



**REPORT**  
**4th EDITION OF THE ISWI-MAGHREB-WEST AFRICA (IMAO 2019)**  
**SCHOOL OF SPACE WEATHER**  
**Thiès / SENEGAL [15 to 25 October 2019]**



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 Web site of IMAO 2019 School : <https://eme-imao19.univ-thies.sn/>

Organized by  
The UFR - SET / University of Thiès  
**LabTPAD Laboratory**  
**In collaboration with: CRASTE-LF , the GIRGEA and the GIRER**

With the support of  
**International Space Weather Initiative (ISWI)**

Under the High Patronage of the Minister of Higher Education, Scientific Research and  
Innovation

**SPONSORS**

- Ministry of Higher Education, Scientific Research and Innovation;
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- Higher Institute of Professional Education (ISEP) of Thiès.
- Polytechnic School of Thiès;
- Polytechnic School of Dakar;
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- African Center of Excellence in Mathematics, Computer Science and ICT (CEA-MITIC);
- Documentation and Information Center of Thiès CDI-NTW;
- Joint Program Office - EGNOS Africa;
- Omega Technology.

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## **Summary**

The IMAO 2019 Space Weather School aimed to strengthen the capacities of young scientists, Master and PhD students from Maghreb and West Africa in all the scientific disciplines concerned with "**Space Weather**".

The Space Weather is a new branch of astronomy that is concerned with understanding and predicting the electromagnetic and solar particle impacts on the Earth's environment. It aims to predict the arrival and the magnitude of solar events, solar winds, magnetospheric and ionospheric disturbances, geomagnetic disturbances and associated ground currents and their impacts on technological infrastructures.

The courses will focus on the Physics of the Sun, of the Magnetosphere and the Ionosphere, the Atmosphere / Ionosphere / Magnetosphere and Geomagnetism couplings, and also on Climate Modeling, on Ocean Dynamics and Tele connections, on the GNSS, (Global Navigation Satellite System).

## **1- CONTEXT AND JUSTIFICATION**

### **1.1 Background**

The enthusiasm generated by the COP21 and COP22 summits in the international community shows the importance of the environmental issues and climate change that were debated there. These summits have all drawn the attention of policymakers around the world to the urgency of collective awareness of the growing threats to our global ecosystem. The fragility of our modern technological infrastructures in both space and terrestrial environments, in front of the electromagnetic impacts of solar activity has made it necessary to develop a new discipline known as "Space Weather".

Space Weather is a very recent discipline, still in development. It studies the impact of solar activity on our terrestrial environment. The interaction of electromagnetic radiation and solar particles with the geomagnetic field and the Earth's atmosphere has important implications for our technological world and our space environment. Indeed, the Sun constantly blows large masses of particles (electrons and protons) of high energy that carry part of the solar magnetic field. This mass called "solar wind" causes in the terrestrial environment important electromagnetic disturbances

(magnetic storms) which may seriously damage our economic infrastructures (satellites, telecommunication networks and transport of energy, pipelines, etc.), and the normal course of certain activities such as air and space navigation. The events of Quebec in January 1989 and Sweden in October 2003 are eloquent examples. In order to better understand and prevent such events, a consortium bringing together the United Nations through its UNOOSA agency (United Nations Office for Outer Space Affairs, <http://www.oosa.unvienna.org>), US NASA space agencies, European ESA and Japanese JAXA, initiated in 2007 the scientific program called "International Year of the Heliosphere" IHY ([http:// ihy2007](http://ihy2007)). As part of this program, several instruments were deployed throughout the Globe. Notably in Africa, magnetometers, GPS receivers, particle detectors, etc. were install in order to collect data on ionospheric, magnetospheric and heliospheric phenomena from 2007 to 2009. To continue the IHY 2007 program, the International Space Weather Initiative ISWI ([www.iswi-secretariat.org](http://www.iswi-secretariat.org)) has been launch in order to promote the study and development of Space Weather. Still under the umbrella of the United Nations, a new program called UNISPACE +50, from 2018 to 2030, was launch during the UN / USA / ISWI workshop in July 2017. UNISPACE +50 will continue the research activities initiated by IHY 2007, and make the acquired knowledge evolve towards their operationalization.

## **1.2 Justifications**

Due to the fragility of our modern terrestrial and space infrastructures facing the disruptive effects of solar disturbances and the obvious scientific interest of Space Weather, the African countries, in particular Senegal, are involved in these international scientific programs. Thus, it was highly appropriated that Senegal organizes the fourth edition of the ISWI-Maghreb-West Africa School (IMAO) on Space Weather in 2019, given the important role it has always played in education and in scientific research in Africa. The UFR-SET is the best choice to host the school, according to its mission of training and research in disciplines related to science and technology: Mathematics, Physics, Computer Science, Physical Sciences, Life Sciences of the Earth, Environment.

The ISWI-Maghreb-West Africa School on Space Weather is a high-level scientific meeting that is organize every two years. The first edition was held from May 6 to 16, 2013 at the University of Science and Technology Houari Boumediene (USTHB) of Algiers (Algeria), the second at CROSTE-LF Rabat (Morocco) from February 16 to 21, 2015, the third at the University Felix Houphouet Boigny of Abidjan from October 16 to 28, 2017. At the end of the third edition, Senegal

was chosen by the organizers and by all participants, because of its strong scientific potential to host the fourth edition in 2019.

The IMAO schools that are organized every two years in different African countries results from the cooperation work of professors from different disciplines and countries working in the research network GIRGEA (International Geophysical Research Group Europe Africa, [www.girgea.org](http://www.girgea.org)). One of the missions assigned to GIRGEA is to train young scientists with a general knowledge in various fields of space physics, in order to establish bridges between disciplines that are addressed their thesis.

## **2. OBJECTIVES**

Organizing the 4<sup>th</sup> school IMAO 2019 in Senegal on Space Weather targeted many objectives, of which the main ones are:

### **2.1 General objective**

Strengthen the capacity of young researchers, including Master 2 students and PhD students from the Maghreb and West Africa, in all the scientific disciplines concerned with "Space Weather"

### **2.2 Specific objectives**

- 1- Develop skills in using already existing data sets and required tools for Space Weather studies;
- 2- Assimilation of recently collected data and existing databases;
- 3- Use space weather results, by combining ground and satellite data, for research and sustainable development;
- 4- Train world class researchers in Space Meteorology in the Maghreb-West Africa region;
- 5- Promote scientific collaboration between researchers from the Maghreb-West Africa region;
- 6- Stimulate vocations in Space Physics through public conferences in schools (secondary and primary schools).
- 7- Help dissemination of the results of research in Space Weather;

### **3. EXPECTED RESULTS**

At the end of the 4th edition of the IMAO 2019 school:

- 1- Techniques for using the multiple databases available for environmental studies are acquired.
- 2- Local expertise in the use of tools for data processing has been developed.
- 3- The training of scientists and researchers from West Africa and the Maghreb in the use of the results of studies combining environmental sciences, space meteorology and sustainable development is carry out.
- 4- Researchers from the Maghreb, West Africa, Central Africa and East Africa have acquired high-level scientific knowledge for space weather forecasting.
- 5- Project to set up an inter-establishment Master in GNSS in collaboration with JPO experts.
- 6- Job creation project to train students in Space Weather with JPO-EGNOS Africa. The JPO is the result of the implementation of the Joint Africa-EU Strategy which advocates the provision of satellite navigation services in the context of infrastructure development. JPO is a Pan-African Program in charge of coordinating the implementation of GNSS / EGNOS in Africa. It is based in Dakar and is hosted by ASECNA.
- 7- The 5th edition of the IMAO school is scheduled for 2021 in Burkina-Faso

### **4. COURSE OF THE SCHOOL**

#### **4.1 Opening Ceremony and Closing Ceremony**

The opening ceremony of the fourth edition of the IMAO -2019 school, was held at the auditorium of the Polytechnic School of Thiès, Tuesday, October 15, 2019 in the presence of the authorities of the University of Thiès; the Rector of the University of Thies, Pr Ramatoulaye DIAGNE MBENGUE, Rector of the University Alioune DIOP of Bambey, Pr Mahi DIAW; the Representative of the Minister of Higher Education, Research and Innovation, Professor Thierno Amadou GAYE; the Director of ANACIM and the Director of JPO-EGNOS Africa.



Organizing Committee: Pr Christine Amory MAZAUDIER - Dr. Idrissa GAYE



Pr Ramatoulaye DIAGNE MBENGUE (Rector of the University of Thiès)



Pr Ibrahima MBAYE (Director of the UFR-SET) - Pr Thierno A GAYE (Representative of MESRI)





Trainers and authorities



Speech of the student RODRIGUEZ



Presentation of the certificates at the closing ceremony of the school in the presence of the rector of the University

## 4.2 Faculty team

The faculty team consisted of professors from the following countries:

Algeria, Burkina Faso, Ivory Coast, France, Morocco, Senegal, US

LOCAL TEACHERS		
1	Grégoire SISSOKO <a href="mailto:gsissoko@yahoo.com">gsissoko@yahoo.com</a> ,	University of Cheikh Anta Diop de Dakar, Laboratoire de Semi conducteurs et d'Energie Solaire. Dakar-Sénégal.
2	Moussa DIAKHATE <a href="mailto:moussa.l.diakhate@ucad.edu.sn">moussa.l.diakhate@ucad.edu.sn</a>	University of Cheikh Anta Diop de Dakar, Ecole Supérieure Polytechnique
3	Herbert NGAYA <a href="mailto:Herbert.ngaya@egnos-africa.com">Herbert.ngaya@egnos-africa.com</a>	EGNOS in AFRICA Support Program – JPO (Joint Program Office)

FOREIGN TEACHERS		
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13	ZERBO Jean-Louis <a href="mailto:jeanlouis.zerbo@gmail.com">jeanlouis.zerbo@gmail.com</a>	University of Bobo Dioulasso Burkina Faso
14	ZAOURAR Naima <a href="mailto:naimaboulasba@gmail.com">naimaboulasba@gmail.com</a>	Laboratoire de Géophysique, FSTGAT /USTHB, BP 32 El Alia Bab- Ezzouar 16111 Algérie

### 4.3 List of participants

The 4th edition of the IMAO school brought together 18 participants from abroad and 15 Senegalese. The table below lists the participants from the following 12 countries:

Algeria, Benin, Burkina Faso, Cameroon, Côte d'Ivoire, France, Guinea Conakry, Morocco, Nigeria, RC, DRC, and Rwanda.

**Table of participants coming from abroad**

	NAME	COUNTRY	STATUT	EMAIL
1	BARRO Pape Abdoulaye	Benin	PhD student	<a href="mailto:Pape.abdoulaye.barro@gmail.com">Pape.abdoulaye.barro@gmail.com</a> <a href="mailto:Pape.barro@imsp-uac.org">Pape.barro@imsp-uac.org</a>
2	LOUA René Tato	Guinea Conakry	PhD student	<a href="mailto:lrenetatometeo@gmail.com">lrenetatometeo@gmail.com</a>
3	GRODJI Oswald Didier Franck	Côte d'Ivoire	Researcher	<a href="mailto:franckgrodji@yahoo.fr">franckgrodji@yahoo.fr</a>
4	NDACYAYISENGA Théogène	Rwanda	PhD student	<a href="mailto:ndacyatheogene@gmail.com">ndacyatheogene@gmail.com</a>
5	KOUASSI Nguessan	Côte d'Ivoire	PhD student	<a href="mailto:nguessank23@yahoo.fr">nguessank23@yahoo.fr</a>
6	AMAECHE Paul Obiakara	Nigeria	Teacher Researcher	<a href="mailto:paoloobiaks@yahoo.fr">paoloobiaks@yahoo.fr</a>
7	NSONGA OUMBA Roselin	Rep. Congo Brazzaville	PhD student	<a href="mailto:njulorroselin@yahoo.fr">njulorroselin@yahoo.fr</a>
8	YOMBO PHAKA Rodriguez	DRC	PhD student	<a href="mailto:rodriguez2yombo@gmail.com">rodriguez2yombo@gmail.com</a>
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10	SANDWIDI Sibri Alphonse	Burkina Faso	PhD student	<a href="mailto:alphonse.sandwidi@yahoo.fr">alphonse.sandwidi@yahoo.fr</a>
11	HONORE Messanga Etoundi	Cameroon	Researcher	<a href="mailto:honormess@yahoo.fr">honormess@yahoo.fr</a>
12	BELHACHIR Tarek	Algeria	PhD student	<a href="mailto:belbachirrafik9@gmail.com">belbachirrafik9@gmail.com</a>
13	BENYAHIA Selma	Algeria	PhD student	<a href="mailto:selma.benyahia.93@gmail.com">selma.benyahia.93@gmail.com</a>
14	ADECHINAN Adébiyi Joseph	Benin	Teacher Researcher	<a href="mailto:adechinanjoseph@yahoo.fr">adechinanjoseph@yahoo.fr</a>
15	HAMMOU ALI Omar	Algeria	PhD student	<a href="mailto:Omar.hammouali47@gmail.com">Omar.hammouali47@gmail.com</a>
16	BOSSE Léo	France	PhD student	<a href="mailto:leo.bosse@univ-grenoble-alpes.fr">leo.bosse@univ-grenoble-alpes.fr</a>
17	LOUFTI Amal	Morocco	PhD student	<a href="mailto:loutifi.amal@gmail.com">loutifi.amal@gmail.com</a>
18	GNABAHOU Allain	Burkina Faso	Researcher	<a href="mailto:gnabahou@yahoo.fr">gnabahou@yahoo.fr</a>

Fifteen Senegalese from different universities and institutions of the country participated in the 4th edition of the IMAO 2019 school. The table below gathers their names and institutions: Cheikh Anta Diop University of Dakar, Assane SECK University of Ziguinchor, Gaston Berger University of Saint Louis, University of Thies, Virtual University of Senegal, Alioune DIOP University of Bambe.

**Table of Senegalese participants**

	NAME	UNIVERSITY	STATUT	EMAIL
1	GUEYE Ahmed	Cheikh Anta Diop University of Dakar (UCAD)	PhD student	<a href="mailto:gueyea67@gmail.com">gueyea67@gmail.com</a>
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4	Ba Abdoulaye	UCAD	PhD student	<a href="mailto:abdoulaye.bakoto@gmail.com">abdoulaye.bakoto@gmail.com</a>
5	SOW Baidy	Gaston Berger University	Student M2	<a href="mailto:sow.baidy1@ugb.edu.sn">sow.baidy1@ugb.edu.sn</a>
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7	TINE Jean Pierre	Alioune Diop de Bambey University	PhD student	<a href="mailto:jptine23@hotmail.com">jptine23@hotmail.com</a>
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9	SALL Alioune	Thiès University	Engineer network	<a href="mailto:alsall83@gmail.com">alsall83@gmail.com</a>
10	NDONG Massa	UVS	Researcher	<a href="mailto:massandong@gmail.com">massandong@gmail.com</a>
11	FAYE Pauline Sanou	Thiès University	Student M2	<a href="mailto:fayepaulinesanou@gmail.com">fayepaulinesanou@gmail.com</a>
12	FAYE Ababacar Sadikh	Thiès University UFR-SET	Student M2	<a href="mailto:faye.ababacarsadikh@gmail.com">faye.ababacarsadikh@gmail.com</a>
13	NDAO Amath	Thiès University	Student M2	<a href="mailto:amathn36@gmail.com">amathn36@gmail.com</a>
14	NGOM Salimata	Thiès University	PhD student	<a href="mailto:salimata.ngom@univ-thies.sn">salimata.ngom@univ-thies.sn</a>
15	TOURE Mory	UCAD	PhD student	<a href="mailto:morytoure2@gmail.com">morytoure2@gmail.com</a>

#### 4.4 Program

IMAO 2019 has made it possible to understand solar physical processes and their actions on the near Earth environment: magnetosphere, ionosphere and atmosphere.

The following points were detailed:

- Recent discoveries on the sun;
- Impact of the Sun on the ionized terrestrial environment;
- Influence of the sun on the earth's atmosphere;
- Use of instruments and useful measurements such as GNSS data (GPS, GLONASS, GALILEO, etc ...) for navigation, space weather, climate or magnetic field measurements for the study of GICs .

The disciplines taught relate to the physical environments and phenomena involved in the Sun-Earth relationship, namely:

- 1- Sun-Earth relations: global approach
- 2- The Sun
- 3- The interplanetary space
- 4- The terrestrial magnetosphere
- 5- The terrestrial ionosphere
- 6- Geomagnetism
- 7- Impact of solar disturbances on technological infrastructures;
- 8- Use of GNSS (Global Navigation Satellite System) data, for the study and the forecast in space meteorology.
- 9- Structure of the atmosphere
- 10- Meteorology
- 11- Climate
- 12- GIS
- 13- EGNOS
- 14- Irradiation of semiconductors

All courses are online on the website of the University of Thiès.

## 4.5 Schedule

### First Week

*Mathieu, Emran, Vafi - Frédéric, Jean, Jean-Louis, Christine, Naima, Yasmina, Rolland [10] + Locaux (Herbert)*

day	Tuesday 15	Wednesday 16	Thursday 17	Friday 18	Saturday 19	Sunday
9h00- 10h00	Opening Ceremony Presentation of Senegal Idrissa-> Senegal	Sun and Geomagnetism Jean-Louis	Magnetosphere Mathieu	Auroral Ionosphere Jean	Auroral ionosphere Frédéric P.	
10h00-11h00	Christine => GIRGEA	Internal magnetic field Yasmina	Sun and Geomagnetism Jean-Louis	Magnetosphere Mathieu	Auroral ionosphere Frédéric P. The wall of Peace Jean	
11h00-11h30						
11h30-12h30		External magnetic field Naima	Electrojet equatorial Vafi	Electrojet equatorial, Sq Vafi + Christine	Amadou Thierno GAYE	
12h30-14h30	meal					
14h30-16h00	Presentation of the participants	Practical work (PW) on the internal magnetic field Yasmina	Excursion à DAKAR	Magnetosphere PW Mathieu	EGNOS GNSS Herbert	
16h00-16h30	16h Coffee Break					
16h00-18h00	Sun Earth Connections Christine	PW on the external magnetic fields Naima + Vafi		SIG Emran	Magnetosphere PW Mathieu	
18h00-19h30	Distribution of the case studies to the participants	Work on the project and Presentation of student's posters		Work on the project and Presentation of student's posters	Work on the project and Presentation of student's posters	

### Second Week

*Ludwig, Pétronille, Serge, Wassila - Frédéric, Jean, Jean-Louis, Christine, Yasmina, Rolland [11] + Locaux (Grégoire, Moussa)*

day	Monday 21	Tuesday 22	Wednesday 23	Thursday 24	Friday 25
9h00- 10h00	Auroral ionosphere Jean	Sun Ludwig	Pétronille Atmosphere	The seasonal cycle of the coupled system ocean atmosphere Wassila Thiaw	radiation application on conductors Grégoire Sissoko
10h00-11h00	Frédéric P Auroral ionosphere	Pétronille Atmosphere	Sun Ludwig	Climate of Sahel Moussa	Serge Atmosphere
11h00-11h30	Coffee Break				
11h30-12h30	Sun Ludwig	Equatorial ionosphere Rolland and Omar	Serge Atmosphere	meteorological applications of remote sensing space Wassila	Work on the Projects
12h30 13h-14h30	Bus start Meal and return				
14h30-16h00	Sun Practical Work (PW) Ludwig	Auroral ionosphere PW Frédéric P.	Rolland + Omar GNSS PW	Wassila Climatic variability	Rolland + Omar GNSS PW
16h00-16h30					
16h00-18h00	Auroral ionosphere PW Jean	Sun PW Ludwig	Pétronille Atmosphere PW	Roland + Naima + Omar GNSS/Meteorology and Ionosphere PW	Serge Atmosphere PW
18h00-19h30	Work on the project and Presentation of student's posters	Work on the project and Presentation of student's posters	Work on the project and Presentation of student's posters	Work on the project and Presentation of student's posters	Presentation of the group's project Certificate delivery Closing Ceremony



## **4.6 Presentations by participants**

### **Friday 18th October**

1) Arame DIEYE: Current changes in sea level near West African coasts

### **Saturday October 19th**

2) Leo BOSSE: polarization of the light of the aurora

3) NDCYAYISENGA Theogene: Type III solar radio burst, solar energetic particles and their associated ionospheric disturbances

### **Monday, October 21st**

4) Omar Hammou Ali: TEC variation from SWARM data

5) Amal LOUTFI: Climatology of neutral winds during extreme solar events above the Oukaimeden observatory in Morocco.

6) René Tato LOUA: Variation of temperature and rainfall in Guinea.

### **Tuesday, October 22**

7) Alphonse Sibri SANDWIDI: Effects of shocks on variations of foF2 at the Dakar station

8) Serign Abdoul Aziz NIANG: Comparative study of the solar energy potential and sizing of a photovoltaic installation for stations in the Sahel

9) Abdoulaye Ba: About the European mission ROSETTA: some advances on the understanding of the solar system through the analysis of the comet core 67P / Choury

10) Mory TOURE: Heat wave and health

### **Wednesday, October 23**

11) Kouassi N'GUESSAN: Electromagnetic induction associated with eruptive solar events at low latitudes

12) Mamadou NDIAYE: Effect of mineral dust on extremes of temperature in the Sahel

13) Rodriguez YOMBO: Air pollution in Kinshasa

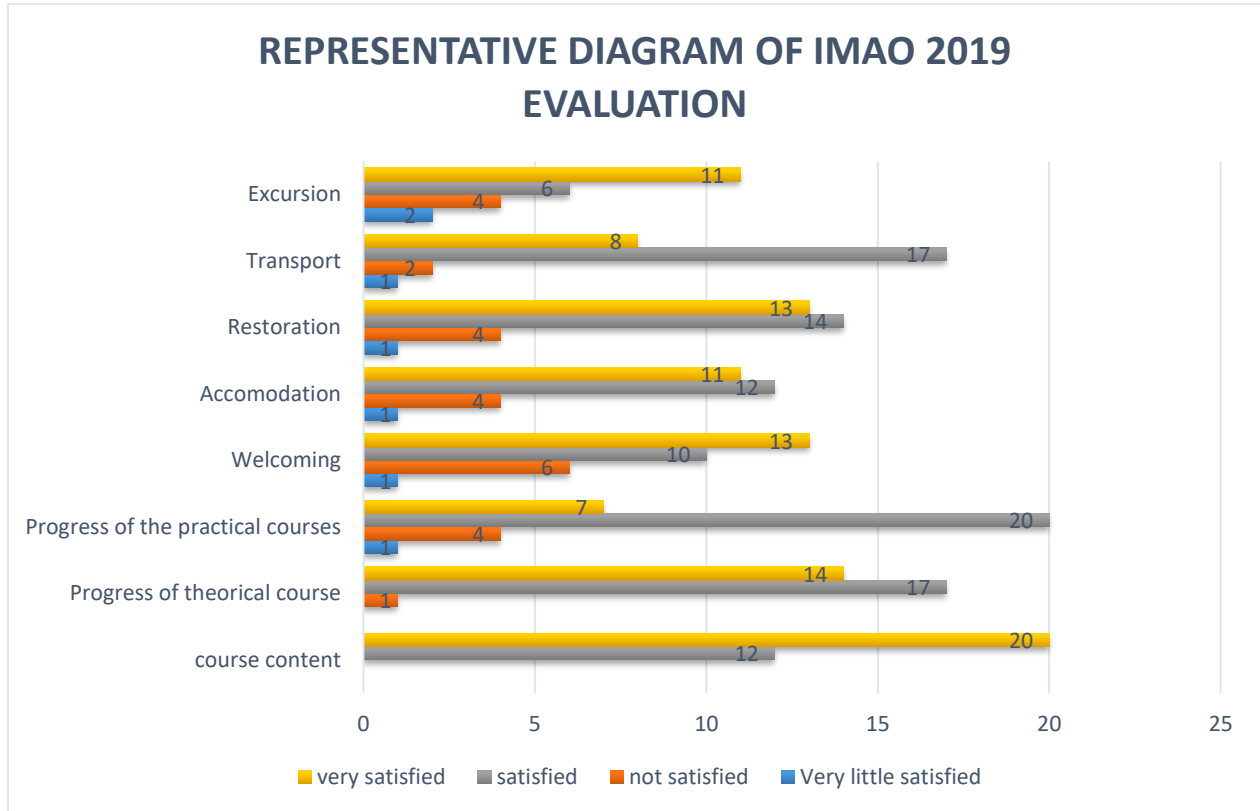
14) Paul AMAECHI and Omar HAMMOU ALI: Practical work on the use of the IRI model

15) Amath NDAO: on "setting up a GPS receiver, influence of the variation of the TEC on the measurements."

16) Tarek BELBACHIR and Selma BENYAHIA: Study of the variations of the ionospheric scintillations at low latitudes from GNSS data

#### 4.7 Evaluation of the school by the participants

The diagram below shows the participants' opinions about the school's progress.





## 5. BUDGET

### 5.1 Local Budget

Chapter	Description	Cost (FCFA)
Consumables	(papers, markers, pencils, envelopes ...)	20 250
Restoration	Breakfast of participants	300 000
	Lunch + Dinner	5 674 600
	Coffee break	630 000
Accommodation	Participants	1 680 000
	Trainers	3 600 000
Communication	Press	95 000
	Visual (Banners + Badges + movie)	156 500
Transport	(AIBD, Shuttles, courriers)	597 550
Excursion	Thiès – Dakar - Parc of Bandia - Saly – Somone - Thiès	295 350
Medical accompaniment for participants		26 348
Various		75 300
	<b>TOTAL</b>	<b>13 150 898 FCFA</b> <b>euros : 20 232 €</b>

#### Sponsors :

- CEA-MITIC/University Gaston Berger of Saint-Louis : **7 692 €** => Accommodation ;
- CDP Rectorat /University of Thiès: **7 631 €** => Restoration ;
- JPO - Egnos Africa: **923 €** => Restoration;
- UFR SET/UT : **2 707€** ; UFR SI/UT : **255€** ; ISEP/Thiès : **183 €** ; UADB/Pr Lamine GUEYE : **385 €** ; Oméga Technologie : **154 €** ; CDI - Nouro Te Woute : **38 €** ;  
Contribution of members of GIRGEA: **264 €**. **Total : 3 986 €**  
=> Communication, Complementary Accommodation, Coffee Break, Transportation, Consumables, Medical Assistance, Excursion.

## 5.2 Cost of the flight tickets

	NAME	COUNTRY/Sponsor	Cost of the Ticket	euros
1	ZOUNDI Christian	Burkina-Faso	479 600 CFA	731€
2	GNABAHOU Allain	Burkina-Faso	479 600 CFA	731€
3	AMORY-MAZAUDIER Christine	France - PNST	746€	746€
4	FLEURY Roland	France - PNST	767€	767€
5	BELHACHIR Tarek	Algérie	56532 Dinard	425,05€
6	BENYAHIA Selma	Algérie	56576 Dinard	425,38€
7	YAHIAI Yasmina	Algérie	56650 Dinard	428,57€
8	ZAOURAR Naima	Algérie	56650 Dinard	428,57€
9	HAMMOU ALI Omar	Algérie	59450 Dinard	447€
10	GRODJI Oswald Didier Franck	Côte d'Ivoire - AUF	214 000 CFA	326.22€
11	PITOUT Frédéric	France – PNST	587€	587€
12	NSONGA OUMBA Roselin	RC - SCOSTEP	672.79€	666.11€
13	BARRO Pape Abdoulaye	Bénin - AUF	451 000 CFA	687.5€
14	AMAECHE Paul Obiakara	Nigéria – SCOSTEP %	239 139 NGN	594.90€
15	LOUA René Tato	Guinée Conakry -AUF	233 700 CFA	356.25€
16	NDACYAYISENGA Théogène	Rwanda - SCOSTEP	666.11€	672.79€
17	DOUMBIA Vafi	Côte d'Ivoire	286 600 CFA	435.97€
18	ADECHINAN Adébiyi Joseph	Bénin - ICTP	298 000 CFA	454.26€
19	HONORE Messanga Etoundi	Cameroun- ICTP	481 000 CFA	733.23€
20	KOUASSI Nguessan	CI – SCOSTEP%	241 000 CFA	367.67€
21	YOMBO PHAKA Rodriguez	RDC - ICTP	558 500 CFA	851.37€
22	ZERBO Jean-Louis	Burkina Faso	400 300 CFA	610.23€
23	SANDWIDI Sibri Alphonse	Burkina Faso	449 300 CFA	685.97€
24	BOSSE Léo	France	800€	800€
25	BERTHOMIER Matthieu	France -ESTER	871,92€	871,92€
26	LILENSTEN Jean	France -PNST	800€	800€
27	EMRAN Anas	Maroc- CRASTE-LF	7294 Dirham	680.75€
28	LOUTFI Amal	Maroc	8100 Dirham	755.97€
29	KLEIN Karl-Ludwig	France - ESTER	963.68€	963.68€
30	KAFANDO Pétronille	Burkina Faso-GIRGEA	724€	724€
31	SOULA Serge	France-	1563.15€	1563.15€
	<b>TOTAL</b>			<b>20 318,51€</b>

### **Sponsors :**

**AUF:** 1369.97€ => 3 tickets / **SCOSTEP:** 2000 USD ~ 1804 .80€ => 2 tickets and contribution to 2 tickets / **ICTP:** 2000€ => 3 tickets/ **PNST :** 2900€ => 4 tickets / **ESTER :** 1835.6€ => 2 tickets

**Total : 9910 .37€**

### **Contributions of institutions**

**OSUP:** 800€ / **University of Marrakech:** 569.62€, **University of Koudougou :** 2147.97€, **CRASTE-LF:** 680,75€ / **Laboratoire d'aérologie:** 1563.15€

**Total of institutions: 5761.47€**

**Contribution of GIRGEA'members: 4646.67€ => 8 tickets and contribution to 5 tickets**

## **6. LOGISTIC**

- Photos of the bus





- Photos of rooms during class







- Pictures of the rooms during Practical work









- Pictures of the dining room and the coffee break





- **Pictures of the excursion**



## ANNEX

### 1. COMMITTEE OF HONOR

Dr Cheikh Oumar HANN, Ministre de l'Enseignement Supérieur, de la Recherche Scientifique et de l'Innovation, Sénégal.

Pr Ramatoulaye Diagne Mbengue, Recteur de l'Université de Thiès, Sénégal.

Pr Grégoire SISSOKO, Directeur du GIRER, Sénégal.

Pr Mamadou SARR, Ancien Directeur de l'UFR SET, Sénégal.

Pr Bamba DIAW, Directeur de l'Ecole Polytechnique de Thiès, Sénégal.

Pr ANAS Emran, Directeur du CRASTE-LF, Maroc

Mr Sémou DIOUF, Directeur du JPO-EGNOS Afrique.

### 2. SCIENTIFIC COMMITTEE

**President:** Pr Thierno Amadou GAYE (Sénégal)

**Vice-President:** Pr. Christine Amory MAZAUDIER (France), Pr. Zaourar NAIMA (Algérie)

**Members:** Pr Rolland Fleury, Pr. Vafi DOUMBIA (Côte d'Ivoire), Pr Cheikh SARR (Sénégal), Pr Ibrahima MBAYE (Sénégal), Pr Ibrahima LY (Sénégal), Pr Salif GAYE (Sénégal), Pr Mapathé NDIAYE (Sénégal), Pr. OUATTARA Frédéric (Burkina Fasso).

### 3. INTERNATIONAL ORGANIZING COMMITTEE

**President:** Pr. Christine Amory-Mazaudier (France),

**Vice-President:** Pr. Zaourar Naima (Algérie),

**Members:** Dr. PITOUT Frédéric (France), Pr. Vafi DOUMBIA (Côte d'Ivoire), Pr. OBROU Olivier (Côte d'Ivoire), Dr Rolland FLEURY (France), Dr. Idrissa GAYE (Sénégal).

### 4. LOCAL ORGANIZING COMMITTEE (Senegal)

**President:** Dr. Idrissa GAYE

**Vice-president:** Pr. Mouhamadou THIAM

**Other members:** Pr Ibrahima MBAYE, Pr Cheikh SARR, Pr Mapathé NDIAYE, M. Abdou Wahab KA, Dr Tala GUEYE, Pr Mouhamadou SECK, Pr Demba Bocar BA, Dr Mamadou Lamine DIAGNE, Dr Moussa Déthié SARR, Dr Ousmane SOW, Dr. Saidou NDAO, Pr Hawa LY

DIALLO, M. Mohamadou Lamine DIA, M. Abdoulaye SY FALL, M. Oumar NDOUR, M. Papa DIOP, M. Bara SY, M. Abdoulaye SY, M. Faly DIAGNE, M. Yamadou FATY, M. Abdou Magib DIAGNE, M. Aboubakry SOKOMO, M. Mamadou GUEYE, Mme Seynabou NIANG SECK, Mme Khadidiatou CAMARA KONATE, Mme Julia Mendes, Mme Rokhaya BODIAN, M. Samba Ndao MBENGUE, M. Fallou MBENGUE, M. Mouhayib SYLLA, M. Michele DIONE, Mlle Fatou DIOUF, Mlle Aida DIOP.

## 5. MODELS of ATTESTATIONS

### 5.1 Attestation of Trainer





## 5.2 Attestation of participant



### 5.3 Certificate of satisfaction



6. AUTRES PHOTOS

