

**'ISWI Maghreb 2' Report**  
**Organization of School of Space Weather-GNSS applications**



**SCHOOL ON SPACE WEATHER  
GNSS  
Ionosphere Atmosphere and Earth's magnetic field  
Basic physics and hands-on experience  
16 - 21 February 2015 / CRASTE-LF/Rabat-Morocco**

The Space Weather GNSS Applications School was organized from 16-21 February 2014 in Rabat (Morocco), in partnership with CRASTE-LF, the International Space Weather Initiative (ISWI), the UN, the ISESCO and Mohammed V University. In connection with this school, the Centre organized the EO open day to the benefit of experts and decision makers under the European projects FP7 EOPOWER and IASON.

**Context of the School**

It was in the framework of UNBSSI (United Nations Basic Space Science Initiative) - [1991-2012] <http://www.oosa.unvienna.org>, that different measurement campaigns were undertaken in Africa:

\* IEEY: International Equatorial Electrojet Year [1992-1994]

\* IHY International Heliophysical Year [2005-2009]/ <http://ihy2007.org>

\* ISWI: International Space Weather Initiative [2010-2012] / <http://www.iswi-secretariat.org>

It was at the end of IEEY project in 1995, that the research network IRGGEA (International Geophysical Research Group Europe Africa) was created. The main objective of this network is to train young scientists in Africa, Europe and Asia. Currently, twenty six PhD have been completed and defended, and thirty are currently underway. The GIRGEA also organized many training schools in geophysics and Space weather, mainly in Africa [www.girgea.org](http://www.girgea.org)

At the end of the ISWI project, the ISWI program was included in the SCOSTEP scientific organization in order to continue the development the ISWI network of instruments.

The school took place at CRASTE-LF, African Regional Centre for Space Science and Technology - French Language, affiliated to UN, located in Rabat, Morocco <http://www.crastelf.org.ma>.

The main objectives of this school were 1) the use of the data of the ISWI instruments by students of the Maghreb and African Countries, mainly GPS and magnetometers networks and 2) the improvement of the level of expertise of the Maghreb and African Countries students to enable them to participate and contribute to international projects.

The two key points of the school for scientists from the Maghreb and African Countries are the development of skills:

- To use existing data sets and tools relating to terrestrial environment studies (less than 10% of the existing data are currently used);
- To use the results of studies based on environmental science and sustainable development and combining ground data with satellite data (example: geophysical studies, telecommunications, etc ...).

**To achieve these goals, the courses included:**

- 1) A scientific part on the understanding of the operations that can be performed with the data and information that can be extracted from the data and examples of applications in different fields.
- 2) A computer part on the algorithms used, their performance and installation.
- 3) Computer lab for the use of algorithms and databases like SPIDR, IRI, GIFL, etc...

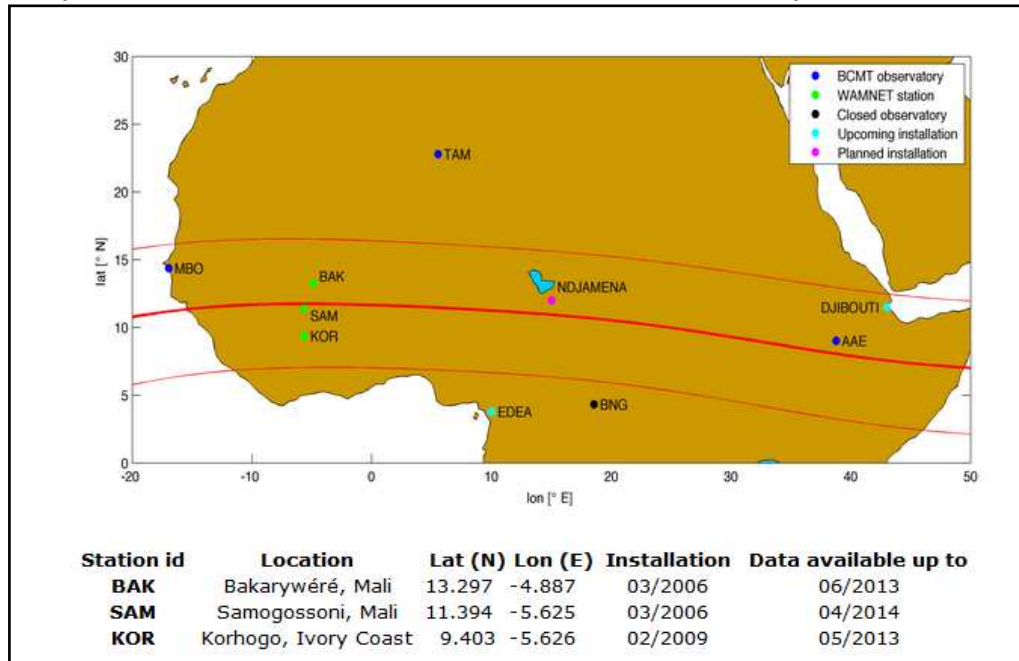
**To meet these objectives, the school allowed using:**

- 1) All possible operations with ground network GPS stations, radar and other instruments available via internet:
  - a. The studies of the ionosphere and the impact of the Sun on the Earth's plasma environment (International Heliophysical Year and ISWI projects);
  - b. The troposphere studies: An estimate of the integrated water vapour content (CIVE) in the atmosphere can be obtained through GPS data with specific treatments. These data provides the opportunity to initiate studies on the water cycle (seasonal variability and intra-seasonal, studies of atmospheric processes...) in this region.
  - c. Other uses of instruments for development
- 2) The use of magnetic data
  - a. The knowledge of the magnetic clues to define the geophysical context is essential. Magnetic indices are important parameters for Space Weather.





## AMNET (3 stations and 1 station to install at Edea au Cameroon)



### The Committees

#### Steering Committee

TOUZANI Abderrahmane (CRASTE-LF) Chairman  
 ZAOURAR Naima, (USTHB/Algeria) Vice Chairman  
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## Program of School

Day /hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
9h-10h30	Space Meteorology Lecture	Ionosphere Lecture	Open Ceremony	Coupling High/ low latitudes Lecture	Middle atmosphere Lecture	Magnetic Field Lecture	
10h30-11h	Pause coffee						
11h-12h30	Space Meteorology Lecture	Ionosphere Auroral Lecture	Plenary Session of EO Open Day	Low Atmosphere Lecture	Middle atmosphere Lecture	Lab/ magnetic field Closing School	
12h30-14h	Lunch						
14h-15h30	GNSS Lecture	Ionosphere Equatorial Lecture	Lab/GPS Ionosphere	Lab/GPS Troposphere	Lab/GPS Troposphere		
15h30-16h	Pause coffee						
16h30-18h	GNSS Lecture	Lab/GPS Ionosphere	Lab/GPS Ionosphere	Lab/GPS Troposphere	Lab/GPS Troposphere		
17h-18h	Time for <b>POSTERS</b> and discussion with professors						



## **The school Course**

The school welcomed 29 participants from universities of North Africa and the French-speaking African Countries. The participants, who were selected, had a background in computer science and database management.

This school has helped participants to:

- Master the use of GPS data and magnetic data according to their area of competence;

After this training, participants were able to:

### For GPS

- Harness the GPS data for studies of the atmosphere and ionosphere
- Know the different fields of application practice.
- Know the interesting databases in the various areas covered;
- Know GPS access existing databases
- Know how to use the data and tools available on the selected databases.

### For magnetometers

- Know the different networks of magnetometers on the web
- Knowledge of site magnetic clues on the web
- Analysis of magnetic data
- Treatment of geomagnetic signals

Practical applications were based on various themes and data related to the fields of national interest.

An analysis of the targeted needs of participants and their level was made at the opening of registrations.

The participants were students for a master's degree or with thesis work in progress, and academic staff and other organizations that also needed training.



The EO open day program was addressed to a wide audience.

Wednesday, February 18, 2015

8h30-9h30 - Hosted the participants

Official opening

9h30-10h30 - Official speeches : (CRASTE-LF, ISESCO, UN-OOSA Vienna, ICG and ISWI Maghreb)



Coffee Break and Family Picture

11h00-13h00 ✓ **Plenary Sessions**

- International Committee on Global Navigation Satellite Systems and its Programme on GNSS applications. **GADIMOVA S., Office for Outer Space Affairs United Nations Office at Vienna (Austria)**

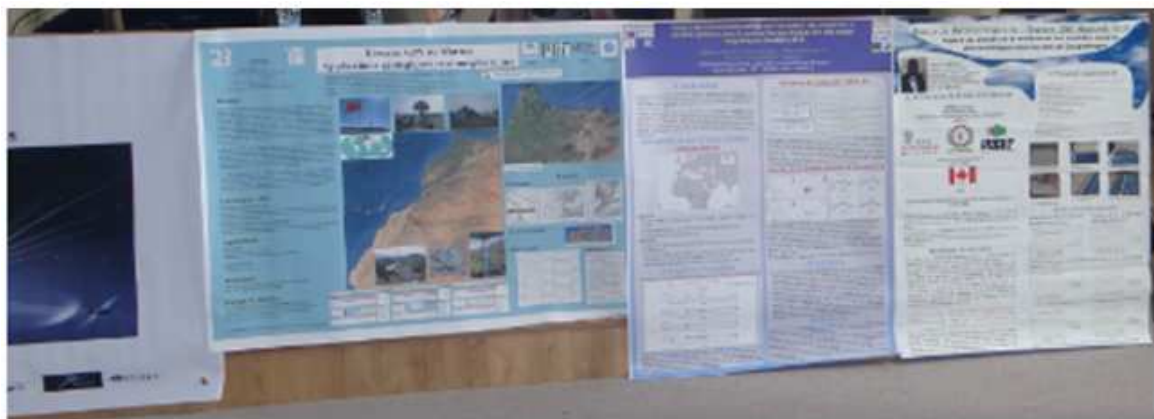
- Space Weather: a comprehensive approach to Earth Sun System. **AMORY C. Laboratoire de Physique de Plasmas /Université Pierre et marie Curie, Paris (France)**
- FP7 project EOPOWER and IASON: example of the contribution of European projects in the GEO capacity building activities. **EMRAN A. / (Scientific Institute, (CRASTE-LF Expert) Mohammed V University (Morocco)**



- EO and Sustainable Development: Now and future. **HAKDAOUI M. Faculty of Sciences of Ben Msik, Hassan II University, Casablanca, (Morocco)**


### Poster Session





The poster session was organized during the “EO Open Day” session on the EO theme that the participants had presented at the end of the day throughout the period of the Space Weather – GNSS Applications School.




















## The Participants

### List of participants in School of Space Weather- GNSS applications

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School of Space Weather – GNSS applications in National Newspaper



Press & Media

**A l'École de la météorologie spatiale**

## Quand le soleil éternue, les satellites toussent !

À l'École Régionale Africaine des Sciences et Technologies de l'Espace en Langue Française, affiliée à l'UNU (CRASTE-IF), basée à Rabat, se tiendront du 14 au 21 février 2015, la deuxième édition de l'École ISW/Maghdoub. Pour les experts et étudiants qui sont réunis sur les bancs de cette école de haut niveau de physique, au moins, sept semaines de cours théoriques, les présentations qui leur permettent d'être familiarisés avec les installations électriques et autres instruments électroniques, des manuels scolaires à effectuer et, plus encore, à résoudre, pour s'entraîner à peigner à chaque fois que le soleil éternue, not-

tant en précis la technologie humaine de pointe, pourtant si fragile devant les manifestations de la Nature. Le programme de la nouvelle édition de l'école ISW/Maghdoub - 1991 pour International Space Weather Initiative, en l'honneur international sur la météorologie spatiale, sera axé autour de deux conférences. La première sur l'évaluation de la Terre, ainsi qu'une formation de cinq jours sur l'impact des rayons cosmiques (Global Navigation Satellite System ou système de positionnement et de données par satellites) en l'honneur de l'Equipe.

Bachicha BENHAM

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Le Maroc, pôle régional de diffusion d'expertise

Plusieurs campagnes de mesure ont été faites en Afrique dans le cadre de l'UNISSN (United Nations Basic Space Science Initiative) (1991-2012). C'est à la fin du projet ARS, en 1995 que s'est constitué le réseau de recherche GERIRA, Centre International de Recherche en Géophysique, Europe Afrique. Ce réseau a permis la formation des chercheurs en Afrique, en Europe et en Asie. Le GERIRA a aussi assuré de nombreuses écoles de formation et de géophysique et de météorologie de l'Espace en Afrique.

**A propos du CRASTE-IF de Rabat**

Le Centre Régional Africain des Sciences et Technologies de l'Espace en Langue Française, CRASTE-IF, créé en octobre 1988, est une institution de formation de haut niveau, de recherche et d'animation scientifique dans les domaines des sciences et technologies de l'Espace, affiliée aux Nations Unies. Il a pour objectifs la diffusion du savoir et la promotion des recherches et des applications au développement en matière de sciences et technologies de l'Espace. Outre le CRASTE-IF basé à Rabat et couvrant l'Afrique pour les enseignements postérieurs à la licence, Terre-Satellite, l'Université pourrait par un usage stratégique, en à un niveau post-secondaire, qui peut aller de 20 à 40 heures, ce qui est géré dans le cas de l'arrangement d'un avion. Il est donc important, et c'est ce qui est demandé à tous les acteurs, que l'on puisse prévoir un état et pas encore le site d'implantation valide et pertinent au niveau de la Terre. Cet objectif appelle la météorologie de l'Espace. Ce cours d'initiation sur le processus ou climat terrestre, est en fait, un avertisseur à son sujet, de fait que l'on peut faire un recensement, sur le soleil, les magnétiques, l'atmosphère... Les



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## افتتاح ورشة تدريبية ثانية حول المناخ الفضائي بالرباط

تمكين المتدربين من إتقان البيانات المتعلقة بالملاحة عبر الأقمار الاصطناعية ■ معرفة استعمال الآلات الإلكترونية المتأثرة بكل التغيرات الفضائية

الرباط - حسن المصفاوي

في إطار برنامج الأمم المتحدة للتعاون في علم المناخ الفضائي وتكنولوجيا الفضاء، تم افتتاح ورشة تدريبية ثانية حول المناخ الفضائي في الرباط، وذلك في إطار التعاون بين المغرب والولايات المتحدة الأمريكية. هذه الورشة هي الأولى من نوعها في المغرب وتهدف إلى تعزيز قدرات المتدربين في مجال الملاحة عبر الأقمار الاصطناعية في ظل التغيرات المناخية الفضائية. تم تنظيم هذه الورشة بالتعاون مع مركز أبحاث الفضاء في جامعة ولاية أريزونا، الولايات المتحدة الأمريكية. وتحت إشراف خبراء من المركز، سيتم تقديم محاضرات وتدريب عملي على استخدام أدوات الملاحة الفضائية. كما سيتم مناقشة التحديات التي تواجه الملاحة الفضائية في ظل التغيرات المناخية الفضائية. وتعد هذه الورشة خطوة مهمة في تعزيز التعاون العلمي والتقني بين المغرب والولايات المتحدة الأمريكية في مجال الفضاء.

بالتعاون مع مركز أبحاث الفضاء في جامعة ولاية أريزونا، الولايات المتحدة الأمريكية. وتحت إشراف خبراء من المركز، سيتم تقديم محاضرات وتدريب عملي على استخدام أدوات الملاحة الفضائية. كما سيتم مناقشة التحديات التي تواجه الملاحة الفضائية في ظل التغيرات المناخية الفضائية. وتعد هذه الورشة خطوة مهمة في تعزيز التعاون العلمي والتقني بين المغرب والولايات المتحدة الأمريكية في مجال الفضاء.

EL AGGIMA Edition N° 410 - Jeudi 19 Février 2015 Issue No. 410 - Thursday, February 19, 2015



The announcement on National Television News (April 18, 2015 at 13 hours pm)

## Conclusion

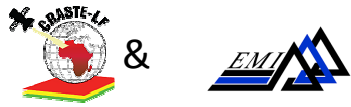





The School of “Space Weather-GNSS applications ISWI Maghreb II – GNSS”, organized in Rabat, was a great success with the participation of 27 trainees and 10 instructors from 12 nationalities in the form of short training courses that were held at the EMI and CRASTE-LF for 6 days.

The opening ceremony of the «EO Open Day”, organized in February, 18, 2015, addressed a large public and had as main objective to promote the dissemination of EO and the actions of GEO/GEOSS. It was organized in the form of a plenary session with 5 lectures. During the course of the “EO Open Day” official presentation of posters took place, accompanied by oral presentations and discussed by the trainees throughout the duration of the school. The number of participants in “EO Open Day” was 70, from 14 nationalities.

This second school of space weather-GNSS applications was addressed to all French-speaking African countries, which constituted an expansion of the network, as before it was restricted only to North African countries. Following this expansion to all countries in African French-speaking countries, it was decided to hold the third edition of this school in Ivory Coast, which will be hosted by the University of Felix HOUPHOUET BOIGNY in Abidjan in 2017 under the title 'School of Meteorology Space Maghreb-West Africa’.

## VIII. BUDGET

EXPENDITURE		
Transport	Amount in MAD	Amount in USD
Plane Tickets	135 385,74	14 326,53
Urban Transport	4 000,00	423,28
Meal and Snack	Amount in MAD	Amount in USD
Open Ceremony	3 025,00	320,11
Lunch	12 870,00	1 361,90
Coffee Break	500,00	52,91
Accommodation	Amount in MAD	Amount in USD
Hotel	26 720,00	2 827,51
Club	15 000,00	1 587,30
Printing & Media	Amount in MAD	Amount in USD
Printing & Prints	5 873,00	621,48
Communications & Media	3 000,00	317,46
Organization and logistics	Amount in MAD	Amount in USD
Amphitheater et Equipped classroom	15 500,00	1640,21
Organization & Secretariat	21 963,05	2 324,13
<b>TOTAL Expenses</b>	<b>243 836,79</b>	<b>25 802,83</b>

Contributions of institutions	Amount in MAD	Amount in USD
	77 257,97	8 175,45
	47 250,00	5 000,00
	94 500,00	10 000,00
	11 374,23	1 203,62
	9 237,80	977,54
	4 216,78	446,22

