TG4 Newsletter Vol. 9, July 2012

Inside this Issue

Article 1

Study of the Equatorial Electrojet and low latitude ionospheric phenomena at the Atmospheric Physics Laboratory, University of Cocody-Abidjan, Cote d'Ivoire

V. Doumbia, O. D. F. Grodji, O. K. Obrou
Universite de Cocody-Abidjan, UFR-SSMT,
Laboratoire de Physique de l'Atmosphere. 22 BP 582 Abidjan 22, Cote d'Ivoire

V. Doumbia

The Equatorial Electrojet (EEJ) is a day side ionospheric current that flows along the geomagnetic dip equator, at about 105km altitude. During the early 1990's an international research program designated as "The International Equatorial Electrojet Year (IEEY)" was initiated by the IAGA Interdivisional Commission on Developing Countries (ICDC). In the framework of that program an important campaign of measurements was carried out in West Africa, which involved a magnetometer meridian chain of ten stations, 3 IPS-42 ionosondes, HF radar and Fabry-Perrot Interferometer (FPI). Following the IEEY campaign, we have setup a research group in Geomagnetism and low latitude Aeronomy in the Atmospheric Physics Laboratory at the

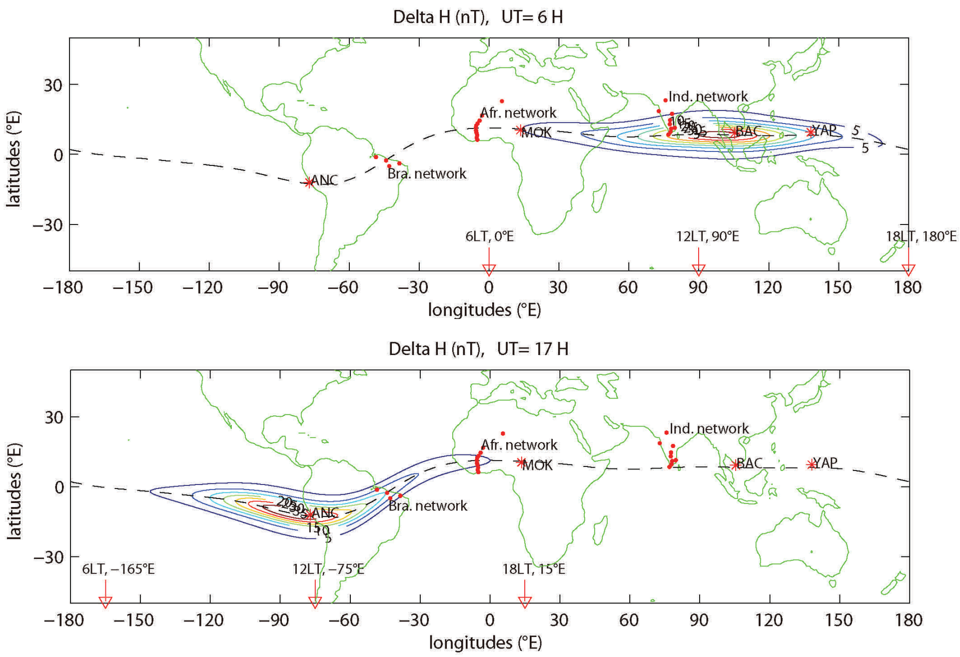

Figure 1. Universal time snapshots of the EEJ magnetic signature at 06:00UT (up) and 17:00UT (bottom), at 400km altitude, provided by the Empirical Equatorial Electrojet Model (3EM).

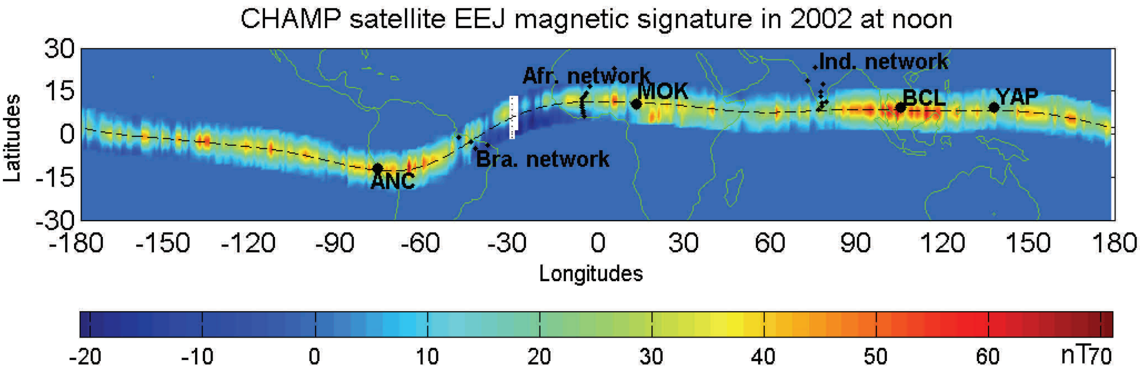

Figure 2. The noon-time EEJ magnetic signature observed by the CHAMP satellite in 2002 along the dip-equator.

University of Cocody-Abidjan, in Cote d'Ivoire. This group is dedicated to the study of the EEJ and related low and mid-latitude ionospheric phenomena.

The IEEY campaign has yielded to important results in characterizing the EEJ through its magnetic signature observed in West Africa (Doumouya et al., 1998 and Vassal et al., 1998). Using the IEEY ground-based magnetic data recorded in different longitude sectors, Doumouya et al. (2003) have proposed an empirical model of the EEJ (3EM) that accounts for its local time, latitude and longitude dependence. Figure 1 exhibits a model snapshot of the EEJ magnetic signature at 06:00UT and 17:00UT, at 400km altitude. The magnetic data analyses were also extended to satellite observations (Doumouya and Cohen, 2004). Figure 2 shows the EEJ magnetic signature observed on board the CHAMP satellite in 2002 along the dip equator.

Our research activities also include ionosonde, HF radar and Fabry-Perot interferometer data analysis, for understanding the dynamics and electrodynamics of the low latitude thermosphere-ionosphere system. Figure 3 shows an estimate of the zonal and polarization electric fields based on ionosonde data recorded at Korhogo (5.43°W, 9.33°N). To enhance our understanding of the coupled dynamics and Electrodynamics of the low latitude thermosphere-ionosphere system, we use the NCAR Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIEGCM) to make simulation studies on the EEJ characteristics as well (Doumbia et al., 2007 and Zaka et al., 2010).

Although the ionosonde and Fabry-Perot Interferometer located at Korhogo have ceased to operate since 2002, due to the rebellion in the northern Cote d'Ivoire, we are still involved in different international programs. Indeed, since 1999, we operate 3 magnetic stations across the dip-equator for surface measurements during Oersted and CHAMP satellite missions. We also collaborate in international research initiatives (IHY 2007 and ISWI), for which we host a magnetometer for MAGDAS and a GPS receiver for SCINDA networks.

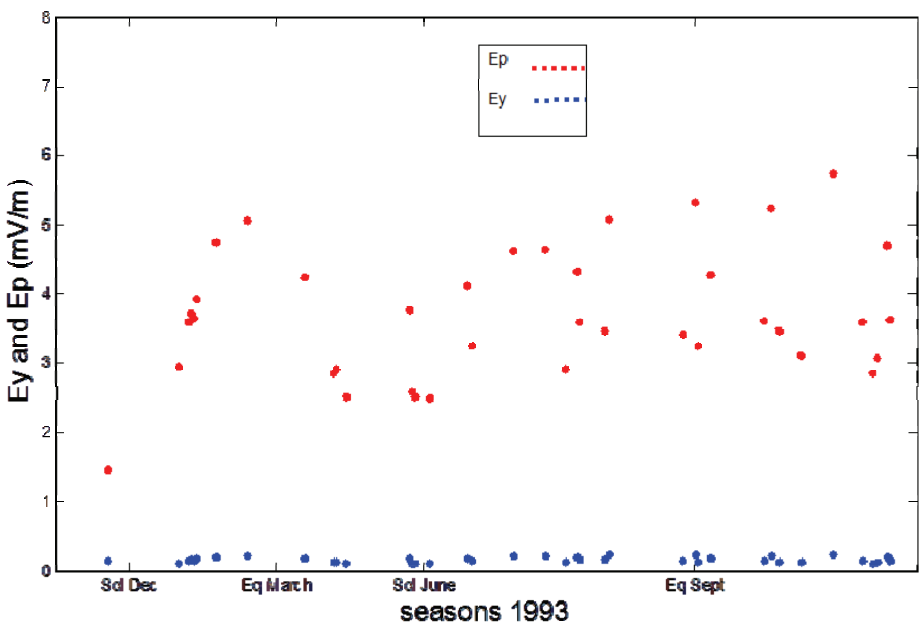

Figure 3: Seasonal variations of the polarization (Ep) and the zonal (Ey) electric fields inferred from ionosonde data in 1993.

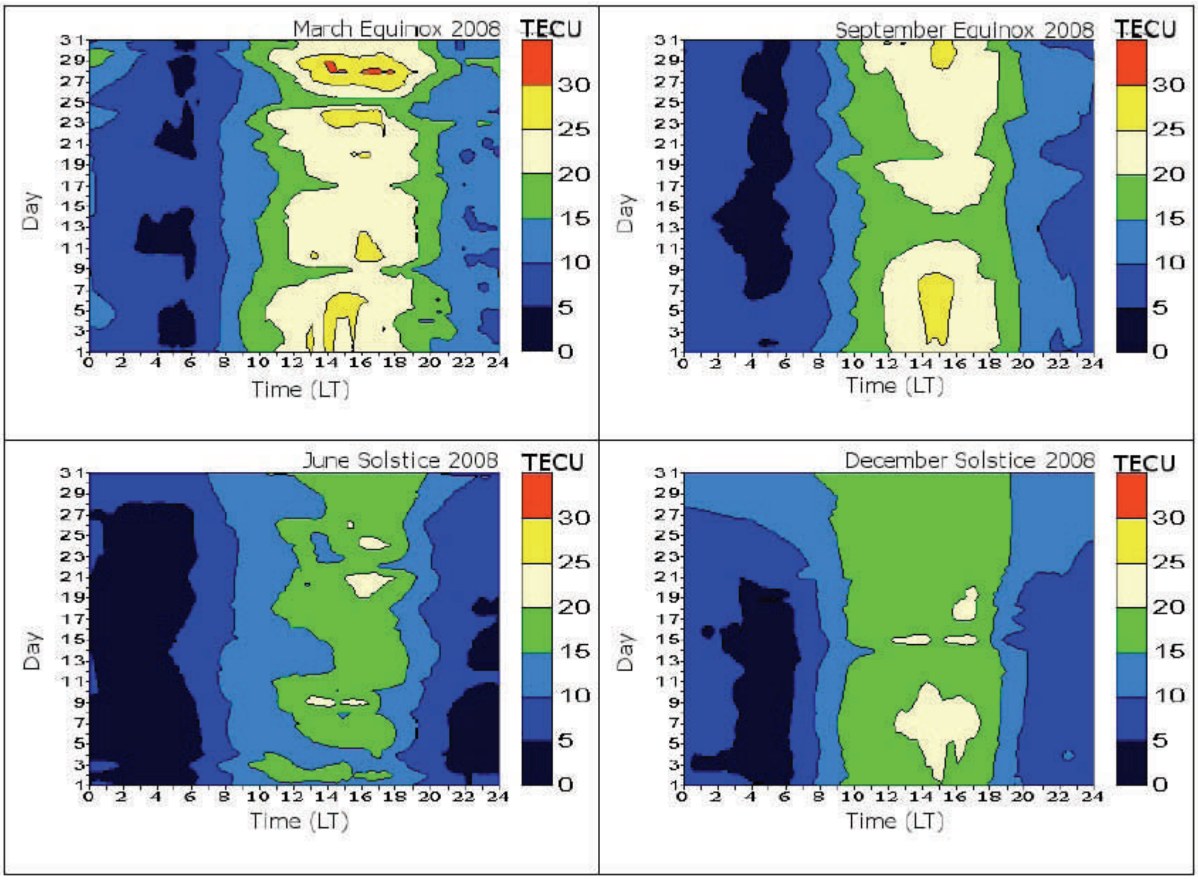

Figure 4: Seasonal variations of the vertical TEC (vTEC) obtained from the Abidjan GPS receiver in 2008.

Our team members actively contribute to the data exploitation at different levels. Figure 4 shows the seasonal variations of the vertical TEC (vTEC) obtained from the Abidjan GPS receiver in 2008.

In the frame of the national reconstruction program, we have submitted a project of building an interdisciplinary Space Weather observatory at Korhogo, named "**Observatory of Geomagnetism and Space Weather of Korhogo (OGSWK)".** Fortunately the budget of the project has been adopted by the Government of Cote d'Ivoire to start in 2013. **OGSWK** is expected to include instruments like Fabry-Perrot interferometer (FPI), digisonde, VHF radar and a magnetic observatory. Note that the choice of Korhogo for the project is motivated by its location under the southern edge of the equatorial electrojet in West Africa.

Article 2

The thermospheric wind observation during aurora activity by all-sky FPI at Chinese arctic Yellow river station

AI Yong, ZHANG Hong, ZHANG YanGe, HU GuoYuan
School of Electronic information, Wuhan university, Wuhan 430072, China

Ai Yong

The atmospheric optics laboratory of Wuhan University devotes the research of the thermospheric wind for several years. We developed our first two channel scanning Fabry-Perot interferometer (FPI) in 2009 which observe 557.7nm and 630.0nm airglow emission. And the mesospheric and thermospheric wind observations in the mid -latitude region were started since then. A new compact and cost-effective single channel all-sky imaging Fabry-

Perot spectrometer was developed in June 2010, and was installed at Chinese arctic Yellow river station (78° 55´ N, 11° 56´ E) in Nov. 2010. The figure 1 shows the photo of all-sky FPI which is inside the observing dome in Chinese arctic Yellow river station.

After the initial installation and testing observation during the winter of 2010, the observation continued for the winter of 2011 at Chinese arctic Yellow River Station which began from 1 October 2011 to the 25 February 2012. The filter can be changed manually for different airglow or aurora emission observation. The 557.7 nm emission was observed before 12 January 2012, and 630.0 nm emission was observed afterwards.

The investigation between aurora activity and thermospheric wind speed is a interesting things. Figure 2 shows the two dimension thermospheric line of sight (LOS) wind distribution that calculated from the Fabry-Perot

Figure 1. The observation room of all-sky imaging Fabry-Perot spectrometer at Chinese arctic Yellow river station in Ny-Alesund, Svalbard.

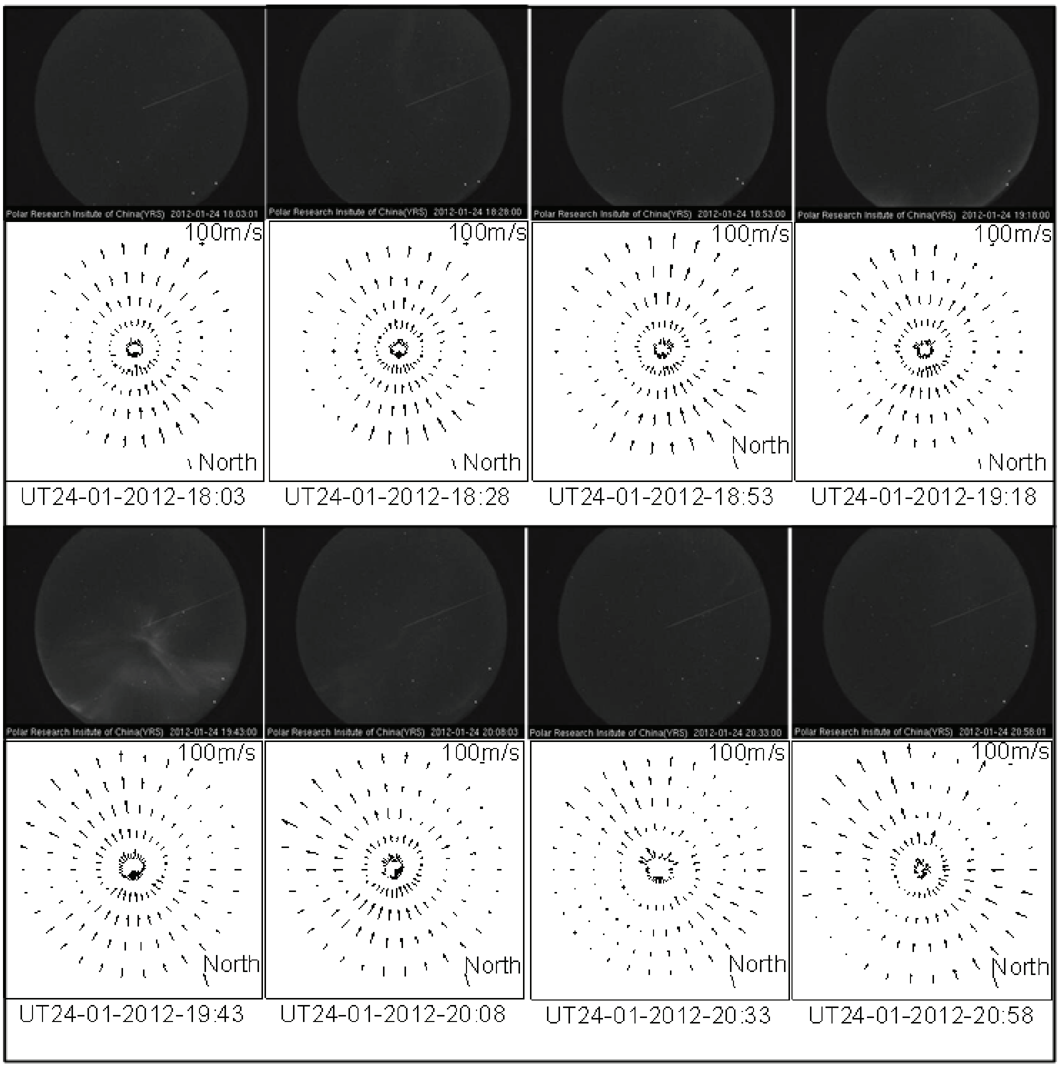

Figure 2. The two dimension thermospheric line of sight (LOS) wind distribution. The all-sky aurora image taken at the same time and same place also displayed. The wind field is symbolized with the short arrow bar, the length of the arrow is corresponding to the magnitude of the wind, 100 m/s scalar is on the top right corner on each picture.

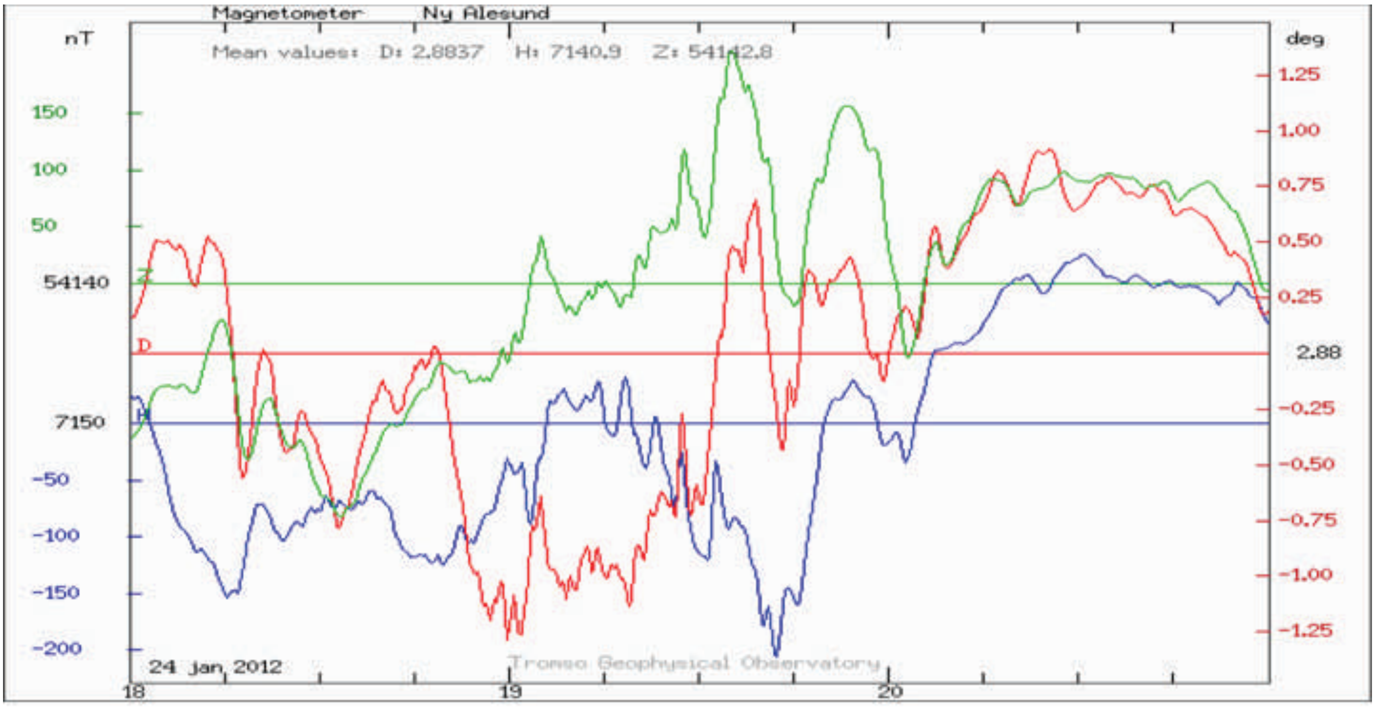

Figure 3. The IMF index for the UT 18:00~21:00 on 24 Jan,2012.(The picture is download from the Tromso Geophysical Observatory); Z(green) is the vertical component; D (red) is the declination; H (blue) is the horizontal component.

interference images (630.0nm). The all-sky aurora image was also displayed in the figure. The white line inside aurora image was green laser radar beam. The wind field is symbolized with the short arrow bar, the length of the arrow represents the magnitude of the wind. 100 m/s scalar is on the top right corner on each picture, and the inward and outward arrow is the direction of the LOS wind. The north pole is indicated in the right corner on the bottom, and is 34.92° on the northeast from the Geomagnetic North Pole.

Figure 3 shown the index for the geomagnetism. The horizontal component decreased sharply at UT 19:30, and we can see the strong aurora appeared at that time (UT 19:30) in the fifth picture in figure 2. Before the UT 19:30, the direction of the LOS wind is toward the northeast .After the aurora appearance, the direction of the LOS wind changed to northward, and the amplitude of the LOS wind went up to 500 m/s from 350 m/s between UT 19:30 and UT 20:08. As the aurora become weaker, the amplitude of the LOS wind decreased.

It also could seen that the LOS wind is directed perpendicular to the arc, with very low wind speeds parallel to the arc. This strong trend for the wind is probably related to the two important processes, the ion drag and Joule heating. The ion drag drives the neutral atmospheric motion through ion-neutral collisions while the Joule heating produce the pressure, the re-balance between the ion and neutral cause the movement for the neutral atmosphere. It is important to combine the other element of atmosphere to research the dynamic of the thermosphere related to the neutral wind, as the background wind for the aurora, neutral wind is also affect the morphology of the aurora, especially for the lower layer like the layer of OI 557.7nm.

Acknowledgement

Aurora data issued by the Data-sharing Platform of Polar Science（http://www.chinare.org.cn）maintained by Polar Research Institute of China(PRIC) and Chinese National Arctic & Antarctic Data Center(CN-NADC).

Article 3

Jicamarca 50th Anniversary Commemoration

David Hysell[1] and Jorge Chau[2]
[1]Earth and Atmospheric Sciences, Cornel University, USA
[2]Radio Observatorio de Jicamarca, Peru

David Hysell

Jorge Chau

The Jicamarca Radio Observatory celebrated its 50th anniversary on March 17, 2012, with an event featuring lectures from prominent observatory managers and users, Peruvian dignitaries, and program directors from affiliated agencies in the U.S. The celebration immediately followed the 13th meeting of the International Symposium on Equatorial Aeronomy held the preceding week in Paracas, Peru, and many attendees of that meeting stayed in Peru for the commemoration. Overall, there were 205 participants including 115 Peruvians and 90 international visitors. Among the Peruvian representatives were current and former observatory staff, current and former students, and Peruvian authorities.

The commemoration began with remarks from the following individuals representing the institutions most closely affiliated with Jicamarca:
* Ronald Woodman (IGP Executive President)
* Miguel Quijandria (Vice Minister, Ministry of Environment)
* Victor Carranza (President of CONCYTEC)
* Richard Behnke (NSF GEO/AGS Section Head)
* Kent Miller (AFOSR Program Manager)
* John Foster (CEDAR Chair)
* Robert Pfaff (NASA Goddard Flight Space Center)
* David Hysell (Cornell Principal Investigator NSF AGS-0905448)

Figure 1. Group Photo in front of Jicamarca Radio Observatory

In addition, Dr. Kenneth Bowles, Jicamarca's first director, appeared in a virtual presentation, and Ing. Alberto Giesecke, founder of IGP, was also present, along with other Peruvian authorities. The presentations were translated into Spanish and English.

Among the highlights of the event was the presentation by Dr. Robert Pfaff of a letter from Dr. Barbara Giles, Heliophysics Division Director at NASA. The letter passed along congratulations to the observatory, recalling the important role it played in the early days of manned space exploration and the Apollo 11 mission in particular.

Following the opening remarks, visitors were led through tours of a number of commemorative activities. These included a photo exposition, an impromptu equipment museum, and some special videos in addition to tours of the main components of the observatory (antenna, transmitters, receivers, computers and control.) A time tunnel showing developments at the observatory in the areas of space science, equatorial aeronomy, and radar techniques was also constructed for visitors.

Many of the key scientists and engineers responsible for founding the observatory were able to be present at the commemoration. Notable among them were Ing. A. Giesecke, Dr. K Bowles (via skype), Dr. R. Woodman, Dr. J. Heraud, Dr. D. Farley, Dr. B. Balsley, and Dr. D. Sterling. Special recognition was further given to some of Jicamarca's most prominent users. These included:
*D. Farley, most visits between 1974-2011 (32), most Ph.D. students (14)
*E. Kudeki (UIUC), second place most visits between 1974 - 2011 (27), most students not from Cornell (9)
*C. Valladares (Boston College), most visits between 2001-2011
*J. Meriwether (Clemson University), second most visits between 2001-2011

Figure 2. Walking at JRO

The organizers of the event also collected statistics regarding students who have passed through Jicamarca and/or based their thesis research on observations from the observatory. Ultimately, the list grew to include 75 names.

An expanding website dedicated to the anniversary events with a complete agenda and an extensive photo album can be found at http://jro-app.igp.gob.pe/jro50/. Participants are encouraged to contribute to the archive.

Highlight on Young Scientists

Model Simulation of the Thermosphere-Ionosphere System

Tzu-Wei Fang
CIRES, University of Colorado at Boulder, USA
Space Weather Prediction Center, NOAA,USA

Tzu-Wei Fang

My research focuses on various ionosphere/plasmasphere model developments and understanding the impact of the lower atmosphere on the ionosphere using model simulations. The Whole Atmosphere Model (WAM), developed in our research group, provides the neutral atmosphere from the ground to 600 km. Combining the WAM with the ionosphere/plasmasphere model, the dynamical links between the lower atmospheres and the upper atmosphere and ionosphere can be determined. The capability of WAM in simulating the generic and specific Sudden Stratospheric Warming (SSW) events and their effects on the

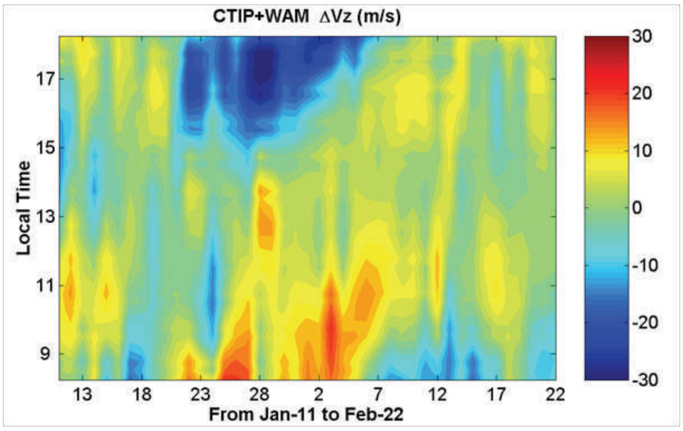

Figure 1. Simulation of the vertical plasma drift differences (m/s) at Jicamarca during the January 2009 SSW.

ionosphere have been demonstrated in several of our publications. The simulation of the vertical drift differences, using the neutral winds from the WAM and ionospheric conductivities from the Coupled Thermosphere Ionosphere and Plasmasphere with Electrodynamics model (CTIPe), has successfully reproduced the amplitude and phase of the electrodynamic response to the January 2009 SSW in the Peruvian sector (Figure 1). These simulations also help us to investigate the longitudinal variation of ionospheric vertical drift during SSWs.

Related to my experience with the ionosphere/plasmasphere models, in 2010 we initiated a project named "Problems Related to Ionospheric Models and Observation at equatorial region (Equatorial-PRIMO)" to understand the strengths and the limitations of theoretical, time-dependent ionospheric models in representing observed ionospheric structure and variability under moderate solar activity and geomagnetically quiet conditions. Currently, modelers contributing 11 physics-based models are participating in the project and we get together at the annual Coupling Energetics and Dynamics of Atmospheric Regions (CEDAR) Workshop to exchange ideas and details of their models. Figure 2 shows a comparison of N_mF_2 at 14 LT from the observations, IRI, and theoretical models.

Validation and improvement of the current thermosphere and ionosphere physical models will enable better understanding of couplings and variability in the upper atmosphere, which provide the foundation for future forecasting of ionospheric weather.

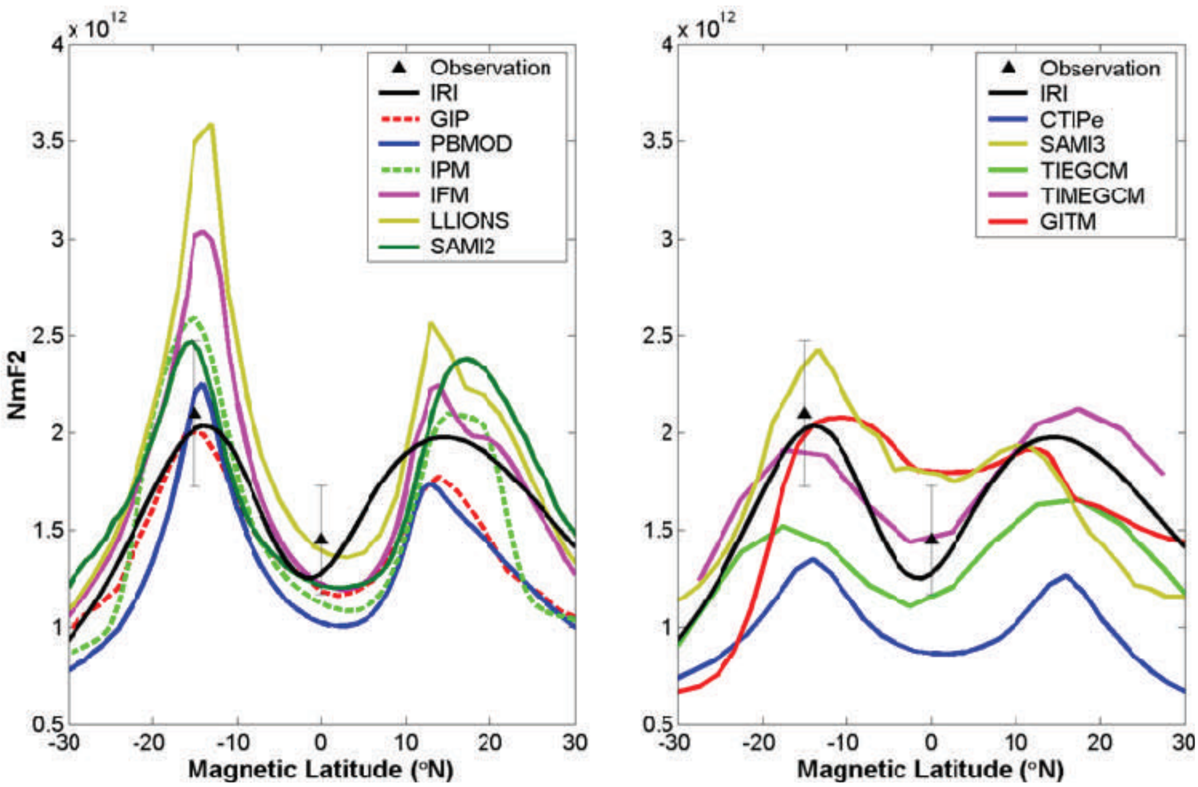

Figure 2. Comparisons of N_mF_2 from observations (triangles), IRI (black lines), and theoretical models (colored lines). On the left are the non-self-consistent models and on the right are the self-consistent models.

Short News 1

CAWSES-II/TG4 Business Meeting at COSPAR in Mysore, India

Jens Oberheide
Clemson University, SC, USA

TG4 will held a Business Meeting at the next COSPAR meeting in Mysore, India, on 20 July from 19:00-20:30, Room G071, right after the end of Session C2.2 (same room). The meeting is open to all participants. The purpose of the Business Meeting to give an update of recent CAWSES-II activities in general and TG4 in particular, including status reports of campaign activities and future plans. An open discussion about the plans until the end of CAWSES-II in 2013 is encouraged. The Business Meeting will be chaired by the two TG4 co-leaders, Jens Oberheide of Clemson University and Kazuo Shiokawa of Nagoya University.

Short News 2

SSR Special Issue and a Book "Dynamic Coupling between Earth's Atmospheric and Plasma Environments"

Kazuo Shiokawa
Solar-Terrestrial Environment Laboratory,
Nagoya University, Nagoya, Japan

Special Issue "Dynamic Coupling between Earth's Atmospheric and Plasma Environments" (eds: T. Bösinger, J. LaBelle, H.J. Opgenoorth, J.-P. Pommerau, K. Shiokawa, S.C. Solomon, and R.A. Treumann) has been published in Space Science Reviews as volume 168, parts 1-4. This issue will be also published as an ISSI book volume 42 in July, 2012. They are summary of a workshop held at the International Space Science Institute (ISSI) in Bern, Switzerland, from September 27 to October 1, 2010.

Upcoming meetings related to CAWSES-II TG4

Conference	Date	Location	Contact Information
39th COSPAR Scientific Assembly	Jul. 14-22, 2012	Mysore, India	http://www.cospar-assembly.org
International Symposium on Solar-Terrestrial Physics	Nov. 6 - 9, 2012	Indian Institute of Science Education and Research, Pune, India	http://www.iiserpune.ac.in/~isstp2012/
AGU Chapman Conference on Longitude and Hemispheric Dependence of Space Weather	Nov. 12-16, 2012	Addis Ababa, Ethiopia	http://www.agu.org/meetings/chapman/2012/fcall/
CAWSES-II2013 Symposium	Nov. 18-22, 2013	Nagoya, Japan	http://www.stelab.nagoya-u.ac.jp/cawses2013/.

The purpose of this newsletter is to make more communications among scientists related to the CAWSES-II Task Group 4 (particularly between those of the atmosphere and the ionosphere). **The editors would like to invite you to submit the following articles to the TG4 newsletter.**

Our newsletter has four categories of the articles:

1. Articles— ~500 words and four figures (maximum)
   on campaign, ground observations, satellite observations, modeling, workshop/conference/symposium report, etc
2. Highlights on young scientists— ~200 words and two figures
   on the young scientist's own work related to CAWSES-TG4
3. Short news— ~100 words
   announcements of campaign, workshop, etc
4. List of planned workshop

Category 2 (Highlights on young scientists) helps both young scientists and TG4 members to know each other. Please contact the editors for recommendation of young scientists who are willing to write an article on this category.

Editors:

Michi Nishioka (nishioka_at_nict.go.jp)
National Institute of Information and Communications Technology,
Tokyo, Japan
Tel: +81-42-327-7375, Fax: +81-42-327-6163

Kazuo Shiokawa (shiokawa_at_stelab.nagoya-u.ac.jp)
Solar-Terrestrial Environment Laboratory, Nagoya University,
Nagoya, Japan
Tel +81-52-747-6419, Fax +81-52-747-6323

This newsletter is also available on the web at http://www.cawses.org/wiki/index.php/Task_4