very promising results. Quality improvement, inclusion of new stations (Germany, Norway), elimination of the troubles caused by the individual PCVs suggest the superiority of the next EPND release. The current pre-combinations include data up to week 2399 (end of 2025) and the presentation show some appetizers of what we can expect from the next release to be published in late 2026.

*Speaker

EPND/CEGRN Analysis Hub

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Most National Mapping Agencies (NMAs) and Analysis Centers (ACs) compute GNSS networks following strict EUREF or EPOS guidelines for submission to the EPN Densification (EPND). While daily solutions are combined into multiyear products at the EPND level, analyzing these results remains complex. We present a new Portal designed to streamline data sharing and time-series analysis. The platform enables users to identify critical issues, including: 1) station discontinuities, 2) noisy observation periods, 3) equipment inconsistencies comparing the SINEX metadata and information on the site logs (currently focusing on antenna metadata), and 4) performance comparisons across different solutions.
The portal includes relevant information for the NMAs and ACs and can be used to test and validate solutions at the solution provider level in dedicated websites. Once the different issues for each provider are clarified, all the solutions will be combined in a unique solution. Any provider not wishing their solutions to be visible can simply contact us and we will provide a password-protected space.
Currently, the Portal hosts data from the EPND (Spain, Portugal) and EPND/CEGRN (Bulgaria, Hungary, Romania, Slovakia, Ukraine). We invite new data providers to join this collaborative effort to enhance GNSS network consistency.

*Speaker

EUREF-IP Real-time Data: Current Practice, Challenges, and Future Perspectives

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EPN real-time station data and products are used for a wide range of scientific, operational, and commercial applications. Yet the goals, reliability, and sustainability of these services are under discussion. Feedback within EUREF has highlighted not only technical issues related to real-time metadata and coordinates, but also growing tensions between the open EUREF-IP data policy and the changing data policies of national and institutional data providers, which in some cases have already led to a loss of real-time station contributions to the EPN.

This contribution first presents a transparent overview of the current EUREF-IP data flow, describing how real-time GNSS streams are provided by EPN station operators, disseminated via EUREF-IP infrastructure, and used by different user groups. It is emphasized that EUREF-IP does not modify station data and largely operates under an open data model.

The presentation then discusses challenges affecting EUREF-IP users, broadcasters, and station operators. These include the limited reliability and clarity of coordinate information in real-time streams, the coexistence of multiple reference frames for stations participating in national, European, and global networks, and the incomplete or inconsistent use of metadata standards and emerging mechanisms for expressing coordinate reference systems. In parallel, the implications of data policy mismatches between EUREF-IP and data providers are considered, along with their impact on the operational effort required by EUREF-IP broadcaster operators and large data users.

Finally, the contribution outlines and compares possible future scenarios for EUREF-IP, ranging from maintaining the current approach with clearer service definitions to stricter metadata requirements or structural changes in real-time data access. Rather than proposing immediate solutions, the presentation aims to initiate an informed community discussion on realistic expectations, responsibilities, data policy alignment, and sustainable development paths for EUREF real-time services.

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NTRIP-catalog - identify the Coordinate Reference System

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Currently the NTRIP providers are not providing information about the CRS used by their corrections in the RTCM messages.
Until RTCM 3.4 there is no way to do it, and in 3.4 it is optional... and not used.

At the end the only way to do it is to carefully read the documentation, that not always mentions it. This is terribly error prone.
ntrip-catalog.org is an open source / open data repository that gathers the information needed to correctly identify the CRS given the connetion parameters like URL, port and mountpoint. It allows any software to clearly identify the CRS an tag the coordinates properly. It covers the whole world and is populated with the contributions of the NTRIP providers.

*Speaker

EUREF Study Group on alternatives to ETRS89

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The European Terrestrial Reference System 1989 (ETRS89) was established in 1990 at the

*Speaker

EUREF symposium in Florence, Italy, following EUREF Resolution 1. To date, 12 realizations have been published, the most recent being ETRF2020. Since its adoption, European countries have aligned their national reference frames with one of the ETRS89 realizations. While most countries have adopted ETRF2000, only a few have implemented the more recent, bias-free updates. On 15 October 2024, the EUREF Governing Board decided to establish a Study Group (SG) to assess whether ETRS89 still meets user requirements and, if necessary, to propose an alternative definition of the system.
This paper presents the ongoing work of the Study Group, with a focus on the preliminary analysis of responses from national mapping agencies to a survey on their current and future needs regarding the European Terrestrial Reference System.

Status report on the UELN: update on available data and schedule for the publication of a new EVRF

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The latest realisation of the European Vertical Reference System (EVRS) was published as the European Vertical Reference Frame (EVRF) in 2019. A new realisation of the EVRS is planned to be published in 2027/2028. Since 2020, new leveling data have been received from countries, which will be participating for the first time in the Unified European Leveling Network (UELN). Hence, the next EVRF will cover a larger area. New cross-border connections were added to the network, especially to connect new countries. Moreover, several countries have provided updated leveling data as well as updated cross-border connections. Furthermore, the latest research results on hydrodynamic leveling will be considered in future realisations in order to reduce systematic errors, e.g. between Great Britain and the European mainland. Additionally, GNSS observations with a gravimetric quasigeoid model values introduced into the network will also contribute to the reduction of systematic long-wavelength errors. Both approaches as well allow the connection of islands to the network.
This presentation shows an overview of the latest available data for the UELN with a focus on cross-border connections.
The ideas of the hydrodynamic leveling are briefly summarised. Moreover, the schedule for the publication of the new realisation is shown including important milestones such as deadlines for new data delivery, preliminary results and the final version of the new EVRF.
After finalization, the new EVRF will serve as a basis for an update of the new European GNSS-leveling dataset (European Height Reference Surface – Control Points, EHRS_CP) and the European Height Reference Surface (EHRS) which are both planned to be published as a first version based on EVRF2019 until the end of 2026.

*Speaker

Status report for the EUREF Working Group "European Unified Height Reference"

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The EUREF Working Group "Unified European Height Reference" was formed by resolution in 2021 with the objective to enhance the usability of European heights, particularly for GNSS-based height determination in practical applications such as civil engineering, digital elevation models, etc. The main goal is to establish a European Height Reference Surface (EHRS) that is tailored to a consistent dataset of GNSS-leveling control points (EHRS_CP) referring to the latest ETRS89 and EVRS realizations, as presented at the EUREF Symposium 2023. Furthermore, comprehensive information about the national integrated spatial reference systems, including heights and geoid models, shall be made available through the Information and Service System for European Coordinate Reference Systems (CRS-EU).
This year's report will be again focussed on the progress of the new homogenized European GNSS-leveling dataset (EHRS_CP) and the European Height Reference Surface (EHRS).

Over the last months, the remaining awaited contributions could be incorporated in the GNSS-leveling dataset. This includes new datasets, additional points or updated coordinates from six countries. Thus, after a multi-national endeavour of about four years, the first version of the EHRS_CP dataset is currently being finalized and will be prepared for publication on the EVRS

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website until the end of the year.

Including ca. 8000 points of 29 countries with varying density per country, the EHRS_CP dataset is a substantial achievement and a manifestation of outstanding pan-European collaboration. For the first time, data of Serbia, Moldova, North Macedonia and Turkey could be included. Compared to the previous GNSS-leveling dataset of the European Unified Vertical Network (EUVN) and the EUVN densification action (EUVN/EUVN-DA) from around 2010, this dataset provides more current, homogeneous and accurate GNSS coordinates which have been homogenized from the national ETRS89 realizations to ETRF2020.
Updated intermediate results for the corrector surface of the EHRS based on the EGG2015 quasigeoid will be discussed. In this context, a patch of the EGG2015 gravimetric quasigeoid model due to a simulated harmonic correction in the RTM method has been developed. It could be shown that the correction improves the agreement between the GNSS-leveling data and the quasigeoid considerably, e.g. for Switzerland. It is planned to publish a first experimental solution of the EHRS alongside with the EHRS_CP dataset until the end of the year.

National and Local Activities

Towards Consistent Reference Frame Realizations: GNSS Reprocessing in Luxembourg, Belgium, and the Netherlands

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The Land Registry and Topography Administration of Luxemburg, the National Geographic Institute of Belgium, and the Netherlands Partnership for Geodetic Infrastructure are performing a large-scale reprocessing of Global Navigation Satellite System (GNSS) reference station data to derive improved national realizations of the terrestrial reference frame. The reprocessing spans more than two decades of observations and aims to generate homogeneous, high-quality station coordinate time series suitable for long-term reference frame definition.

These national activities are closely aligned with the EUREF REPRO3 initiative, initiated following the release of the International Terrestrial Reference Frame 2020 (ITRF2020). The consistent application of updated observation models, geophysical corrections, and processing strategies ensures compatibility with the latest international reference frame standards and enhances the accuracy, temporal stability, and internal consistency of the national frame realizations.

A common set of international GNSS stations is included in the processing to provide a coherent connection between the individual national solutions and the global reference frame. This enables detailed intercomparison of station coordinates, velocities, and residual time-series characteristics, as well as the assessment of combination strategies for a regionally consistent reference frame realization. In this contribution, we present and compare initial results from the national reprocessing efforts, focusing on reference frame alignment, systematic differences, and preliminary combined solutions.

The results demonstrate the benefits of close collaboration between the agencies, showing that coordinated GNSS reprocessing significantly improves the compatibility, realization, and long-term maintenance of stable, high-precision terrestrial reference frames.

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Updating the Spanish national reference frame: A reprocessed ETRF2000 solution based on ITRF2020

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An updated national realization of the ETRF2000 frame in Spain is presented, derived from a complete reprocessing of all available observations from the public permanent GNSS networks operating in the Iberian Peninsula and the Balearic Islands in ITRF2020. Spain currently maintains a unified geodetic reference frame in ETRF2000, established through a coordinated effort between national and regional institutions to ensure consistency across the different positioning services. The latest reprocessing continues this collaboration, incorporating improved modelling, updated metadata and extended observation time spans. The Working Group responsible for the maintenance of the national frame has integrated data from all participating GNSS networks into a single multi-agency solution combination, ensuring homogeneity of processing standards and parameter constraints. The resulting realization includes revised coordinates at the reference epoch, updated velocities, time series and a coherent set of station discontinuities, representing the most complete and accurate depiction of ground motion released by the WG to date.

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Lantmäteriet's Strategy for Geodesy 2026–2035

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One of the tasks assigned to Lantmäteriet – the Swedish Mapping, Cadastral and Land Registration Authority – is to meet society's need for a coherent and sustainable geodetic infrastructure and to ensure that it is easily accessible and usable.
The Strategy for Geodesy for 2026–2035 describes how Lantmäteriet will meet future needs in an era of rapid technological development, increased use of GNSS-based positioning, and growing demands for robustness.

This presentation describes the strategic positions that Lantmäteriet has taken for the geodetic infrastructure for the coming ten years. The starting point is that the current geodetic infrastructure largely fulfils the needs, but management and development is required to ensure long-term reliability. The strategy also highlights the importance of contributions to the global geodetic supply chain and international cooperation in the field of geodesy.

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Status report from the project to compute the new Serbian quasigeoid model SQM2026

Jonas Ågren *† [1], Vladan Nikolić [2], Vančo Božinov [2], Vladimir Milenkovic [2], Filip Kostadinović [2], Jelena Varenica [2]

[1] Lantmäteriet – Sweden
[2] Republic Geodetic Authority – Serbia

The old Serbian quasigeoid model, SQM2011, was derived by first computing a gravimetric model using Least Squares Modification of Stokes' formula with Additive corrections (LSMSA or KTH method) applied on gravity data from the times of the former Yugoslavia. The gravimetric model was then adapted by means of a smooth residual surface to the Serbian three-dimensional ETRS89 realisation, ETRF2000, and to the NVT2 height frame that resulted from the second high accuracy levelling of Yugoslavia.
Since then, the Republic Geodetic Authority (RGA)in Serbia has worked hard on improving the Serbian reference frames and the different datasets. A new dense national levelling network and corresponding height frame, RNM, has for instance been finalised using precise levelling. A completely new Serbian detail gravity dataset covering the whole country has also been surveyed relative to a new fundamental gravity network, ultimately connected to three absolute gravity stations.

A project to compute the new quasigeoid model SQM2026, based on the new reference frames and datasets, recently started as a collaboration between RGA and Swedish Lantmäteriet. The main purpose of this presentation is to describe the status of the still on-going SQM2026 project. The new datasets and reference frames are presented, the quasigeoid computation method is discussed, and the results obtained so far are analysed.

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Status report on the installation and testing of InSAR radar reflectors in Denmark

Aslak Meister * [1]

[1] The Danish Agency for Climate Data – Denmark

In recent years, the Danish Agency for Climate Data has carried out various activities related to the installation and testing of artificial radar reflectors for InSAR.
A key activity has been the execution of a five-year field test involving data collection from two compact active transponders (CATs) and a passive corner reflector (CR). Based on the results of this field test, it can be concluded that the phase stability of the CATs is _˜0.1-0.2 mm/yr (projected vertically and horizontally) and that a vertical displacement can be resolved with an accuracy of a few millimeters. Thus, CATs can potentially be useful for geodetic and technical applications, provided that practical issues regarding maintenance and durability can be solved.

Another key activity has been the establishment of a fundamental network of artificial radar reflectors with the purpose of linking SAR/InSAR with other geodetic observation techniques. Currently, this network consists of nine passive, double square trihedral CRs, all of which are co-located with class A GNSS-stations.
In parallel to the activities of the Danish Agency for Climate Data, private businesses specializing in the installation of artificial radar reflectors and the processing of InSAR deformation maps have emerged. As a result, an additional _˜140 CRs have been installed throughout the country for various purposes.

*Speaker

Towards the GNSS-InSAR integration in the Hungarian geodetic infrastructure

Ambrus Kenyeres * [1]

[1] Satellite Geodetic Observatory Budapest – Hungary

In Hungary since 2023 a new geodetic infrastructure is being built, where the permanent GNSS stations are moved from buildings down to the ground. The new stations follow the Dutch IGRS (Integrated Geodetic Reference Station) design, which include an active GNSS station, two InSAR corner reflectors and a levelling benchmark. Additionally gravity measurements are also possible on the concrete block encompassing the station elements. The so called IMMA stations are serving as base stations for the Hungarian GNSS RTK service and are being part of the re-defined 1st order levelling network as well. Actually the network includes 35 stations and the development program ends in 2026 with the installation of 10 more stations. The increased number of reference stations improved the quality of the Hungarian RTK service under the hard circumstance during the past years due to the increased solar activity.
Parallel to this network upgrade a semi-kinematic digital height reference surface is also under development, which will be based on an improved geoid integrated with the ground motion model generated from long term InSAR analysis.
The presentation show the actual status and summarizes the achievements.

*Speaker

25-25 Jun 2026

National and Local Activities

National report of Lithuania

Ogintas Jokubas * [1], Eimuntas Paršeliūnas [1], Saulius Urbanas [2], Jūratė Bojarunienė [3], Ramunė Žygaitė [3], Dominykas Šlikas [1], Romuald Obuchovski [1]

[1] Vilnius Gediminas Technical University – Lithuania
[2] Environmental Ministry of Lithuania – Lithuania
[3] National land service – Lithuania

During 2025-2026 main geodetic efforts in Lithuania were directed into two fields:

· Second levelling of the First order vertical network of Lithuania and

· Marine gravity survey in the territorial waters of Lithuania.

· Management of LitPOS network.

The first (initial) levelling of the state first order vertical network was carried out in the period from 1996 till 2008. Network consists from the five loops, total length of levelling lines is about 2000 km. Connections to corresponding networks of neighbouring countries Poland and Latvia were observed also. Data set of vertical network was included into UELN data base, and served also transferring European Vertical System of 2007 to Lithuania, Latvia and Estonia. 20 years have passed since the first levelling was performed, so the time has come for its updating. In 2023-2025 a half of the network was checked and re-surveyed aiming to completely update the network by the end of 2027.

The marine gravity survey was never executed in the territorial waters of the Lithuania in the Baltic Sea. By National Land Service's initiative the first gravity observations were commenced in 2021 and shall be completed in 2024. Total length of the observed lines is about 8000 km. Gravity observations are carried out by two marine gravimeters: MSG-6 (Gdansk University of Technology, Poland) and ZLS (Lantmäteriet, Sweden). The data of gravity survey were transferred to the database of Nordic Geodetic Commission for the modelling of the new geoid model.

LitPOS network continues to serve as the main state geodetic control in Lithuania. LitPOS service is free of charge. Technical LitPOS infrastructure consists of 35 ground stations, equiped by Trimble NetR9 receivers with Chock ring antennas. Two connections to national CORS networks of neighboring countries are established to : 6 LatPOS stations (Latvia) and 3 ASG-PL stations (Poland). In 2025 the number of registered users in LitPOS reached close to 2300, the number of involved rover receivers exceeds - 7000. From the 2003 the network managing software Trimble PIVOT v5.1 v5.1 (RTX processor) was employed. Operational processing are performed by BERNESE 5.4 software, Reference Frame: Aligned to IGS20 (Epoch 2020.0).

*Speaker

Second reprocessing of the network is done (GPS weeks 887 to 2237).

National Report of Romania

Miluta Dulea-Flueras * [1]

[1] Head of Geodesy and ROMPOS, National Center for Cartography – Romania

This report summarises the activities carried out in Romania in the field of geodetic reference systems and GNSS infrastructure.
The first part presents the current status and continued modernisation of the ROMPOS network, the Romanian national CORS infrastructure operated by NCC in support of geodetic, cadastral, and real-time positioning applications. We report on software and processing-chain upgrades, network densification, and user-engagement trends across RTK, DGNSS, and post-processing services. Particular attention is given to the Romanian EPN stations, their performance, and the completion to date of Romania's contribution to the EPN-Repro3 campaign over 2022–2026, together with processing results, quality indicators, and integration into national products.

On the international side, we report the signing of the CEGRN (Central European GNSS Geodynamic Reference Network) Memorandum of Agreement, formalising Romania's long-standing participation in the consortium and securing continued contribution of Romanian sites and data to coordinated geodynamic investigations in Central Europe, in synergy with the CEGRN–EUREF MoU.

The second part addresses progress on the national quasi-geoid model and on the refinement of the transformation between GNSS-derived ellipsoidal heights and the national normal-height system, in line with the EUREF Working Group on a Unified European Height Reference. Recent levelling, gravimetric, and GNSS/levelling validation campaigns are described.
The report concludes with an outlook on ongoing projects - including GNSS signal-quality and interference monitoring, and the alignment of Romanian realisations of ETRS89 and EVRS with the latest EUREF products - and on planned European collaborations.

*Speaker

National report of Serbia

Filip Kostadinovic * [1]

[1] Vladan Nikolic – Serbia

This national report highlights key geodetic activities and advancements in Serbia, focusing on the validation of the EUREF Serbia 2023 densification campaign by the EUREF Governing Board; the comprehensive reprocessing of AGROS GNSS network data (2018–present) using unified models consistent with IGS repro3 and IGS20; the derivation of a preliminary national velocity model supporting future kinematic reference frame development; the completion of a nationwide gravimetric survey; the ongoing development of a new high-resolution quasigeoid model; the preparation of strategic studies addressing the establishment of a zero-order geodetic network and the transition to the UTM projection for cadastral applications. These activities, carried out over the past year, represent significant steps toward Serbia's further integration into European geodetic frameworks and support the continuous modernization and development of its national geodetic infrastructure.

*Speaker

National report of Slovakia

Martin Ferianc * [1], Branislav Droscak [1], Karol Smolik [1], Martin Imrisek [2]

[1] Geodetic and Cartographic Institute Bratislava – Slovakia
[2] Slovak University of Technology in Bratislava – Slovakia

National report of Slovakia presents joint, national authority, university and research institutes contribution about present status and news focused primarily on the field of geodetic controls, geodesy, geoinformatics, metrology, InSAR and Earth sciences which have happened since the last EUREF 2025 Symposium.

*Speaker

National Report of Switzerland

Arturo Villiger * [1]

[1] Federal Office of Topography Swisstopo [switzerland] = Office fédéral de topographie swisstopo [Suisse] = Bundesamt für Landestopografie swisstopo [Schweiz] = Ufficio federale di topografia swisstopo [Svizzera] – Switzerland

Important highlights and developments of the national mapping agency swisstopo are presented. This includes aspects of the Permanent Network Anlaysis Center PNAC, the Swiss Positioning Service swipos, as well as GNSS meteorology.

*Speaker

National Report of the Czech Republic

Jan Reznicek * [1]

[1] Czech Office for Surveying, Mappng and Cadastre (CUZK); Land Survey Office – Czech Republic

National Report of the Czech Republic presents activities of the Land Survey office and Research Institute of Geodesy, Topography and Cartography, that have taken place in the past year, including the administration of CZEPOS GNSS network, levelling measurements, Geodetic Observatory Pecny (GOP) contributions to science & reference frames, or Gravimetry research at GOP.

*Speaker

National Report of The Netherlands 2026

Bas Alberts * [1]

[1] Rijkswaterstaat – Netherlands

The National Report highlights the various activities of the Netherlands Partnership for Geodetic Infrastructure (NSGI) for the period 2025 – 2026. The activities include the survey campaign of 2026 as well as several new developments and experiments.

*Speaker

National Report of Germany

Wolfgang Soehne * [1], Andreas Gerschwitz [2]

[1] Federal Agency for Cartography and Geodesy – Germany
[2] Landesamt für Vermessung und Geoinformation Schleswig- Holstein – Germany

The National Report of Germany contains news and information on the national reference frames and is compiled by the German Surveying Authorities (AdV) together with BKG.

*Speaker

National report of France

José De Oliveira Pinheiro *† [1]

[1] IGN – Institut National de l'Information Géographique et Forestière [IGN] – France

French national report on geodetic activities.

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Advancing Geodesy with EUREF: Research, Innovation and Future Perspective

Genesis: ESA's unique future geodetic satellite mission

Gaia Fusco * [1], Sara Gidlund† [1], Pierre Waller‡ [1], Evelyn Honoré-Livermore§ [1], Antonia Bieringer¶ [1], Erik Schoenemann‖ [2], Jean-Christophe Berton** [2], Francesco Gini†† [2], Alexandru Mancas‡‡ [3]

[1] European Space Research and Technology Centre – Netherlands
[2] European Space Operations Center – Germany
[3] European Space Astronomy Centre – Spain

The Genesis mission is conducted by the European Space Agency (ESA) Navigation Directorate as part of the FutureNAV program. Its primary objective is the contribution to the improvement of the International Terrestrial Reference Frame (ITRF) towards an accuracy of 1mm and a long-term stability of 0.1mm/year. Secondary objectives include the contribution to a high number of other scientific disciplines (geodesy, geodynamics, earth rotation, geophysics, earth gravity field, atmosphere and ionosphere sciences, metrology, relativity...) (1).
The Genesis Space Segment consists of a spacecraft in MEO (400kg, 6000km altitude, 95∘ inclination) co-locating for the first time in space the four geodetic instruments used for the realisation of the ITRF: a GNSS receiver, an SLR reflector, a VLBI transmitter and a DORIS receiver. The Ground Segment is composed of a Mission Control Centre (including a Ground Station) and will make use of the existing ground infrastructure, operated by the Services of the International Association of Geodesy (IAG): GNSS sensor stations network of the IGS, SLR stations of the ILRS, VLBI antennas of the IVS, and DORIS beacons of the IDS. The scientific mission data and related Precise Orbit Determination products will be processed by the ESA Navigation Support Office, before being archived, and distributed by the ESA GNSS Science Support Centre (GSSC), together constituting the ESA Genesis PROcessing, Archiving and Distribution Centre (PROAD) in close collaboration with the scientific community.

Genesis' fully calibrated satellite will establish precise and stable ties between the key geodetic techniques, implementing a unique dynamic space geodetic observatory. As the ITRF is recognised to be the foundation of countless space and ground-based applications, Genesis will have a major impact on almost any space mission and, in particular, on Navigation and Earth Science.

On the industrial side, a consortium led by OHB Italia S.p.A. has been contracted by ESA

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for the development, qualification, launch and 2 years operation of the mission (with option for extension), with a launch currently planned in 2028. Antwerp Space, as payload prime, is responsible for the geodetic instruments and the Ultra Stable Oscillator (USO) for instruments' synchronization. Industrial activities were kicked off in April 2024, covering the System Requirements Review in 2024, and the System Preliminary Design Review in 2025, and work is on-going to consolidate the design towards a Critical Design Review starting towards the end of 2026.

On the scientific side, a Genesis Scientific Exploitation Team (GSET) was set-up and members appointed in 2024. This structure encompasses representatives of ESA, a lead Scientific Coordinator and Co-Coordinator, as well as five Working Groups covering the four geodetic techniques and their combination. The GSET includes members of the international geodetic services and will interact with them for the coordination of the ground infrastructure. Three successful Genesis Scientific Workshops have been held in February 2024, April 2025, and March 2026. The GSET are actively supporting the mission development, the design consolidation, and will play a key role in the future exploitation of the mission data.

This presentation will provide an up-to-date overview of the Genesis mission from a system and programmatic point of view.
(1): Delva et al. Earth, Planets and Space 75, 5 (2023)

IGS LEO-PNT Pilot Project: Preparing Geodetic Infrastructure and Products for Future LEO-PNT Integration

Lotfi Massarweh * [1], Francesco Gini [2]

[1] Delft University of Technology – Netherlands
[2] European Space Agency – Germany

A new class of space-based Positioning, Navigation and Timing (PNT) systems is emerging in low Earth orbit (LEO), involving constellations of satellites transmitting GNSS-like signals to support ground-user positioning and timing services. Several initiatives from private industry, space agencies, and institutional actors are expected to deploy these LEO-PNT missions in the coming years. According to the latest FrontierSI State of Market Report, 2025 Edition, most planned constellations will comprise several hundred satellites and are expected to transmit signals compatible, and potentially interoperable, with existing GNSS signals. The widespread availability of these new signals also has the potential to expand and complement current products, datasets, and formats established within the International GNSS Service (IGS). It is therefore essential for the IGS to prepare for LEO-PNT by investigating whether and how this emerging technology can be integrated into its operational activities for the benefit of its product portfolio. In this presentation, we introduce the recently established IGS LEO-PNT Pilot Project and discuss its relevance for geodetic innovation, European geodetic infrastructure, and future reference frame activities. In particular, the project addresses how emerging LEO-PNT constellations and their GNSS-like signals may complement existing geodetic products and observing strategies, with implications for data standards, tracking infrastructure, real-time capabilities, orbit and clock products, atmospheric sensing, and reference frame activities. Emphasis is placed on interoperability, open data, and coordinated international preparation, so that the geodetic community can assess whether LEO-PNT may become a valuable future layer within operational geodesy and EUREF-related activities.

*Speaker

Impact of electromagnetic interferences on geodetic GNSS receivers: A comparative analysis among GPS, GLONASS, Galileo and BeiDou

Michail Gianniou * [1]

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In recent years, the problem of electromagnetic interferences on Global Navigation Satellite Systems (GNSS) has become increasingly severe. Radio Frequency Interferences (RFI) consist a serious threat to modern societies as they depend strongly on GNSS for various crucial civil applications including transportation safety, air navigation, time transfer etc. As the occurrence of unintentional and intentional RFI increases steadily, high precision applications using geodetic receivers are also increasingly affected. However, not all GNSS signals are equally affected. The susceptibility of each signal on RFI depends on its characteristics like bandwidth, modulation scheme, effective power etc. This study investigates the vulnerability of GNSS to both intentional and unintentional interferences using field data. The analysis is based on quantitative indexes like the Signal to Noise Ratio (SNR) value and the number of cycle slips and tracked satellites. Results from a comparative evaluation among all available signals of GPS, GLONASS, Galileo and BeiDou are presented and analyzed. The analysis revealed a large variation in the impact of RFI between the various GNSS signals, proving that the vulnerability of each signal depends strongly on it's characteristics. Novel signals designed with modern technologies, like the Galileo and BeiDou-3 signals as well as the modernized GPS signals proved to be superior, showing enhanced resistance on RFI.

*Speaker

Multi-Source Fusion for Real-Time GNSS Interference Detection, Spoofing Classification, and Predictive Forecasting on a National CORS Infrastructure

Miluta Dulea-Flueras * [1]

[1] Head of Geodesy and ROMPOS, National Center for Cartography – Romania

The integrity of Global Navigation Satellite Systems (GNSS) is increasingly threatened by terrestrial radio-frequency interference, meaconing, and spoofing, yet few operational monitoring networks expose the raw observables needed to detect, characterise, and anticipate such events at national scale. We present an integrated interference-monitoring and forecasting framework built on top of the Romanian ROMPOS continuously operating reference network (81 geodetic receivers streaming per-second records over persistent TCP sessions with failover). A distributed asynchronous ingestion layer parses detection and spectrum records into a time-series store that currently contains more than 88×10 interference events and 24×10^3 spoofing records; on each insert, a seven-indicator analytical engine jointly evaluates temporal co-occurrence, spatial clustering, multi-band correlation, and spectral shape, classifying each detection as clean, matched-spectrum, meaconing candidate, or spoofing candidate. To densify the picture in the IF domain, a complementary high-rate receiver array streaming raw binary observations is co-located at strategic sites, providing per-band FFT on baseband samples, AGC and notch-filter telemetry, and cross-station event correlation at 60-second granularity. Regulatory feeds - automated electromagnetic-interference alerts from the national telecom regulator, and long-term field-strength and channel-occupancy series from the national fixed spectrum-monitoring network - are temporally aligned with GNSS detections to disambiguate licensed emissions and cross-border propagation from intentional attacks. A parallel offline pipeline reprocesses archived RINEX observations (GPS, GLONASS, Galileo, BeiDou, QZSS, IRNSS) with a Rust-based per-epoch C/N analyser to derive signal-quality scores and historical threat fingerprints that baseline live events. Targeted field campaigns using a coherent five-channel software-defined radio (KrakenSDR) provide ground-truth direction finding and spectral verification for selected candidates. Finally, a gradient-boosting model (200 estimators, 16 cyclical–geospatial features, trained on 2.56×10 labelled samples) delivers 24-hour per-station interference probability and band-level forecasts with 94.6 % classification accuracy; station ephemeris baseline and weekday/weekend periodicity emerge as dominant predictors. The fused architecture demonstrates that combining reference-network telemetry, high-rate receiver baseband data, regulatory spectrum feeds, offline RINEX reprocessing, field SDR verification, and supervised learning produces a reproducible, near-real-time national GNSS threat-intelligence capability.

*Speaker

Multi-GNSS Analyses in the Time and Frequency Domains

Joaquín Zurutuza * [1,2], Anna Fantoni [2], Alessandro Caporali [2], Marco Pertile [2]

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In accordance with the Galileo Open Service Definition Document, multi-GNSS interoperability is defined as the exploitation of the diverse navigation signals to produce combined solutions with enhanced accuracy and availability. This study presents results from Work Package G3.5 of the GEMOP project (Galileo and EGNOS Monitoring Of Performances), a EUSPA-funded initiative providing independent monitoring of European satellite navigation systems. The analysis focuses on two primary domains: (A, or time domain) pseudorange observations for the determination of user position and receiver/GNSS time offsets, and (B, or frequency domain) Doppler observations for user velocity and frequency offset characterization.
Using data from 2025 Q4, the pseudorange analysis evaluated GNSS-system time offsets and the quality of tracked systems through post-fit range residuals. Based on monthly Key Performance Indicators (KPI) threshold of +/-2 m (95% percentile), Galileo (dual-frequency I/NAV and F/NAV) emerged as the top performer and the only constellation to fully satisfy the KPI. GPS, BDS, and GLONASS followed as the next best performers, while regional systems showed varied results: QZSS performed excellently within its coverage, whereas NAVIC and GAGAN exhibited the highest residuals (worst KPIs).
The Doppler analysis assessed frequency domain performance against a monthly Figure of Merit (FOM) threshold of 0.066 m/s (95% percentile). The results indicate that all GNSS constellations successfully met the FOM. Interestingly, QZSS and GLONASS showed the highest precision in the Doppler domain. For Galileo, satellites E11 and E19 (IOVs equipped with Rubidium clocks) exhibited systematic offsets relative to the constellation, with E11 showing the largest mean deviation of approximately -0.1 m/s. These findings highlight the current capabilities of multi-constellation timing and frequency synchronization.

*Speaker

An Automated Platform for GNSS Processing and Time-Series Analysis in a Complex Geodynamic Region

Dimitrios Anastasiou *† [1], Georgios Mytilinaios [1], Alexandros Mylonas [1], Georgios Serelis [1], Xanthos Papanikolaou [1], Vangelis Zacharis [1], Maria Tsakiri [1]

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Dionysos Satellite Observatory (DSO) has been systematically processing continuous GNSS data for over a decade, contributing to the monitoring of crustal deformation in Greece, a region characterized by complex tectonic and geodynamic activity. Emphasis is placed on the development of robust methodologies capable of handling the large volume and inherent heterogeneity of GNSS sites arising from diverse network configurations, equipment, and temporal sampling schemes.

To address these challenges, DSO employs a multi-software processing strategy, utilizing different GNSS analysis packages to ensure cross-validation, and flexibility in handling diverse datasets. This approach supports both rapid and final analyses, producing a comprehensive suite of geodetic products, including station coordinates, Zenith Path Delay (ZPD), Total Electron Content (TEC) maps, and SINEX solutions. Recent software upgrades and the transition to the IGS20 reference frame have further motivated the reprocessing of available datasets to enhance homogeneity and long-term consistency.

Following the GNSS processing stage, daily station position time-series are produced with a particular focus on capturing geophysical signals associated with crustal deformation. The analysis includes the identification and modeling of discontinuities, linear trends, seasonal variations, and transient signals related to seismic events and post-seismic deformation. This enables a more comprehensive interpretation of both long-term and episodic deformation processes across the region.

All derived products and results are integrated into a newly developed database infrastructure, designed to operate in an automated manner. The system ensures continuous data processing and seamless updating of results while maintaining consistency. This database forms the backbone of an online platform, through which processed products, time-series, and derived parameters are made accessible, supporting both scientific research and operational monitoring.

Overall, the presented framework demonstrates the value of combining multi-software GNSS

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processing, advanced time-series analysis, and automated data management within a unified platform, providing an efficient and scalable solution for long-term crustal deformation monitoring in Greece.

CEGRN Status as of 2026

Joaquín Zurutuza [*†] [1], Alessandro Caporali [1], Marco Pertile [1], Anna Fantoni [1], Ambrus Kenyeres [2], Martin Ferianc [3], Oleg Khoda [4], Nikolay Dimitrov [5], Miluță FlueraȘ [6]

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[5] Bulgarian Academy of Sciences – Bulgaria
[6] National Center for Cartography – Romania

In 2019, a *Data in Brief* paper summarized the CEGRN latest cumulative solution aligned to the IGb08 reference frame and based on weekly solutions. By then, almost all the CEGRN Analysis Centers (ACs) and Data Providers (DPs) could produce their own high-quality GNSS solutions, in standard SINEX (SNX) format, based on very strict guidelines to ensure the exchange and also for further analyses, such as multiyear analysis (CEGRN, EPND, EPOS,...). After the IGS20 was introduced (2022/NOV/27), the repro3 campaign followed, together with the transition of the software to the new IGS20 standards and file naming. With these in mind, it was time to update the CEGRN solution using the new IGS20-compliant solutions -these are the new solutions provided by the ACs and new CEGRN computed solutions, based on repro3 products and focused only on DPs not able to produce their own GNSS solutions.
In this presentation we show the preliminary results of the combination of the daily SINEX solutions provided by the Bulgarian Academy of Sciences - Bulgaria (BAS), the *Geodetický a Kartografický Ústav* - Slovakia (GKU), the ROMPOS - National Center for Cartography - Romania (ROM), the Lechner Non-profit Ltd. - Hungary (SGO), and the Main Astronomical Observatory (National Academy of Sciences of Ukraine MAO) together with the subset of repro3 recomputed CEGRN Campaigns (2023 to 2015, more will be added as they are available).
The approach is AC-wise: all the individual solutions are treated individually, and the results are shared and discussed with the AC before the combination of the whole network, which includes all the individual solutions plus the available CEGRN repro3. The preliminary results show an excellent agreement with the IGS20 (IGS cumulative solution) and the AC-wise mean repeatabilities range from 1-2 mm (horizontal) to some 3-5 mm (vertical), which are numbers one can expect in current multiyear solutions.

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Preliminary GNSS Station Analysis and ETRFxx-Aligned Residual Velocity Assessment towards deformation modeling in Southern Iberia

José Antonio Tarrío * [1], Catalina Cea *

[1], Catalina Caceres [1], Juan Giglio [1], Marcelo Caverlotti [1], Rui Fernandes
[2]

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[2] Universidade da Beira Interior, Instituto Dom Luiz Covilhã – Portugal

Recent EUREF discussions on alternatives to ETRS89 highlight the need to handle deformation in areas where coordinates acquired at different epochs cannot be compared through a purely static approach. Southern Spain has been mentioned in this context as a region where small deformation may require specific treatment, potentially through an additional rotation pole or a related regional correction. This contribution presents a preliminary GNSS station analysis and an ongoing ETRFxx-aligned residual velocity assessment for Southern Iberia, without proposing an operational deformation model at this stage.
The analysis is based on a GNSS station-summary dataset comprising 2,294 records, including coordinates, time spans, observation completeness, instrumental jumps, earthquake indicators, WRMS values, secular velocities, and seasonal amplitudes. After longitude normalization, a working Southern Iberian peninsular window identifies 113 stations. Applying quality-control criteria based on coordinate time span, observation completeness, WRMS values, and velocity consistency retains a conservative subset of 41 stations. This subset has a median time span of 16.0 years, median observation completeness of 93.8%, median WRMS values of 1.32, 1.31, and 4.41 mm in east, north, and up, respectively, and a median horizontal velocity of 24.75 mm/yr.

The workflow is informed by previous SIRGAS/ADELA experience in GNSS-based kinematic-frame implementation, but it is reformulated here as an EUREF-compatible screening exercise. The observed velocities are treated as absolute station motion in the original solution frame. The ongoing step is a time-dependent transformation of coordinates and velocities towards an appropriate ETRFxx realization, retaining ETRF2000 as a continuity reference.
The resulting residual field could then be used to assess whether an additional rotation pole, a spatially continuous correction, or a hybrid approach should be further tested and compared with EPN/EUREF products and official IBERRED/IGN-derived solutions.

*Speaker

The Future Datacenter: Motivation and Vision of the newly installed IGS Workinggroup on Data Architecture

Helmut Titz * [1], David Mencin† [2], Brandon Owen‡ [3], Markus Bradke§ [4]

[1] Federal Office of Metrology and Surveying [Vienna] – Austria
[2] EarthScope Consortium – United States
[3] Geoscience Australia – Australia
[4] German Research Centre for Geosciences - Helmholtz-Centre Potsdam – Germany

During a "Technical Workshop on Modernized GNSS Storage and Exchange Formats" in February this year in Coimbra, Portugal, 23 participants discussed the problems, limits and weaknesses of the present GNSS datacenters. Three factors have been identified as extremly problematic for scaling up datacenters:
1) The RINEX-Format especially in the double compressed form as CRX.GZ files produces an enormous amont of CPU time

2) The combined and redundante storage of data and metadata leads to inconsistencies and requires cross checks

3) The storage in files is not cloud scaleable in cloud systems

Two prototype implementations developed by Earthscope and GFZ have been presented and discussed ad the workshop and a whitepaper has been created. At the last IGS GB meeting the new WG on Data Architecture has been set up and a pilot project has been startet. The driving ideas and the structure of this pilot project will be presented.

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Towards land and sea vertical unification thanks to hydrodynamic levelling

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France mainland, Great Britain, Corsica and French overseas territories vertical datums are assessed with hydrodynamic leveling approach, by combining observational products of ocean mean dynamic topography and tide gauges data. IGN69 French and ODN British vertical datums south-north slopes are confirmed to be both equal to about 3 cm/deg, depending on the chosen MDT product. IGN78 Corsican vertical datum slope is much more uncertain. French overseas territories vertical datums are only assessed with a translation with respect to MDT geoids. Hydrodynamic levelling approach allows to connect territories separated by the sea : vertical differences between IGN69, IGN78 and ODN vertical datums origins, Marseille, Ajaccio and Newlyn, respectively, are also calculated: the vertical difference between IGN69 and IGN78 is estimated to be equal to 23.0 cm, and 12.6 cm between IGN69 and ODN. Height differences between IGN69 and IGN78 tide gauges benchmarks are introduced in the vertical adjustment of French levelling network to form a unified vertical adjusted virtual system between mainland and Corsica. Then the IPCC sea level 1995-2014 reference surface is calculated for each territory by using the Sea level anomaly, derived from space altimetry, combined with the MDT, and rigorously expressed in each single vertical datum. Finally, IPCC sea level rise projections are added to this reference surface rigorously expressed in local vertical datums, displaying non-negligible shifts in some places. Hydrodynamic levelling approach shows a way for unifying vertical reference surfaces between land and sea, and between territories separated by the sea, as well as for aligning large-scale vertical datum to global geoid models, or to express sea level rise projections in legal national vertical datums.

*Speaker

Open poster session and National Reports

National Report of Austria

Helmut Titz * [1]

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The renewal of the EUREF BEV AC and DC is shown. The anonymous FTP service will be switched of this year and will be replaced by a SFTP server. The HTTPS service will be unchanged.
The reprocessing ot the Austrian Densification Network AMON has been started. In a first step the missing analyses for the years 2017 - 2026 will be processed and combined with the existing SGO-Solution for 2020 - 2026. The Austrian Realisation of ETRS89 called "ETRS89 Austria 2002.56" does not fulfill modern requirements expecially of the APOS realtime service any more and will be replace be a new combined solution. Coordinates and velocities will be calculated from a NEQ-stacking approach of at least the years 2011 - 2026.

The 19 Austrian EUVN-DA datum points have been remeasured in 2024. Especially the elliptical heights have been improved by using advanced tropospheric approches..These - now called "EHRS Control Points" - could be used to check the horizontal quality ot the official Austrian National ETRS realisation too. The comparison of the 2002 and the 2024 solution is shown.

The GNSS realtime service APOS has been extended. 2 new Reference Stations have been built up, a dataexchange with the Italien OGS/Frednet has been established and additional 6 APOS-Stations have been included into EPOS.

*Speaker

National Report of Estonia

Karin Kollo * [1]

[1] Karin Kollo – Estonia

Activities in Estonia 2025-2026

*Speaker

Geodesy Cartoons: Visualizing Geodesy for Everyone

Martin Sehnal * [1]

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Communicating complex geodetic concepts such as reference systems and GNSS to non-expert audiences remains a key challenge. The **Geodesy Cartoon** initiative (https://geodesy.science/cartoon/) launched in 2024 by the Coordinating Office of the Global Geodetic Observing System (GGOS) at BEV (Federal Office of Metrology and Surveying, Austria), addresses this challenge by translating scientific content into clear, engaging, and humorous visual narratives.
This contribution presents a curated selection of Geodesy Cartoons with a particular focus on themes relevant to the EUREF community, including terrestrial reference frames, coordinate systems, positioning, and GNSS. The cartoons demonstrate how abstract concepts, such as the realization and maintenance of reference frames or the role of GNSS in positioning, can be made accessible to a wide audience, thereby strengthening public understanding of geodesy and its societal relevance.

In addition, the poster highlights the outcomes of the **Geodesy Cartoon Competition** (https://geodesy.science/cartoon/competition/), a global outreach effort that attracted 274 submissions from 119 contributors across 46 countries. The competition, evaluated by an international jury, emphasized clarity, creativity, accessibility, and scientific relevance. The final results, including award-winning cartoons, will be presented.
The Geodesy Cartoons illustrate the potential of creative science communication to complement traditional dissemination approaches, support education and outreach, and increase the visibility of geodesy within and beyond the scientific community.

*Speaker

National Report of Portugal 2026

Helena Ribeiro * [1]

[1] Directorate-General for Territory (DGT) – Portugal

This poster aims to present the activities of the Directorate-General for Territory (DGT), the national mapping agency of Portugal, responsible for the establishment, maintenance and development of the Portuguese National Geodetic Infrastructure, in alignment with European and global reference systems. It provides a concise overview of the geodetic activities carried out by Portugal within the framework of EUREF during last year.

*Speaker

Towards an update of the French vertical maritime reference surfaces

Nolwenn Portier * [1], Gaël Andre * † [1], Didier Rouxel [1]

[1] Shom – Service Hydrographique et Océanographique de la Marine (SHOM) – France

The French chart datum (CD), defined at tide gauge stations, corresponds to the approximate Lowest Astronomical Tide (LAT). At tide gauge stations, the CD is referenced to the GRS80 ellipsoid. It is the vertical marine reference against which sea levels are expressed, and therefore also the mean sea level (MSL) and characteristic tidal levels as LAT and Highest Astronomical Tide (HAT). The BathyElli project allows to spatially extend the CD height with respect to the GRS80 ellipsoid. This knowledge is essential to ensure the continuity of the land-sea reference system along the coastline. It facilitates the referencing of bathymetric surveys to the CD and contributes to the referencing of hydrodynamics studies.
Currently, the BathyElli CD surface is created by the sum of the mean sea surface (MSS) deduced from altimetry and a tidal model providing LAT with respect to MSL; a correction is applied to force the consistency with the local tide gauge data. The quality of its definition is linked to the MSS precision which is known lower on the coast. Data collected during several dedicated GNSS surveys are used to enhance surface models, particularly near the coasts, by incorporating short wavelengths. The improvement of the MSS model accuracy motivates the update of the French BathyElli vertical reference surfaces.
MSS DTU 2025 differs from the three other studied models (MSS CLS 22, MSS CLS hybrid 23 and MSS DTU 21) by using SWOT altimeter data; it also has a highest spatial resolution (1/100∘). Furthermore, analysis shows a good agreement with 31 tide gauge measurements after taking into account the dynamic atmospheric correction and the difference of reference periods. The consistency is better in Atlantic (1.5 +/- 6.7 cm) than in Mediterranean Sea (-1.5 +/- 15.1 cm).

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National Report of Poland

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Head Office of Geodesy and Cartography in Poland (GUGiK) has been carrying out measurements of the basic levelling network since 2024. The work in 2025 covered the east and central-south part of the country, and this year the work is continuing in the south-western Poland. To obtain the latest gravimetric data at the levelling network points, we made measurements at some of levelling points in north-western Poland. These measurements will be continuated in coming years, coverering the entire territory of Poland.
Since 2024, measurement work on the gravimetric basic control points has also been underway. After measurements in the southern part of the country, gaps resulting from instrumental problems in 2024, will being filled. Measurements are made by the A10 instrument. In 2025 we made also inventory of magnetic fundamental control points.
In ASG-EUPOS network, our works were focused on modernizing the hardware infrastrucrure and ensuring data security in Management Centers. In 2026, 2 ASG-EUPOS system stations will change their location. The system is facing a constantly growing number of users.

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Real-Time GNSS Monitoring System for Poland (RTGMS)

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In 2024 Head Office of Geodesy and Cartography in consortium with National Institute of Telecommunication applied to the European Space Agency under NAVISP-Element 3 Programme for funding for a pilot project which will result in the development of a dedicated system for real-time GNSS bands interference monitoring. The project was approved by ESA, began in November 2024 and is scheduled to be completed in May 2026. At this stage, the RTGMS system comprises more than a dozen fully operational monitoring stations, located in the most critical regions of Poland (along Poland's eastern border, around the Kaliningrad Oblast of the Russian Federation and along the Polish coastline). In the longer term, the system may be expanded to cover further regions of Poland.
As part of the project, software is being developed to detect anomalies in observations from high-end GNSS equipment installed at ASG-EUPOS reference stations. Observation data provided by GNSS receivers are processed in parallel by the RTGMS software and the existing ASG-EUPOS system software. In the event of a notification from the RTGMS system regarding an interference, ASG-EUPOS operators can carry out detailed analyses and decide on further steps to ensure reliable and accurate services.

The main part of the system was completed at the end of November 2025, and includes a detection algorithm with a web portal where the analysis results are presented. The portal is available free of charge to all interested users at https://rtgms.pl. Data from monitoring stations are transmitted to the calculation server, where a proprietary algorithm works that allows detecting interference on 3 levels:

High level – analysis and graphical presentation of real-time data and archival data obtained from RTCM SC-104 and NMEA 0183 observation streams.

Medium level – this module provides access to GNSS observation data from RTGMS monitoring stations and presents the results of analyses of recorded GNSS observations in relation to the number of predicted observations extracted from satellite ephemeris files.
Low level - this module presents the results of the analysis of spectral data transmitted from monitoring stations. Based on data from the proprietary RTGMS detection algorithm, the table and the map view present the status of individual monitoring stations in colour, along with a specification of the band in which interference occurs.

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National Report of Spain

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National and Local Activities of Spain in the last year.

*Speaker

Great Britain National Report

Mark Greaves * [1]

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EUREF related activties in GB since EUREF 2025

*Speaker

Swiss Terrestrial Reference Frame CHTRF2022

Lars Prange *† [1], Daniel Ineichen [1], Simon Lutz [1], Stefan Schaer [1], Arturo Villiger [1]

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The national coordinate reference frame CHTRF is the basis for georeferencing of official geospatial data in Switzerland. It is maintained by the Federal Office of Topography (swisstopo). We inform about the latest realization CHTRF2022, which is currently under preparation. We will provide an overview of the station network, monitoring, data processing, and methods of accessing the national reference frame. The resulting horizontal and vertical velocity field, which is dominated by alpine uplift, will be shown.

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Modern Geodetic Reference Frame of Albania

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The State Authority for Geospatial Information (ASIG), based on Law No. 72/2012, is responsible for establishing and maintaining the Geodetic Reference Frame (GRF) in the Republic of Albania. The national GRF consists of several fundamental networks, including the National GNSS Network, the National Gravimetric Network, the National Tide Gauge Stations Network, the National Magnetometric Stations Network, and the National Levelling Network.
The implementation of the modern geodetic reference frame is based on GNSS technology and the development of a precise gravimetric geoid, in accordance with European standards and reference systems such as ETRS89, EVRS, and IGRS.

Since 2018, ASIG has been developing and modernizing these national geodetic networks. Currently, the implementation of the third-order gravimetric network is in its final stage. The main objective is the computation of a high-resolution gravimetric geoid and the establishment of a new vertical reference system for Albania.
This poster presents the current status of the GRF in Albania and outlines the future steps toward the realization of a modern vertical reference system based on the gravimetric geoid.

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National Report of Finland

Pasi Häkli * [1]

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National Report of Finland

*Speaker

From Service to Reference Frame: The Role of SWEPOS Post Processing Service in SWEREF 99 Realization

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1

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Modern geodetic reference frames increasingly rely on continuously operating GNSS infrastructure and consistent processing strategies. In Sweden, the SWEREF 99 reference frame is realized through the SWEPOS network and accessed via positioning services, including the SWEPOS Post-Processing Service (SWEPOS-PPS). This study presents SWEPOS-PPS not only as a user-oriented positioning service, but as a key component in the maintenance, monitoring, and quality assurance of the national reference frame.
SWEPOS-PPS employs a network-based double-differenced processing strategy using Bernese GNSS Software, ensuring consistency with the methods used for the definition and maintenance of SWEREF 99. The impact of processing choices including ionosphere handling, ambiguity resolution, and tropospheric modeling, is analyzed with respect to coordinate accuracy and reference frame stability. In particular, the transition to a full VMF3 tropospheric model significantly reduces height biases, especially in cases involving elevation differences or extrapolation beyond the reference station network.

Using test campaigns and operational data, we evaluate the influence of observation time, multi-GNSS combinations, and reference station geometry on solution quality. Results show that centimeter-level accuracy can be achieved within one to two hours when multi-GNSS observations are used, while longer sessions enable sub-centimeter precision. However, degraded geometry and edge-of-network conditions introduce systematic effects.

A comparison with real-time Network RTK solutions indicates that post-processing provides more stable and bias-free coordinates for longer sessions, whereas real-time solutions may exhibit

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systematic effects related to modeling assumptions. These findings underline the complementary roles of real-time and post-processing services in modern geodetic infrastructure.

The study demonstrates how a modern GNSS post-processing service contributes to reference frame realization and long-term stability, providing insights relevant for national and regional infrastructures within the EUREF framework.

National Report of Belgium

Jeffrey Verbeurgt * [1], Fikri Bamahry [2], Carine Bruyninx [2], Robson Nascimento [1], Andras Fabian [2], Elise Kazmierczak [1], Juliette Legrand [2], Florian Sauerland [1], Anna Miglio [2], Eric Pottiaux [2]

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This national report summarizes recent geodetic activities in Belgium relevant to the EUREF community. As in previous years, the poster combines the contributions of both the National Geographic Institute (NGI) and the Royal Observatory of Belgium (ROB), two Belgian federal institutions working on reference frame related activities.

*Speaker

National Report of Slovenia to the EUREF 2026 Symposium in Paris

Klemen Medved * [1], Sandi Berk† [1], Peter Prešeren [1], Niko Fabiani [2], Natalija Novak [2], Mihaela Triglav Čekada [2], Božo Koler [3], Polona Pavlovčič Prešeren [3], Oskar Sterle [3], Bojan Stopar [3]

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[2] Geodetic Institute of Slovenia – Slovenia
[3] University of Ljubljana, Faculty of Civil and Geodetic Engineering – Slovenia

The National Report of Slovenia presents recent activities related to the national geodetic reference system. Most of the projects are realized in close cooperation between the Surveying and Mapping Authority of the Republic of Slovenia, the Geodetic Institute of Slovenia, and the Faculty of Civil and Geodetic Engineering of the University of Ljubljana. The so-called SLO4D project has just been completed. The main project achievements are an updated national combined geodetic network – densified and equipped with InSAR corner reflectors –, a national geokinematic model and a time-depended reference frame transformation software, and a study of the 4D national coordinate reference system, which is expected to be introduced in the near future. Some other recent projects and research activities are also mentioned that deal with the height datum transformation, gravity gradient determination, and renovation of the levelling networks in urban areas. A research project on the risk of jamming and spoofing of GNSS signals for the positioning and navigation services was also completed. It dealt with geodetic and low-cost GNSS receivers. An applied research project on geodetic technical and cultural heritage is being completed this year.

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Geodetic Observations and Geopotential Determination for the Optical Clock at BEV

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In October 2025 a new optical clock was installed at the Federal Office of Metrology and Surveying (BEV) in Vienna. To correct for the relativistic redshift of the clock's frequency the geopotential at the clock's position has to be known accurately. This report outlines the geodetic observations and the geopotential determination carried out by the Department "Reference Frames" at BEV in support of the optical clocks deployed in Vienna. The measurement campaign encompassed GNSS-based position determination, as well as local trigonometrical and levelling surveys. A new GNSS reference station was installed on the roof of the building to enable the connection to the international reference frame. A series of local trigonometrical and levelling surveys facilitated the connection between global and local reference frames, ultimately providing precise coordinates of the optical clock reference point in the ITRS. Finally, the geopotential was determined by locally modelling the gravity field using a compute-remove-restore method and terrestrial gravity data.

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