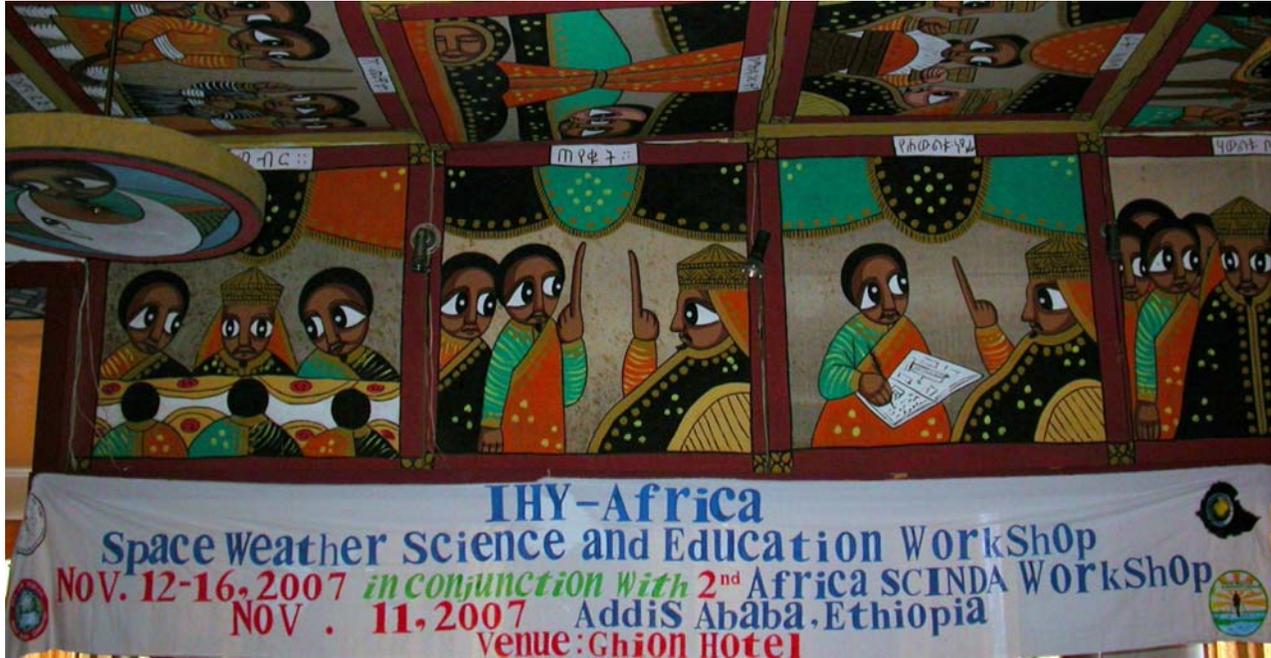


IHY-Africa Space Weather Science and Education Workshop Report



The Ethiopian Physical Society

in conjunction with



Addis Ababa University and Bahir Dar University

at website

<http://kuiper.colorado.edu/IHY-Africa>

Sponsors:

National Aeronautics and Space Administration (NASA)
National Science Foundation (NSF)
European Office of Aerospace Research and Development (EOARD)
International Center for Theoretical Physics (ICTP)
Air Force Office of Scientific Research (AFOSR)
Office of Naval Research (ONR)
Air Force Research Laboratory (AFRL)
Climate and Weather of the Sun-Earth System (CAWSES)
Committee for Space Research (COSPAR)

Summary

More than one hundred international scientists met in the Ghion Hotel, Addis Ababa, Ethiopia, in November 2007, for a workshop focused on Space Weather Science and Education. The meeting was the culmination of more than 2 years of planning, spurred on by the IHY-United Nations Basic Space Sciences Initiative (UNBSSI) to promote deployment of instrument arrays in developing countries. The success of the workshop was greatly assisted by the generous support by several national and international organizations including the National Aeronautics and Space Administration (NASA), National Science Foundation (NSF), European Office of Aerospace Research and Development (EOARD), International Center for Theoretical Physics (ICTP), Air Force Office of Scientific Research (AFOSR), Office of Naval Research (ONR), Air Force Research Laboratory (AFRL), Climate and Weather of the Sun-Earth System (CAWSES), and Committee for Space Research (COSPAR). We were also fortunate that representatives of many of the sponsoring agencies were able attend the meeting.

The IHY-Africa workshop had two overall objectives:

- To study space weather science at mid and low latitudes in the African longitude sector
- To support African space science and education

The international space science community is currently exploring ways to increase the observational infrastructure in the African sector, a region of particular geographic and geomagnetic interest for understanding space weather phenomena. There is currently a large gap in Global Positioning Satellite (GPS) and magnetometer observations over African equatorial latitudes. The new observational infrastructure will facilitate the study of space weather in the region, will spark interest in space science education and research, and encourage the next generation to become inspired by space science. The workshop provided an ideal opportunity to develop a strong interaction among scientists in African and other international scientists, and to promote space science and education in Africa.

We were honored to have the Ethiopian Minister of Education, Dr. H.E. Sintayehu, and the Dean of the University of Addis Ababa to open the ceremony, and encourage us in our endeavor. The meeting was organized under the auspices of the International Heliophysical Year (IHY). The facilities were ideal for the number of participants, which included 72 representatives from 20 African countries, together with more than 56 participants from other countries and the Ethiopian Universities. The list of participants and their affiliations is attached.

The science focus was built around three major themes that are described by the session titles:

- 1. Ionospheric Irregularities***
- 2. GPS Total Electron Content***
- 3. Electrodynamics/ Magnetometer and Plasmasphere.***

The ionospheric irregularities session was an extension to the one-day SCINDA workshop held on the Sunday preceding the IHY workshop. A separate workshop report is available for the SCINDA workshop. Six excellent tutorial presentations were the core of the oral presentations, and were greatly appreciated by the attendees. In both the tutorials and other science presentations, an effort was made to adhere to comments during the discussion periods that reinforced the need to keep all the presentation at a level understandable to the broad audience and with minimal jargon.

In addition to the three main science sessions, the breadth of the meeting was expanded to include a session on ***Infrastructure and Communications*** in Africa, which was followed by a

Panel Discussion. This session highlighted the urgent need to improve the cyber infrastructure in Africa. Although the lack of basic infrastructure is well-known, the particular cause for concern was that the situation is not improving at a rate comparable to other continents or emerging nations. It was clear from the presentations that the digital divide is growing, denying many African communities the benefits of communication through the internet. It was also noted that this situation is acute in Universities, where internet services are often poor or even non-existent, severely impeding progress in all disciplines. The regrettable situation led to a recommendation by the workshop participants that a high priority should be given to improving the cyber-infrastructure for Universities and other national science and technology institutions in Africa as a cost-effective and essential means of achieving national Millennium Development Goals. A copy of the resolution is attached, which will be sent to the Science and Education Division of the African Union, and is available for all the participants to forward to their own national science and education ministers or other government officials.

The *Infrastructure and Communications* session also discussed the plans to develop a database of observations over Africa. Initially the database will be hosted by the National Geophysical Data Center, in Boulder, Colorado, but eventually a mirror site will be available in Africa. The GPS datasets will be targeted first, and one of the first steps will be to establish a viable data sharing policy. One of the advantages of GPS observations is that, in addition to space weather, several disciplines use the technique, so with an effective data sharing policy significant leverage can be applied. Representatives from two such disciplines were present at the workshop. The first was the African Monsoon Network (AMMA) utilizing GPS observations for estimating tropospheric water vapor content; the second was the African Geodetic Network (AFREF) using GPS to develop a positioning reference frame for Africa, in much the same way the National Geodetic Survey (NGS) provides the reference frame in the US.

The workshop also highlighted the infrastructure that already exists in Africa to support space science and technology education. Nigeria hosts the African Regional Centre for Space Science and Technology Education (ARCSSTE-E), catering for the educational needs of Anglophone Countries. A similar Centre for the benefit of Francophone countries in Africa has been established in Morocco. The centers are the result of a United Nations effort to establish regional centers for space science and technology education in existing national/regional educational institutions in developing countries. The Office for Outer Space Affairs (UNOOSA) endorsed the recommendation of its Committee on the Peaceful Uses of Outer Space (COUPOS) that the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort. This endorsement was in recognition that an essential pre-requisite to successful space technology application was the building of indigenous capabilities, particularly human resources, within each region. In particular, the endorsement recognized that, if effective administrative and appropriate applications of space technology were to succeed in the developing countries, efforts must be devoted at the local level to the development of necessary high level knowledge and expertise in space technology-related fields. Other international education centers exist in other African countries, including the Space Weather Center in South Africa.

The participants also became aware of the *AfricaArray* initiative. AfricaArray's objective is to promote coupled training and research programs for building and maintaining a scientific workforce for Africa's natural resource sector, in the full spirit of the New Partnership for Africa's Development (NEPAD). The initial focus is on geophysics, so clearly it has potential to

overlap with the development of the observational infrastructure for space weather inspired by IHY and others. The particular objective of AfricaArray is to:

- Maintain and develop further geophysical training programs in Africa, in response to industry, government, and university needs.
- Promote geophysical research in Africa, and establish an Africa-to-Africa research support system.
- Obtain geophysical data, through observational networks in participating countries, for studying scientific targets of economic and societal importance, as well as fundamental geological processes shaping the African continent.

In addition to being involved in the AfricaArray initiative, there are other international activities such as the International Committee on Global Navigation Satellite Systems (ICG). ICG was established in 2005, and promotes cooperation on matters related to satellite-based positioning, navigation, and timing to support sustainable development, particularly in developing countries. The concept was based on the recommendation of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS). With the development of GPS arrays in Africa and the connections with AFREF, it is natural for African scientists to become increasingly involved in ICG.

The final oral session was on *Data from Ground and Space-based Instrumentation*. This session provided information to the participants on additional current and future datasets available for their research, including satellite missions and ground-based arrays. Many of the lead scientists from each instrument were available to describe the measurements and access to the data.

Note that all the presentations will be available from the IHY-Africa web page, and in addition, recognizing the lack of Internet access for some participants, the IHY Secretariat has agreed to mail a CD of all the talks to the participants.

On Tuesday evening, a very successful poster session was held with over 30 papers presented. The session provided an ideal opportunity for more in-depth discussion and communication among the participants. Many of these posters will also be included on the web page and CD.

The Thursday session was designated NSF-IHY day in recognition of their support for the meeting and included the morning oral session on additional data followed by the Breakout Working Groups:

1. *GPS and TEC*
2. *Magnetometers/Electrodynamics/Plasmasphere*
3. *Education and Outreach.*

The following are brief summaries of the breakout working groups; The full reports presented at the meeting will be available on the IHY-Africa Space Weather Science And Education Workshop website at: <http://kuiper.colorado.edu/IHY-Africa>

GPS/TEC Breakout Working Group, after introductions, examined the information in the responses to a “data inquiry” survey from scientists representing 14 African countries. The interest in GPS covered three main disciplines, the majority focusing on ionospheric studies including irregularities/scintillations, F-layer electron density, total electron content (TEC), data assimilation, flares, and magnetic storms. A small number expressed interest in two other disciplines, using dual-frequency GPS observations for either tropospheric water vapor or

geodetic studies. Coordinating observations and databases with other disciplines, and the optimum choice for location of new sensor was regarded as a priority. The GPS receiver is a good example of scientific instrumentation suitable for sustainable research in Africa, because it has wide applicability, is relatively inexpensive, and is easy to operate. The GPS training session during the SCINDA workshop on the Sunday, highlighted the versatility and utility of the instrument. Note that the GPS network in Africa is already developing rapidly with contributions from SCINDA, IGS, AMMA, and AGREES.

The need for additional training courses in GPS was seen as a high priority. As Africa begins to employ and benefit from GNSS applications, it is important to initiate programs in GNSS science and technology at the university level for capacity building and sustainability. In an effort along these lines, Boston College (BC) and the International Centre for Theoretical Physics (ICTP) are entering into a partnership to organize a series of workshops for university professors, young scientists, and graduate students from Africa. These workshops will be led by US and European experts in GNSS science and technology, in collaboration with African partners. The workshops will be held at ICTP and will comprise classroom and hands-on lessons in GNSS hardware, applications, and scientific exploration with GNSS. In addition to hands-on and classroom training, GNSS equipment will be donated to the universities for use in their academic programs. This effort supports IHY goals to provide education in Space Weather studies using GNSS. Additional training schools are also established in South Africa, Morocco, and Nigeria.

In addition to the intensive training courses, the need to develop on-going student-mentor interactions was clearly needed. Masters and Ph.D. students need the opportunity to present their results to established scientist, solicit ideas for Ph.D. topics, and seek advice on developing a science project and writing science papers. The established scientists at the workshop were encouraged to donate time to this valuable endeavor. A method of facilitating and maintaining communication via email or through a discussion group between the scientists and students needs to be established.

Magnetometers/Electrodynamics/Plasmasphere Breakout Working Group had four overall conclusions:

- Longitudinal structure/coherence of the Equatorial Electrojet (EEJ) is a problem ripe to tackle within IHY with the new deployment of magnetometers at several longitudes and CHAMP over-flights;
- Collaborations should grow out of this IHY-Africa workshop by scientists hosting and deploying the new instrumentation;
- Suggest that African science leaders propose a session on EEJ longitudinal structure at the next Africa workshop, with scientists and students tackling the problem in the intervening timeframe; and
- An African GeoSpace Science Union/Society should have the support of the international community to enable communication and collaboration among African scientists.

After introductions and discussion of research interests, the group began the discussion by asking the questions “What currently hinders the study of the EEJ?” and “What is responsible for the longitudinal variation observed in the EEJ?” This led to the discussion of what is currently known about the EEJ from comparison of space and ground based observations. A study of CHAMP satellite data and an Indian ground-based magnetometer found that the spatial

coherence falls off rapidly within 15 degrees of station separation. The group agreed that the EEJ is not only a quiet-time (S_q) phenomenon, but that its dependence on geomagnetic activity and latitude is an important area of study.

The discussions elucidated the significant differences in graduate education funding in the US and Africa (i.e., African faculty do not need funds to support graduate students, just the infrastructure and facilities to do research). It was noted that collaborations generally form naturally and that it is up to the African and US investigators interested in common science problems to come together, and that visits, shared supervision of students, and data exchange, are the main mechanism of collaborations.

The group reported on the new initiative to develop an African-wide Earth and Space Science-type Union to facilitate collaboration, education, and communication. The international societies (AGU, EGU etc.) should support and help the development of this sister organization. It was suggested that perhaps EGU can help by having one of its yearly meetings in Africa every other year similar to AGU having spring meetings in South America bi-annually.

Education and Outreach Breakout working Group discussed two major themes:

- Education and Public Outreach (EPO) in terms of IHY, access to resources, and
- Space Science Education in Africa, in the context of setting up space science programs, and training African scientists to teach Space Science

The idea behind EPO is clearly to engage the public, excite learners and students to ensure a future generation of scientists, and to assist with building capacity. Many African countries have growing space science programs, or wish to start them, so there is a growing need for resources for teachers, learners, and students. It was noted that Kenya has implemented the Hands on Universe Program. Nigeria has been marketing Space Science to final year high school students, set up successful space club, and built on programs such as world space week. South Africa has existing science centers and outreach coordinators, which could assist. The group also highlighted the many resources that could be made available to support EPO in Africa.

The second topic focused on ways to train the Space Science educators. Some countries (South Africa, Nigeria, Ethiopia) already have trained educators but this needs to be built on in other countries, who wish to have Space Science programs. The need for schools for training African educators in Space Science and related technology, either in Africa or at ICTP, was reiterated. The ICTP GPS training school mentioned above is a good example, where qualified scientists from around the world would be invited to give the courses. It was also noted that there would be a need for continued support after the training school, including some kind of mentoring program.

Panel Discussion: How to Facilitate and Support Space Science and Education in the Region and the following Open Discussion

The final panel discussion on the Friday morning brought together many of the ideas that had surfaced during the meeting and breakout working groups. It was stressed there is a need to build upon the existing regional education centers to benefit all the African nations. It was emphasized that the way forward is to develop sustainable research programs, ones that can survive locally and do not rely on the ongoing support from outside. It was also reiterated that free exchange of information is essential to enable African science to grow. This requires a paradigm shift in the Universities, journals, and societies in developed nations not to block access to information and

material, but to share data between developed and developing nations. The point was made to encourage individual to put papers on the web for easy access; one of the challenges is not contravening established copyright laws.

During the open discussion, it was clear there was a need for a *science resolution*, in addition to the resolution on Cyber Infrastructure. The second ***Space Science Resolution*** was drafted and approved by the participants. It recognized that space science and space weather are no longer the concern only of the developed nations of the world, and that space science and technology are critical for Africa to deliver economic, environmental, and social benefits to communities, such as wireless communications, resource management, remote sensing, and an educated population. It was noted that the African continent uniquely fills a critical gap in the observations required to understand the global space environment, and that resources for space science research opportunities in Africa have been limited. The participants strongly recommended that vigorous efforts should be made to expand and strengthen the space science programs in universities and research institutions, increase funding for experimental facilities, and strengthen and take advantage of international collaborations.

There was a general agreement that establishing an African Geospace Society Union (AGS) would be of significant benefit for development of the science and facilitate communication between Africa scientists. A forum for scientists to come together and exchange ideas is an essential. The need to forge a close connection with the geographically-close European Geophysical Society (EGS) is particularly important.

It was agreed that the participants support the IHY observing campaign planned for March/April 2008. The interval has since been named the Whole Heliosphere Interval (WHI), and is an international coordinated observing and modeling effort to characterize the 3-dimensional interconnected solar-heliospheric-planetary system. It is under the auspices of the International Heliophysical Year (IHY) Program designated to study the solar Carrington Rotation 2068: March 20–April 16, 2008, and its impacts on the Earth and the entire planetary system. Since the meeting it has been suggested that a Targeted Observing Campaign (TOC) will be initiated for the African GPS, Magnetometer, and ionosonde observations at equatorial and low latitudes. The TOC will address:

- Day-to-day variability of total electron content (TEC) and scintillations.
- Day-to-day variability of *F*-region vertical drifts at the magnetic equator.
- Development and Decay of the Equatorial Anomaly.

Before concluding the workshop, it was agreed to hold another workshop in 2009, which will be a joint IHY/AFGU meeting, possibly also under the auspices of an International AGU Chapman Conference. This time period will be after the end of the official IHY focused period and will be an ideal opportunity to review the accomplishments and contemplate the legacy of IHY. Several suggestions for venues were discussed, and an international scientific organizing committee was nominated to begin planning and decide on a venue.

Conclusion

In conclusion, the ISOC would like to acknowledge the Local Organizing Committee chairs, Gizaw Mengistu and Baylie Damtie, and their support staff, for the excellent job they did in preparation for the meeting in Addis Ababa. The banquet on the Thursday evening was a wonderful celebration of Ethiopian music and dance. During the evening, Christine Amory-Mazaudier was recognized with a plaque for her tireless efforts and dedication to promote space

science in Africa over the past 15 years. Sunanda Basu and Tim Fuller-Rowell were thanked with gifts as co-chairs of the International Scientific Organizing Committee.

In reviewing the accomplishments of the workshop, it is clear that a solid foundation has been laid in important areas, which will support the space sciences and education in Africa, and provide a legacy for the future.

Related Workshops

In addition to the main IHY-Africa workshop, the meeting was supported by three additional related workshops. On the Saturday before the IHY-Africa workshop, a Geophysical Information for Teachers (GIFT) workshop was conducted. On the Sunday before the IHY-Africa workshop, the SCINDA2007 workshop was held, and on Monday evening, a Sudden Ionospheric Disturbance Monitor (SIDs) workshop took place. All three additional workshops were extremely successful and greatly appreciated by the participants.

GIFT Workshop

Geophysical Information for Teachers

November 10, 2007

Cristina Rabello-Soares, Stanford University

Mark Moldwin, University of California Los Angeles

Endawoke Yizengaw, University of California Los Angeles

Deborah Scherrer, Stanford University

Barbara Thompson, NASA Goddard Space Flight Center

Mulugeta Bekele, Addis Ababa University

Negatu W Yohannes, Addis Ababa

SCINDA2007 Workshop

November 11, 2007

Keith Groves, Air Force Research Laboratory

Abebe Kebede, North Carolina A&T State University

SIDs Workshop

Sudden Ionospheric Disturbance Monitors

November 12, 2007, 7-9 p.m.

Deborah Scherrer, Stanford University

Cristina Rabello-Soares, Stanford University

Attachments:

1. Resolution 1 (See Attachment I)
2. Resolution 2 (See Attachment II)
3. Members of the International Scientific Organizing Committee (See Attachment III)
5. List of participating countries (See Attachment IV)
6. List of participants and email addresses (See Attachment V)
7. IHY-Africa Workshop Schedule (See Attachment VI)

ATTACHMENT I

Resolution 1: “The IHY-Africa Recommendation on Cyber-Infrastructure”

Preamble

The IHY-Africa Space Weather etc here Workshop held in Addis Ababa, 12-16th November 2007 brought into sharp focus the outstanding scientific and technical abilities of African scientists and their commitment to education. Their achievements as independent, resourceful researchers and as effective communicators were highlights of the workshop. African scientists offer a huge reservoir of talent and enthusiasm. The workshop also highlighted the single largest barrier that prevents countries and individuals from benefiting from this talent – poor access to the Internet. Overcoming this barrier will ensure the continued regeneration and expansion of that talent in a manner that is achievable in no other way.

Internet infrastructure has profound effects on educational and economic outcomes. Affordable access to the Internet is essential for sustaining a viable University and high school sectors, and fuels economic success. Even more important, it will ensure the continued regeneration and expansion of that talent in a manner that is achievable in no other way.

Modern information & communications technologies offer a low-cost way for all communities, regardless of wealth and level of industrialization, to share on equal terms the benefits of the information revolution.

The resolution

We, the 72 African scientists, representing 20 African countries, and more than 56 scientists from other nations participating in the International Heliophysical Year Workshop (IHY-Africa Space Science and education Workshop) in Addis Ababa, 12-16 November 2007,

RECOGNIZE that modern information and communications technologies have revolutionized the conduct of research, education, and training in science and technology, as well as elsewhere, by providing rapid and effective means to

- communicate among people,
- discover, access, and share data and information,
- utilize free computational services, including data processing, visualization, and analysis,
- benefit from the vast world-wide research and teaching resources and publications that exist,
- transmit observational data efficiently,
- participate in international, regional, and national scientific and educational efforts,

NOTE that the capabilities listed above deliver economic and social benefits to communities that have an efficient cyber-infrastructure and good Internet connectivity,

REGRET that the digital divide is growing and denying most African communities those very benefits, and that the situation is particularly acute in Universities, where internet services are often poor, or even non-existent,

RECOMMEND that high priority be given to improving the cyber-infrastructure for Universities and other national science and technology institutions in Africa as a cost-effective and essential means of achieving national Millennium Development Goals.

ATTACHMENT II

Resolution 2: “The IHY-Africa Recommendation on Space Science”

We, the 72 African scientists, representing 20 African countries, and more than 40 scientists from other nations participating in the IHY- Africa Space Weather Science and Education Workshop in Addis Ababa, 12-16 November 2007.

RECOGNIZE that

- Space science and space weather are no longer the concern only of the developed nations of the world
- Space science and technology are critical for Africa to deliver economic, environmental, and social benefits to communities, such as wireless communications, resource management, remote sensing, and an educated population
- Reduce dependency...
- Consistent with UN BSS Initiative objectives...
- African scientists have significant but underutilized capability in space science and space weather research

NOTE that

- The location of Africa uniquely fills a critical gap in the observations required to understand the global space environment
- Space science research opportunities in Africa have been limited

Therefore, we strongly RECOMMEND that vigorous efforts should be made to

- Expand and strengthen the space science programs in universities and research institutions
- Increase funding for experimental facilities
- Strengthen and take advantage of international collaborations

Ghion Hotel, Addis Ababa,
16 November 2007

ATTACHMENT III

International Scientific Organizing Committee

Christine Amory-Mazaudier, France
David Anderson, USA
Sunanda Basu, USA Co-chair
David Byers, USA
Mihail Codrescu, USA
Baylie Damtie, Ethiopia
Patricia Doherty, USA
Tim Fuller-Rowell, USA Co-chair
Keith Groves, USA
Abebe Kebede, USA
Ian Mann, Canada
Gizaw Mengistu, Ethiopia
Karen Fay O'Loughlin, USA
Monique Petitdidier, France
Babatunde Rabiou, Nigeria
Robert Robinson, USA
Endawoke Yizengaw, USA

Local Organizing Committee

Gizaw Mengistu, Addis Ababa University, Ethiopia
Baylie Damtie, Bahir Dar University, Ethiopia

ATTACHMENT IV

African Countries Represented (20): (72 representatives)

Algérie
Bénin
Burkina Faso
Cameroon
Cape Verde
Côte d'Ivoire
Démocratique République du Congo
Egypt
Ethiopia
Kenya
Liberia
Libya
Mozambique
Namibia
Niger
Nigeria
République du Congo
Sénégal
South Africa
Uganda

Other Nations Represented (9): (56 representatives)

Australia
Austria
Canada
France
India
Italy
Japan
UK
USA

ATTACHMENT V

IHY-Africa Participants

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ATTACHMENT VI

SUNDAY Evening (November 11, 2007)

06:00-07:30 **Ice Breaker**

All SCINDA and IHY-Africa SWS&E workshop participants

MONDAY Morning (November 12, 2007)

Chair: Sunanda Basu

Official Opening Ceremony

07:30-09:00

Registration

09:00-09:15

Gizaw Mengistu

Introductions

09:15-09:30

Prof. Endrias, AAU President

Welcoming Speech

09:30-09:45

Dr. H. E. Sintayehu, Minister of Education

Opening Speech

09:45-10:05

Joseph Davila

IHY Overview from the Secretariat:
The International Heliophysical Year
IHY2007: Space Physics in Africa

10:05-10:25

Marius Potgieter

10:25-10:55

Coffee Break

10:55-11:15

Roger Smith

Universal Processes

11:15-11:35

Christine Amory-Mazaudier

Space Science Experiences in Africa

11:35-11:55

Lee-Anne McKinnell

Space Physics Educational Needs in Africa

11:55-12:15

Gbenga Jegede

UN African Regional Centre for Space Science and Technology Education in English (ARCSSTEE)

12:15-12:35

Julia Rottier

Views from State Department

12:35-02:00

Lunch Break

MONDAY Afternoon

Chair: Ian Mann

02:00-02:20

Herb Carlson

Introduction to EOARD

02:20-02:40

Lika Guhathakurta

IHY a Global Initiative:
Contributions by NASA and ILWS

Infrastructure and Communication Session—Organizer: Monique Petitdidier

02:40-03:00

Monique Petitdidier

GRID Infrastructure for Africa

03:00-03:20

Les Cottrell

Quantizing the Digital Divide from an Internet Point of View: Special Reference to Africa and the IHY

03:20-03:50

Coffee Break

03:50-04:10

Justin Mabie

Africa GPS Network Database

04:10-04:30

Charlie Barton

eGY - An Opportunity to Improve Access to Earth and Space Science Data

04:30-05:30

Discussion

How to Promote Cyber Infrastructure in Africa.
Moderator: Charlie Barton

TUESDAY Morning (November 13, 2007)

Chair: Dave Anderson

Ionospheric Irregularities Session—Organizers: Keith Groves, Sunanda Basu, Baylie Damtie

08:30-08:50

Keith Groves

Summary of the SCINDA Workshop

08:50-09:20	Santi Basu	Tutorial on Ionospheric Scintillations
09:20-09:50	Sunanda Basu	Tutorial on Magnetic Storm Effects on Communication and Navigation Systems in the Equatorial Region
09:50-10:20	Coffee Break	
10:20-10:40	Patricia Doherty	GPS Total Electron Content (TEC) as a Global Ionospheric Sensor
10:40-11:10	Discussion	What do participants hope to learn from the workshop

GPS Total Electron Content Session-Organizers: Christine Amory-Mazaudier, Tim Fuller-Rowell, Ayman Mahrous

11:10-11:40	Cesar Valledares	Tutorial on the Low-latitude Ionospheric Sensor Network (LISN) - The First Distributed Observatory in South Americas
11:40-12:10	Sandro Radicella	Tutorial on Ionospheric Model Adaptation by Means of Experimental Data
12:10-12:30	Charlie Carrano	Variability of Large-Scale TEC Gradients and Small-Scale Fluctuations in the Equatorial Ionosphere

12:30-02:00 **Lunch Break**

TUESDAY Afternoon

Chair: Mike Taylor

02:00-02:20	Olivier Bock	Total Column Water Vapour Estimated with a Ground-based GPS Network over West Africa during the African Monsoon Multidisciplinary Analysis (AMMA) Project
02:20-02:40	Dozie Ezigbalike	The AFREF Project and Its Potential to Support Science and the IHY in Africa
02:40-03:00	John Habarulema	Application of Neural Networks to TEC Modeling using Data Derived from South African GPS Receiver Network
03:00-03:20	Elijah Oyeyemi	New foF^2 Developments for the International Reference Ionosphere (IRI)
03:20-03:50	Coffee Break	
03:50-04:10	Jacob Adeniyi	December 15-17 2006 Magnetic Storm Analysis at Ilorin Nigeria
04:10-04:30	Baylie Damtie/ Gizaw Mengistu	An Ionospheric Radar Signal Estimation by Means of an Adaptive Filter
04:30-04:50	Mihail Codrescu	Data Assimilation for the Ionosphere: US-TEC and WinTEC
04:50-05:10	Tim Fuller-Rowell	Connections Between Terrestrial and Space Weather
05:10-05:30	Discussion	

TUESDAY Evening

06:30-09:00 **Poster Session and Buffet**

WEDNESDAY Morning (November 14, 2007) *Chair: Mark Moldwin*

Electrodynamics/Magnetometer and Plasmasphere Session-Organizers: Ian Mann, Dave Anderson, Esayas Shume

08:30-09:00	Rod Heelis	Tutorial on Ionospheric Electrodynamics at Low and Middle Latitudes
09:00-09:20	Kiyohumi Yumoto	MAGnetic Data Acquisition System (MAGDAS) Project and Its Preliminary Results
09:20-09:40	Vafi Doumouya	Magnetic variations at the magnetic equator
09:40-10:00	Dave Anderson	Low Latitude, Daytime, Vertical ExB Drift Velocities, Inferred from Ground-based Magnetometers
10:00-10:30	Ian Mann	Tutorial on the Plasmasphere
10:30-11:00	Coffee Break	
11:00-11:20	Arsene Koba	Equatorial Geophysics Studies: Past and Recent Activities and Campaigns in West African Region
11:20-11:40	Babatunde Rabi	Magnetometer Data and Equivalent Current Systems
11:40-12:00	Esayas Shume	Equatorial Electrojet Studies
12:00-12:20	Asratemedhin Bekele/ Desalegn	Longitudinal and Temporal Variations of the Equatorial Electrojet Inferred from Ground-based Magnetometer Observations
12:20-12:40	Umran Inan	VLF Remote Sensing of the Lower Ionosphere and Radiation Belts with AWESOME Receivers
12:40-01:00	Discussion	
01:00-02:00	Lunch Break	

WEDNESDAY Afternoon

02:00-05:00 **Tour of Addis Ababa**

THURSDAY Morning (November 15, 2007) *Chair: Tim Fuller-Rowell*

NSF-IHY day

Data from recent/forthcoming missions; new ground-based facilities Session-Organizer: Tim Fuller-Rowell

08:30-08:50	Larry Paxton	TIMED, SSULI/SSUSI
08:50-09:10	Keith Groves	C/NOFS
09:10-09:30	Stefan Maus	SWARM Satellite Constellation Mission
09:30-09:50	Andrew Yau	Scientific Collaboration Opportunities Associated with the Enhanced Polar Outflow Probe (e-POP) Mission
09:50-10:10	Scott Bailey	AIM Satellite Observations of Atmospheric Gravity Wave Influences on Ozone

