Some scientific achievements IHY and ISWI

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Summary

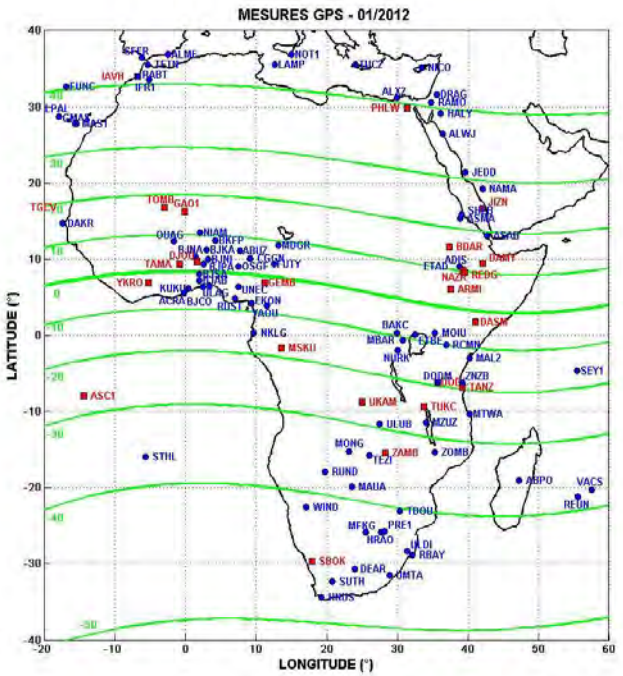
- **Sociology of science: results**
  - Deployment of tools -> observatories
  - Training -> schools -> organization of Masters
  - Teams of Research -> position for students

  (http://www.iswi-secretariat.org -> Achievements presented at Quito meeting)
- **Scientific Results**
- **IHY : New approach**
  - Geophysics to Heliophysics
- **ISWI : strong connections with society**
  - Politics and medias

GPS

NOT FREE ON THE WEB

~ 50 stations in South Africa
~ 15 stations in Morocco
~ 9 stations in Burkina Faso
~ 9 stations in Egypt
~ 15 SCINDA stations
etc…



GPS available on the web, in red since 2011

Recommendations made at Quito during the ISWI meeting in 2012

It is important to increase:

- **SCINDA GPS network**, even the data are not yet share on the web => constitution of a data base for scintillation

- **National networks of GPS** with all the users of GPS in the different fields of research
  - Ionosphere, Atmosphere, Geography, Geodesy etc…

- **GPS Networks available on the Web** Contact UNAVCO http://www.unvaco.org

IGS
http://sopac.ucsd.edu
http://cddis.gsfc.nasa.gov
http://igs.ensg.ign.fr
AMMA stations are now in IGS
NOAA et UNAVCO
http://www.ngs.noaa.gov/CORS
http://www.unvaco.org

SCHOOLS

http://www.iswi-secretariat.org

First school in Africa / Abidjan 1995
IEEY Project

Schools organized by GIRGEA in the framework of IEEY, IHY, ISWI programs

GPS, GIS, INTERNET, DATA BASE, NEW TECHNOLOGIES AND SPACE WEATHER : INTRODUCTION
Congo 2009, Egypt 2010, RDC 2011, Burkina Faso 2014
Different communities : Physic, Geography, Agronomy, Mathematics and ICT

SPACE WEATHER : Physic of the Sun Earth System
Ivory Coast 1995, Morocco 2011, Algeria 2013
Physicists level M2

GPS DATA PROCESSING FOR IONOSPHERIC STUDIES
France 2011, France 2012, probably France 2013
PhD students using GPS data (few students : 5 and 2 professors during 5 days)

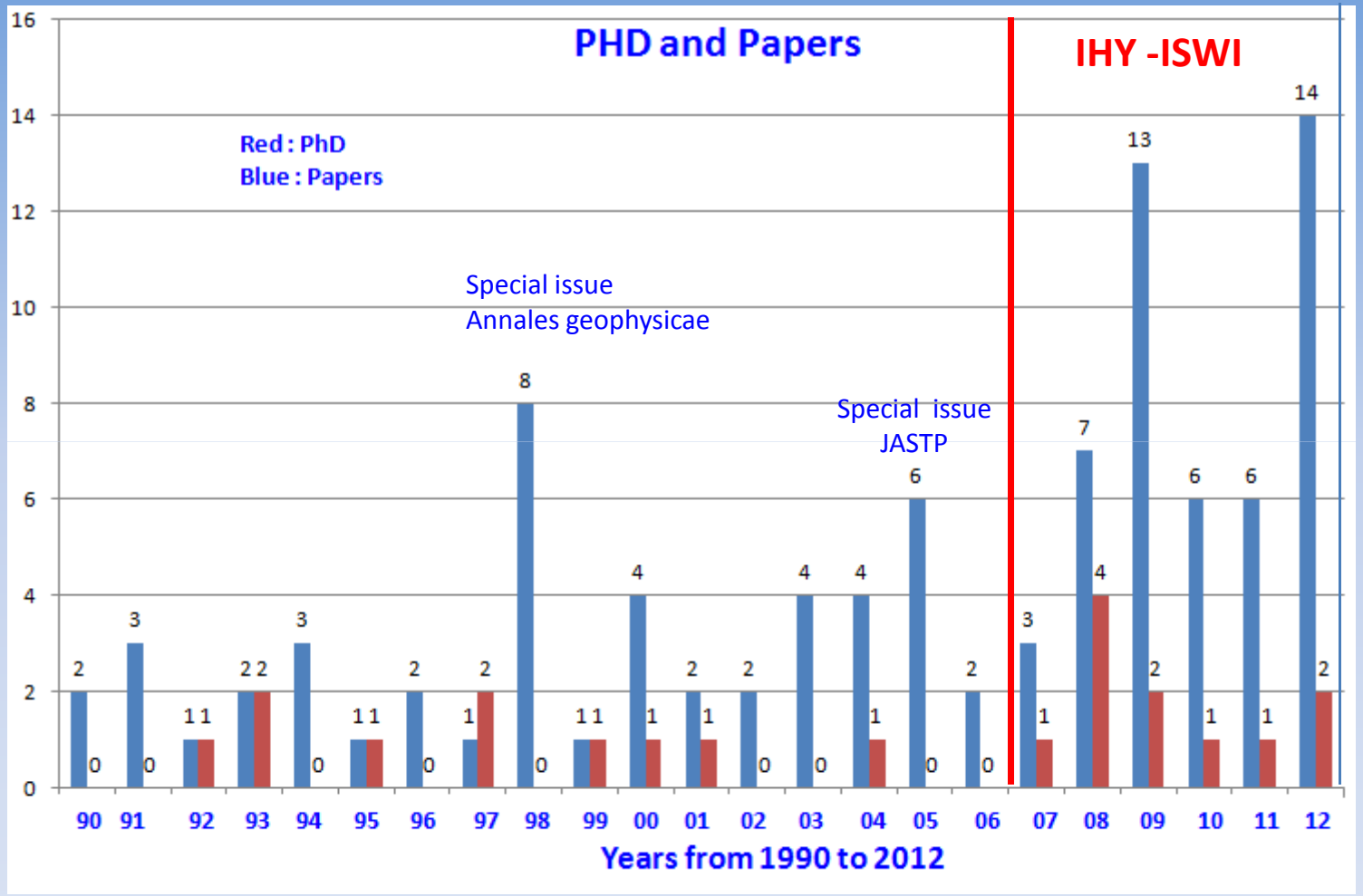
International Equatorial Electrojet Year – IEEY / Brazil 1992

Schools are organized
by IRGGEA since 1992
by SCINDA since 2006
by MAGDAS since 2010
by IHY and ISWI since 2007
by African countries since 2008

IRGGEA

Newsletters since 1992
www.girgea.org

17 years : 1990-2006 : 48 papers + 10 PhD
6 years : 2007-2012 : 51 papers + 11 PhD



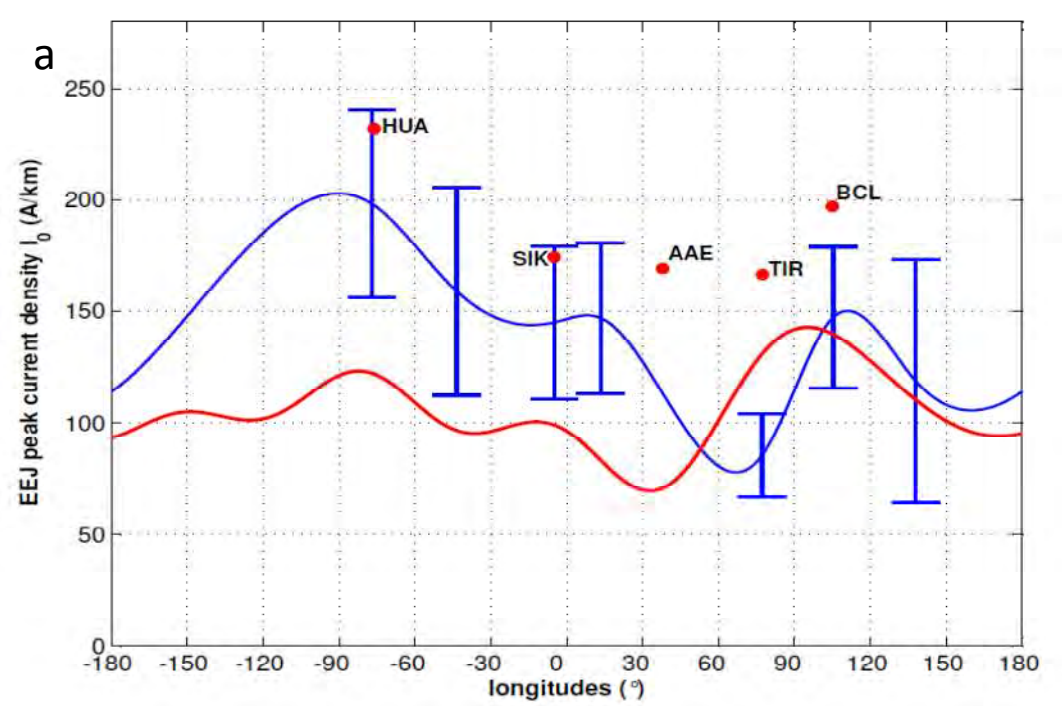
More results if we add other African countries
South-Africa/Rwanda, Nigeria, Kenya …

Summary

- **Sociology of science: results**
  - Deployment of tools -> observatories
  - Training -> schools -> organization of Masters
  - Teams of Research -> position for students
- **Scientific Results**
- **IHY : New approach**
  - Geophysics to Heliophysics
- **ISWI : strong connections with society**
  - Politics and medias

Longitudinal Asymmetry of the Equatorial Electrojet

Talk of V. DOUMBIA



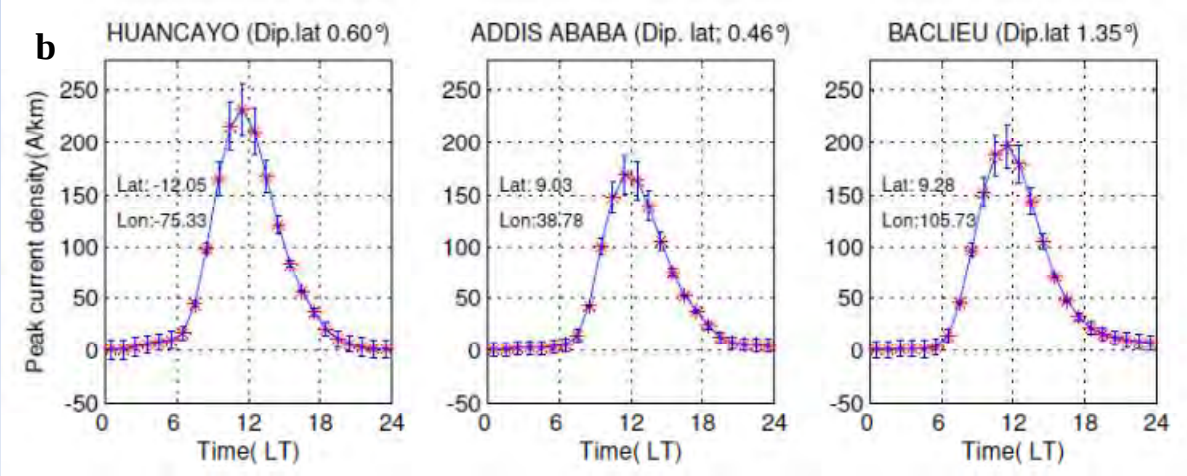
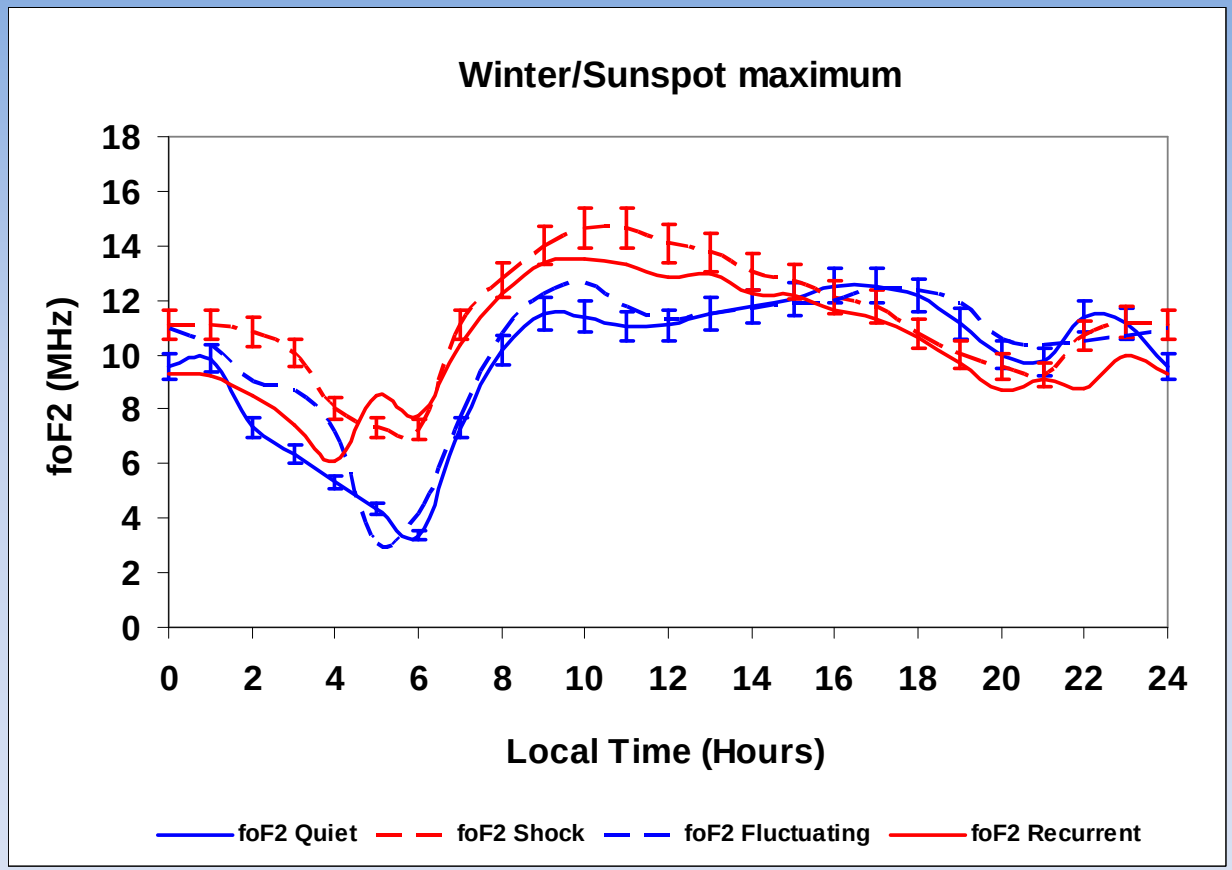


Figure 2: (**a**) Mean longitude variation of the EEJ noontime peak current density from CHAMP satellite observations (red curve), from ground-based IEEY data (blue curve) and the mean annual value of the peak current density (red thick dots) at Huancayo, Addis Ababa, Sikasso Tirunelveli and Baclieu in 2002. The error bars of the IEEY profile correspond to the standard deviations. (**b**) Average daily variation of EEJ peak current density at 3 magnetic observatories Huancayo, Addis Ababa and Baclieu for the year 2002. The error bars correspond to the standard deviations.

Statistical study of The F2 Layer using the classification of Legrand and Simon

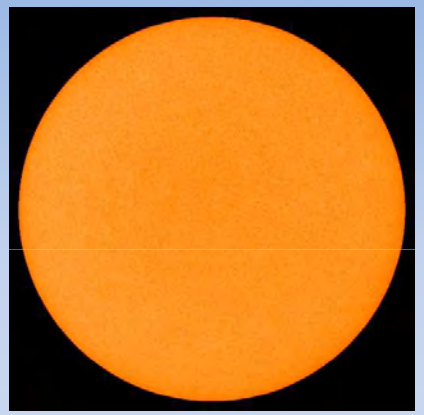
See the talk of F. OUATTARA



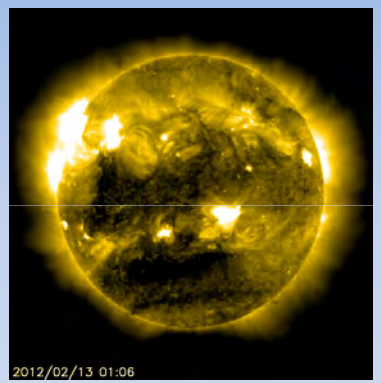
Ouattara and Amory-Mazaudier to appear in SWSC, 2012

Classification of Legrand and Simon is based on the Aa indices, SSC, Solar events and the empirical relation between solar wind and geomagnetic indices given by L. Svalgaard (1977) Annales Geophysicae, 1989

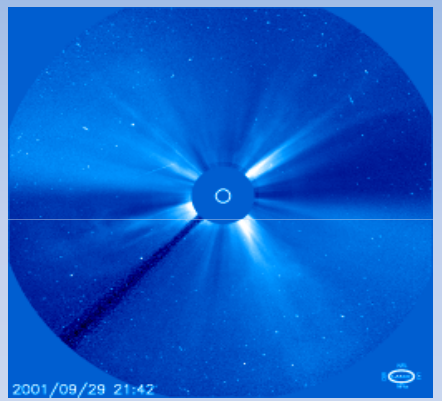
Aa < 20 nT
Quiet magnetic activity



Aa > 40 nT
Recurrent activity
High speed solar wind streams from coronal holes

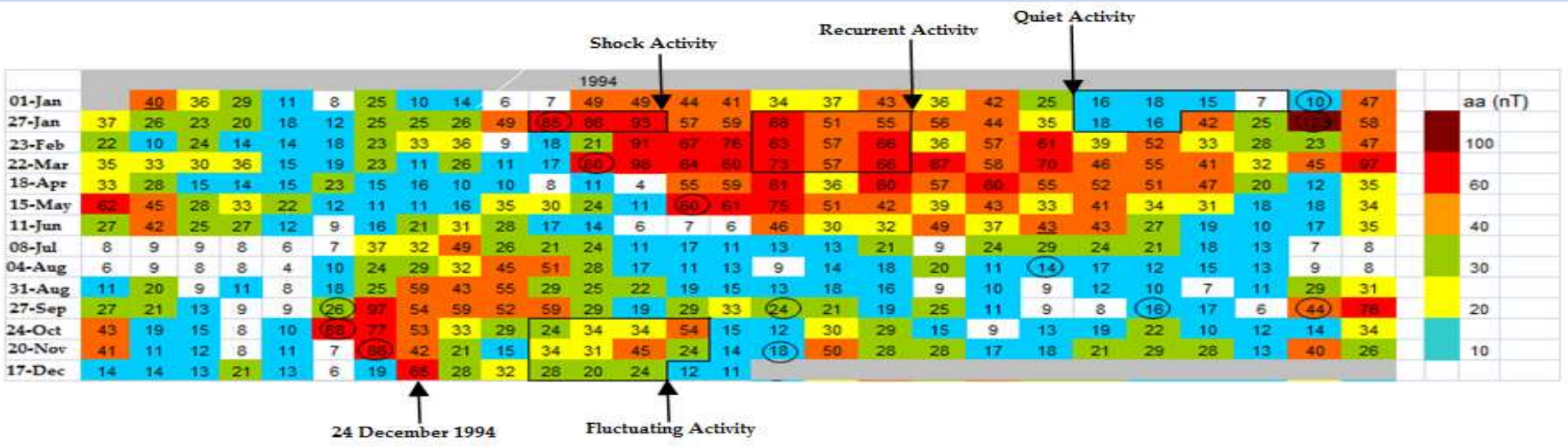


Aa > 40 nT
Shock activity /SSC
CME



20nT<Aa<40nT
Fuctuating activity

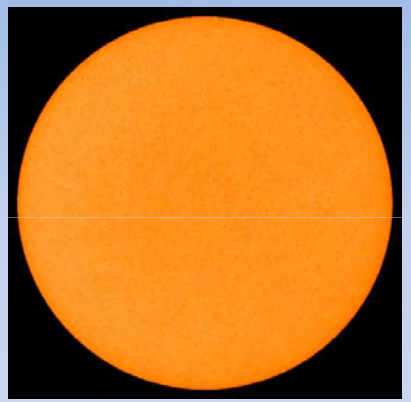
All the other cases are ~ 40%



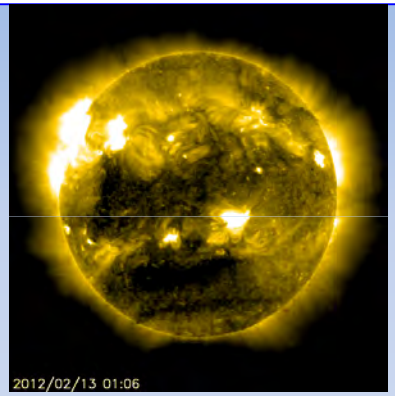
Improving of the classification of Legrand and Simon using Aa indices, SSC, Solar events and empirical relation between solar wind and geomagnetic indices

By J-L. ZERBO et al. (Annales Geophysicae 2012)

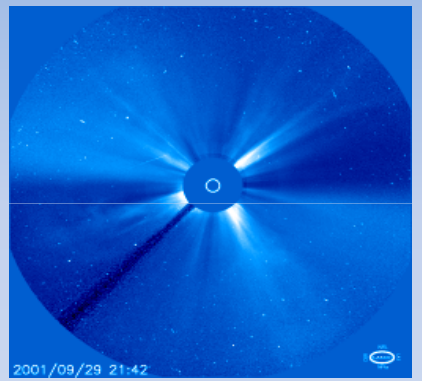
Aa < 20 nT
Quiet magnetic activity



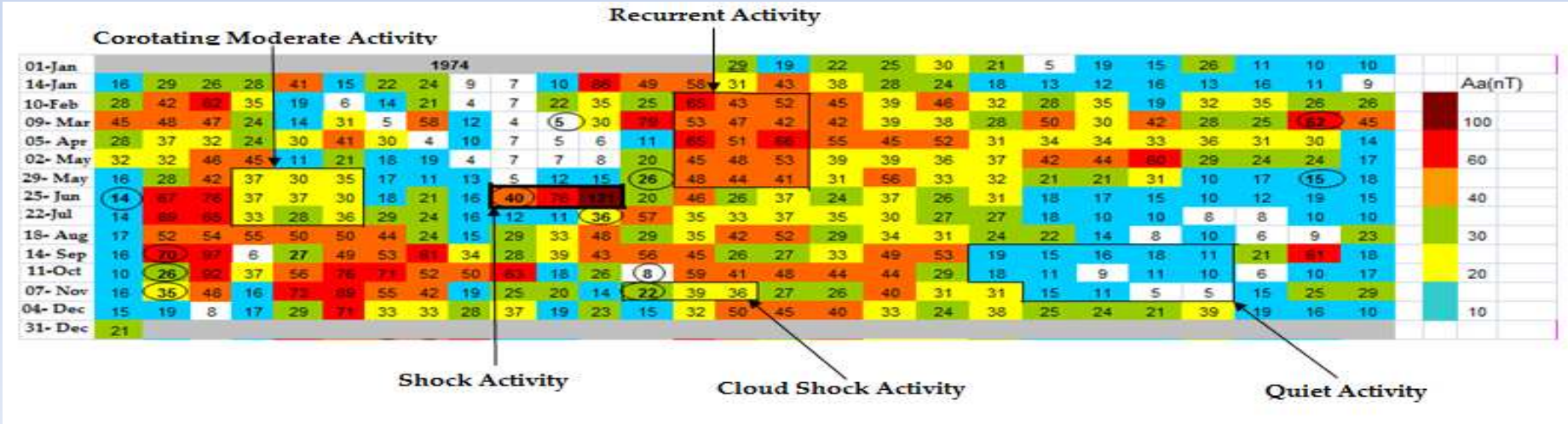
Aa > 20 nT
Recurrent activity
High speed solar wind streams from coronal holes



Aa > 20 nT
Shock activity /SSC
CME

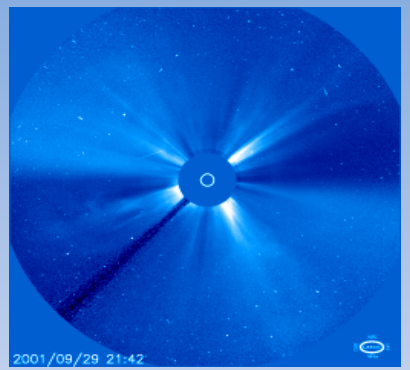


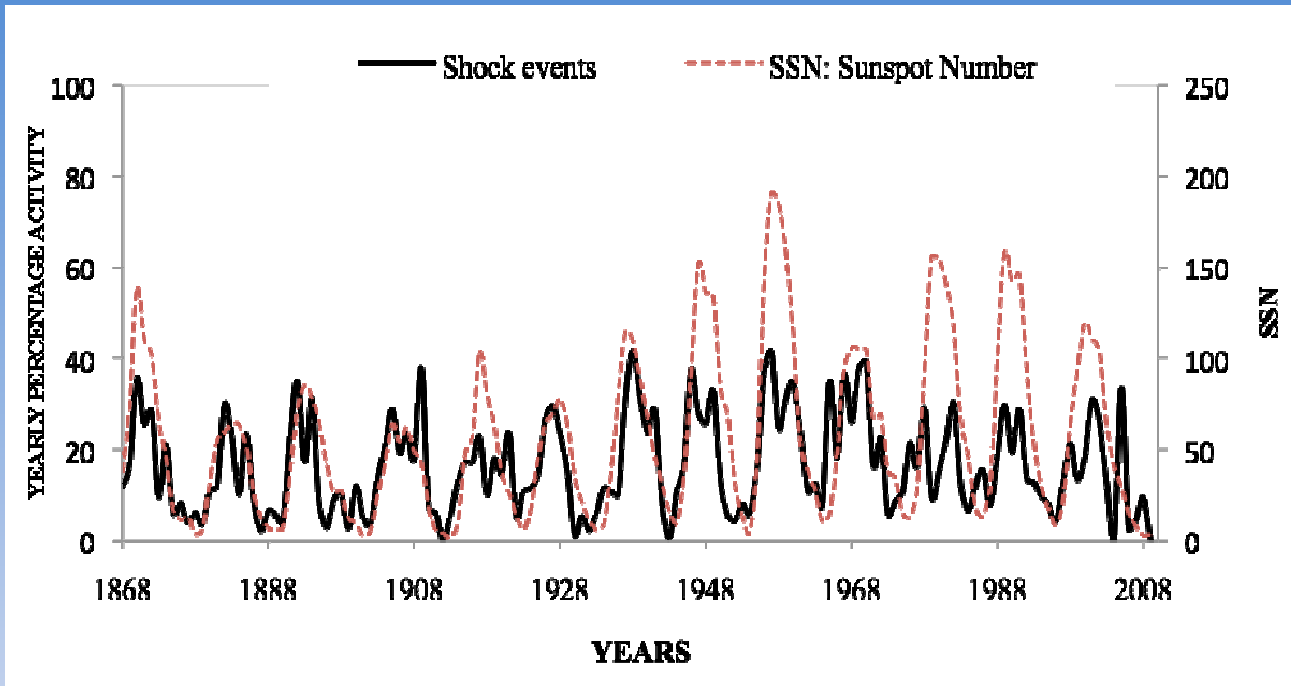
All the other cases are classified in the fluctuating activity ~ 20%



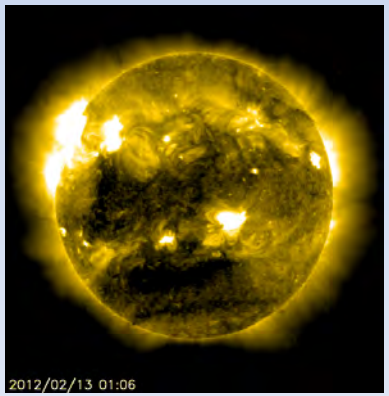
J-L. ZERBO et al. 2012
(Annales Geophysicae)

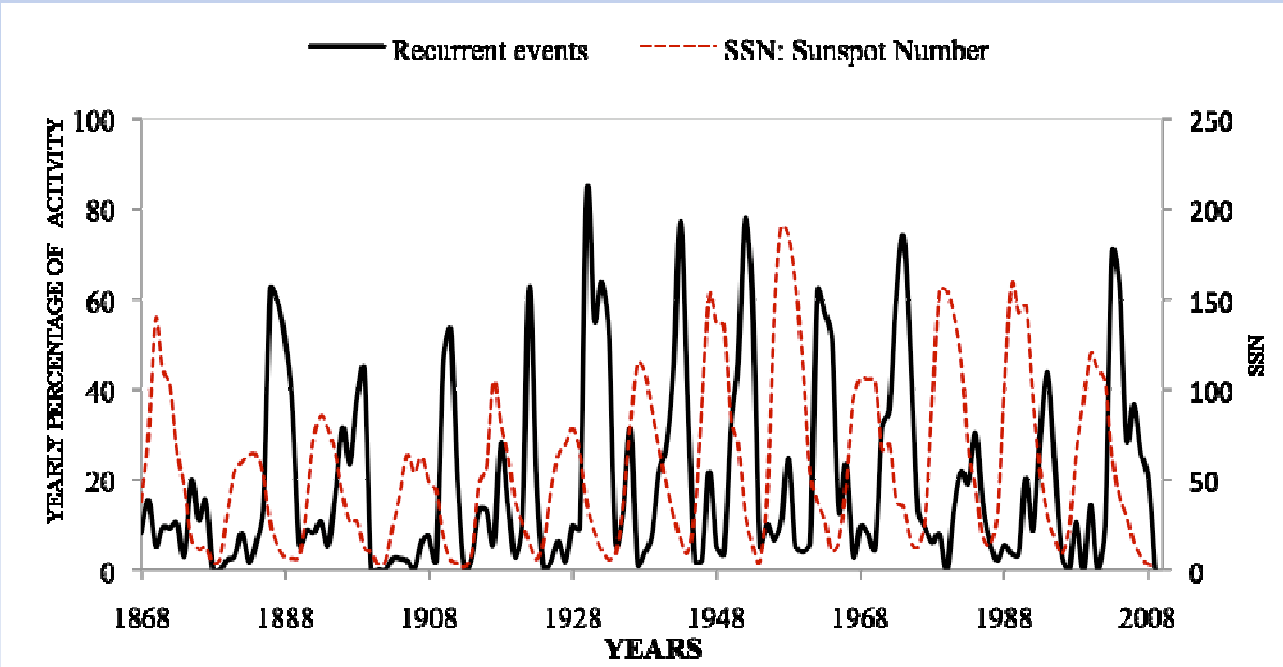
Shock events -> CME

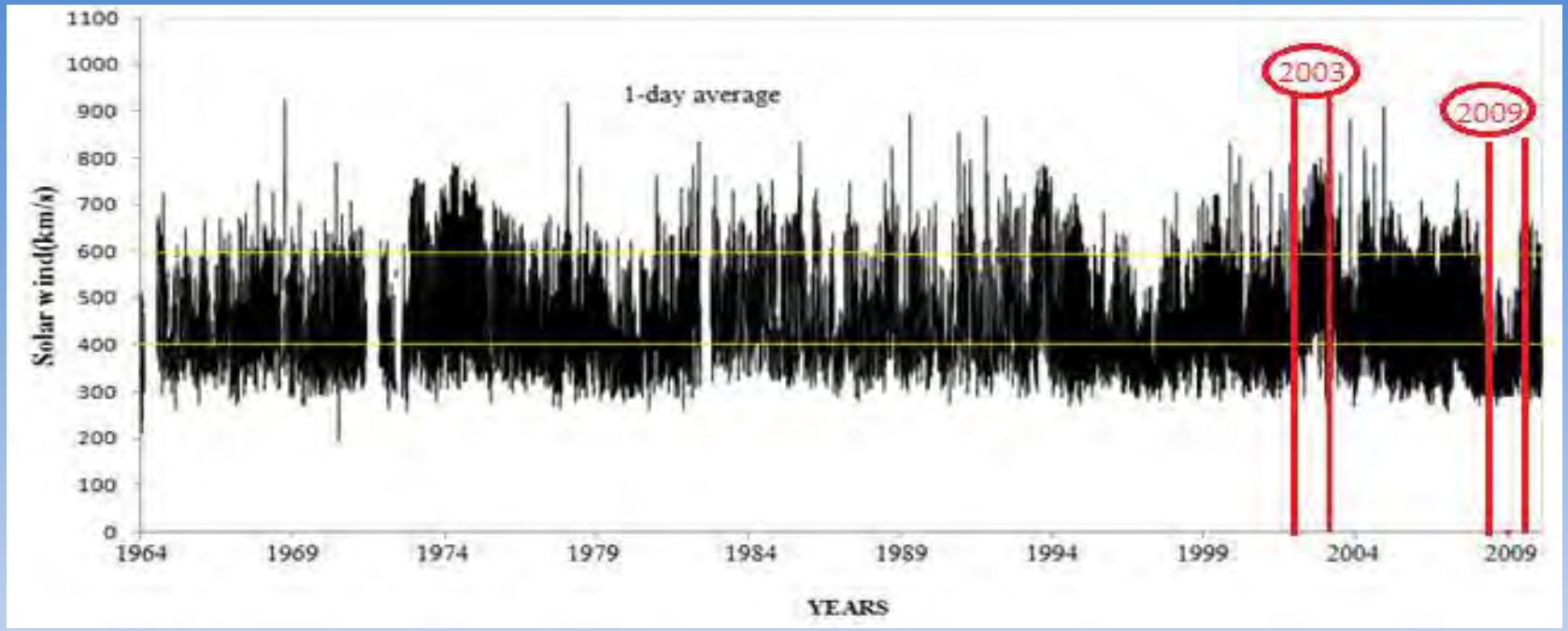


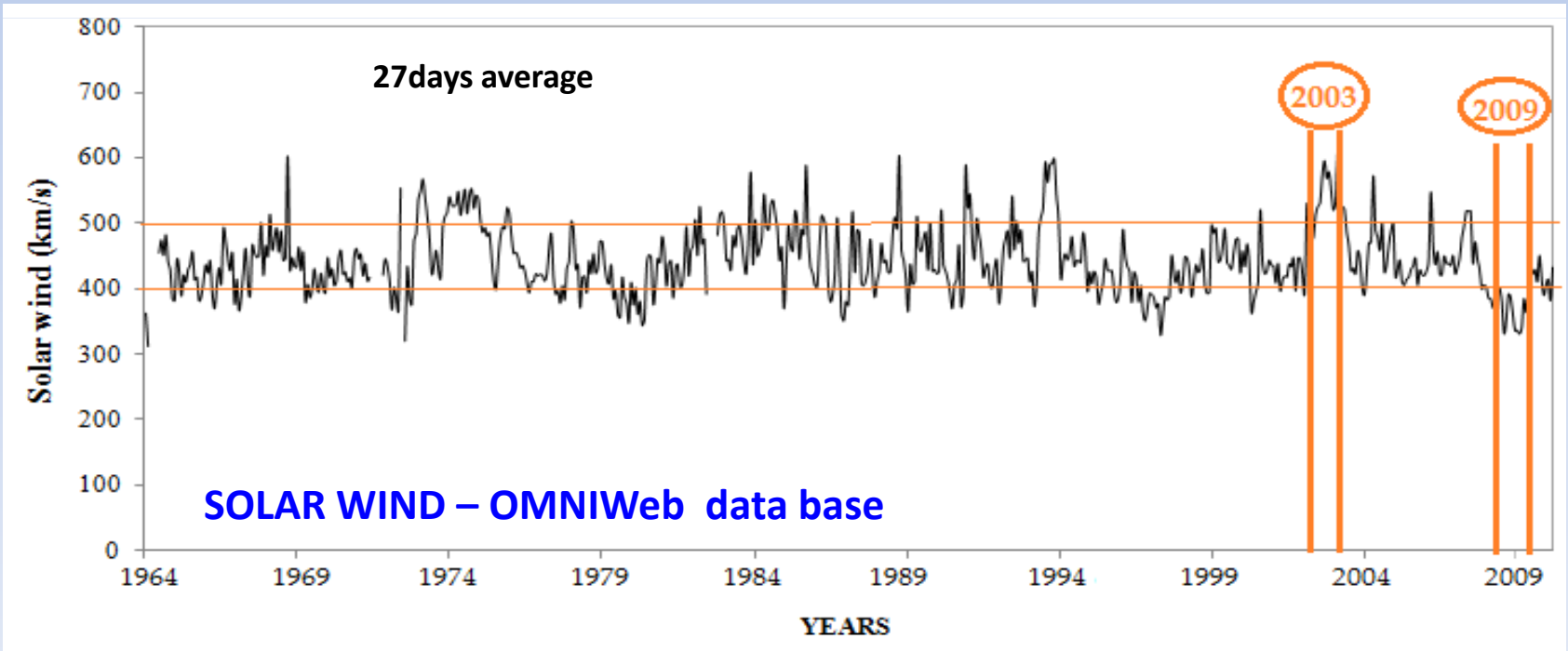


High speed solar wind Streams flowing from coronal holes

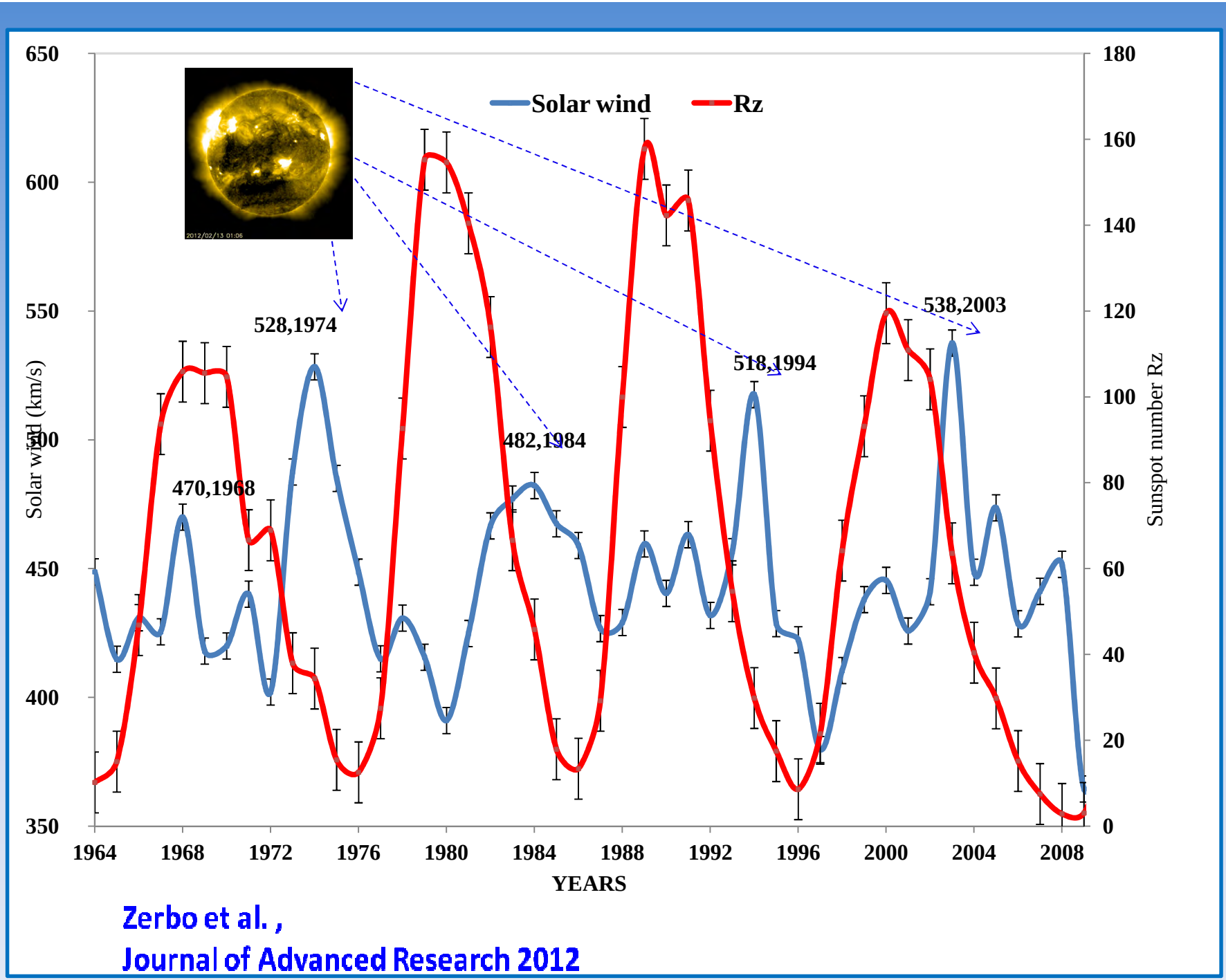




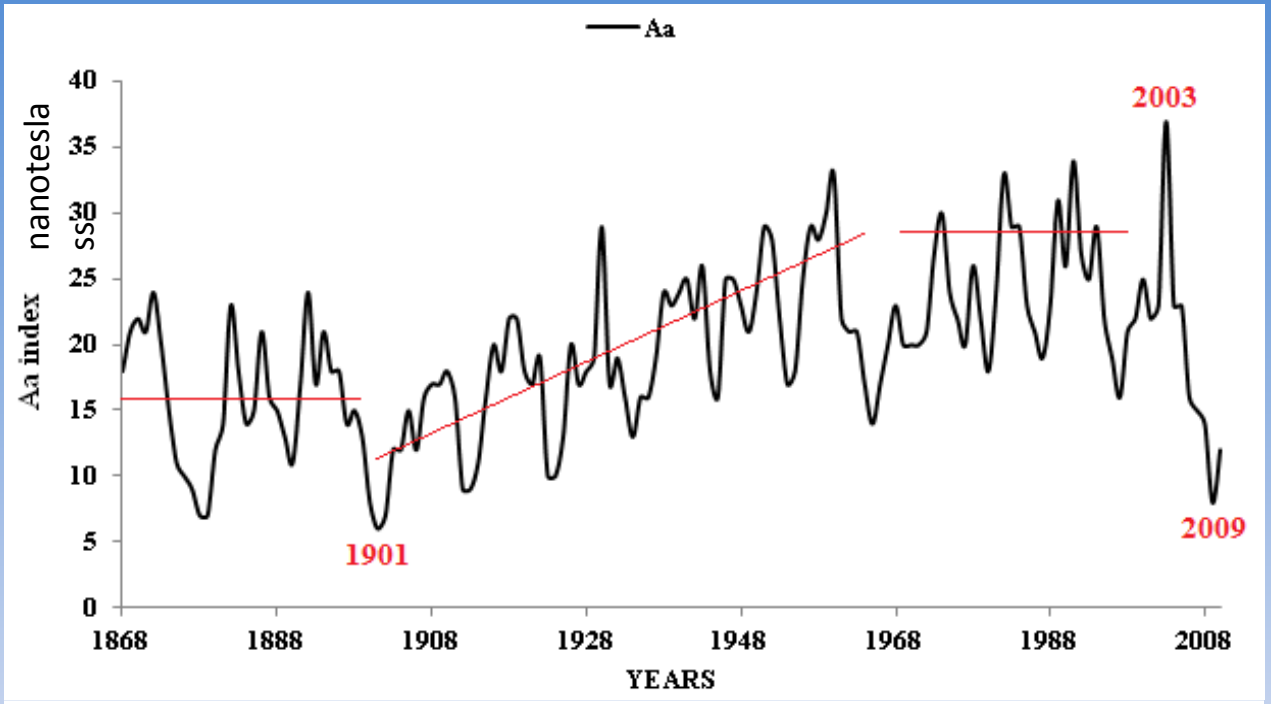


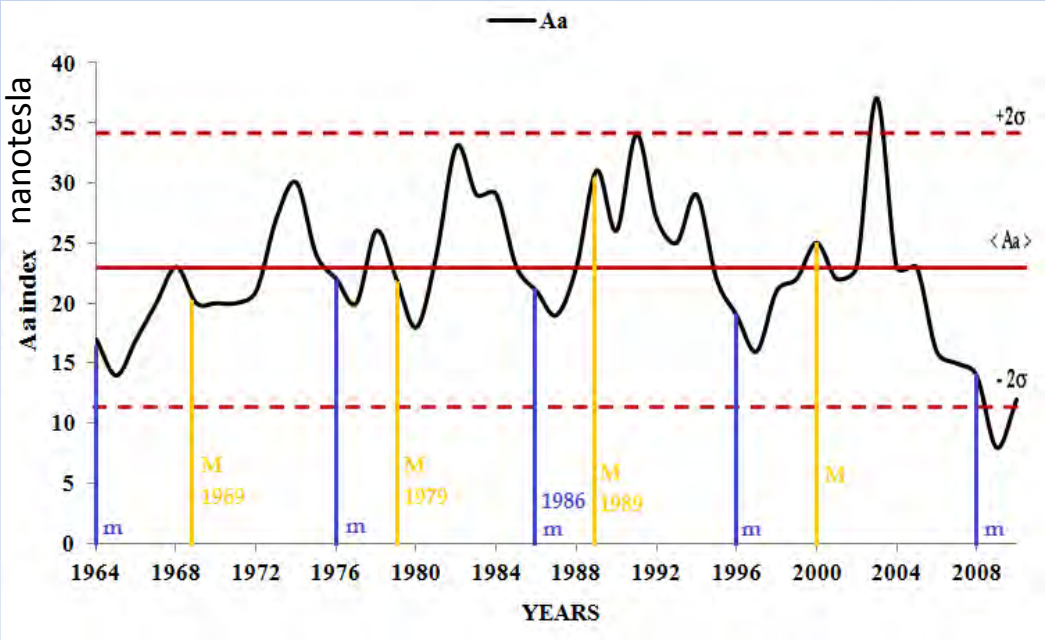


Zerbo et al. , invited paper
Journal of Advanced Research 2012


Solar wind
Rz
528,1974
470,1968
482,1984
518,1994
538,2003
Solar wind (km/s)
Sunspot number Rz
YEARS
650
600
550
500
450
400
350
180
160
140
120
100
80
60
40
20
0
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
2004
2008
Zerbo et al. ,
Journal of Advanced Research 2012

Exceptionnal Years

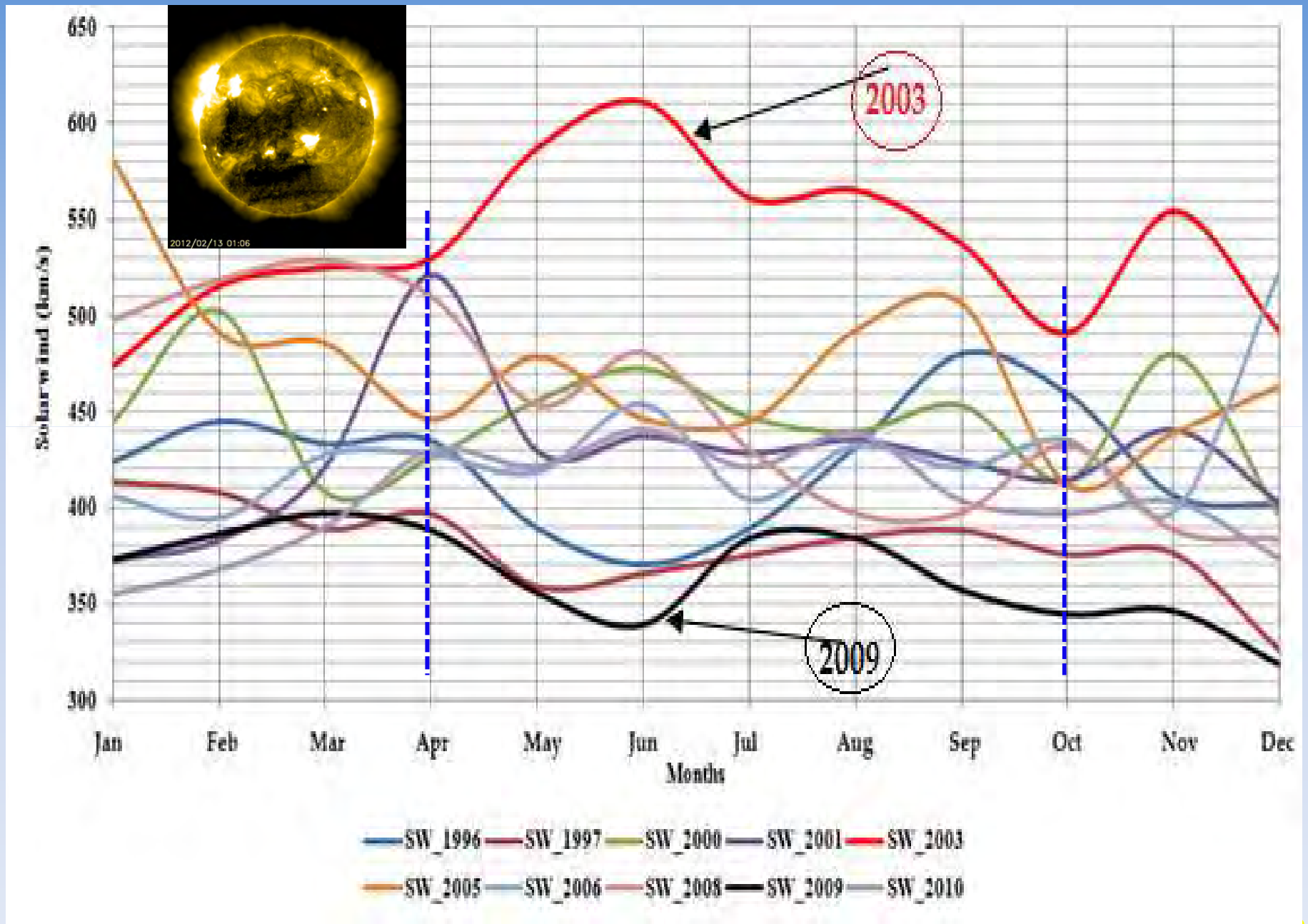




ISGI data base

Zerbo et al. , invited paper
Journal of Advanced Research 2012

Zerbo et al. , Journal of Advanced Research 2012

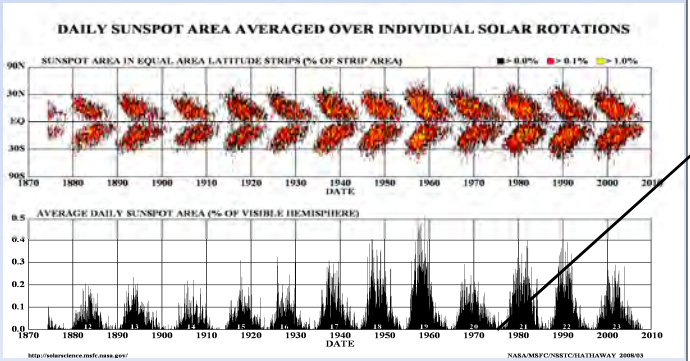


SOLAR CYCLE VARIATIONS AT PHU THUY/ VIETNAM

Pham et al., 2011a

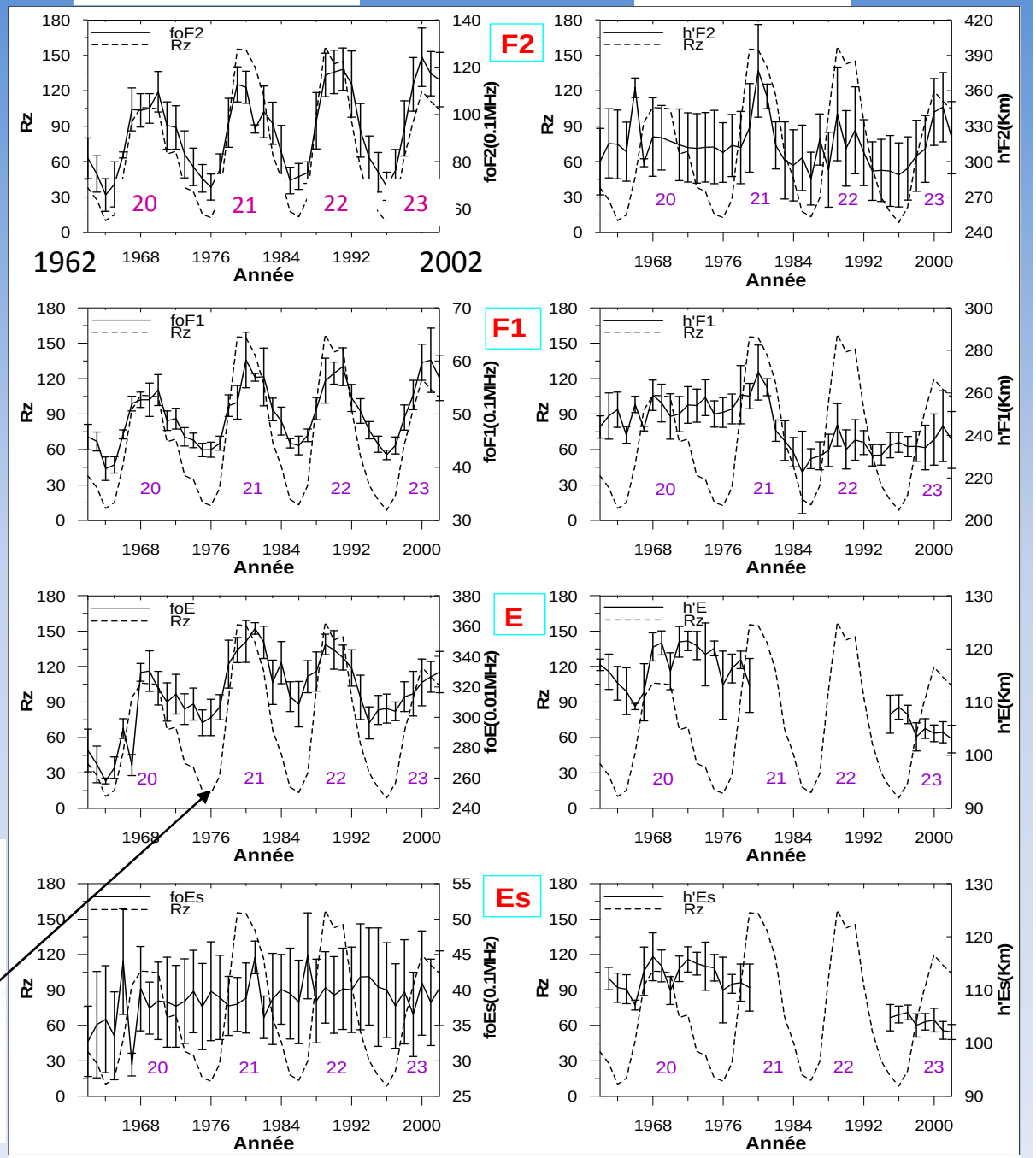
Correlation for solar cycle 20, 21,22 (99%)

- foF2 et Rz ~0. 835, 0.846 et 0.841
- foF1 et Rz ~0.89, 0.791 et 0.867
- foE et Rz ~0.611, 0.652 et 0.754



Critical frequencies

Virtual Height



LONG TERM VARIATIONS AT Phuy Thuy/ Vietnam PHAM et al., 2011a

The long term variations are computed by using the linear regression :

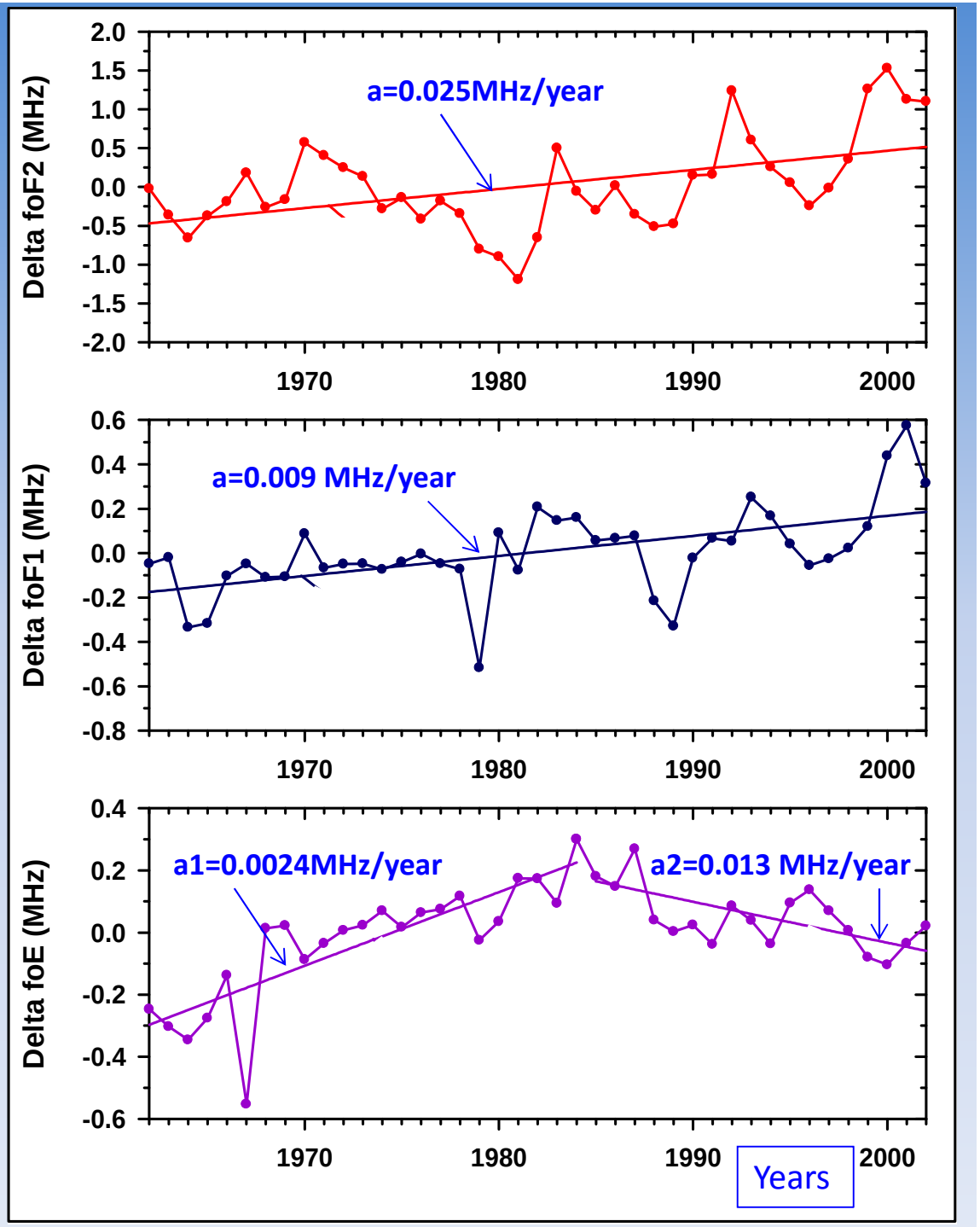
$$Xth = a.R+b \quad (1a)$$

R: the sunspot number

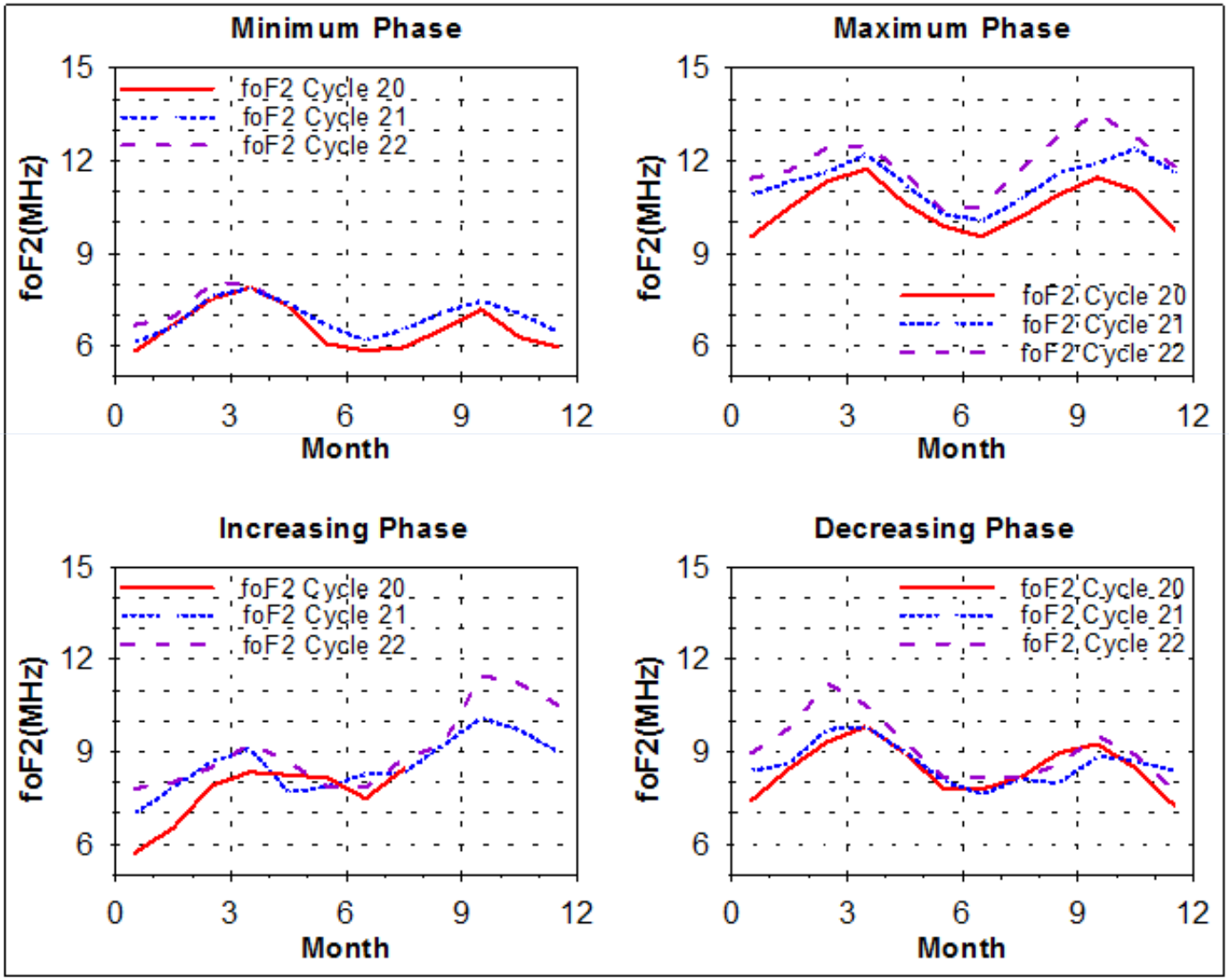
$$\Delta Xi = Xi - Xth \quad (1b)$$

Xi: critical frequencies observes

- foF2 increases with a rate of 0,025 MHz/year
- foF1 increases with a rate of 0,009 MHz/year
- foE increased from 1962 to 1984 with a rate of 0,024 MHz/ year and then decreased with a rate of -0,013 MHz/year



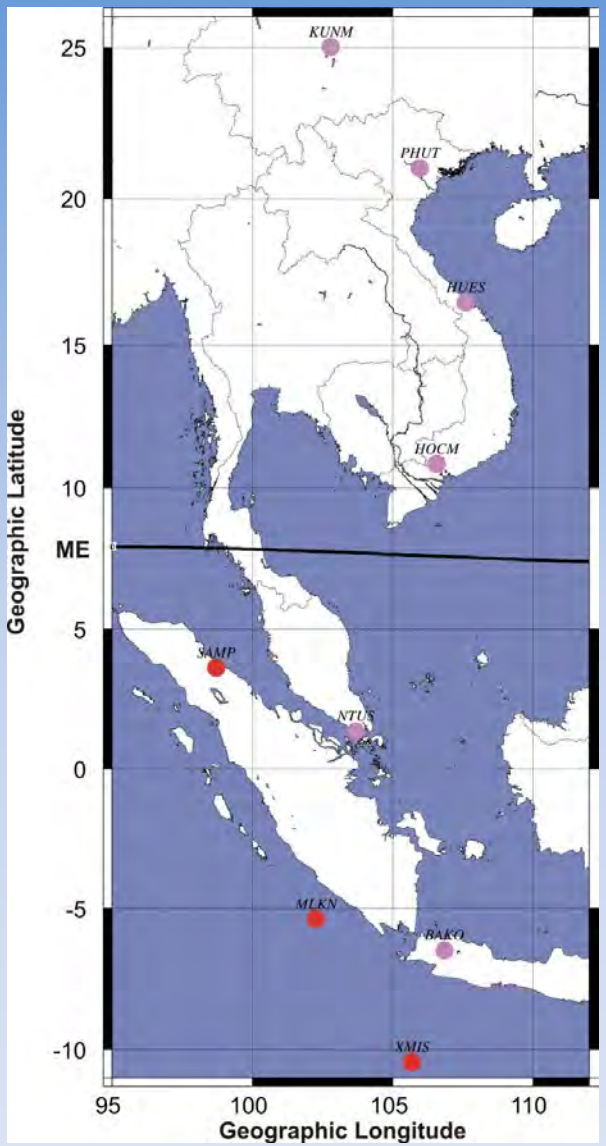
EQUINOXIAL ASYMMETRY AT PHU THUY VIETNAM
Pham et al., 20011a -Annales Geophysicae



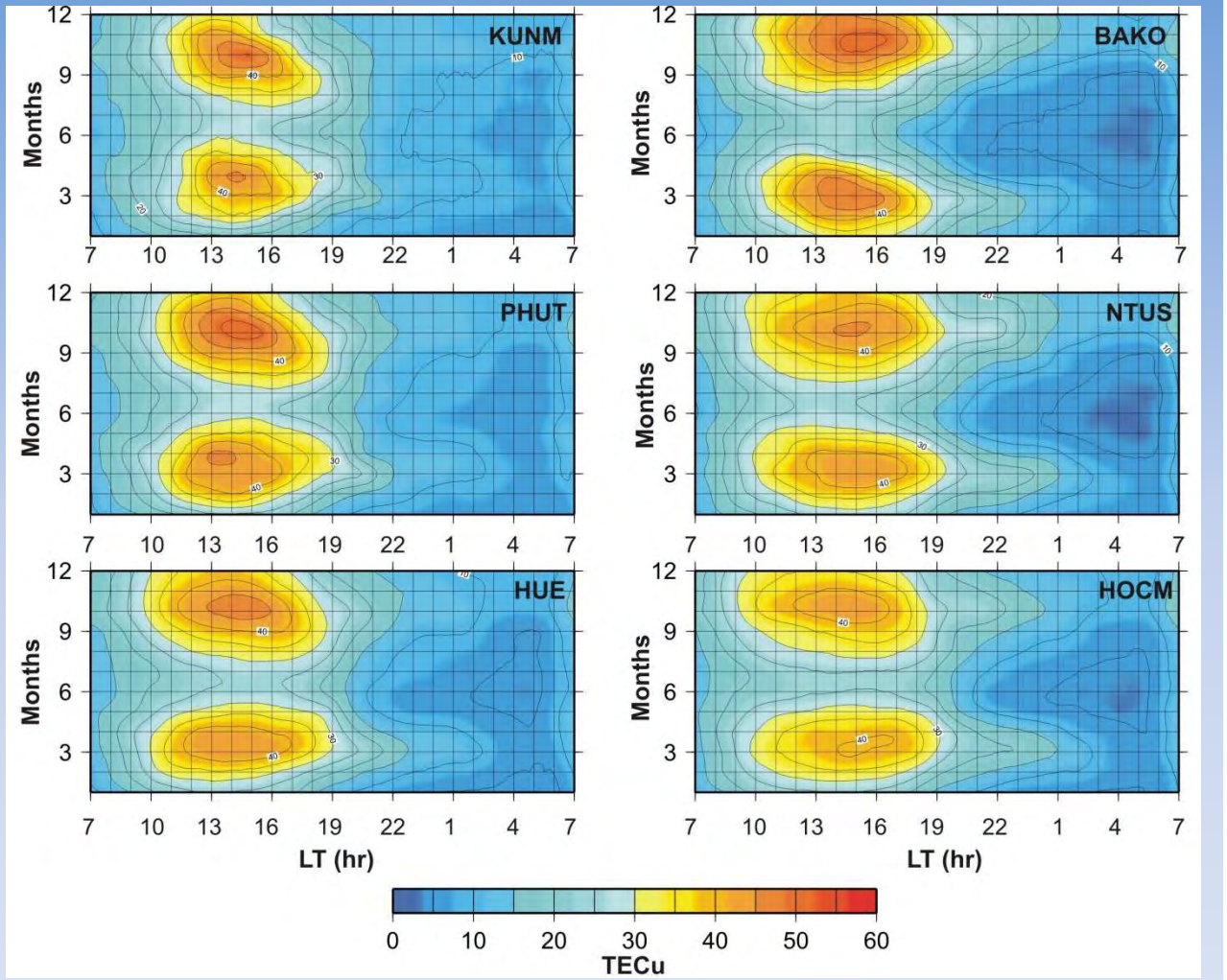
Equionoxes

- 2 maxima in March April or October
- The asymmetry changes with solar cycle phases

Equinoxial asymmetry along a latitudinal chain of GPS in the East Asian sector.



Year 2010 increasing phase of solar cycle

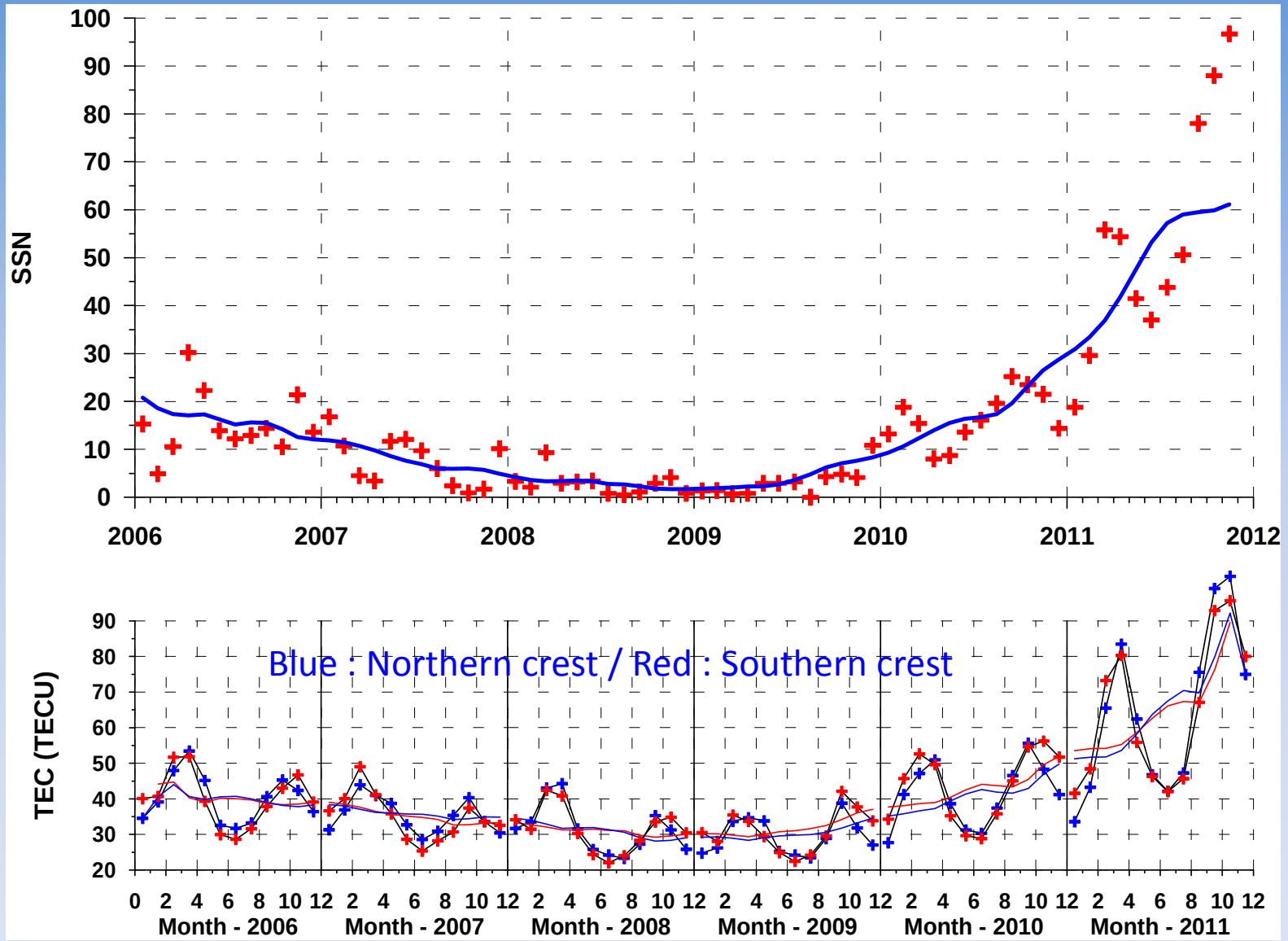


autumnal Equinox > vernal equinox

GPS from IHY

Le Huy et al., submitted to Annales Geophysicae, 2012

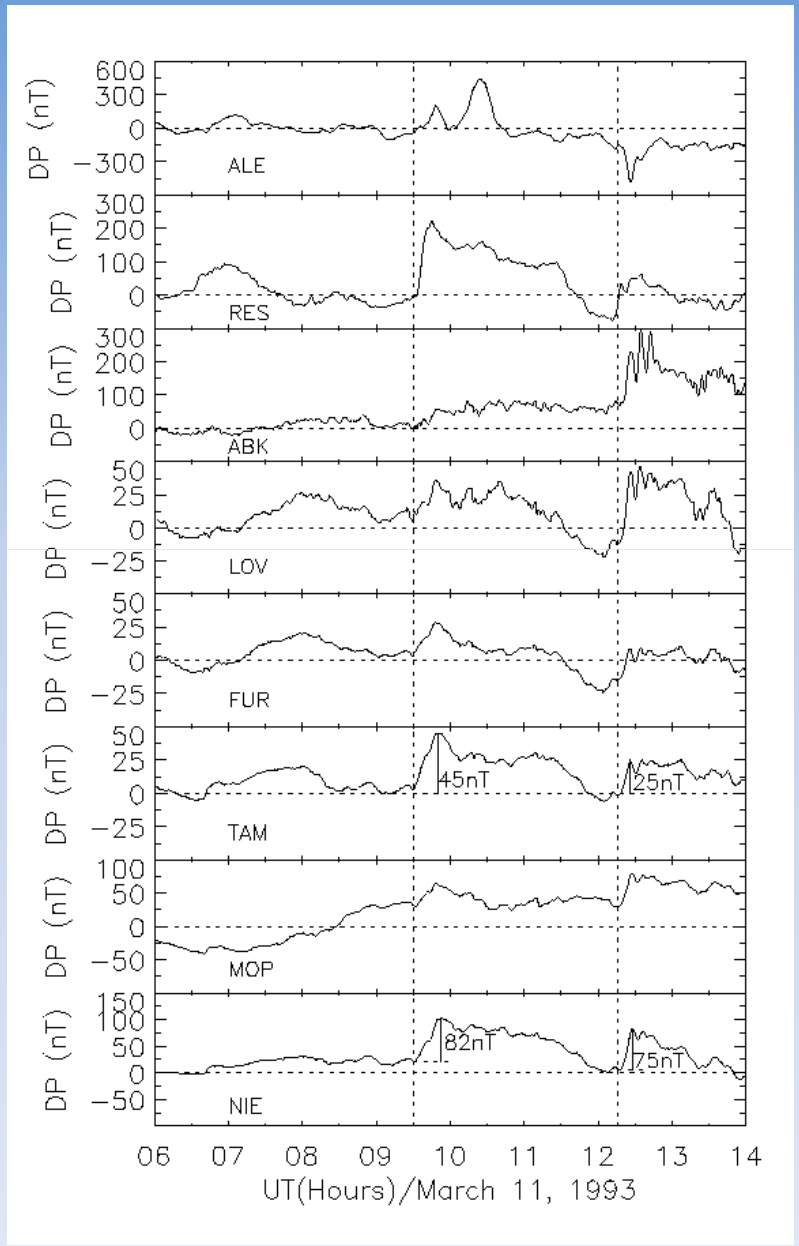
Solar cycle and annual variations of the TEC in the East Asian sector



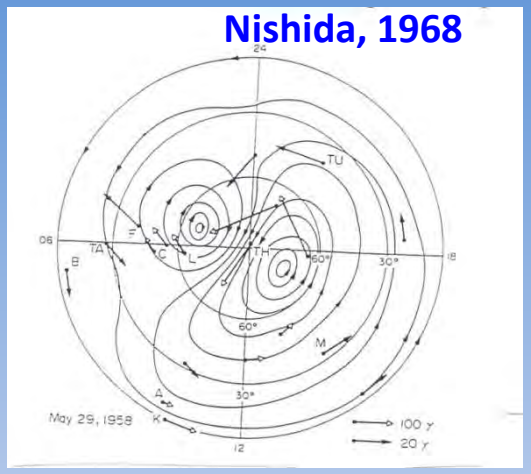
Le Huy et al., submitted to Annales Geophysicae

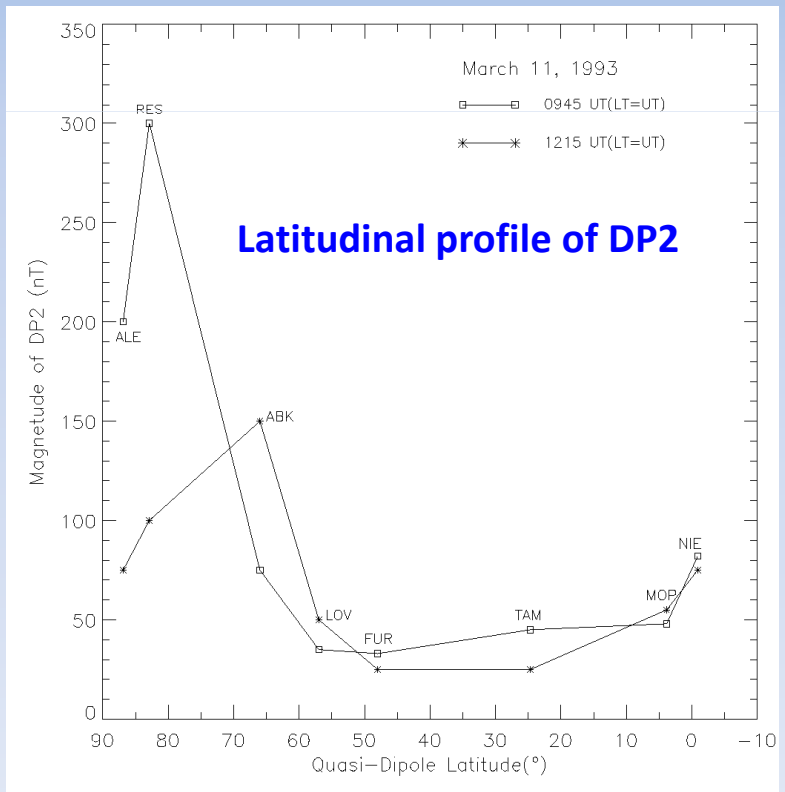
Mene et al., Annales Geophysiace, 2011
Côte d'Ivoire -> PhD in 2013

STATISTICAL STDY OF THE DP2 Current System

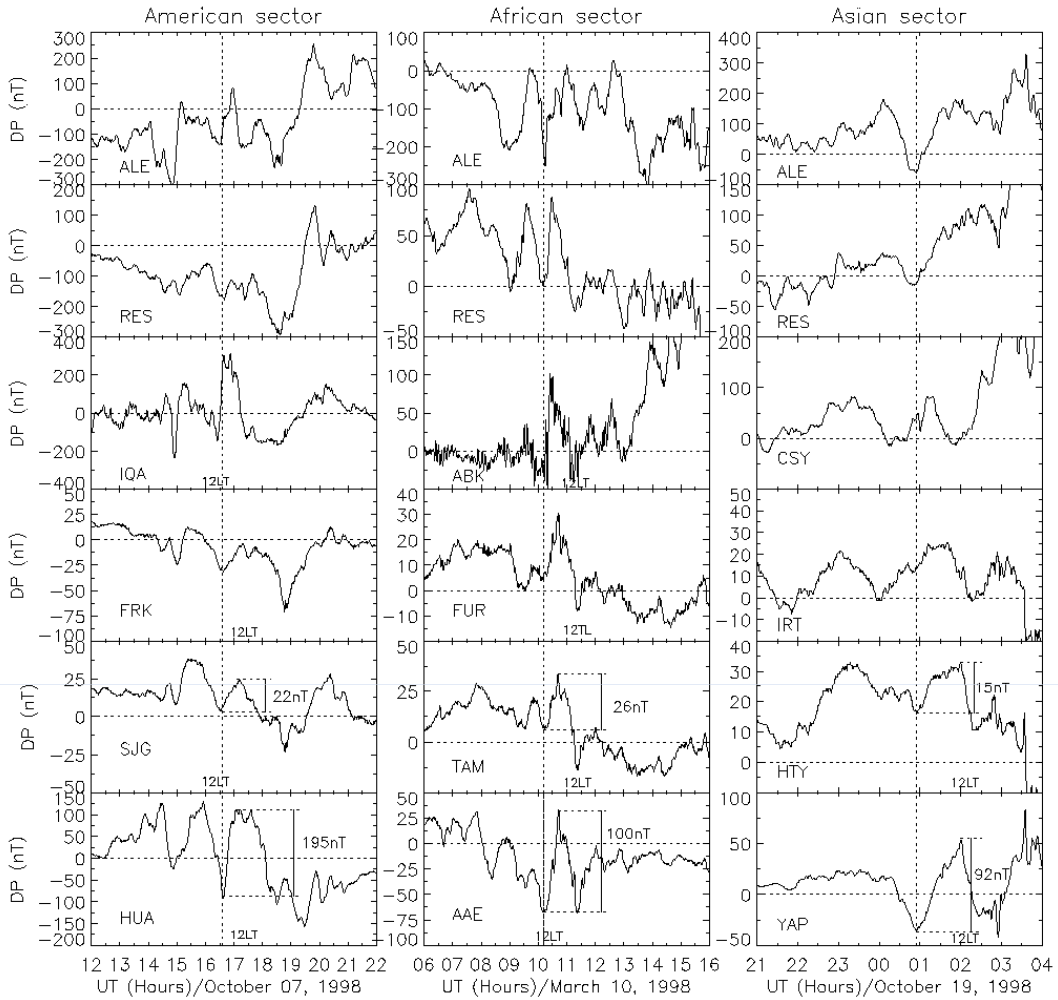


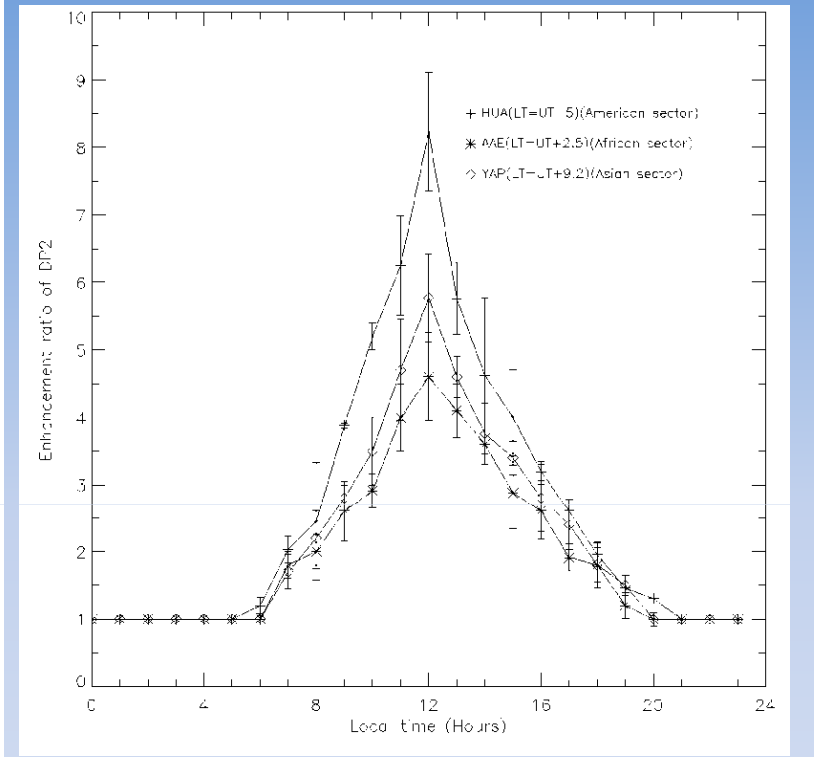
Nishida, 1968

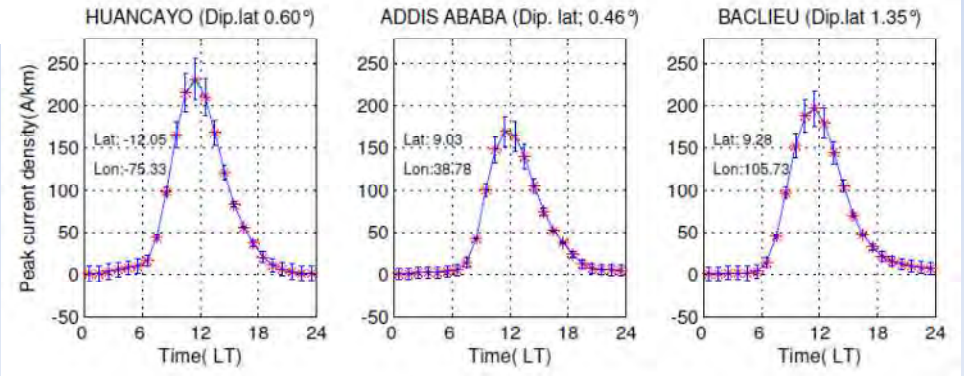




Enhancement of DP2 in the Three Longitude sectors

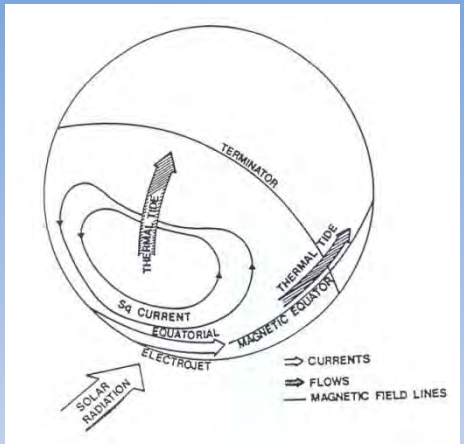






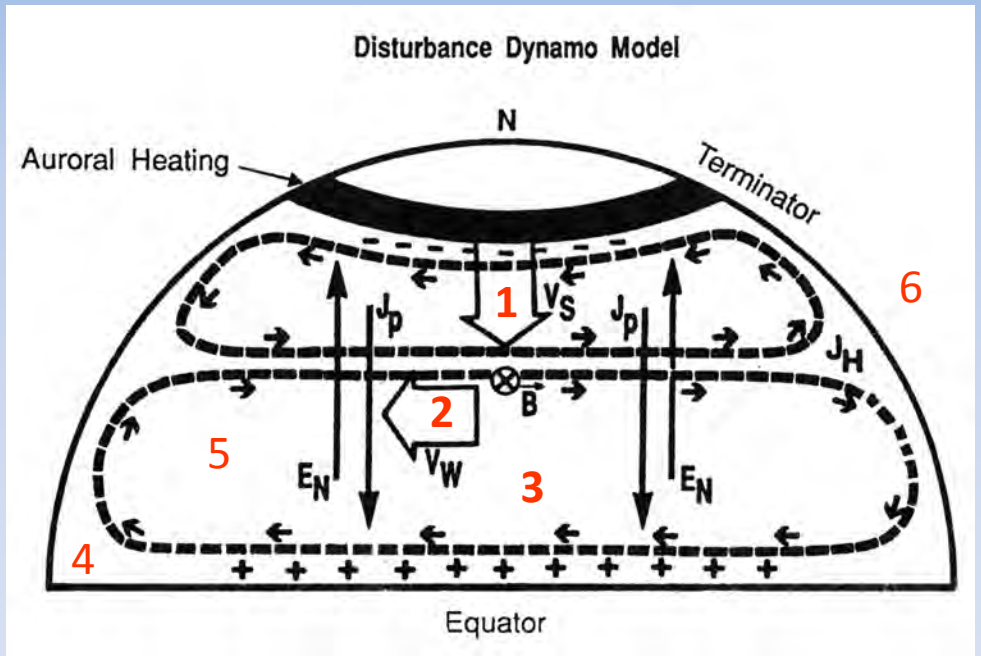
Mene et al.,
Annales Geophysiace, 2011

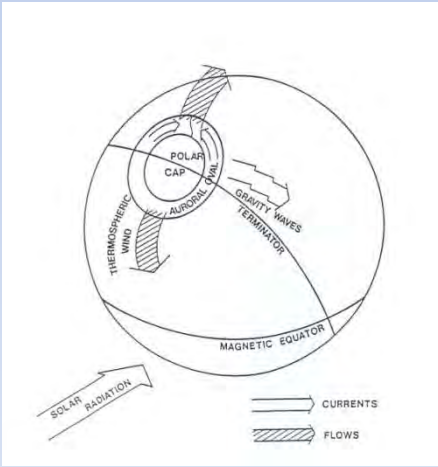
The Ionospheric Disturbance Dynamo
Blanc and Richmond, JGR 1980



Regular wind

Mazaudier and Venkateswaran
Annales Geophysicae, 1990





Storm wind

Richmond and Matshushita, JGR, 1975
Thermospheric response to a magnetic storm

Magnetic signature of the ionospheric disturbance dynamo at equatorial latitudes : Ddyn

Le Huy and Amory-Mazaudier, JGR, **2005 and 2008**

Blanc and Richmond, 1980

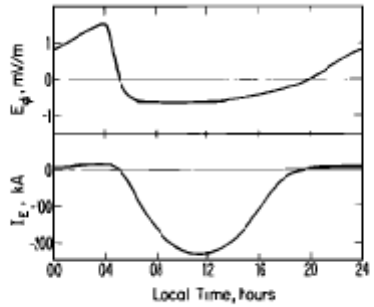


Fig. 9. Local time distributions of the equatorial electrojet parameters E_ϕ, eastward electrostatic field, and I_E, total eastward current flow between +10° and -10° magnetic latitude. Both are basically reversed from their observed normal quiet-day variation.

2. Criteria for the Selection of Cases and Data Analysis

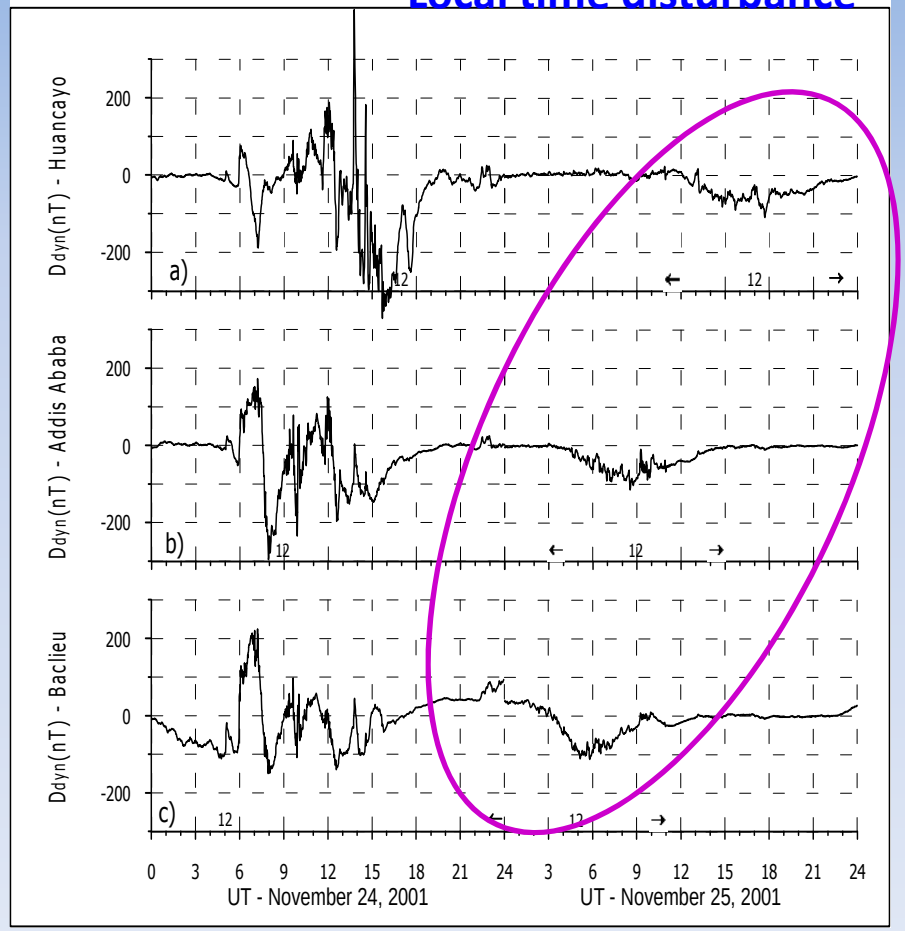
2.1. Criteria

[10] Our purpose being to study the sole ionospheric disturbance dynamo process, we must point out that only daytime signatures can be inferred from the data. Here are the criteria for the selection of the period of observation: (1) daytime period => to study the dynamo action in the E region, (2) period immediately after a storm => there is Joule heating in auroral regions during the period preceding our selected period, (3) no auroral electrojet => there is no penetration of the magnetospheric convection electric field during our selected period.

$D_{dyn} = \Delta H - S_R - DR$

Figure 9.

Local time disturbance



Zaka et al, Annales Geophysicae, 2010
Zaka et al., JGR 2011

PhD on the Ionospheric Disturbance Dynamo in 2010

REPUBLIQUE DE CÔTE D'IVOIRE
UNION-DISCIPLINE-TRAVAIL

UNIVERSITE DE COCODY

UNITE DE FORMATION ET DE RECHERCHE
SCIENCES DES STRUCTURES DE LA MATIERE
ET DE TECHNOLOGIE

LABORATOIRE DE PHYSIQUE DE L'ATMOSPHERE (LAPA)

N° d'ordre

THESE UNIQUE DE DOCTORAT ès SCIENCES PHYSIQUES

présentée par

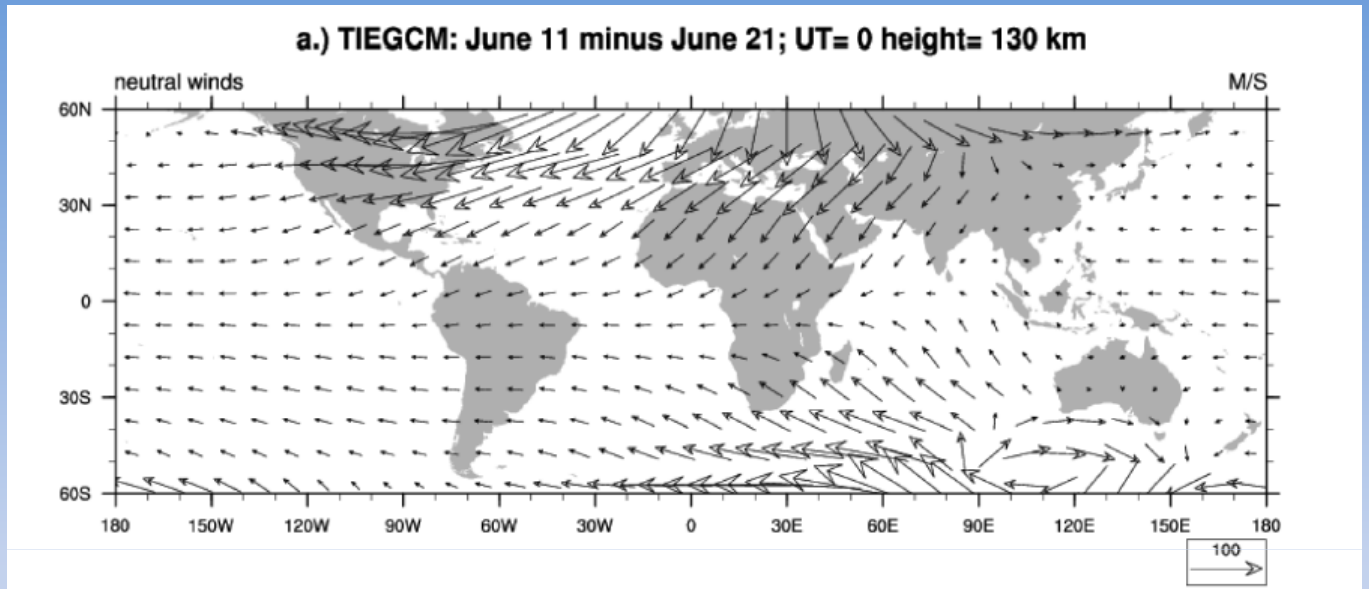
ZAKA KOMENAN ZACHARIE

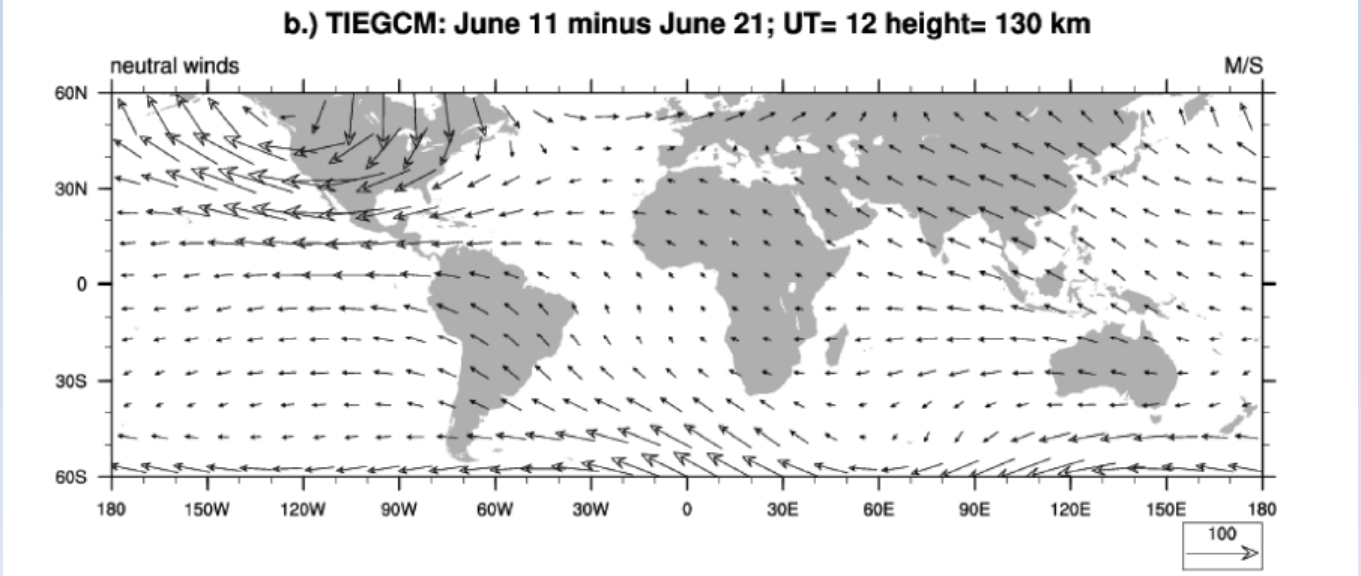
Pour obtenir le grade de DOCTEUR ès SCIENCES

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)*





Zaka et al., JGR 2011

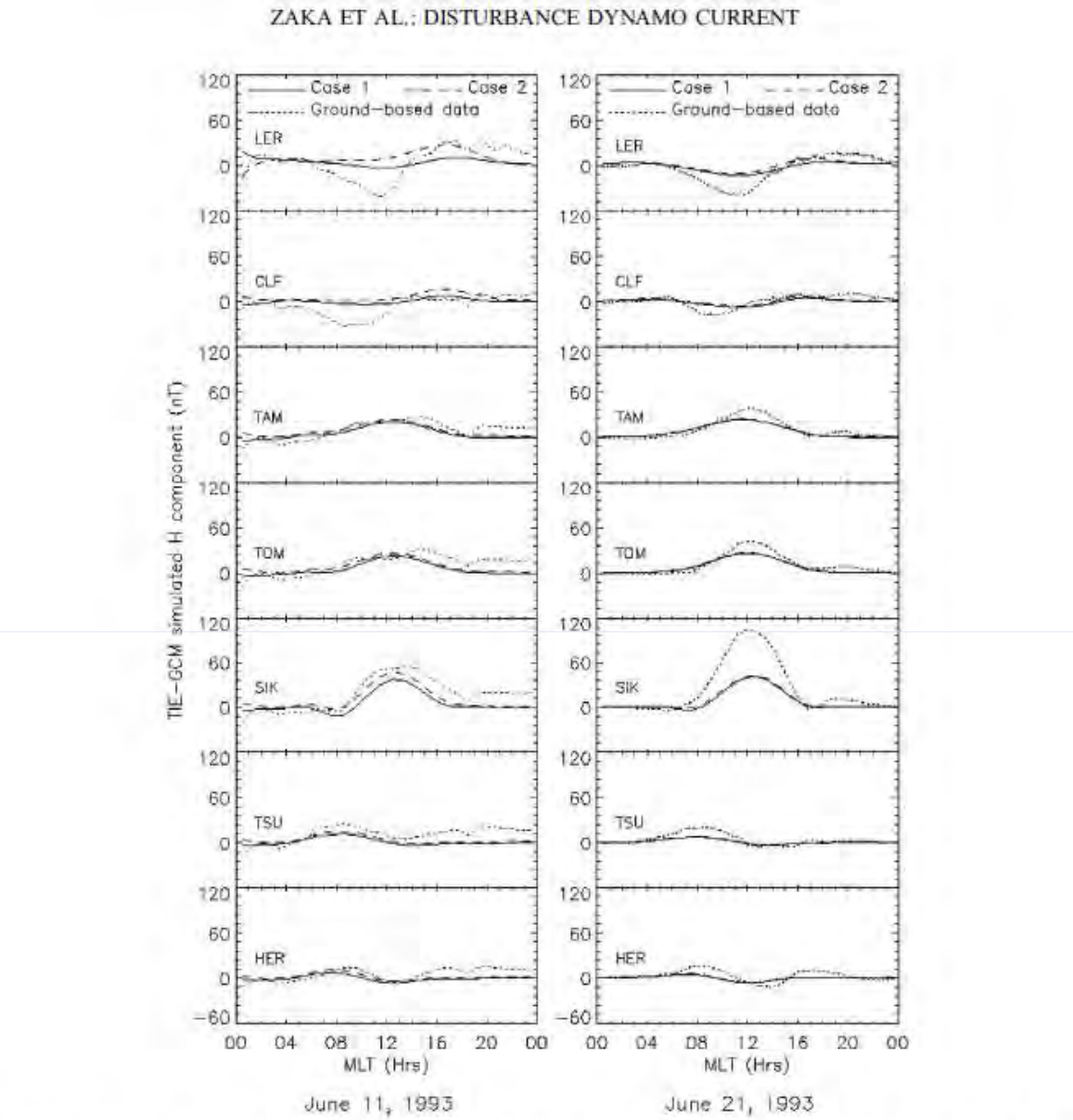
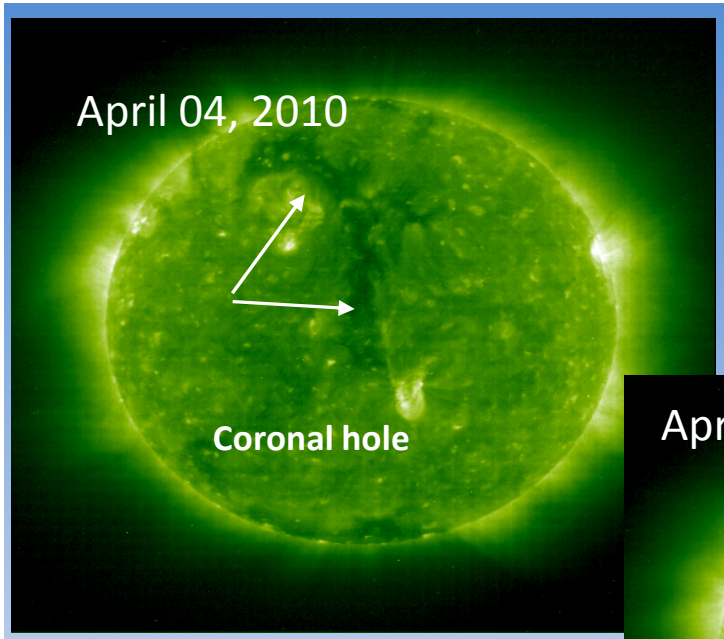


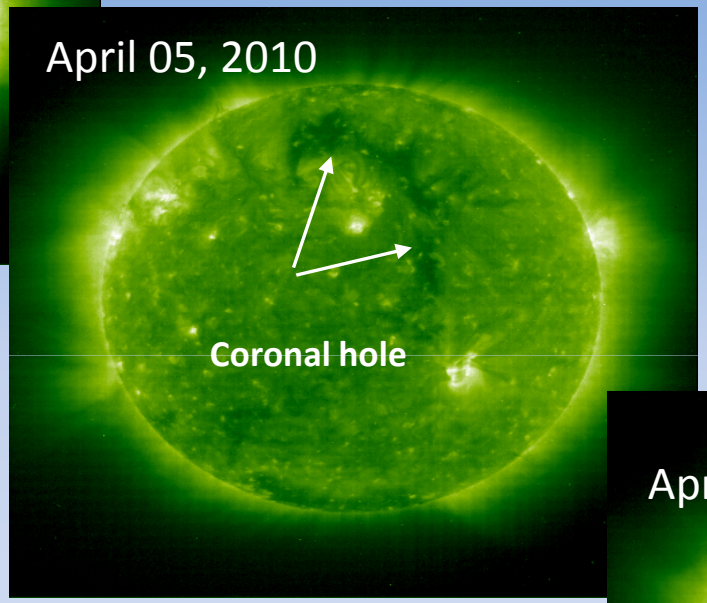
Figure 6. Comparison of the diurnal variations of the simulated *H* component in case 1 simulations (solid lines) and in case 2 simulations (dashed lines) with the observations (dotted lines) on (left) 11 June 1993 and (right) 21 June 1993.

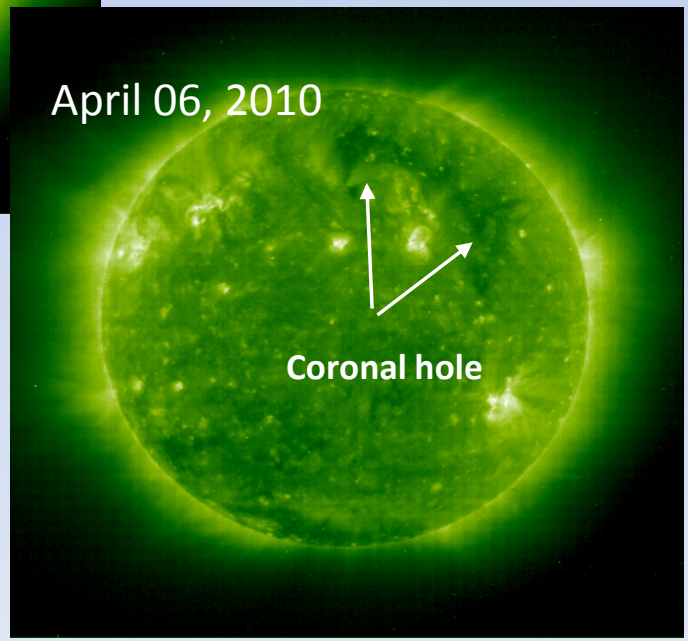
Summary

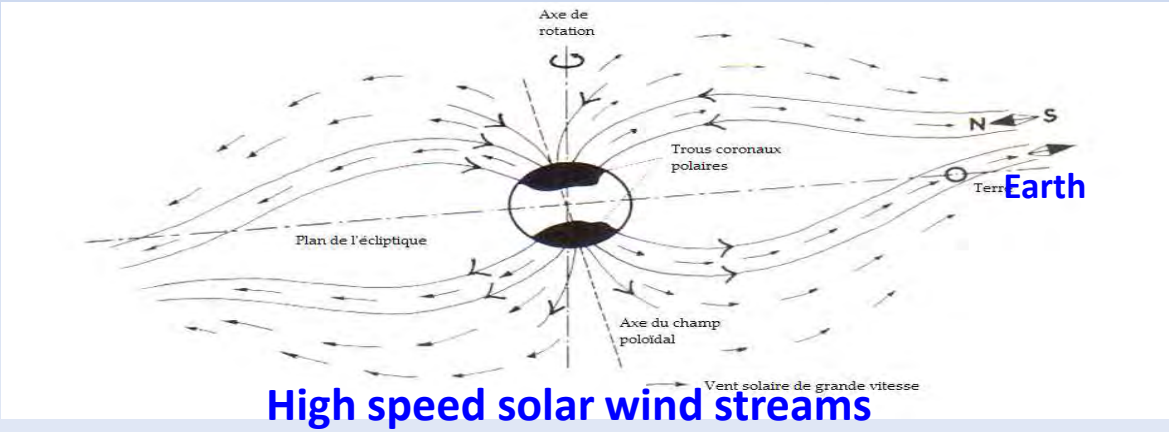
- **Sociology of science: results**
  - Deployment of tools -> observatories
  - Training -> schools -> organization of Masters
  - Teams of Research -> position for students
- **Scientific Results**
- **IHY : New approach**
  - Geophysics to Heliophysics
- **ISWI : strong connections with society**
  - Politics and medias



Solar event :
coronal hole -> April 2010



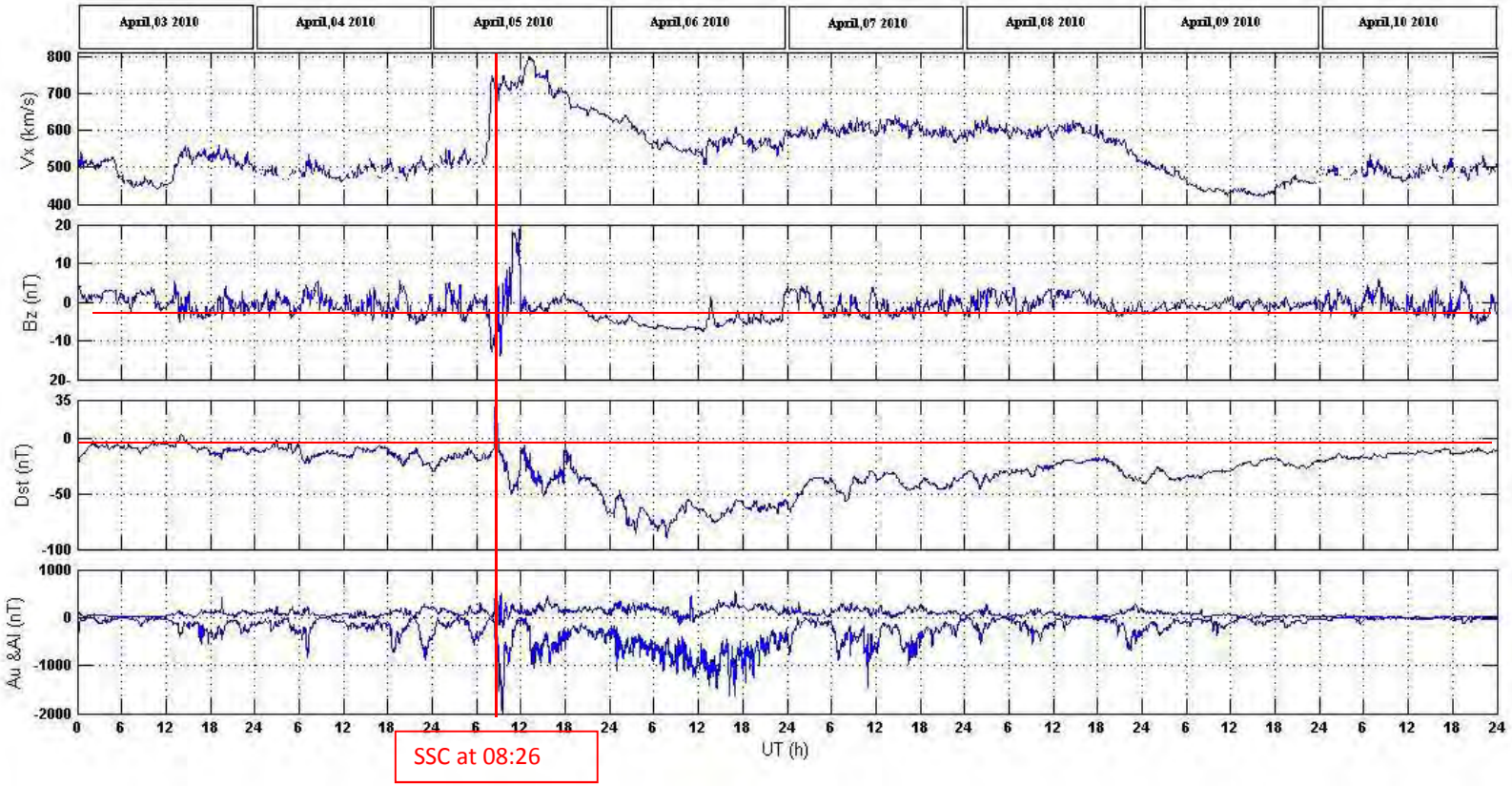




High speed solar wind streams

Shimeis et al., JGR 2012

From the Sun to the Earth

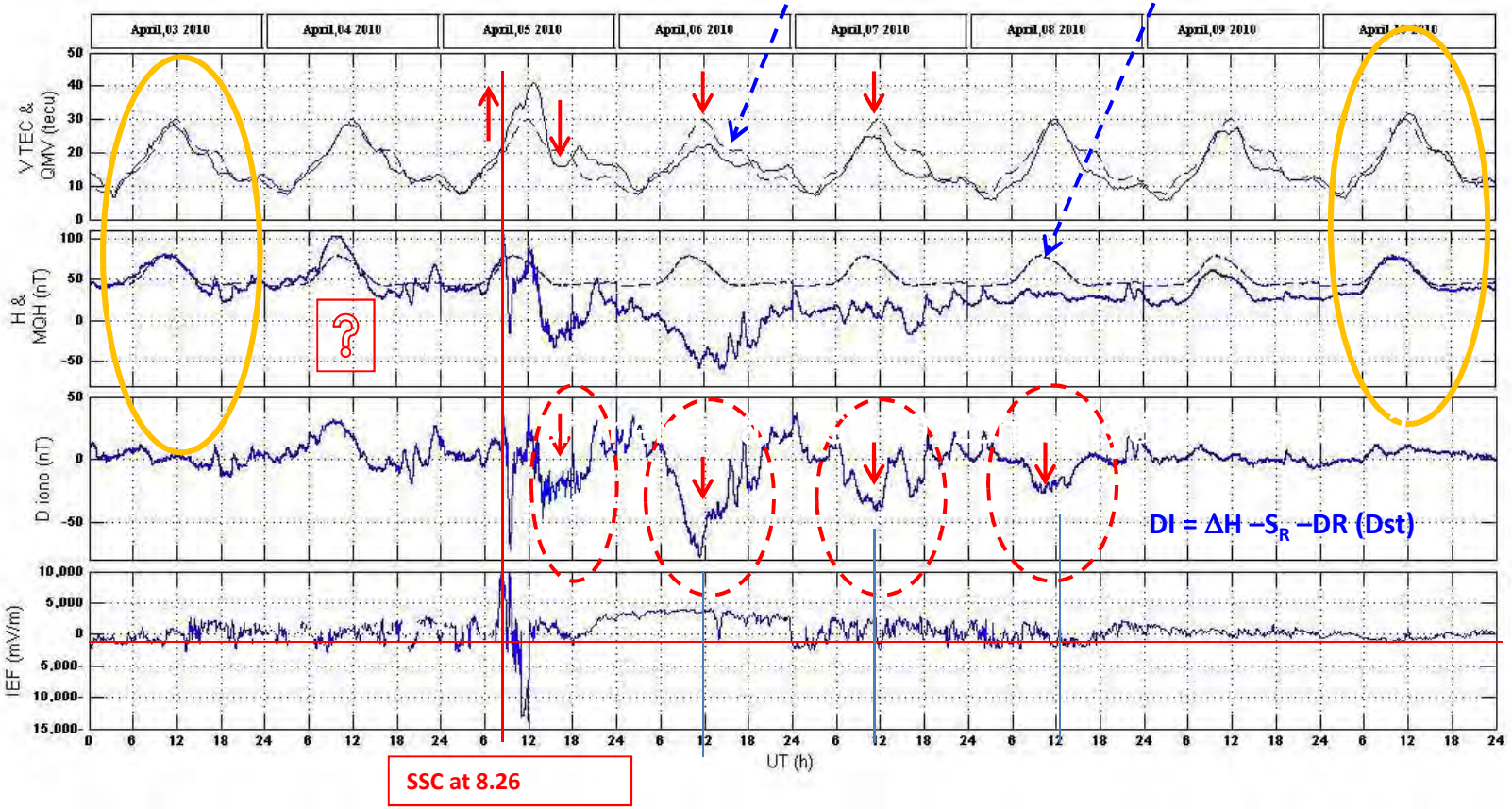


Shimeis et al., JGR 2012

dashed lines : the magnetic quiet time variation

April 2010

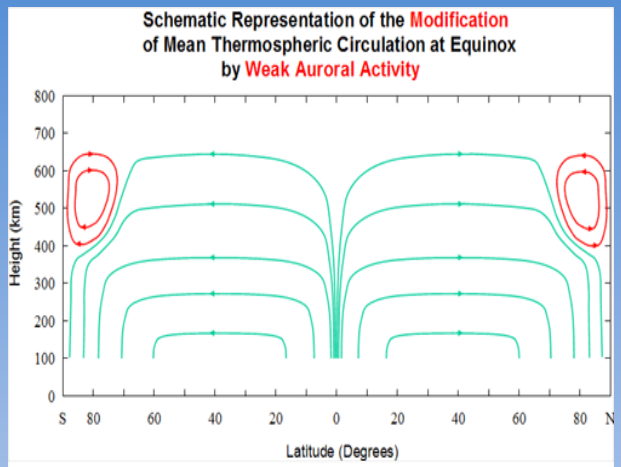
3 4 5 6 7 8 9 10

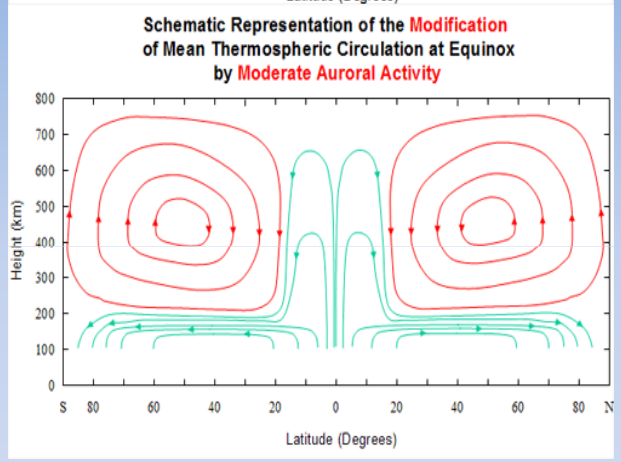


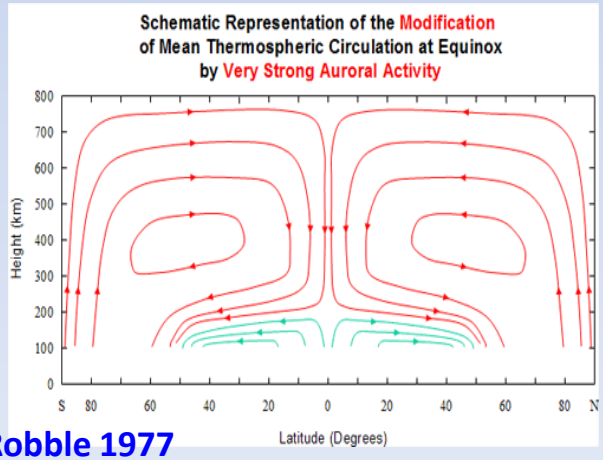
At the beginning of the storm
-> Prompt penetration of the magnetospheric electric field, (Vasyliunas, 1970)
DP2 (Nishida, 1968)

Three hours after the beginning of the storm
-> ionospheric disturbance dynamo (Blanc and Richmond, 1980) is acting at low latitudes
Ddyn (Le Huy Minh and Amory-Mazaudier, 2005, 2008)

Interpretation of the observations

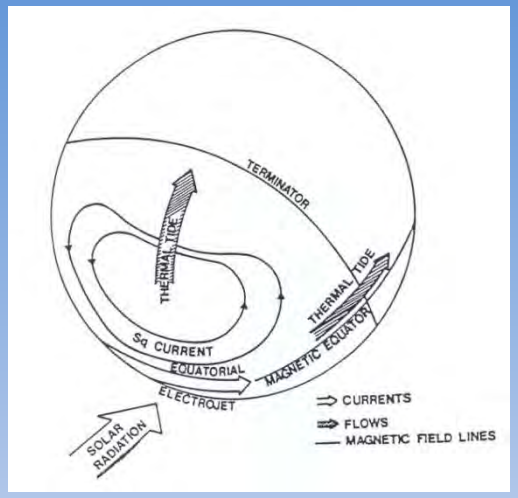






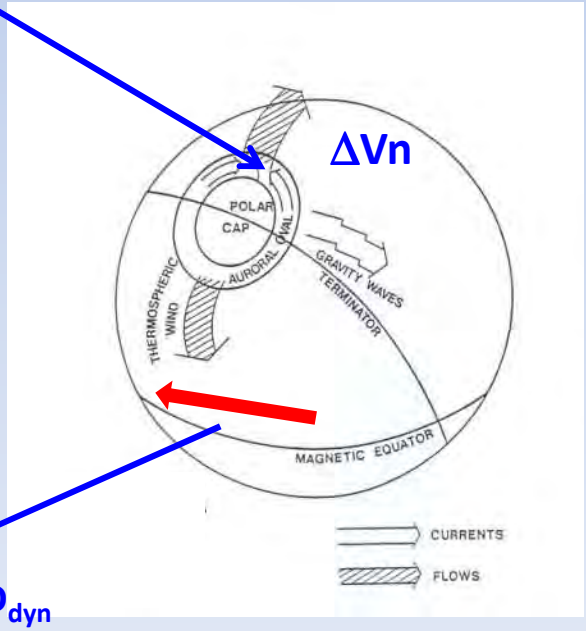
Robble 1977

Quiet magnetic variations
Regular electric current
$J = \sigma (E + Vn \times B) \rightarrow Sq$

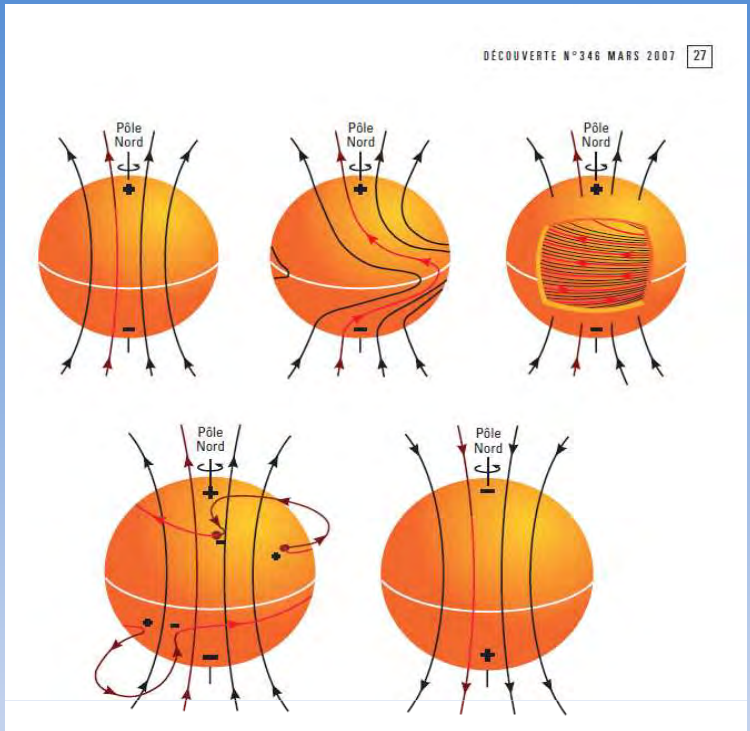


Joule heating in auroral zone
Storm wind

In equatorial zone
$\Delta J = \sigma (\Delta E + \Delta Vn \times B)$



Reversed equatorial electrojet D_{dyn}



Necessity of Pluridisciplanirity

Main field
V. Doumbia -> Geomagnetism
F. Ouattara -> Ionosphere
J. Richardson -> Solar wind and solar physics
C. Amory-Mazaudier -> Ionosphere and Atmosphere

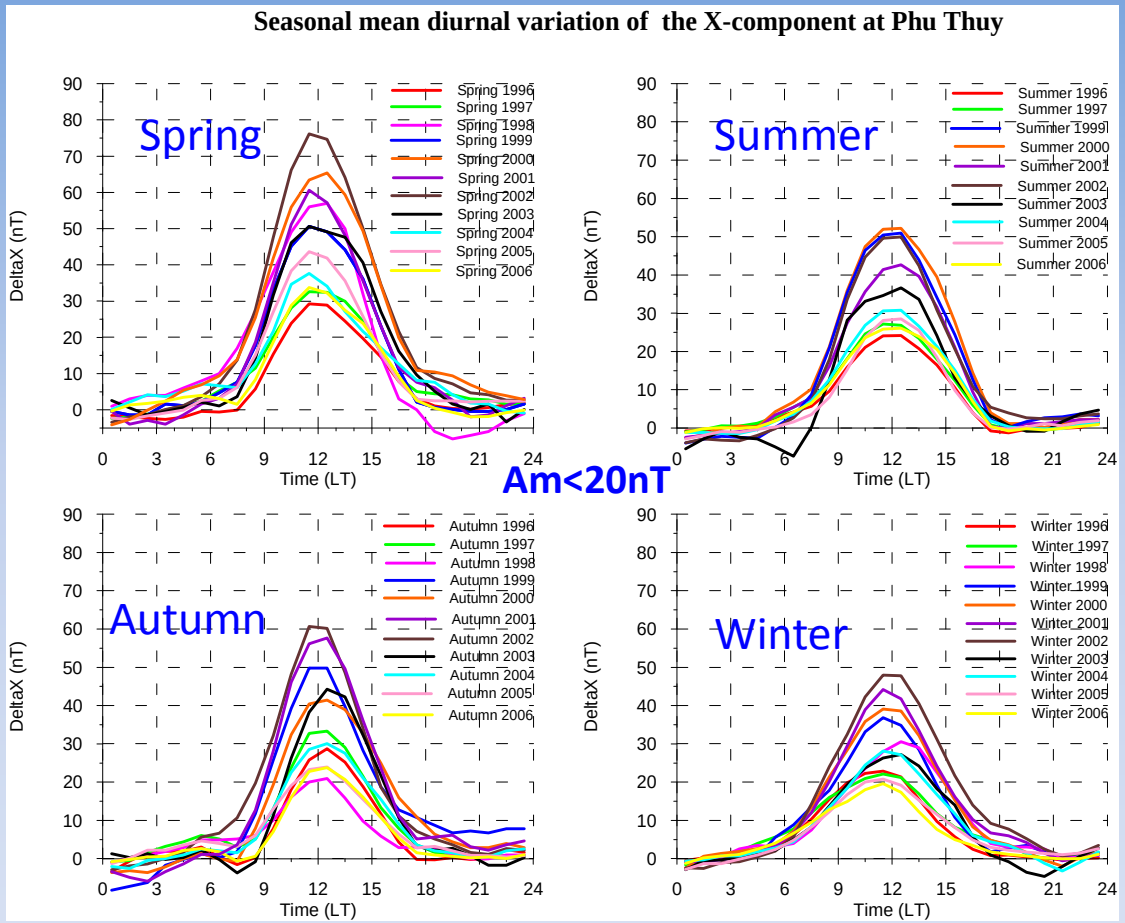
Necessity to learn solar physics and particularly to know the two components of the solar dynamo

Necessity to know exactly the state of the sun

Necessity to know the connection with the atmosphere

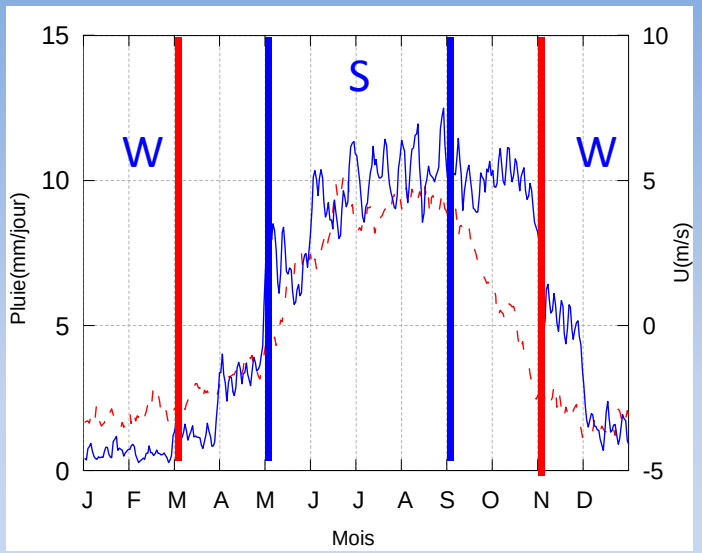
PhD of Jean-Louis Zerbo / Ouagadougou, October 20, 2012

Sq Field at Phu Thuy – H component – Asymmetry of the two equinoxes Pham et al., 2011b



Am<20nT

Study of the Monsoon Pham Xuan, 2008, Pham Xuan et al., 209



blue: rain / red : zonal wind ground level – data average 1979-2004

Necessity of pluridisciplinarity Coupling with low atmosphere

In magnetism we have to consider
4 seasons and not 3 seasons
Winter
Summer
Vernal equinox
Autumnal equinox

Summary

- **Sociology of science: results**
  - Deployment of tools -> observatories
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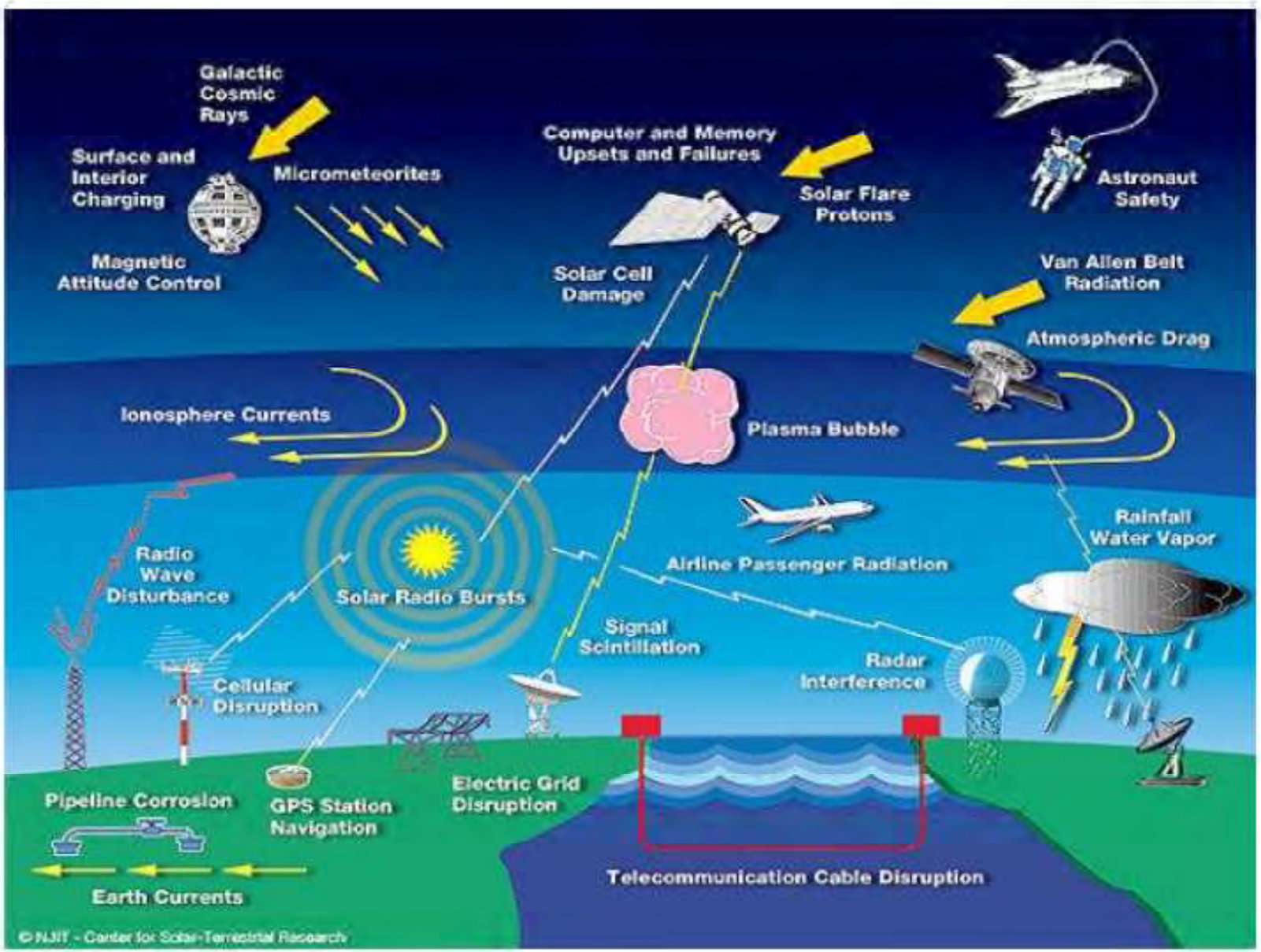
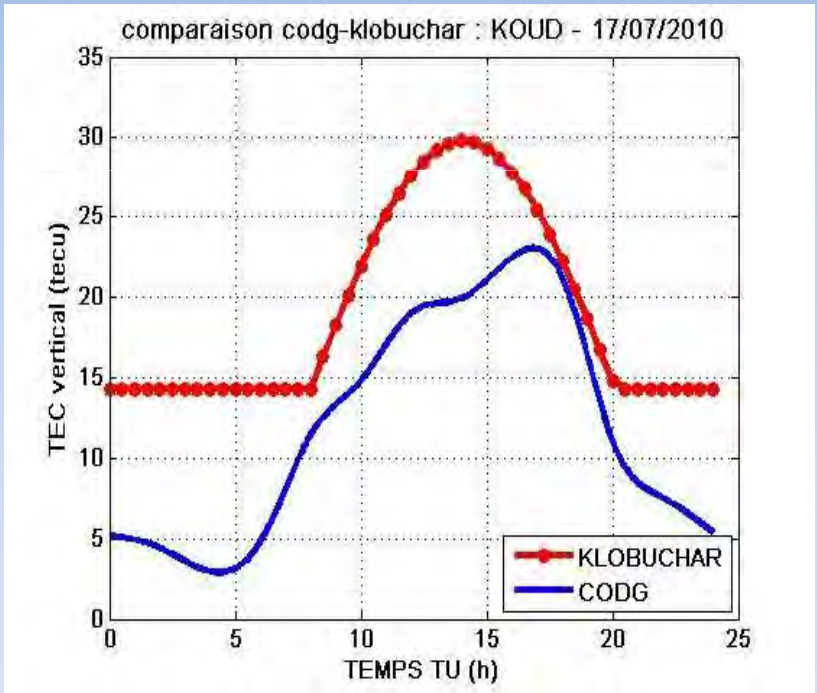
From L. J Lanzerotti



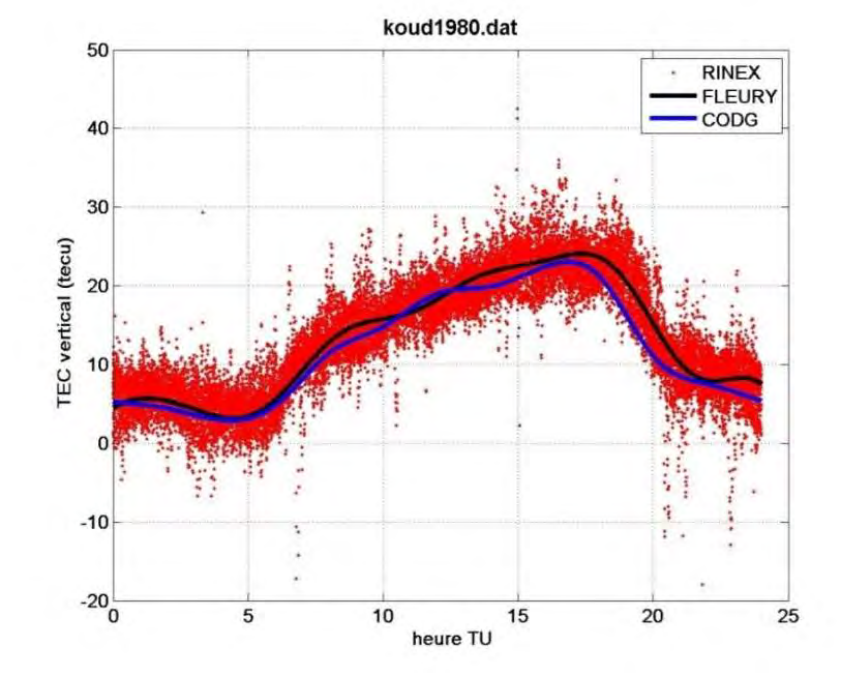
Ouattara et al., Journal des Sciences 2011, Zoundi et al., Luxor 2012

TEC diurnal variation at Koudougou

Comparison between two ionospheric models: Klobuchar and CODG



Comparaison between measurements and two ionospheric models: Fleury and CODG



Public conference in Nigeria, January 2012

National Mirror www.nationalmirroronline.net | Thursday February 2, 2012 | Education Today | 21

FEATURES

How research into space weather can solve man's problems –Scientists

*The significance of space weather condition to human survival was the thrust of a two-day international mini conference last week at the Bells University of Technology, Ota, in Ogun State. Physicists and other space weather experts from various academic institutions in the country joined the renowned French Professor of space weather –Christine Amory-Mazaudier, to appraise the advances in space weather research in Africa. **MOJEED ALABI**, who witnessed the opening session, reports:*

Like most people in Africa and other developing countries, Nigerians do not understand the influence of space weather on their daily living. In fact, on a global stage, experts have revealed that attention did not shift to space weather research until 1990s when the world scientists realised the need to discuss space weather activities, no longer as a branch of Physics or Aeronomy, but as a separate field of study.

However, within the last two decades or so, evidences have revealed the impressive progress recorded in the developed nations in the understanding and control of the happenings on the space, and the results are the advancements in technologies, economic activities and military affairs, among several others. Scientists cited the American military onslaught and eventual killing of late Osama Bin Laden, leader of al-Qaeda- a global broad-based militant Islamist terrorist organisation, as a product of the country's huge investment in space sciences.

Though Nigeria as a country is not lagging behind, in her efforts to move along with the global trend in investing in space science, particularly with the successful launch of Nigeria Communication Satellite One and Two, space researchers strongly believe the country has a potential of doing better if her abundant resources were to be taken into consideration. And taking into cognisance the current spate of unrestricted violence being unleashed on Nigeria and her hapless people, space experts say the time can only be now.

Such need for a focused attention on African space informed the recent space research group brain-tasking academic conference jointly put together by the Bells University of Technology (BELLSTECH), Ota in Ogun State, National Space Research and Development Agency (NASRDA) and the Space Physics Laboratory of the Federal University of Technology (FUTA), Akure, in Ondo State. The two-day research exercise which held at BELLSTECH drew participants from about 15 higher institutions of learning and other related research institutions in the country.

Vice-Chancellor, Bells University of Technology, Ota, Prof. Isaac Adeyemi (middle) and participants at the conference.

The event, which was themed: 'Advances in Space Weather Research in Africa," had Prof. Christine Amory-Mazaudier, the French space weather expert as the special guest, who, in her introductory graphic presentation analysed the effects of activities in the terrestrial weather on human life. She thus demanded for a much more focused study on the African space weather not only to improve the continent's agricultural investment but also to further enhance economic growth and development and to stem the rising tide of insecurity across Africa.

> "STUDYING SPACE WEATHER IS CRUCIAL TO THE SURVIVAL OF OUR NATIONAL ECONOMY BECAUSE THESE RELEASED ENERGIES FROM THE SUN CAN AFFECT THE TECHNOLOGY WE HAVE BECOME SO DEPENDENT UPON IN OUR EVERYDAY LIVES"

In his welcome address, BELLSTECH's Vice-Chancellor, Prof. Isaac Adebayo Adeyemi, explained that the developments around the world have confirmed that the world has truly arrived the age of space and that "Nigeria cannot afford to be left behind."

He further disclosed that his university grabbed the idea of hosting the conference as a step to move higher in its investment in the study of space science "as we currently enjoy successful collaboration with the Nigeria Meteorological Agency (NIMET). This makes BELLSTECH one of the NIMET stations with the capacity to, at least for now, supply data like sunshine, wind and rainfall records which forms part of NIMET data bank."

The relevance of the scientific efforts, the VC explained was geared towards helping the country overcome the vagaries of climate change which he said would have strong negative effects on the country's and indeed the continent's food and nutrient security as an agrarian society that still depends on rain-fed agriculture.

In its practical sense, the Dean of the university's College of Natural and Applied Science, Prof. Israel Bakiolola, explained in detail why human beings are bound to experience space weather effect as a result of the energies released from the sun towards the earth. He said this happens when those energies in form of solar storm travels through space and impact the earth magnetosphere.

"Studying space weather is crucial to the survival of our national economy because these released energies from the sun can affect the technology we have become so dependent upon in our everyday lives. These energies from the sun which come in solar storms, solar flares and coronal mass ejections can affect space and ground systems and terrestrial weather. Some of the effects on space systems include malfunction of spacecrafts, changing of space orbit and radiation on human in space while on the ground system the effects include disturbance of Global Positional System (GPS) and other space signals, disruption of long distance radio signals, cause radiation on humans at and near the ground level, induce geomagnetic currents that disrupt electrical transmissions and cause leakages on buried pipelines," the dean explained.

One of the participants threw a poser at his fellow colleagues on the theory of the earth expansion, which rattled the non-science-oriented participants. He said if the theory was true, it may affect the way sun reaches the planet earth which he said if it continues, a time may come when sun may no longer reach the earth and the inhabitant would "just perish." The consensus is that the theory has still not been proven beyond doubt, and according to Prof. Mazaudier, such include the work of researchers without exempting the gathering.

When asked how the research group would ensure the exercise does not end in futility, one of the Deputy Directors of the National Space Research and Development Agency (NASRDA) and an Associate Professor at the Federal University of Technology, Akure, Dr. Babatunde Rabiu, sharply responded that the involvement of NASRDA would guarantee the government endorsing the conference and would work on its findings.

Dr. Rabiu believes Nigeria's commitment to space research is not in doubt and that the country on constant basis reviews the work of her experts, who continue to research into the field and anchor the management of her investment in space. But he urged the Federal Government to pump more fund into space weather researches in order to update the events around it and guarantee the mitigation of their negative impacts on the country.

On his part, the Chairman of the Local Organising Committee and BELLSTECH Head of Department of Physical Sciences, Dr. Sunday Oluyamo, urged the participants and the world at large to continue to probe into space weather because with space, he said, "we can find out and learn more about other planets and see if we could live there in the future."

'Nigeria's academic environment inimical to quality research'

CONTINUED FROM 20

live to job seekers. Many take to teaching only as a last resort. People prefer to work in oil farms, in banks, in telecoms and in other industries considered to be lucrative where they would be paid fat salary and enjoyed fringe benefits and not as a teacher. This issue is a great contributor to the falling of standard of education in the country and if the foundation is weak, the structure can never be strong. So, the problem of Nigeria education sector starts from primary to secondary schools and move up the ladder to get to the university level. That is why some teachers are distracted from their original work and looking elsewhere to make complementary income at the expense of students and government. By that, there won't be quality service. To worsen the situation, many parents also encourage their wards in academic frauds.

Nevertheless, I would advise the governments across tiers to improve teachers' conditions of service and welfare and also provide necessary facilities that would make the environment academic friendly.

School
Congo, December2009

SOCIETE

Première école S.i.g-G.p.s au Congo-Brazzaville

Le S.i.g est devenu un outil incontournable, pour l'organisation de la société

Du 2 au 9 décembre 2009, la première école internationale S.i.g-G.p.s (Systèmes d'information géographique - Global positionning system) réunissant des participants de Côte d'Ivoire, du Congo-Brazzaville, de France et de la République Démocratique du Congo a été ouverte au Cerve (Centre d'étude sur les ressources végétales) et s'est déroulée au Campus numérique de l'Université Marien Ngouabi, à Brazzaville. Les S.i.g (Systèmes d'information géographiques) sont des bases de données géo-référencées, utilisées dans tous les domaines (géographie, pharmacologie, aménagement du territoire, navigation, épidémiologie, recherche, etc) et sont devenus un outil incontournable, pour l'organisation de la société.

Que signifie donnée géo-référencée? Cela signifie donnée localisée sur la terre, par ses coordonnées de latitude, de longitude et d'altitude. Le G.p.s localise les données, le S.i.g intègre les données et permet leur traitement et leur analyse dans un cadre global. Le S.i.g est une aide précieuse pour la prise de décision. Au cours de cette école, les participants ont présenté des intérêts très différents:

étude de l'érosion dans la ville de Kinshasa;
- taillement des déchets et de la pollution à Kinshasa;
- occupation des sols à Kinshasa;
- navigation fluviale à Brazzaville et Pointe Noire;
- réchauffement climatique sur l'ensemble de la planète;
- stockage du carbone par les racines des arbres dans les forêts du Congo;
- pharmacologie en RDC;
- épidémiologie en Côte d'Ivoire;
- déforestation en Côte d'Ivoire;
- étude des scintillations ionosphériques;
étude de l'impact des événements solaires sur l'environnement ionisé de la terre;
- étude du contenu en eau de la troposphère;
- navigation aérienne, etc.

Le S.i.g apporte aussi la possibilité de coupler de nombreux jeux de données et ainsi comprendre, par exemple, le développement de certaines maladies liés à l'environnement, par le rassemblement de données des médecins recevant les malades, des chimistes, des écologistes et biologistes étudiant les qualités de l'environnement (air, eau, plantes, etc), dans des S.i.g multidisciplinaires.

Durant cette dernière décennie, le S.i.g est devenu un outil incontournable, pour l'organisation de la société, dans quelques domaines que ce soit. Cet outil est indispensable pour la prise de décision concernant l'amélioration de la vie des populations. Ainsi, pour organiser les constructions dans la ville et définir le P.o.s (Plan d'occupation des sols), il est nécessaire de connaitre les zones de risques d'inondation, les zones d'érosion importante, les zones palluées, etc. Le S.i.g permet aux experts d'intervenir et, par exemple, d'empêcher le développement anarchique des cités sur des zones à risque, en informant les développeurs sur l'existant et les risques courus en négligeant cet existant.

L'intérêt de ces écoles transversales S.i.g-G.p.s réunissant des professionnels et des étudiants autour de l'utilisation d'outils communs est important, car chaque participant a l'opportunité de connaître d'autres disciplines. Ce type d'école permet de développer des synergies entre différents groupes d'étudiants, de professionnels, de chefs d'entreprise, etc. utiles pour le développement.

Les écoles S.i.g-G.p.s vont se multiplier dans les années à venir. La formation doctorale en sciences de l'environnement de l'université Marien Ngouabi et la recherche scientifique naf, d'ores et déjà inscrit, dans son programme de formation, les S.i.g et l'utilisation des G.p.s.

Cette école a été sponsorisée par Microsoft International, l'U.g.g.i (Union des organisations scientifiques en sciences de la terre), le C.n.r.s (Centre national de la recherche scientifique), l'A.u.f (Agence universitaire francophone), le S.e.a.c Côte d'Ivoire (Service de coopération et d'action culturelle), le G.r.s.e.n/D.g.r.s.t (Groupe de recherche en science exactes et naturelles).

Photo famille des participants

BI-HEBDOMADAIRE D'INFORMATION ET D'ACTION SOCIALE PARAISSANT AU CONGO-BRAZZAVILLE

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LA SEMAINE AFRICAINE

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57ème année

PhD
in Burkina Faso, October 2012

Première thèse en météorologie de l'Espace au Burkina Faso

Le 20 octobre 2012, Jean-Louis Zerbo a soutenu la première thèse en météorologie de l'Espace à l'Université de Ouagadougou au Burkina Faso devant le jury suivant :

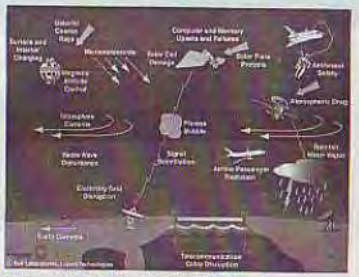
Président du jury : Pr John Richardson, Université MIT-USA (deuxième à droite)
Pr Daudonné Joseph Bathiebo, Université de Ouagadougou (premier à droite) ;
Pr Frédéric Ouattara, Université de Koudougou (sixième en partant de la droite) ;
Pr Vafi Doumbia, Université de Cocody- Côte d'Ivoire (cinquième en partant de la droite) ;
Pr Alhadi Woremo, CNRST (troisième en partant de la droite) ;
Pr Christine Amory-Mazaudier, Université Pierre et Marie Curie- France (quatrième à droite).

Sur cette photo à gauche ; il y a le nouveau Docteur Jean- Louis Zerbo à côté du Pr Ouattara et le frère de Jean-Louis Zerbo.

Le titre de la thèse est : **Activité solaire, vent solaire, géomagnétisme et ionosphère équatoriale.**

Qu'est-ce que la Météorologie de l'Espace ?

La figure ci-dessous de L.J. Lanzerotti illustre les principaux processus physiques impliqués dans la météorologie de l'Espace. Notre société moderne qui s'appuie sur de nombreuses technologies modernes (GPS, Internet, télécommunications Terre satellite, etc...) est sensible aux phénomènes électromagnétiques produits par le soleil.



Processus physiques dans la météorologie de l'Espace

Le soleil interagit avec l'environnement terrestre électromagnétique suivant deux canaux principaux, les radiations solaires (se propageant à la vitesse de la lumière 300 000 km/s et atteignant la terre en 8 minutes) et le vent solaire flot de particules, essentiellement des protons et des électrons, émises par le soleil se propageant à des vitesses de quelques centaines de km/s atteignant la terre en 1 à plusieurs jours. La thèse de Jean-Louis Zerbo a porté sur les relations entre l'activité du soleil, le vent solaire et les perturbations du champ magnétique terrestre et de l'ionosphère (couches ionisées entourant la terre entre 60 et 800km d'altitude).

Les objectifs principaux du projet ISWI (International Space Weather Initiative) sont :

**Comprendre les différents processus physiques agissant dans le système Terre Soleil ; reconstruire et prédire les évènements de météorologie de l'Espace.*

Instrumentation, analyse des données, coordination des études sur les paramètres dérivés des données, modélisation. Coordination scientifique pour établir les relations essentielles entre les paramètres physiques et développer des prévisions en météorologie de l'Espace.

** Education et information dans les écoles, l'université et le grand public ;*

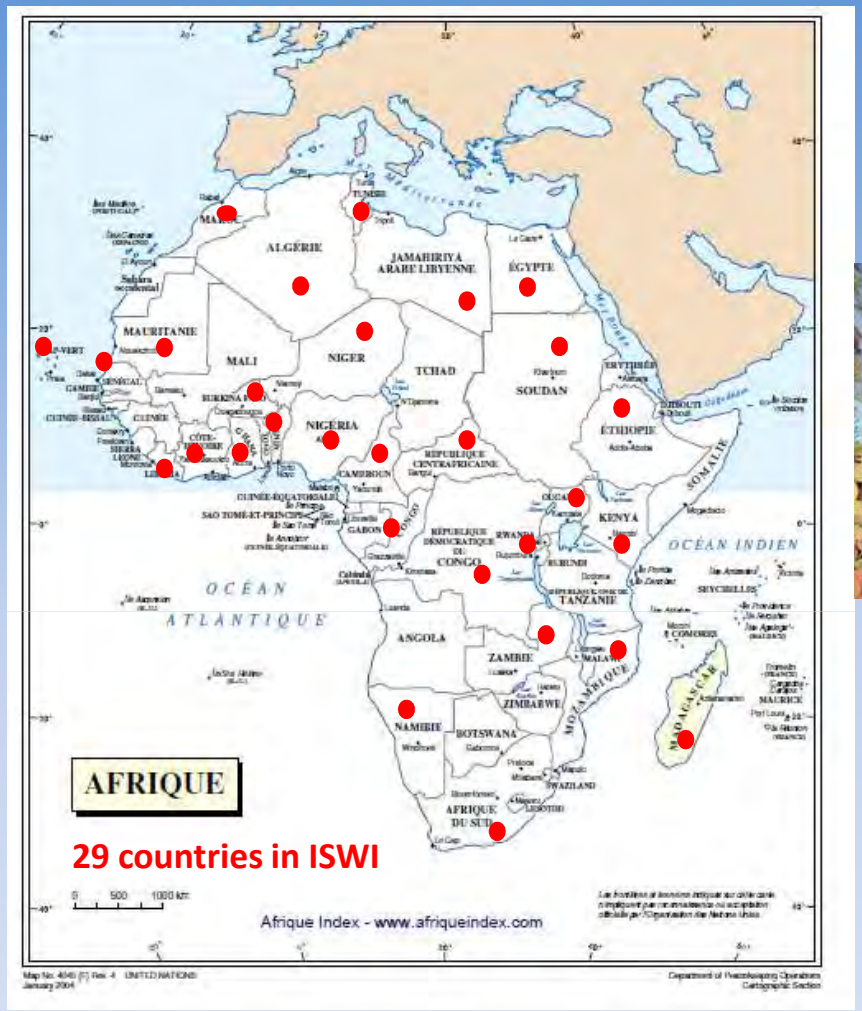
Développement d'outils de communication et de vulgarisation ».

Le projet ISWI http: **//www.iswi-secretariat.org** rassemble plus d'une centaine de pays et s'inscrit dans le cadre de la commission pour les applications pacifiques de la science à l'Espace http: **//www.oosa.unvienna.org**

Le GIRGEA http**://www.girgea.org** est un réseau de scientifiques de par le monde qui a pour objectif principal l'introduction des sciences de l'Espace dans les pays émergents.

Ce réseau prévoit d'organiser en 2014 une école sur la météorologie de l'Espace à l'Université de Koudougou au Burkina Faso.

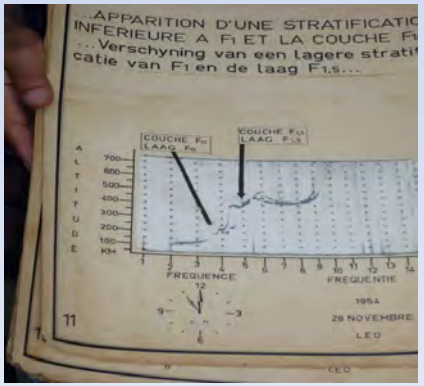
University Mohamed V Agdal / Rabat/Morocco -> 2 PhD Students



University of Kinshasa/RDC – 8 PhD students

Observer since 1957
Papa NDUAZU

Ionogramme
November, 28, 1954



New countries for IRGGEA
Permanent observatories with technicians
Morocco -> Prof. Anas EMRAN emranans@yahoo.fr
RDC -> Prof. ZANA : azanan202@yahoo.fr

Conclusion

- **Scientific tools lead to sustainable research in Africa => we have to continue to deploy scientific instruments in Africa (neccesary but not sufficient)**
- **Schools are important to attract students in these new fields of research**
- **PhD and positions are necessary for the perenniality**
- **PhD must be obtained on the basis of publications in international journals : the student must learn the job of scientist during the PhD**
- **Education of the population by conference**
- **Development of the country (especially with tools as GPS and GIS)**
- **Necessity to develop national communities of the user of GPS to share data**
- **Emergence of new scientific communities : heliophysics and Space Weather breaking walls between disciplines**
- **Necessity of the development of African organizations as AGS, CAMES etc..**
- **Now it is necessary to reanalyze ionospheric and magnetic data including the knowledge on the sun and on the low atmosphere.**