The Eastern Africa Global Navigation Satellite System and Space weather Workshop

13th -17th May 3, 2019, Pwani University, Kilifi-Kenya

PROGRAMME

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Message from the Workshop Directors:

Global Navigation Satellite Systems (GNSS) are space technology that can help in socio-economic transformation and full integration of developing countries into the world economy. GNSS applications can used to increase food security, manage natural resources, provide efficient emergency location services, improve surveying and mapping, and provide greater precision and safety in land, water and air navigation systems. It also has applications in numerous fields of scientific study in areas such as space weather, geophysics, geography, geology, ecology and biology. This work is designed to give an in depth view of science applications of GNSS technology.

The workshop is being hosted by Pwani University in collaboration with the Kenya Space Agency. We are very grateful to the Kenya Space Agency which is hardly a year old for taking up this noble task of supporting capacity building initiative. We are also thankful to the African Initiative for planetary and Space Science (AFIPS) for initiating and supporting the idea of regional workshops aimed at enhancing capacity building. Through the AFIPS support we were able to get financial support from the European association of Geochemistry. We equally thankful to the Union Radio Scientifique Internationale, URSI for the prompt response to our short notice for financial support. The China Research Institute of Radio wave Propagation (CRIRP) have also supported by sending an expert to the event and also donating stationery to be used in the workshop. In Addition a number of worldwide experts in GNSS have also generously donated their time to participate in workshop as lecturers.

The workshop will include formal lectures and hands on practice in GNSS architecture, signal structure, hardware, state of art applications and principally scientific exploration using GNSS. Participants are drawn mainly from the East African region. The lecturers have been recruited from Europe, China, Africa and all have a reputation for their excellence in research and teaching and GNSS technology. This diverse collection of people will generate an environment for social understanding, regional/international friendship and collaborations. Most importantly it will represent a regional group committed to facilitating the use of GNSS technology for science applications in their home countries.

As we begin this intensive workshop, we sincerely thank you for your participation and look forward to working with you over the next four days and if we can be of assistance during the workshop, please let us know.

With Regards

Olwendo O. Joseph
Pwani University-Kenya

Claudio Cesaroni
INGV-Italy

Sponsors

We are grateful to our hosts Pwani University in collaboration with the Kenya Space Agency.

Pwani UNIVERSITY

The Kenya Space Agency

EUROPEAN ASSOCIATION OF GEOCHEMISTRY

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CHINA RESEARCH INSTITUTE OF RADIO WAVE PROPAGATION

Dr. Joseph Ouko Olwendo

Dr. Joseph Ouko Olwendo is a lecturer and a research scientists in space weather science at Pwani University. He received his BSc, and MSc, in theoretical Physics in 2005 and 2008 respectively from the University of Nairobi. He got his Ph.D. in Space Physics under the supervision of Prof. Paul Baki from Pwani University in 2014. His research interest has been on equatorial Ionospheric dynamics and Ionospheric plasma density irregularities using GNSS signals over the East African sector. He also works on Ionospheric model validation and navigation applications. He has been on several times visiting scientist at the ICTP on short term basis in his capacity as a junior associate scientist since 2014. At ICTP he works with NeQuick 2 model research group under Prof. Sandro M. Radicella. He is the author/co-author of more than 20 papers published in scientific peer-reviewed journals.

Dr. Olwendo has been recognized for his contribution in the understanding of equatorial ionospheric dynamics and plasma process; and was awarded the 2016 Sunanda and Santimay Basu Early Career Award in Sun-Earth science by the American Geophysical Union (AGU) Honors Team, and was also a recipient of the Young scientist award of Union of Radio Science Atlantic in 2015 (URSI-2015). He is currently the Principal investigator on Ionospheric Scintillation at the low latitudes and has a scintillation monitoring laboratory based in Pwani University with a number of international collaborations.

Dr. Claudio Cesaroni

Claudio Cesaroni, holds a PhD degree in Geophysics and is a confirmed researcher at INGV in Italy. His main research interests are related with low and mid latitude ionosphere and space weather. His expertise spans from regional and global TEC modelling and forecasting to ionosonde data automatic scaling and interpretation. Recently, he works also in mid-latitude ionospheric irregularities (TIDs) dynamics by means of GNSS and All Sky Imager data. He is author of an international patent dealing with a model for TEC and scintillation forecasting. He is author and co-author of more than 30 papers and he acted as task responsible in several international projects funded by European Space Agency and European Commission. He is one of the responsible of the Italian contribution to the PECASUS consortium for the provision of a Space Weather service to ICAO. In 2015 he was awarded with Young scientist award of International Union of Radio Science (URSI).

Dr. Ou Ming

Dr OU Ming is currently a senior engineer of China Research Institute of Radiowave Propagation (CRIRP). He received his master degree from CRIRP and Ph.D degree from the Wuhan University. His research interests is on GNSS data processing and ionospheric remote sensing.

Prof. Laneve Giovanni

Giovanni Laneve received the Laurea degree in aeronautical engineering from the Università di Napoli, Naples, Italy, in 1985, and the Laurea degree in aerospace engineering from the Università di Roma "La Sapienza," Rome, Italy, in 1988. From 1987 to 1991, he was a Consultant with the Centro di Ricerca Progetto San Marco, Rome, Italy, where he was involved in the San Marco 5 satellite mission control and data analysis. He is associate professor at the School of Aerospace Engineering, Università di Roma "La Sapienza". Since 1998, he has been teaching the course of "Aerospace Systems for Remote Sensing". His research interests include aeronomy, satellite thermal control, mission design, new algorithms for the exploitation of satellite images, satellite remote sensing applications for fire management, applications of satellite data for the African regions, and studies on environmental and disaster monitoring.

Prof. Babatunde Rabiu

Babatunde Rabiu, a Professor of Space Physics, is the pioneer Director and Chief Executive of the Centre for Atmospheric Research of the Nigerian National Space Research and Development Agency. His research interest lies mainly in Ionospheric Physics, space weather Solar Terrestrial Interactions and alternative energy development. He was named the Young Scientist of the Year 2000 in Nigeria by the then Third world Academy of Science, Italy in collaboration with the Nigerian Academy of science. He was a postdoc fellow at the National geophysical Research Institute, Hyderabad, India in 2004 and a visiting Associate Professor to the solar terrestrial environment laboratory of the Nagoya University, Japan in 2008. He is a visiting Professor to a number of African universities and has been a regular visiting professor to the InternationalCentre for Space Weather Science and Education ICSWSESof Kyushu University, Japan since 2008. He is at the moment amongst many other responsibilities the national coordinator of the international space weather initiative ISWI and serves on the international steering committee of the UN/NASA-endorsed global cooperation.

Dr. John Bosco Habarulema

John Bosco Habarulema completed his BSc, Physics and Maths (2004) from Mbarara University of Science and Technology in Uganda; and BSc Hons in 2005 (University of Cape Town, South Africa). He then went ahead to complete MSc (2008) and PhD (2011) in Space Physics (from Rhodes University, South Africa) focussing on analytical and empirical modelling of total electron content (on a regional scale) with the use of satellite and ground based data. His research interests include ionospheric modelling including F2-layer parameters as well as total electron content; ionospheric electrodynamics including modelling of low latitude vertical drifts; and studies of Atmospheric Gravity Waves leading to travelling ionospheric disturbances especially during geomagnetically disturbed conditions.

He is the currently the scientific Principal Investigator of the South African Ionosonde Network which comprises of four ionosonde stations. Since 2013, he has been a researcher within the

Science Research and Applications Unit at the South African National Space Agency, Hermanus, South Africa. He is a research associate in the department of Physics and Electronics, Rhodes University, South Africa. He is a founding member of the African Initiative for Planetary and Space Sciences; which is partly responsible for us being here today.

Dr. Michael Pezzopane

Michael Pezzopane has been a researcher at the Istituto Nazionale di Geofisica e Vulcanologia since 2001. He got his Master Science in Physics at "Sapienza" University of Rome, Italy, and his Ph.D. in Geophysics at the "Alma Mater Studiorum" University of Bologna, Italy. His main research interests mainly focus on: mid-latitude and low-latitude ionospheric behaviour for both quiet and disturbed conditions, radio wave propagation in the ionosphere, atmospheric gravity waves, autoscaling of vertical ionospheric soundings, electron density irregularities at low latitudes, E sporadic layer, spread-F, and three dimensional electron density modelling of the ionosphere. He is one of the two developers of the "Autoscala" algorithm, able to automatically scale vertical ionograms, which is installed in several ionosonde stations in Italy, Argentina, Russia and Poland. He has recently developed a method, called IRI UP, to real time update the IRI model and a new NeQuick topside formulation based on Swarm data.

He is author/co-author of more than 75 papers published in scientific peer-reviewed journals. He is one of the authors of the patent "Digital Ionosonde". He is involved in several Italian and European projects, sometimes with leading roles. He was supervisor of several Master Science in Physics students and Ph.D. in Geophysics students. He was several times visiting scientist at the Physics and Astronomy Laboratory of the Universidade do Vale do Paraiba (UNIVAP) – São José dos Campos, Brazil. He was Guest Editor for three special issues in *Advances in Space Research* and he is Editor of *Annals of Geophysics*. In 2013, he was awarded the first prize for the best communication in Geophysics presented at the XCIX National Congress of the Italian Physical Society, held in Trieste.

Dr. Christine Amory-Mazaudier

Dr Christine Amory-Mazaudier is professionally qualified in the fields of Computer Science (Master), Administration (MBA) and Physics (Master, PhD and 'Thèse d'Etat'). She worked at CNRS (National Centre for Scientific Research) from 1978 to 2014. She is now senior Scientist at Sorbonne Universities and Staff Associate at ICTP (International Centre for Theoretical Physics). Between 1978 and 1989, Dr Amory-Mazaudier conducted research in various fields of the Earth's environment, and presently on the Sun Earth relations and Space Weather. Her scientific work had led to 182 publications, comprised 116 scientific papers, 35 proceedings, 28 technical reports, 2 doctoral theses and a book. Dr Amory-Mazaudier has been in charge of young researchers and has trained 10 master students and 40 PhD students in various countries of Europe, Africa, Asia and USA. In 1995, she has founded the IGRGEA (International Group of Research in Geophysics Europe Africa), based upon the practice of sharing. This group develops research on the connections between the Sun and the Earth, throughout Africa and also Asia

since 2005. In the framework of the International Heliophysical Year (IHY) and the International Space Weather Initiative (ISWI) projects, she was in charge of the survey of GPS networks in Africa. She has received awards of recognition to her work from USA, Africa, Europe and Asia.

Dr. Zama Katamzi-Joseph

Dr Zama Katamzi-Joseph is a research scientist at the South African National Space Agency and a research associate of the Department of Physics and Electronics at Rhodes University. Her main research interest centres around ionospheric dynamics. These include studying traveling ionospheric disturbances, plasma bubbles and the influence of thermospheric neutral winds on the ionosphere. For her research projects, she uses measurements from Global Navigation Satellite Systems, Low-Earth Orbit satellites, ionosondes, magnetometers, Fabry-Perot interferometer and airglow cameras.

Dr. Halilu Ahmad Shaba

Dr Halilu Ahmad Shaba was born 1st October 1966 to the family of Halilu Shaba from Lapai in Niger State and Zainab Olayanju Abdulkadir from Ilorin in Kwara State. He began his basic education from Capital School Sokoto where he did his nursery school and Primary one and then finished his primary education from Local Education Authority, Polytechnic Road Kaduna. He attended Rimi College Kaduna and Government Secondary School, Rijau respectively between 1978 and 1984. He graduated from Bayero University with Bsc Geography in 1988 and did his National Youth service Corps 1988-1989. He started work immediately with National Population Commission till 2001. He further obtained his masters in Technology in remote sensing application in 1993 and a PhD in the same field January 2000 all from Federal University Technology Minna. He transferred his service from National Population Commission in 2001 to Federal University Technology Minna and later left to join National Emergency Management Agency in 2006. Dr Halilu Ahmad Shaba joined the National Space Research and Development in 2009 and is currently the Director Strategic Space Applications. He is a member of academics of Science, Nigeria Geographic Association, Association of Nigerian Authors and GEOSON and also a fellow of Nigeria Cartographic Association. He has written two novels (Darkness of Doom and Bubble Dreams) and has supervised over forty master's and Post Graduate Diploma thesis and about thirty undergraduate researches. He has co supervised over seven PhD both in Nigeria, United Kingdom and Ghana and have written or coauthored about 35 Journals and conferences articles. He is still lecturing, and farming and a scholar.

TENTATIVE PROGRAMME

EASTERN AFRICA GLOBAL NAVIGATION SATELLITE SYSTEM AND SPACE WEATHER WORKSHOP

THEME : *Capacity Building in Space Weather Science and GNSS Technology*

DATE: 13TH - 17TH MAY 2019

VENUE: PWANI UNIVERSITY

TIME	ITEM	RESPONSIBILITY
DAY 1	**MONDAY - 13TH MAY, 2019**	
8:30 – 9:00	Registration	Secretariat
9:00 – 9:30	Welcome Remarks	VC Pwani University. Director, Kenya Space Agency AFIPS representative
10:00-10:15	Space Activities in Broglio Space Centre -Kenya	Prof. Giovanni Laneve
10:15 – 10:30	Status of space science in Africa	Prof. Rabiu Babatunde
10:30 – 11:00	**TEA/HEALTH BREAK** **Session Chair: Prof. Paul Baki**	
11:00 – 12:30	SUN-EARTH connection and Space weather	Prof. Christine Amory
12:45:13:00	Group work- identification of the groups	moderator
13:00 – 14:00	**LUNCH** **Session Chair: Dr Bonface Ndinya**	
14:00 – 15:30	Global Navigation Satellite Systems Technology and Ionospheric Tomography	Dr Zama Katamzi
15:30 – 16:00	**TEA/HEALTH BREAK**	
16:00 – 17:30	GNSS applications in Remote Sensing and GIS	Dr Halilu Ahmad Shaba
DAY 2	**TUESDAY – 14TH MAY, 2019**	
	Session Chair: Dr John Bosco	
8:30 – 10:30	HF Propagation and IRI model	Dr Michael Pezzopane
10:30 – 11:00	**TEA/HEALTH BREAK**	
11:00 – 12:20	Three-dimensional ionospheric electron density reconstruction by GNSS and COSMIC-RO data ingestion	Dr Ou Ming

	into IRI-2016".	
12:20-13:00	Group discussion and project	Moderators/group leaders
13:00 – 14:00	LUNCH Session Chair: Dr Michael Pezzopane	
14:00 – 15:30	TIDs and Techniques used in Monitoring them	Dr. John Bosco Habarulema
15:30 – 16:00	TEA/HEALTH BREAK	
16:00 – 17:30	Ground Induced Current-GIC	Dr. Stefan Lotz
DAY 3	WEDNESDAY – 15TH MAY, 2019 Session Chair: Dr. Zama Katamzi	
8:30 – 9:30	Ionospheric Physics	Dr. Claudio Cessaroni
9:30-10:30	Group work discussions	Moderators/group leaders
10:30 – 11:00	TEA/HEALTH BREAK	
11:00 – 13:00	Zonal Electric fields – The Equatorial Electrojet	Prof. Rabiu Babatunde
13:00 – 14:00	LUNCH Session Chair: Dr. Claudio Cessaroni	
14:00 – 15:30	Ionospheric Effect on satellite Signals –Scintillation	Dr. Olwendo Joseph
15:30 – 16:00	TEA/HEALTH BREAK	
16:00 – 17:30	GNSS installation	Dr. Claudio Cessaroni
DAY 4	THURSDAY – 16TH MAY, 2019	
	Session Chair: Dr. Stefan Lotz	
8:30:9:00	On the necessity of GPS networking in Africa	Prof. Christine Amory
9:00-10:00	The African Space programme and Agenda 2063	Prof. Paul Baki
10:00-1030	Presentation from participants	
10:30 – 11:00	TEA/HEALTH BREAK	
11:00-12:30	Presentation from participants and group work on project	
12:30 – 14:00	LUNCH	
14:00 – 17:00	Visit to Gede Ruins	

18:00-21:00	Workshop Dinner
DAY 5	FRIDAY – 17TH MAY, 2019
	Session Chair: Dr. John Bosco
8:30 – 10:30	Participants Presentations of group projects
10:30 – 11:00	TEA/HEALTH BREAK/PHOTO
	Session Chairs: Directors + Afips + LOC
11:00 – 13:30	Discussion on Way Forward & Conclusion
13:00 – 14:00	LUNCH
14:00 – 15:30	Participants have a free afternoon to plan their travels
15:30 – 16:00	TEA/HEALTH BREAK