NATIONAL PROJECT LIST

Directory of International Polar Year (IPY) and International Heliophysical Year (IHY) Activities

South Africa 2007

CONTENTS

Compiled by Marius Potgieter and Arthur Hughes

May 2006

1. Introduction

The intention has been to produce a directory of all those active in Space Physics including Heliospheric Physics and Geospace Physics in South Africa and to catalogue their activities and the stations where they maintain experiments. The aim is to create a comprehensive directory that will be useful in general and to the South African IPY&IHY Committee in particular. We also envisage that the directory will be made available internationally so that contacts can be easily made by overseas researchers.

In 1957 a program of international research, inspired by the International Polar Years of 1882 and 1932, was organized as the International Geophysical Year (IGY) to study global phenomena of the Earth and geospace. The IGY involved about 60,000 scientists from 66 nations, working at thousands of stations, from pole to pole to obtain simultaneous, global observations on Earth and in space. There had never been anything like it before. The year 2007 will mark the 50th Anniversary of the International Geophysical Year (IGY) and 50 years of space exploration. As we also approach the 50th anniversary of NASA, we have established an extensive suite of spacecraft and observatories, our "Great Observatory," which places on the verge of a system-wide understanding of the entire interconnected heliophysical system. Fifty years after the IGY, the world's science community will again come together for an international program of scientific collaboration: the International Heliophysical Year (IHY) and the International Polar Year (IPY), 2007.

Remark: It has been no part of our intention to either leave anyone out or not to catalogue any activity, so if anyone or anyone who knows of anyone who has been omitted would they please let the authors know and the omission will be corrected.

2. Centres of Space Physics

Hermanus Magnetic Observatory (HMO), Hermanus

Geospace Physics and SHARE Radar, Hermanus Magnetic Observatory, P.O. Box 32, Hermanus, 7200

Peter Sutcliffe	psutcliffe@hmo.ac.za
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Elisa Fraser	efraser@hmo.ac.za

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University of KwaZulu-Natal (UKZN), Durban

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Andrew Collier	colliera@ukzn.ac.za

SHARE Radar

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Space Plasma Physics

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Hartebeesthoek Radio Astronomy Observatory (HartRAO)

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Rhodes University, Grahamstown

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Institute for Satellite Applications and Software (ISSA), Grabouw

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Timothy Boyle timothy@issa.org.za, boyle@absamail.co.za

South African Weather Service (SAWS), Pretoria

Full address

G C Schulze schulze@cirrus.sawb.gov.za

University of Cape Town (UCT), Cape Town

Dept of Electrical Engineering, UCT, Postal code, Cape Town

Trevor Gaunt ctg@ebe.uct.ac.za

3. Summary of Group Activities and Equipment

SHARE Radar, UKZN

Project leader: Jon Rash
HF Radar, Sanae , Antarctica; part of the SuperDARN Network

Geospace Physics, UKZN

Project leader: Arthur Hughes
VLF direction finding, geomagnetic pulsations, particle precipitation, lightning detection. RSA, Sanae Antarctica, and Marion Island.

North-West University, USP,

Space and Ionospheric Physics in Antartica

Project leader: Harm Moraal
Four Cosmic Ray Neutron Monitors at Sanae, Antarctica, Potchefstroom and Hermanus, RSA; Tsumeb, Namibia.
Imaging Riometers, auroral imaging, Sanae, Antarctica.

Heliospheric and Space Physics

Project leaders: Marius Potgieter and Adri Burger
Theoretical and numerical modeling. Magneto-hydrodynamic modeling of the heliosphere

HartRAO

Project leader: Ludwig Combrinck
POLENET (Polar Earth Observing Network)
GPS receivers, total electron content, Marion Island and Sanae.
Solar cycle effects of GPS derived ionospheric total electron content observed over Southern Africa

HMO

Geomagnetic Pulsation

Project leader: Peter Sutcliffe
ULF geomagnetic pulsations, RSA and Sanae, Antarctica

Space Physics

Project leader: Peter Sutcliffe
Super Dual Auroral Radar Network (SuperDARN)

Space Weather

Project leader: Pierre Cilliers:
Solar wind, high energy particle precipitation, magnetosphere, ionosphere, and geomagnetic field variations and their effects on radio communication.

Rhodes University

Ionospheric Research

Project leader: Lee-Anne McKinnell
Three ionosondes

4. Project details

HERMANUS MAGNETIC OBSERVATORY

Project
SPACE PHYSICS Project leader: Peter Sutcliffe Members: Pierre Cilliers, Ben Opperman, Shimul Maharaj, Lindsay Magnus, Chris Ndiitwani
Main Research Field and Interest
Ionosphere and magnetosphere, dusty plasmas, magneto-hydrodynamic (MHD) wave modes, ULF waves, HF radars
Research
The Space Physics Group carries out research in order to add to the present understanding of plasma behavior in the Earth's ionosphere and magnetosphere and its impact on Earth. Research methods include theoretical, modeling, and data analysis studies, the results of which are presented at conferences and published in ISI indexed journals. Researchers in the group collaborate with researchers at universities and research institutes, both locally and internationally. The current research fields and collaborations include the following: • Theoretical studies of waves in dusty plasmas: • Studies of ULF waves using ground-based and satellite data • Pc5 field line resonant pulsation observations using the SuperDARN HF-radars • Ionospheric characterisation using dual frequency GPS observations • Modelling of the lower and bottomside ionospheres using the technique of neural networks Research activities and collaborations during IPY/IHY2007 Theoretical studies of waves in dusty plasmas. This research is being carried out in collaboration with researchers at the University of KwaZulu–Natal and the Indian Institute of Geomagnetism (IIG) in Mumbai, India. [Dr Shimul Maharaj: smaharaj@hmo.ac.za) Studies of ULF waves in the magnetosphere using ground-based and satellite data. This research is being carried out in collaboration with researchers at the GeoForschungsZentrum, Potsdam, Germany. [Dr Peter Sutcliffe: psutcliffe@hmo.ac.za , Chris Ndiitwani: cndiitwani@students.hmo.ac.za] Pc5 field line resonant pulsation observations using the SuperDARN HF-radars. The Super Dual Auroral Radar Network (SuperDARN) is an international collaborative network of HF radars that monitors ionospheric plasma convection over the majority of the northern and southern polar regions. South Africa's involvement in SuperDARN is made through the Southern Hemisphere Auroral Radar Experiment (SHARE), which, besides the HMO, also involves the University of KwaZulu-Natal (UKZN) in Durban, the North-West University (NWU) in Potchefstroom, the British Antarctic Survey (BAS) in Cambridge, UK, and the Johns Hopkins University Applied Physics Laboratory (APL) in Baltimore, USA. [Lindsay Magnus: lmagnus@hmo.ac.za] Ionospheric characterization using dual frequency GPS observations. Techniques for real-time mapping of total electron content (TEC) and real-time determination of electron density profiles over Southern Africa are being developed. This research is being carried out in collaboration with researchers at the Department of Electronic and Electrical Engineering, University of Bath, UK and at the Institute of Radio engineering and Electronics (IRE) of the Russian Academy of Science (RAS). [Dr Pierre Cilliers: pjcilliers@hmo.ac.za , Ben Opperman: bopperman@hmo.ac.za] Modeling of the lower and bottomside ionospheres using the technique of neural networks. Researchers at HOIA pioneered this technique for ionospheric modeling. From this research a South African ionospheric model, called the LAM model, has been developed and is currently being implemented in the Direction Finding Systems in industry. Presently, a neural network based model, called IMAZ, is being developed and tested for predicting the lower ionosphere. The research for the IMAZ model is being undertaken in collaboration with the Graz University of Technology in Austria. [Dr Lee-Anne McKinnell: l.mckinnell@ru.ac.za] Solar-wind/magnetosphere interactions. A research project in collaboration with physicists from the Max-Planck Institute for Extraterrestrial Physics (MPE) in Garching, Germany, using data from

the Cluster mission, consisting of 4 identical satellites, has been started after a visit to MPE in August 2005. Events of intense solar-wind magnetosphere interactions have been identified and are currently analyzed to investigate global sawtooth oscillations in the magnetosphere. These sawtooth oscillations are periodic changes in the morphology of the magnetosphere wherein the magnetic field in the inner regions stretches and then rapidly crashes or dipolarizes in about 3 hours and can even be detected in energetic ion measurements. It is envisaged to model these observations by means of a three-dimensional electromagnetic particle simulation code as well as a current wedge model. [Dr Pieter Kotzé: pkotze@hmo.ac.za]

Equipment

Super Dual Auroral Radar Network (SuperDARN)

SPACE WEATHER STUDIES

Project Leader: Pierre Cilliers
Team: Peter Sutcliffe, Andrew Collier, Lindsay Magnus, Lee-Anne McKinnell, Shimul Maharaj, Ben Opperman, Pieter Kotze, Harm Moraal, Piet Stoker, Louis Linde, Trevor Gaunt, Ludwig Combrinck, Richard Wonnacot

Main Research Field and Interest

Space weather observations, models and applications including solar wind, high energy particle precipitation, magnetosphere, ionosphere, and geomagnetic field variations and its effects on radio communications, radio astronomy and 50 Hz power line systems.

Research

Specific research questions addressed by this SANAP IPY/IHY proposal are:
How and where is particle energy from the sun and from the solar wind deposited into the Earth's ionosphere and magnetosphere?
How does the magnetosphere couple to the ionosphere?
How is the geomagnetic field affected by external sources and how can the effects of rapid changes in geomagnetic field on the power grid be modelled and predicted better, leading to improved approaches to mitigate costly damage to the power system and its components?
What are the mechanisms of the influences of these variations, generally referred to as space weather, on satellite technology, radio astronomy, trans-ionospheric electronic communication, power grids and "ordinary" tropospheric weather?
How can data-driven models be implemented to improve the decoding of polar processes that are linked to the ionosphere and the aurora?
How can Global Positioning System (GPS) technology be implemented as a multidisciplinary diagnostic tool to enhance our knowledge of the ionosphere and neutral atmosphere, and produce near real-time imaging of ionospheric total electron content and ionospheric structures?
How do ionospheric scintillations, which affect GPS positioning, radio-astronomy and radio-communications linked to ionospheric dynamics, arise and how frequently do these occur?

- How frequently do mid- and high latitude ionospheric scintillations occur?
- With which magnetospheric and geomagnetic incidents are scintillations correlated?
- Which scintillations are associated with travelling wave disturbances in the ionosphere as identified with ionospheric tomography and ionosonde measurements?
- Which scintillations are associated with events of energetic particle precipitation?
- Are scintillation measurements near the South Atlantic anomaly supportive of scintillation models such as the WBMOD ionospheric scintillation model of North West Research Associates?
- Are scintillation events correlated with whistler events as detected by VLF radio?

Experimental equipment

<u>Multi-instrument observation and modelling of the high latitude ionosphere and magnetosphere:</u>

- A GPS dual frequency receiver be installed on board the SA Agulhas,
- A GPS dual frequency receiver on Marion Island, installed in 2004 by HartRAO, but which needs to be repaired to make it operational again

- A GPS dual frequency receiver currently operational at SANAE IV (previously installed under the SANAP GPS Project by the Chief Directorate Surveys and Mapping (CDSM))
- Multi-frequency scintillation receivers on board the SA Agulhas and at SANAE IV.
- An automated whistler detector at SANAE IV, to be installed during summer 2005.
- A VLF Receiver currently in operation at SANAE IV.
- A new VLF receiver and an automated whistler detector to be installed at Marion island.

Magnetic Field Observations in the polar regions

- Two three-component fluxgate magnetometers, both currently operational at SANAE IV, one on the ice shelf, and one anchored on rock.
- A pulsation magnetometer, currently operation at SANAE IV.
- A suspended dIdD absolute magnetometer to be installed at SANAE IV in 2007.

Ionospheric studies with riometers and aurora imaging

- Cosmic radio noise absorption with a 64-element narrow angle imaging riometer at 38.2 MHz, and broad beam riometers at 51.4 and 30 MHz, currently operational at SANAE IV.
- Auroral events with a low-level white-light, digitized all-sky auroral camera, and a narrow angle (field of view 25°) colour camera, currently operational at SANAE IV.

SAWTOOTH OSCILLATIONS IN THE MAGNETOSPHERE

Project leader: P.B. Kotze

Main Research Field and Interest

Magnetosphere, Interplanetary Magnetic Field, Space Weather. ULF magnetic pulsations

Research

Successively occurring enhancements in energetic particle fluxes and concurrent magnetic field changes are investigated during intervals of sustained southward IMF (Interplanetary Magnetic Field), such as geomagnetic storms and steady magnetospheric convection periods, using data from the CLUSTER satellite mission. This will be complimented by observations at geosynchronous orbit as well as magnetic observatory

Experimental equipment

Cluster Space Mission

University of KwaZulu-Natal

Project

SHARE (SOUTHERN HEMISPHERE AURORAL RADAR EXPERIMENT)
Project Leader: Jon Rash
Team: Dave Walker, Judy Stephenson, Erhard Mravlag, Lindsay Magnus, Sandile Malinga

Main Research Field and Interests

Physics of the Magnetosphere and Ionosphere

Research

The SHARE group uses data from the Sanae HF radar and other radars in the SuperDARN network (see below) to study various aspects of magnetospheric and ionospheric physics. The large field of view and relatively short scan time of the radar make it an ideal ground based instrument for observing motions in the ionosphere in response to processes occurring further out in the magnetosphere. Thus ionospheric convection, and its response to changing interplanetary conditions, is one area of interest. Other studies include atmospheric tides and waves. The major current interest is oscillations, or ULF waves, observed in the radar data. Several data sets have been analysed in detail, using a number of techniques, to understand the modes and other

properties, such as the polarization, of the oscillations. The most significant recent finding has been the observation in the ionospheric radar data of oscillations with frequencies corresponding to those observed in the solar wind. It has been shown that discrete frequencies seen in the solar wind correlate well with field line resonances seen in the radar.
A model has been developed to provide an explanation of the propagation of these pulsations from the solar wind to the magnetosphere.

Experimental equipment in operation

SHARE has operated an HF (8-20 MHz) radar at the South African Antarctic base Sanae (72°S, 3°W) since 1997. This radar uses an array of 16 antennas with dimensions ~15 m to generate 16 directed beams each of width 3.3° and maximum range ~3000 km observing an area of approximately 3 million km^2 of the ionosphere, assumed altitude 300 km, over the Antarctic continent on a time scale of the order of 1 minute per scan. The parameters returned by the radar are backscatter power, Doppler velocity and spectral width in each of 75 range bins over 16 beams. The data may be combined with data from the radar operated by the British Antarctic Survey at Halley to provide two-dimensional ionospheric velocity vectors. SHARE is part of SuperDARN (Dual Auroral Radar Network) and the radar operates in accordance with the agreed SuperDARN schedule.

WAVE-PARTICLE INTERACTIONS IN THE MAGNETOSPHERE

Project leader: Arthur Hughes
Team: Andrew Collier, Remmy Musumpuka

Main Research Field and Interest

VLF waves: propagation and interaction with particles; geomagnetic pulsations; lightning

Research

The association of VLF chorus with substorm particle injections.
The occurrence of VLF whistlers and their relation to their source in lightning
The study of the occurrence of lightning in Southern Africa and its possible variation with solar activity and global warming.
Ground based measurements of Pi2 and Pc5 pulsations and comparisons with pulsations observed on the Cluster spacecrafts.
The occurrence of Pi2 and Pc5 events in relation to solar wind perturbations as measured by the ACE spacecraft.
The study of wave-induced electron precipitation.
VLF experiment to be flown on the SA ZA002 satellite (launch date Dec 2006)
The measurement of magnetospheric electric fields from the drifting of plasma duct enhancements.
The study of pulsations on the Cluster spacecraft.

Experimental equipment

VLF direction finder (Antarctica, since 1990), Pulsation magnetometer (Antarctica, since 1900), phase sensitive receivers (Antarctica, since 2005)
VLF direction finder (Marion Island, Aug 2006), VLF Doppler (Marion Island 2007) with British Antarctic Survey.

North-West University (NWU), Potchefstroom

Project

EXPERIMENTAL HELIOSPHERIC AND IONOSPHERIC STUDIES

Project leader: Harm Moraal
Team: Pieter Stoker, Marius Potgieter, Adri Burger, Stefan Fereirra

Main Research Field and Interest
Cosmic Rays, Neutron Monitor Physics, Heliosphere, Magnetosphere, Ionosphere

Research

Our primary objective for the IHY is "Advancing our understanding of the electrodynamic processes and particle intensities that govern the sun, heliosphere, and near-earth environment". This objective will be pursued by:

1. Continuing to measure the cosmic ray intensity with the Sanae neutron monitor and neutron moderated detector at a cutoff rigidity of 0.8 GV, to facilitate our further study of the 22-year, 11-year, diurnal and other short term variations induced by solar activity and heliospheric dynamics.
2. Supplementing these measurements with similar ones with neutron monitors at Potchefstroom, Hermanus and Tsumeb for studies of cosmic ray intensity variations, noting that the Hermanus neutron monitor recordings go back since the IGY (1957/58).
3. Enhancing the quality of neutron monitor data by intercalibrating the world's neutron monitors against one another with a newly designed and tested calibration neutron monitor.
4. Making use of the unique features of the ice shelf in Queen Maud Land to drill holes to retrieve and analyze the ice for its Beryllium 10 content, which is a proxy for the cosmic ray intensity. This will be compared to the actual neutron measurements back to 1964, in order to measure the Beryllium 10 yield function accurately. This yield function can then be used to derive the cosmic ray intensity, the state of the heliosphere, and solar activity in the distant past, more accurately then is now available.
5. Collaborating in the Global Riometer Array (GLORIA), which is an internationally coordinated programme to study the coupling mechanism between the solar wind, magnetosphere and the ionosphere on a global scale from the perspective of energetic particle precipitation. Institutions included in this international collaborative program are from the UK, Canada, USA, Japan, China, Norway, Denmark, Italy, Germany, Finland, and South Africa. Building our investigations on our successful SANAP projects which have been operating at SANAE, Antarctica, from 1964. H. Moraal and P.H. Stoker of North-West University, Potchefstroom campus will continue their scientific activities of the past with the current suite of experiments at Sanae IV. The instruments consist of: a 64-element narrow angle imaging riometer at 38.2 MHz, and broad-beam riometers at 51.4 and 30 MHz, a low-level white-light, digitized all-sky auroral camera, and a narrow angle (field of view 25 degree) colour camera, two three-component fluxgate magnetometers.
6. In addition to the measurements in (4) and (5) above, we will also make use in our scientificendeavour of the recordings of Prof. J.P.S. Rash with the Share HF radar experiment and Prof. A.R.W. Hughes of Durban with the pulsation magnetometer and a very low frequency (VLF) experiment, both of the University of Kwazulu-Natal.

Equipment
Four neutron monitors, Several Riometers

COSMIC RAY ACCELERATION, PROPAGATION AND MODULATION IN THE HELIOSPHERE

Project leaders: Harm Moraal and Marius Potgieter
Team: Adri Burger, Stefan Ferreira, Ulrich Langner, Ingo Buesching

Main Research Fields and Interest
Space Physics, Heliospheric physics, Space Weather, Astrophysics, Computational physics

Research

The physics of the propagation and modulation of cosmic rays in the heliosphere is studied with state-of-the-art numerical models. Cosmic rays are used as probes to gain knowledge of the origin of high energy cosmic rays and how they react to the heliospheric magnetic field carried outwards by the plasmatic solar wind. This study further provide information about the charateristics of locally formed cosmic rays, of the heliospheric structure as an example of typical astrospheres, of the geometry of the solar magnetic field, and the underlying microphysics of the trubulence imbedded in the solar wind.

Cosmic Rays in the Inner heliosphere: This project is strongly related to the Ulysses mission, in particular the observations made by the COSPIN-KET telescope/detector on board this spacecraft.

Numerical models have been developed to simulate e.g., the electron and proton/helium observations between 1 MeV and 5 GeV. These models are successful in explaining the detail physics behind charge-sign dependent modulation and the small latitudinal gradients for cosmic rays in the inner heliosphere (up to 10 AU). The study includes the Jovian magnetosphere as a relatively strong source of low energy electrons which serve as a direct tool to understand the diffusion process of the particles. The project will continue until the end of the Ulysses mission.

Physics of the Outer Heliosphere: The interaction between the solar wind and magnetic field with the local interstellar medium creates the heliosphere. The plasmatic solar wind is supersonic and causes a termination shock when it subsides to a subsonic velocity. The balance between the heliospheric and interstellar pressure causes the heliopause which can be considered the heliospheric boundary. These features of the outer heliosphere are presently being sampled by the two Voyager spacecraft, in particular the crossing of the termination shock by Voyager 1 in December 2004 and its entering of the heliosheath. The physics of the outer heliosphere is studied using state-of-the-art numerical models, and galactic and anomalous cosmic rays as probes of the fine-structure of the magnetic field and solar wind characteristics.

MAGNETOHYDRODYNAMIC MODELLING OF THE HELIOSPHERE

Project leader: Stefan Ferreira
Team: Marius Potgieter, Jasper Snyman

Research

In this project different numerical codes are developed, refined and applied to model the interaction of the solar wind with the local interstellar medium. This interaction creates the heliosphere which can be seen as a 'bubble' in the interstellar medium filled with the solar wind plasma and its magnetic field. The heliosphere includes two important structures, the termination of the solar wind flow (the heliopause as an outer boundary), and a transition from supersonic to subsonic speeds (termination shock). Of special interest is the effect of the different fluids (e.g. protons, neutral Hydrogen and pickup ions) on these structures, as well as the transport and acceleration of cosmic ray particles inside the heliosphere. These models also include dynamic effects, e.g. the dissapation of the fast solar wind above the solar poles over a solar cycle and solar cycle related changes in the heliospheric magnetic field. Taking these into account, time dependant cosmic ray modulation can be studied and compared to different spacecraft observations. It is important to know for manned spacecraft missions the background particle radiation and also for the solar-terrestrial link where cosmic ray particles influence Earth's climate.

AB INITIO MODULATION STUDIES FOR THE HELIOSPHERE

THE STRUCTURE OF THE HELIOSPHERIC MAGNETIC FIELD

Project leader: Adri Burger
Team: Mariette Hitge, Marius Potgieter, Harm Moraal, Stefan Ferreira

Research

Theoretical models for the heliospheric magnetic field are developed, with starting point the processes on the Sun that determines the characteristics of the trajectories of magnetic field footpoints on the so-called source surface. These hybrid Fisk-type fields are implemented in three-dimensional numerical modulation models to determine the effects on cosmic-ray modulation as function of position in the heliosphere and of energy. Particle observations are therefore used to probe the structure of the heliospheric magnetic field. So far Fisk-type fields are able to explain properties of 26-day recurrent cosmic-ray variations as observed by the Ulysses spacecraft. A next step is to determine how Fisk-type fields influence the propagation of Jovian electrons.

Ab initio modulation studies, by definition, attempt to explain the modulation of cosmic rays from first principles. The scope of this project is such that some aspects are focussed upon while others have to be neglected at first. The current focus is on the properties of the diffusion tensor and the turbulence quantities that it depends upon. Theoretical predictions for the elements of the diffusion tensor are compared with results from numerical simulations, using a particle code originally developed at the Bartol Research Institute of the University of Delaware. Theoretical predictions for the spatial evolution of turbulence quantities are also compared with available in situ observations.

The resulting diffusion tensor or approximations thereof are implemented in the numerical modulation models developed at North-West University. The output of the latter models is compared with cosmic-ray observations and is used as a diagnostic to determine whether the diffusion tensor and it associated turbulence quantities are appropriated for the heliosphere.
Equipment for above mentioned projects
Experimental data from spacecraft such as Ulysses and Voyager 1&2 are used. PC-cluster. Model results are compared to plasma, magnetic and particle observations onboard various spacecraft like Ulysses, SOHO, the Voyager and Pioneer missions.

HARTEBEESTHOEK RADIO ASTRONOMY OBSERVATORY, HARTRAO

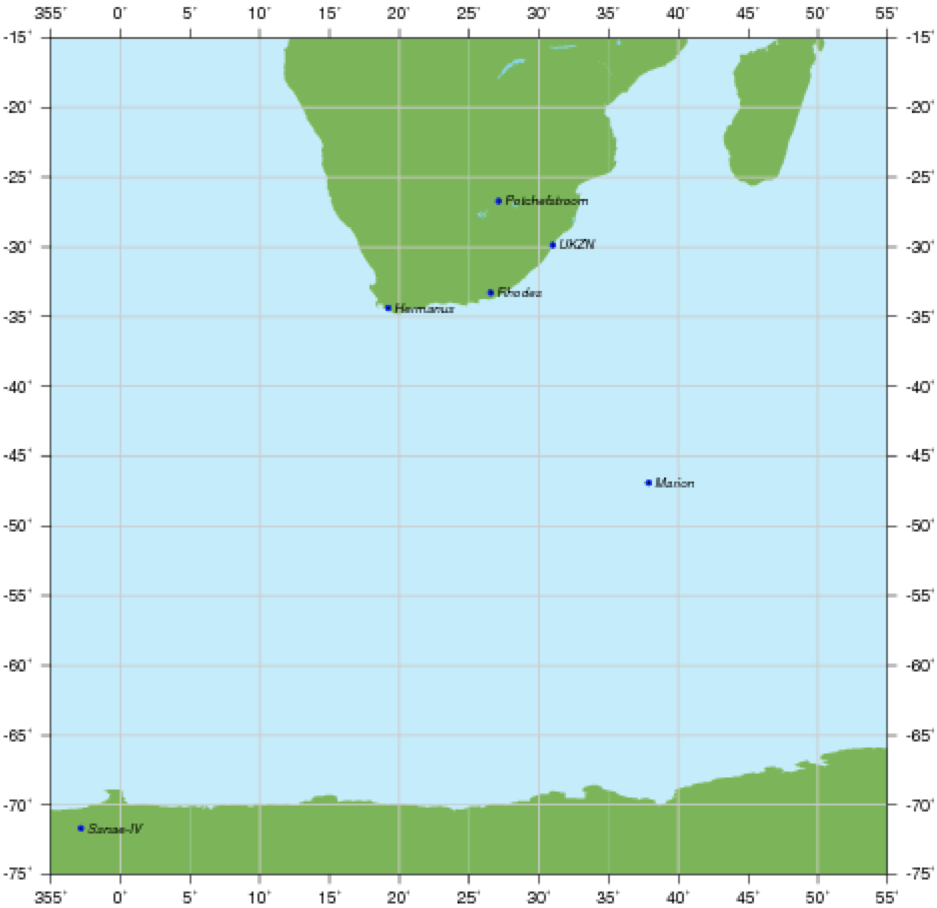
Project
POLENET (Polar Earth Observing Network) Project leader: Ludwig Combrinck Team:
Main Research Field and Interest
Space Geodesy, Ionosphere, Global Positioning System, Space Weather
Research
Within the POLENET (Polar Earth Observing Network) project, we plan to: Install GPS receiver and tide gauge on Marion Island. This project will provide valuable data to scientists doing Total Electron Content studies, will measure integrated water vapour for assimilation into numerical weather prediction models, and will provide calibration ties between the existing French DORIS station, as well as provide ocean level data which will be corrected by the GPS system for vertical crustal movement. Collocate a Water Vapour Radiometer with the VLBI and GPS system at O'Higgins (Palmer peninsula) for comparison of water vapour as determined from the three space geodetic techniques. Within the SANAP proposal SNA2005081500001 for participation in ICESTAR/IHY/UAMPY entitled "Polar Space Weather Studies during IPY/IHY" with collaborators (P Cilliers et.al.) we have also proposed the installation of the GPS receiver on Marion Island. The tide gauge was not included here as it missed the 'theme'.
Equipment
Within the SANAP proposal SNA2005081500001 for participation in ICESTAR/IHY/UAMPY entitled "Polar Space Weather Studies during IPY/IHY" with collaborators (P Cilliers et.al.) we have also proposed the installation of the GPS receiver on Marion Island. The tide gauge was not included here as it missed the 'theme'.
SOLAR CYCLE EFFECTS OF GPS DERIVED IONOSPHERIC TOTAL ELECTRON CONTENT OBSERVED OVER SOUTHERN AFRICA Team: Lee-Anne McKinnel, Daniel M. Moeketsi
Main Research Field and Interest
Solar-Terrestrial Physics, Space Physics, Heliosphere, Cosmic rays, Ionosphere, Global Positioning System, Space Weather, Space Geodesy
Research

Solar activity cycle effects of Global Positioning System (GPS)-derived ionospheric total electron content (TEC) observed over Southern Africa will be investigated and discussed in great detail using the University of New Brunswick ionospheric modelling Technique. The available data from the Southern African dual frequency GPS network will be used in the study. The TEC results obtained in this way will be compared with other techniques such as the International Reference Ionosphere (IRI) predictions and the Ionosonde TEC measurements over South Africa. The ultimate goal of this study is to use TEC values obtained from GPS to estimate ionospheric contributions on the astronomical VLBI observations at Hartebeesthoek Radio Astronomy Observatory geodetic site during different periods of solar cycle 23.
Equipment
Southern African Development Community and IGS Network of GPS dual frequency receivers (Data available from 1998 - present).South Africa Ionosonde located at Grahamstown, Louisvalle, and Madimbo (Long term data records).Data from instrument aboard Spacecraft and Geostationary Satellite such as SOHO, GOES etc. will be used during the investigation.

5. South African Station locations and their conjugates

Station	L-Value	Location	Conjugate
Sanae IV	4.36	71.67 S 2.83 W	57.23 N 42.85 W
Marion Island	2.63	46.88 S 37.86 E	55.65 N 16.13 E
Hermanus	1.84	34.40 S 19.22 E	47.35 N 6.54 E
Rhodes	1.71	38.80 S 27.97 E	45.43 N 19.34 E
UKZN	1.67	29.87 S 30.98 E	44.71 N 23.30 E
Potchefstroom	1.56	26.72 S 27.10 E	42.68 N 20.88 E

Map showing the location of South African geophysical stations



6. Web Links

Hermanus Magnetic observatory: http://www.hmo.ac.za

Hartebeesthoek Radio Astronomy Observatory: http://www.hartrao.ac.za

Unit for Space Physics, North-West University:
http://www.puk.ac.za/fakulteite/natuur/fisika/navorsing_e.html

South African Astronomical Observatory: http://www.saao.ac.za

National Research Foundation: http://www.nrf.ac.za/

South African Weather Service: http://www.weathersa.co.za