



This project has received funding
from the PNRA, under contract
2013/C3.01.



DEMO GRAPE

Demonstrator for GNSS Research and Application for Polar Environment

Lucilla Alfonsi

Istituto Nazionale di Geofisica e Vulcanologia

lucilla.alfonsi@ingv.it



INGV: Vincenzo Romano, Ingrid Hunstad, Federica La Longa, Massimo Crescimbene

POLITO: Fabio Dosis, Nicola Linty

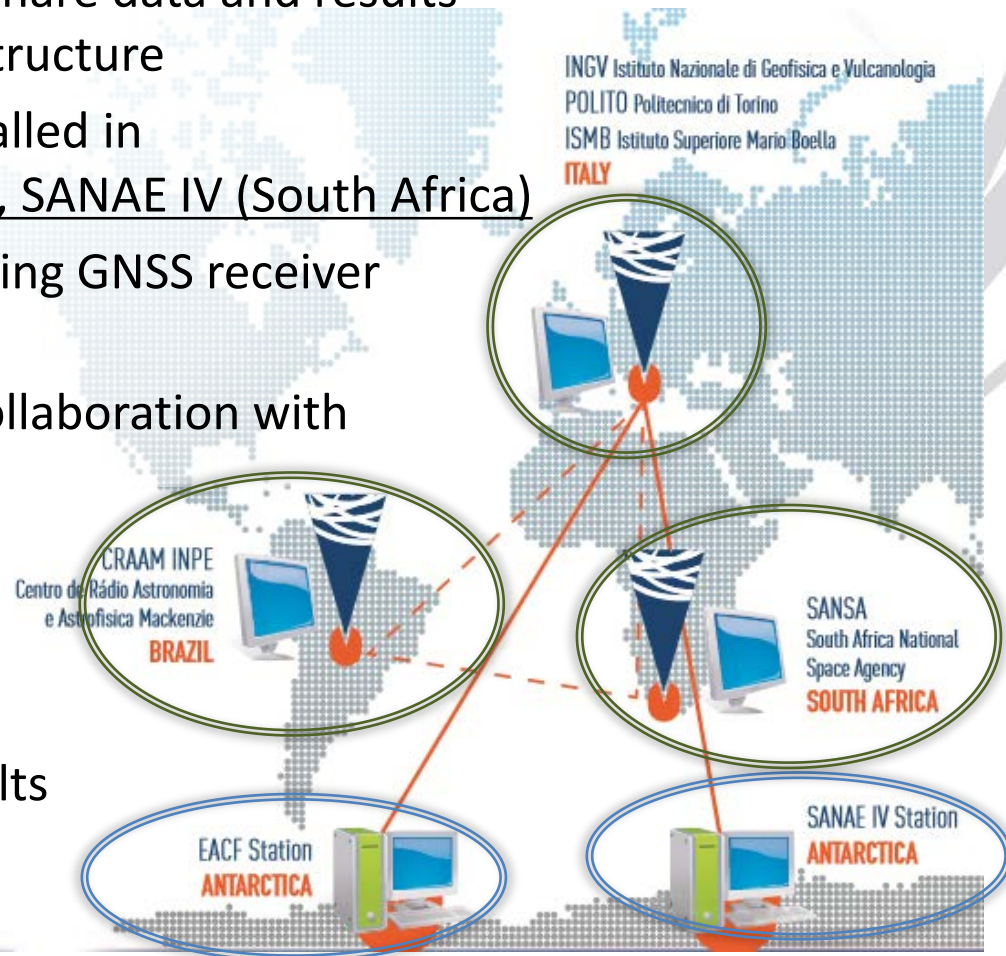
ISMB: Olivier Terzo, Pietro Ruiu, Alberto Scionti

INPE: Emilia Correia

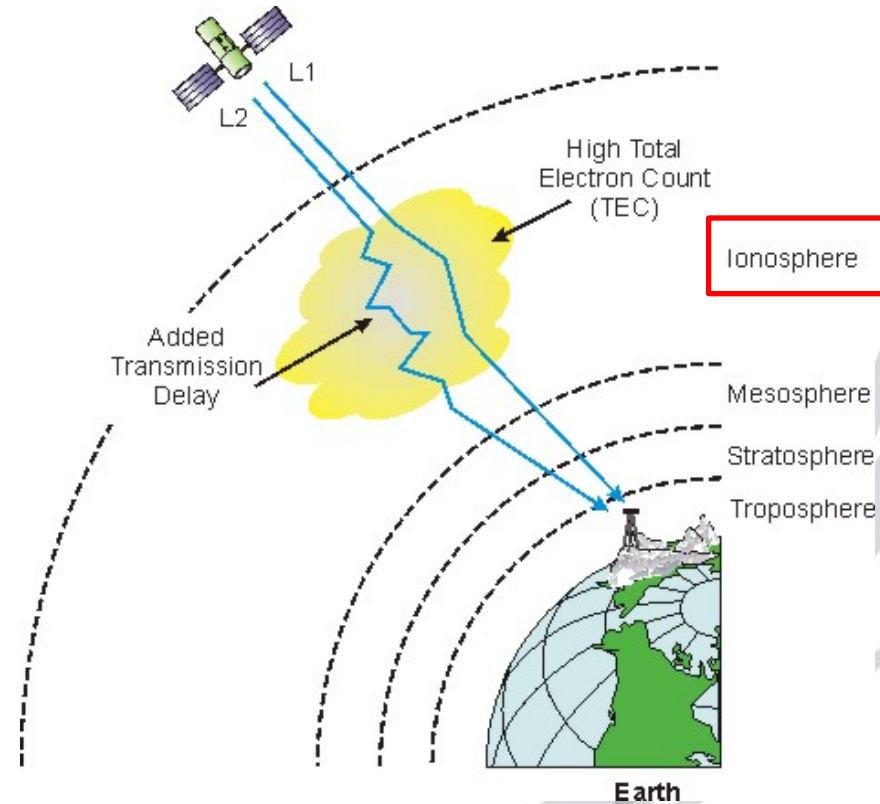
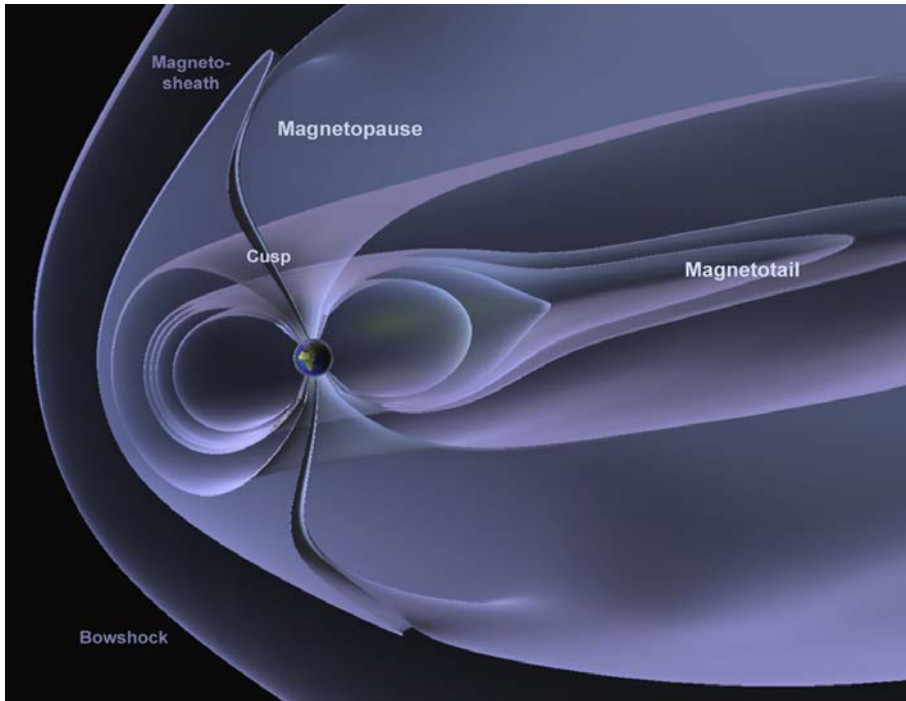
SANSA: Pierre Cilliers, Padraig Riley

The project

- Italian project founded by PNRA with international partners
- **Objective: improve quality of GNSS position solution in polar regions**
- **Demonstrator**, able to assess the corruption induced by ionospheric propagation on GNSS signals and to share data and results by means of a federated cloud infrastructure
- **Ionosphere monitoring stations** installed in two Antarctica stations: EACF (Brazil), SANAE IV (South Africa)
 - **Professional** Ionosphere monitoring GNSS receiver
 - **GNSS signal acquisition** system and **software radio receiver** in collaboration with the Joint Research Centre (JRC) of the European Commission
- A federated **cloud infrastructure** (nodes in Brazil, South-Africa, Italy)
 - To efficiently share data and results
- **A demonstrator**, running processors on collected data



Scientific Rationale

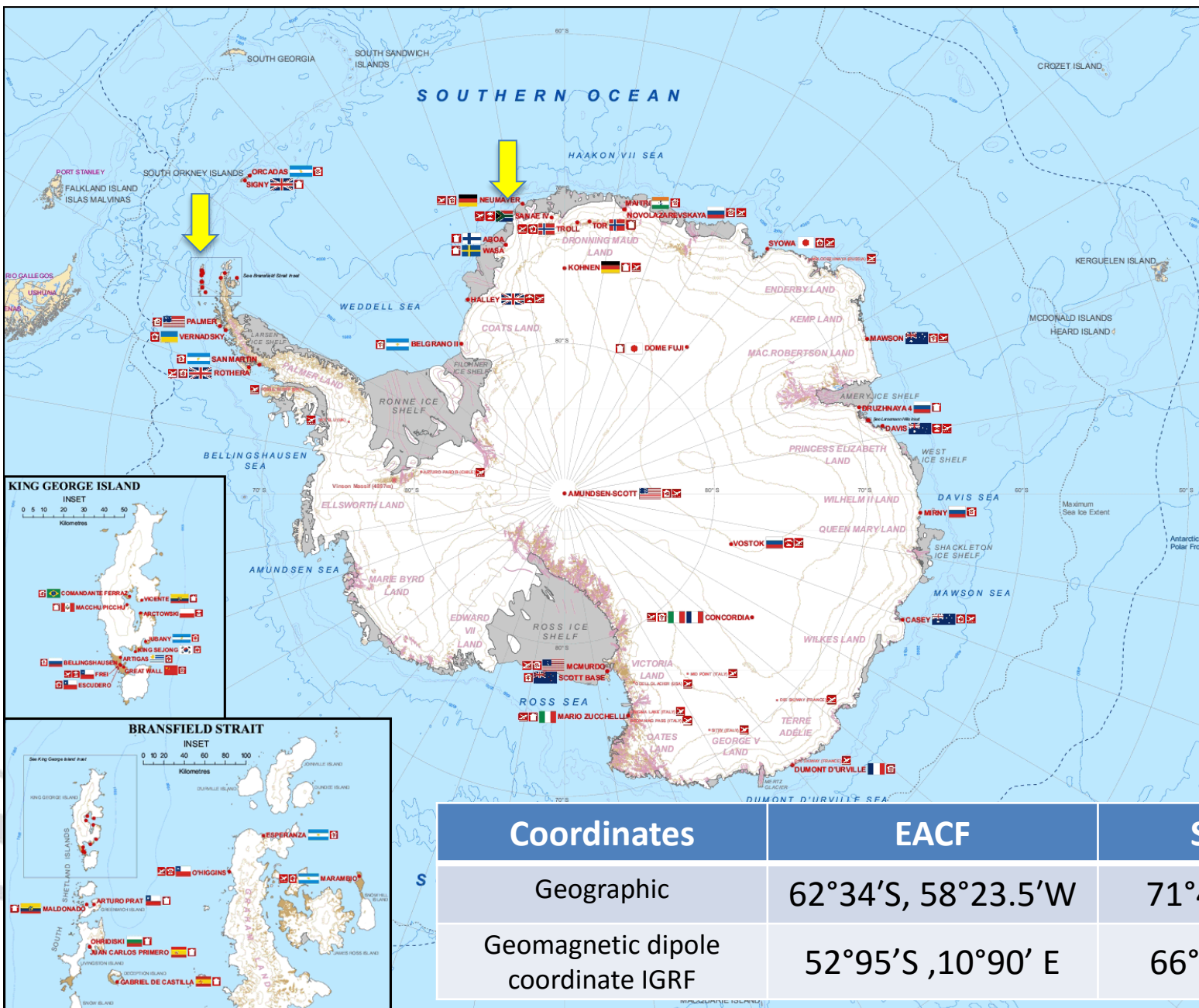


Solar Wind-Magnetosphere coupling causes
turbulences of the ionosphere

Gradients of the electron density

Large range of spatial and temporal scales

The activities in Antarctica



Coordinates	EACF	SANAE IV
Geographic	62°34'S, 58°23.5'W	71°40'S, 2°50'W
Geomagnetic dipole coordinate IGRF	52°95'S, 10°90' E	66°45', 48°00'E

First expedition: EACF

Estação Antártica Comandante Ferraz, King George Island, South Sh

October 23 – November 24, 2015



Second expedition: SANAE IV

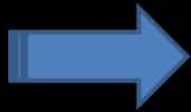
Queen Maud Land Region of Eastern Antarctica

December 2, 2015 – March, 2017

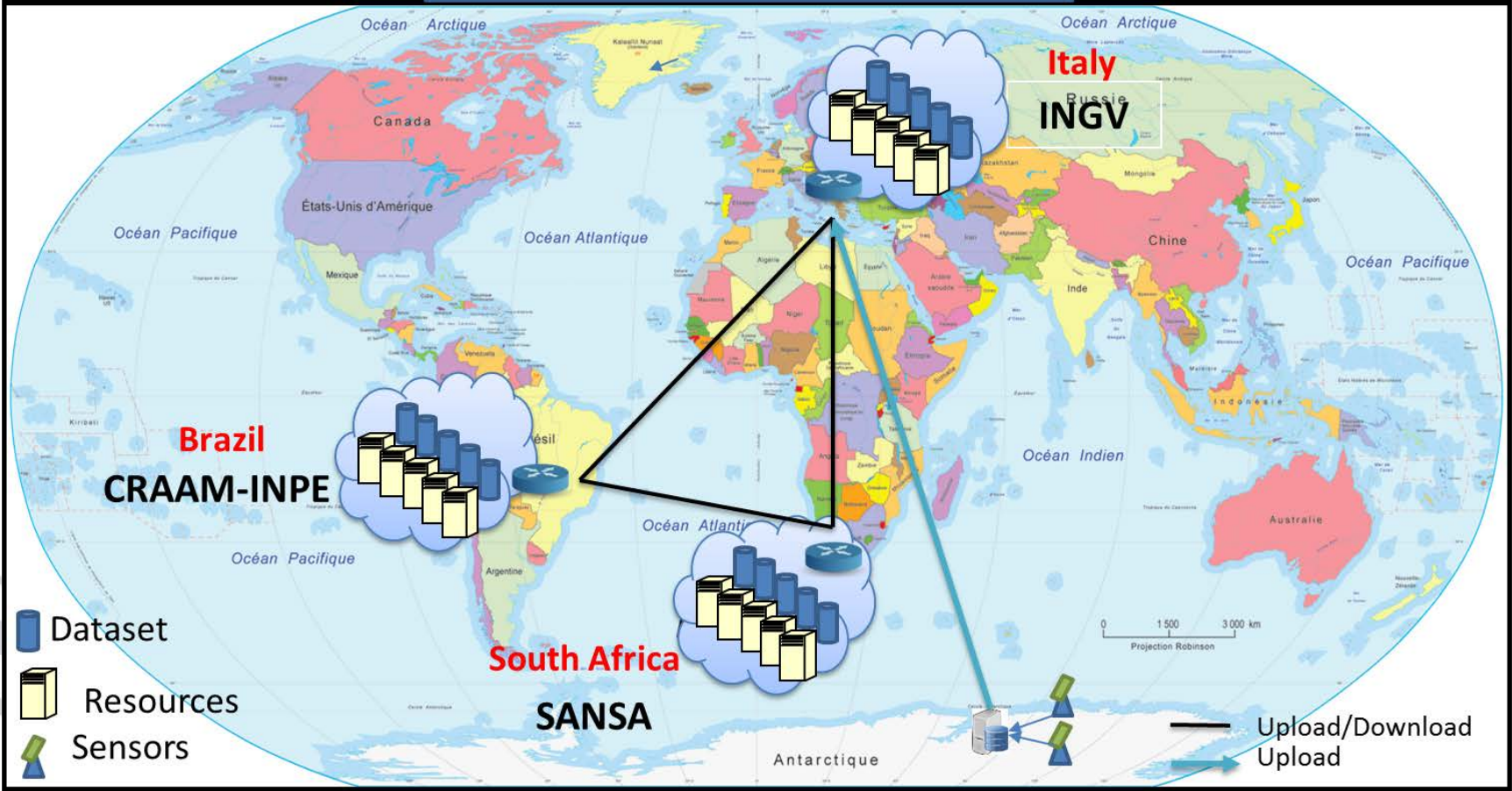
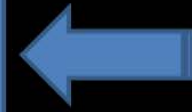
62° 05' 07" S
58° 23' 29" W



The activities in Italy, Brazil, South Africa

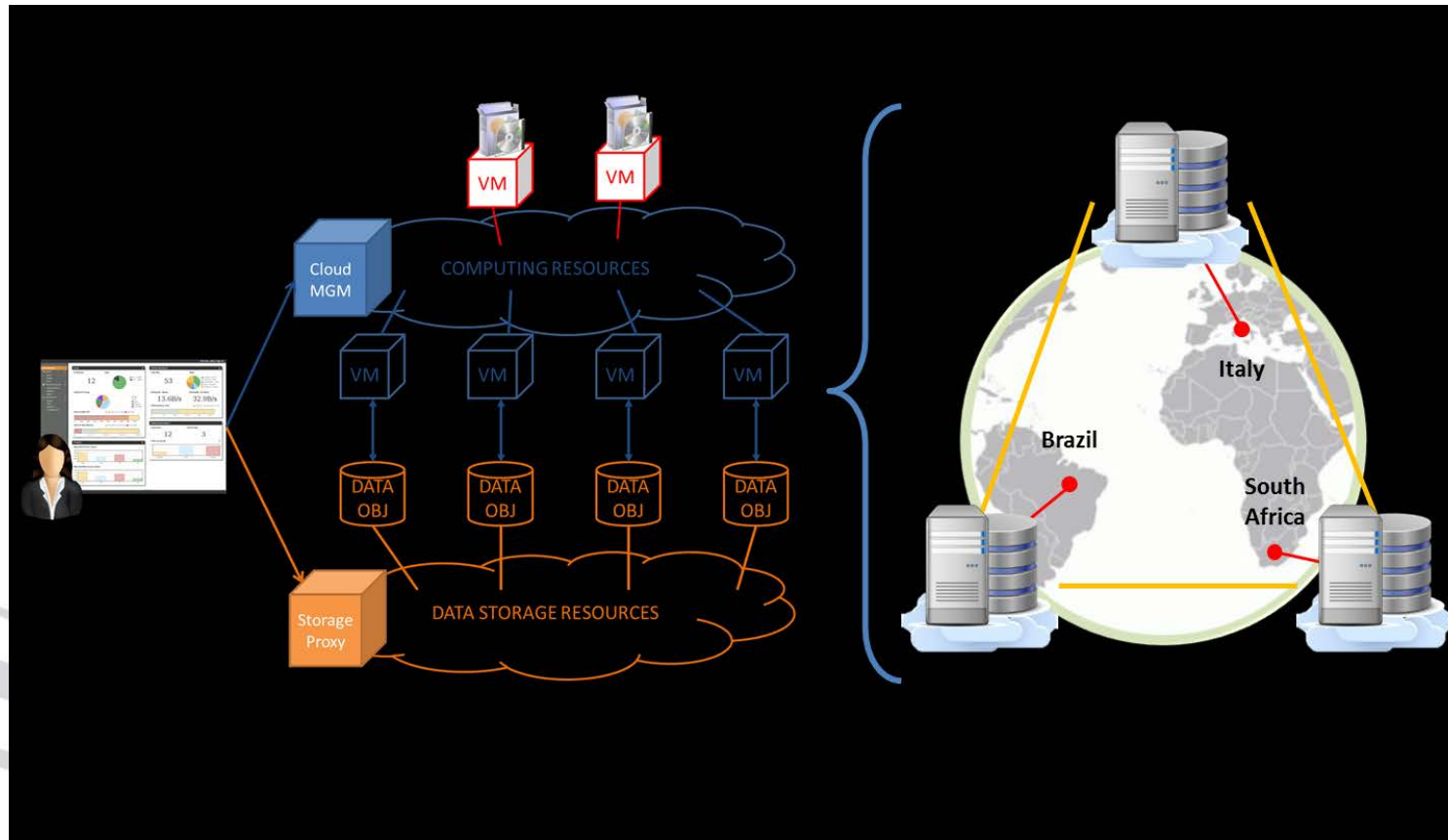


WEB PLATFORM
Sharing data
Sharing resources
Deploy applications



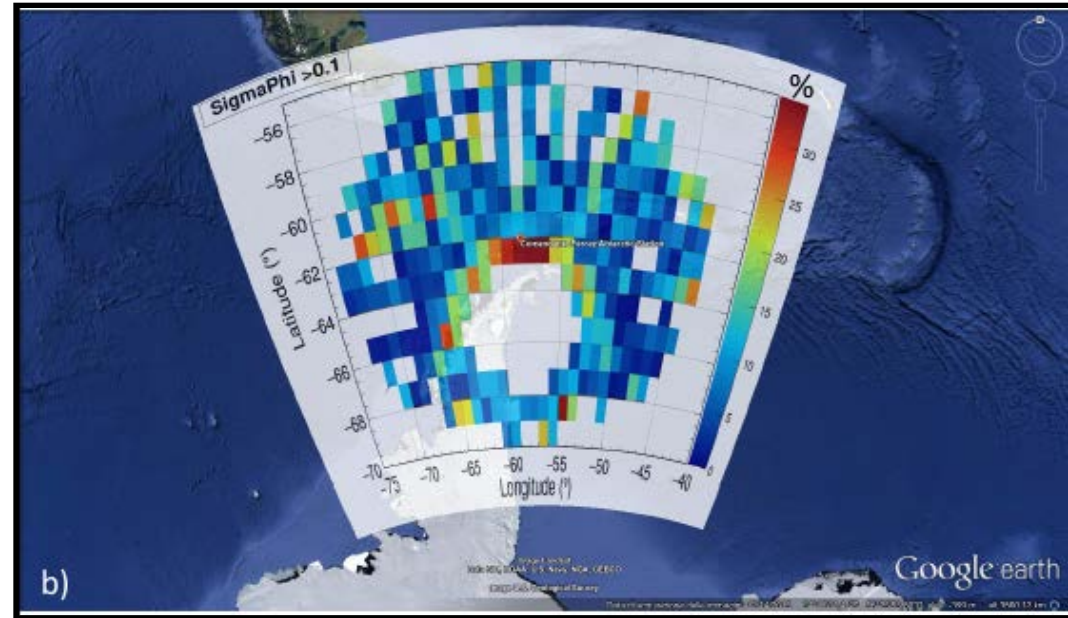
The Cloud computing advantages for Antarctic sciences

- Keep the **intellectual property** of the owners' data and software
- **Reduce** time machines consuming
- **Optimize** data transmission and storage requirements
- Allow to run the software where data are stored **without moving the data**

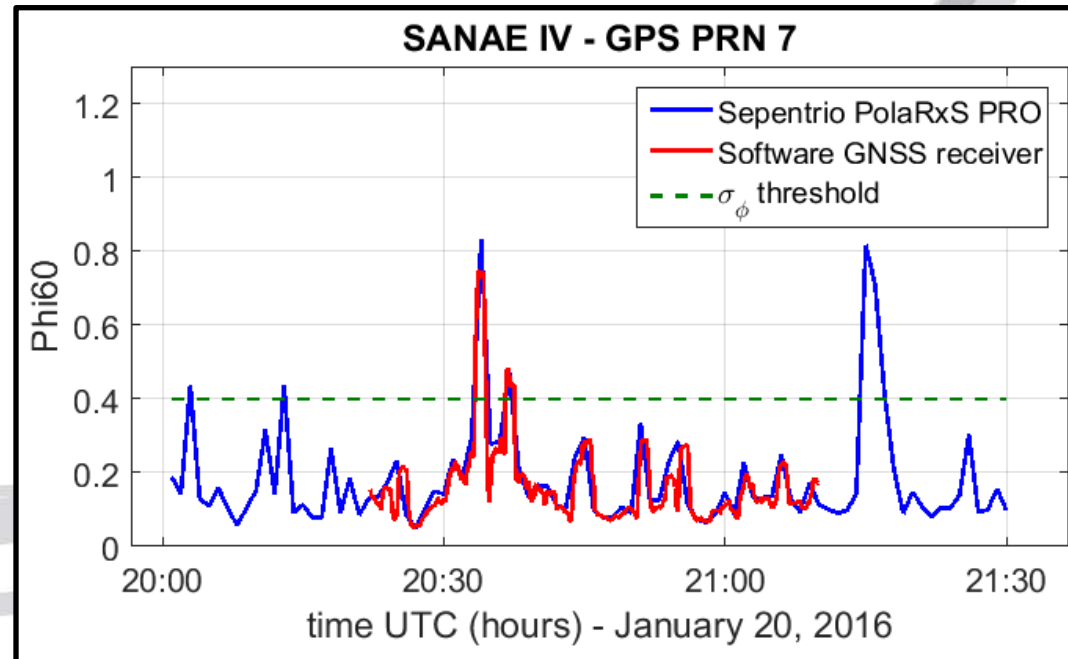


The DemoGRAPE software handled by the Federated Cloud

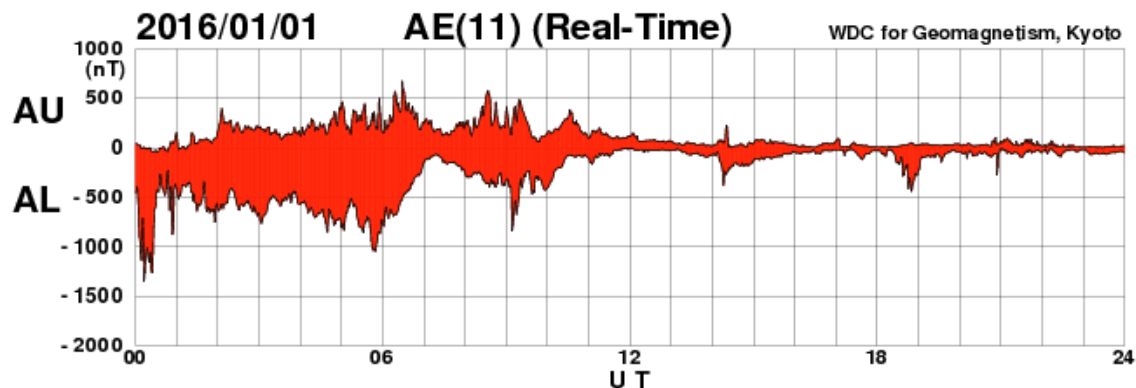
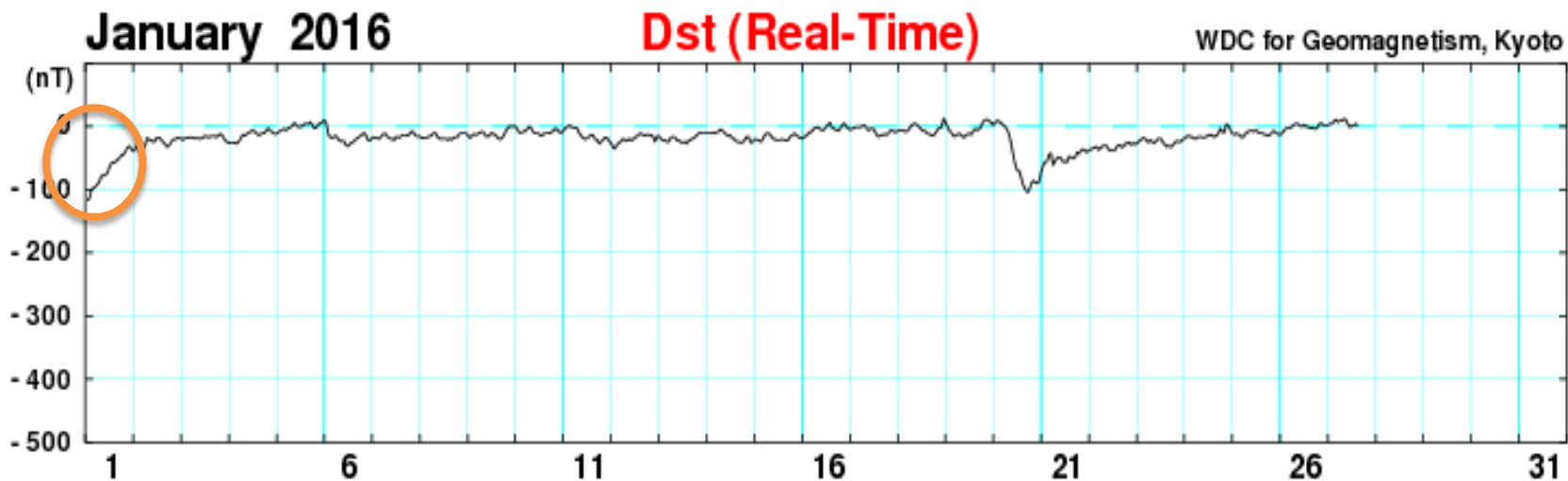
Comandante Ferraz
GBSC – occurrence of $\sigma_\phi > 0.1$
10-13 November 2015



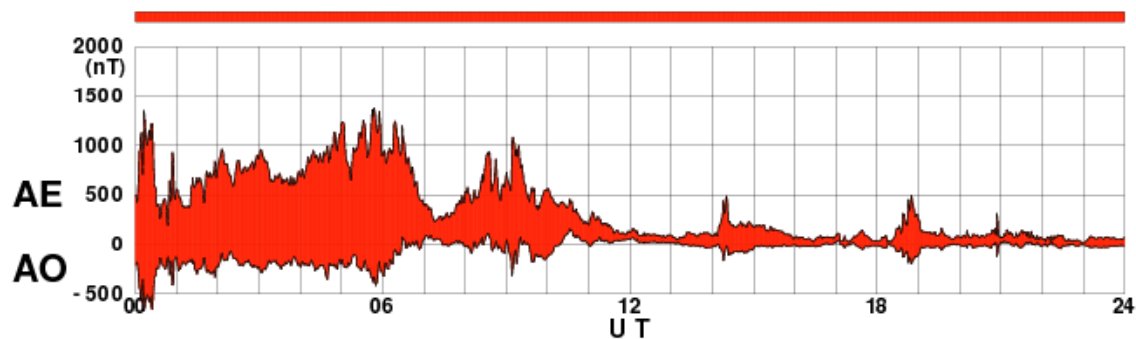
σ_ϕ monitoring from SDR and
Professional receiver
SANAE IV
20 January 2016



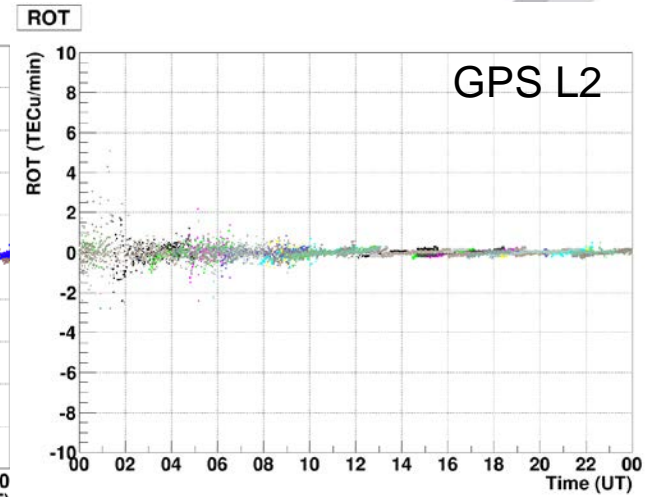
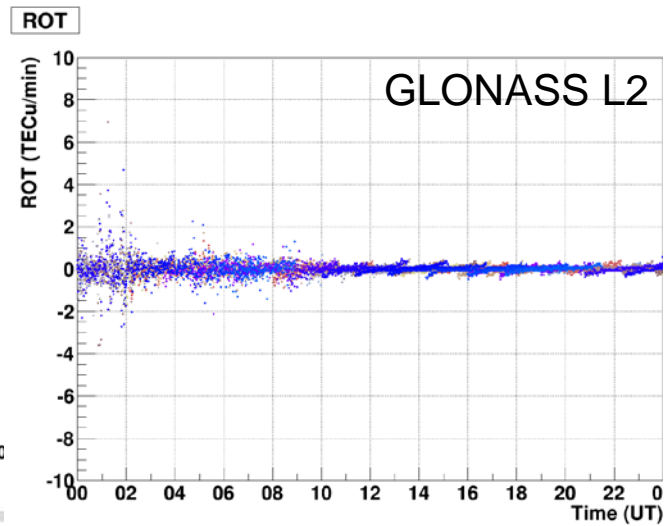
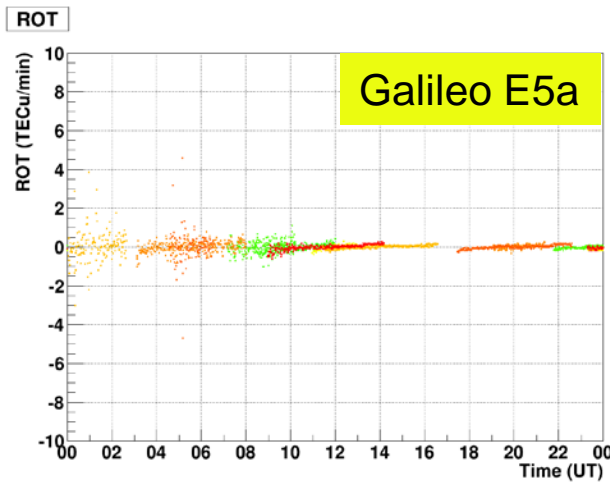
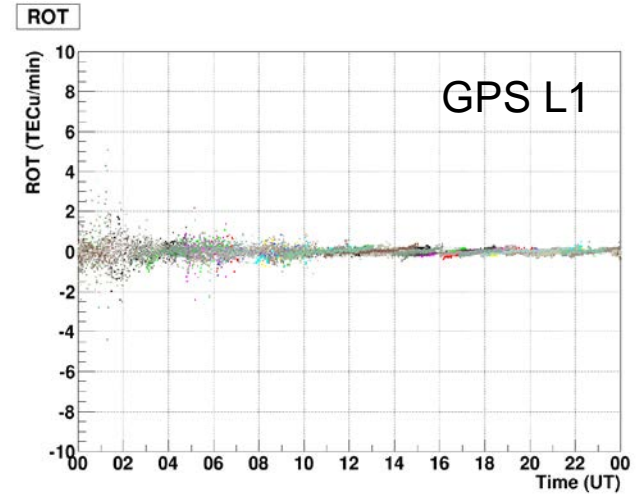
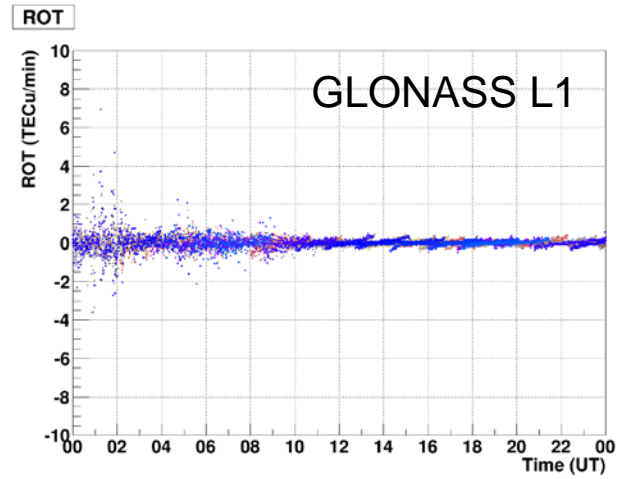
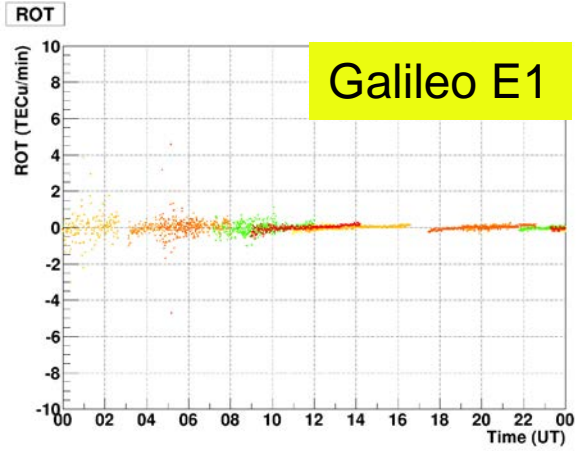
DemoGRAPE observations of scintillation events



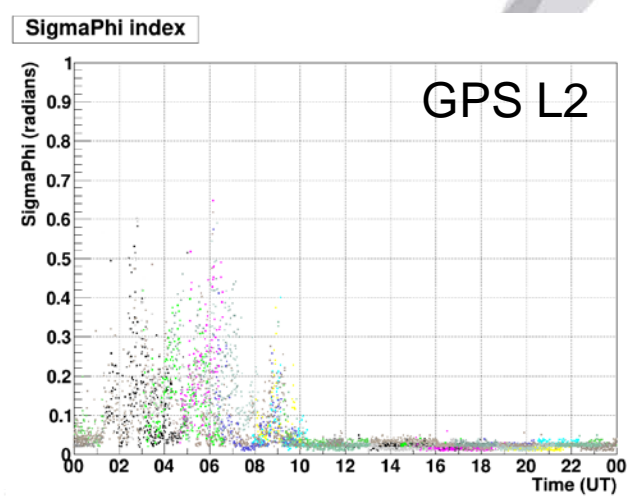
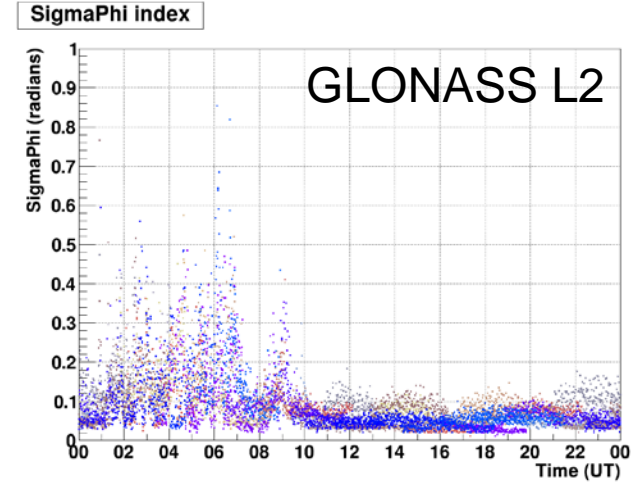
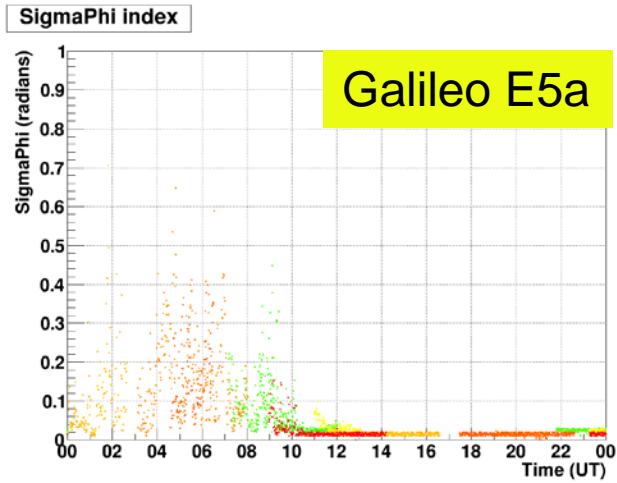
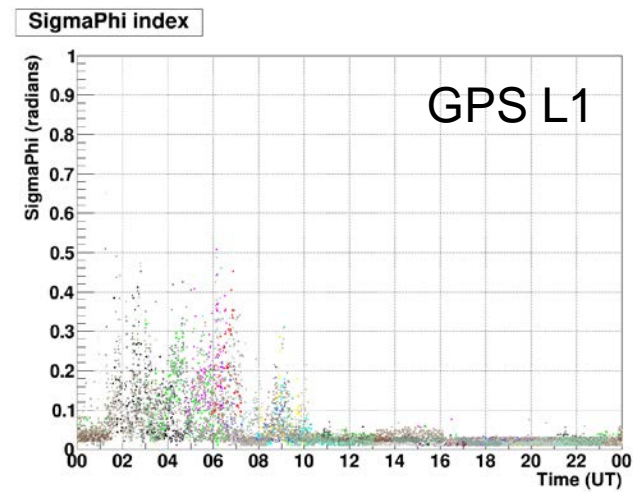
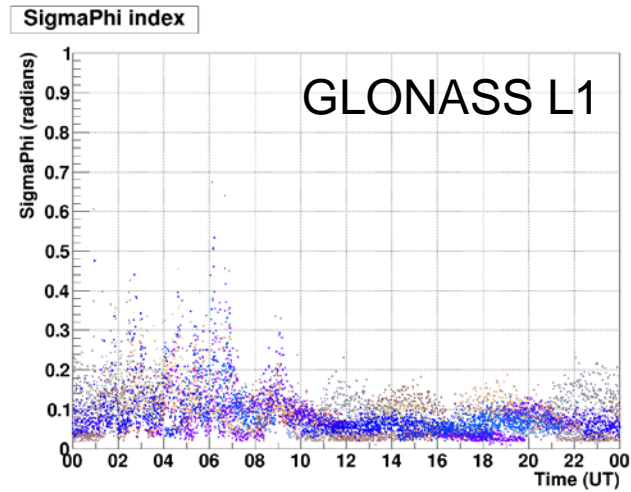
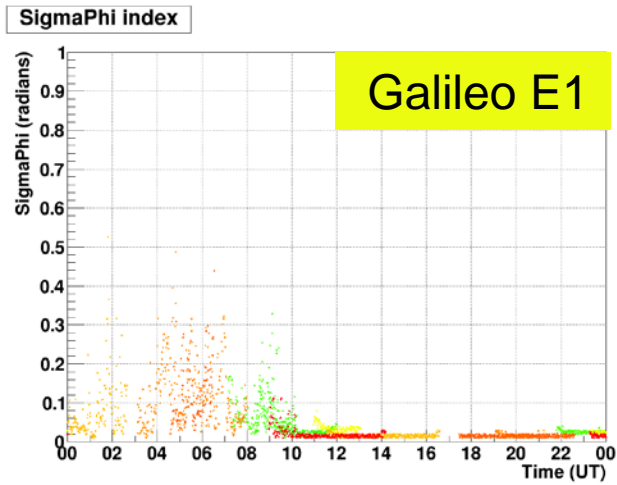
Courtesy WDC for Geomagnetism Kyoto



1 January 2016 - SANAE IV




1 January 2016 - SANAE IV



The Demo

DemoGRAPE Project

Founder



Project Partners

DemoGRAPE ACCOUNTS DEMOGRAPE PROJECT PROCESSOR LAUNCHER PROCESSORS DATA VIEWER ADMIN

simple_latest_admin Started yesterday at 3:17 pm
130.192.85.188:5000/simple.latest

Pause Stop Restart Destroy Logs Console

Processor Configuration

Processor ID: 024bf56c0624
Command: /usr/sbin/sshd -D

Environment

PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
NOTVISIBLE=in users profile

Hostname: simple_latest
Domain Name: N/A


DemoGRAPE ACCOUNTS DEMOGRAPE PROJECT PROCESSOR LAUNCHER PROCESSORS DATA VIEWER ADMIN

Port Configuration

Internal 22/tcp

Processes

UID
root



Launched Processors admin

Refresh

Search processors...

Node	Name	Image	Status	Created	Actions
dmg_it	simple_latest_admin	130.192.85.188:5000/simple.latest	Up 18 hours	2016-06-15 15:56:08 +0200	[Search] [Edit]
dmg_br	alpha_latest_admin	130.192.85.188:5000/alpha.latest	Up 2 seconds	2016-06-22 09:45:31 +0200	[Search] [Edit]
dmg_sa	simple_latest_admin	130.192.85.188:5000/simple.latest	Up 44 seconds	2016-06-22 10:43:11 +0200	[Search] [Edit]

Soon available at: www.demogrape.net

Final Remarks

DemoGRAPE has introduced an original approach to do science in remote sites

- Proposing the use of **SDR to monitor high latitudes** ionosphere to:
 - Reduce the costs
 - To access raw data to reprocess the acquisitions
- Proposing the **Federated Cloud** approach to:
 - Keep the data and software IPR
 - Facilitate the data and software sharing
 - Facilitate the data transmission and storage
- Proposing the **simultaneous use of SDR and Professional receivers** to test the respective performances
- Proposing a **multi-constellation GNSS monitoring** of the Antarctic ionosphere

Final Workshop - 8 November 2016 @ JRC (Ispra, Italy)

DemoGRAPE workshop will present the results achieved by the project to collect feedbacks and to delineate the actual scientific advancement in the field.

The event is free of charge but registration is required. Information and registration at: www.demogrape.net



Thanks!



lucilla.alfonsi@ingv.it
www.demogrape.net



Project External Partners



CONTACT:

Dr. Lucilla Alfonsi
Project Coordinator
lucilla.alfonsi@ingv.it

Istituto Nazionale
di Geofisica e Vulcanologia
(INGV)

Via di Vigna Murata 605
00143 Rome
Italy

Tel. +39 06 51860524
Fax +39 06 51860397

www.demogrape.net

www.demogrape.net