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Attachment(s):
(1) "2013 MAGDAS School", 400 KB pdf, one page.
(2) "Bisulco Article", 620 KB pdf, 3 pages.
(3) "SPACE RESEARCH IN AFRICA", 2.9 MB pdf, 9 pages.

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----------------------------------------------------------------
:                      Re:
:                      (1) 2013 ISWI/MAGDAS School in Africa
:                          -- F i r s t   C i r c u l a r
:                      (2) Application of the SID monitor
:                          -- high school science project
:                      (3) Report by Dr Christine Amory on
:                          space research in Africa, 2007-2012.
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Dear ISWI Participant:

There are three items today:

1.
The 2013 ISWI/MAGDAS School will be conducted in the nation of
Cote d'Ivoire this year September. First Circular is attached.
The host of this school is Prof. Vafi DOUMBIA, Universite de Cocody,
UFR-SSMT Laboratoire de Physique de l'Atmosphere, 22 BP 582,
Abidjan 22, Cote d'Ivoire, Africa.
2.
The SID monitor is an ISWI instrument (see the ISWI website for
more details). SID monitors have been deployed throughout the
world. Attached is a report written by a high school student
who used the SID monitor for a science project. The report is
remarkable, as is the project. A short excerpt:
: Preface: Amongst the instruments distributed through
: the ISWI are the SID space weather monitors. Designed
: to detect changes to the ionosphere caused by solar activity,
: these monitors are being distributed to high school and
: early college students around the world. Over 700 instruments
: have been placed, and requests continue to come in.
3.
Finally, attached is a fine report by Dr C. Amory-Mazaudier about space
research in Africa during the years 2007-2012. The abstract goes
like this:
:----------------------- Abstract -----------------------
: This article presents the results of a research network
: Europe Africa established in 1995 after the International
: Electrojet Equatorial Year (1992-1994). During the last
: decade, this research network has been involved in
: two international projects: the International Heliophysical

: Year (2007-2009) and International Space Weather Initiative
: (2010-2012). The participation in these international projects
: increased the number of PhD and multiplied the number
: of scientific papers. Many scientific results have been obtained.
: Teaching and working methods have been also developed. We
: emphasize in this article the last two points.

Most cordially yours,
. George Maeda
. The Editor
. ISWI Newsletter

FINAL VERSION FOR ISWI Newsletter DISTRIBUTION

JSPS Core-to-Core Program
2013 MAGDAS / ISWI School in Africa
September 23-27, 2013

Important dates:
First circular: Mai 30, 2013
Abstract submission deadline: July 31, 2013

Organizing Committee:
Assamoi Paul, Akimasa Yoshikawa, George Maeda, Vafi Doumbia, Obrou Olivier, Kobéa Arsène. Ayman Mahrous.

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- Université Félix Houphouet Boigny,
- ICSWSE of Kyushu University
- JSPS Core-to-Core Program, B. Asia-Africa Science Platforms.

Summary
This space science school is aiming to address the major topics that are related to the Sun-Earth system. Courses will cover Solar Physics, Magnetosphere, Ionosphere, Geomagnetism, coupling processes and impact of Space Weather on the electromagnetic environment of the Earth.

Venue: N'Sa Hotel, Grand-Bassam, **Cote d'Ivoire**
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- First Circular -

Real Time Solar Flare Analysis

Anthony Bisulco
Commack High School, New York, NY USA

Preface: Amongst the instruments distributed through the ISWI are the SID space weather monitors. Designed to detect changes to the ionosphere caused by solar activity, these monitors are being distributed to high school and early college students around the world. Over 700 instruments have been placed, and requests continue to come in.

Many of the students who receive these monitors are doing amazing research with them. What follows is an article by a high school student at Commack High School in New York, USA. The student author, Anthony Bisulco, started using a SID monitor last year and developed an interest in solar flares and radio technology. He is in 11th grade now and has put together an elaborate science project based on his SID. Earlier this year he entered his project in the very competitive Long Island Science and Engineering Fair. His project, "A Practical Notification System to Identify Incoming Sudden Ionosphere Disturbances", won first place in his category! He was selected to attend the International Science and Engineering Fair held in Phoenix. Anthony's teacher, Richard Kurtz, reports "This is a fantastic opportunity and honor and we thank you for your support over the years." Congratulations go both to Anthony and to his teacher, Richard Kurtz, who has encouraged many high-achieving SID students over the years.

Below is an article Anthony has written about his project.

Deborah Scherrer
Stanford University Solar Center
Director of the SID Project

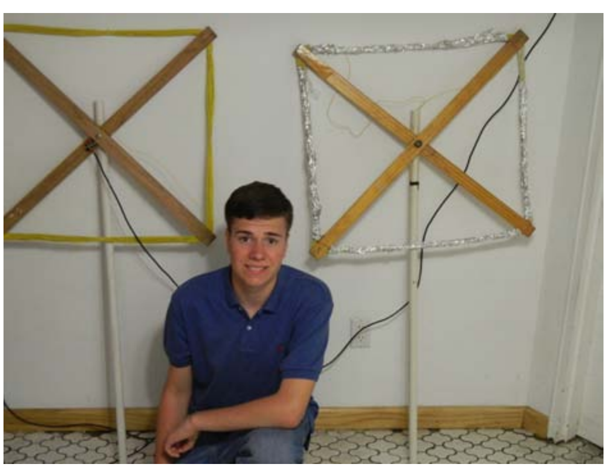

Figure 1. Antennas built to obtain Very Low Frequency waves

My name is Anthony Bisulco and I am an 11th grade student at Commack High School on Long Island, NY. This year I became interested in radio propagation because I had just finished getting my ham radio licensee. While learning the material for my ham license I read about radio blackouts, which intrigued me. Radio blackouts occur when particles, coming from solar flares from the Sun, hit and ionize the Earth's ionosphere. Soon after I began researching different radio blackout occurrences I realized that not only do solar flares have the potential to affect radio waves on Earth but they also can have major negative impacts on a wide range of electrical systems. When I read about an incident in Quebec in 1989 where the entire Quebec power grid was knocked out by a solar flare, I was curious to see if there could be a way to warn people when these events were about to occur to reduce the damaging effects of solar disruptions.

I conducted a literature search to find out if there were any methods in use to predict solar flares. One method currently used employs the Solar and Heliospheric Observatory (SOHO) satellite [*the Stanford group has the MDI instrument on SOHO*]. I questioned what would happen to the ability to warn people of solar flares if a solar event or cosmic rays disabled SOHO. Given this possibility I decided to design a simple inexpensive warning system. My teacher introduced me to the Stanford Solar Center that makes available a device through the Society of Amateur Radio Astronomers (SARA) known as the Super SID. The Super SID is a program that detects solar flares using Very Low Frequency (VLF) wave propagation. I built a 1-meter loop antenna with 50 turns of copper enameled wire with a custom designed PVC base. I connected the antenna wires to the Super SID and computer and tried to collect data. I was initially disappointed because I did not receive any of the signals from the VLF stations. So I contacted the Stanford Solar Center support team and after I spent the summer debugging my system. I finally figured out that the webcam on my computer was the problem because it was recording the audio data being sampled.

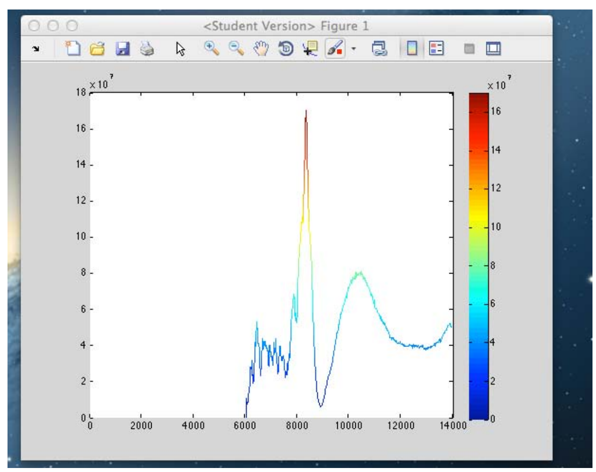

Figure 2. Solar Flare Data Real Time Analysis

Now with a working system I was finally able to start my investigation. I started to collect data though I became frustrated with having to plot the data and look for solar flares manually and I wondered whether or not plotting could be done automatically. At this point I developed my research goal, which was to develop a computer program that could take in the signals from the Super SID in real time and identify the solar flare from the plotted data. To do this I first found that I had to isolate one station to look for an increase in signal strength. I used a mathematical transformation called the Fourier transform that takes the received signals from the voltage domain and puts it into the frequency domain. I then took one of the frequencies from the Fourier transform and plotted against time to look for increase in signal strength. I had the computer calculate the rate of change of the Fourier function to help identify this. To make this more universal I then created a twitter feed that indicates in real time if a solar flare has erupted. This could warn people, who have responsibilities related to electrical and communication systems that could be affected by solar disturbances about an incoming flare.

Acknowledgements: I would like to thank Richard Kurtz, Doctors Fred and Barbara Kruger and my parents. Richard Kurtz has guided me and helped me so much throughout the past year. Without Richard Kurtz I may have not ever have been able to begin my research on solar flares which has allowed me to gain a wealth of knowledge in many different disciplines of science. I would also like to thank Doctors Fred and Barbara Kruger for helping me understand the theory behind the SID receiver and for helping me improve my research paper and board so that I could perform my best at science fairs. Finally I would like to thank my parents for always supporting me in no matter what I do.

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ISWI Newsletter

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SPACE RESEARCH IN AFRICA
SOME ACHIEVEMENTS FROM 2007 to 2012

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Abstract

This article presents the results of a research network Europe Africa established in 1995 after the International Electrojet Equatorial Year (1992-1994). During the last decade, this research network has been involved in two international projects: the International Heliophysical Year (2007-2009) and International Space Weather Initiative (2010-2012).The participation in these international projects increased the number of PhD and multiplied the number of scientific papers. Many scientific results have been obtained. Teaching and working methods have been also developed. We emphasize in this article the last two points.

Introduction

It was at the Vancouver conference in 1987, that the Inter divisional Commission for Developing Countries ICDC of International Association for Geomagnetism and Aeronomy (IAGA) has asked the international community to develop studies on the equatorial electrojet and International Equatorial Electrojet Year (IEEY) was organized to answer to this attempt. Instruments were deployed in West Africa (Amory-Mazaudier et al., 1993) and many scientific results obtained (Amory-Mazaudier et al, 2005). This first project has trained researchers of Benin Senegal Ivory Coast and France. Research teams have been formed in various African countries and research continued. In 2005, researchers of the International Group Europe Africa have been contacted by the international community to develop Heliophysics (http://ihy2007.org) and Space Meteorology in Africa (http://iswi-secretariat.org).This paper presents the organization of the work in these two last projects and includes in three parts: 1) deployment of scientific GPS instruments, 2) training and 3) results. The three projects IEEY, IHY and ISWI are part of the United Nations Basic Space Science Initiative program (http://www.oosa.unvienna.org).

Deployment of scientific instruments

Under the first IHY project (2007-2009), the work of international coordination began in 2005 (. A fundamental objective was to identify the different African institutions and scientists capable of maintaining scientific instruments and data sharing.. The principle is to distribute a large number of few expensive scientific instruments, to develop networks of geophysical measurements in Africa, (Harrison et al., 2005; Davila et al., 2007; Kitamura et al., 2007).
We report here on the GPS networks .Two GPS networks participated in IHY project:
1) AMMA network (http://www.amma-international.org)
2) SCINDA network (http://www.fas.org.org/spp/military/program/nssrm/initiatives/scinda.htm).
To facilitate the work and the sharing of data it was recommended to equip laboratories with dual frequency GPS receiver 4004B and use the standard RINEX format for the data. It was also recommended to facilitate the exchanges, to put the data on the web. GPS data are interesting for

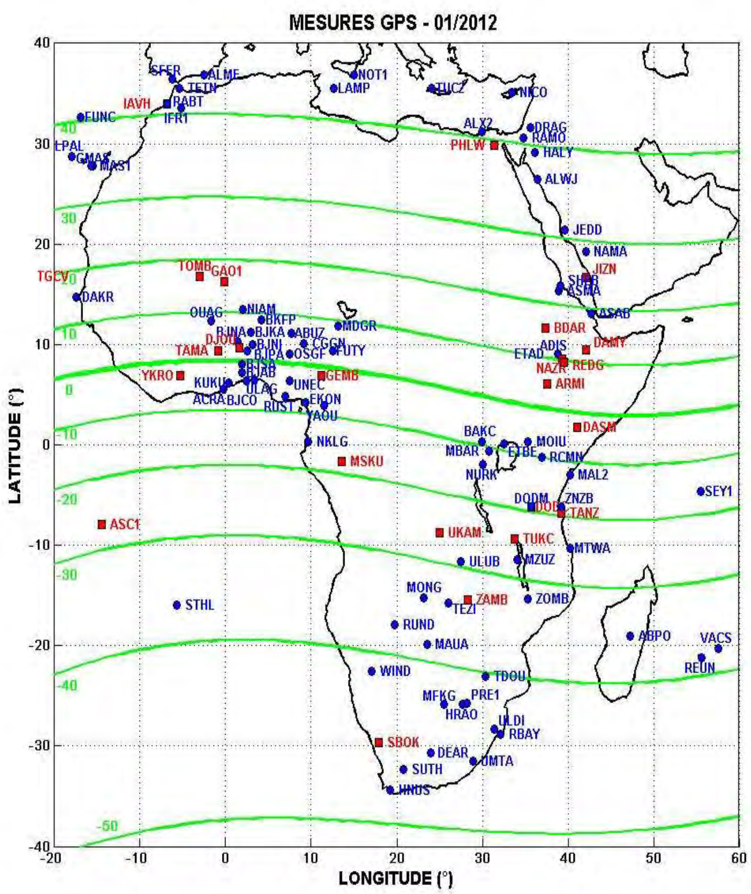
different communities (radio navigation, geodesy, ionosphere, atmosphere etc ...), so it seemed important to work in an interdisciplinary framework.

This international project has identified communities interested in using GPS and helped to increase the number of GPS data shared via the internet. In 2007 Amory-Mazaudier et al. (2008) identified 35 GPS stations in Africa (20 on the web) from different networks (SCINDA: 9, AMMA: 6, UNAVCO+NOAA+IGS: 19, Telecom Brest: 1). Figure 1 shows the number of GPS stations shared on the web in early 2012, more than 100. In figure 1, the red points represent the stations installed in 2011 (23 stations). The AMMA GPS network is now on the web included in the IGS network (IGS International Geodetic Survey). The significant increase of GPS stations in Africa is due to the UNAVCO. There is now an open archive for African GPS data in RINEX format: www.afrefdata.org. AFREF is the African geodetic Reference Frame.

We must note here that many existing GPS stations are not yet shared via the internet (*Egypt: 9 GPS, Morocco: 15 GPS, South Africa: 50 GPS, Algeria: ~ 50 GPS etc* ...).

This is a next goal: the sharing of all GPS data from Africa.

Figure 1: GPS receivers in January 2012
(from Rolland Fleury)



GPS websites

IGS:

http://sopac.ucsd.edu

http://cddis.gsfc.nasa.gov **http://igs.ensg.ign.fr**

NOAA et UNAVCO

http://www.ngs.noaa.gov/CORS **http://www.unvaco.org**

Training

Training was one of the major objectives of the program UNBSSI. This led to the formation of many scientists in the Space Sciences in Africa and the creation of many research teams. In this part we present the training developed in the IRGGEA network.
The main objective of IRGGEA schools is to improve the level of research in the countries concerned and to enable African scientists to participate in and contribute to international projects.

The key points are:

- the competence to use existing data sets and tools related to studies of Space Weather.
- the use of data recently collected in Africa by African scientists, and the data existing in the database. It is estimated that the use of existing data within 10%.
- Use the results of space weather combining ground data and satellite data, research and sustainable development (eg use of GPS for geophysical studies, navigation, etc ...)

To achieve these objectives, the course included:

- Lectures on the scientific understanding of the measures, information that can be extracted from the data and examples of applications in Space Weather.
- Computer labs for the use of existing databases as SPIDR, IRI, IGRF, etc ...

To meet these objectives, the school has:

- Understand the solar physical processes and their actions on the environment near Earth: magnetosphere, ionosphere, atmosphere,
  - *Knowing the recent discoveries about the sun,*
  - *Study the impact of the Sun on the Earth's plasma environment,*
  - *Understand the sun's influence on Earth's atmosphere,*
  - *Knowing other uses of measuring instruments useful for the development as GPS for navigation*
- Use the existing relevant data in different databases and the old data with the instruments deployed within the current International Projects data.

Table 1 present the different schools organized within the framework of this research network. There are three types of training.

1) <u>Schools introducing to Space Weather</u>, with training on the use of GPS, GIS, databases and new technologies; students attending these schools come from different disciplines and exercises are organized by grouping students according to their discipline.

2) <u>Highly specialized schools on GPS data processing</u>: the training is provided by the institute of Telecommunications at Brest. Few PhD students participate in the school with their own data.

3) <u>Schools on the physical relationship of the sun earth system</u>, trying to highlight the impact of the sun on the Earth's electromagnetic environment. The training is for students in M2.

All schools include lectures on fundamental physics and practical work in small groups.
Except for the school in Morocco, organized with the CRASTE-LF, all the schools organized in a country are financially supported by the country. Column 4 gives the percentage of the contribution of the country. In general the students participating to a school are mainly from the country where the school took place, only few students are coming from closer countries.

Table 1 : IRGGEA Schools

Scientific project	Country/year	Training Organizer in the country	Participants	Main financial supports
IEEY	France 1992	Physical process in the Sun earth system + technical training in laboratories PhD students / 6 weeks **Christine Amory-Mazaudier**	5	France ~100%
IEEY	Côte d'Ivoire 1995	Physical process in the Sun earth system/2 weeks Students M2 **Antoine Achy Séka**	30	Côte d'Ivoire ~ 50% France
IHY	Congo 2009	GPS, GIS and Introduction to Space Weather/ 7 days **Bienvenue Dinga**	30	Congo ~ 18% France Microsoft
ISWI*	Egypte 2010	GPS, GIS, new technologies Data base and Introduction to Space Weather/2weeks **Ayman Marhous**	50	Egypte ~50% France Microsoft
ISWI*	DRC 2011	GPS, GIS, new technologies Data base and Introduction to Space Weather/2weeks **Bruno Kahindo**	90	DRC ~75% France Microsoft
ISWI	France 2011	GPS data processing PhD students / 5 days **Roland Fleury**	4	Participants (ticket) France
ISWI*	Morroco CRASTE-LF 2011	Physical process in the sun earth system Student M2/2 weeks **Christine Amory-Mazaudier** **Abderramahmane Touzani** **Nicole Vilmer**	28	France NASA UN
ISWI	France 2012	GPS data processing PhD students/5days **Roland Fleury**	4	Participants (ticket) France
ISWI	Nigeria 2013	Physical process in the sun earth system **Babatunde Rabiu**	20	Nigeria 100%
ISW*I	Algeria 2013	Physical process in the Sun earth system Students M2/2weeks **Naima Zaourar**	30	Algeria ~90% France
* : the reports on these schools are available on the site http://www.iswi-secretariat.org				

Figure 2 shows the class rooms used for the practical work during the school in DRC, in 2011. Each student has a computer to perform the exercises proposed by the professor. In general the training is made in computer centers

Figure 2: Class rooms for practical work in ISWI school in DRC (September 2011)

Room of OFSAC

Room of ERAIFT

One of the schools was organized in the United Center CRASTE-LF at Rabat in Morocco. The interest is that students from different African countries were financially supported by United Nations and NASA. The figure 3 shows the country of the participants to the ISWI school in Morocco.

Figure 3: countries of the participants to the school in Morocco

In these schools, more than fifty teachers taught in French and English about 300 students. Following each school students are mentored to theses by professors teaching in schools. To defend their thesis students must have published several articles in international journals. Figure 4 shows the number of papers and PhD since 1990 at the beginning of the first project: the International Equatorial Electrojet Year. We must recall here that the IRGGEA is also working in Asia and that the publications concern all the students from Africa and Asia. From 1990 to 2006 there are 48 papers (~3 per year) and 10 PhD (1 PhD each 2 year) and 2 schools. Since 2007 there are 54 papers (~9 per year) and 11 PhD (~2 per year) and 7 schools. The participation to the international IHY and ISWI projects boosted the IRGGEA. The fact that many scientific instruments were deployed all over the world obliged to train the students in the use of data collected during the IHY or ISWI projects.

The concept of Heliophysics has brought together different communities (solar physics, magnetosphere, ionosphere, atmosphere etc…) and leads to analyze very large databases because solar activity is linked to the solar cycle of about 20 years. Major results on the relations between the solar magnetic field and the equatorial ionosphere were obtained by African scientists during the last decade. In the IRGGEA network the first authors of publications are very often students from Africa or Asia (Amory-Mazaudier 2012). This figure does not list all the publications made in Africa in the context of IHY and ISWI projects. There are also other publications by researchers from South Africa, Kenya, Nigeria etc …

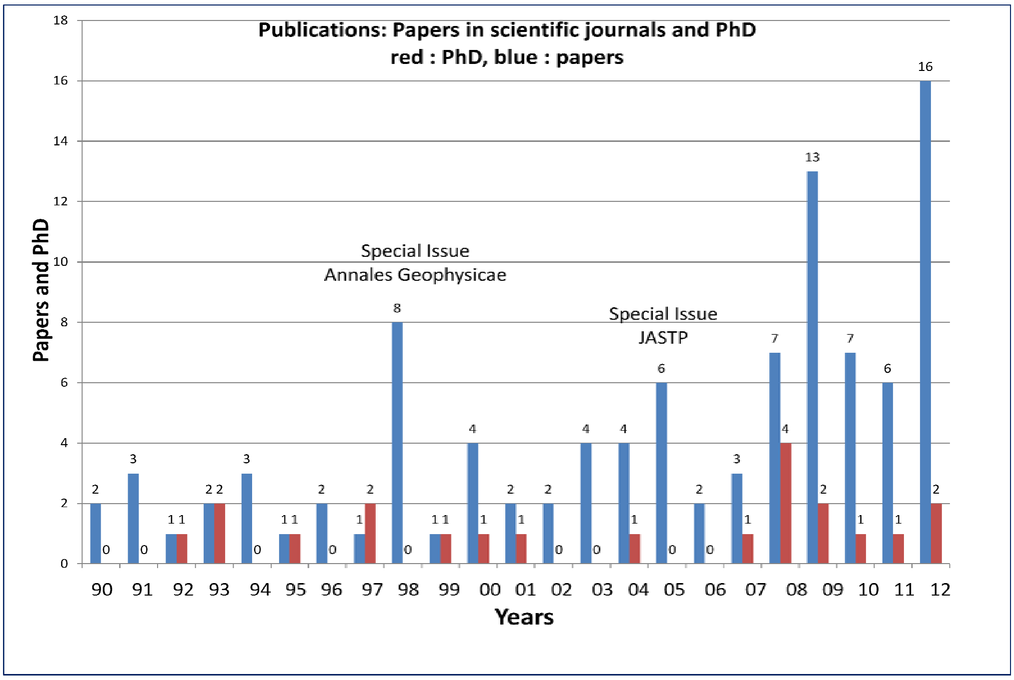


Figure 4: Publications in the IRGGEA

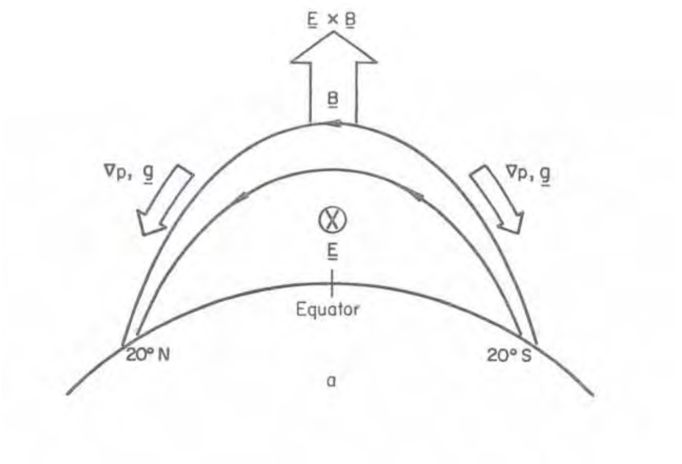
With the ISWI program, we have now to add the impact of the Sun on technological systems.

The instruments deployed are very useful. GPS receivers can estimate changes in the total ionization (TEC), and we know that this ionization is responsible for the modification of the signals from the satellites to the earth, useful signals for air navigation. Networks magnetometers will estimate the ionospheric electric currents and the induced currents in the earth which are causing damage transformers.

Results

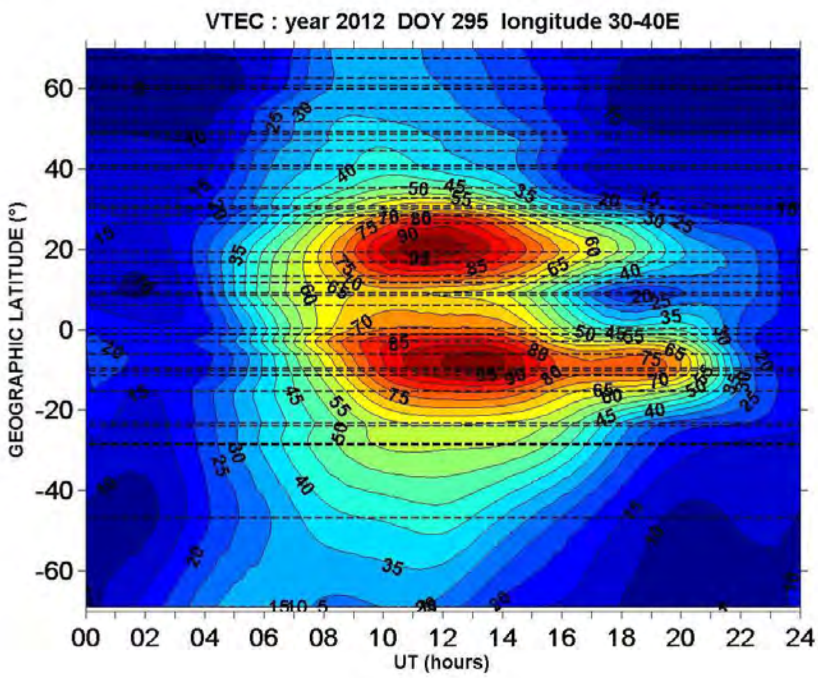
One of the results that we wanted to achieve, by developing the network of GPS, was to study the phenomenon of Equatorial Fountain in Africa. Figure 5 shows the physical processes at the origin of the equatorial fountain. At the magnetic equator the terrestrial magnetic field is horizontal as well as the movement of the neutral atmosphere. The ionospheric dynamo produces a vertical electric drift ExB/B2 which transports electrons to high altitudes. At high altitudes (several hundred kilometers), the forces related to the pressure gradient and gravity produce a shift of the motion of the electrons towards lower latitudes. It thus forms a hole density at the equator and two maxima density at magnetic latitudes 15 ° N and 15 ° S (see Figure 5).

Figure 5: Equatorial Fountain



Through the deployment of GPS stations in Africa, it is now possible to establish maps of ionization (VTEC) in the equatorial region. Figure 6 shows such a map recorded on October 21, 2012. We see two maxima of density and the equatorial through at the magnetic equator which is above the geographic equator.

Figure 6 : First map of the VTEC



There are other possible studies with GPS stations, which are studies of scintillations. The scintillation phenomenon is observed by rapid variations in amplitude and phase of the signal transmitted by the satellite signal to Earth. This phenomenon is a significant source of error in the positioning performance.

The Equatorial Fountain and scintillations and are observable phenomena in the equatorial zone, and many studies on these phenomena remain to be done.

Conclusion

This presentation shows the importance of international cooperation to develop scientific research in all countries. In the past many measures have been made in the North and few in southern countries. The modeling of geophysical phenomena on a global scale requires deploying instruments all over the world. Such a deployment of scientific instruments does not just be led by a single country. The support of the United Nations in such global program is essential.

Acknowledgements

We thank all the organizers of international projects, all the organizers of training school in the different African countries, all the providers of tools and the sponsors see the website www.iswi-secretariat.org.

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