



UAMPY: a contribution to the ICESLAR/IHY activities for the International Polar Year 2007-2008



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WHAT IS UAMPY?

UAMPY (Upper Atmosphere Monitoring for Polar Year 2007-2008) was an Expression of Intent submitted on January 14, 2005 to the IPY joint Committee. After a positive and encouraging outcome of the IPY evaluation and the incorporation of idea 95 ("Multi-instrument observation of the high latitude ionosphere", proposed by Pierre J. Cilliers), UAMPY is now part of the IPY core project: "ICESLAR/IHY", which was endorsed by the IPY joint committee in November 2005.

WHAT ARE ITS PRINCIPAL AIMS?

UAMPY would be an example of the necessary international cooperation to develop a polar upper atmosphere observation network on both the hemispheres. The UAMPY team could allow unprecedented observation of the polar ionosphere, with extended auroral and polar coverage, making possible the mapping of ionospheric features from mid- through polar latitudes and studies of associated polar ionospheric processes. The project includes a unique ability to monitor polar scintillation globally, providing the opportunity to study the ionospheric irregularities causing degradation on HF Radio Communications and trans-ionospheric signals. Scintillation is a significant concern for trans-polar navigation and communication. The potential exists for numerous new studies - both scientific and practical investigations.

WHO ARE THE PROPOSERS?

UAMPY is actually proposed by: INGV (Istituto Nazionale di Geofisica e Vulcanologia – Rome, ITALY), IFAC/ISC-CNR (Istituto di Fisica Applicata "Nello Carrara"/Istituto dei Sistemi Complessi, Florence, ITALY), UNIVERSITY OF BATH (UK), SRC-PAS (Space Research Center, Polish Academy of Sciences Warsaw, POLAND), UNIVERSITY OF CALGARY (CANADA), HMO (Hermanus Magnetic Observatory, Hermanus, SOUTH AFRICA) together with other participants from South African including ISSA (Institute for Satellite and Software Applications), HartRAO (Hartebeesthoek Radio Astronomy Observatory), NWU(Northwest University), UKZN (University of KwaZulu-Natal in Durban), UP (Department of Electrical, Electronic and Computer Engineering, University of Pretoria), CDSM(Chief Directorate Surveys and Mapping, South Africa), and UCT(Department of Electrical Engineering, University of Cape Town).

WHICH KIND OF INSTRUMENTS THEY MANAGE?

These groups manage several experimental observations in the **Arctic and in Antarctica**: GPS scintillations receivers at Ny Alesund (Svalbard, Norway), at the Italian Station "Mario Zucchelli" (Terra Nova Bay, Antarctica) and at the EISCAT sites in Tromso, Kiruna and Sodankyla and one to be installed at the South African Station (SANAE IV, Antarctica) in December 2006; ionosonde, scintillation receivers and magnetometer at the Polish Polar Station in Hornsund (Svalbard); the Canadian GPS Network for Ionosphere Monitoring (CANGIM); riometers and a digital ionosonde AIS-INGV (Advanced Ionospheric Sounder INGV) in Antarctica at the Italian Station "Mario Zucchelli"; magnetometer, riometer, GPS dual frequency receivers, VLF receivers with automatic whistler detectors and HF Radar (part of the SuperDARN network) at the South Africa observatory at SANAE IV in Antarctica.

WHAT ARE THE RECENT ACHIEVEMENTS OF THE UAMPY TEAM?

In January 2006 the INGV group has installed another GISTM (GPS Ionospheric Scintillations and TEC Monitor) receiver in Antarctica at "Mario Zucchelli" station, giving hopefully the unique opportunity to monitor the ionospheric scintillations over both the poles. For Polar Year 2007/8 the Antarctic scintillations monitoring could be realized as a permanent station. The INGV group is working on the realization of a DATABASE to collect mid and high latitudes upper atmosphere observations acquired by all INGV instruments (see the UAMPY proposal attached for details). The DB will be accessible via the INGV web pages, enriching the facilities to be offered to the IPY community in 2007/8.

The Space Research Center, the ISC-CNR and the INGV are jointly working on a model to forecast the ionospheric scintillations over the poles based on ion density in situ data and tested on INGV GPS measurements. The UAMPY consortium within ICESLAR/IHY project could support the work in progress with data, expertise and know-how exchange. In such a way the model could be provided to the scientific community to be tested during the IPY 2007/8.

The HMO has collected measurements by a GPS dual frequency on board the SA Agulhas research vessel recording data at 1 second sampling intervals for characterization of the ionosphere during its transit from Cape Town to SANAE IV (South Africa Antarctic station) during the period 1 to 15 December 2005. This is a trial run for a similar experiment which forms part of the proposal for IPY/IHY 2007. "The data was successfully retrieved upon the return of the ship to Cape Town on 21 February 2006. A team from the South African consortium left for Marion Island on 6 April 2006 for the installation of a dual frequency GPS receiver on the Island. GPS TEC measurements were made on board the SA Agulhas during the transit to Marion Island. The South African consortium have applied for a broadband link to be in place by IPY for real-time access to the data on board the SA Agulhas and at Marion Island and Antarctica." During a recent campaign in November 2005, the University of Calgary has installed an additional GPS scintillation monitor in Antarctica, at the South Pole station. Personnel from the USGS (US Geological Survey) installed and operated this receiver at their research station. High-latitude scintillations have been characterized using several years of data from the CANGIM, and collaborations with researchers at MIT Haystack Observatory have been conducted to investigate mechanisms for high-latitude scintillations during storm enhanced density events. A focus of current research is the design of improved GNSS receiver technologies for reliable tracking performance during periods of high-latitude scintillations. A team of faculty members and graduate students have developed a GPS software receiver with capabilities for both simulation studies and real-time operation. Scintillation models have been developed for simulations, and the software receiver allows flexibility in easily reconfiguring tracking loops for optimal performance. Additional capabilities are being developed for this software receiver, to study and develop reliable methods for tracking new GPS and Galileo signals during scintillations.

WHAT ABOUT THE NATIONAL ENDORSEMENTS AND FUNDINGS?

Italian Government is evaluating the possibility to provide extra funds (supplementary respect to the ordinary funds for scientific and technological Italian activities) to PNRA (Italian National Program for Antarctic Researches) to support Italian participations to IPY initiatives. Moreover the Italian Government is going to establish a National Committee to choose the IPY initiatives to be endorsed.

The HMO has received from the South African Department of Science and Technology, a copy of a letter from the Minister of Science and Technology of South Africa, Mr Mosibudi Mangena, directed to Dr T Rosswall, ICSU Executive Director, in which the role of the HMO in the proposal 'Upper Atmosphere Monitoring for Polar Year 2007/8' (UAMPY) for participation in IPY 2007/2008 as part of the ICESLAR/IHY consortium has been endorsed. SANAP proposal for participation in ICESLAR/IHY/UAMPY entitled "Polar Space Weather Studies during IPY/IHY" has been accepted on February 2006. Funding for 2006 and 2007 has been approved for most of the proposed activities and one overwintering expedition member for Antarctica for the 2006/2007 period has been allocated, enabling the RSA consortium to play an active role in the International ICESLAR/IPY project during IPY2007-2008.

