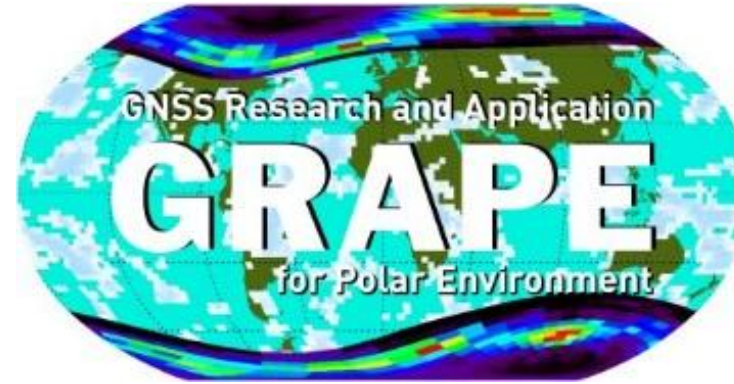




Istituto Nazionale di
Geofisica e Vulcanologia



GRAPE

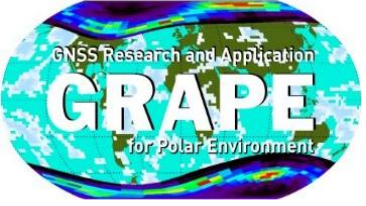
“GNSS Research and Application for Polar Environment”

A joint SSG PS and GS Expert Group



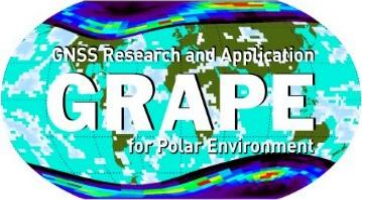
Giorgiana De Franceschi, Istituto Nazionale di Geofisica e Vulcanologia, giorgiana.defranceschi@ingv.it

SCAR SSG PS Meeting, 24 August 2016
KUALA LUMPUR, MALAYSIA

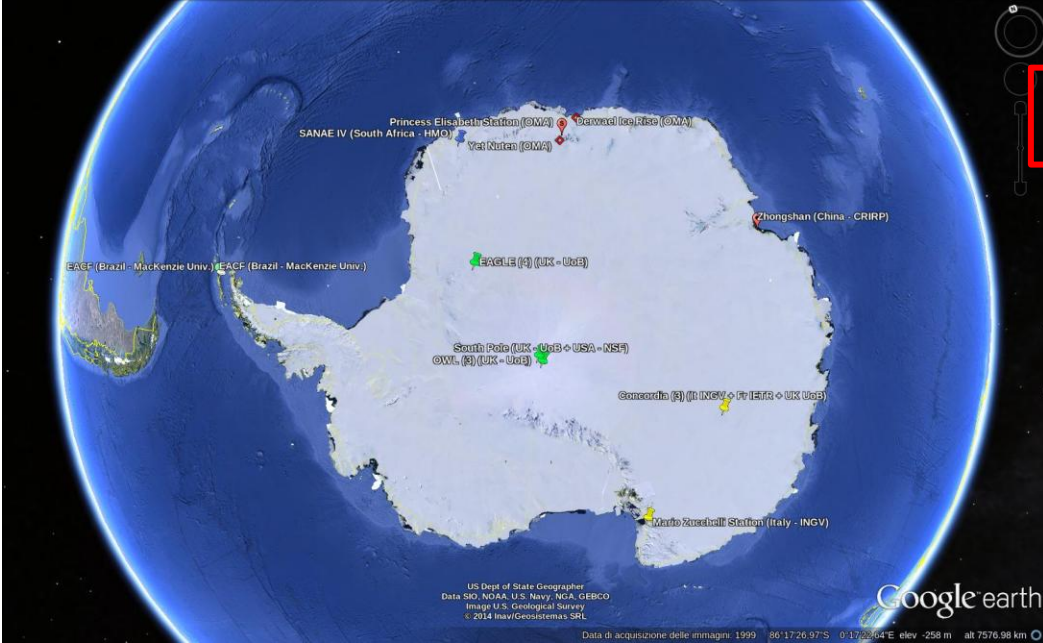


GRAPE main objectives:

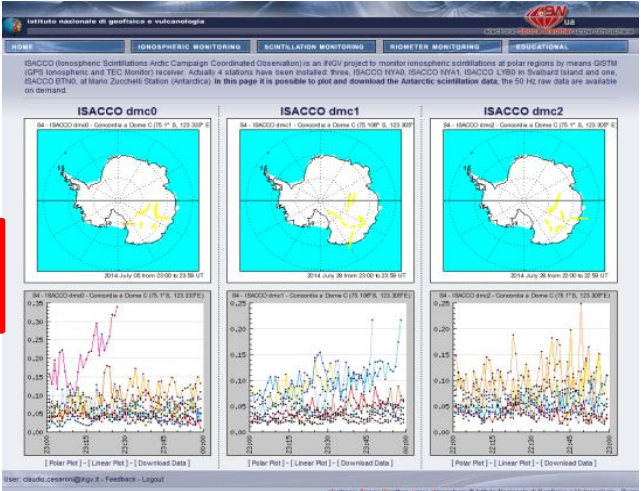
- Create and maintain distributed **networks** of specialized **GPS/GNSS** Ionospheric Scintillation and TEC Monitors
- Identify and quantify mechanisms that cause **scintillation** and control **interhemispheric** differences, asymmetries and commonalities
- Develop **ionospheric** scintillation climatology, tracking and mitigation **models** to improve prediction capabilities of **space weather**.
- Retrieve **tropospheric PWV** for input to **weather forecast** models and to develop **regional PWV climatology** for atmospheric sensing in remote areas.



GNSS network – Northern and Southern Hemisphere

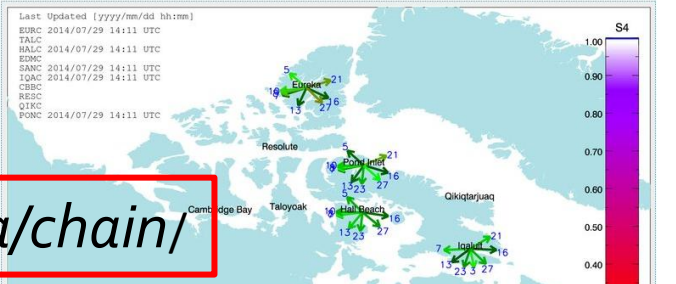


www.eswua.ingv.it



CHAIN
the Canadian High Arctic Ionospheric Network
Home About People Instruments Stations Data Products Photos Publications Software

Welcome to the Canadian High Arctic Ionospheric Network
Real-time Scintillation Activity in the Polar Cap



<http://chain.physics.unb.ca/chain/>

Madrigal home page

Selected Instrument:

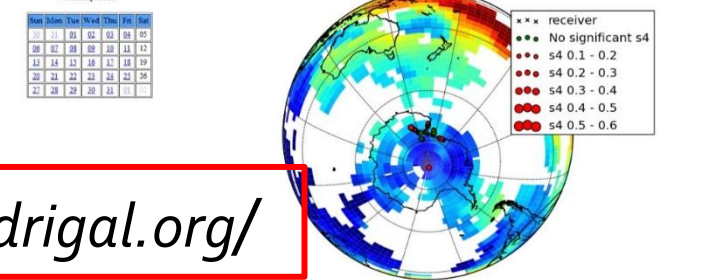
- McMurdo Scintillation Receiver
- PE Allen T. Weatherman - please contact before using this data

Select File:

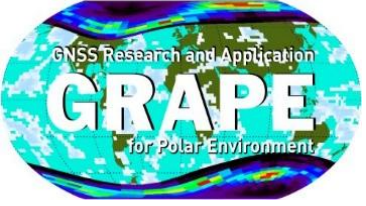
1721_2_00_gps_all_out_ionospheric_scintillation - Final

Download data Print data View info Show Plot

Scintillation/TEC map for 2013-01-01 00:00:46 - 2013-01-01 00:20:46



<http://cedar.openmadrival.org/>



GRAPE 2012-2016 RESULTS (1/2)

- **WEB** www.grape.scar.org , contribution to www.scar.org pages
- **Outreaches –INGV**

The screenshot shows the GRAPE website homepage. At the top left is the GRAPE logo. The navigation menu includes: HOMEPAGE, PARTICIPANTS, WORK PACKAGES, INFRASTRUCTURES, CONFERENCES, RESOURCES, DATA, JOIN US!. The main content area features a 'Welcome to GRAPE' section with a paragraph: 'GRAPE (GNSS Research and Application for Polar Environment) is a joint GeoSciences and Physical Sciences Expert Group lasting from 2012 to 2015. Contact: Giugiana De Franceschi (e-mail: giugiana.defranceschi@ingv.it)'. Below this is a section titled 'Main Objectives' with a bulleted list:

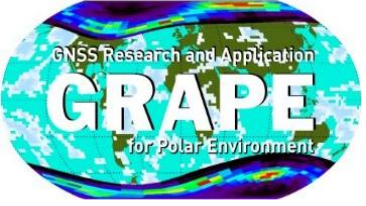
- Create and maintain distributed networks of specialized GPS/GNSS Ionospheric Scintillation and TEC Monitors particularly at high latitudes.
- Identify and quantify mechanisms that cause scintillation and control interhemispheric differences, asymmetries and commonalities in scintillation occurrence and intensity as a result of the geospace environment conditions.
- Develop ionospheric scintillation climatology, tracking and mitigation models to improve prediction capabilities of space weather.
- Retrieve tropospheric PWV for input to weather forecast models and to develop regional PWV climatology for atmospheric sensing in remote areas.

 At the bottom of the page, there is a SCAR logo and footer text: 'Site maintained by Silvia Pau (silvia.pau@ingv.it) Design by Free CSS Templates.'

The poster is titled 'Expedition to the South Pole: a role play for pupils'. It features the logos of INGV (Istituto Nazionale di Geofisica e Vulcanologia) and SCAR (XXXIV SCAR KUALA LUMPUR 20-30 AUGUST 2016). The contact information is: 'Contacts: lucilla.alfonsi@ingv.it'. The authors listed are: 'Lucilla Alfonsi¹, Claudio Cesaroni¹, Massimo Crescimbeni¹, Federica La Longa¹, Vincenzo Romano^{1,2}'. The affiliations are: '¹ Istituto Nazionale di Geofisica e Vulcanologia' and '² SpacEarth Technology S.r.l.'. The poster is divided into sections: 'Motivation' and a central illustration of a penguin and a person in a boat. The text in the 'Motivation' section states: 'The idea to communicate and to share the experience of the scientific research in Antarctica with the public and with the school is a challenge that a team of INGV researchers, engaged for many years in scientific missions in Antarctica, carries on with great enthusiasm within the several outreach activities of the Italian National Program for Antarctic Research (PNRA). The present work reports the experience of the outreach laboratory "Expedition to the South Pole", realized in the frame of events organized by INGV and dedicated to the primary school (8-11 years). The educational themes developed within the laboratory concern the research in Antarctica, with particular focus on the human aspects, the geophysics and the progress of new technologies. The innovative aspect of the laboratory stands in the strategy to deal with Antarctica with an educational aim, proposing Antarctica as a natural laboratory, not only from a scientific point of view, but also as a laboratory of human experiences sharing.'



N. Bergeot (ROB, Be), Why do we need to continue scientific research in Antarctica? Cognac Rotary Club, France, March 2, 2016

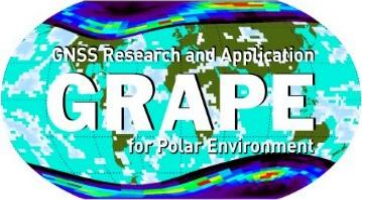


GRAPE 2012-2016 RESULTS (2/2)

- **Publications** (full list at www.grape.scar.org) > 30 papers

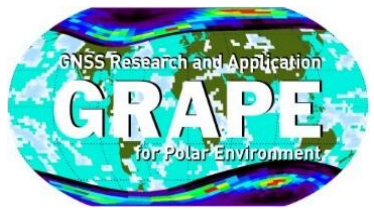
- **SCAR reports**

- **Conferences, Meetings, Workshops**
 - **URSI AT RASC 2015** (Gran Canaria, Spain): **GRAPE Oral session and side meeting** (>30 attending people from URSI community)
 - **BSS, 2016** (Trieste, Italy): **Session 7-Polar (high-latitude) Effects on GNSS** (20 papers presented)
 - **SCAR OSC 2016** (Kuala Lumpur, Malaysia)- **GRAPE Session and Side Meeting:**
 - **Nicolas Bergeot (ROB, Be) will act as GRAPE co-chair 2016-2018!**



GRAPE future activities (1/4)

- **Contribute** to one of the six priorities for Antarctic Science (Theme: Observe space and the Universe- *Solar events impact on global communications and power systems*)
- **Maintain** and improve **the networks** of specialized GPS/GNSS Ionospheric Scintillation and TEC Monitors and **encourage multi-instrument data** approach to investigate the neutral and ionized atmosphere (SuperDARN, magnetometers, ionosondes, all-sky camera, in-situ data, etc....)
 - **Develop** data management strategies and algorithms (**ICT**) to combine data from different sources
- **Disseminate** the results (SCAR reports, conferences, publications, web)



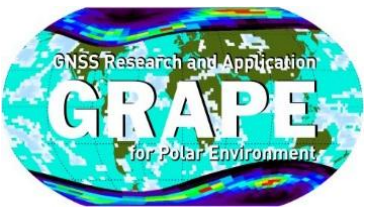
GRAPE future activities (2/4)

RESOURCE (Radio Sciences Research on AntarctiC AtmospherE)

Task force established in May 2015 (IT,UK,USA,CA,BE, SA, BR)

➤ Motivation:

1. **promote the coordination of multi-disciplinary and multi-instrumental studies to look at the atmosphere and its impact on complementary measurements** also in collaboration with other programmes acting inside and outside SCAR.
2. **support the definition of the best practices to protect the Intellectual Property Rights (IPR) on the data and software sharing. Some best practices adopted within the GRAPE community, as the use of Cloud computing, will be extended to all the involved communities.** That part of the job will be coordinated in **close contact with SC-ADM, the SCAR Standing Committee on Antarctic Data Management.**

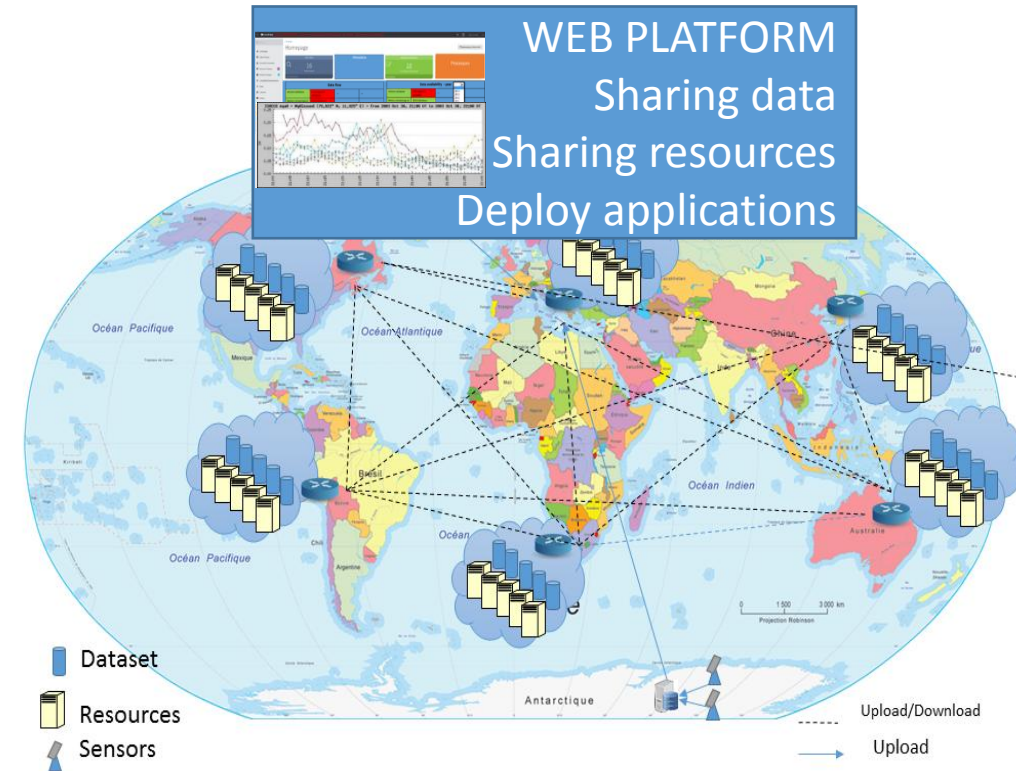


GRAPE future activities (3/4)

EFFORTS ADDRESSED TO ICT DEVELOPMENT FOR DATA AND TOOLS MANAGEMENT (RESOURCE GOAL N.2)

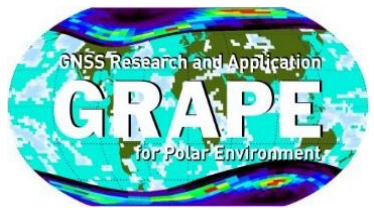
NEEDS to improve data/algorithms/resources sharing

- **Adopt** flexible datasets discovery mechanism
- **Improve** Data
 - Management
 - Accessibility
 - Availability
- **Improve** interoperability applications/data



INFRASTRUCTURE MODEL PROPOSED

- **Federation of infrastructures by CLOUD environment**
Move tools not DATA!



GRAPE future activities (4/4)



Montreal-CA, 19-26 August 2017

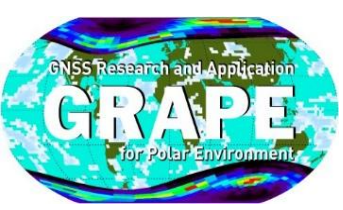
Comissions G-F joint Scientific Session **Radio Studies on Polar Aeronomy**

Conveners: G. De Franceschi (INGV, IT) -V. Chandrasekar (Colorado Sate Univ, USA)- L. Baldini (CNR, IT)

Neutral and ionized atmosphere can affect remote sensing radar systems for Earth science dedicated to observations of surface deformation, cryosphere dynamics, etc...**To pose a solid bridge between the ionosphere and remote sensing communities, this session solicits contributions to facilitate exchange of information on their respective states of the art as well as on their future needs.**

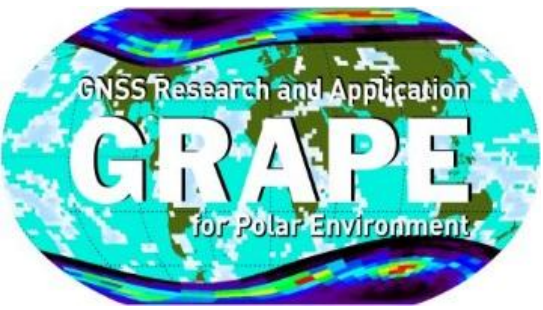
PAPER SUBMISSION DEADILE: JANUARY 30, 2017

www.gass2017.org



PROPOSED BUDGET 2017-2018

Month/Year	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
01/2017	GRAPE web updating	2500	Giorgiana De Franceschi	Giorgiana.defranceschi@ingv.it
04/2017	URSI GAS registration fees for GRAPE participants of which 3 earlier career scientists presenting a paper.	5000	Giorgiana De Franceschi	Giorgiana.defranceschi@ingv.it
09/2017	SA,BE,BR scientific visits at INGV or viceversa	5000	Claudio Cesaroni, Pierre Cilliers Nicolas Benoit	Claudio.cesaroni@ingv.it
03/2018	SCAR OSC registration fees for GRAPE participants of which 3 earlier career scientists presenting a paper.	5000	Giorgiana De Franceschi Lucilla Alfonsi Pierre Cilliers Nicolas Benoit	Giorgiana.defranceschi@ingv.it

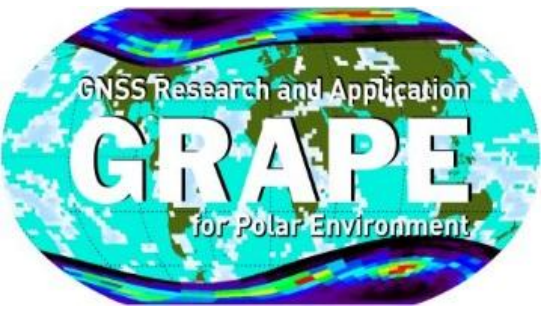


GRAPE Expert Group side meeting

2016-08-21, Renaissance Hotel, Kuala Lumpur

MEETING AGENDA:

- GRAPE state of the art and future activities
- GRAPE-National projects/initiatives: (Brazil, Italy, Malaysia, Argentina, Belgium)
- The challenge on DATA sharing and management: the example of DemoGRAPE
- RESOURCE- The proposal for a new SRP (Lucilla Alfonsi, GRAPE task force)
- Discussion and wrap up (All)



GRAPE Expert Group side meeting

2016-08-21, Renaissance Hotel, Kuala Lumpur

GENERAL REMARKS AND ADOPTIONS

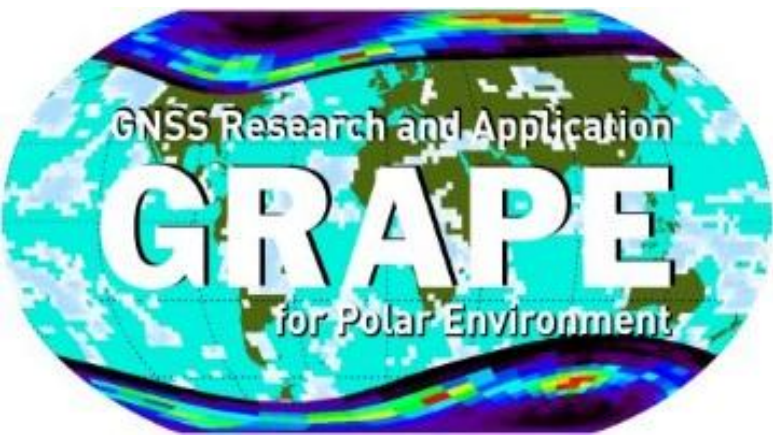
- **Participants:** support GRAPE and the vision proposed on the federate infrastructures under CLOUD environment to share data and tools.
- **Participants:** spread GRAPE and future activities
- **Pierre Cilliers (SANSA, SA)** as the GRAPE representative to be in **contact with AAA and radio-astronomy community.**
- **Malaysia has joined the GRAPE expert group.**

RESOURCE SRP

- Mark Clilverd, Al Weatherwax, Adriana Gulisano, joined the current SRP task force and will support the SRP process
- Proposed (and agreed) schedule: KO meeting at URSI General Assembly 2017 in Montreal Canada

GRAPE LEADERSHIP

G. De Franceschi to continue the **leadership of the GRAPE Group**, and carry the RESOURCE proposal forward and submit it during the next SCAR meeting in Davos. **Nicolas Bergeot of the Royal Observatory of Belgium, is appointed as co-leader of the group with immediate effect.**



THANKS

WWW.GRAPE.SCAR.ORG

TABLE OF NATIONAL ACTIVITIES SUPPORTING GRAPE

Country	Projects (acronym, starting-end date, 1-sentence description)	Experimental Infrastructure, Station name and coordinates (IF APPLICABLE)	Contact person(s)
Argentina	<ul style="list-style-type: none"> Permanent Measurements: Ionospheric vertical sounding, Cosmic noise for ionospheric absorption, relative magnetic field components and absolute magnetic measurements. LAGO (Latin American Giant Observatory) new 	Ionosonde, magnetometers, riometer, at Belgrano II Base, Nunatak Bertrab (bahia Vashel), costa Confin (Tierra de Coats) (77°51'S 34°33'W), San Martin Base, Islote Barry - islote San Martin (caleta Sanaviron, paso Mottet), islotes Debenham (bahia Margarita, costa Fallieres), (68°08'S 67°06'W)	agulisano@dna.gov.ar diegogi@dna.gov.ar
Belgium	<ul style="list-style-type: none"> Permanent GNSS network in the frame IceCon project (Constraining Ice Mass Change in Antarctica - since 2012) ANTION: SUBMITTED 	GNSS receivers at Derwael Ice Rise (70.14S; 26.2 E), Yet Nuten (72.20S;22.6E), Princess Elisabeth Station (71.5S;23.2E)	nicolas.bergeot@oma.be
Brazil	1) Sun-Earth connections inside the INCT-APA (National Institute of Science and Technology - Environment Antarctic Research, since 2009). 2) Characterization of the ionosphere dynamics over Antarctic region and your connection with the South America (monitoring the ionosphere using radio sounding techniques since 2013). 3) Monitoring the ionosphere using VLF and GPS-TEC receivers in Antarctica (since 2004).	Ionosonde, GPS-TEC JAVAD, GNSS for TEC and scintillation, riometers, VLF for ionosphere monitoring at Brazilian Antarctic Station Comandante Ferraz (EACF 62.8S, 58.4W). GNSS for TEC and Scintillation, riometers and VLF at Radio Observatory of Itapetinga (ROI, 23.2S, 46.6W)	ecorreia@craam.mackenzie.br
Canada	Canadian High Arctic Ionospheric Network (CHAIN) - An array of ground-based radio instruments including high data-rate Global Positioning System ionospheric scintillation and total electron content monitors and Canadian Advanced Digital Ionosondes operating since 2008	chain.physics.unb.ca/chain/pages/stations/	paul.prikryl@unb.ca

TABLE OF NATIONAL ACTIVITIES SUPPORTING GRAPE

Country	Projects (acronym, starting-end date, 1-sentence description)	Experimental Infrastructure, Station name and coordinates (IF APPLICABLE)	Contact person(s)
Italy	1) DemoGRAPE (GRAPE Demonstrator), 2014-2016; 2) ISACCO (Ionospheric Scintillation Arctic and Antarctic Campaign Coordinated Observation), Permanent GNSS network, Since 2003; 3) IDIPOS (Italian Database Infrastructure for Polar Observation Sciences), Italian Antarctic Data Infrastructure 2012-2014, 2) PNRA 2016-2018: CONCORDIA and MZS-New! 3) GRAPEVINE: SUBMITTED! (IT-BE-SA-BR)	Ionosonde, GNSS for TEC and scintillation monitoring at Mario Zucchelli Station (74.7S, 164.1E, Antarctica); NyAlesund (79.9N, 11.9E,;Svalbard), Longyearbyen (78.2N, 15.9E; Svalbard), Concordia Station (75.1S, 123.3E, Antarctica,)	lucilla.alfonsi@ingv.it, vincenzo.romano@ingv.it, claudio.cesaroni@ingv.it
	1) VLNDEF (Geodetic and geophysical survey for geodynamical modelling of Northern Victoria Land) since 1999; 2)MALOX (Mass Lost in wind fluX), 2014-2016		negusini@ira.inaf.it
Poland	MISTECS (Monitoring Ionospheric Scintillation and TEC on Spitsbergen)	Ionosonde and GNSS receivers for TEC and scintillation monitoring, Hornsund (77.0 N; 15.33E)	pajak@cbk.waw.pl
South Africa	1) Polar and high latitude ionospheric scintillation studies using permanent GNSS network in Antarctica, Marion Island, and Gough Island since 2006 2) SCAR DemoGRAPE (GPS research for Polar Environment) partner since 2012	HF radar, Magnetometers, GNSS receivers for TEC and scintillation monitoring at SANAE (Antarctica,72.0°S, 2.5°W), Marion Island (Indian Ocean, 46.87° S, 37.86°E) and Gough Island (Atlantic Ocean, 40.34°S, 9.88°W)	pjckilliers@sansa.org.za, sltoz@sansa.org.za, mkosch@sansa.org.za
UK	GNSS network in the frame of a EPSRC funded project, "GNSS scintillation: detection, forecasting and mitigation"	GNSS for TEC and scintillation monitoring at: Trondheim (63.42N; 10.41E, Norway); Lerwick (60.15N; 01.13W, UK);	sreeja.veetil@nottingham.ac.uk marcio.aquino@nottingham.ac.uk