WOMEN IN AN INTERNATIONAL GEOPHYSICS RESEARCH LABORATORY WITHOUT BORDERS
Topic 1 : Science and Technology Education for All
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Abstract

Since 1991 an original project of Environmental research has been developed in West Africa by a European informal group of external and internal geophysicists. The **IGRGEA** (**I**nternational **G**eophysical **R**esearch **G**roup **E**urope-**A**frica) has begun to train young scientist men for PhD and Doctorat es Sciences, and since 2003 young scientist women. In this paper we describe the North-South work structure effectively built first between European laboratories and African University groups, and later Vietnamese group of research to create instrumental and theoretical capabilities. In French Geophysics (CNRS), about 25,3% of scientists are women. In the IGRGEA group, after 12 years we have only one African young woman scientist for 13 men (7.7%). In Vietnam where we just start, there are two Vietnamese young women for 4 men (33%). We are pursuing our efforts of feminizing science.

Introduction

It was at Vancouver, in 1987 that **ICDC** (Interdivisional Commission for Developing Countries) of **IAGA** (International Association for Geomagnetism and Aeronomy) planned an International campaign on the Equatorial Electrojet. This paper relates the work of a group of scientists to develop the North-South cooperation in Geophysics and help young scientists of developed and developing countries (men and women) to access international scientific level. The paper is composed of three sections : the Geophysics fields of Research and scientific projects, the human self experience and the **L**aboratory **W**ithout **B**oarders (LWB) , and Women in LWB.

Geophysics Fields of Research and scientific projects

Our fields of research concern dynamics, electrodynamics and electromagnetism in the Earth's environment (*from 50 km deep in the ground up to 1500 km height*) and the following various disciplines of external and internal geophysics : atmospheric dynamics, ionospheric studies, Earth's magnetic field, telluric electric fields etc….We use high technology tools as radar HF(*propagation of electromagnetic waves in the Earth's Environment*), magnetometers (*measurements of the Earth's magnetic field*), ionosondes (*measurements of electronic densities in the Ionosphere altitude 90km to 500km*), meteorological stations (*atmospheric pressures, temperatures, winds*….), satellites (*various geophysical parameters*), etc…

Project in Africa : IEEY 1993-1994 (International Equatorial Electrojet Year)

During the years 1993-1994, a continuous campaign of measurements has been held in the frame of the IEEY with a network of 10 magneto-telluric stations and a network of 3 ionosondes, Figure 1 presents the magneto-telluric network and figure 2 a magneto-telluric station. Other instruments have participated during shorter periods, HF radar and optical Fabry-Perot 630nm interferometer. In a paper published in 2005, Amory-Mazaudier et al. presented the scientific results obtained during one decade. The scientific topics are study of the equatorial electrojet (*electric current circulating along the Earth's magnetic equator at the altitude 100-120km*), ionospheric irregularities, telluric electric field, electromagnetic coupling between the pole and equator etc… . **13** PHD subjects (4 are still in progress), allow scientists of Ivory Coast, Senegal, Benin, France and Spain to access International level. The Group in Ivory Coast was awarded by its Government the Prize of Excellence Scientific and the prize of Research.

Project in Vietnam and Africa : CAWSES 2003-2011 (Climatology and Weather in the Sun-Earth System)

For the next decade, the IAGA staff proposed to federate scientists around the program CAWSES.The Hanoi Institute of Geophysics (Vietnam) defined three scientific topics for its contribution to this program : 1) Atmospheric sciences, 2) Ionospheric studies and 3) Geomagnetism. Figure 3 (Amory-Mazaudier et al., 2005) presents the Vietnamese network of instruments involved in scientific campaigns of measurements. For each scientific topic, several research objectives (**8** PHD subjects) are defined. All these studies are related to dynamics, electrodynamics and electromagnetism in the Sun Earth System. PHD will be done for the different topics : climatology of the monsoon, lightning, ionospheric density gradients, Transient variations of the Earth's magnetic field, telluric electric fields, numerical processing of ionospheric signals, bubbles etc…New themes of research have been introduced by Vietnamese scientists in the IGRGEA programme.

Human self experience, the IGRGEA a Laboratory Without Boarders (LWB)

After 15 years of collaborative studies between North and South countries we built together a Laboratory without boarders, LWB, (geographic boarders as well as scientific boarders). We are now used to work together and plan future projects in the frame of international scientific programmes. Each member of LWB proposes to his own institution his contribution to the international programme. LWB is not an administrative structure and not an hierarchic authority. A quarterly letter connects all the members. Depending on the subject, a group of about 7 persons from developed and developing countries, as the board of an association, manage the current scientific work. This board is not controlled by formalized or finance contracts (*the financial support is granted by the various institutions*). We select subjects concerning various disjoined research fields to train multidisciplinary studies. We rely on history of sciences to introduce these studies. The students trained in LWB became members of the LWB, Actually LWB is composed of over 60 persons not necessarily working full time.

Women scientists in Geophysics in LWB and French CNRS*

In 15 years 24 training teachers from 7 countries have been training 21 students, with 18 from developing countries. Table 1a presents the number of students from each country and table 1b the number of teaching persons. There are three women students (two in Vietnam and one in Burkina Faso) and five teaching women (all in France). Since two years only, there are young women scientists from developing countries in LWB. When they entered in LWB these three women were single and childless. The Hanoï Institute gave positions to Vietnamese students to do PHD in the LWB (later on the Vietnamese young women are now married and with a child) Concerning Africa, the unmarried girls in general bear witness of their heavy burden in family chores that boys absolutely evade. The African women who are under family constraints of early marriage are lost for research.
These cases do not allow statistical conclusions.
In a developed country like France, the percentage of University women is increasing : 56,2% in 1998-1999, 54% in 1990-1991 and 49,7% in 1980-1981 (Vouillot, 1999). Whereas they are more in the first and second cycles, they are only 39,2% women with PhD (table 2) and only 22% with PhD in Mathematics and Physics (table 3). In the French National Research Centre (CNRS), women scientists in Geophysics are 25,3% . The weak percentage of women scientists in Geophysics results from education and social pressure : "Mathematics, Physics, techniques are works for men and not for women", (**CNRS (www.cnrs.fr) is the European research institution with the largest number of scientists 11650 (all disciplines), of which 3617 are women (31,0%))*

Conclusion : to complete not to compete

In this paper we show that it is possible to develop high level of Geophysics in a different manner than by the official laboratories structures. Nevertheless our informal LWB benefits from the official institutions and keeps dynamic character and freedom. We introduced higher scientific work into African countries and we promote opportunities for women to contribute equally in Geophysics. We showed the capability of scientists from developing countries to use their results. The fact that there is few women scientists in Geophysics in developed as well as in developing countries results from society : the world of labour is a world thought by men from developed countries and for men from developed countries. It is based on power, competition, money and techniques concern men not women. LWB based on sharing complete the official institutions based on competition. Finally LWB reveals as a capital asset for scientific development.

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Figure 1 : SCHEMATIC MAP OF WEST AFRICA
Senegal-Ivory Coast-Burkina Faso-Benin-Nigeria-Republic Centre Africa

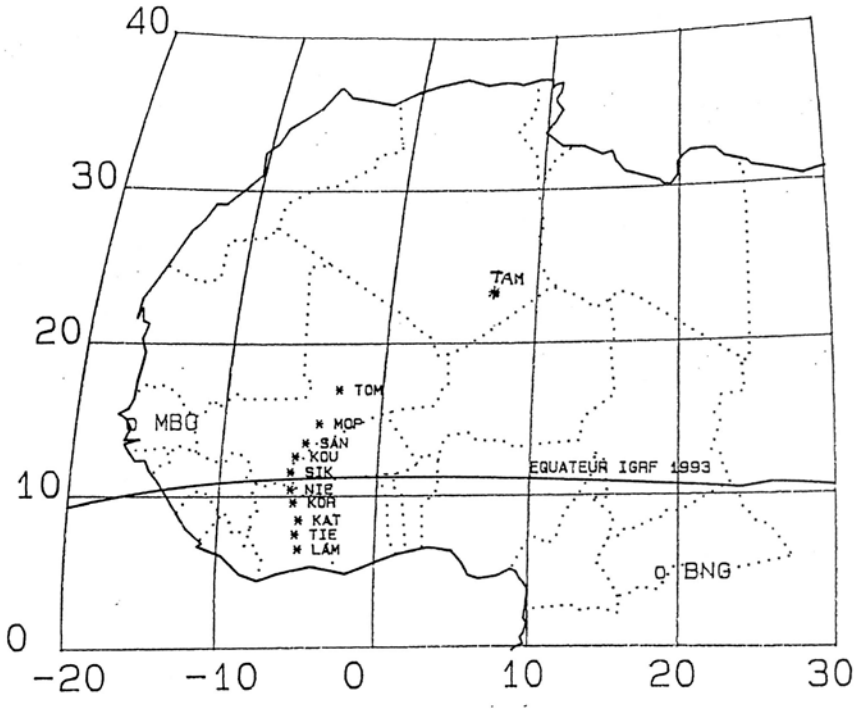

Figure 2 : a magneto-telluric station
This station measures the three components of the Earth's magnetic field (X,Y,Z) and the two components of the Telluric electric field 'Ex, Ey).

Figure 3 : MAP OF VIETNAM
The atmospheric stations are marked by red circles, the magnetometers by blue circles, and the ionosondes by green square. New instruments were brought to Vietnam for this project : three GPS receivers are marked by violet pentagons.

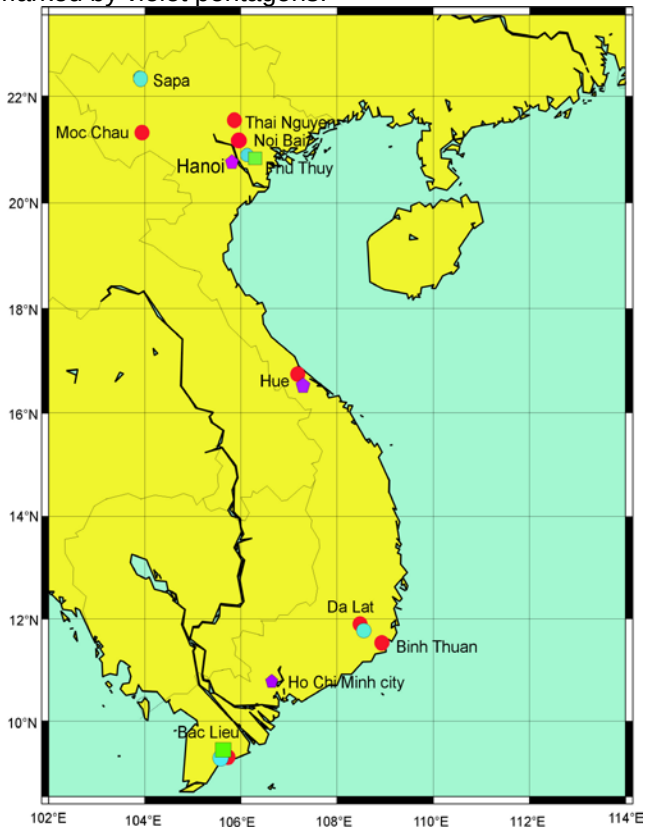

Table 1a: Students in LWB

Country	students	Country	students
Benin	1	Senegal	1
Burkina Faso	2 (1w)	Spain	1
France	2	Vietnam	6 (2w)
Ivory Coast	8		

Table 1b : Teaching in LWB

Countries	Men	Women
England	1	0
France	14	5 (26,3 %)
Ivory Coast	1	0
Nigeria	2	0
Spain	1	0
USA	2	0
Vietnam	3	0

Table 2 : percentage of Women – all disciplines

French University – year 1997	% of women
First cycle (Two first years)	56,2
Second cycle (third and four years)	58,5
Third cycle (fifth year and later)	49,7
PhD	39,2

Table 3 : PhD of French Women (1997)

Speciality	% of Women
Biology, Medicine, Health	51,9%
Human Sciences (Sociology, Law, etc…)	50,6%
Chemistry	49,3%
Mathematics, Informatics, Physics and technical Sciences	22%