

DemoGRAPE: Demonstrator for GNSS Research and Application for Polar Environment

Lucilla Alfonsi¹

¹ Upper Atmosphere Physics, Istituto Nazionale di Geofisica e Vulcanologia, Via di Vigna Murata 605,
Rome, ITALY.
(E-mail: lucilla.alfonsi@ingv.it)

ABSTRACT

The ionosphere is the major natural cause of degradation of the quality of the GNSS signals received at ground. In polar regions, such as in Antarctica, this degradation can be stronger, creating serious problems in using GNSS devices for navigation, logistic and scientific purposes.

The DemoGRAPE project has been funded by PNRA (Italian National Program for Antarctic Research) to develop a Cloud computing federated infrastructure to manage GNSS data and “ad hoc” applications coming from different teams in a multi-user environment. The scope is to develop a prototype of a service addressed to the scientific and technological communities that relies on GNSS (Global Navigation Satellite Systems) for their investigations and applications. Commonly, to assess the ionospheric impact on GNSS based technological systems, these communities make use of standard models, which have been demonstrated to fail at high latitudes. GNSS signals are widely used in different disciplines including navigation, precision positioning, space weather monitoring, solid Earth and polar cap dynamics investigations, and monitoring of cryosphere evolution

The team of DemoGRAPE comprises INGV as coordinator, Politecnico di Torino and Istituto Superiore Mario Boella as partners and SANSA (South African National Space Agency) and INPE (Brazilian National Institution of Space Physics) as external partners (Figure 1).

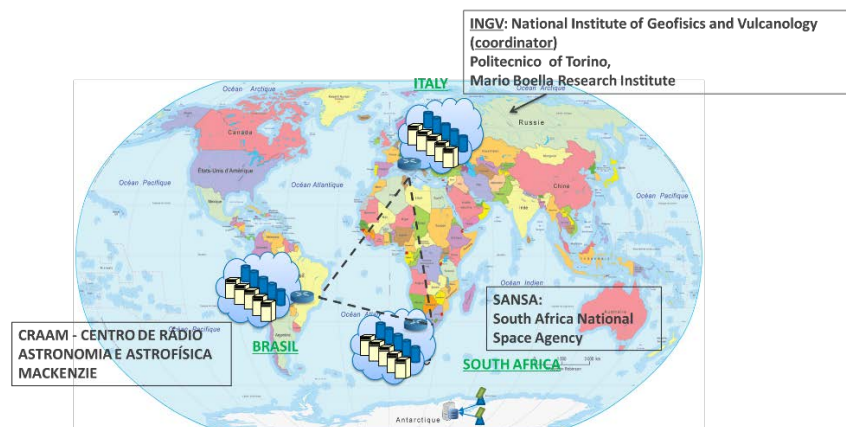


Figure 1. The DemoGRAPE Team

The DemoGRAPE prototype demonstrates its potential by using data acquired during the Antarctic campaigns performed at the South African polar research station (SANAE IV) and Brazilian station (EACF) from late 2015 to early 2016 (Figure 2). In the frame of the project, each of the two stations have been equipped by a pair of professional and software defined radio GNSS receivers [1]. The deployment of the new-concept of GNSS data acquisition is also supported by the Joint Research Centre of the European Commission (JRC).

The data have been made available at the South African and Brazilian nodes of the IT



infrastructure. Two data analysis tools have been fully integrated on virtualized machines in

Figure 2a. Antenna deployment at the Antarctic Brazilian station (EACF), left, and at the South African Antarctic station (SANAE IV).

the Cloud computing infrastructure. The first is based on the Ground Based Scintillation Climatology (GBSC) tool that enables the description of the Antarctic ionospheric climate; the second tool compares the performance of the two types of receivers to monitor the ionospheric TEC and scintillations.

A demonstrator of DemoGRAPE has been developed to validate and test the proposed architecture. The demonstrator is also available via a user-friendly web interface that facilitates the description of its potential.

The presentation will give an overview of the project's achievements, highlighting the importance of its results as a pioneering tool to test new solutions and to share data and software keeping the intellectual properties as a contribution to the Antarctic exploration.

Key words: GNSS, TEC and Scintillation, Cloud, Software Defined Radio Receiver, Antarctica

References:

- [1]. Nicola Linty, Fabio Dovis, Rodrigo Romero, Calogero Cristodaro, Lucilla Alfonsi, Emilia Correia, Monitoring Ionosphere Over Antarctica by Means of a GNSS Signal Acquisition System and a Software Radio Receiver, proceeding of the ION International Technical meeting 2016, January 26-28, Monterey (CA), USA

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