

**MEETING OF THE SCAR ACTION GROUP “GPS FOR WEATHER AND  
SPACE WEATHER FORECAST”**

Istituto Nazionale di Geofisica e Vulcanologia, Rome 10-11 September 2009.

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## Agenda

September 10

### 9.00 - 9.30 Opening

*Antonio Meloni (SCAR Vice-President, Director of INGV RM2 Dept.)*

*Maurizio Candidi (SCAR PS-SSG Chair)*

*Alessandro Capra (SCAR GS-SSG Chair)*

*Bruno Zolesi (Head of the INGV Upper Atmosphere Physics Unit)*

### 9.30 – 12.00 Invited talks on:

#### **- National activities of relevance for the Action Group**

##### **Emilia Correia**

*CRAAM/INPE Universidade Presbiteriana Mackenzie*

*GPS ionospheric monitoring at 'Comandante Ferraz' station - King George Island*

##### **Juha-Pekka Luntama, Kirsti Kauristie**

*FMI (Finland)*

*Finnish interests in POLENET: Space Weather monitoring and geospace-atmosphere interactions*

##### **Andrzej W. Wernik**

*SRC-CBK (Poland)*

*High-latitude phase scintillation during solar minimum: some Hornsund results*

##### **Joao Francisco Galera Monico**

*FCT/UNESP (Brasil)*

*FCT/UNESP activities related to GNSS applications on atmosphere*

##### **Ben Opperman, Pierre Cilliers, Rory Meyer**

*Hermanus Magnetic Observatory (HMO)*

*A Facility of the National Research Foundation (South Africa)*

*Investigation of ionospheric scintillation over South Africa and the South Atlantic Anomaly using GPS signals: First Results*

### 11.00 Coffee Break

##### **Marcio Aquino**

*University of Nottingham (UK)*

*Ionospheric Research at the IESSG*

##### **Biagio Forte**

*Un. of Nova Gorica (Slovenia)*

*Current activities and experiments developing in Slovenia*

##### **Paul Prikryl**

*Communications Research Centre (Canada)*

*GPS Scintillation Observed with the Canadian High Arctic Ionospheric Network during Solar Minimum*

**Giorgiana De Franceschi, Vincenzo Romano, Lucilla Alfonsi, Luca Spogli**  
*INGV (Italy)*  
*Italian Contribution to bipolar ionospheric investigations*

12.00-13:00 Summary and discussion of the morning session

13:00-14:30 Lunch

14:30-16:00 Invited talks on

- **Recent results and open scientific questions**

**Pierguido Sarti, Monia Negusini**

*IRA-INAF (Italy)*

*GPS and Radiosonde Derived Precipitable Water Vapour Content and its Relationship with 5 Years of Long-Wave Radiation Measurements at "Mario Zucchelli" Station, Terra Nova Bay, Antarctica*

**Cathryn Mitchell**

*Un. Of Bath (UK)*

Antarctic imaging and Scintillations

**Massimo Materassi**

*ISC-CNR (Italy)*

*Something new on scintillation analysis: multi-scale et al.*

**Lucilla Alfonsi**

*INGV (Italy)*

*Bipolar scintillation climatology as contribution to Space Weather forecasting.*

16:00-17:00 Summary and discussion of the afternoon session

20:00 *Icebreaker party at Excel Hotel Roma Montemario*

Via Degli Scolopi 31, Rome

<http://www.excelmontemario.it/it/index.html>

### **September 11**

9:00-12:00 Next steps of the Action Group:

9:00 -10:00

- Steps in view of the next SCAR Open Science Conference (3-6 August 2010, Buenos Aires).

#### **10:00-10:30 Coffee Break**

10:30-12:00

-Joint papers, publications, conference presentations, organise thematic science sessions

-Realization of Action Group web pages

-Data sharing policy

-Exploration of possible joint measurements campaigns

-Exploration of possible participation to international calls on GNSS atmospheric delay issues.

12.00-13.00 Conclusions

End of the meeting

## MINUTES OF THE MEETING

SCAR Action Group “GPS for weather and space weather forecast”  
10-11 September 2009, Rome (Italy)  
Venue: Istituto Nazionale di Geofisica e Vulcanologia

### Thursday, 10 September 2009.

The morning session of the first day was dedicated to invited talks on national activities of the Action Group members.

During the discussion it was pointed out that it is mandatory for the Action Group to precisely define the scientific goals (based both on previous and new ideas). It is also important the interaction with the Geoscience community for what concerns the data (policy, quality, archiving, sharing, etc.). Useful contact within SCADM (Standing Committee Antarctic Data Management) are Kim Finney ([kim.finney@aad.gov.au](mailto:kim.finney@aad.gov.au)) and Helen R. Campbell ([hcamp@bas.ac.uk](mailto:hcamp@bas.ac.uk)).

It has been discussed for a scientific research proposal to be submitted during the next SCAR Open Science Assembly 2010 throughout the Standing Scientific Groups for Physical Sciences and Geoscience. It has been agreed to discuss on such an opportunity later, as 1) at the moment the competition with the already existing proposals/programs appears to be hard, 2) only limited funds are available at SCAR, so that an SRP (Scientific Research Program) has to be funded on national Polar Programs. So, Action Group efforts will be also addressed to attract and involve more groups/institutions working on bipolar GNSS networked activities for multi-discipline purposes (from Geodesy to Upper Atmosphere). In fact, as a SRP needs to be approved by countries delegates, each participating country should take care of providing and circulating complete information to their national SCAR representative.

The SERCE (<http://www.scar.org/researchgroups/geoscience/serce/>) proposal, presented by the POLENET community led by Terry Wilson, is going to become a SRP. Among the various SERCE topics, there is an explicit mention of the objectives of this Action Group. This has been welcomed and will motivate a close contact of the Action Group with the SERCE community. SERCE is looking for people covering their issues, with a possible interest by GIANT (Geodetic Infrastructure of Antarctica) (<http://www.scar.org/publications/reports/23/giant/index.htm>) people, not still assessed.

The discussion continued with the data format issue. A form, to be filled by the Action Group participants, will be prepared (Vincenzo Romano (VR), INGV). It will specify the type of data format, sampling rate, and whatever else needed in order to have a clear picture on the data specification needed. VR will be also the Action Group contact person with the SCADM.

The dissemination of the Action Group work will be provided also by a dedicated website (Ben Opperman (BO), HMO), starting as soon as possible with the presentations and the minutes of this meeting.

The afternoon session was dedicated to the recent results and new scientific open questions. Two main points have been highlighted during the discussion, i.e. the

opportunity to develop an unprecedented imaging of the Antarctic ionosphere, and the importance of a bipolar approach to investigate the conjugacy between the two hemispheres. These issues could be addressed tacking the opportunity of novel observing infrastructures (e.g. CHAIN, Paul Prykyl (PP)) and the data sharing with the geodetic community.

### **Friday, 11 September 2009.**

The day was dedicated to the discussion on the next steps of the Action Group.

#### 1) Leadership of the Action Group.

Firstly, it has been pointed out the crucial opportunity, given by the establishment of this Action Group, to approach national funding agencies with such an international co-operation. In particular BO pointed out the great interest of South Africa on polar research, welcoming and supporting Countries without access to Antarctica to use their facilities, cooperating with measurement campaigns. From a national point of view, South Africa wants to extend an experimental network to monitor the ionosphere over Africa. Cathryn Mitchell (CM), has backed the project of giving a GPS scintillation monitor to a student from Nigeria, to install it in Lagos (now operating).

South Africa could also be a good candidate to support Italy in leading this Action Group. South Africa is also creating its own space agency: within 2-3 years some funds and support could be foreseen for the Action Group initiatives. Also the British Antarctic Survey might be a useful actor for leading this Action Group efforts. Canada interest will be investigated by PP. Some funding was made available to INPE for strengthening Brazilian role in polar science (as reported by Emilia Correia (EM)), also relevant funding for strengthening the Space Weather programme and climate change science. Input from Brazilian colleagues on the co-leadership of this Action Group will be given in the future.

The representative from Slovenia, Biagio Forte (BF), informed about negotiation talks on a possible SCAR Associate Membership for Slovenia.

#### 2) Funding Search

Services may be a market place where this type of efforts may be successful. Governments are responsible for these services but they are not aware of this issue. TM (SCAR vice president) told that SCAR has interest in coordinating groups running different GPS based measurements. It is not necessary to have a programme as large as SERCE, but it may be part of it. SCAR is a sort of framework where science can be developed: if SCAR supports this idea, then SCAR will influence national funding programmes to support related projects.

#### 3) Who, When and Where

In the forthcoming days, before the end of October 2009, it has been planned:

ALL - send meeting contribution pdf to Giorgiana De Franceschi

BO - verify the possibility to prepare a webpage on this Action Group

(VR, Paolo Spalla, CM) - circulate the data form and contact SCADM. Within POLENET, this Action Group may recommend the type of receiver we need to cover multi-purposes scientific topics. It is a good opportunity to use a huge amount of data. Also MIDAS (Multi-Instrument Data Analysis System, CM) could be integrated with this type of data. We have to agree on common data format and sampling rates.

(Lucilla Alfonsi, LA) - contact SERCE

ALL - identify Conferences (in the course of 2010) attended by the participants of this Action Group to organize extra meetings and or propose a dedicated session related to the topics of this Action Group (e.g. AGU (Brazil), SCAR (Buenos Aires), EGU, etc..)

Massimo Materassi, (MM) and Monia Negusini, (MN) - coordinate a review paper in order to describe the state of art and future opportunity of *GNSS as a multiple tools for polar sciences*

ALL - identify, within this Action Group, possible work packages (data, etc.) and relative chairs in order to start contacting people, coordinating funding applications, and so on. Two possible work packages have been envisaged on solar-terrestrial dynamics (lower-upper atmosphere), and magnetospheric effects at conjugate points joining together the Physical Sciences and Geosciences communities. Multi-science and multi-disciplinary should be the focal point and GNSS may be used for several scientific purposes. Most important: the available time to work around any possible ideas, either successful or not, is about 1 year.

## **Proposed Science Plan (to be discussed via e-mail).**

### **INTRODUCTION**

The high latitudes ionosphere contains the footprints of processes that have their origin in the interplanetary space. Many different techniques are now available for probing the ionosphere, from radar measurements to the analysis of radio cosmic noise. Among them the use of GNSS high rate (50 Hz) measurements allows to describe the 3D plus time evolution of the ionospheric plasma over restricted regions. Mathematical techniques combined with experimental observations provide the ability to study the ionosphere from high in the F-region to the bottom of the D-layer. Thus coupling processes from the magnetosphere and to the neutral lower atmosphere can be considered. At high latitudes perturbation phenomena due to solar events have a high occurrence percentage even during solar minimum activity, propagating towards middle latitudes with both different time delay and spatial distribution, can seriously degrade technological systems useful for human life.

### **SCIENTIFIC CONTENT**

As the lack of GNSS high rate sampling receiver coverage over polar regions particularly in Antarctica, the Action Group will contribute to the questions still open within the Sun-Earth interactions studies. Issues of scientific international debate of particular interest are:

- 1) characterization of the cause-effect mechanisms driving the formation and evolution of ionospheric irregularities;
- 2) distribution and evolution of Precipitable Water Vapour in polar regions which play a key role in the characterization and evolution of global earth phenomena.

### **PROPOSED SCIENTIFIC OBJECTIVES**

Encourage the establishment of a permanent network of GNSS receivers for a multi-purposes investigation over Arctic and Antarctica. Stimulate international collaboration addressed to bi-polar investigations particularly at conjugate regions. To facilitate these processes, it is envisaged the establishment of a common portal where data and products will be available for scientific communities.

### **CROSS CUTTING ISSUES**

The POLENET (SCAR-Geosciences Standing Group) and ICESTAR – UAMPY(Upper Atmosphere Monitoring for Polar Year, SCAR-Physical Sciences Standing Group) Communities are cooperating to achieve the followings:

1. Ionospheric imaging over Antarctica.
2. Exchange of data and expertise for the application of tomography to other fields of interest for both the communities (e.g. 3D water vapour reconstruction).
3. Exchange of technologies to install and manage remote GPS stations.
4. Possibility to host instruments in the polar stations represented by the two communities.

## Participants list

Name	Institution
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## COSTS

Meeting of the SCAR Action Group “GPS for Weather and Space Weather forecast” held at Istituto Nazionale di Geofisica e Vulcanologia, Rome 10-11 September 2009

<b>INGV ID order</b>	<b>Item</b>	<b>Cost in euro</b>
n 11327	Coffee breaks	340.00
n. 11328	Icebreaker party	756.00
n. 11329	Participants overnight	710.00
<b>Total</b>		<b>1806.00</b>
<b>Funds by SCAR</b>		<b>1792.92</b>

Financed by INGV: local transportation, lunch, secretariat support.