



AFRICAN GEODETIC REFERENCE FRAME (AFREF)-NEWSLETTER

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Introduction

I am pleased to welcome you to read the fourth edition of the AFREF newsletter. In this issue we report on the AFREF activities in Nigeria, Kenya and South Africa. We thank Dr. Combrinck, and Mr. Onyinloye for their contributions. We appeal to you all to send your reports on AFREF and related activities to us to be included in the next issues of this newsletter which is scheduled to come out in January 2008.

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CORS Established at RECTAS

In July 2007, Regional Centre for Training in Aerospace Surveys (RECTAS) established the first permanent reference station in Nigeria as part of the AFREF initiative. Leica Geosystems continues to support the AFREF initiative with both its knowledge and financial sponsorship by donating the complete system at RECTAS. The system consists of a Leica GRX1200 Pro GG receiver, a Leica AT504 GG Choke Ring antenna and the Leica GPS Spider Software and Site Server as well as the Leica GNSS QC Software for quality control and data analysis.

Mr. Joel van Cranenbroeck, Business Development Director GNSS at Leica Geosystems led the installation of the station and training of staff at RECTAS.

The station, produces both GPS and GLONASS daily data and Real-Time GNSS Multi-Stream NTRIP data. The daily RINEX data is available at IGS data centers including HARTRAO(South Africa); <ftp://geoid.hartrao.ac.za/rinex/> and CDDIS(USA); <ftp://cddis.gsfc.nasa.gov/gps/data/>, Real-Time data is available at the web site <http://www.igs-ip.net/home>



CORS installed at RECTAS in Nigeria

Trimble Navigation Limited donates GNSS receivers

Trimble Navigation Limited announced the donation of five GNSS receivers to the AFREF community. The announcement was made on 9th August 2007 in Nairobi during a dinner hosted for GNSS base station and data processing course participants at RCMRD. The announcement was made by the Director Institutional Business Development of Trimble, Mr. Stefano Ghielmetti. He said that Trimble will also carry out the installation of the receivers and training of personnel in the operations of Continuous Operating Reference Stations. He emphasised the importance of AFREF and pledged Trimble's continued support. Dr. Wilbur Ottichilo, the Co-Chair of AFREF Steering Committee thanked Trimble on behalf of the AFREF community. He appealed for more support from the international community so that implementation of AFREF is made faster.

Global Navigation Satellite System (GNSS) Base Station Installation and Data Processing Training Course held at RCMRD

A two-week training course on *Establishment of Continuous Operating Reference Stations and GNSS Data Processing* was held at the Regional Centre for Mapping of Resources for Development (RCMRD), Nairobi Kenya from 30th July – 10th August 2007. The course was organized by RCMRD in conjunction with the Center of Geophysics of the University of Lisbon, the University of Beira Interior, Portugal and Hartebeesthoek Radio Astronomy Observatory of South Africa. The objective of the course was to equip geodesist with practical skills in the establishment and operation of Continuous Operating Reference Stations. The topics discussed include AFREF implementation strategy, IGS products & data,

hardware and software requirements to establish Continuous Operating Reference Stations, design of geodetic networks and GNSS data processing. Participants from nine countries namely; Ethiopia, Kenya, Malawi, Nigeria, Portugal, Uganda, South Africa, Tanzania and Zambia took part in the course.

The course was officially opened by Hon. (Prof.) Kivutha Kibwana, the Minister for Lands of the Republic of Kenya. In his opening speech the Minister said "currently in Africa there are poor and out dated surveying and mapping technologies that hamper the progress of mapping in Africa. It is for these reasons that modern geo-information which include Global Navigational Satellite System are increasingly been used to speed up surveying and mapping activities. This training course is therefore very important and timely. I am particularly pleased that the course will focus on the standardisation and harmonization of maps in Africa to enhance cooperation and economic integration of our countries."

We wish to sincerely thank the International Association of Geodesy (IAG), UNAVCO, Trimble Navigation Limited, Leica Geosystems and Topcon Europe Positioning B.V. for supporting the course



Group photo of course participants with Minister Prof. Kivutha Kibwana of Kenya

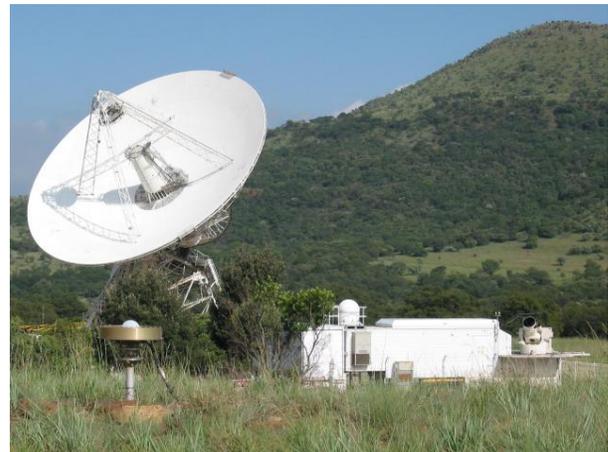
New proposed Fundamental Space Geodesy for South Africa

The international Space Geodesy community faces major instrumental and network changes within the next decade. Societal relevant issues such as natural hazards, climate change and space engineering requirements demand an increase in performance from the global geodetic networks. The interdisciplinary nature of Space Geodesy plays a major role in improving our understanding of the causes and the effects of man's contribution to global climate change and the mitigation of natural hazards.

The different space geodesy techniques need to meet requirements of the Global Geodetic Observing System (GGOS) (<http://www.ggos.org/>) project of the International Association of Geodesy (IAG) and the science driven geodetic objectives as set out by the NASA Solid Earth Science Working Group Report. All the space geodetic techniques face major challenges; the global networks need to be re-equipped and its geometric distribution improved.

In order to meet current and new requirements in the Space Geodesy arena, South Africa is considering to build a new Space Geodesy facility, which could be an outstation of HartRAO or even a new National Facility. A white paper is available which sketches the background and rationale for the new station and proposes a strategy to enable South Africa to remain and improve its contributions and participation in the field of Space Geodesy.

Facilities at HartRAO in South Africa



In the left foreground is a GPS antenna, in the right is the Satellite Laser Ranger and the 26 m Radio Telescope dish can be seen

Currently, Matjiesfontein is being evaluated as a possible site for a new space geodesy observatory (dubbed International Space Geodesy and Earth Observation Institute, IISGEO). Matjiesfontein meets requirements of clear skies, power, water, and accessibility. This site should eventually house a facility which will be a new Fundamental Station for South Africa, hosting all the main Space Geodesy techniques (VLBI, SLR/LLR, GPS DORIS) as well as complimentary scientific equipment. All these techniques are globally managed and steered by the IAG services (IVS, ILRS, IGS, IDS, IERS) and will operate within the framework of GGOS, which forms an important component of the Global Earth Observing System of Systems (GEOSS). The different space geodetic techniques have unique and overlapping properties. GPS is suitable for densification of the reference frames and dense scientific networks, SLR/LLR allows accurate determination of Earth scale, VLBI uniquely determines Earth orientation parameters in an inertial reference frame

and DORIS provides continuous orbit determination. All of these techniques are accurate enough to provide station velocities and all have unique scientific products. When combined, the benefits exceed the sum of the individual contributions; this leads to a strong interdependency between the techniques to support the large number of different uses and applications of the data and its consequent products

The first major instrument will be a satellite/lunar laser ranger which will be developed in collaboration with France. Several local institutes (CSIR, NMISA, University of Pretoria) are involved, which ensure capacity building and local know-how. Additional partners will be welcomed. Collaboration from African countries to ensure that the new station will be truly "international" with active participation from Africa.

A website will be released soon which will help to keep everyone informed. For more information, please contact Dr. Ludwig Combrinck (ludwig@iisgeo.org)

Workshop on space geodesy to be held in South Africa

A workshop on space geodesy workshop will be held in Matjiesfontein, South Africa (where the proposed new space geodesy observatory is to be built) from 12th November 2007 to 15th November 2007. The workshop is being organized by Hartbeesthoek Radio Astronomy Observatory of South Africa.

The objectives of the workshop is to expose participants to the different space geodesy techniques. Those interested should contact Dr. Ludwig Combrinck (ludwig@iisgeo.org). Some travel assistance may be available.

Determining Transformation parameters between WGS 84 and Arc 1960 Datum for Kenya

A key outcome of the AFREF project will be the transformation parameters from AFREF to local frame on which currently most geo referenced products including maps are based. Conversion of all national surveying and mapping products to the same common reference system (AFREF) is big challenge to National Mapping Organizations. This is because there is huge number of maps and spatial data that need to be converted from local datums to the new global geocentric datums. The change can be done all at once or by products or region or on demand. For example there is a demand by ICAO that all aeronautical charts or maps should be in WGS 84. Kenya has collected a lot of GPS data cover the entire country during the survey of new district in 2006 and 2007. There is now enough data to determine transformation parameters at the national level. Survey of Kenya and RCMRD have started a joint exercise to determine the transformation parameters between WGS 84 and Arc 1960

datum. The out come of the exercise is also expected to act as a demonstration for other African countries that need a practical guide of how to undertake the transformation of datums at the national level.

The exercise involves the following:

- Collect, format, quality check GPS data in Kenya held by Survey of Kenya, Kenya Institute of Surveying and Mapping and RCMRD
- Compute precise WGS 84 coordinates
- Develop suitable datum transformation programme
- Determine the best transformation parameters for different regions in Kenya
- Determine the best transformation parameters for the country.

AFREF Data Analysis Centres to start work

In the last one year, more and more data is becoming available from Continuous Operating Reference Stations in Africa. There is now enough data to start computing the first/initial AFREF solution. Hartbeesthoek Radio Astronomy Observatory (HartRAO) of South Africa and RCMRD have agreed to start data analysis of the available AFREF data. The procedures to be followed is currently been worked out and when ready will be circulated to the AFREF Scientific Advisory Group and the AFREF Steering Committee for comments and approval. HartRAO will use GAMMIT software for the computations while RCMRD will use GIPSY.