

# ReSouRCE

## Radio Sciences Research on AntarCtic AtmosphEre

### The roadmap for a new SRP



Lucilla Alfonsi INGV (Italy) and Nicolas Bergeot (Belgium)  
on behalf of the RESOURCE Planning Group Core Membership

#### MOTIVATION

RESOURCE (Radio Sciences Research on AntarctiC AtmospherE) aims to gather the communities that investigate the polar atmosphere, with particular reference to Antarctica, by means of radio probes into a common shared initiative.

The scope is:

- improve the current understanding of the Antarctic atmosphere sharing the expertise and the experience achieved by several scientific teams in the world, thus facilitating the advancement in the field and avoiding any duplication of activities already in action;
- take advantage of the experience of the Expert Group GRAPE (GNSS Research and Application for Polar Environment);
- build upon the GRAPE legacy 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.

**Sponsoring SSGs:** GeoScience, Physical Science

Expected duration of the programme 8 years

20,000 \$US / year = 160,000 \$US

## **SPECIFIC OBJECTIVES**

While the users of radio devices often consider the atmospheric contribution as a source of error that needs to be corrected, deleted, or mitigated, atmospheric scientists who rely on radio techniques have a common interest:

to isolate the atmospheric contribution and use it in the study of the near-earth space environment.

**RESOURCE** aspires to such common goal to pursue two main scientific objectives:

- 1. To monitor and to investigate the polar atmosphere**
- 2. To support the radio sciences interested in removing or mitigating the atmospheric contribution.**

# THE ReSouRCE OPPORTUNITY

## INSTRUMENTS

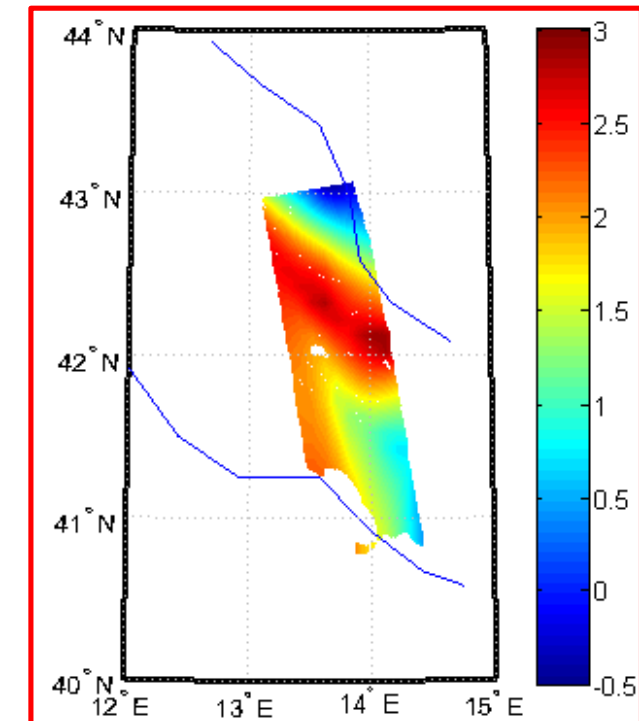
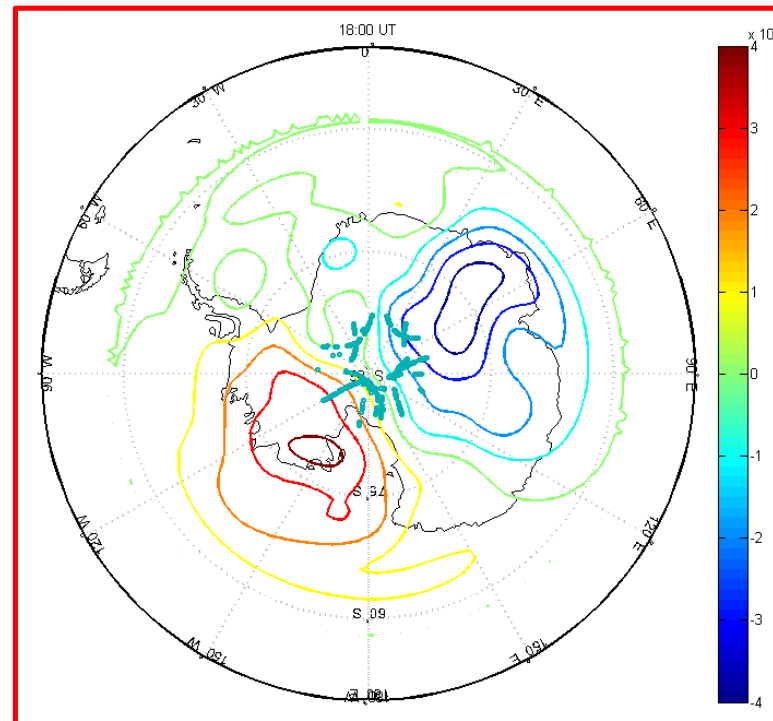
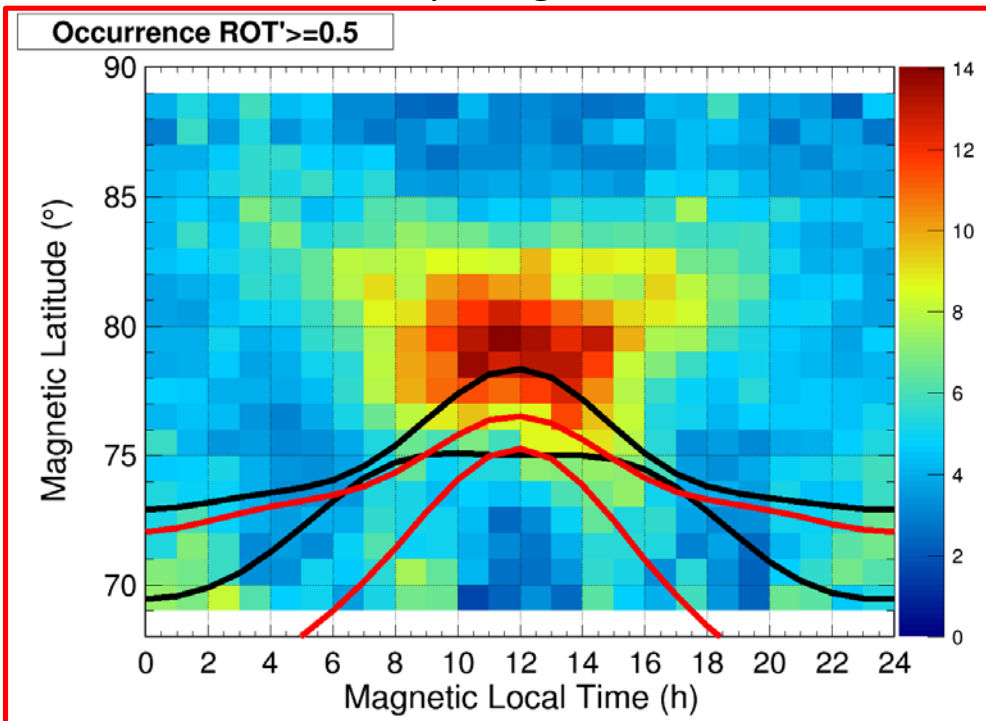
- **Ionosondes:** HF backscattering radars equipped with magnetic loop, rhombic or delta antennas to measure the ionospheric plasma frequency and virtual heights;
- **SuperDARN:** A network of HF over-the-horizon radars that perform experiments individually and collaboratively to measure and monitor ionospheric convection through the observation of ionospheric irregularities.
- **Riometers:** passive radio receivers operating on HF band to measure the ionospheric absorption;
- **GNSS receivers:** L-band dual-frequency receivers;
- **GNSS TEC and scintillation monitors:** L-band dual-frequency receivers equipped with ad hoc firmware for ionospheric monitoring;
- **Geomagnetic observatories** to monitor the geomagnetic field variations due to external origin.



# THE ReSouRCE OPPORTUNITY

## SKILLS

- Analysis of radio occultation data to derive atmospheric characteristics;
- Analysis of space-based measurements to derive electron density, ion and electron temperatures measurements;
- Analysis of P, L, X-bands SAR images to derive ionospheric information;
- Calibration of Total Electron Content measured from different GNSS receivers;
- Computation of the location and velocity (line-of-sight and convective motion) of ionospheric irregularities from SuperDARN
- Derive the Precipitable Water Vapour from the GNSS stations
- Provide a regional model to obtain Precipitable Water Vapour at remote sites where no meteorological data are available
- Use of cloud computing to share data and software



- **RESOURCE Planning Group submitted to SCAR on early March 2020**
- RESOURCE Community is contributing to the preparation of a **joint review paper**
- A summary of the review paper is going to be submitted to SCAR as the **RESOURCE White Paper**

#### White Paper

### Polar atmosphere and Geospace: Present knowledge, infrastructures and future research directions



Authors: N. Bergeot<sup>1</sup>, L. Alfonsi<sup>2</sup>, P. Cilliers<sup>3</sup>, G. De Franceschi<sup>2</sup>, E. Correia<sup>4</sup>, C-F Enell<sup>5</sup>, M. Engebretson<sup>6</sup>, I. Häggström<sup>5</sup>, G. Heygster<sup>7</sup>, Kirsti Kauristie<sup>8</sup>, C. Lee<sup>9</sup>, E. Macotela<sup>10</sup>, F. Marcucci<sup>11</sup>, J. Morton<sup>12</sup>, M. Negusini<sup>9</sup>, E. Pottiaux<sup>1</sup>, P.R. Shreedevi<sup>13</sup>, P. Prikryl<sup>14</sup>, L. Spogli<sup>2</sup>, J.A.E Stephenson<sup>15</sup>, O. Troshichev<sup>16</sup>, R. Van Malderen<sup>17</sup>, S. Zou<sup>16</sup>, the GRAPE EG and RESOURCE future SRP.

(1) Royal Observatory of Belgium, Belgium; (2) National Institute of Geophysics and Volcanology, Italy ; (3) South African National Space Agency, South Africa; (4) National Institute for Space Research, Brazil; (5) EISCAT Scientific Association, Sweden; (6) Augsburg University, USA; (7) Institute of Environmental Physics, Germany; (8) Finnish Meteorological Institute, Finland; (9) Korea Polar Research Institute, Korea; (10) Sodankylä Geophysical Observatory, Finland; (11) National Institute of Astrophysics, Italy; (12) University of Colorado, USA; (13) School of Space and Environment, China; (14) University of New Brunswick, Canada; (15) University of KwaZulu-Natal, South Africa; (16) Arctic and Antarctic Research Institute, Russia; (17) Royal Meteorological Institute of Belgium, Belgium; (18) University of Michigan, USA

**ReSouRCE Planning Group welcomes everybody interested TO JOIN!!!**  
**Contact: [lucilla.alfonsi@ingv.it](mailto:lucilla.alfonsi@ingv.it)**