

Other ISWI reports from Africa

- South Africa and Kenya
- Algeria
- Burkina Faso
- Cote d'Ivoire
- Egypt
- Guinea
- Morocco
- Senegal
- Tunisia
- eLearning in Africa

South-Africa report

John Bosco Habarulema

- 1. Space Weather Project in preparation for providing ICAO advisories for aviation industry. We are currently developing products such as real-time TEC maps, scintillation products and 3-dimensional electron density reconstruction maps.
- 2. Coupled to the one above, there has been focus on installation of GNSS receivers outside South Africa such as in Kenya and Zambia. All these are aimed at improving the accuracy of our Space weather products.

Paul Baki

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Technical University of Kenya

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Research and training:

- A number of Masters and Ph.D. students are in the pipeline

Infrastructure

- In 2020, Kenya Space Agency awarded a grant of Ksh 5,000,000 (USD 50,000) to Taita Taveta University and University of Eldoret to install space weather observing facilities across the country.
- Pwani University has installed 3 scintillation receivers in partnership with a Chinese institute. The University in partnership with Italian Space Agency to instal an Ionosonde and ascintillation receivers at Broglio space Centre in Malindi, Kenya.
- SCINDA -GPS receivers at University of Nairobi (UoN), Maseno University and Jomo Kenyatta University of Agriculture and Technology are non-operational
- VHF receiver at UoN not operational
- Satellite Beacon Receiver at the Technical University of Kenya not operational
- Digisonde at Maseno University non-operational

ISWI –COORDINATORS /GIRGEA

ALGERIA : Prof Naima ZAOURAR / University of Science and Technology Houari Boumedienne, Alger

BURKINA FASO: Prof. Frédéric OUATTARA/University Norbert ZONGO / Burkina Faso

CÔTE D'IVOIRE : Prof Vafi DOUMBIA/ University Houphouët Boigny / Abidjan

EGYPT: Prof Ayman MAHROUS/Director of SWC / Helwan University

GUINEA: Director René Tato LOUA/ Meteorology National of Guinea Conakry

MOROCCO: Prof Aziza BOUNHIR/ University Mohammed, Rabat

SENEGAL: Prof Idrissa GAYE/ University of Thiès

TUNISIA: Prof Hassen Ghalila/Université de Tunis El Manar I , Tunis

ALGERIA

Dr Omar HAMMOU ALI defended his PhD on November 21, 2021

University Science and Technology Houari BOUMEDIENNE/ ALGERIA
Response of ionospheric VTEC and scintillations from SWARM
satellite data and ground network data, to solar events at low
latitudes

ISWI –COORDINATOR OF ALGERIA Prof Naima ZAOURAR

ALGERIA

JURY

M. Amar BOUDELLA
Professeur (USTHB) Président / Professor, President

M. Mourad DJEBLI
Professeur (USTHB) Examineur/ Professor, Examiner

M. Toufik ABDELATIF
Directeur de Recherche (CRAAG) /Director, Examiner

Mme. Soraya MAKHLOUF Maitre de Conférences A (USTHB)
Examinatrice / Senior Lecturer, Examiner

Mme. Naima ZAOURAR Professeur (USTHB) Directrice de
thèse /Director of the PhD

Mme. Christine Amory-Mazaudier Senior scientist
LPP/polytechnique Sorbonne universités /Examiner



ALGERIA/ PAPERS PUBLISHED by Dr Omar HAMMOU ALI

1. **Hammou Ali O**, Zaourar N, Fleury R, Amory-Mazaudier C. Transient variations of vertical total electron content at low latitude during the period 2013-2017. *Advances in Space Research*, volume 68, issue 12 and coverdate 15 Decembre 2021.

<https://www.sciencedirect.com/science/article/abs/pii/S0273117721001861>

2. Imtiaz, Nadia, **Omar Hammou Ali**, and Haider Rizvi. "Impact of the intense geomagnetic storm of August 2018 on the equatorial and low latitude ionosphere." *Astrophysics and Space Science* 366.11 (2021): 1-14.

<https://link.springer.com/article/10.1007/s10509-021-04009-2>

3. Abdellaoui H, Zaourar N, Meslem MA, **Hammou Ali O**, Fleury R. CAMPAIGN FOR THE SELECTION OF SITES ELIGIBLE FOR INSTALLATION OF GNSS/CORS STATIONS IN ALGERIA: STUDY AND ANALYSIS. *International Multidisciplinary Scientific GeoConference: SGEM*. 2019; 19(2.2):47-55.

<https://www.proquest.com/openview/448f93b664c96184ba2c8db663e66f62/1?pq-origsite=gscholar&cbl=1536338>

4. Sur D, **Hammou Ali O**, Binti Sarudin I, Rupiewicz J, Bravo M, Sun X, Toriashvili L. Effects of geomagnetic storm on equatorial ionization during 27 February-1 March, 2014. In *AGU Fall Meeting Abstracts 2018 Dec* (Vol. 2018, pp. SA31B-3418).

<https://ui.adsabs.harvard.edu/abs/2018AGUFMSA31B3418S/abstract>

BURKINA FASO

Mr. Abdoul Kader SEGDA defended his thesis on January 19, 2021 at the Norbert ZONGO University in Koudougou

on the topic: "*Modeling of the variability of the critical frequencies foF2 during the shock activities for the sunspot cycles 21 and 22 . Assessment of the predictive values of URSI and CCIR of IRI-2012 on in situ measurements of the ionosonde station at Ouagadougou*".



From left to right

Dr (Senior Researcher) Emmanuel NANEMA (referee), Burkina Faso

Dr (Senior Lecturer) Jean-Louis ZERBO (examiner), BF

Prof. Saïdou MADOUGOU (President of the Jury), Niger

Prof. Frédéric OUATTARA (Thesis Director), BF

Dr (Associate Professor) Bétaboalé NAON (referee), BF

ISWI COORDINATOR OF BURKINA FASO: Prof. Frédéric OUATTARA

BURKINA FASO

Dr M'bi KABORE, from the Nazi BONI University of Bobo Dioulasso defended his thesis on June 04, 2021 at the Norbert ZONGO University in Koudougou on the topic: " : *"Variability of the critical frequency foF2 between the sectors Africa-Asia, Africa -America in the equatorial zone and between the Africa-Europe sectors during geomagnetic quiet periods for sunspot cycles 20 and 21 "*.



From left to right

Dr (Senior Researcher) Emmanuel NANEMA (referee), Burkina Faso (BF)

Dr (Senior Lecturer) Jean-Louis ZERBO (examiner), BF

Prof. Saïdou MADOUGOU (President of the Jury), Niger

Prof. Frédéric OUATTARA (Thesis Director), BF

Dr (Associate Professor) Bétaboalé NAON (referee) BF

BURKINA FASO

Mr. Sibri Alphonse SANDWIDI defended his thesis at Norbert ZONGO University on June 05, 2021 in Koudougou on the theme: "*Variability of foF2 during disturbed geomagnetic activities at the Dakar station during solar cycles 21-22*".



From left to right

Dr (Senior Researcher) Emmanuel NANEMA (referee), BF

Dr (Senior Lecturer) Jean-Louis ZERBO (Examiner)BF,
Pr Saïdou MADOUGOU (President and referee), Niger

Bernard SANDWIDI (brother of the applicant),

Pr Frédéric OUATTARA (Thesis Director), BF

Dr (Senior Lecturer) Bétaboalé NAON (referee).BF

Côte d'Ivoire

On January 23, 2021, **Dr. Josée N'gbesso YAO** successfully defended her doctorate in physics at the University Félix Houphouët Boigny (UFHB), Abidjan, Côte d'Ivoire under the supervision of Professor Olivier OBROU and Dr. Bruno NAVA of T / ICT4D Lab, ICTP, Italy.

Her subject was on: *“Evaluation of the NeQuick 2 model in the equatorial region of West Africa using GNSS data”*.



The jury was composed :

Chairman: M. KOBEA Toka Arsène, Research Director, Félix Houphouët-Boigny University (Abidjan)

Director: M. OBROU Kouadio Olivier, Associate Professor, Félix Houphouët-Boigny University (Abidjan)

Referee: Mr. ZOUEU Thouakesseh Jérémie, Full Professor, Institut National Polytechnique Félix Houphouët-Boigny (Yamoussoukro)

Referee : M. ADOHI Bibi Jean Pierre, Full Professor, Félix Houphouët-Boigny University (Abidjan) Examiner: M. DOUMBIA Vafi, Associate

Professor, Félix Houphouët-Boigny University (Abidjan).

Côte d'Ivoire
GIRGEA school in October 2022 in Abidjan

SUMMER SPACE WEATHER SCHOOL

Physics and use of tools

17-28 October 2022

Houphouët Boigny University, Abidjan, Côte d'Ivoire

2022

- ✓ Centenary of the discovery of the Equatorial Electrojet
- ✓ Thirty years of the International Year of the Equatorial Electrojet

ISWI COORDINATOR OF CÔTE D'IVOIRE : Prof Vafi DOUMBIA

EGYPT

Dr Ola AHMED MUSTAFA ABU ELEZZ successfully defended her PhD in Physics at Helwan University / Egypt on October 11, 2020.

Her subject was on: "*Nowcasting and Modeling of the Ionosphere over Africa*"

This thesis has been approved for submission by the thesis directors:

Ayman MAHROUS: Professor, Department of Physics, Faculty of Sciences, University of Helwan, Egypt

Pierre CILLIERS: Professor of Space Sciences South African National Space Agency (SANS) Hermanus, South Africa.

Muhammed YOUSEF: Associate Professor, Department of Physics, Faculty of Sciences, University of Helwan, Egypt

Rolland FLEURY: Professor, Micro-Ondes Télécom Bretagne department, Brest, France.

Jury Members

Professor Mohamed SALAH EL NAWAWY, Department of Astronomy, Faculty of Sciences, University of Cairo, Egypt. Professor Makram Ibrahim KHALIL, Director of the Sun and Space Research Laboratory, NRIAG, Cairo, Egypt.

Associate Professor Muhammed YOUSEF, Department of Physics, Faculty of Sciences, University of Helwan, Egypt.



Dr Safinaz AHMED ABD ELRAHMAN KHALED successfully defended her doctorate in physics on June 12, 2021.

subject: "*Lyman Alpha and H Solar Activity Monitoring from Satellites and Ground Stations: Space Weather Prediction and Application*"



EGYPT

This thesis has been approved for submission by the thesis directors:

Magdy YOUSEF AMIN: Professor in the Department of Astronomy, Space Sciences and Meteorology, Faculty of Sciences Cairo University, Cairo, Egypt
Shahinaz YOUSEF: Professor in the Department of Astronomy, Space Sciences and Meteorology, Faculty of Sciences Cairo University, Cairo, Egypt
Ahmed GHITAS: Professor in the Sun and Space Research Department, NRIAG, Helwan, Cairo, Egypt
Luc DAME: Professor at the Atmospheres, Environments, Space Observations Laboratory (LATMOS), Guyancourt, France.

Jury members

Prof / Dr. Carsten DENKER, Director, Solar Physics, Leibniz-Institut d'Astrophysique Potsdam ((AIP, Germany)

Prof / Dr. Magdy YOUSEF AMIN, Department of Astronomy, Space Sciences and Meteorology, Faculty of Sciences, University of Cairo, Egypt. Dr Christine AMORY-MAZAUDIER, LPP, Polytechnique, Sorbonne Universités, France.

GUINEA

Dr René Tato LOUA was appointed Director of National Meteorology
On January 22, 2022, he is the ISWI Coordinator of Guinea



René Tato LOUA defended his thesis, in atmospheric physics, at the University of Réunion, June 24, 2020.

The title of his thesis is: "*Variability and trends of meteorological parameters in Guinea: analysis of forcings by digital methods*".

from left to right: Prof. G. PENNOBER (President of the jury), Mr. René Tato LOUA (the candidate), Dr. N. BEGUE and Prof. EL HASSAN BENCHERIF. NB: the other members of the jury followed the defense by video conference.

MOROCCO / A Bounhir –ISWI coordinator

Amal LOUTFI brilliantly defended her thesis
titled

Low-latitude ionosphere-thermosphere couplings during extreme
solar events

University of Marrakech, on December 8, 2021

Papers

Loutfi, A., Bounhir, F. Pitout, Z. Benkhaldoun, and J. J. Makela, Thermospheric Neutral Winds Above the Oukaimeden Observatory: Effects of Geomagnetic Activity , Journal of Geophysical Researchj <https://10.1029/2019JA027383>

Loufti et al., Interhemispheric asymmetry of the equatorial ionization anomaly (EIA) on the African sector over 3 years (2014-2016): Effects of thermospheric meridional wind, in revision Journal of Geophysical Research-Space Science

JURY

President

SEFIANI Fouad, Uni. Cadi Ayyad, Marrakech

Reporters

LILENSTEN Jean, IPAG-Fr

TAHAYT Abdelilah, Uni. Abdelmalek Essaadi,
Tanger

AMORY-MAZAUDIER Christine , LPP-Fr

Examiners

ASTAFYEVA Elvira, IPGP-Fr

EMRAN Anas, Uni. Mohammed V, Rabat

MARCHAUDON Aurélie, IRAP-Fr

Directors

BOUNHIR Aziza, Uni. Mohammed V, Rabat

BENKHAKDOUN Zouhai, Uni. Cadi Ayyad,
Marrakech

PITOUT Frédéric, IRAP-Fr

MOROCCO

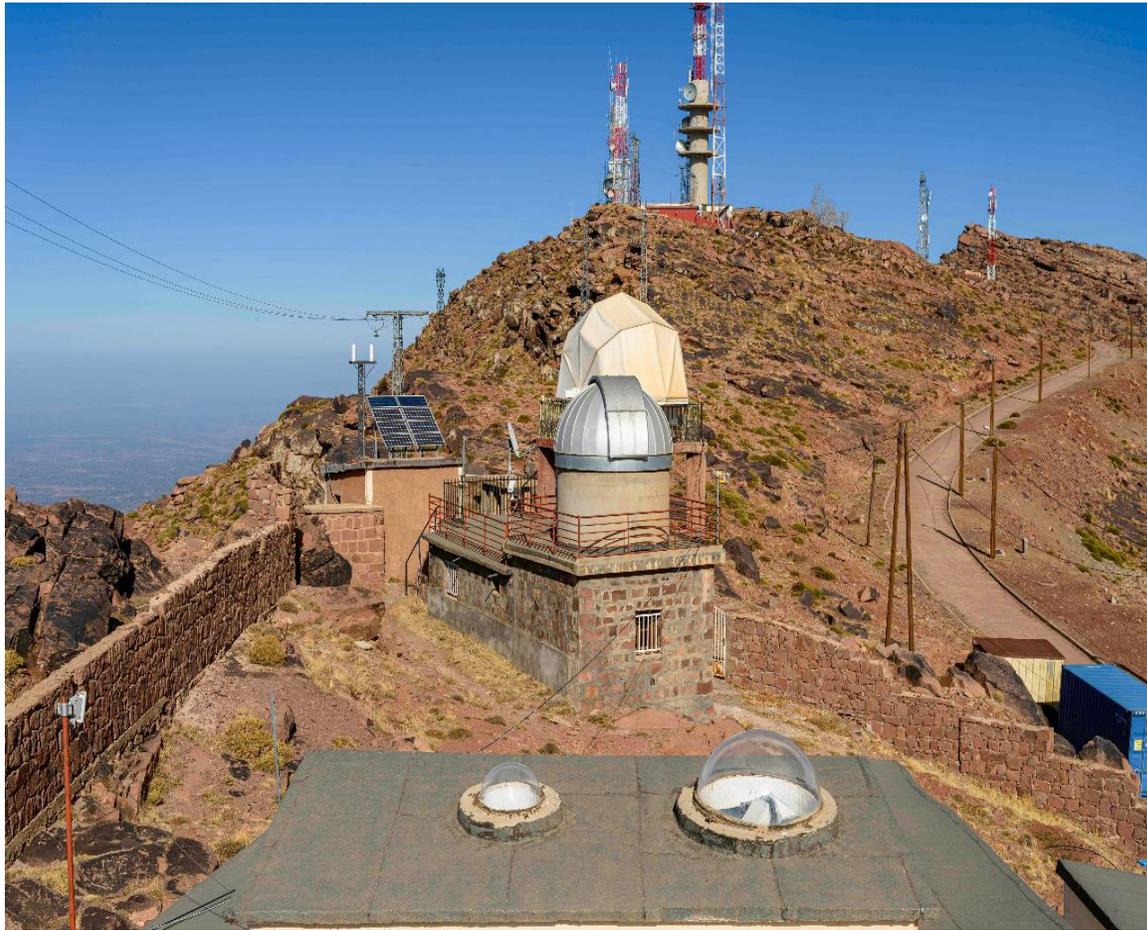
in the room from left to right

EMRAN Anas , TAHAYT Abdelilah, BENKHALDOUN Zouhair,
LOUTFI Amal, SEFIANI Fouad

on the screen

MARCHAUDON Aurélie, ASTAFYEVA Elvira, LILENSTIEN Jean,
PITOUT Frédéric, AMORY-MAZAUDIER Christine
et/and BOUNHIR Aziza





INTERFEROMETER FABRY PERROT

Installed by the University of ILLINOIS, USA



Space weather in Senegal Dr Idrissa GAYE [ISWI-Coordinator]

Iba Der Thiam University of Thiès

Email: idrissa.gaye@univ-this.sn

- Partnership
- Following of the spaceweather school organized in Senegal IMAO-2019, we negotiated a partnership agreement with the **JPO-EGNOS Afrique**.
- JPO is a Pan-African entity based in Dakar its premises made available by ASECNA within the contractual framework with the European Commission and the Director of the JPO manages in full autonomy the technical execution of the Program for the benefit of the entire Africa organization. The JPO has a staff of nine recruited from across Africa
- The specific objective of the Program is the acceleration, adoption and development in Africa of satellite-based augmentation systems (SBAS) based on EGNOS (European Geostationary Navigation Overlay Service) technology. It is funded by the European Commission and ASECNA which provides office infrastructure and provides financial administration in Senegal

Training

Courses on:

- GNSS in Topography;
- GNSS positioning strategies
- EGNOS

Research Project

- Research capacity building Project between GIRGEA and Iba Der Thiam University of THIES. The objective is to train Master and Doctors in Spaceweather and GNSS.

Perspectives:

- Establish partnership for GNSS station acquisition,
- Create a GNSS research laboratory,
- Create startups in GNSS domain.

SENEGAL / PHD students



Herbert NGAYA

Subject: Study on the validity of ionospheric TEC measurements transmitted in EGNOS messages against global GIM (Global Ionospheric Model ') maps



Pauline Sanou FAYE

Subject: Contribution of space observation for the characterization of storm systems on the African continent.



Amath NDAO

Subject: Climatology of plasma irregularities in Dakar: study using the ROTI index and variations in the Earth's magnetic field.

ISWI COORDINATOR TUNISIA: Prof Hassen Ghalila



LSAMA Laboratory



Faculty of Sciences of Tunis



University Tunis ElManar



Tunisia

Ionospheric analysis via ELF-VLF waves

Hassen Ghalila (national coordinators) – Ahmed Ammar

hassen.ghalila@gmail.com, hassen.ghalila@fst.utm.tn

Equipment

AWESOME receiver

Antenna (Roof)



SID and superSID receivers

Antenna (Roof)



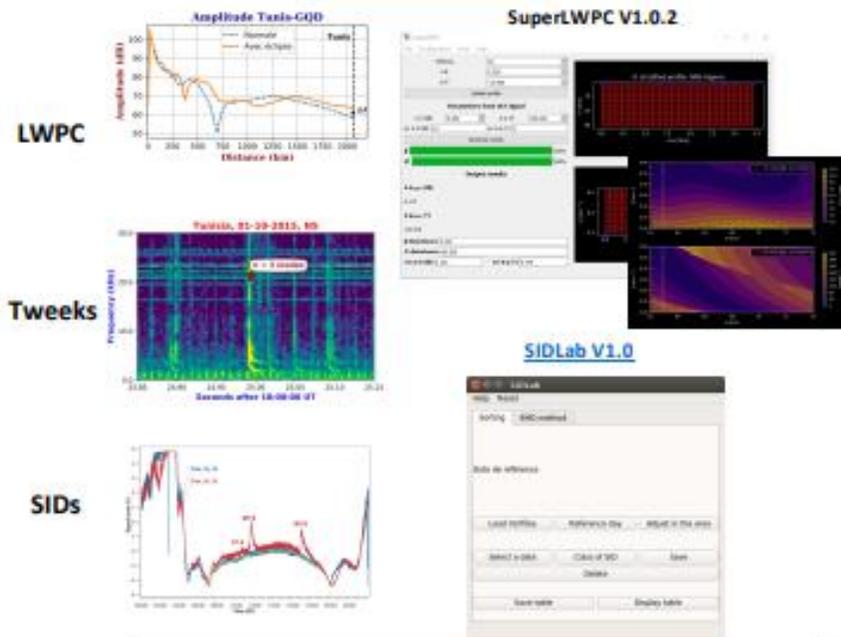
Future facilities

New receivers ?

- Radio Jove
- VLF
- superSID receivers

Signals and data Analyses

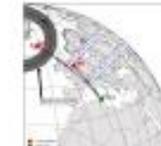
Software developments



Applications



GiganticJet & BlueJet



Solar Eclipse



Lightnings & Thunderstorms



Solar Flares

• A. Ammar et al., *Radio Astronomy Journal of the Society of Amateur Radio Astronomers*, (2013)
 *New numerical tool SIDLab to monitor Sudden Ionospheric Disturbances (SID)

• A. Ammar et al., *Advances in Space Research* 66 (2020) 2528–2536
 • A. Ammar et al., *Acta Geophys.* 64, 2794–2809 (2016)
 • S. NaitAmor et al., *JGR Space Physics*, 122, 1 (2016)
 • S. NaitAmor et al., *JGR Space Physics*, 118, 8 (2013)

MBA Research Thesis Proposal



The Hague University of Applied Science - MBA PT 2020-2022 - Claudia Paparini, PhD
(at present working as Consultant - Performance Engineer- for RheaGroup in EUSPA, The Netherlands)

MBA Research Proposal Objectives:

- To gain an insight in the definition of the **needs for students and professors and their expectations** when it comes to online education.
- To **formulate advices and recommendations** in terms of strategy and ways to **improve monitoring systems of learning processes** by adjusting formative and authentic learning evaluation. The work aims at **identifying the threats and issues** associated with distance learning, as well as the benefits of the advancement in related information technology.

Research Methodology:

- **Interviews** to specific professionals working in an education context.
- **Questionnaires** (both in English and French) – 2 types of questionnaires, one for students and one for professors.

Target groups:

- Individuals who have taken online courses (students) or provided/organized online courses (professors)