Donostia - San Sebastian
May 25th - 27th, 2016

EUREF2016 Symposium

Abstracts

SESSION 1 - SYSTEMS: ETRS89, EVRS

Session-Conveners: **Zuheir Altamimi, Markku Poutanen**

EUREF designed, established and maintains the European Geodetic Reference Systems, such as the European Terrestrial Reference System 89 (ETRS89) for satellite geodesy and the European Vertical Reference System (EVRS) for heighting. Both systems have a continent-wide significance and acceptance. ETRS89 is based on the International Terrestrial Reference System (ITRS) realizations, but tied to the stable part of Europe, so that the relationship between the two systems is entirely defined by a similarity transformation formula. ETRS89 unifies national reference systems for surveying, mapping, GIS and navigation in Europe. The benefit of ETRS89 is well demonstrated through its acceptance by several communities, e.g. EuroControl and the European Commission.

EVRS is a kinematical height reference system. It is the basis for harmonisation of the vertical reference of spatial coordinates. Presentations of this session report on the expected development of the systems, their practical realizations, legal acceptance, potential use and benefits in geo-referencing applications.

SESSION 2 - NETWORKS: EPN, UELN, DENSIFICATION

Session-Conveners: **Elmar Brockmann, Ambrus Kenyeres**

The reference networks through their observations are maintaining but also providing access to the reference system realizations. The EUREF Permanent Network (EPN) and the United European Levelling Network (UELN) are the core infrastructures of EUREF. The EPN is linked to the global network of the International GNSS Service (IGS) and contributes to the definition of the International Terrestrial Reference System (ITRS) realizations, but also serves as reference for the national permanent GNSS networks. This hierarchy ensures the conformity and homogeneity of the geodetic reference system realizations from the global to national level. The operation of a permanent GNSS network requires several well organized components: network coordination, data centres, analysis centres and product gateways. The routine cooperation with the station managers and the user community guarantees the appropriate implementation and usage of GNSS.

The objective of the UELN is to establish a unified vertical datum for Europe at the one-decimetre level. Due to the different technology characteristics of GNSS and levelling, UELN is developing on a much longer time scale. The session presents experiences and improvements of the provision and dissemination of data and results stemming from the geodetic reference networks. Improved analysis strategies and the latest results are expected to be presented.

SESSION 3 - TECHNIQUES: GNSS, LEVELLING, COMBINATION

Session-Conveners: **Rolf Dach, Martina Sacher**

EUREF's main task is the implementation of European geodetic reference frames for geometry and gravity related measurement techniques. The Global Navigation Satellite System (GNSS) is the dominant technique to measure positions and the geometry on continental scale. GNSS, due to the emerging new navigation satellite systems such as Galileo, BeiDou, QZSS or IRNSS (now called multi-GNSS) is facing significant evolution during the next couple of years both in research and in practical applications. The expected developments will comprise new data standards, handling of real-time data streaming and positioning at all levels as developer, user and service provider. EUREF must devote special care for the implementation and promotion of the European Galileo system.

Levelling and gravimetric measurements are techniques related to the gravity field of the earth. All precise techniques need to take variation of system earth into account, if a longer time period or higher accuracy of site locations is in the focus. Combination and comparison of different techniques is not only a validation of one technique against another one, but support the integration of the reference networks and also opens new application fields, e.g. levelling with GNSS using known geoid information. EUREF supports such practical approaches e.g. by the EUVN-DA network, where a homogeneous GPS/levelling network had been established supporting the future continental height reference surface realizations. While GNSS and levelling measurements refer to sparse discrete points the use of series of Synthetic Aperture Radar (SAR) images we are able to estimate the height changes at huge number of points on the earth's surface allowing to model precisely the height changes. The combination of SAR (PSI, PS-inSAR) and GNSS is a challenge for the future for long-term geodetic applications.

This session solicits and presents developments, analysis and results of all stand-alone and combined techniques that are relevant for the establishment and maintenance of reference frames. Real-time and multi-GNSS developments are of special interest.

SESSION 4 - APPLICATIONS: EARTH SCIENCES, POSITIONING, GEO-INFORMATION

Session-Conveners: **Alessandro Caporali, Rosa Pacione**

Geodetic techniques measure the situation on the Earth's surface. Modern space techniques extend observations to satellites orbiting the planet Earth or even to extra-terrestrial targets. Today the position and the variation of permanent GNSS stations on the Earth's surface are known to the sub-millimetre level for the period of decades. As these techniques are also sensitive for various processes within the system Earth, e.g. tectonic and man-made site displacements, variation in the state of the troposphere and ionosphere, geodesy can efficiently contribute to the understanding of system

Earth. The cross-linking of geodetic estimates and knowledge from other geosciences is in the focus of research projects since long time. This session presents recent research projects of geosciences such as the European Plate Observing System (EPOS) and updated results of ongoing projects. Real-time analysis of GNSS observations provides geophysical parameters in real-time, e.g. information about the troposphere state. It contributes to online monitoring of the natural environment. Beyond this, determining a location in real-time with a remaining uncertainty in the order of some "cm" is possible. The so-called Precise Positioning obtains significance for many areas of the daily life. Surveying of infrastructure components, such as for road construction or gas supply line maintenance, is noted as an example. Considerable time and cost reduction becomes possible, if Precise Positioning is applied for surveying work, provided the acceptable quality level could be reached. Advantages of Precise Positioning are not bounded by national territory, but are likewise important throughout Europe.

This session invites presentations of activities and projects on the national as well as European level in the field of positioning. Interdisciplinary cooperation for geo-monitoring and visualising in geo-information systems could be addressed here as well.

SESSION 5 - NATIONAL REPORTS

Session-Conveners: **Jan Krynski, Guenter Stangl**

Representatives of European countries meet the challenge to report on national activities related to projects of geodetic reference systems. These are GNSS networks, height systems and geodetic methods based on the gravity field of the earth. New projects could be introduced, but also updated results of ongoing projects are of interest. Knowledge about progress in particular European countries provides valuable ideas for future planning in the home country and for a pan-European realisation of geodetic reference systems. Oral presentations should be concise, to allow all participating nations to report. A written (printable) version of the National Report – at least as an extended description of the slides – is very much appreciated.

Session 3:

High precision techniques for Earth's crust movement observations in Latvia

Presented by: Diana Haritonova
Authors: Diana Haritonova, Janis Balodis, Ansis Zarins, Augusts Rubans

SUMMARY

The application of two principal space geodetic techniques: Global Navigation Satellite System (GNSS) and Satellite Laser Ranging (SLR), is under discussionin this study. The objective is to discover geodynamic processes of the Earth's crust in the territory of Latvia, placed at the coast of the Baltic Sea and at the edge of Fennoscandian land uplift phenomenon, by analysing GNSS time series obtained from Latvian GNSS permanent stations with reference to EUREF Permanent Network (EPN), and to develop additional observation device for relation to International Laser Ranging Service (ILRS) network.

Latvian GNSS permanent networks: EUPOS®-Riga and LatPos, which have been operating since 2006, provide an important opportunity. These networks are primarily geodetic reference networks established for surveying and navigation purposes in the territory of Latvia, however, according to the worldwide experience and trends in space geodesy it is commonly accepted to use GNSS stations for studies of geophysical processes as well.

EUPOS®-Riga and LatPos station displacements have been summarized for the period of 8 years - from 2008 to 2015. Two solutions are presented: EUPOS® Combination Centre (ECC) cumulative weekly solution (2008-2014) and re-processed daily solution (2012-2015).

According to the deformation model NKG_RF03vel vertical velocities of Latvian GNSS stations have range of 1.68 mm/year, with the minimum 0.04 mm/year and the maximum 1.72 mm/year. According to the daily solution vertical velocities of western GNSS stations correspond to the data of NKG_RF03vel. The highest velocity differences in vertical component between obtained results and values from the model are more pronounced in the case of stations located in south-eastern part of Latvia, however, these differences are less than 1 mm/year. Station horizontal velocities from the weekly solution have comparatively good correspondence with the NKG_RF03vel velocity field.

Additionally, in this study main results of the development of a new multi-purpose optical tracking system for both positioning and laser ranging observations of near-Earth objects are stated.

SLR is a proven geodetic technique with significant potential for contributions to scientific studies of the solid Earth, its ocean and atmospheric systems. As SLR enables most accurate determination of the geocentric positions of Earth satellites, it provides a reliable reference system for monitoring of postglacial rebound, sea level and ice volume change.

The study presents design of the universal satellite laser ranging device, as well as results of astrometric subsystem's functionality tests performed at the Institute of Geodesy and Geoinformatics (GGI) of the University of Latvia.