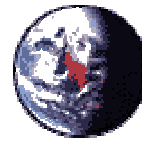




Université Kinshasa



Unité de Physique appliquée à l'espace



Université



Microsoft Research



DGRST  
Délégation Générale à la Recherche Scientifique et technologique



**SCHOOL ON SPACE WEATHER  
GIS, GPS Data Base, Internet and Grid Computing  
Kinshasa September 11 to 24, 2011**

Plan

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**This school was financially supported by RDC (75,2%)/ Ministry of Education and Universities of RDC, Ministry of Hydrocarbon and the University of Kinshasa/, the French embassy of Kinshasa (9,45%), MICROSOFT (9,14%), AUF (4,57%) and GIRGEA (1,64%) total cost : 54701€ for 90 participants.**

**The school took place at the ERAIFT school.**

Bruno Kahindo  
Coordinator ISWI of RDC  
Local scientific secretary

Marcelline Ngomba  
Scientific secretary assistant

Christine Amory-Mazaudier  
International scientific secretary of the school

## I. Introduction

In the framework of the ISWI (International Space Weather Initiative ) project colleagues from RDC requested the contribution of International scientists involved in the space weather field and related domains to the training of young scientists from RDC. We proposed and organized a Space Weather school.

The main objective of this school was to increase the level of expertise of the students from RDC in order for them to participate and contribute to international programmes. Then the two important key points of this school are:

- 1) The ability to use already existing data sets and tools related to the Earth's environment by RDC Scientists. There are a lot of existing data on environmental and natural resources and less than 10% of these data are used. Those data, using new technologies, are a source of original scientific work.
- 2) The development and the use, by RDC Scientists, of results connecting Environmental Sciences and sustainable development by using data from instruments ground-based as well as onboard satellites for geophysics, telecommunications, etc...

To reach these objectives the lectures included:

- 1) a scientific part necessary to understand the observations and their data processing, and applications using them in different disciplines;
- 2) an informatics part on the algorithms, their performance and their installation;
- 3) a training part on computer for the use of algorithms and data bases as SPIDR, IRI, IGRF, etc...
- 4) an information part on new technologies in use in this field like Grid, Web services, databases, monitoring of network...
- 5)

To fulfil those objectives in the school we proposed the following topics:

- 1) the network of GPS stations, radars and other tools installed in Egypt and in other place of Africa:
  - a) to study the ionosphere and the impact of the sun on the ionised Earth's environment (IHY International Heliophysical Year and ISWI);
  - b) to study geodesy;
  - c) other application domains;
- 2) the geographic information system (GIS) which allows the management and the visualisation of spatial data in many domains;
- 3) the development of local data bases, the use of existing data bases via internet and the initiation to the new technologies.

## **II. COMMITTEES**

### **Honorary Committee**

Minister of Superior training and Universities (ESU)  
Rector of Kinshasa University  
General Academic Secretary

### **Local Committee**

Prof. Lubunga Pene Shako – Fac Polytechnic/UNIKIN (President)  
Bruno Kahindo – Un. Physics applied tp Space / Fac Polytechnic/UNIKIN (scientific secretary)  
Marcelline Ngomba –Fac. of Agronomy/UNIKIN (scientific secretary)  
Prof Baudouin Michel -ERAIFT  
Prof. Bertin Bagula Chibanvunya- Fac Polytechnic/UNIKIN  
Prof. Tozin Rosemond- Fac Polytechnic/UNIKIN  
Prof. Jean-Marie Moanda Ndeko- Fac Polytechnic/UNIKIN  
Prof. Albert Kazadi Mukenga- Fac of Sciences/UNIKIN  
Prof. Jean-Pierre Nzuru Nsekere- Fac Polytechnic/UNIKIN  
Muyaya Bruno- ERAIFT

### **International Committee**

Dr Christine Amory-Mazaudier (France) - scientific secretary  
Dr Nicolas Bergeot (Belgium)  
Prof. Téléspore Brou (France)  
Dr Les Cottrell (USA)  
Bienvenu Dinga (Congo Brazzaville)  
Dr Frédéric Ouattara (Burkina Faso)  
Dr Viviane Pierrard (Belgium)  
Dr Monique Petitdidier (France)  
Dr Mikhael Zhizhin (Russia)

### III. Place of the school and logistic

Opening Ceremony : September 12 at 10h



The choral of the University of Kinshasa



Two ministers participating to the opening ceremony

Minister of Education and Universities : Léonard Mashako Mamba

Minister of Hydrocarbon : Célestin Mbuyu kabango

General Academic Secretary : Prosper Kanyankogonte Mpangazehe



Bruno Kahindo : ISWI coordinator for RDC presenting the school activities



Photo at the end of the opening ceremony

Lecture room of the ERAIFT



Rooms for practical work



Room of OSFAC



Room of ERAIFT

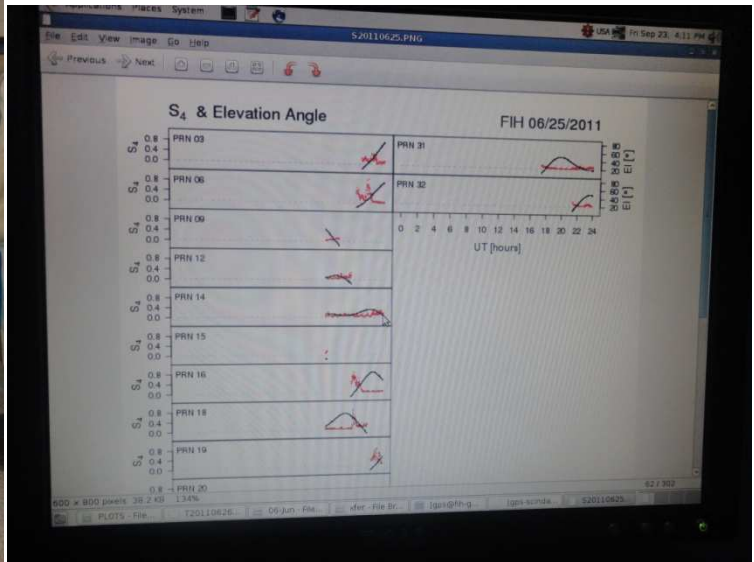
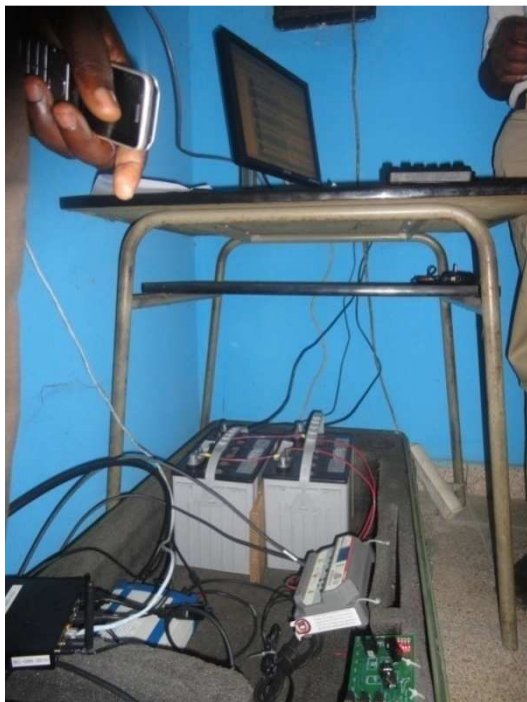
## Transport



## Lunch



Visit of the Unit of physics applied to Space, Faculty of Engineering (UNIKIN/Kinshasa) : SCINDA experiment



Day on computer resources at the faculty of pharmacy

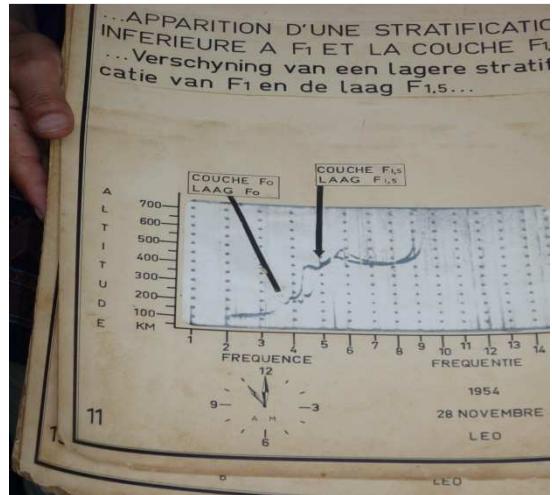


Visit of the observatory near Kinshasa

This observatory was operating during the International Geophysical Year 1957



Papa NDUAZU was working at the observatory in 1957



Ionogramme of November 28, 1954












Photo : closing ceremony

All the students received a certificate and the CD of the school

## IV. TEACHERS

### **Burkina Faso, Côte d'Ivoire, France, RC, RDC, Réunion, Russie, USA**

|                                                                                                                                  |                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <p>KAHINDO Bruno, RDC</p>                     | <p><u>Coordinator ISWI of RDC and local scientific secretary</u><br/>         Faculty of Kinshasa, Unit of Physics applied to Space, Kinshasa, democratic Republic of Congo (RDC)<br/> <a href="mailto:bkahindo@gmail.com">bkahindo@gmail.com</a></p>                      |
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Teachers Team

From left to right : Mikhail, Marcelline, Bienvenue, Bruno, Monique, Les, Frédéric  
Téléspore was missing



Guest house for the professors



## V. SUMMARY OF THE PROGRAMME

### Training on GIS by Prof. BROU Téléphone and NGOMBA Marcelline

- GIS : Geographical Information System

### Training on a Combination of SIG and GPS, by DINGA Bienvenu

- GPS applied to navigation on the Congo River

### Training on internet and mobile computing by Dr COTTRELL Les

1. The Internet Digital Divide: the emergence of Africa, see <http://www.slac.stanford.edu/grp/scs/net/talk11/kinshasa.pptx>
2. Internet History, trends and futures, see <http://www.slac.stanford.edu/grp/scs/net/talk11/internet-history.pptx>
3. How is the Internet performing, see <http://www.slac.stanford.edu/grp/scs/net/talk11/perform.pptx>
4. Cell Phones, see <http://www.slac.stanford.edu/grp/scs/net/talk11/cellphone-work.pptx>
5. Smart phones & other Mobile computing, see <http://www.slac.stanford.edu/grp/scs/net/talk11/smartphones.pptx>
6. Diagnosing network problems for non-networkers, see <http://www.slac.stanford.edu/grp/scs/net/talk11/diagnosis.ppt>

Others

1. Geolocation, see <http://www.slac.stanford.edu/grp/scs/net/talk10/geolocation.pptx>
2. How does the Internet work, see <http://www.slac.stanford.edu/grp/scs/net/talk09/ictp-tcpip.ppt>
3. Network Measurements, see <http://www.slac.stanford.edu/grp/scs/net/talk10/internet-measure.pptx>

### Training on SPIDR (Space Physics Interactive Data Resource) by Dr ZHIZHIN Mikhail

The Space Physics Interactive Data Resource (SPIDR) (<http://spidr.ngdc.noaa.gov>) is a de facto standard data source for solar-terrestrial physics, functioning within the framework of the World Data Center System. It is a distributed database and application server network, built to select, visualize and model historical space weather data. SPIDR can work as a fully-functional web-application (portal) or as a

Grid of web-services, providing functions for other applications to access its data holdings.

The hands-on training included basic course for interaction with the SPIDR web portal as well as in-depth lessons for web service use with SOAP and REST clients (Java, Matlab, IDL), installation and management of a SPIDR node, database architecture, and metadata management in SPIDR Virtual Observatory.

### **Day on intensive computing by PETITDIDIER Monique & KALENDA Dibungi :**

The agenda was divided in 4 parts :

- *Introduction to various compute means:* HPC (High Performance Computing) Grid and cloud
- *Internet network* overview in sub-saharian Africa and in RDC with eb@le (new partner in Ubuntunet) – important to access databases, journals, and for collaboration
- *Compute Resources:* description of the resources available in the digital Campus at AUF, [eb@leGrid](#) presented by RDC computer science students, European Grid (EGI) : important due to new applications ; introduction to parallel computing used in many simulations.
- *Applications:* 4 domains that need a reliable fast internet and compute resources
  - o Earth science and environmental applications ported on the European Grid, EGI
  - o SPIDR that permits to extract data to be included into softwares
  - o Geographical information system applications
  - o Space weather applications based on GPS

Most of the speakers and conveners are from RDC ; the others were professors at the school.. This day gathered more than 100 participants

### **Training of Dr PIERRARD Viviane on Space Weather made by Dr Christine Amory-Mazaudier and Bruno Kahindo**

The Sun

Interplanetary medium

The Interactions between the Sun and the Magnetosphere

Ionosphere and Plasmasphere

Motions of particule in a magnetic field

Neutral Atmosphère (statosphere, toposphere ..)

Effects of the solar radiations

### **Training of Dr AMORY-MAZAUDIER Christine on The Earth's magnetic field**

Transient variations of the Earth's magnetic field associated to the different sources

- Regular source : atmospheric tides
- Irregular source : magnetic storms and all the kind of solar events

Use of the geomagnetic indices to characterize the event

Indices presented : AU,AL, Aa, Dst, Am

### **Training of KAHINDO Bruno : Tools of the ISWI programme SID et GPS**

In the framework of the ISWI (International Space Weather Initiative), different scientific tools were deployed in Africa. The RDC received one SID (Sudden Solar Ionospheric Disturbance) monitor from Stanford University and 2 SCINDA GPS stations from the Boston University. This training presented the tools the data obtained, which are the ionospheric solar flare signature for SID and the Total Electron Content for GPS. The first results are also presented.

### **Training of Prof. OUATTARA Frédéric : Equatorial Ionosphere and the use of GPS**

- Generalities on the Equatorial Ionosphere
- GPS : GNSS
- Systems of measure of Ionosphere
- Use of GPS for the determination of the TEC
- Method to determine the TEC from one stations

**VI. SCHEDULE OF THE SPACE WEATHER SCHOOL SEPTEMBER 11-24, 2011**

**First Week September 12 to 17 : Space Weather, GIS, Data base Internet 34.5h**

|             | Monday 12                   | Tuesday 13                                     | Wednesday 14                                                                                                                                        | Thursday 15                                                                | Friday 16                   | Saturday 17                                      |
|-------------|-----------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------|--------------------------------------------------|
| 9h-10h30    | Opening Ceremony            | Space Weather Introduction<br><b>Christine</b> | Space Weather :<br>The sun<br><b>Bruno</b>                                                                                                          | Space Weather<br>GIRGEA<br><b>Christine</b>                                | Data Base<br><b>Mikhail</b> | Computer resources<br>And Grid<br><b>Monique</b> |
| 10h30-11h00 | Coffee Break                |                                                |                                                                                                                                                     |                                                                            |                             |                                                  |
| 11h00-11h15 | GIS<br><b>Marcelline</b>    | Internet<br><b>Les</b>                         | Contribution of ERAIFT at the management of natural resources in Subsaharienne Africa<br>Reinforcement of capacities<br><b>Prof Baudouin Michel</b> | Internet<br><b>Les</b>                                                     | Internet<br><b>Les</b>      | Computer resources and Grid<br><b>Monique</b>    |
| 11h15-12h30 |                             |                                                | Practical work<br>On data base<br>Group of Geopgraphy<br><b>Mikhail</b>                                                                             |                                                                            |                             |                                                  |
| 12h30-14h00 | Lunch                       |                                                |                                                                                                                                                     |                                                                            |                             |                                                  |
| 14h00-15h30 | Internet<br><b>Les</b>      | Data base<br><b>Mikhail</b>                    | Practical work<br>On data base<br>Group of Physicists<br><b>Mikhail</b>                                                                             | Internet<br><b>Les</b>                                                     | <b>Poster session</b>       | Computer resources and Grid<br><b>Monique</b>    |
| 15h30-16h00 | Coffee Break                |                                                |                                                                                                                                                     |                                                                            |                             |                                                  |
| 16h30-17h30 | Data Base<br><b>Mikhail</b> | Data Base<br><b>Mikhail</b>                    | Space Weather<br><b>Christine</b>                                                                                                                   | Practical work<br>On data base<br>Group of the engineers<br><b>Mikhail</b> | <b>Poster session</b>       | Computer resources and Grid<br><b>Monique</b>    |

**Second Week September 19 to 24 GIS, GPS/ GNSS , Ionospheric studies 30h**

|             | Monday 19                                                         | Tuesday 20                                    | Wednesday 21                                  | Thursday22                                | Friday 23                                                                     | Saturday 24      |
|-------------|-------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------|------------------|
| 9h-10h30    | GIS<br><b>Télesphore + Marcelline</b>                             | Equatorial Ionosphere /GPS<br><b>Frédéric</b> | Equatorial Ionosphere /GPS<br><b>Frédéric</b> | GPS/applications<br><b>Bienvenu</b>       | Equatorial Ionosphere /GPS<br><b>Frédéric</b>                                 | Closing ceremony |
| 10h30-11h00 | Coffee Break                                                      |                                               |                                               |                                           |                                                                               |                  |
| 11h00-12h30 | GIS<br><b>T+M</b><br><br>Presentation of OSFAC<br><b>Florence</b> | Lecture GIS<br><b>T+M</b>                     | Lecture GIS<br><b>T+M</b>                     | Lecture GIS<br><b>T+M</b>                 | GPS/applications<br>ISWI Instruments<br>SID and GPS<br><b>Bienvenu+ Bruno</b> |                  |
| 12h30-14h00 | Lunch                                                             |                                               |                                               |                                           |                                                                               |                  |
| 14h00-15h30 | GIS<br><b>T+M</b>                                                 | Practical work GIS<br><b>T+M+B</b>            | Practical work GIS<br><b>T+M+B</b>            | Terrestrial Magnetism<br><b>Christine</b> | <b>Poster session</b>                                                         |                  |
| 15h30-16h00 | Coffee Break                                                      |                                               |                                               |                                           |                                                                               |                  |
| 16h00-17h30 | GIS<br><b>Bienvenu</b>                                            | Practical work GIS<br><b>T+M+B</b>            | Practical work GIS<br><b>T+M+B</b>            | Meeting                                   | Visit of a Laboratory<br>SCINDA GPS<br><b>Bruno</b>                           |                  |

## VII. PARTICIPANTS : ADRESSES E-MAIL

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