SCAR Sub-Group	**xxx**
SG	PS/LS/GS
Person Responsible:	xxx

SCAR Delegates Meeting 2018

Davos, Switzerland, June 2018

SCAR EG "GRAPE" GNSS RESEARCH AND APPLICATION TO POLAR ENVIRONMENT

2016-2018 Report

Report Author(s):
Giorgiana De Franceschi (Italy), Nicolas Bergeot (Belgium)

Summary of activities from 2016-18 and any other important issues or factors
GRAPE is a joint Physical Sciences and Geosciences Group aiming to intensify the international efforts to build and coordinate a robust network of collaborations in order to answer a variety of weather and space weather related needs at high latitudes and polar regions (Arctic and Antarctica), through ad hoc data sharing and models development. The main outcome from the activities carried out relies on the increasing interest and participation of the international community and early career scientists to the scientific and business sessions focused on GRAPE topics organized within: 1) the International **Beacon Satellite Symposium 2016** (26 June-1 July, Trieste, IT), 2) the **SCAR OSC 2016** (22-26 August, Kuala Lumpur), 3) the **URSI GASS 2017** (19-26 August, Montreal, CA), 4) the **IAGA 2017** (27 August- 1 September, Cape Town, SA) GRAPE mini symposium, 5) the **GRAPE workshop at ROB** (4 December 2017, Brussels, BE) and finally the forthcoming **POLAR2018** (15-23 June 2018, Davos, Switzerland).

Recommendations that EXCOM and Scientific Group Chief Officers should consider
(*Please indicate if approval is necessary or if they are just asked to note information*).
Please note GRAPE is coordinating/leading efforts addressed to the new SRP proposal RESOURCE (Radio Sciences Research on AntarctiC AtmospherE), that is hopefully expected to be approved and to start in 2020. In case of RESOURCE success, GRAPE will be then disbanded in 2020 because will be included in this more ambitious SRP.

Summary Budget 2017 to 2020

	2017	2018	**2019**	**2020**
	Spent	Allocated	Request	Request
(US$)	4021	2500	2500	2500

Progress and Plans

- **The observing infrastructures** (mainly based on GNSS receivers able to monitor ionospheric TEC and scintillations), managed and upgraded by National Projects, is growing above all over Antarctica however not yet filling the existing gap between the Northern and Southern Hemispheres. **New solutions for data exchange and management** addressed to Space Weather products development assisting communications, navigation and positioning have been tested with success.
- A new SRP proposal **"RESOURCE"** (Radio Sciences Research on AntarctiC AtmospherE) has been submitted to SCAR in May 2017 aiming to improve the current monitoring and knowledge of the Antarctic atmosphere in relation to the Arctic environment in a bipolar framework, achieved using radio sensors and supported by complementary instrumentation. In this frame, the establishment of a closer link between neutral/ionized atmosphere and **Synthetic Aperture Radar** communities in respect to the past is also in progress.
- The 2018 **school "Polar Upper Atmosphere: from Science to Operational Issues"**, will be held at the International School of Space Science in L'Aquila, Italy on 17-21 September 2018 (http://www.cifs-isss.org/application_september.asp). The event is kindly highlighted on SCAR web

Sub-group Outcomes Summary
(*Summarize the above and in each case provide your sub-group name in left hand column*)

Sub-group	Activity/Outcome/Benefit/Achievement
GRAPE	Infrastructures (observing systems and ICT) / new tools in progress to contribute to Weather and Space Weather / better coverage of Antarctica/ satisfactory.
GRAPE	Preparation of a new SRP proposal/ submitted/involvement of a larger community on Radio Science at polar regions/in progress
GRAPE	School organization/appreciated by international bodies (e.g. EGU)/training of students on polar atmosphere and preparation of proposals/hopefully very good

Sub-group Cash Flow
(F*rom previous Delegates meeting to date*)

Sub-group	Allocation	Amount spent 2016	2017	2018
GRAPE	6500 (2017-2018) 3000 (2015-2016)	3000	4021	2500

Notable Papers
(*Three most notable papers, if applicable*)

- Alfonsi, L., Cilliers, P. J., Romano, V., Hunstad, I., Correia, E., Linty, N., ... & Riley, P. (2016). First observations of GNSS ionospheric scintillations from DemoGRAPE project. *Space Weather*, *14*(10), 704-709, doi:10.1002/2016SW001488

This work provides the outcomes of the DemoGRAPE project concerning new solutions on Software-Hardware infrastructures tested in different Antarctic Stations in the frame of GRAPE.

- M. Negusini, B. H. Petkov, P. Sarti and C. Tomasi, (May 2016) "Ground-Based Water Vapor Retrieval in Antarctica: An Assessment," in IEEE Transactions on Geoscience and Remote Sensing, vol. 54, no. 5, pp. 2935-2948,. doi: 10.1109/TGRS.2015.2509059.

This work provides a contribution to GRAPE neutral atmosphere topic and the advancement on the capability to retrieve Water Vapor.

- Correia, E., Spogli, L., Alfonsi, L., Cesaroni, C., Gulisano, A. M., Thomas, E. G., ... & Rodel, A. A. (2017, October). Ionospheric F-region response to the 26 September 2011 geomagnetic storm in the Antarctica American and Australian sectors. In Annales Geophysicae (Vol. 35, pp. 1113-1129), doi: 10.5194/angeo-35-1113-2017

This work provides a detailed investigation on the ionized atmosphere reaction to a geomagnetic storm in different longitudinal sectors over Antarctica and comes from a strong collaboration among scientists of different Countries supporting GRAPE.

Forthcoming Activities
(*Plans for next two years, half-page maximum, if applicable. Why important, why now? If Sub-group is coming to a close please indicate this*)

Efforts will be addressed to the improvement/refinement of the SRP proposal RESOURCE, built upon the important GRAPE legacy, firstly by enhancing interactions between the scientists who measure and utilise the entire radio spectrum, either as an auxiliary or principal observation, to study the atmosphere. This will be reached through ad hoc meetings/workshops/ scientific sessions focused on these aspects. Another important goal of the GRAPE-RESOURCE community will be to strength collaborations with the SAR community to develop atmospheric (troposphere and ionosphere) mitigation tools to be used as correction of the SAR images. Efforts of GRAPE participants will focus also on the development/improvement of data archive and database in order to make experimental observations and tools available to the international community. Finally, GRAPE will continuously update the web site to share information/activities/proposals as much as possible. Just as an example, in January 2018 GRAPE has been contacted via the web site by Korean groups dealing with upper atmosphere that from now will actively participate to the GRAPE_RESOURCE initiatives.

In case RESOURCE will be approved from 2020, GRAPE will be disbanded and included in RESOURCE.

Budget

Planned use of funds for 2018 to 2020
(*Please provide detail of all activities with total at end, start with 2020 and work back to 2018 down the table*)

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2020	SCAR2020	2500	Giorgiana De Franceschi	Giorgiana.defranceschi@ingv.it
2019	WORKSHOP GRAPE_RESOURCE_ URSI, WEB	2500	Nicolas Bergeot	nicolas.bergeot@oma.be
2018	POLAR2018 One registration fee for an early career scientist	600	Giorgiana De Franceschi	Giorgiana.defranceschi@ingv.it
2018	SCHOOL “POLAR UPPER ATMOSPHERE”	1900	Giorgiana De Franceschi	Giorgiana.defranceschi@ingv.it
Total		**7500**		

Briefly describe what the funds will be used for and what the desired results are
(*Use the same subtitles as the line items above with no more than 1-3 sentences per item. Please keep these high-level. Please also make clear note of expenditure associated with Davos meeting in 2018* both here and in the table above)

- 2020 SCAR2020- Funds will support registration fees and early career scientists expected to present a paper
- 2019 WORKSHOP GRAPE_RESOURCE_URSI, WEB- funds will support the organization of dedicated meetings/scientific sessions to enlarge the GRAPE RESOURCE community. Funds will also support the web maintenance and updating
- 2018 POLAR2018- Funds will support the registration fees of Elvira Musicò, early career scientists. Through the dedicated side meeting and scientific session, the challenge is the involvement of other groups in the discussion of the SRP proposal RESOURCE.
- 2018 SCHOOL "The Polar Upper Atmosphere: from science to operational issues" – this training course aims to foster excitement and encourage involvement of the next generation of space researchers in studies of the geospace environment of Polar Regions. Funds will support travel expenses of the co-director of the school (Michael Mendillo- Boston College) and one student that will be selected on the base of his/her cv as well of the Country.

Percentage of the budget to be used for support of early career researchers

2018:~50%
2019:~30%
2020:~30%

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes
We cannot provide an estimation; it will depend on the adhesion to GRAPE of scientists from countries with developing Antarctic programs, which are more than welcome. Of course, they will be facilitated as much as possible.

2018:
2019:
2020:

Linkages

Direct support from outside organisations received for your activities
(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

Most of the groups participating in GRAPE are supported by their own Countries through specific projects for Antarctic sciences.
GRAPE is not directly supported by any of these projects but of course takes advantage of the existing infrastructures at Polar Regions to monitor neutral and upper atmosphere.

Major collaborations your sub-group has with other SCAR groups and with organisations/groups beyond SCAR
(*Numbered list of substantive collaborations*)

Within SCAR

1. SCAR GS
2. SERCE SRP

Outside SCAR

1. EC and ESA initiatives focusing on GNSS services and Space Weather
2. URSI COMMISSIONS G and F
3. IAGA

Outreach and Capacity Building

Outreach, communication and capacity building activities
(*Provide a numbered list of no more than half a page*)

GRAPE participants support locally outreach, communication activities and events (e.g. Festival of Sciences) addressed to the general public as well to pupils and students from intermediate to high schools. Special lectures are also organized for Masters, e.g.:
Spogli Luca, "Space climate and space weather from the Pole" lecture within the "Master in sustainable development, geopolitics of resources and arctic studies" organized by the Società Italiana per l'Organizzazione Internazionale (The Italian Society for International Organization), 2016 and 2017.

SCAR Fellowship Reviewers
As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Professor Awards, we are looking for people from all the SCAR groups including SRPs to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your SRP who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.

First Name	Last Name	E-mail	Principal Expertise
Nicolas	Bergeot	nicolas.bergeot@oma.be	PLASMASPHERE
Lucilla	Alfonsi	lucilla.alfonsi@ingv.it	IONOSPHERE
Monia	Negusini	negusini@ira.inaf.it	WATER VAPOR
Emilia	Correia	ecorreia@craam.mackenzie.br	Multi-instrument upper atmosphere monitoring

Membership

The complete list of membership is available at www.grape.scar.org

Leadership

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
Chief officer	Giorgiana	De Franceschi	INGV	Italy	Giorgiana.defranceschi@ingv.it	August 2012	
Deputy chief officer	Nicolas	Bergeot	OMA	Belgium	nicolas.bergeot@oma.be	August 2016	

*Please identify Early Career Scientists with * in first column*

Other members

First Name	Last Name	Affiliation	County	Email

*Please identify Early Career Scientists with * in first column*

Requests to the Secretariat

(*If there are specific administrative tasks you would like help with such as your webpages, mailing list, online meeting tools, etc., please include them below as a numbered list*)