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差出人　maeda@serc.kyushu-u.ac.jp

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*　I S W I = International Space Weather Initiative *
*　(www.iswi-secretariat.org) *
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* Publisher: Professor K. Yumoto, SERC, Kyushu University, Japan *
* Editor-in-Chief: Mr. George Maeda, SERC (maeda@serc.kyushu-u.ac.jp) *
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Attachments:
(1) Phd thesis summary of Zaka Komenan Zacharie (Ivory Coast of Africa);
pdf 8 pages, 1.1 MB in size.

Dear ISWI Participant:

At the request of Dr J. Davila (ISWI Secretariat, based at Goddard Space Flight Center, NASA, Greenbelt, Maryland), I reprint information from Dr Christine Amory-Mazaudier (originally email from her to Dr Davila, Dr Gopalswamy, and Dr Haubold). I reprint it verbatim (text between + and &, below). And I attach as pdf the Power Point file that she mentions in this text. The labelled photos are especially delightful. I might mention here that Dr Vafi and Dr Obrou take care of the MAGDAS magnetometer operating in Abidjan, the main city of the Ivory Coast.

Christine: Merci beaucoup for this info from Abidjan. I was there for the original MAGDAS installation in 2006. Cheers, Editor.

+

From: Christine Mazaudier
Sent: Wednesday, February 24, 2010 5:44 AM
To: Gopalswamy, Natchimuthuk (GSFC-6710).;
Davila, Joseph M. (GSFC-6700).; Hans HAUBOLD
Subject: news from Ivory Coast

Hi Joe, Nat and Hans:
Here is some news from the Ivory Coast.
The team of research is composed of 13 scientists:
6 scientists (4 are professors or Associate professors)
and 8 students. One of them (Zacharie) defended his Phd last week.

He plans to visit Prof. Yumoto and to work with MAGDAS Data.

Find attached a Power Point with some photos and also the research programme which is part of the ISWI project.
Also a very good new one of the student (directed by Olivier Obrou) work on GPS data. He analyzed 2 years (2008, 2009), He will present his results at the next ISWI workshop.

Sincerely,
Christine

&

If you have any ISWI news that you feel should get circulated within the ISWI community, please send to me.

Cordially yours,
George Maeda
SERC (staff member), Editor of ISWI Newsletter

Thèse de ZAKA komenan Zacharie

Côte d'Ivoire

University of Cocody
February 11, 2010

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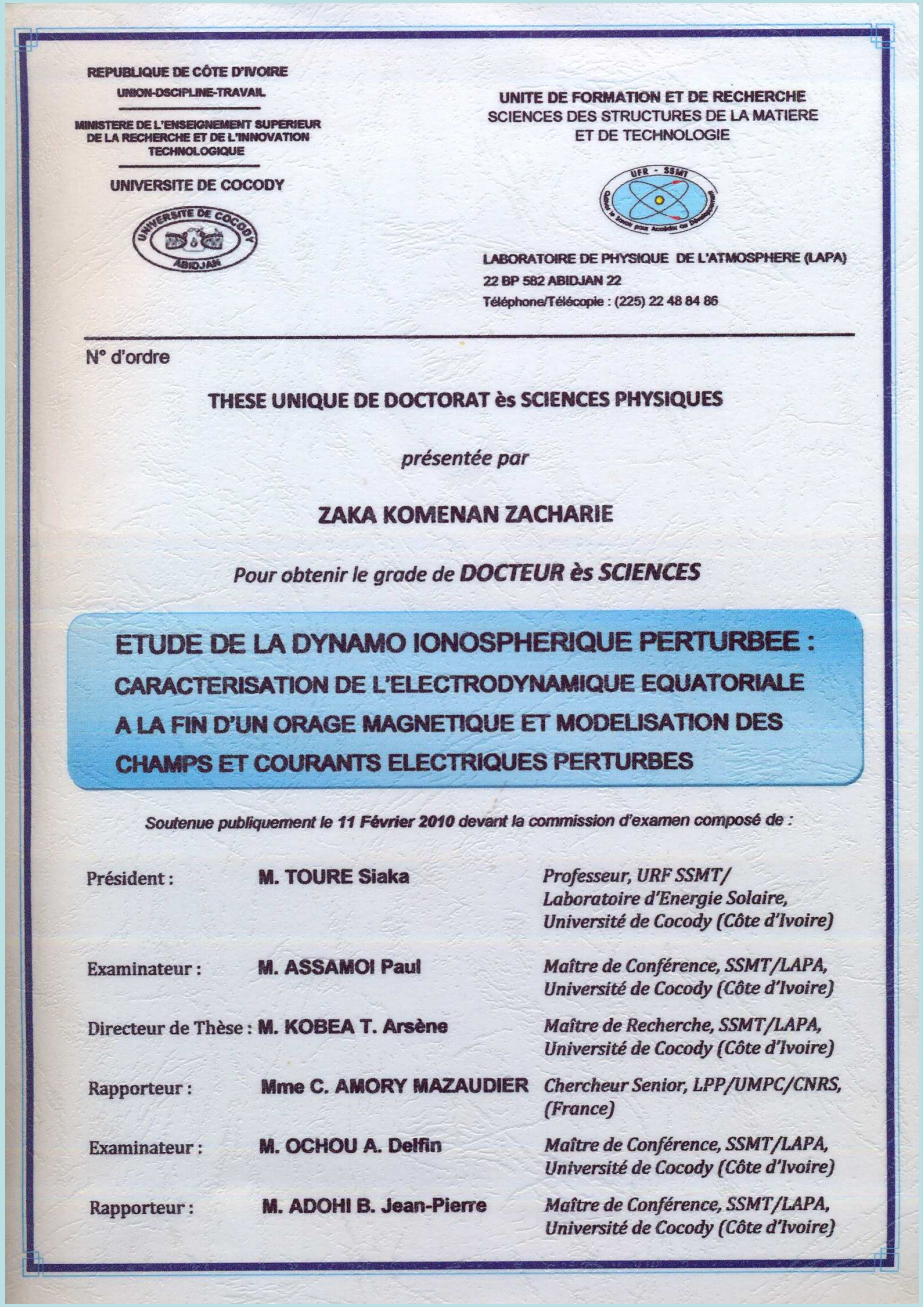

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N° d'ordre

THESE UNIQUE DE DOCTORAT ès SCIENCES PHYSIQUES

présentée par

ZAKA KOMENAN ZACHARIE

Pour obtenir le grade de ***DOCTEUR ès SCIENCES***

ETUDE DE LA DYNAMO IONOSPHERIQUE PERTURBEE : CARACTERISATION DE L'ELECTRODYNAMIQUE EQUATORIALE A LA FIN D'UN ORAGE MAGNETIQUE ET MODELISATION DES CHAMPS ET COURANTS ELECTRIQUES PERTURBES

Soutenue publiquement le 11 Février 2010 devant la commission d'examen composé de :

Président :	M. TOURE Siaka	*Professeur, URF SSMT/ Laboratoire d'Energie Solaire, Université de Cocody (Côte d'Ivoire)*
Examinateur :	M. ASSAMOI Paul	*Maître de Conférence, SSMT/LAPA, Université de Cocody (Côte d'Ivoire)*
Directeur de Thèse :	M. KOBEA T. Arsène	*Maître de Recherche, SSMT/LAPA, Université de Cocody (Côte d'Ivoire)*
Rapporteur :	Mme C. AMORY MAZAUDIER	*Chercheur Senior, LPP/UMPC/CNRS, (France)*
Examinateur :	M. OCHOU A. Delfin	*Maître de Conférence, SSMT/LAPA, Université de Cocody (Côte d'Ivoire)*
Rapporteur :	M. ADOHI B. Jean-Pierre	*Maître de Conférence, SSMT/LAPA, Université de Cocody (Côte d'Ivoire)*

Based on 3 papers in International Journals

Annales Geophysicae
JGR
Science Direct

Arsène KOBEA | Jean-Pierre ADOHI | Delfin OCHOU | Zacharie ZAKA | Siaka TOURE | Christine AMORY MAZAUDIER | Paul ASSAMOI

They are now Professors or Associate Professors

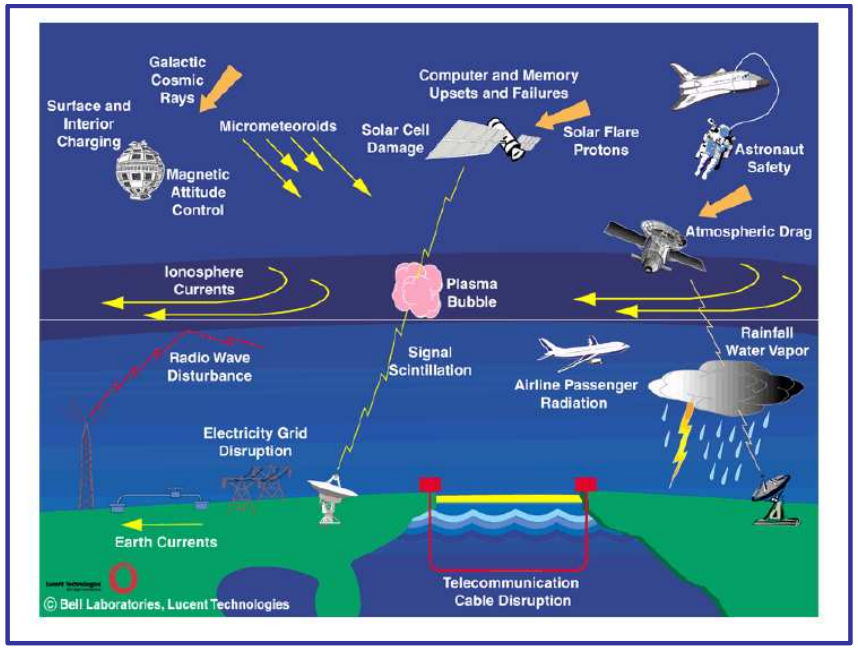
Jean-Pierre ADOHI	**Arsène KOBEA**	**Vafi DOUMBIA**	**Olivier OBROU**

RESEARCH PROGRAM
TRANSIENT VARIATIONS OF THE EARTH MAGNETIC FIELD DUE TO THE EXTERNAL IONOSPHERIC AND MAGNETOSPHERIC SOURCES

Our research program is part of the ISWI (International Space Weather Initiative) which deals with electromagnetism in the earth environment. The figure 1, below, illustrates the physical processes concerned by this program.

Our specific topic is ionospheric electric currents (shown in the middle of this figure) and their associated transient variations of the earth magnetic field and earth current.

Figure 1 : Physical processes –ISWI program



Importance of this field

With the development of space transmission, all the electromagnetic physical processes in the earth environment must be studied in order to understand their impacts on new technologies systems used in navigation as the GPS system.

- **Objectives of Proposed Research**

The earth magnetic field expression is given by :

$$B = Bp + Ba + Be + Bi$$

Where Bp is the main field, Ba the aimantation litospheric field, Be the magnetic field related to the external ionospheric and magnetospheric sources and Bi, the ground field induced by the external sources (see figure 1).At the time scales of the year and smaller than the year, DBp~DBa~0, and therefore the transient variations DB of the Earth's magnetic field is:

$$DB = DBe + DBi$$

We plan to study these transient variations of the earth magnetic field and the external sources at their origin by using the MAGDAS magnetometer network and other data sets (ionospheric parameters as electronic densities, ionospheric electric fields etc..). Figure 2 shows the world distribution of the MAGDAS network of magnetometers.

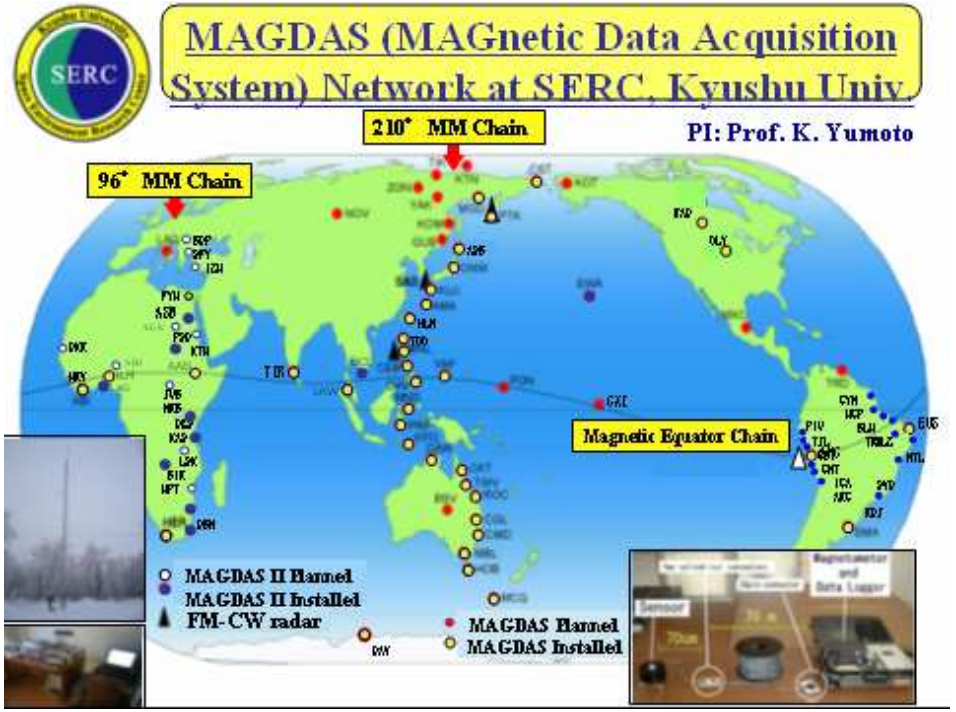


Figure 2: MAGDAS network

Our objective : to understand the transient variations of the earth magnetic field, resulting from physical processes at work in the earth environment mainly in the :
Ionosphere – conductive layer around the earth at the altitude from ~80 to ~ 500 km
Magnetosphere – cavity of the earth magnetic field.

- **Proposed Research Plan**

- **Determination of the geophysical context to understand the different magnetic field signatures :**
- Following the Biot and Savart law, the earth magnetic field integrates the signatures of all the current systems existing in the Ionosphere and the Magnetosphere. These current systems vary with solar activity and solar events such as flare, CME etc…. The sun is acting on the earth environment through solar radiations and solar wind (flow of solar particles).
- Therefore it is necessary to analyze solar data to know exactly the physical processes at work on the sun in order to interpret the transient variations of the terrestrial magnetic field.
- **Classification of the events**
- The events are organized in different classes by using solar events and also geomagnetic indices. The geomagnetic indices such as AL, AU, Dst, Am etc… allow (permit) to understand the response of the Ionosphere and magnetosphere to the solar activity and the resulting solar events.
- **Data analysis**
- The data analysis will be conducted separately according the different classes (in each class*) in order to qualify each physical process. We will analyze the mean characteristics of each class and investigate further (analyze) specific cases in order to develop a data base for numerical simulations. In the following, these different classes are presented:
- Class of magnetic quiet days: this class deals with days which are under the main influence of the regular radiation from solar source (ionospheric dynamo)
- Class of solar flares: this class are related to strong emissions of radiations from the sun (ionospheric dynamo)

- Class of magnetic disturbed days: this class concerns days which are under the main influence of the solar wind source (solar wind /magnetosphere dynamo). This class will be split into different sub class related to the different type (kind) of perturbations (prompt penetration of the magnetospheric electric field, ionospheric disturbance dynamo…)
- etc…
- **empirical model for the regular variation**
- With the MAGDAS magnetometer network which records continuously the earth magnetic field, it is possible to establish a model of the regular variation of the earth magnetic field in the Asian sector as a function of solar cycle, season and local time. This model will be useful to study the magnetic disturbance.
- **numerical simulations for selected event**
- In the framework of my PhD, I carried out a simulation of a disturbance dynamo event with the TIEGCM (Thermospheric Ionospheric Electrodynamics General Circulation Model) model of NCAR (National Center for Atmospheric Research). The obtained results constitute an incentive for me to continue in order to contribute more to the improvement of the global circulation model.
- **Expected results and impacts**
- Geomagnetic transient variations result from those of external ionospheric and magnetospheric sources originating from solar activities. To predict the impact of the sun on the earth environment, it is then necessary to investigate geomagnetic variations in coordination with ionospheric data to approach the physical processes at work in the earth environnement. The coming era dedicated to radiocommunications require a better knowledge of the sun-earth environment physical process to forecast eventual harmful event to ground and on-board radiocommunication systems and all the way improve their reliability.