



NTRIP IN SOUTH AMERICA THROUGH THE SIRGAS-RT PROJECT

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ABSTRACT

Since many years ago SIRGAS community is working trying to define and to determine the best reference system for the continent. Most of the countries have a group of permanent GNSS stations as reference frame of this system, some of them can be used in real time because they transmit corrections for the observations. The next step is to offer this datum, these corrections to all users; "to cover the continent with SIRGAS in real time". A very good way to reach this objective is the possibility to use the NTRIP protocol to transmit GNSS corrections by Internet and cellular phone to interested users. In the last SIRGAS meeting, May 2008, held in Montevideo-Uruguay, was created a commission to evaluate the possibility to distribute GNSS corrections through NTRIP or another wide area way. As always, some countries have accumulated more experience than others.

The purpose of this work is to present the status of the NTRIP applications in South America through the very different cases of three countries: Brazil, Uruguay and Venezuela. We try, too, to show ideas to conform a SIRGAS NTRIP project that permit to integrate these efforts and to extend this applications to another countries.

Brazil go ahead in the continent, since 2006 FCT/UNESP (Sao Paulo University) has been operating a NTRIP Caster, today it make available the 6 active stations of Sao Paulo State. About two years ago IBGE (Geographic and Statistic Brazilian Institute) has been operating a NTRIP Caster that makes available, data from 26 stations from RBMC (Rede Brasileira de Monitoramento Continuo). These and some other institutions are doing important test and researches to optimize the use of the technique.

In Uruguay UDELAR (Republic University) and SGM (Military Geographic Service) are working together to implement a pilot national project to cover the country with NTRIP. At the university there is a caster that makes available the data from 2 stations. Researches about accuracy, distances and information transfer are done by UDELAR.

LUZ (University of Zulia) and PDVSA (National Petroleum Company) are making progress to evaluate the potential use of NTRIP in Venezuela. Through a thesis a diagnosis about the potential applications of the technique in the petroleum industry and the proposal of a pilot project was done.

The paper is beginning the analysis of the next steps in SIRGAS NTRIP commission: a) to inform and educate the potential users of the region about the advantage of real time differential GNSS positioning over the Internet b) to consolidate at least a central continental NTRIP broadcaster in South America c) to answer the most frequently questions about accuracy, equipments, software, connectivity and data transfer problems in the region d) to conform a continental service in this matter.

NTRIP ACTIVITIES IN URUGUAY

- Researches and test measurements at the UDELAR (Universidad de la República-Facultad de Ingeniería).
- Joint work between UDELAR and SGM (Servicio Geográfico Militar) for the establishment of a real time GPS network with NTRIP.
- Developing the national NTRIP network with 3 SIRGAS stations.

SOME NTRIP MEASUREMENTS IN URUGUAY TO TEST CONNEXION, ACCURACY AND DISTANCES

In a joint work between SGM and UDELAR was planned and executed test measurements with L1, L2 equipment (Leica 1200). The objective was to determine the possible accuracy in different distances or ranges between the Caster and the Client receiver. In this case the Caster was located in Montevideo in a test station and the rover receiver was positioned from 15 to 70km away. The NTRIP position was compared with post-processing results. The differences between the coordinates (NTRIP vs. post-processing static position) are showing in the next table.

BASELINE (m)	Δ Lat. (m)	Δ Lon. (m)	Δ h. (m)	Amb. Rx	Time (s)
15.677	0.016	0.016	0.051	Yes	20
20.436	0.016	0.015	0.054	Yes	20
26.224	0.014	0.012	0.049	Yes	35
40.047	0.015	0.014	0.056	Yes	40
51.222	0.017	0.015	0.047	Yes	40
52.073	0.014	0.011	0.055	Yes	50
70.134	0.037	0.035	0.069	Yes	70

Since July 2009 is working a VNP (linked by cell phone) in Uruguay with 3 SIRGAS Stations (UYTA, UYRO, UYMO) and a new CASTER in (SGM-FI), in the next days the data will be available by Internet.



GOALS

1. Contribute to the dissemination of SIRGAS data in real-time in the continent.
2. Joint work with BKG and Real-time IGS (RTIGS) Working Group in order to obtain support and experiences:
They can help through providing free software for collecting and disseminating GNSS observations in the area and help/advice in software setup, configuration and operation. When real-time orbits/clocks become available, they could help to disseminate these products in SIRGAS area.

ACTIVITIES

1. Check out some public and private institutions are running reference stations capable of streaming data in real-time over the Internet.
2. Convince reference station operators to start streaming/uploading data (if they don't do so today) to a central continental NTRIP broadcaster in their area.
3. Start disseminating GNSS data from that central continental NTRIP broadcaster in South America. Add more broadcasters when/where necessary.
4. Convince and educate DGPS/RTK network operators in the SIRGAS area to exchange streams and coordinates (via a central continental NTRIP broadcaster) to make sure that all of them are providing coordinates in the same reference system.
5. As many receivers are capable of providing DGPS and/or RTK corrections in RTCM format, we could set up conventional DGPS/RTK services for local (metropolitan) areas. What it means is: before starting to operate expensive high-precision network DGPS/RTK software, we could simply disseminate DGPS/RTK streams in RTCM format from reference stations for local applications (local RTK coverage of 10..20km resp. regional DGPS coverage of 300..400km around reference stations).
6. Organize workshops to inform/educate about the advantage of real-time differential GNSS positioning over the Internet.
7. Contribute with a few well-distributed streams to the IGS real-time network.

NTRIP:

Network Transportation of RTCM via Internet Protocol

NTRIP is a generic, stateless protocol based on the Hypertext Transfer Protocol (HTTP), the HTTP objects are enhanced to GNSS data streams. It is an RTCM standard designed for disseminating differential correction data (e.g. in the RTCM-104 format) or other kinds of GNSS streaming data to stationary or mobile users over the Internet, allowing simultaneous PC, Laptop, PDA, or receiver connections to a broadcasting host. NTRIP supports wireless internet access through mobile IP networks like GSM, GPRS, EDGE or UMTS.

It is implemented in three system software components: NTRIPClients, NTRIPServers and NTRIPCasters. The NTRIPCaster is the actual HTTP server program whereas NTRIPClient and NTRIPServer are acting as HTTP clients.



NTRIP is meant to be an open non-proprietary protocol. Major characteristics of NTRIP's dissemination technique are: Application not limited to one particular plain or coded stream content; ability to distribute any kind of GNSS data; potential to support mass usage, disseminating hundreds of streams simultaneously for up to thousand users possible when applying modified Internet Radio broadcasting software; considering security needs; stream providers and users don't necessarily get into contact, streams often not blocked by firewalls or proxy servers protecting Local Area Networks.



http://igs.bkg.bund.de/index_ntrip.htm

NTRIP ACTIVITIES IN BRAZIL

- FCT/UNESP has been operating a NTRIP Caster since 2006. Nowadays their Caster makes available data from the Active Stations of São Paulo State for the general public.
- IBGE has been operating a NTRIP caster since 2007. IBGE caster makes available data from 26 stations from RBMC (Rede Brasileira de Monitoramento Continuo).
- Other institutions are doing projects and researches about NTRIP.

RBMC-IP

It is a real-time service via Internet using NTRIP from the RBMC for users who make use of RTK technique or DGPS in surveys. All the results obtained by RBMC-IP will be automatically put in SIRGAS2000, the reference system officially in use in Brazil since 2005.

A NTRIP caster is in operation at IBGE since 2007, but was opened to Brazilian users only in May of 2008. A number of 26 stations established in the main cities of Brazil are streaming data to the caster located in IBGE office in Rio de Janeiro. The receivers of these stations have been configured to transmit DGPS and RTK corrections in RTCM 3.0 format.

The access to the IBGE caster is free, however it is necessary that users fill a registration form in order to use the RBMC-IP service. Some access restrictions are necessary in order to prevent IBGE network traffic congestion:

1. A user can only access three stations;
2. The access identification and password will be valid for a maximum period of three months;
3. A maximum of 50 simultaneous accesses to the service will be allowed.

Some users belong to a special group, like Brazilian universities and public institutions. The UNESP (Universidade Estadual Paulista/Campus Presidente Prudente) and INPE (Instituto Nacional de Pesquisas Espaciais) are working together with RBMC data in order to generate numerical weather forecast models. At present, more than 500 users have registered for this service, most heavily used by representatives of receiver manufacturers.



FINALS COMMENTS

- NTRIP is a very convenient way to disseminate GNSS corrections in the continent in order to realize in real time the SIRGAS reference system.
- Many countries in the continent have achieved researches and experiences with this technique.
- It is very important to set up a central continental NTRIP broadcaster in the area (or more if necessary).
- We need to homogenize the uses and applications of NTRIP in the SIRGAS area to make sure that everybody are providing (and working with) coordinates in the same reference system.
- We invite you (operators and researchers from academicals, officials and private institutions) to incorporate and contribute with this project. If you are interested please write to: melvnhoyer@gmail.com

INTRODUCTION

In the SIRGAS Meeting held in Montevideo, Uruguay in May 2008 was created the SIRGAS Real Time Commission with the objective to investigate the foundations and applications associated with the distribution in the SIRGAS area of observations and corrections of GNSS measurements in real time through NTRIP and other long range ways.

The group was conformed by Melvin Hoyer (University of Zulia and PDVSA, Venezuela) as coordinator, Roberto Perez Rodino (Republic University, Uruguay), Edvaldo Simoes da Fonseca (Sao Paulo University, Brazil), Claudia Krueger (University of Curitiba, Brazil) y Newton Junior (IBGE, Brazil).

The commission is trying to contribute with the study, development and disclosure of NTRIP as an important way to realize SIRGAS as reference system in the continent.

Institutions working with NTRIP in the three countries:

BRASIL:

- Instituto Brasileiro de Geografia e Estatística -IBGE
- Universidade Federal de Santa Maria -UFSM
- Universidade Estadual Paulista -UNESP
- Centro de Hidrografia da Marinha-CHM

URUGUAY:

- Universidad de la República -UDELAR
- Servicio Geográfico Militar -SGM

VENEZUELA:

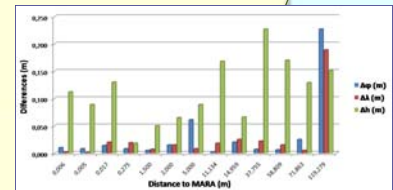
- Universidad del Zulia-LUZ
- Petróleos de Venezuela-PDVSA
- Mediciones Científicas e Industriales C.A.-MECINCA

ADVISER:

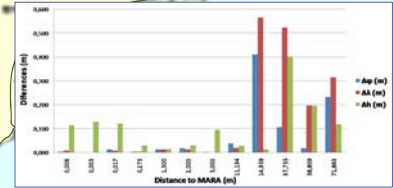
- Bundesamt für Kartographie und Geodäsie-BKG (Germany).

NTRIP ACTIVITIES IN VENEZUELA

- In 2007 first experiences in the use of NTRIP were conducted by MECINCA, a Venezuelan private company, obtaining successful results (Marquez A., 2007).
- Modernization of SIRGAS station MARA observational platform (Sokkia GSR2700 RS), allowed to LGFS-LUZ to begin studies about NTRIP and its applications. Since October-2008 station MARA belongs to IGS-NTRIP worldwide network.
- Some measurements in real time using NTRIP system over short, medium and large baseline were executed by LGFS-LUZ with single and double frequency GPS receivers. A comparison between NTRIP coordinates and those from static survey on the same points show its high potentiality (Bricieño A., Massi Rubi L., 2009).



Differences between coordinates from double frequency GPS-NTRIP measurements and static surveys.



Differences between coordinates from single frequency GPS-NTRIP measurements and static surveys.

- Additional researches and test measurements allowed to determine the potential applications of NTRIP in the Venezuelan Petroleum Company -PDVSA (Ramos F. and Viloria D., 2009).

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