



Achievements in Space Science : Capacity building GIRGEA: 1991–2015

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The Abdus Salam
International Centre
for Theoretical Physics



Outlines

- The basic ethical rules for the GIRGEA
- The first project in Côte d'Ivoire
- The schools organized in the framework of IHY and ISWI
- Today : capacity building in DRC
- Results and institutions involved
- Sustainability
- AGS the future of Africa

25 years ago : Difficulties to overcome

Taking into account several facts concerning research in developed countries

1° the need of observations over the whole world to do global studies

 creation of observatories in the Southern Hemisphere

2° the fact that satellites and ground observatories are complementary

 creation of observatories in the Southern Hemisphere

3° the constant increase of research fields

 more researchers in the Southern Hemisphere

4° for all disciplines, the multitude of tools and techniques

 sharing between developed and developing countries

5° the constant increase of data base, and our impossibility to analyse all the data

 sharing between developed and developing countries
etc...

Taking into account several facts concerning research in developing countries

1° the impossibility to stay in their country to do research in particular fields

 to develop research in developing countries

2° the lack of data to do research in their country

 creation of observatories in the Southern Hemisphere

 sharing between developed and developing countries

3° the need of books, reviews, computers etc....

 sharing between developed and developing countries

4° the difficulty to publish in international scientific journals

 sharing between developed and developing countries
etc....

A change is needed

GIRGEA (IGRGEA) is existing since more than 20years

The method to maintain the project is developed day after day in accordance with the situation

 We organize

- training in several disciplines in the project
- teaching in management and data base organization
- teaching in history of geomagnetism and aeronomy
- we follow the students and help them to enter the international community
- the students are involved in the project and can propose new developments
- we maintain communication with a newsletter and keep contact with all participants.

 We consider that we are in the same laboratory : "An International Laboratory, without frontiers"
- we share knowledge, books, financial support,etc...

The IGRGEA has no direct financial support. The IGRGEA establishes and maintains connections between research teams in different laboratories in Europe and Africa. The IGRGEA organize scientific projects, data base, research, training and teaching, communication between the research teams.

IDEAS AND RESEARCH PROGRAMMES -EARTH'S ENVIRONMENT INTERNATIONAL COOPERATION

Published in a book of History of geomagnetism and aeronomy, Solar variability and Geomagnetism, lectures from the IAGA Assembly in Hanoi 2001, collected and edited by W. Schroder, Science edition AKGGKP, Bremen-Ronnebeck, Postdam, 2002.

La science au service du développement

Dans cet ouvrage est présentée une expérience humaine d'un réseau de scientifiques, GIRGEA, qui a réuni, et qui réunit toujours plusieurs centaines d'étudiants, ingénieurs, techniciens, chercheurs, enseignants, etc. autour d'un objectif central : développer la recherche en sciences de l'espace en Afrique en installant des instruments, en formant des chercheurs de niveau international qui pourront constituer des équipes de recherche dans leur pays et assurer ainsi la pérennité du réseau.

Il semble impensable, et pourtant... qu'au XXI^e siècle un scientifique puisse prétendre développer des études planétaires des phénomènes physiques de l'environnement terrestre sans mesurer sur l'ensemble du globe.

Le Nord est indispensable au Sud et le Sud est indispensable au Nord. L'éruption du volcan Eyjafjöll en 2010 a révélé la fragilité des pays du Nord techniquement avancés. Le tsunami du 26 décembre 2004 a mis en évidence la grande vulnérabilité des habitants de certaines régions du Sud ayant des réseaux d'aide au tsunami défaillants ou inexistantes. Mais ces événements ont aussi surtout démontré nos liens, nous vivons tous sur la même planète : la terre est un petit village et nous dépendons les uns des autres.

Le GIRGEA propose donc une méthode pour allier science de l'espace au niveau international et règles éthiques afin de favoriser une recherche à l'échelle planétaire indispensable à l'avancée des connaissances et profitable à tous.

Christine Amory

Cursus universitaire : maîtrise en physique théorique (Paris VI, 1972), diplômée de l'Institut d'informatique appliquée (Paris VII, 1972), DEA en géophysique (Paris VI, 1973), thèse de 3^e cycle en physique (Paris VI, 1974), diplômée de l'Institut d'administration (Paris Sorbonne I, 1979), docteur d'État en sciences physiques (Paris VI, 1983).

Parcours professionnel : enseignante dans le secondaire et le supérieur (1971-1975), ingénieur au Centre à l'énergie atomique (1976-1977), chercheur du Centre national de la recherche scientifique (depuis 1978).

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Christine Amory

La science au service du développement

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La science au service du développement



Préface de Dominique Kounkou

L'Harmattan



Côte d'Ivoire, first experiment

1991 : first mission to prepare the work (with O. Fambitakoye)

1992 : creation of the observatory of KORHOGO (1992-2002)

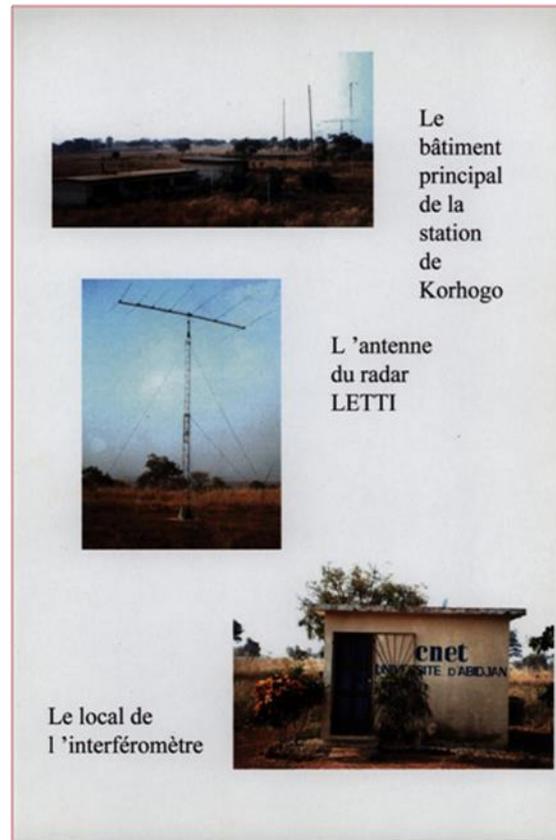
1992 : first school in Paris

1992-1994 : IEEY experiment [~ 2 millions euros from France]

1995 : School at Abidjan
and then PhD

**Observatoire permanent de Korhogo / Côte d'Ivoire
opérationnel de 1992 à 2002 : E. Kone**

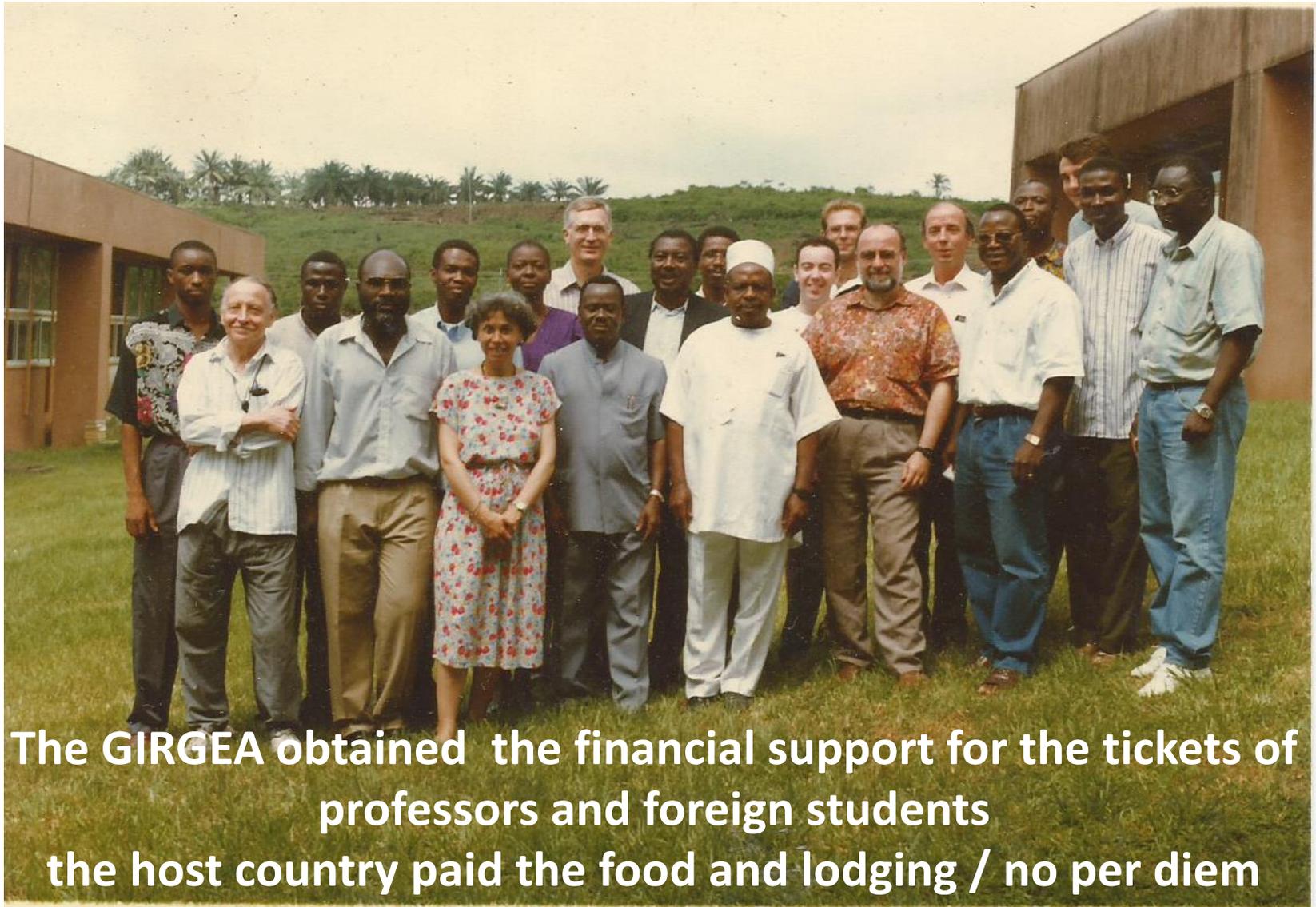
We train also technicians
and engineers



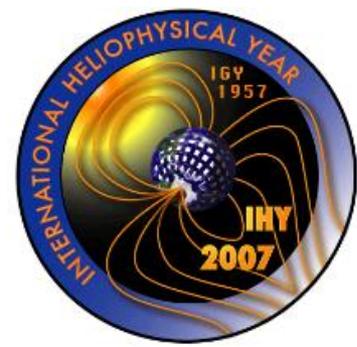
Guerre de 2002 à 2006 : les instruments scientifiques ont été mis en sécurité

The observatory will be repaired - Interferometer of NCAR / V. Doumbia and O. Obrou

Second school/ ABIDJAN/ October 1995
Professors from France, Niger, Nigeria, USA
Students from Benin Burkina Faso, Côte d'Ivoire, France, Senegal



**The GIRGEA obtained the financial support for the tickets of professors and foreign students
the host country paid the food and lodging / no per diem**

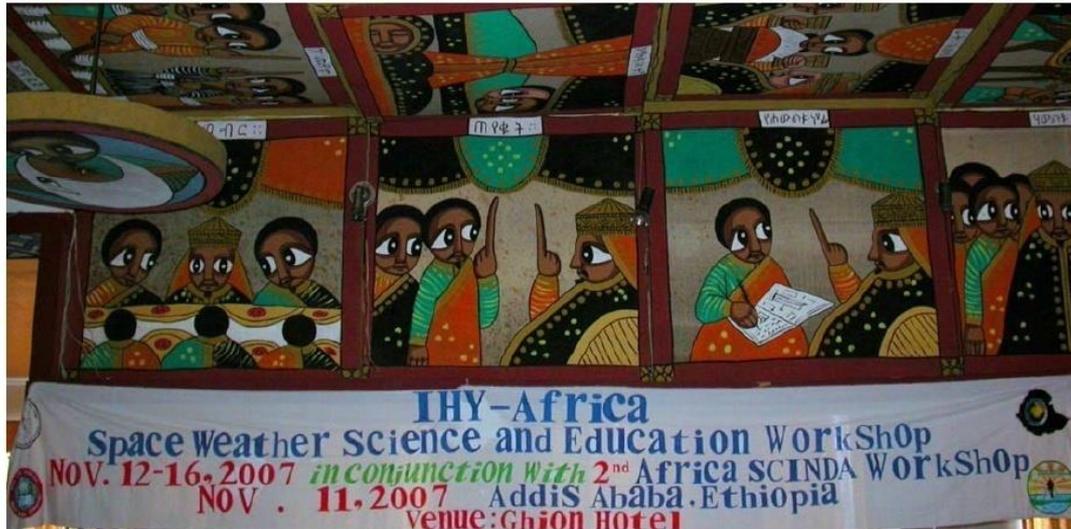


International Heliophysical Year 2007-2009

a turning point in the participation of African countries

WHOLE AFRICA

IHY-Africa Space Weather Science and Education Workshop Report



African Countries Represented (20): (72 representatives)

Algérie
Bénin
Burkina Faso
Cameroon
Cape Verde
Côte d'Ivoire
Démocratique République du Congo
Egypt
Ethiopia
Kenya
Liberia
Libya
Mozambique
Namibia
Niger
Nigeria
République du Congo
Sénégal
South Africa
Uganda

Other Nations Represented (9): (56 representatives)

Australia
Austria
Canada
France
India
Italy
Japan
UK
USA



The Ethiopian Physical Society

in conjunction with

Addis Ababa University and Bahir Dar University



Request of the international community: to train in French

Scientific project	Country/year	Training Organizer in the country	Participants	Main financial supports
IEEY French	France 1992	Physical process in the Sun earth system + technical training in laboratories PhD students / 6 weeks Christine Amory-Mazaudier	5	France ~100%
IEEY French	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 French	Congo 2009	GPS, GIS and Introduction to Space Weather/ 7 days Bienvenue Dinga	30	Congo ~ 18% France Microsoft
ISWI* English	Egypt 2010	GPS, GIS, new technologies Data base and Introduction to Space Weather/2weeks Ayman Marhous	50	Egypte ~50% France Microsoft
ISWI* French English	DRC 2011	GPS, GIS, new technologies Data base and Introduction to Space Weather/2weeks Bruno Kahindo	90	DRC ~75% France Microsoft
ISWI French	France 2011	GPS data processing PhD students / 5 days Roland Fleury	4	Participants (ticket) France

Scientific Project	Country/year	Training Organizer in the country	Participants	Main financial support
ISWI* French	Morocco 2011	CRASTE-LF Physical process in the sun earth system / Student M2/2 weeks C. Amory-Mazaudier A. Touzani N. Vilmer	28	France NASA UN
ISWI French	France 2012	GPS data processing PhD students/5days / R. Fleury	4	Participants (ticket) France
ISWI* French	Algeria 2013	Physical process in the Sun earth system / Students M2/2weeks Naima Zaourar	30	Algeria ~94% France
ISWI French	France 2013	GPS data processing PhD students/5days / R. Fleury	4	Participants (Ticket) France
ISWI French English	Morocco 2014	Physical process in the sun earth system /Student M2/6 days Azziza Bounhir	30	Morocco France others
ISWI French	Morocco 2015	CRASTE-LF GPS data processing and use of data for different fields of research M2 and PhD	30	UN, France Crate-LF
ISWI English	NIGERIA National school each year since 2012	Space Weather Babatunde Rabiou	70	Nigeria
ISWI French	Maghreb /West Africa Each 2 years 2017:Côte d'Ivoire	Space Weather Vafi Doumbia + Naima Zaourar		National and international

* : The reports on these schools are available on the site <http://www.iswi-secretariat.org>

School in Republic Democratic of Congo, at Kinshasa in September 2011

2 weeks



Work with politics : to request
position for the students

Work with medias
the television reported each day
on this school

Opening ceremony with 2 Ministers

Minister of education and higher education: Léonard Mashako Mamba

Minister des Hydrocarbures: Célestin Mbuyu Kabango

General secretary of Academia : Prosper Kanyakongote Mpangazehe

Capacity building in DRC : 11 students (9 in physics, 2 computer science)

Results from 1992 to 2015

31 PhD (24 years) concerning students of the following countries
Algeria (1) Benin (1), Burkina Faso (4), Côte d'Ivoire (9), Egypt (3),
France (3), India (1) Senegal (2), Spain (1), Vietnam (6)

PhD in progress in the same countries + new countries
Morocco, DRC, RC,

Since the last meeting in Ethiopia in 2012

[2013-2015] : 9 PhD (3 years)

Algeria (1), Burkina Faso (2), Côte d'Ivoire (1), Egypt (2),
Senegal (1), Vietnam (2),

8 students obtained a position in their country and 1 obtained a position in
Saudi Arabia

Papers in journal with reviewers

140 From 1990-2015 (25 years)

31 from 2013-2015 (3 years) + 5 papers in review process

Foreign coaching (PhD)

Europe

U.K. : UCL

Spain : Ebre Observatory

Italy: ICTP

France

University Pierre and Marie Curie

University St Quentin Yvelines

University of Toulouse

University of Grenoble

University of Dijon

University of Strasbourg

University of Besançon

University Paris-Sud Orsay

IPGP

Observatory Paris-Meudon

National school of Telecom.

CEA

America

USA (NCAR, NASA, MIT)

University of Tucuman/ Argentina

PhD students and local coaching

Africa

University Houari Boumedienne/ Algeria

CRAAG/ Algeria

University Cotonou / Benin

University of Ouagadougou/ Burkina Faso

University of Koudougou/ Burkina Faso

Polytechnic University of Bobo Dioulasso /
Burkina Faso

University Houphouët Boigny/ Côte d'Ivoire

University of Helwan/ Egypt

NRIAG / Egypt

University of Cairo/ Egypt

University Cheik Anta Diop/ Senegal

University of Marakkech/ Morocco

CRASTE-LF / Morocco

University of Rabat / Morocco

University de Kinshasa/ DRC

University Marion Ngouabi/ RC

Asia

Institut of Geophysics of Hanoi/ Vietnam

University of Kyushu/ Japon

Europe

Ebre Observatory

CEA



Doctorat d'Etat Vafi Doumbia
Côte d'Ivoire, October 2008
USA : A. Richmond (NCAR)

PhD J-L. Zerbo
Burkina Faso, October 2012
African Professors: V. Doumbia, F. Ouattara
USA : J. Richardson (MIT)



Doctorat d'Etat F. Ouattara, Dakar Octobre 2009



Training – French speaking Curricula at Universities

- University Houari Boumediene (USTHB)/ Algeria, N. Zaourar 2014
- University Houphouët Boigny/ Côte d'Ivoire, Vafi Doumbia, 2013
- University of Marakkech/ Morocco, A. Bounhir, 2015
- University of Ougadougou and Koudougou/ Burkina Faso,
P. Kafando et F. Ouattara, To be opened at the University of
Koudougou : Master in Space weather 2016-2017
- University of Kinshasa/RDC, A. Kazadi (Plasma Physics)
- CRASTE-LF /Master on GNSS, 2013
- University Pierre and Marie Curie/ Master of plasma physics, teaching
by internet, 2015

Outreach/Nigeria May 2015

Conference on Advances in Space Science the new discoveries



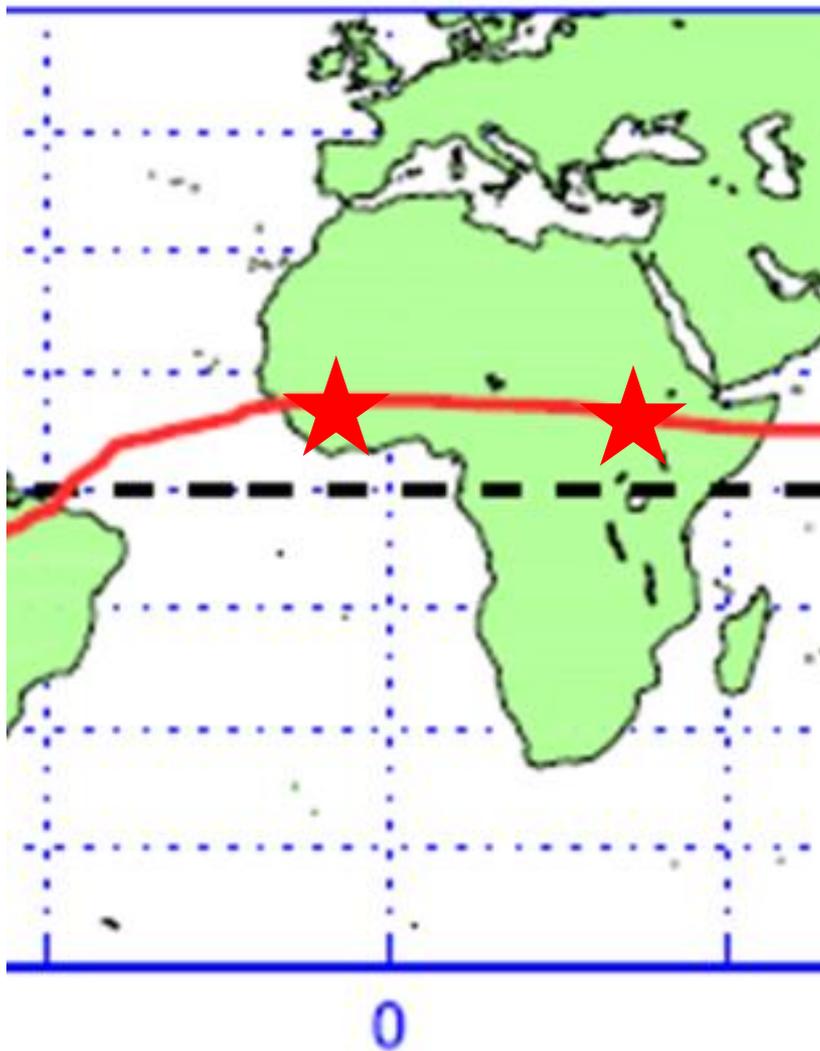
450 Teen agers



NIGERIA
National school each year
Prof. B. RABIU

AGS, the Future : the Challenges

- To develop curricula in the African Universities
- Communication in Africa
 - inside each country
 - between African Countries
 - with the rest of the World
- To know all the scientific instruments in Africa and the data sets available (GIS)
- To maintain scientific instruments -> Observatory
- To build scientific instruments in Africa
- To know the works made in Space Science in Africa
- History of Space Science in Africa -> committee in AGS
- To continue the deployment of scientific instruments : ionosondes and GPS
- Incoherent scatter sounders and Lower orbital satellite



Large instruments for Africa



Incoherent scatter sounders



Lower orbiter satellite