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Abstracts

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Algeria

GNSS geodetic applications in Algeria

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Key words: Space Positioning, GNSS, GPS, Ionosphere, Auscultation.

Abstract

The aim of space geodesy is essentially to determine the form and the dimension of the earth, including its gravity field. The main tool to set geodetic applications in a global geocentric reference frame is based on the dynamic of the GNSS (global navigation satellite systems) orbital motion around the earth. Practically, all the geodetic applications are done from the establishment of the homogeneous and precise geodetic networks for the determination of the earth surface and monitoring its time variation caused by geophysical effects.

For the realisation, the GNSS, as GPS (Global Positioning System- USA), Glonass (GLobal NAvigation Satellite System - Russia) and future Galileo (Europe) or Compass (China), which have a spatio-temporal cover of the world, allows real time localisation, precise positioning and geophysical (ionosphere, etc.) modelisation.

The main applications developed in Algeria are about the setting up of three Differential GPS emitting stations for maritime signalling, for a real time positioning with meter (1,7m) accuracy. For the study of disaster industrial risks, the monitoring of the underground storage tank of LNG (liquefied Natural Gas) is based on a local network composed by more than hundred GPS and Terrestrial stations which permit the detection of the small movements (32 mm) caused by the structural hazards.

In large scale applications, the setting up of an urban GPS network on the Oran City area, permit to establish a geodetic network composed by 65 precise points, with an accuracy less than 2 cm in both WGS84 and Nord Sahara Datum's, based on a local determination of the geoid. The geodynamical studies on the North of Algeria are conducted during the Tyrgeonet project, in collaboration with the INGV (Italy), and cover the West Mediterranean area, and Algeonet and REGAT project in the North of the country. Several GPS observing campaigns are done with bifrequency receivers and the data collected are processed using specific software.

For the realisation of a Total Electronic Contain (TEC) map, a network based on 115 IGS stations and local data was used to evaluate the ionospheric errors on the area for precise positioning.

In perspective, a national network is planned to be establish, with more than fifty GPS permanent stations, to elaborate a seismic risk map using space technology and seismogenese data. This project conducted by the Algerian Space Agency will associate several national institutions, developing activities in the GNSS field.

Bangladesh

GNSS and its application in the context of Bangladesh

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Keywords: Remote Sensing, GIS, Satellite, Technology, GPS, DGPS, GNSS

Abstract

Application of Global Navigation Satellite System (GNSS) technology effectively started in Bangladesh SPARRSO in the early 1990s. SPARRSO are using Global Positioning System (GPS) and Differential Global Positioning System (DGPS) for collecting control points for geo-referencing remotely sensed data. Other regular application of GPS/DGPS by the organization is to locate the position of the features in the field for ground truth data collection. Such data were extensively used under Mangrove afforestation project (BGD 85-031) of SPARRSO for reclaim land by sedimentation, creation of a protection base against the tropical cyclone and storm surges. Ground truth data also used during the devastating floods of 1998, 2004, 2007 and 2009 to identify and delineate flood-affected areas as well of storm surges, which helped the Government considerably in taking appropriate timely measures action plan and policy.

Now-a-days satellite navigation is increasingly being used in land use and land cover mapping, forest resources monitoring and mapping, survey of water resources and water-logging, natural resources monitoring and mapping, crop monitoring, disasters monitoring, damage assessment and also great applications in the sectors of Inland shipping, maritime, seaport management, coastguard, fisheries, marine, border control etc. This data provides reliable positioning, navigation, and timely services to worldwide users on a continuous basis in all weather, day and night. It also provides three-dimensional locations plus precise time. Under the above context SPARRSO will undertake GNSS navigation project collaboration with Asia Pacific Space Cooperation Organization (APSCO).

This paper deals with some major GNSS applications in Bangladesh SPARRSO as well as other Government and non-Government Organizations and Academic Institutions.

China

Design and realization of delay mapping receiver based on GPS for sea surface wind measurement

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Keywords: Geometry of GPS scattered signal, Delay Mapping Receiver Design, Data Collection, Results analysis

Abstract

GNSS is quite popular now in many applications like transportation, surveying and personal entertainment. Most of all the applications make use of the direct signal from the navigation satellite and eliminate the multipath signal as interference. However, the reflections from the sea or land could be collected by the specific receiver (Delay Mapping Receiver) used for the physic parameters retrieval, which is based on the different time and Doppler value compared with the direct signal. This presentation introduces the receiver design and the data collection, data analysis result in China Sea. Geometry of GNSS-R, measurement technique, DMR design based on commercial chipset have been

discussed and the experiment through real flight were also introduced. The wind retrieval result and the data comparison are given in the presentation.

Update of COMPASS and its Applications

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Keywords: Geometry of GPS scattered signal, Delay Mapping Receiver Design, Data Collection, Results analysis

Abstract

Nowadays, the focus of satellite navigation system is to provide global accurate and reliable PNT services. The future global services are composed of two parts, open services, which is open and free to users, and the other one called authorized services aims to ensure highly reliable use even in complex situations. At present, various augmentation systems are under construction in the world, such as GNSS Augmentation (COMPASS), MSAS, WAAS, EGNOS and SA/WAAS. COMPASS Navigation Satellite System is no doubt a most famous representative. It is planned to have the stage of deployment accomplished from 2007 to 2020 and the stage of operation and replacement started from 2010.

The development of COMPASS can be divided into three phases. During the first phase, demonstration phase, 3 GEOs were launched from 2000 to 2003. At present, the system construction has come into the second phase, system deployment, during which one MEO, four GEO and two IGSO have been successfully launched with orbit determination precision smaller than 10m and time synchronization precision smaller than 2ns, in Xichang, Sichuan Province. In addition, COMPASS Navigation Satellite System can be extendedly applied in numerous scenarios, such as fishery, transportation, water conservation, meteorology, forest fire prevention, timing, disaster prevention and mitigation and soil monitoring. For example, COMPASS can be integrated with fishery information service network (fishery management services, fishing boat services and SMS services) to help ensure fishermen's safety of life, oceanic and economic security and protect marine resources and sovereignty. What's more, the specific geographical features decide China to be a calamitous country, which means improving rescue response and decision making capability are extremely urgent and important. Thanks to COMPASS terminals, the disaster and rescue information were sent to command center at the first time after earthquake happened on Wenchuan and Yushu so that thousands of lives were saved while billions of properties protected.

Cote d'Ivoire

Study of a geomagnetic storm effect on the ionosperic scintillation and total electro content (TEC) over the SCINDA station in Abidjan

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Keywords: Ionosphere effects of the magnetic storm

Abstract

This study investigates the ionospheric effects of the magnetic storm of April 5th, 2010. Using ionospheric data recorded with a SCINDA GPS receiver installed in Abidjan (*Lat=5.3° N, Long=3.9° W*), an equatorial station, we analyzed the

variation of the ionospheric scintillation and the TEC during the storm. The ionospheric scintillation is characterized with the so called scintillation index S_4. To reduce the multipath effects on the scintillation, S_4 values recorded at elevation angle lower than 30˚ according to the criteria of *Otsuka et al., (2006).* The TEC is calibrated using the technique by *Carrano et al., (2009).* The TEC shows tow phases of increasing followed by a depression during the main phase of the storm.

Croatia

Space weather effects on GNSS performance and operation: a fundamental component of GNSS curriculum

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Keywords: Space weather, education

Abstract

Space weather effects are the single most important contributor to GNSS error budget and the major source of the GNSS vulnerabilities, and degradation effects on the GNSS performance and operation. Traditional view on space weather GNSS effects assumes the global approach, with no consideration given to the local geomagnetic and ionospheric effects on GNSS performance and operation. The number of systems and services relying on GNSS is steadily growing, which demands a proper education of the GNSS professionals, with GNSS vulnerabilities identification and management should be given a higher priority than before. In those matters, better understanding of the effects of the space weather on GNSS performance and operation should be particularly emphasised.

Here a targeted university course is presented, which provides the necessary understanding of the space weather effects on GNSS performance and operation to the students in the fields of applied GNSS (navigation, telecoms, agriculture, asset management). Based on the interactive education through experimental field activities, utilisation of the open-source software, and space weather data and materials openly available on the internet, this course aims to provide students with the hands-on experience with common cases of so-far rarely considered, but potentially threatening space weather effects on GNSS performance and operation.The course is tailored in order to minimise the costs, and thus especially suitable for education environments with restricted funds and limited technical support.

GNSS performance in times of natural disasters: a Chilean 2010 earthquake case-study

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Keywords: Natural disasters

Abstract

Satellite navigation systems do not only improve the every-day life and normal activities of society, but provide the fundamental contribution in times of safety-critical activities. The role of GNSS is even more emphasised in the periods

of life-threatening situations of the large scale, such as the natural disasters. With the growing number of earthquakes, floodings and forest fires, that pose the increasing threat to the safety of society, GNSS performance and operation are fundamental for saving lives and property. However, the actual ability of GNSS in such situation has not been analysed in detail so far.

Here the results of the analysis of the GPS positioning performance and operation during the Chilean 2010 Earthquake are presented, as a contribution to better understanding of the GNSS performance in the times of natural disasters that may cause the effects on GNSS. The archived GPS observables taken at the reference sites in Chile and Croatia were processed in order to identify the disturbing patterns of the GPS positioning performance, and a comparative analysis with the geomagnetic and ionospheric data sets was conducted, with the aim to identify the possible correlation in GPS service disruptions caused by geomagnetic and ionospheric effects. The effects of the earthquake in question on the GPS positioning performance have been identified not only at the earthquake site, but in the distant locations (reference sites in Croatia) as well. While being short-lasting, the large earthquake effects cause notable disruptions of the GPS positioning performance, with the patterns and appearance related to the GPS user position.

The paper concludes with proposal for recommendation on how to use the GNSS in times of affecting natural disasters in order to minimise the disruption of GNSS positioning service.

Egypt

GPS measurements of current crustal movements along the Gulf of Suez, Egypt

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Keywords: Gulf of Suez region, GPS and seismic data, analysis and interpretation

Abstract

Gulf of Suez area is found to be one of the most active seismic zones in Egypt. As a result of tectonic activity, economic and strategic importance of this area, it has been selected for the present study. The subject of the research work is dealing with the use of GPS and seismological data for the investigation of recent crustal movements and its relation to seismicity and tectonics along the Gulf of Suez and surrounding area. Also, try to solve many questions and problems connected with the geodynamics.

A geodetic network consists of 13 GPS stations was established and observed many times in different campaigns. The observed data was analyzed using scientific Bernese 5.0 software and the velocity vectors along the Gulf of Suez were determined. On average, the survey data indicated the motion varies between 1 to 5mm/yr. The detected motions reflect the general trend movement of the Gulf of Suez. Moreover the deformation analysis indicates that the entire Gulf of Suez is predominated by extensional deformation in southern part.

The obtained extensional deformation style is obviously decreased from south to the north that is consistent with earthquake distribution and regional tectonic models. Earthquake focal mechanisms in the Gulf of Suez have been predominated by normal faulting with left-lateral strike slip components that is consistent with regional tectonic. The extension axes derived from fault plane solutions are oriented in NNE-SSW direction in a good agreement with the current stress field from borehole breakouts along the Gulf of Suez. Moreover, the recent GPS results are highly consistence with the obtained extension direction.

Germany

High-end GNSS based application used for the German railway clearance measuring train

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Keywords: Terrestrial Laser scanning for engineering survey, high speed surveying, data processing, data bases

Abstract

Along with the increased demands of the rail road operation itself, track surveying has also taken on greater importance. Several approaches to Railway clearance measurements haven been taken in the past, with most applying optical principles. However, none of them alone satisfies the requirements of modern lines for precision and speed. A track referencing system enhances the overall precision, as an inertial navigation and GPS system (INS/DGPS) monitors the position of the train. A high sequence camera completes the visualization data acquisition. New processing approaches and a new developed data base concept will be presented. The solution is part of the German railway database. Corrections data form the BKG and EUPOS Networks are used for precise positioning. Real time navigation applications based on this solution are part of the presentation on this integrated approach.

Indonesia

Indonesian permanent GNSS stations network: the current status

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Keywords: Natural Disasters

Abstract

The Sumatra earthquake sequence of 2004 and 2005 and the tsunami of 2004 were natural disasters of unparalleled proportions in our lifetimes. The Aceh-Andaman earthquake of December 26, 2004 is the first giant (Mw>9.0) earthquake to occur since the advent of modern space-based geodesy. Field GPS observations taken prior and subsequent to the earthquakes were critical in physical modeling of these great events. Regional continuous GPS (cGPS) stations were also important in constraining significant far-field deformation. Although understanding the physics of earthquakes and improving our abilities to forecast these great events is a major impetus for continued geodetic observations and research, the events of 2004 and 2005 also revealed the potential of using geodetic observations as components of early warning systems to help reduce the loss of life and infrastructure from such disasters. The key is the ability to make high-rate GPS observations of dynamic and co-seismic displacements in real-time and to assimilate these data into an earthquake model within a few minutes of a large event. In response to the growing list of natural disasters in Indonesia over the last few years, the government of Indonesia is funding the implementation of the Indonesian Tsunami Early Warning System (InaTEWS) with the goal of achieving operational status by the end of 2010. The main focus of instrument deployment is for monitoring earthquakes, sea level change, and crustal deformation. The grand design is to establish a wide area of the Indonesian Permanent GNSS Stations Network (IPGSN) of cGPS network operating in real time mode throughout the archipelago. The cGPS network will be designed to provide other societal benefits such as improved navigation safety, fleet management, survey and mapping, as well as a robust data set for meteorological forecasting and climate change.

Japan

Quasi-Zenith Satellite Systems (QZSS) update

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Keywords: QZSS

Abstract

Japan successfully launched the first satellite of the QZSS, Quasi-Zenith Satellite System, named “Michibiki” in September 2010. QZSS satellite have unique orbit of Quasi-Zenith, that enables high angle positioning and improves positioning availability time. With the augmentation capability, QZSS also enables positioning accuracy. QZSS is a regional system and is expected to contribute to the peaceful development of the Asia-Pacific region.

Examples of Quasi-Zenith Satellite Systems (QZSS) applications

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Keywords: QZSS

Abstract

In Japan, mobile penetration rate has reached 92.4% in 2010 and almost 50% of mobile terminals have GPS functions, so positioning information using satellites is imperative to peoples' lives. The successful launch of QZSS, MICHIBIKI (means "Guidance" in Japanese) will help make our society more secure and comfortable as it enhances the accuracy of positioning information and makes it ubiquitous. Japan has established technology to utilize GPS signals for navigation systems, and the high-accuracy QZSS positioning system promises to expand the possibilities in a variety of fields. This presentation introduces some examples of QZSS applications which are currently envisioned.

Kazakhstan

The ground-based infrastructure of High-Accuracy Satellite Navigation System in the Republic of Kazakhstan

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Keywords: High-Accuracy Satellite Navigation System

Abstract

One of the Company projects is «Creation of the Ground-based infrastructure of High-accuracy Satellite Navigation

System in the Republic of Kazakhstan». The purpose of the Project is obtaining quality-assured conditions for timing and navigation services for users of GNSS information in the Republic of Kazakhstan.

Project Goals: 1) creation of the ground based infrastructure of high-accuracy satellite navigation system in the Republic of Kazakhstan and distribution of differential correcting information to the users of the system that provides demanded level of co-ordinate definitions accuracy; 2) monitoring of the GNSS for the purpose of providing consumers with timely information about inappropriate work the systems.

Implementation period of the project: 2008 - 2012 years: The participation of chief experts at a seminar topic for discussion would be useful as the discussion topics cover: - description of current activities on the application of GNSS technology in the countries of seminar participants; - identification of specific requirements for action plans and ongoing projects of companies; - familiarization with the experimental models of cooperation on the use of custom applications in GNSS; - introduction of comprehensive information on national projects implemented to create conditions for the reliable delivery of high-quality position-time and navigation services to users of GNSS information in the Republic of Kazakhstan; - participation in the discussions on pilot projects, requirements for implementation, mechanisms and resources of the GNSS technologies application in the framework of international and regional cooperation.

Kyrgyz Republic

Satellite-based navigation systems and their application in Kyrgyz Republic

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Keywords: location based service (LBS), LBS Components, LBS Technologies, Applications

Abstract

Today, fast and prompt communication facilities have their own key places all over the world at the same level that country defense and finance has. Satellite communication systems became an integral part of world telecommunication backbones, connecting countries and continents. Developed countries of the world are actively using the opportunities of satellite communications. However, in other countries there is a considerable information gap in development and use of satellite communication technologies.

Navigation is the process of planning, reading and controlling the movement of a craft or a vehicle from one place to another. The world navigate is derived from Latin roots “Navis” meaning “To move” or “To Direct”. All navigation Techniques involve locating the Navigator’s Position, compared to known locations or patterns. It deals with the art of directing vehicles in Land, Sea or Space. Navigation is characterized by four main procedures: 1. Determination of destination; 2. Choice of a suitable route; 3. Estimation of Course and Speed; 4. Regular or Continuous monitoring of the progress of the vehicle, so that you can reach the destination through the selected route.

Currently, only two satellite navigation systems are being operated worldwide. They are the U.S. Department of Defense’s Global Positioning System (GPS) and the Russian military controlled Global Navigation Satellite System (GLONASS). Both GPS and GLONASS systems provide a three dimensional position, velocity and time dissemination on a worldwide basis. A third system, Galileo, is a joint initiative between the European Commission (EC) and the European Space Agency (ESA) and is expected to be operational in the near future.

Location based service (LBSs) are information services accessible with mobile devices through the mobile network and utilizing the ability to make use of the location of the mobile devices. Location based services are possible when the mobile’s position is known with respect to the digital map. That means the spatial database is an essential feature in the development of any Location Based Application.

Latvia

GNSS Reference Station System LatPos in Latvia: regional cooperation with Lithuania

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Keywords: GNSS Base Stations

Abstract

Latvia Coordinate System was founded in 1992. New coordinate set was determined in August 29, 1992, totally with 20 GPS receivers. Each Year geodetic network was improved. In Year 2004 decision about establishing next generation geodetic network – RTK GPS base station Network was agreed. Base station established at the end of Year 2005. System consists of 19 base stations and one data center. System uses Leica Spider software. In Year 2010 additional 3 reference stations was installed. To improve reference station system 2 stations was moved to new locations. Additional data streams added from Lithuania – improving preciseness near by state border with Lithuania. 6 receivers upgraded to receive GLONASS satellite systems. There are 135 real-time users and about 500 post processing data users. Real-time users use wireless (GPRS) connection to cell phone providers to connect to internet and to system. System is working 24 hours a day and 365 days in Year. In three Years only 0,5% of time system was offline. Main problem why system goes down is data lines from base stations to server and main power failure, where processing center is located. System preciseness is controlled with measurements on control points – on geodetic network. Control measurements were done in all country. Coordinate compatibility with old fashion geodetic network, inside of LatPos system network reaches two centimeters. As base stations are not placed near country border, measurements outside network are possible. Maximum error reached is four centimeters.

Coordinate compatibility with old pre-historic geodetic network – triangulation network can reach level of twenty centimeters because of coordinate determination with transformation from old coordinate systems. Another problem shows up is local network fragmentation as LatPos is homogenous network in all country. Each local network raises problems to be kept up and running because of many constructions going on. Height measurements with RTK are possible with Latvia geoid model. Geoid model preciseness is seven centimeters. New Geoid model is in progress. Combined Geodetic Network will be created. Second GPS RTK network – Riga has five stations. System compatibility test on ten control points in Riga territory was carried out. There was compatibility within five millimeters between system's measurements.

Lebanon

Monitoring major landslides using Global Positioning System (GPS): case study Hammana region, Lebanon

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Keywords: Landslides (LS), real time monitoring

Abstract

Monitoring is essential to understand the dynamic behaviour of landslides (LS) and to reduce their risk. It may help to

detect early indications of catastrophic movement. It provides immediate (real time monitoring) notification of landslide activity, possibly saving lives and property. Continuous information from monitoring also provides a better documentation of LS behaviour, enabling scientists and engineers to create more effective designs for the physical processes that trigger and control LS. In the course of the last two decades, new methods for LS monitoring have developed one of which is the Global Positioning System (GPS). GPS kinematic mode (Fixed station with rover instruments) enables defining the slide body movement geometry by measuring the coordinates of points distributed on a high density grid. Being one of the classically known areas affected by a major landslide and several other failure phenomena; Hammana region was selected in an attempt to compare the landslide conditions over time, to measure the speed and direction of the movement. Two sets of Trimble 5700 receivers with Zephyr Geodetic antennae. The GPS network used in this study includes one reference station and twelve survey monuments extending on a radius of 2 Km. We choose to distribute the twelve GPS monuments in order to cover the entire landslide in the form of four profiles. Each profile consists of three monuments. The reference station was mounted on top of the cliff and above the slide in a relatively stable area. In order to attain good accuracy of the readings, each point was observed for two hours using one GPS set. While the reference GPS set was kept observing continuously during the time span of the campaign. Preliminary analysis of four years annually repeated static GPS measurements suggests that parts of the slide may be presently sliding at an average rate of up to 2 cm per year.

Myanmar

Planned differential GPS system at Yangon international airport

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Keywords: DGPS landing system

Abstract

In Yangon International Airport, Department of Civil Aviation (DCA) Myanmar is currently commissioning instrument landing system (ILS) comprising the following components (i) localizer (ii) glide path and (iii) distance measuring equipment (DME). Conventional methods are expensive, and limited to a certain extent. Signals from GPS have proven to be fast, accurate and cheaper alternative to conventional methods. Therefore, a new landing aid system based on GPS is being under consideration and DGPS system may replace the existing instrument landing system (ILS) in the future. Referring to the ICAO SARPs Annex 10 and Doc 9849, Myanmar DCA is now planning Differential GPS landing system for Yangon International Airport.

Myanmar DCA is the sole authority who is responsible for planning, supervision and execution of DGPS system for Yangon International Airport. This space-borne systems' accuracy, availability and reliability are subjected to numerous biases or errors. To meet the operational requirement of landing phase of the flight, augmentation system is required. Myanmar DCA is planning for ground-based augmentation system by using VHF data broadcast (VDB) ground station and GPS receiver stations to verify the validity of satellite signals and calculate corrections to enhance accuracy.

Since the implementation of GNSS operations requires to be considered a number of elements, Myanmar DCA will establish the GNSS team including the appropriate personnel from related areas. Moreover, we will fully coordinate with ICAO planning and implementation regional groups. Myanmar DCA is frequently sending its staffs to abroad training in order to be able to cope with latest development regarding to GNSS. GNSS transition planning will be done on national, regional and global basis and with close coordination with users to ensure that they are properly equipped to take advantage of new DGPS service.

Moldova

Geodetic Infrastructure for GNSS Positioning Services (GIGPS)

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Keywords: Geodetic Infrastructure for GNSS

Abstract

The worldwide ongoing process of the establishment of high precise DGNSS-positioning services and respective GNSS-reference station networks, which are related to the globally GNSS-consistent ITRF and ITRF-derivatives (e.g. ETRF89), implies the replacement of the georeferencing in the old independent classical national reference frames by an ITRF-related one. Accordingly the new age of GNSS-positioning services - as interdisciplinary tool with a broad and growing spectrum of precise satellite positioning, navigation, mobile GIS and mobile IT applications - requires the establishment and maintenance of a geodetic infrastructure for GNSS positioning services (GIGPS). The development mathematical models and software of a GIGPS must be appropriate to fulfil the requirements of its implementation with respect to the existing and to future belongings, technical concepts and standardizations (e.g. RTCM).

The authors divide the geodetic infrastructure for GNSS-services (GIGPS) into a transformation and a geomonitoring component. As concerns the transformation component, the old plan position data, which is related to a classical reference frame, has to be transformed to the ITRF-related horizontal geoferencing provided by the GNSS-service. This forward transformation concerns the establishment of modern GNSS-related databases for the infrastructure for spatial information in Europe (INSPIRE) and worldwide (cadastre, GIS, navigation, urban planning, construction, transportation, meteorology, land management, precise agriculture, etc.). The backward transformation of the ITRF–related GNSS-position to an old classical datum is needed, because the classical non-ITRF reference frames will still be relevant for at least one decade or more. The software COPAG solves the above 3D-datum transformation problems by a finite element related mathematical modelling (FEM). The software DFHBF solves the height transformation problem and models in a Finite Element (FEM) concept. The CoPaG and DFHBF databases can be used on all GNSS-controller types. Alternatively they can also be implemented as so-called reference transformations for setting up the recent world-standard of RTCM 3.1 transformation messages for the GNSS rover-clients using a RTCM transformation messages server. The capacity of an absolute positioning by GNSS-positioning services requires that possible changes of the coordinates of the GNSS reference stations in the amount of few millimetres are detected immediately. To solve that task, the GNSS-reference-station MONitoring by the KArlsruhe approach and software (MONIKA) has been developed. The MONIKA approach and software can, besides the coordinate control of GNSS-positioning services, also be applied for a use of the permanent GNSS-stations as a geosensor-network for geodynamical questions and research, as well for a setting up temporary GNSS-arrays as a disaster monitoring and early warning GNSS service , e.g. for land-slides, flood and construction areas.

Morocco:

Developing GNSS applications in Morocco: projects, research, training and action plan

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Keywords: training, research projects on GNSS applications, regional and international cooperation

Abstract

This presentation will inform about the activities developed in Morocco in the fields of GNSS. Most of these activities are leaded by the GIE Galileo Morocco Group and the Centre Regional Africain des Sciences et Technologies de l'Espace en Langue Francaise (CRAST-LF). CRASTE- LF is affiliated to the UN, its main goal is training and research in space technology for African countries. GIE Galileo Morocco Group is an Economic Interest Group created by Moroccan government in 2007 in order to pilot GNSS projects in Morocco. Its main mission is to initiate and encourage training, research and applications development in the GNSS field. The GIE established an action plan and started a wide range of activities focusing on initiating research projects on GNSS applications in the academic institutes, co-organizing workshops, developing a GNSS application, and establishing relationships with actors in other countries.

The GIE and the CRASTE-LF participated in many activities developed in Morocco:

- Cooperate in training programs and develop GNSS educational curricula
- Promote research activities (GNSS signal, Receiver design, Algorithm, Antenna, Simulation)
- Participate to International committees and working groups (EU-AU EGNOS)
- Initiate Research and Development in GNSS with Universities and Research Institutions
- Promote GNSS Services and applications in public and private sectors (fleet management, e-Tourism, container
- Tracking, GIS applications, Civil engineering, etc.)
- Disseminate knowledge on GNSS technology
- Establish partnerships with others national and international actors
- Maintain effective communication between all the partners
- Participate in National projects: Fleet management, Meteorology, Assistance to the blind persons, Management of Natural disasters
- Participate in European projects: METIS, Med-Tracking

This presentation will discuss developing GNSS applications in Morocco and collaboration with regional and international institutions through GNSS projects: Action plan, main axes, objectives, orientations, projects, research, training, challenges, constraints and partnership propositions (Sup'Com-Tunis, RMEI, etc.)

Pakistan

Pakistan Satellite Based Augmentation System (PakSBAS)

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Keywords:

Abstract

The presentation will focus on the planned Pakistan Satellite Based Augmentation System (PakSBAS). This Satellite Based Augmentation System will support regional augmentation through the use of additional Pakistan MM2 (Planned) satellite, to broadcast messages, and GPS/COMPASS/Galileo as core GNSS. This system will be composed of multiple reference stations, located at accurately-surveyed points, Master Control Station and Uplink Station. The ground stations take measurements of one or more of the GNSS satellites, the satellite signals, or other environmental factors which may

affect the signal received by the users. Using these measurements, correction messages will be generated and sent to MM2 Geostationary Satellite to broadcast to the end users.

PakSBAS will employ a ranging function to generate GPS/Compass-like signals and enable users to use the geo-stationary satellite as one more GPS/Compass satellite for ranging purposes. Information of the GPS/Compass constellation will be transmitted to each user in the real time via the integrity function of PakSBAS, while the differential correction function will provide the ranging error data to each user. The PakSBAS will provide augmentation services with ample reliability and continuity. The presentation includes the infrastructure requirements, Architecture, Concept of operation, ground segment coverage plan, phases of development and the stakeholders in Pakistan.

Romania

An initiative for developing a training structure on GNSS and geomatics at national and regional level

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Keywords: Romanian educational system relating to GNSS

Abstract

The Romanian Space Agency (ROSA) as coordinator of national GNSS activities identified the educational system as a conservative element having a negative influence for the assimilation, progress and implementation of useful projects and services. The partnership established in the framework of common R&D projects previously realized by ROSA, Romanian Centre for Remote Sensing Apply in Agriculture (CRUTA) and Faculty of Land Reclamation and Environmental Engineering of the Agronomical University of Bucharest (USAMV-FIFIM) offered the possibility to identify the right way for modernizing the improving of the quality and the usefulness of a robust thematic educational system for GNSS and Earth Observation. Two components of the system were analyzed: trainers and educational infrastructure. Five researchers having a real experience in applied space applications are involved in the teaching process. Concurrently, the university was able to modernize the infrastructure with laboratories and various devices: GPS, total stations, laser scanner, photogrammetrical stations, GIS, CAD and image processing facilities. This successful partnership has a regional replica concluded by a long term agreement signed recently with the technical University of Moldova for cooperation in the field of Earth Observation/GNSS disciplines.

Russian Federation

The Moscow Geodesy and Cartography State University (MIIGAIK) experience in the education of specialists in the applications of GNSS

Victor Savinych, Vasily Malinnikov, Andrey Maiorov, Andrey Kupriyanov

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Keywords: Education

Abstract

This presentation describes the education system of the Moscow State University of Geodesy and Cartography, which is a 232 years old university for geodesy and cartography in Russia. The Russian Federation has two higher education institutions with geodesy and cartography profiles: the Moscow State University of Geodesy and Cartography (MIIGAIK), in Moscow, and the Siberian State Academy of Geodesy (SGGA), in Novosibirsk. At present, MIIGAIK and SGGA count more than 10.000 students and post graduators. The class of graduators counts more than 1000 students annually. The Education Tutorial Association under MIIGAIK includes 35 higher education institutions of the Russian Federation. More than 300 students graduate at the faculty of geodesy of these institutes annually. The education structure of Moscow State University consists of several levels: pre-higher education professionally oriented with high-school children, including distance education, bachelor's programmes, specializations, master's degree programmes, graduate school, doctoral candidacy, extended education, professional development. The major disciplines are: applied geodesy, astronomy-geodesy, aerial survey, space geodesy and navigation, cartography, remote sensing, applied informatics in geodesy, land registry, cadastre, etc. Special focus is on the following courses: satellite navigation systems, GNSS equipment, GNSS technologies in geodesy and cartography, GNSS applications in mapping, aero survey and laser scanning, GNSS positioning in oil and gas sector, GIS, machine control, cadastre, VTS, etc. At present, MIIGAIK is preparing 14 courses for students and distance education for different applications like: reference stations networks, GNSS different accuracy positioning in railroads applications, GNSS monitoring of construction, etc.

GLObal NAvigation Satellite System (GLONASS) status, performance and modernization efforts

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Keywords: current status, performance and modernization program of GLONASS system, Russian Federation's government policy in the field of space-based positioning, navigation and timing.

Abstract

The Presentation comprises the relevant information on current status, performance and modernization program of GLONASS system. The information on current status includes the data on GLONASS space segment featuring constellation orbital parameters and core "GLONASS-M" navigation satellite performance characteristics. Moreover, data on orbital constellation status for the date of presentation is provided including information on the amount of healthy satellites, spares, satellites on maintenance and satellites in commissioning phase.

Part of the Presentation deals with the ground control segment and its modernization plans. The Presentation also gives information on current and planned GLONASS signals and information on the system performance in terms of navigation availability and accuracy. Currently the GLONASS orbital constellation configuration provides for continuous navigation service over the territory of Russian Federation and in northern latitudes. However the deployment of the full 24 satellite constellation will allow ensuring the continuous global navigation service of worldwide users by the mid 2011 and the modernization of the ground control segment will allow achieving the positioning accuracy comparable to that of GPS by the end of 2011. In this respect the presentation covers the system modernization and strategic development efforts which apart from ground control modernization include launches of next generation spacecraft and CDMA signal implementation.The Presentation also describes the basic principles behind the Russian Federation government policy in the field of space-based positioning, navigation and timing as well as the key aspects and achievements of international cooperation activities.

Continuous operating GNSS network for Saudi Arabia

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Keywords: GNSS, COGNET, CORS

Abstract

The Continuous Operating GNSS Network COGNET for Saudi Arabia will be based on current satellite positioning technologies. It will be materialized through a set of CORS (Continuously Operating Reference Station) GNSS (Global Navigation Satellite Systems) observation systems that shall be distributed throughout the Kingdom. This network would be at such a density that professionals (scientists, engineers, environmentalists, agriculturalists, mineral prospectors, etc) can use it as reference at any place on the Arabian Peninsula for their geo-referencing activities and scientific applications in geodynamics, ionospheric and tropospheric research.

To achieve all these goals, it will be necessary to: 1) Establish a network of fiducial CORS systems to realize the peninsula reference frame; 2) Incorporate observations from other existing CORS in the Arabian Peninsula; 3) Determine the best-fitting set of coordinates for those points; 4) Create an infrastructure (Center of Computation and Analysis – CCA) capable of permanently producing solutions and monitoring the quality of the network.

COGNET will be fully consistent and homogeneous with the International Terrestrial Reference Frame (ITRF) and will therefore be part of the global geodetic infrastructure that includes other regional frames like the European EUREF, the African AFREF, the South American SIRGAS, and the North American Datum (NADREF). Such a global infrastructure is a prerequisite for many multi-disciplinary applications.In this phase, the goal is to cover Saudi Arabia with a complete network of permanent stations that shall establish the COGNET fiducial network. In order to establish the link with the global reference frame (International Terrestrial Reference Frame - ITRF), the existing IGS (International GNSS Service) stations in the region will also be incorporated in the network. When completed, it is envisaged that users will not be more than 400 Km from one such point any place in the Kingdom.

In addition, with the implementation of COGNET, there will also be an urgent need to determine the transformation parameters between the current existing traditional national reference frame, and its associated legacy geospatial data in order that the information based on traditional reference frames will not be lost or discarded.

Establishing Space Policy

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Keywords: Space policy

Abstract

In 1957, the Union of Soviet Socialist Republic (USSR) launched SPUTNIK-1. In 1958, United States of America (USA) set up NASA. The United Nations General Assembly (UN) established the Committee on the Peaceful Uses of Outer Space (COPUOS) in 1959. Since then space-related services have played a large role in our daily activities. When integrated into a Nation's development plans, space technology can impact its socio-economic development. A

country's space goals are often reflected in the statement of its national strategy that can be used as guidelines for its agencies and for the deployment of resources.

From the above discussion, it can be seen that a Nation should establish a space policy to address its needs. A national space policy can shape a country's scientific interests and activities in the space arena, its national security; its civil and commercial applications. A good policy should also include implementation guidelines for each space sector.

Spain

Implementation of EGNOS-based LPV approaches in Europe

Luis Chocano [(1)], Javier Murcia [(1)], Pablo Haro [(2)], Hans de With [(3)], Richard Farnworth [(4)]

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Keywords: Avionics, GIANT, 7FP

Abstract

The most important objective for the utilization of the EGNOS system in aviation is to achieve the complete operational implementation in daily revenue operations, specially the LPV approach operations with integrated avionics. The effort has to focus on supporting the EGNOS adoption by interested end users of identified niche markets. Therefore, the main activities in Europe have focused on regional airlines, business and general aviation, as well as helicopters operator.

The first GIANT project for the "GNSS Introduction in the Aviation Sector" (www.gnss-giant.com) paid special attention to how GNSS systems particularly meet the needs of regional airlines, general aviation and helicopter operators and special effort within the project was devoted to the Flight Demonstrations in two of these domains. The project successfully promoted and trialled the introduction of EGNOS-based LPV applications in the area of Regional Aviation, helicopter HEMS (Medical) operations and North Sea Oil Rigs operations, with special focus and effort devoted to the flight demonstrations with the Bombardier CRJ200 with integrated Rockwell Collins avionics.

After the successful completion of the GIANT Project, the European GNSS Supervisory Authority (GSA) awarded a contract (GIANT-2 Project, http://giant2.ineco.es/) under the first Call of the Galileo 7th Framework Programme, for the continuation of these activities in other three key identified niche markets for the EGNOS-based LPV approaches, namely: Corporate Aviation, General Aviation and SAR Helicopters, with special focus and effort devoted to the flight demonstrations with Dassault Aviation Falcon 2000 with Rockwell Collins equipment and Cessna 172 with Garmin avionics in different scenarios in Europe.

Therefore, EGNOS-based LPV approach demonstrations and related technical support studies and analyses are being performed in different projects and benefits have been demonstrated for the key interested markets in Europe.

The coming steps and projects supported by the European Commission and Eurocontrol are aiming at starting a European wide-scale real-life adoption of EGNOS and GNSS in aviation, facilitating, fostering and providing support to airlines, end users for aircraft equipage, as well as ANSPs and airports for the publication of LPV procedures.

This paper will present the results of EGNOS-based LPV implementation projects in Europe in the niche domains covered by the projects, the main outcomes and the foreseen activities for the coming years.

Thailand

GNSS education and training program in Thailand

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Keywords: THEOS, UniNet, Satellite Image, Environmental Monitoring, Earth Monitoring, GNSS Education.

Abstract

GISTDA (Geo-Informatics and Space Technology Development Agency), ministry of science and technology, which assumes all responsibilities and activities for space technology and geo-informatics applications, operates Thailand's first Earth observation satellite (THEOS - THailand Earth Observation Satellite). GISTDA provides geo-informatics training course and workshop e.g. remote sensing, GPS, Fundamentals of GIS, Spatial Analysis in GIS, etc. GISTDA is also planning to provide training course about interpretation of GPS raw data such as those collected on THEOS satellite.

Since THEOS was launched on 1st October 2008, it assists environmental monitoring by providing satellite images that can be used not only in Thailand but also in other countries for many applications such as agriculture, geology, forestry, biodiversity conservation, regional planning ,mapping. It also supports the disaster management in flood or earthquake.

Satellite Images are a powerful source of derivation information and can also greatly enhance research and education. Therefore, in order to encourage study of GNSS and satellite image in Thailand, the cooperation agreement between GISTDA and UniNet (University network) has been established on 12 March 2010. The cooperative concepts are beneficial to GNSS, GIS, remote sensing, image processing or other applications relating to satellite images. This association provides researchers the ability to access information expeditiously.

Tunisia

Comparison between remote sensing and GPS measurements for earthquake ground deformation monitoring

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(1) School of Communication of Tunis – Sup'Com (Academic institution)

Keywords: Remote Sensing

Abstract

This work presents comparison between remote sensing, especially radar interferometry approach and GPS measurements for detecting and monitoring ground deformation related to earthquakes. The results are obtained in one hand, from the analysis of a large population of radar images (81 differential interferograms) covering the period of 1992–1999 and in the other hand, from a large amount of GPS data collected during eleven campaigns between 1990 and 2001. The area of study is the Gulf of Corinth which was struck by two earthquakes: the 1992 Ms = 5.9 Galaxidi earthquake and the 1995 Ms = 6.2 Aigion earthquake. Both events are covered by the data.

For the remote sensing analysis, the differential interferogram is obtained by combining three radar images and contains

information only related to topographic changes. Since 1992, DinSAR has improved considerably deformation measurements associated with earthquakes, ground movements, volcanic eruptions, etc. However, the accuracy of this technique is compromised by atmospheric effects. To overcome this limitation we propose a methodological approach to reduce at both global and local scales atmospheric contributions directly from differential interferograms. This approach has been tested on 81 European Remote Sensing 1 and 2 (ERS-1/2) differential interferograms of the Gulf of Corinth computed from 38 ERS satellite images acquired on three different tracks. We obtain a deformation map corresponding to millimetric displacements for all the covered area. The maximum of deformation near the fault is about – 204.4 mm.

Moreover, GPS collected data provide velocities of 57 points with millimetric accuracy. It shows that Peloponnesos located at the south part of the Corinth Gulf is moving at 30mm yr-1 to the north with respect to the fixed Europe.

To cross validate the remote sensing and the GPS results, we compared the measured deformation before and after the atmospheric corrections to the deformation carried out by the GPS measurements available in the area and for the same period. Only some GPS points have been used for the comparison because the time spanning of the GPS measurements of the Gulf of Corinth network does not cover always the time spanning of the DinSAR analysis.

The obtained results are very sufficient and show the importance of combination between GPS measurements and remote sensing data corrected from atmospheric effects for increasing results accuracy.

United Arab Emirates

Positioning with Internet-based, wide-area, real time GPS

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Keywords: virtual reference station (VRS)

Abstract

Internet-based, wide-area, real-time GPS provides an integrated positioning system that consists of GPS hardware, software and communication mechanism to attain sub-centimeter positioning accuracy. This is a continuously operating positioning system that employs communication mechanism and a central server, which utilizes GPS data from continuously operating reference stations to perform quality checks on the data, and further model atmospheric ephemeris errors throughout the coverage area. The model is then used to create virtual reference station (VRS) near the user's location which then provides corrections to the GPS rover, which should then be able to compute its location robustly. In this presentation, the architecture, design, and the benefits of such a positioning system for many applications ranging from surveying and mapping to transportation and construction engineering will be presented.

GNSS implementation within the United Arab Emirates aviation sector

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Keywords: Performance Based Navigation (PBN), ATC procedures development

Abstract

This presentation will focus on the status of GNSS applications within the UAE Civil Air Navigation Service Providers - both present and foreseen until 2030 - related to the UAE National PBN Strategic Plan and in line with the ICAO Performance Based Navigation (PBN) required implementation time-line targets. The following issues will be tackled: navigation accuracy standards, benefit of modern aircraft fleet, flight planning formats and processes, airspace change management methods, ATC procedures development and training requirements, needed to safely implement the proposed GNSS related airspace updates.

Developing GNSS applications industry and understanding the legal issues involved

Sethu Nandakumar Menon

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Keywords: Legal issues, market, research and development associated with GNSS

Abstract

There has been a steady growth in the GNSS market and it is still in the early stage of growth. Several studies show that the GNSS and its application industry is going to expand exponentially and to become a 250 billion euro industry by the year 2030. There will be an exodus of products, services and application using and connected with GNSS industry. With the fast growth in application industry, there is a need to understand the legal issues that are associated with the GNSS. This presentation will be scrutinizing the different legal issues associated with GNSS and particularly the application industry that is already in market and the future research and development. Any new business entrant needs to look into the legal aspects relating to Intellectual Property rights, liability, etc. relating to GNSS. Hence, the presentation will give a detail analysis of the liability issues connected with this industry as well as the Intellectual property right issues.

United Kingdom

SSTL role in the Galileo navigation project

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Keywords: Galileo Programme

Abstract

Following an announcement by the European Commission in January 2010, ESA's contract for the provision of the first batch of 14 Galileo satellites is now underway. The OHB-SSTL team building these satellites has OHB responsible for the satellite platforms (buses) and SSTL responsible for the navigation payloads. The presentation will provide an overview of the Galileo programme, and the implementation through the development of the satellite constellation.

United States of America

GNSS augmentation and applications

Jeffrey Auerbach

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Keywords: GNSS augmentation and applications

Abstract

The U.S. has developed GPS augmentation systems which enable advanced navigation capabilities that span into aviation, maritime, agricultural use, and many other areas. This presentation will provide an update on the status of these systems and examine the various applications and services that they provide.

Global Positioning System (GPS) modernization: GPS IIIA – on the road to the future

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Keywords: GPS/GNSS applications, current status and capabilities of GPS IIIA.

Abstract

GPS/GNSS systems have become a critical component of today's global information infrastructure bringing many new applications that are enabling broad capabilities facilitating innovations in efficiency, safety, security, environmental and science throughout the globe. While GPS has been in operation since the mid 1990's, the GPS modernization programme is currently underway bringing additional and new capabilities to positioning, navigation, and timing users throughout the world. In May 2008, the U.S. Air Force awarded a contract to Lockheed Martin Space Systems to develop the next generation of GPS satellites, known as the GPS IIIA. In August 2010, the GPS IIIA program completed a highly successful Critically Design Review and the program has now entered into the production phase for the GPS IIIA satellites.

GPS IIIA will be the first GPS satellites that will broadcast the new fourth civil signal, called L1C, in addition to the second and third civil signals as well as the Military M-code signal. Significantly, the L1C signals from GPS IIIA will be both compatible and interoperable with services from other international GNSS systems to include the Open Service from the European Galileo system. The first GPS IIIA satellite is projected to be completed and available for the launch in 2014 in support of both normal constellation sustainment and a continuation of the GPS modernization program.

This presentation discusses a number of GPS/GNSS applications that are contributing to a wide variety of improvements throughout the globe and update the UN GNSS workshop on the current status and capabilities of the GPS IIIA program.

Uzbekistan

Improvement of the ellipsoid height for the maps of Uzbekistan on the basic of GPS data

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Keywords: Geodetic heights

Abstract

Geodetic heights on the Uzbek maps are usually stated to be height above Baltic sea level. These heights were received in 1950-1960 on the basic of the classical measurements. At present, the Uzbek geodetic coordinate system are not very accurate because of local geotectonic plate moving. Especially, it is belong to geodetic heights which there are rms ± 10-20m. All heights are measured relative to the "zero-point" Kronstadt see-gauge (Baltic sea level). Different countries have adopted different local mean sea levels as their "zero height" definition. To ensure that the relative height of map points correctly, we must measure height as the distance between the ground and the Geoid, not the ellipsoid.

Baltic heights system have become a standard in Uzbekistan , and are likely to remain so. It is important to understand the reasons for the differences which might arise when comparing Baltic heights system with those obtained from modern gravimetric geoid models. Therefore, in order to obtain a high precision geodetic and orthometric heights for Uzbekistan territory based on the GPS technology it is necessary to investigate modern gravimetric geoid models taking into account the local geotectonic plate moving and geophysical variations. For improving of geodetic heights on the Uzbek maps we are going to use 5 reference stations, 14 GPS stations and 15 stations of CATs.

Working out of the Uzbekistan ellipsoid is very important to increasing the accuracy of height coordinate systems. A good ellipsoid model allows us to determine geodetic heights using GPS technology. The GPS ellipsoid height alone gives us the geometric information we need, but does not give real height because it tells us nothing about the gravity field. Different ellipsoid models will give different geodetic heights for a point, even though the ellipsoid height (determined by GPS) might be very accurate.

United Nations

UN-affiliated Regional Centres for Space Science and Technology Education

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Keywords: Education in space science and technology, including GNSS

Abstract

The United Nations General Assembly (UNGA), in its resolution 45/72 of 11 December 1990, endorsed the recommendation of the Working Group of the Whole of the Scientific and Technical Subcommittee, as endorsed by the Committee on the Peaceful Uses of Outer Space (COPUOS), that the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries (A/AC.105/456, annex II, para. 4 (n)).

Five years later, the GA, in its resolution 50/27 of 6 December 1995, also endorsed the recommendation of COPUOS that those centres be established on the basis of affiliation to the United Nations and that such affiliation would provide the centres with the necessary recognition and would strengthen the possibilities of attracting donors and of establishing academic relationships with national and international space- related institutions.

Regional centres have been established in India for Asia and the Pacific, in Morocco and Nigeria for Africa, in Brazil and Mexico for Latin America and the Caribbean and in Jordan for Western Asia, under the auspices of the Programme on Space Applications, implemented by the Office for Outer Space Affairs (A/AC.105/749). The objective of the centres is to enhance the capabilities of Member States, at the regional and international levels, in various disciplines of space science and technology that can advance their scientific, economic and social development. Each of the centres provides postgraduate education, research and application programmes with emphasis on remote sensing, satellite communications, satellite meteorology and space and atmospheric science for university educators and research and application scientists.

The Office for Outer Space Affairs is currently in the process to develop, together with prominent experts in the field, two new education curricula respectively on the topic of GNSS and Space Law.

International Committee on Global Navigation Satellite Systems

Sharafat Gadimova, Hans Haubold

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Keywords: UNISPACE III, GNSS, ICG

Abstract

Following the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III), held in 1999, the United Nations General Assembly endorsed the "Vienna Declaration: Space Millennium for Human Development." The Vienna Declaration called for action to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility among, space-based navigation and positioning systems. The International Committee on Global Navigation Satellite Systems (ICG) held its first meeting in Vienna on 1- 2 November 2006 to review and discuss matters relating to global navigation satellite systems (GNSS) and their applications. The ICG work plan includes compatibility and interoperability; enhancement of performance of GNSS services; information dissemination and capacity building; interaction with national and regional authorities and relevant international organizations; and coordination. The ICG members cooperate, as appropriate, on matters of mutual interest related to civil satellite-based positioning, navigation, timing and value-added services. In particular, they cooperate to the maximum extent practicable to maintain radio frequency compatibility in spectrum use between different GNSS systems in accordance with the International Telecommunication Union (ITU) Radio Regulations. The United Nations Office for Outer Space Affairs, as the Executive Secretariat of the ICG develops a wide range of activities focusing on capacity building, specifically, in deploying instruments for the international space weather initiative (ISWI), developing a GNSS education curriculum, and utilizing regional reference frames that support sustainable development, particularly in developing nations. In the coming year, we will assist the process of the establishment of the ICG Information Centres for training and information dissemination on global applications of GNSS and their socio-economic benefits for humanity. The ICG website: www.icgsecretariat.org.

Annex I

United Nations/United Arab Emirates/United States of America Workshop on the Applications of Global Navigation Satellite Systems

Dubai, 16 – 20 January 2011

Provisional PROGRAMME

Day 1, 16 January 2011

09:00 Registration of Participants

10:00 **Opening and Welcome Remarks, and Key Note Addresses**

- HE SHEIKH NAHAYAN MABARAK AL NAHAYAN, *Minister of Higher Education and Scientific Research, United Arab Emirates*
- HE Mr. AHMED AL MANSOORI*, Director General of EIAST, United Arab Emirates*
- Ms. Sharafat GADIMOVA*, United Nations Office for Outer Space Affairs*
- Mr. Jeffrey AUERBACH, *Department of State*, *United States of America*

Objectives of the Workshop
Ms. Sharafat GADIMOVA, United Nations Office for Outer Space Affairs

11:00 *Coffee Break*

11:30 **Key Note Presentations**

11:30 International Committee on Global Navigation Satellite Systems, *Ms. Sharafat GADIMOVA, United Nations Office for Outer Space Affairs*

11:50 Establishing Space Policy, *Mr. Mohamed Ahmed TARABZOUNI, Saudi Arabia*

12:15 **Presentation Session 1: Trends in satellite-based navigation systems**

Chairperson: Mr. Alexandru BADEA, Romania
Rapporteur: Mr. Janis ZVIRGZDS, Latvia

12:15 - 12:35
- Global Positioning System (GPS) modernization: GPS IIIA – On the road to the future, *Mr. Michael SHAW, United States of America*

12:40 – 13:00
- GLObal Navigation Satellite System (GLONASS) status, performance and modernization efforts*, Ms. Tatyana MIRGORODSKAYA, Russian Federation*

13:05 *Lunch Break*

14:35 **Presentation Session 1: Trends in satellite-based navigation systems (continues)**

14:35 – 14:55 ▪ SSTL role in the GALILEO navigation project, *Mr. Ramon Alexander da SILVA CURIEL, United Kingdom*

15:00 – 15:20 ▪ QZSS (Quazi-Zenith Satellite Systems) Update, *Mr. Mikio AOKI, Japan*

15:25 – 15:45 ▪ Update of COMPASS and its applications, *Mr. Jingnong WENG, China*

15:50 *Coffee Break*

16:20 **Presentation Session 2: GNSS services and reference frames**

Chairperson: Mr. Sethu Nandakumar MENON, *United Arab Emirates*
Rapporteur: Mr. Ivo MILEV, Germany

16:20 – 16:40 ▪ Continuous operating GNSS network for Saudi Arabia, *Mr. Nasr ALSAHHAF, Saudi Arabia*

16:45 – 17:05 ▪ Indonesian permanent GNSS stations network: the current status, *Mr. Cecep SUBARYA, Indonesia*

17:05 – 17:25 ▪ GNSS reference station system LatPos in Latvia: regional cooperation with Lithuania, *Mr. Janis ZVIRGZDS, Latvia*

17:30 – 17:50 ▪ Geodetic Infrastructure for GNSS Positioning Services (GIGPS), *Mr. Vasile CHIRIAC, Moldova*

17:55 Adjourn

18:00 **Welcoming Reception**

Day 2, 17 January 2011

09:00 **Presentation Session 3: GNSS augmentation and applications**

Chairperson: Mr. Michael SHAW, United States of America
Rapporteur: Mr. Vasile CHIRIAC, Moldova

09:00 – 09:20 ▪ GNSS augmentation and applications, *Mr. Jeffrey AUERBACH, United States of America*

09:25 – 09:45 ▪ Implementation of EGNOS-based LPV approaches in Europe, *Mr. Luis CHOCANO, Spain*

09:50 – 10:10 ▪ Examples of QZSS applications, *Mr. Koichi KISHI, Japan*

10:15 – 10:35 ▪ GNSS implementation within the United Arab Emirates aviation sector, *Mr. Michael HAYES, United Arab Emirates*

10:40 – 11:00 ▪ Pakistan satellite based augmentation system (PakSBAS), *Mr. Ajmal MUHAMMAD, Pakistan*

11:05 *Coffee Break*

11:30 **Presentation Session 4: Activities in the field of GNSS applications**

Chairperson: Mr. Olivier OBROU, Cote d'Ivoire
Rapporteur: Mr. Ajmal MUHAMMAD, Pakistan

11:30 – 11:50 ▪ Positioning with Internet-based, wide-area, real time GPS, *Mr. Tarig ALI, United Arab Emirates*

11:55 – 12:15 ▪ High-end GNSS based application used for the German railway clearance measuring train, *Mr. Ivo MILEV, Germany*

12:20 – 12:40 ▪ Design and realization of delay mapping receiver based on GPS for sea surface wind measurement, *Mr. Dongkai YANG, China*

12:45 – 13:05 ▪ Comparison between remote sensing and GPS measurements for earthquake ground deformation monitoring, *Ms. Ferdaous CHAABANE, Tunisia*

13:10 *Lunch Break*

14:30 **Presentation Session 4: Activities in the field of GNSS applications (continues)**

Chairperson: Mr. Cecep SUBARYA, Indonesia
Rapporteur: Mr. Renato FILJAR, Croatia

14:30 – 14:50 ▪ Study of a geomagnetic storm effect on the ionosperic scintillation and total electro content (TEC) over the SCINDA station in Abidjan, *Mr. Olivier OBROU, Cote d'Ivoire*

14:55 – 15:15 ▪ Developing GNSS applications industry and understanding the legal issues involved, Mr. Sethu Nandakumar MENON, *United Arab Emirates*

15:20 – 15:40 ▪ GNSS geodetic applications in Algeria, *Mr. Salem KAHLOUCHE, Algeria*

15:45 – 16:05 ▪ The ground-based infrastructure of high accuracy satellite navigation system in the Republic of Kazakhstan, *Mr. Abdikul ASHUROV, Kazakhstan*

16:10 *Coffee Break*

16:40 **Discussion Session 1: Use and Implementation of GNSS Technologies**

Moderators: UNOOSA and UAE

▪ Issues and concerns, requirements of implementation, mechanisms and resources of implementation, experience in the use of the GNSS signal in specific applications

18:00 Adjourn

Day 3, 18 January 2011

09:00 **Presentation Session 5: Education and training on GNSS**

Chairperson: Ms. Ferdaous CHAABANE, Tunisia
Rapporteur: Mr. Mozammel SARKER, Bangladesh

09:00 – 09:20
- UN-affiliated Regional Centres for Space Science and Technology Education, *Ms. Antonella BINI, United Nations Office for Outer Space Affairs*

09:25 – 09:45
- The Moscow State University of Geodesy and Cartography education system and the GNSS applications, *Mr. Andrey KUPRIYANOV, Russian Federation*

09:50 – 10:10
- An initiative for developing a training structure on GNSS and geomatics at national and regional level, *Mr. Alexandru BADEA, Romania*

10:15 – 10:35
- GNSS education and training programme in Thailand, *Ms. Pirada TECHAVIJIT, Thailand*

10:40 – 11:00
- Space weather effects on GNSS performance and operation: a fundamental component of GNSS curriculum, *Mr. Renato FILJAR, Croatia*

11:05 ***Coffee Break***

11:30 Discussion Session 2: Education/training opportunities in the use of GNSS

Moderators: UNOOSA and UAE

Type and level of training/education required; specific GNSS fields requiring education/training; available GNSS-related materials/software and curricula.

13:00 Lunch Break

14:30 – 18:00 Technical Visit/City Tour

Day 4, 19 January 2011

09:00 Presentation Session 6: GNSS applications and technology development: Case studies

Chairperson: Mr. Nasr ALSAHHAF, Saudi Arabia
Rapporteur: Ms. Pirada TECHAVIJIT, Thailand

09:00 – 09:20
- Improvement of the ellipsoid height for the maps of Uzbekistan based on GPS data, *Mr. Erkin MIRMAKHMUDOV, Uzbekistan*

09:25 – 09:45
- Developing GNSS applications in Morocco: projects, research, training and action plan, *Mr. Mustapha AMGHAR, Morocco*

09:50 – 10:10
- Monitoring major landslides using GPS: case study Hammana region, Lebanon, *Mr. Chadi ABDALLAH, Lebanon*

10:15 – 10:35
- GPS measurements of current crystal movements along the Gulf of Suez, Egypt, *Ms. Nadia ABO-ALI, Egypt*

10:40 – 11:00
- Satellite-based navigation systems and their application in Kyrgyz Republic, *Mr. Azamat DYIKANBAEV, Kyrgyz Republic*

11:05 *Coffee Break*

11:30 Presentation Session 6: GNSS applications and technology development: Case studies (continues)

Chairperson: Mr. Chadi ABDALLAH, Lebanon
Rapporteur: Mr. Azamat DYIKANBAEV, Kyrgyz Republic

11:30 – 11:50
- GNSS and its application in the context of Bangladesh, *Mr. Mozammel SARKER, Bangladesh*

11:55 – 12:15
- Planned differential GPS system at Yangon international airport, *Mr. Thet LWIN, Myanmar*

12:20 – 12:40
- GNSS performance in times of natural disasters: a Chilean 2010 earthquake case-study, *Mr. Renato FILJAR, Croatia*

12:45 – 13:00 Organization of the work of the working groups

Working Groups Sessions (in parallel)

Discussion points:

- *plans/ framework for a functional partnership that could be established in order to present GNSS technology and to strengthen regional information and data exchange networks on the use of GNSS technology and its application*
- *where should the efforts be focussed on in terms of GNSS use/education/training*
- *possible follow–up projects/initiatives*

Working Group 1: Capacity Building and Institutional Strengthening

Working Group 2: Geodetic Reference Network

Working Group 3: Specific global navigation satellite systems applications

13:00 *Lunch Break*

14:30 **Working Groups Sessions (in parallel)**

Informal discussions/drafting of session reports and recommendations in groups lead by co-chairs of sessions

16:00 *Coffee Break*

16:30 **Working Groups Sessions (continues)**

Informal discussions/drafting of session reports and recommendations in groups lead by co-chairs of sessions

18:00 Adjourn

Day 5, 20 January 2011

09:00 **Discussion Session 3: Round table to finalize the recommendations/observations**

Assess the practical benefits of the follow-up actions resulting from the workshop and its contribution to the ICG and its working groups

- Summary report of discussion sessions: presentation of proposals and

recommendations consolidated at the discussion sessions

11:00 *Coffee Break*

11:30 Plenary Closing Session

- Summary reports of presentation sessions
- Concluding Remarks, *United Nations Office for Outer Space Affairs*
- Concluding Remarks, *United Arab Emirates*

13:00 *Adjourn*

Annex II

United Nations/United Arab Emirates/United States of America Workshop on the Applications of Global Navigation Satellite Systems

Dubai, 16 – 20 January 2011

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