

EUREF Activities

Markku Poutanen

President of EUREF

Director of Department of Geodesy and Geodynamics
Finnish Geospatial Research Institute FGI
National Land Survey of Finland



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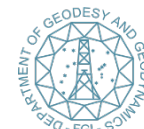
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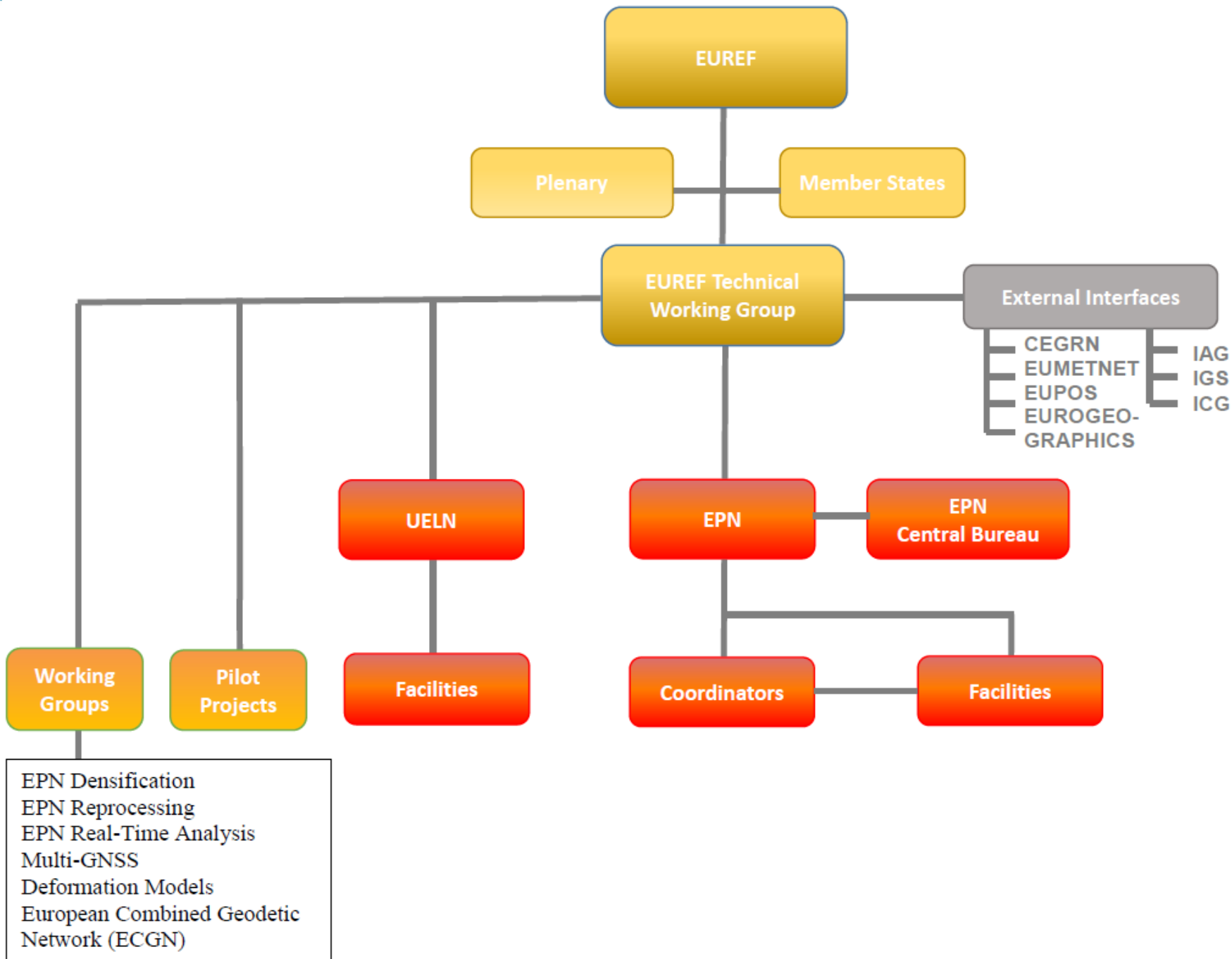


EUREF

Reference Frame Sub Commission 1.3a for Europe of the International Association of Geodesy (IAG)

- EUREF is composed of representatives from **European IAG member countries**; annual symposium (plenary) and Technical Working Group (TWG)
- Links to about **130 European organizations**, agencies, universities from more than 30 countries – related to geo-referencing, positioning, and navigation (activities like EUREF Permanent Network and annual symposium)
- The **TWG** is composed of members elected by the plenary, members in charge of special tasks and ex-officio members. Control of EUREF activities and policy.
- Close **co-operation** with pertinent **IAG** components (Services, Commissions, and Inter-commission projects), **EuroGeographics** (the consortium of the European National Mapping and Cadastre Agencies), **EUPOS** (DGNSS service providers), **UN-GGIM Europe** (Geo-information expert group) among others
- **EUREF is a user and a provider of GNSS**
- Provides all of its products and services on the “best effort” basis and **free of charge** to the public

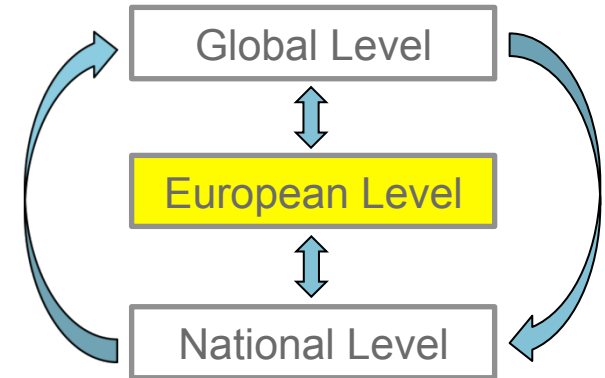




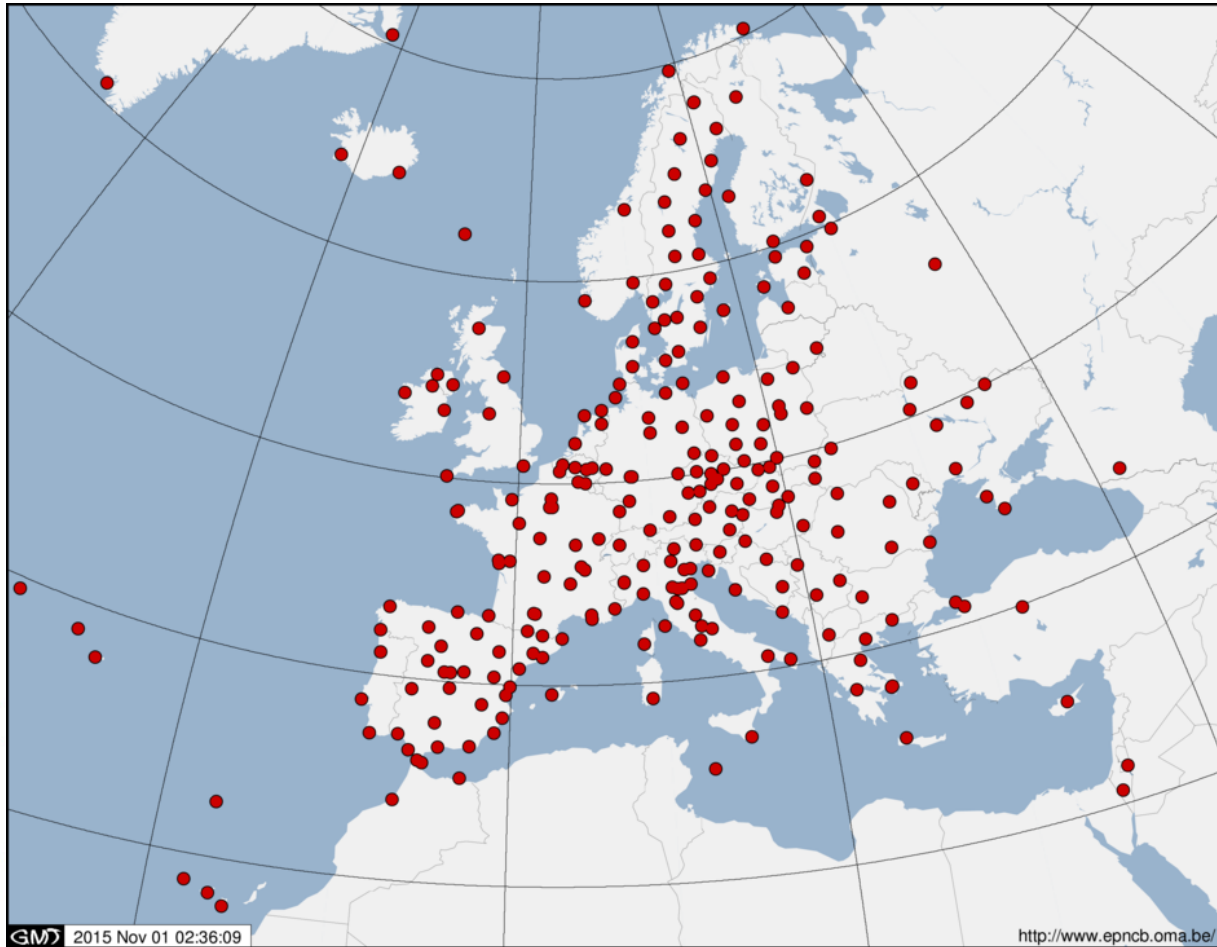
- EPN Densification
- EPN Reprocessing
- EPN Real-Time Analysis
- Multi-GNSS
- Deformation Models
- European Combined Geodetic Network (ECGN)

Main activities of EUREF

- Develop the **EUREF Permanent Network** (EPN) for the maintenance of the European Reference Frame, as contribution to the ITRF and as infrastructure to support other relevant projects, e.g. European initiatives related to Galileo;
- Implement necessary projects for the long-term maintenance of the **ETRS89** (European Terrestrial Reference System) and the **EVRS** (European Vertical Reference System);
- Promote the adoption of the reference systems defined by EUREF (ETRS89 and EVRS) in the European countries and European-wide organizations involved in geo-referencing activities;
- Improve the **Unified European Levelling Network** (UELN) by extending it to all European countries, taking into account the perspective of a geokinematic computation



EPN, EUREF Permanent Network



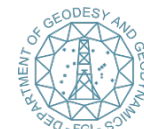
More than 200 permanent
GNSS stations

Data centers; data upload
and archiving

Analysis centers; data
analysis, daily and weekly
solutions of station position,
tropospheric parameters;
combination

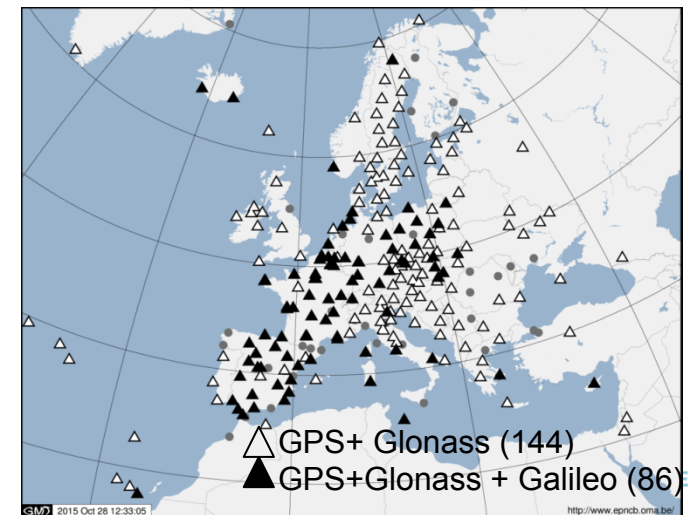
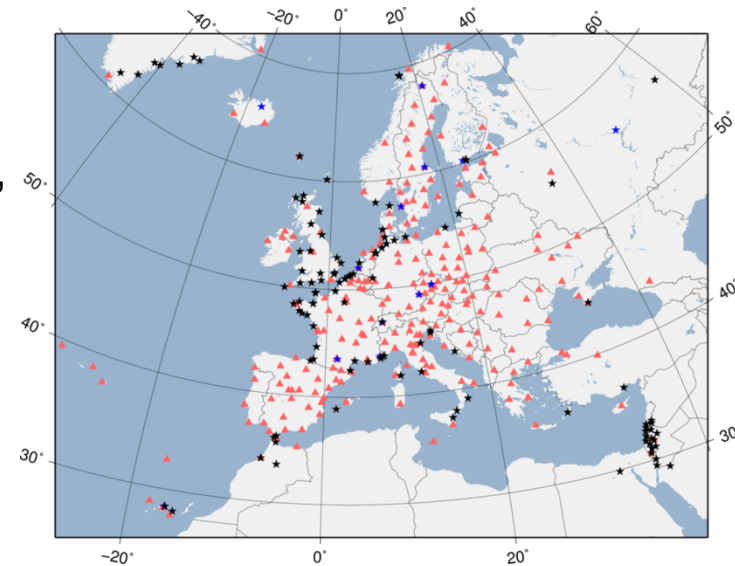
EPN Central Bureau

EPN products freely
available



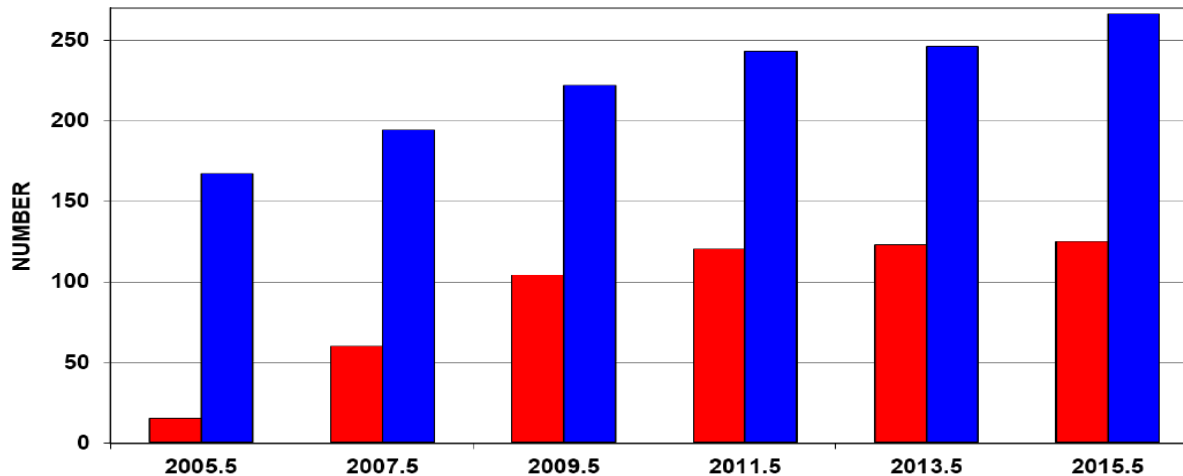
EPN Activities

- **EPN Densification:** Provide an added-value to the EPN, fill possible gaps in network, network extension, @tide gauges, multi-GNSS receivers, real-time data; must fulfil guidelines for station structure, equipment, data flow and quality
- **Data reprocessing:** Reprocessing historic data to improve station time series, antenna corrections, satellite orbit information,... Several teams.
- **Multi-GNSS:** New GNSS available (Galileo, BeiDou); GPS and Glonass. More stations are able to observe all available GNSS satellites. EPS is adopting new systems.
- **RINEX3 format:** Adoption of RINEX3 format for GNSS data submission, archiving and analysis. Needed for new GNSS data

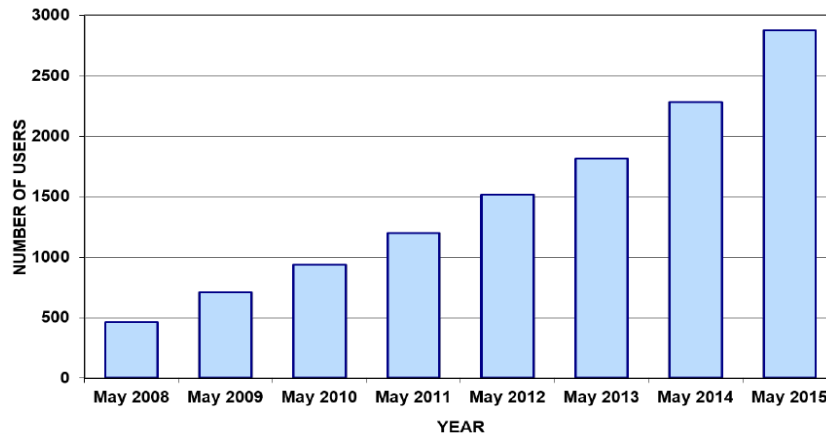


EUREF real-time GNSS data transfer and products

Total number of EPN stations and number of EPN real-time stations



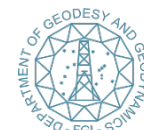
Number of registered users at BKG broadcasters



Stations providing real-time GNSS data is slowly increasing

Number of users is increasing rapidly; there is a need for European-wide real time data

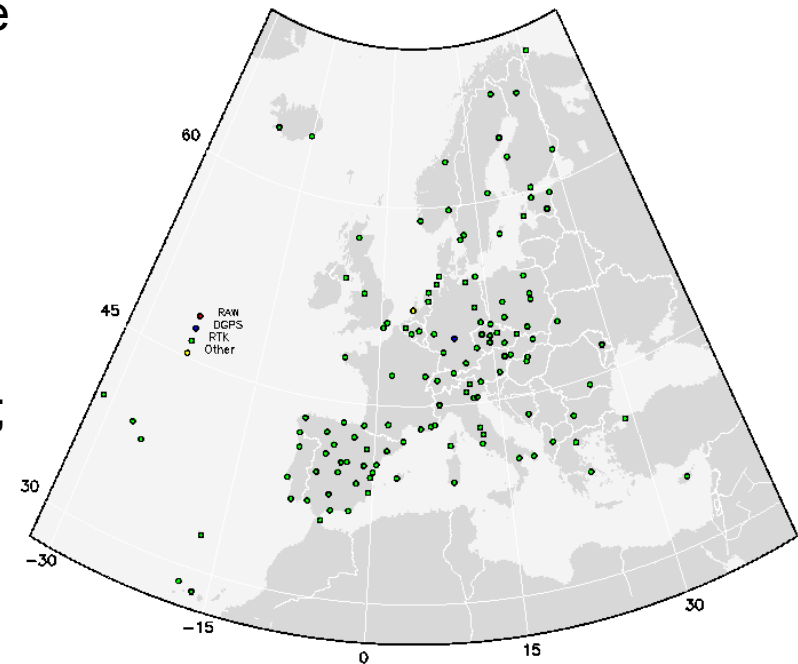
(Courtesy: Söhne)



EUREF Broadcaster

- Purpose: User should be able to get access to RT data through different casters, and be able to switch between broadcasters without degradation of performance (e.g. availability, latency, ...)
- Requirement: Identical setup at each broadcaster
- IGS Real-Time Service (RTS) started in 2013; EPN RT Data used as input for IGS RTS
- EPN RT Analysis; currently no real EUREF RT products
- Precise Point Positioning (PPP) increasing; needs real-time analysis e.g. for troposphere, orbits, clocks,...; new RT PPP software are coming

Real-Time GNSS NtripCaster EUREF-IP, Status 130723



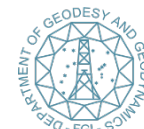
Reference frames in PPP

- Local RTK networks (national level)
 - realization of ETRS89
 - a few cm accuracy
 - **local reference stations and reference frames realization**
- PPP-RTK
 - PPP is a global approach; **does not use local reference stations**
 - **global reference frame realization**; if needed transformed to regional or local reference frames
- Basic input for science and safety (e.g., tectonic risk assessment) in large networks (e.g. Japan)
- Global reference frames
- Issues when needed on national level; one needs to know crustal movements and transformation to the national system
- Network RTK resources will not become obsolete, combination of PPP-RTK will be an alternative; EUREF contribution in testing/validation/software



EUREF Multi-GNSS activities

- TWG established 2012 a Multi-GNSS Working Group
 - Handling data formats RINEX3.0x and/or RINEX2.1x and compatibility to RTCM 'High Precision Multiple Signal Messages' (HP MSM) and procedure for implementation in the EPN
 - Enhancing the EPN infrastructure by Multi-GNSS-ready receivers and antennas
 - Developing of software (post-processing and real-time) capable to handle multi-GNSS signals
 - Setting up a time schedule in order to plan the operational switch to RINEX3 which also is in line with IGS
- EUREF will support all satellite navigation systems: currently GLONASS and Galileo from data collection to analysis
- The new GNSS satellites will be a big challenge for EUREF by upgrading the station equipment while maintaining a stable reference frame; issue of software as well for data analysis.



EUREF and UN-GGIM Europe

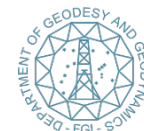
- UN-GGIM Europe is a regional committee of the United Nations Initiative on Global Geospatial Information Management (UN-GGIM)
- It shall identify European issues relevant to geospatial information management and recommend necessary actions on them
- The aim is to ensure that e.g. the national mapping and cadastral authorities contribute to the more effective management and availability of geospatial information in Europe
- GGRF (Working Group on Global Geodetic Reference Frame) of UN-GGIM provides an intergovernmental forum for communication and cooperation on issues relating to the maintenance and enhancement of a GGRF; **UN Resolution on a global geodetic reference frame for sustainable development** (Feb 2015); roadmap and implementation ongoing
- An European group, within the UN-GGIM Europe will deal with special issues related to Europe and to implement the global topics within Europe. EUREF will be the central technical advisor for this group.



Future

Multi-GNSS

- New satellite systems will be fully operational during next few years
- EPN challenges to track all systems
- Software challenges to analyse and compute all signals
- ETRS89 maintenance with new stations and new satellites
- Emerging PPP; rules and guidelines for users, compatibility of coordinates with old ones, crustal movements
- Increasing use of real time applications



EUREF links

- EUREF web page: <http://www.euref.eu/>
- EUREF permanent Network EPN: <http://www.epncb.oma.be>

Thank you for your attention

