GRAPE
“GNSS Research and Application for Polar Environment”
A joint SSG PS and GS Expert Group

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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

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

http://cedar.openmadrigal.org/
N. Bergeot (ROB, Be), Why do we need to continue scientific research in Antarctica? Cognac Rotary Club, France, March 2, 2016
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!
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)
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.
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!
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 DEADLINE: JANUARY 30, 2017
www.gass2017.org
<table>
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<td>01/2017</td>
<td>GRAPE web updating</td>
<td>2500</td>
<td>Giorgiana De Franceschi</td>
<td><a href="mailto:Giorgiana.defranceschi@ingv.it">Giorgiana.defranceschi@ingv.it</a></td>
</tr>
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<td>04/2017</td>
<td>URSI GAS registration fees for GRAPE participants of which 3 earlier career scientists presenting a paper.</td>
<td>5000</td>
<td>Giorgiana De Franceschi</td>
<td><a href="mailto:Giorgiana.defranceschi@ingv.it">Giorgiana.defranceschi@ingv.it</a></td>
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<td>09/2017</td>
<td>SA,BE,BR scientific visits at INGV or viceversa</td>
<td>5000</td>
<td>Claudio Cesaroni, Pierre Cilliers Nicolas Benoit</td>
<td><a href="mailto:Claudio.cesaroni@ingv.it">Claudio.cesaroni@ingv.it</a></td>
</tr>
<tr>
<td>03/2018</td>
<td>SCAR OSC registration fees for GRAPE participants of which 3 earlier career scientists presenting a paper.</td>
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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)
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.
<table>
<thead>
<tr>
<th>Country</th>
<th>Projects (acronym, starting-end date, 1-sentence description)</th>
<th>Experimental Infrastructure, Station name and coordinates (IF APPLICABLE)</th>
<th>Contact person(s)</th>
</tr>
</thead>
</table>
| **Argentina** | • 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), isletes Debenham (bahia Margarita, costa Fallieres), (68°08’S 67°06’W) | agulisano@dna.gov.ar  
diegogi@dna.gov.ar |
| **Belgium** | • Permanent GNSS network in the frame IceCon project (Constraining Ice Mass Change in Antarctica - since 2012)  
• **ANTION: SUBMITTED** | GNSS receivers at Derwaal 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 |
<p>| <strong>Canada</strong> | 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/chains/pages/stations/ | <a href="mailto:paul.prikryl@unb.ca">paul.prikryl@unb.ca</a> |</p>
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<tr>
<td>Italy</td>
<td>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)</td>
<td>Ionosonde, GNSS for TEC and scintillation monitoring at Mario Zucchelli Station (74.7S, 164.1E, Antarctica); NyAlesund (79.9N, 11.9E, Svalbard), Longyearbyean (78.2N, 15.9E, Svalbard), Concordia Station (75.1S, 123.3E, Antarctica,)</td>
<td><a href="mailto:lucilla.alfonsi@ingv.it">lucilla.alfonsi@ingv.it</a>, <a href="mailto:vincenzo.romano@ingv.it">vincenzo.romano@ingv.it</a>, <a href="mailto:claudio.cesaroni@ingv.it">claudio.cesaroni@ingv.it</a></td>
</tr>
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<td></td>
<td>1) VLNDEF (Geodetic and geophysical survey for geodynamical modelling of Northern Victoria Land) since 1999; 2) MALOX (Mass Lost in wind flux), 2014-2016</td>
<td></td>
<td><a href="mailto:negusini@ira.inaf.it">negusini@ira.inaf.it</a></td>
</tr>
<tr>
<td>Poland</td>
<td>MISTECS (Monitoring Ionospheric Scintillation and TEC on Spitsbergen)</td>
<td>Ionosonde and GNSS receivers for TEC and scintillation monitoring, Hornsund (77.0 N; 15.33E)</td>
<td><a href="mailto:pjak@cbk.waw.pl">pjak@cbk.waw.pl</a></td>
</tr>
<tr>
<td>South Africa</td>
<td>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</td>
<td>HF radar, Magnetometers, GNSS receivers for TEC and scintillation monitoring at SANAE (Antarctica,72.0°S, 2.5°W), Marion Island (Indian Ocean, 46.87º S, 37.86ºE) and Gough Island (Atlantic Ocean, 40.34ºS, 9.88ºW)</td>
<td><a href="mailto:pjcilliers@sansa.org.za">pjcilliers@sansa.org.za</a>, <a href="mailto:siltoz@sansa.org.za">siltoz@sansa.org.za</a>, <a href="mailto:mkosch@sansa.org.za">mkosch@sansa.org.za</a></td>
</tr>
<tr>
<td>UK</td>
<td>GNSS network in the frame of a EPSRC funded project, &quot;GNSS scintillation: detection, forecasting and mitigation&quot;</td>
<td>GNSS for TEC and scintillation monitoring at: Trondheim (63.42N; 10.41E, Norway); Lerwick (60.15N; 01.13W, UK);</td>
<td><a href="mailto:sreeja.veettil@nottingham.ac.uk">sreeja.veettil@nottingham.ac.uk</a>, <a href="mailto:marcio.aquino@nottingham.ac.uk">marcio.aquino@nottingham.ac.uk</a>,</td>
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