Organizers

National Space Science Center, Chinese Academy of Sciences
National Astronomical Observatories, Chinese Academy of Sciences

Co-organizer

Yunnan Astronomical Observatory, Chinese Academy of Sciences

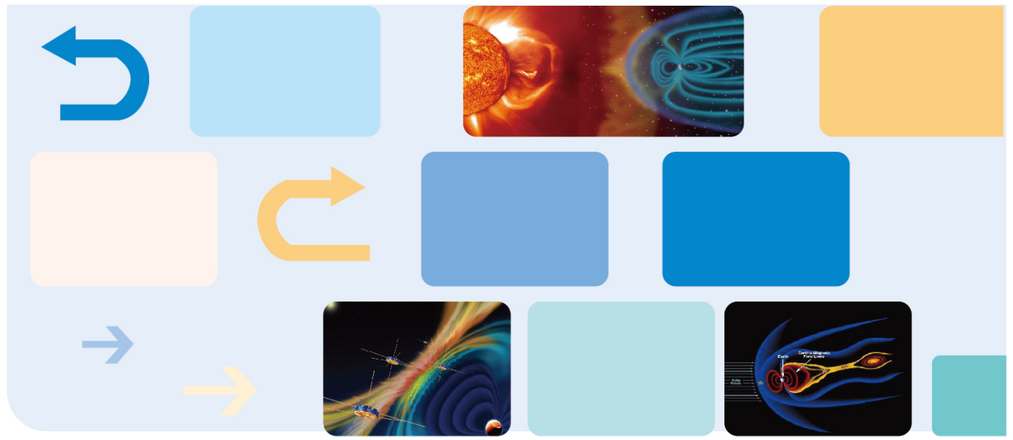
The 2nd Asia-Oceania Space Weather Alliance Workshop (AOSWA 2013)

Conference Program & Abstracts

AOSWA
Asia-Oceania Space Weather Alliance

The 2nd Asia-Oceania Space Weather Alliance Workshop (AOSWA 2013)

4-7 November 2013
Kunming, China



Conference Program & Abstracts

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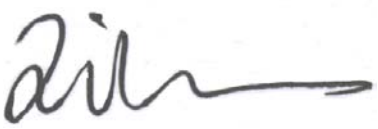
Message from the Director-General of NSSC

On behalf of the National Space Science Center (NSSC) of the Chinese Academy of Sciences, the National Astronomical Observatories (NAO), including the Yunnan Astronomical Observatory (YNAO) of the Chinese Academy of Sciences, and the Local Organizing Committee of the 2nd AOSWA (Asia-Oceania Space Weather Alliance) Workshop, it is our privilege to invite you to attend the AOSWA Workshop on November 4-7, 2013, in Kunming, China. We are honored to host this event and look forward to welcoming our friends and colleagues from around the Asian and Oceania countries as well as from international research community.

This will be the 2nd workshop held by AOSWA. AOSWA seeks both global and regional cooperation on the development of research and practical operation of space weather, and kicked off the regional alliance for space weather among Asian and Oceania countries.

The purpose of this workshop is to promote the regional linkage and information sharing of operation and research on space environment by bringing together members of the Asian-Oceania scientific community as well as other international organizations concerning with space weather. This workshop will provide an opportunity in which various communities can come and discuss recent achievements of observational, theoretical, modeling, forecasting, and application addressing the aforementioned areas.

We wish all the participants a successful and fruitful workshop and hope you enjoy the stay in Kunming!



Dr. Ji WU
Director-General of National Space Science Center
Chinese Academy of Sciences
And General Chair of 2013 AOSWA workshop

Program Committee

General Chair	**Dr. Ji WU** (National Space Science Center, China) wuji@nssc.ac.cn
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	Dr. Weixing WAN (Institute of Geology and Geophysics, China) wanw@mail.iggcas.ac.cn
	Dr. Toshio IGUCHI (National Institute of Information and Communications Technology, Japan) iguchi@nict.go.jp
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	Dr. Mamoru ISHII (National Institute of Information and Communications Technology, Japan) mishii@nict.go.jp
	Mr. Sunhak HONG (Korean Space Weather Center, Korea) sunhak.hong@gmail.com
	Dr. Alexander POTAPOV (Institute of Solar-Terrestrial Physics, SB-RAS, Russia) potapov@iszf.irk.ru
	Dr. Huaning WANG (National Astronomical Observatories, China) hnwang@nao.cas.cn
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	Dr. Jun LIN (Yunnan Astronomical Observatories, China) jlin@ynao.ac.cn
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Program Agenda

<table>
<tr><th>Date</th><th>Monday
04 November</th><th>Tuesday
05 November</th><th>Wednesday
06 November</th><th colspan="2">Thursday
07 November</th><th>Friday
08 November</th></tr>
<tr><td>AM1</td><td rowspan="7">Registration
Hotel Lobby</td><td>Opening Ceremony
(08:30-09:00)
Meeting Rm. 4

Photo Shooting
(09:00-09:30)
Hotel Entrance</td><td>Session 3: RO
(08:00-10:00)
Meeting Rm. 4</td><td>Session 4: SA
First Half
(08:00-09:45)
Meeting Rm. 4</td><td>Session 5: IT
First Half
(08:00-09:45)
Meeting Rm. 1</td><td>Business Meeting[1]
(08:00-10:00)
Meeting Rm. 1</td></tr>
<tr><td>Coffee/Tea</td><td rowspan="5">Keynote Report
(09:30-12:00)
Meeting Rm. 4</td><td>10:00-10:15</td><td colspan="2">09:45-10:00</td><td rowspan="5"></td></tr>
<tr><td rowspan="2">AM2</td><td rowspan="3">Poster Viewing
(10:15-12:15)
2/F, Lobby</td><td>Session 4: SA
Second Half
(10:00-11:45)
Meeting Rm. 4</td><td>Session 5: IT
Second Half
(10:00-11:45)
Meeting Rm. 1</td></tr>
<tr><td colspan="2">Closing Ceremony
(11:45-12:15)
Meeting Rm. 4</td></tr>
<tr><td>Lunch</td><td>12:00-13:30</td><td>12:15-13:30</td><td colspan="2">12:15-13:30</td></tr>
<tr><td>PM1</td><td>Session 1: RE
(13:30-15:30)
Meeting Rm. 4</td><td rowspan="3">Technical Visit
(Fuxian Solar Observatory)
13:30-18:00
Dinner Outside</td><td colspan="2" rowspan="3">Excursion
(Stone Forest)
13:30-18:00
Dinner Outside</td></tr>
<tr><td>Coffee/Tea</td><td>15:30-15:45</td></tr>
<tr><td>PM2</td><td>Session 2: FM
(15:45-17:45)
Meeting Rm. 4</td></tr>
<tr><td>Evening</td><td>Ice Breaking
(20:00-21:00)
2/F, Lobby</td><td>Welcoming Banquet
(18:00-20:00)
Cafeteria</td><td>Poster Viewing
(Optional)
(20:00-21:00)
2/F, Lobby</td><td colspan="2"></td><td></td></tr>
</table>

[1] Data circulation, Regional cooperation, and Host of next AOSWA Workshop will be discussed. Any participants are welcomed.

Presenter Guide – Oral

1. *Presentation ID – How to Read*

FM – 07	
Session Code	**Presentation NO.**
FM	**07**

2. *Session Code and Topics*

O	**Opening Address**
K	**Keynote Report**
RE	**Space Weather Research and Exploration**
FM	**Space Weather Forecasting and Modeling**
RO	**Space Weather Research to Operations**
SA	**Research on Solar Activity**
IT	**Research on Ionosphere & Thermosphere**

3. *Prepare Your Presentation*

Length of the presentation material should be in accordance with your time allotted. You are requested to load your presentation material before the session starts.

4. *Determine Your Visual/Audio Needs*

All meeting rooms are equipped with the following items. Please bring along your presentation files in thumb drives only.

1 LCD Projector	1 Laser Pointer	1 Screen	1 Windows-based Laptop

5. *Create a Backup Copy of Your Presentation*

It is strongly recommended that you bring at least 2 copies of your presentation to the meeting for backup purposes. Only thumb drives are acceptable.

6. *Give Your Presentation*

- Please be considerate to other speakers and audience by staying within your allotted time. Session Chairs will hold you to the allotted time. This is essential for schedule performing.
- Please discuss the same material as reported in your abstract submission.

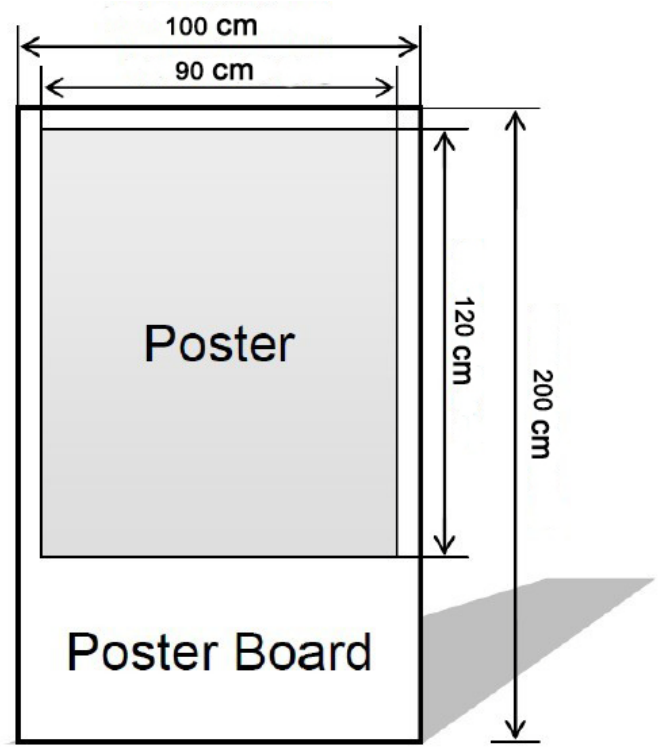
Presenter Guide – Poster

1. *Poster Set-up, Viewing, and Removing Arrangement*

	Poster Set-up	Poster Viewing	Poster Removing
Time	18:00-20:00, Nov 4 20:00-21:00, Nov 5	10:15-12:15, Nov 6 20:00-21:00, Nov 6 (Optional)	12:15, Nov 7
Venue	2nd Floor, Hotel Lobby		

2. *Prepare Your Poster*

- Each presenter is provided with a 2 meter high by 1 meter wide poster board. The presentation must cover the same material as the abstract submission.
- Vertical Format in 900mm width × 1200 mm height is strongly suggested.
- The Abstract ID will be written at the top of the poster board in advance. Please use the correct poster board.
- The Abstract title and author's name should be placed prominently at the top of your poster to allow viewers to identify your abstract easily. **Presenter's Name must be underlined and in Bold Letterings.**
- Adhesive tapes and scissors will be provided. If you have special needs for your poster presentation, please bring those supplies with you to the workshop.



Session Schedule – Oral

05 November (Tuesday) AM: Meeting Room 4, 2/F

08:30-09:00 Opening Ceremony

Ceremony Chair: **Jiancun GONG** (NSSC, China)

O-01 08:30-08:45	Opening Address Ji Wu (NSSC, China)
O-02 08:45-09:00	Opening Address Toshio Iguchi (NICT, Japan)

09:00-09:30 Photo Shooting

09:30-12:00 Keynote Report

Chair: **Huaning WANG** (NAO, China)

K-01 09:30-09:50	NSSC Activities in Space Weather Jiancun Gong (NSSC, China)
K-02 09:50-10:10	Scientific and Operational Activities of NICT Space Weather Mamoru Ishii (NICT, Japan)
K-03 10:10-10:30	Space Weather Operations and Research Activities at the Korean Space Weather Center Sunhak Hong (RRA, Korea)
K-04 10:30-10:50	International Actions to Improve Space Weather Preparedness Terrance Onsager (NOAA SWPC, USA)
K-05 10:50-11:10	Space Weather Expert Group in the Committee on the Peaceful Uses of Outer Space of the UN Takahiro Obara (Tohoku University, Japan)
K-06 11:10-11:30	Regional Ionospheric Monitoring and Forecasting Using GNSS Techniques Zahra Bouya, Michael Terkildsen, Matthew Francis, and David Neudegg (IPS, Australia)
K-07 11:30-11:50	The Activity and Supporting Facility Related to Space Weather Program in Indonesia Timbul Manik and Clara Y. Yatini (LAPAN, Indonesia)

05 November (Tuesday) PM: Meeting Room 4, 2/F

13:30-15:30 Session 1: Space Weather Research & Exploration

Session Chair: **Siqing Liu** (NSSC, China)

RE-01 13:30-13:45 Invited	New Science Results from Van Allen Probes (aka Radiation Belt Storm Probes) Mission Xinlin Li (University of Colorado, USA)
RE-02 13:45-14:00 Invited	The Research of Middle Upper Atmosphere by LIDAR Observations Xiankang Dou (USTC, China)
RE-03 14:00-14:15 Invited	PC Index as a Proxy of the Solar Wind Energy that Entered and Accumulated in the Magnetosphere Oleg Troshichev (Arctic and Antarctic Research Institute, Russia)
RE-04 14:15-14:30 Invited	Precursors, Similar Cycles and Prospects for Cycles 24 and 25 Kristof Petrovay (Eötvös University, Hungary)
RE-05 14:30-14:45 Invited	Introduction to the 1m New Vacuum Solar Telescope Zhong Liu (YNAO, China)
RE-06 14:45-15:00	Prediction Method for High-Energy Solar Energetic Particle Events Yuki Kubo (NICT, Japan)
RE-07 15:00-15:15	Operational Relativistic Electron Flux Forecast at GEO Satellite Tsutomu Nagatsuma, Kaori Sakaguchi, and Yasubumi Kubota (NICT, Japan) Shinji Saito, Yoshizumi Miyoshi, and Kanako Seki (Nagoya University)
RE-08 15:15-15:30	Direct LET Measurement in Space Hongfei Chen and Xiangqian Yu (Peking University, China) Sipei Shao (Institute of Shan Dong Aerospace Technology, China)

15:45-17:45 Session 2: Space Weather Forecasting & Modeling

Session Chair: **Mamoru Ishii** (NICT, Japan)

FM-01 15:45-16:00 Invited	Solar Eruptions: Numerical Simulation of the Coronal Plasma Dynamics Based on Photospheric Magnetic Field Observations Jörg Büchner (Max-Planck-Institute for Solar System Research, Germany)
FM-02 16:00-16:15 Invited	Predicting the Onset of Coronal Mass Ejections Terry Forbes (University of New Hampshire, USA)
FM-03 16:15-16:30 Invited	Questions that We are Facing in Forecasting CME's Arrival Yuming Wang and Chenglong Shen (USTC, China)
FM-04 16:30-16:45 Invited	Present Status and Future Perspective of AE/Dst Index Derivation Masahito Nose and Toshihiko Iyemori (Kyoto University, Japan) Alexander Janzhura, and Oleg Troshichev (Arctic and Antarctic Research Institute, Russia) Juergen Matzka (DTU, Denmark) Gunnlaugur Bjornsson and Thorsteinn Saemundsson, (University of Iceland, Iceland) Gerhard Schwarz (Geological Survey of Sweden, Sweden) Yoshiki Ishii, (Kakioka Magnetic Observatory, JMA, Japan) Pieter Kotze, and Herman Theron (South African National Space Agency, South Africa)
FM-05 16:45-17:00 Invited	Global Simulation of the Solar Wind-Magnetosphere Interfaces: Magnetopause and Open-Closed Boundary. Jianyong Lv (NUIST, China)
FM-06 17:00-17:15	A Three-Dimensional Asymmetric Magnetopause Model Ruilin Lin, Siqing Liu, and Jiancun Gong (NSSC, China) Xiaoxin Zhang (CMA, China) Yongli Wang (NASA GSFC, USA)
FM-07 17:15-17:30	Ensemble Prediction model of Solar Proton Events associated with Solar Flares and Coronal Mass Ejections Xin Huang and Huaning Wang (NAO, China)
FM-08 17:30-17:45	Geomagnetic Indices Forecast Models in SEPC Bingxian Luo, Siqing Liu, Qiuzhen Zhong, Jiancun Gong, and Yang Liu (NSSC, China) Xinlin Li (University of Colorado, USA)

06 November (Wednesday): Meeting Room 4, 2/F

08:00-10:00 Session 3: Space Weather-Research to Operations (R2O)

Session Chair: **Jae-Woo Park** (WeSpace, Korea)

RO-01 08:00-08:15 Invited	NICT Science Cloud: A New Approach to Regional Collaboration in Space Weather Research and Operation Ken T. Murata and Hidenobu Watanabe (NICT, Japan)
RO-02 08:15-08:30 Invited	Space Weather Operations in China Meteorological Administration Jingsong Wang and Xiaoxin Zhang (CMA, China)
RO-03 08:30-08:45 Invited	Operation of Two Solar Wind Prediction Models at Korean Space Weather Center: ENLIL and IPS Tomography Jung-Hoon Kim, Saeho Yoo, and Ji-Hye Lee (SETsystem, Inc., Korea) Jae-Hun Kim, Sunhak Hong, and Ki-Chang Yoon (KSEC, RRA, Korea)
RO-04 08:45-09:00 Invited	Space Anomalies and Space Weather: Relationship, Alarms and Countermeasure Shaojie Qu, Ying Wang, Shanshan Qin, and Zhenbo Cai (China Academy of Space Technology, China)
RO-05 09:00-09:15 Invited	Automatic Solar Synoptic Analyzer, the Analog-to-Digital Converter for SWx Prediction Seung Jun Oh, Sang Woo Lee, and Jeong-Deok Lee (SELab, Inc., Korea) Sunhak Hong, Ki-Chang Yoon, and Jae-Hun Kim (KSWC, RRA, Korea)
RO-06 09:15-09:30	The Development of Operational Models for Space Weather Forecasting at SEPC Siqing Liu, Liqin Shi, Yanhong Chen, and Yanxia Cai (NSSC, China)
RO-07 09:30-09:45	The Discussion on Space Weather Forecast Verification Qiuzhen Zhong, Fanghua Liu, and Yanmei Cui (NSSC, China)
RO-08 09:45-10:00	The Operational Space Weather Data System in NSSC, CAS Yanxia Cai, Guorui Lu, Zhaofeng Chen, Liqin Shi, Siqing Liu, and Jiancun Gong (NSSC, China)

10:15-12:15 Poster Session: 2/F, Lobby

07 November (Thursday) AM1: Meeting Room 4, 2/F

08:00-10:00 Session 4: The research on solar activity (First Half)

Session Chair: **Yuki Kubo (NICT, Japan)**

SA-01 08:00-08:15 Invited	Empirical Approach to Predicting Key Parameters for a Sunspot Number Cycle Harjit Ahluwalia (University of New Mexico, USA)
SA-02 08:15-08:30 Invited	Solar Cycles Amplitudes Robert Cameron (Max-Planck-Institute for Solar System Research, Germany)
SA-03 08:30-08:45 Invited	A New Sunspot Number: Diagnostics of Recent and Past Trends in Sunspot Statistics Laure Lefevre and Frédéric Clette (Royal Observatory of Belgium, Belgium)
SA-04 08:45-09:00 Invited	Flowing Features in the CME/Flare Current Sheet Shown in GHz band Jun Lin (YNAO, China)
SA-05 09:00-09:15	Research about the Real Time Flare Onset Detection Algorithm Jiaben Lin, Juan Guo, and Yuanyong Deng (NAO, China)
SA-06 09:15-09:30	Sunspot Monitoring at Langkawi National Observatory Farahana Kamarudin, Mohammad Redzuan Tahar, Nor Rafidah Saibaka, and Karzaman Ahmad (National Space Agency of Malaysia, Malaysia) Bambang Setiahadi, (Indonesian National Institute of Aeronautics and Space, Indonesia)
SA-07 09:30-09:45	The 24th Solar Cycle--A Very Small Cycle Zhitao Li, Qiuzhen Zhong, and Juan Miao (NSSC, China)

07 November (Thursday) AM2: Meeting Room 4, 2/F

10:00-11:45 Session 4: The research on solar activity (Second Half)

Session Chair: **Oleg Troshichev** (Arctic and Antarctic Research Institute, Russia)

SA-08 10:00-10:15 Invited	A New Concept of Solar Activity Forecast Huaning Wang, Xin Huang, Xinhua Dai, Xiaoshuai Zhu, Zhanle Du, Han He, and Yan Yan (NAO, China)
SA-09 10:15-10:30 Invited	Solar Cycle Predictions Javaraiah Javaraiah (Indian Institute of Astrophysics, India)
SA-10 10:30-10:45 Invited	Some Results of Research on Solar Cycle Activity using Vietnamese Geomagnetic and Ionospheric Data Ha Duyen Chau, Le Truong Thanh, and Nguyen Thanh Dung (Hanoi Institute of Geophysics, Vietnam)
SA-11 10:45-11:00	Maximum of Solar Cycle 24 Shinichi Watari and Takashi Watanabe (NICT, Japan)
SA-12 11:00-11:15	Solar Bi-dynamo Model Zhanle Du (National Astronomical Observatories, China)
SA-13 11:15-11:30	Solar Observation Based on Atomic Frequency Discriminator Yong Yang, Xuewu Cheng, Faquan Li, Yajuan Li, and Shunsheng Gong (Wuhan Institute of Physics and Mathematics, China) Wei Gong and Baoping Wang (Wuhan University, China)
SA-14 11:30-11:45	A Three Dimensional Self-similar Expansion model and 3 April 2010 Coronal Mass Ejection Case Study Jingjing Wang, Bingxian Luo, Siqing Liu, and Jiancun Gong (NSSC, China)

07 November (Thursday) AM1：Meeting Room 1, 2/F

08:00-10:00 Session 5: Ionosphere and Thermosphere (First Half)

Session Chair: **A.K. Upadhayaya** (NPL, India)

IT-01 08:00-08:15 Invited	The Thailand Ionospheric and GNSS Data Center Project Pornchai Supnithi, Prasert Kenpankho, and Athipu Mongkolkachit (King Mongkut's Institute of Tech., Thailand) Takuya Tsugawa, Tsutomu Nagatsuma and Takashi Maruyama (NICT, Japan)
IT-02 08:15-08:30 Invited	GPS Monitoring of Ionospheric Disturbances Natalia Perevalova, Sergey Voeykov, Yury Yasyukevich, Ludmila Leonovich, Artem Ishin, Ilya Edemsky, and Anna Polyakova (The Institute of Solar-Terrestrial Physics SB-RAS, Russia) Elvira Astafyeva (Institut de Physique du Globe de Paris)
IT-03 08:30-08:45 Invited	Development of a Whole Atmosphere-Ionosphere Coupled Model for Space Weather Forecast Hiroyuki Shinagawa and Hidekatsu Jin(NICT, Japan) Yasunobu Miyoshi (Kyushu University) Hitoshi Fujiwara (Seikei University)
IT-04 08:45-09:00	A New Data Format to Promote International Exchange and Share of GNSS-TEC Data Takuya Tsugawa, Michi Nishioka, and Mamoru Ishii (NICT, Japan) Susumu Saito (Electronic Navigation Research Institute, Japan) Akinori Saito (Kyoto University) Yuichi Otsuka (Nagoya University)
IT-05 09:00-09:15	Modeling and Prediction of Global Ionospheric Delay with IGS Ground-based GNSS Observations Mingyuan Wang and Jinsong Ping (NAO, China)
IT-06 09:15-09:30	A Statistical Analysis of Occurrence Characteristics of Spread-F Irregularities over Indian region Sumedha Gupta and A.K. Upadhayaya, MVSN Prasad (NPL, India)
IT-07 09:30-09:45	Ionospheric Response to CIR-induced Recurrent Geomagnetic Activity during the Declining Phase of Solar Cycle 23 Yanhong Chen (NSSC, China) Wenbin Wang and Alan Burns (NCAR HAO, USA)

07 November (Thursday) AM2: Meeting Room 1, 2/F

10:00-11:45 Session 5: Ionosphere and Thermosphere (Second Half)

Session Chair: **Zahra Bouya** (IPS, Australia)

IT-08 10:00-10:15 Invited	Space Weather and Space Climate: Ionospheric F2- region Variability and Sudden Stratospheric Warmings A.K.Uadhayaya (NPL, India)
IT-09 10:15-10:30 Invited	An Investigation on Ionospheric Spread-F and Scintillation in Low Latitude Region Jiankui Shi, Guojun Wang, and Zheng Wang (NSSC, China)
IT-10 10:30-10:45 Invited	Atmosphere-Ionosphere Coupling via Atmospheric Waves and its Possible Application to Ionospheric Forecasting Zuo Xiao, Yongqiang Hao, and Donghe Zhang (Peking University, China) Saiguan Xiao (NSSC, China)
IT-11 10:45-11:00 Invited	Variations of Thermospheric Density from CHAMP and GRACE Jiuhou Lei (USTC, China)
IT-12 11:00-11:15	GPS/GLONASS Operation Quality Deterioration Caused by Solar and Geophysical Activity Yury Yasyukevich, Artem Ishin, Eugene Kosogorov, and Gennadyi Smolkov (ISTP SB-RAS, Russia) Elvira Astafyeva (Institut de Physique du Globe de Paris) Vladislav Demyanov (Irkutsk State Railway University)
IT-13 11:15-11:30	Introduction of Newly Developing And Setting Tri-band Beacon Receivers For Ionosphere Study in Eastern China Jinsong Ping and Mingyuan Wang (NAO, China) Peng Guo, Weihua Wang, Rongbin Zhao, Nianchuan Jian (SHAO, China) Zhenjie Hong (Wenzhou University, China) Honglin Jin (Institute of Earthquake Prediction, China) Zhen Wang (Xinjiang Observatory, China)
IT-14 11:30-11:45	Analyzing the Asymmetric Thermospheric/Ionospheric Response to External Driving Ercha Aa (NSSC, China) A.J.Ridley (University of Michigan, USA) Donghe Zhang and Zuo Xiao (Peking University, China)

Session Schedule - Poster

Poster: Space Weather Research and Exploration

PRE-01	Analysis of Particle Radiation Environment on Middle-Earth and Geosynchronous Orbits Xiaochao Yang, Chunqing Wang, and Tao Jin (NSSC, China)
PRE-02	Downward Motions of Plasmoids in the CME-Flare Current Sheet Observed in the GHz Band Guannan Gao, Min Wang, and Jun Lin (YNAO, China) Ning Wu (Yunnan Normal University, China) Chengming Tan (NAO, China) Kliem Bernhard (University of Potsdam, Germany) Yang Su (University of Graz, Austria)
PRE-03	Dramatic Decrease of the Relativistic Electron Fluxes in the Outer Radiation Belt during two Geomagnetic Storms Ying Xiong and Lun Xie (Peking University, China)
PRE-04	Acceleration of Electrons and Protons in Reconnecting Current Sheets Including Single or Multiple X-points Yan Li and Jun Lin (YNAO, China)
PRE-05	Secondary Fast Reconnection with Radiation Cooling in Solar Chromosphere Lei Ni (YNAO, China)
PRE-06	L-band Solar Radio Burst Events-A Potential Interference for Navigation Signal and its Pre-alarm Method Research Liang Dong (YNAO, China)

Poster: Space Weather Forecasting and Modeling

PFM-01	The Analysis of Correlation between the Variation of the Absolute Solar Flux and Degradation in the SNR of the GPS Satellites Reception on Solar Radio Burst Chul-hwan Lee, Seung-min Shin, and Soon-cheol Hong (SETsystem, Inc., Korea)
PFM-02	Development of Long-term Solar Activity Forecast System using 2.8GHz Solar Radio Data of Korea Space Weather Center (KSWC) Heeseon Noh, Jung-Hoon Kim, and Saeho Yoo (SETsystem, Korea)
PFM-03	Development of Automatic Detection Software of Type II/III Solar Radio Burst Seung-min Shin, and Ji-Hye Lee (SETsystem, Inc., Korea) Yong-sun Park (Seoul National University)

PFM-04	Global MHD Simulation of the Magnetospheric Response to Large and Sudden Enhancement of the Solar Wind Dynamic Pressure Yasubumi Kubota, Mitsue Den, and Tsutomu Nagatsuma (NICT, Japan) Ryuho Kataoka (National Institute of Polar Research) Takashi Tanaka (Kyushu University) Shigeru Fujita (Meteorological College)
PFM-05	Full Halo Coronal Mass Ejections: Do We Need to Correct the Projection Effect in terms of Velocity? Chenglong Shen, Yuming Wang, Pinzhong Ye, Shui Wang (USTC, China)
PFM-06	Classification of Ambiguity in Polarimetric CMEs Reconstruction Xinghua Dai, Huaning Wang, Xin Huang, Zhanle Du, Han He (NAO, China)
PFM-07	What Time will the Solar Proton Event Arrive? Yanmei Cui (NSSC, China)
PFM-08	Development of International Cooperation System for Analysis of WSA-ENLIL Model Saeho Yoo, Seungmin Shin, and Chulhwan Lee (SETsystem, Inc., Korea)
PFM-09	Fine Structures inside the Reconnecting Flare/CME CS Zhixing Mei and Jun Lin (YNAO, China)
PFM-10	Modeling of Energetic Electrons in Outer Radiation Belt Lun Xie (Peking University, China)

Poster: Space Weather-Research to Operation (R2O)

PRO-01	Correlation study between Ensemble Parameter of CME Analysis and Estimated Arrival Time of CME via ENLIL Model. Ji Hye Lee, Jung Hoon Kim, and Soon Cheol Hong (SETsystem, Inc., Korea)
PRO-02	The Possibility of Pre-alarm Health Events Based on Low Frequency Solar Observation during the Hazard Space Weather Period Xuesong Li, (First affiliated hospital of Kunming medical university, China)
PRO-03	SEPC Alert Scales for Major Space Weather Events Juan Miao, Qiuzhen Zhong, and Siqing Liu (NSSC, China)
PRO-04	Web-based Software for Space Environment Forecast Analysis Zhaofeng Chen,Yanxia Cai, Liqing Shi,Siqing Liu (NSSC, China)
PRO-05	The Renewal of ISES Website Ki-Chang Yoon, Sunhak Hong, Jaehun Kim, JinWook Han, and YoungKyu Kim (KSWC, RRA, Korea) Bowon Lee, Ilseok Kim, Ye-jin Han, and Jeong-Deok Lee (SELab Inc., Korea) Terrance Onsager (NOAA SWPC, USA) David Boteler (IPS, Canada)

PRO-06	Virtual-Sun: A new-generation 3-D computer platform for space weather service Han He, Huaning Wang, Xin Huang, Zhanle Du, Yan Yan, Xiaoshuai Zhu, and Xinghua Dai (NAO, China)
PRO-07	Space Weather Concerns in Spacecraft design Qi Huyan (China Academy of Space Technology, China)

Poster: The research on solar activity

PSA-01	The Magnetic Field Extrapolation of AR11158 Xiaoshuai Zhu and Huaning Wang (NAO, China)

Poster: Ionosphere and Thermosphere

PIT-01	A Study of Solar X Class Flare Effects on the Ionosphere Jeong-Heon Kim and Yongha Kim (Chungnam National University, Korea) Geonhwa Jee, (Korea Polar Research Institute, Korea) Seungjun Oh, (SELAB, Korea) Young-Sil Kwak (Korea Astronomy and Space Science Institute, Korea)
PIT-02	Electron Density Profiles Derived from Obliquely Sounded Ionogram Yongmin Lee, Jinho Jo, and Cheoloh Jeong (Electronics and Telecommunications Research Institute, Korea)
PIT-03	Nowcast and Forecast of GPS Total Electron Content in Japan Michi Nishioka, Takuya Tsugawa, Takashi Maruyama, and Momoru Ishii (NICT, Japan) Susumu Saito (Electronic Navigation Research Institute, Japan)
PIT-04	TEC Variation and Comparison with NeQuick Model during Low Solar Activity Phase Shengguo Wang (The Applied Meteorological Institute of Beijing, China) J.K. Shi, G.J. Wang, and X. Wang (State Key Laboratory for Space Weather, China)

Oral Session Abstracts

K

Keynote Report

November 5 (Tuesday) 09:30-12:00

Meeting Room 4, 2/F

K-01: NSSC Activities in Space Weather

Jiancun Gong (National Space Science Center, Chinese Academy of Sciences, China)
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Abstract

National Space Science Center, CAS (NSSC) started space weather prediction in 1992. As the earliest organization in the space weather prediction field in China, NSSC has made much progress in space weather observation, model research and user service recently. The operational ground-based Space Environment Monitoring Network in CAS was completely built in 2012 to acquire real-time solar, cosmic ray, geomagnetic field, ionosphere and middle and upper atmosphere observations. NSSC is planning for future satellites projects including MIT, Kuafu l5 and SPORT to improve the lack of space-based data in China. Some different research divisions are engaged in space weather prediction research in NSSC. Space Environment Prediction Center has transformed several operational space weather prediction models. The MHD model on solar eruption, three-dimensional solar wind and coronal-interplanetary couple are developed in the State Key Laboratory of Space weather. These years, there is a booming demand for space weather in China. The wide range of space weather include military sectors, industrial sectors and universities.

K-02: Scientific and Operational Activities of NICT Space Weather

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Keywords: Empirical Model, Observation

We have a long history of space weather activities; Solar radio has continuously observed at Hiraiso observatory since 1952, and Ionosphere observation also since 1957, International Geophysical Year (IGY). In addition, we start space weather forecast as routine work on 1988. Nowadays, space weather information increase its importance for communication, broadcast and positioning satellite operation, and HF communication. It is necessary for us to provide precise and useful information for them as soon as possible. The significant differences between the space and usual weather forecast is (1) observing points for space weather is sparse comparing with usual weather observing points; and (2) many of space weather mechanism is still unknown. Developing simulation code is necessary for compensate the former issue, and developing empirical models is for the later. Our present targets are follows; (1) forecast of high energy particle distribution along the gestational orbit, and (2) forecast of ionospheric perturbation for precise satellite positioning. We have developed observation technique, empirical model and numerical simulation code to achieve these goals. In addition we have been discussing the forecast of sun and solar wind which is important for longer lead time. I will present some scientific results in addition to our business activities.

K-03: Space Weather Operations and Research Activities at the Korean Space Weather Center

Sunhak Hong, Ki-Chang Yoon, Jae-Hun Kim, and Young-Kyu Kim (Korean Space Weather Center, Korea)
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Keywords: Space Weather Operation, ISES

Abstract

The Korean Space Weather Center (KSWC) of the National Radio Research Agency (RRA) is a national institute which is the official source for space weather information for Korean Government and also a Regional Warning Center of the International Space Environment Service (ISES). KSWC provides alert and forecast services for space weather events to minimize the impacts on satellites, aviation, communications, navigation, power grids and other technological systems. KSWC also develops new observation systems and prediction models and deploys them into operations.

In this talk, we will present KSWC's recent efforts to reinforce its service capabilities such as 1) providing timely space weather information; 2) operating observation systems; 3) developing and deploying new prediction models; and 4) preparing national response system against critical space weather events.

K-04: International Actions to Improve Space Weather Preparedness

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Keywords: International Cooperation, Research to Operations

Abstract

The impacts of space weather are becoming increasingly important due to our growing reliance on technologies that either depend on space-based assets or are affected by space weather storms. Consequently, national governments are recognizing space weather as an important risk area, and mitigation plans are being developed. At the same time, various international organizations are working to coordinate the national efforts and to advance our understanding of the risks and required actions. This presentation will focus on the activities of the International Space Environment Service, the World Meteorological Organization, the UN Committee on the Peaceful Uses of Outer Space, the International Civil Aviation Organization, and the Coordination Group for Meteorological Satellites. Each of these organizations has a unique role in the space weather enterprise. As these space weather efforts develop, it is essential that the space weather experts in every country work through their representatives in these organizations to ensure that effective progress is made in understanding the risks, developing accurate predictive services, maintaining the observing infrastructure, and achieving global coordination.

K-05: Space Weather Expert Group in the Committee on the Peaceful Uses of Outer Space of the United Nation (UNCOPUOS)

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Keywords: Space Weather, United Nation Committee on the Peaceful Uses of Outer Space

Abstract

The expert group for space weather was made under the Working Group on the Long-Term Sustainability of Outer Space. Activities in the Committee on the Peaceful Uses of Outer Space of the United Nation in 2010 and T. Obara was assigned a chair of the expert group. The objective of the expert group is to gather existing information on space weather and its impacts on space activities, and also on the current practices, operating procedures and technical standards for mitigating the effects of space weather phenomena on operational space systems. The expert group will provide this information to the Working Group for inclusion in its report and propose voluntary guidelines to enhance the safety of space activities and to reduce the risks from space weather phenomena to the long-term sustainability of space activities. The expert group intends to carry out its work and finish them by the end of 2013. The expert group has considered the topics and methods of work regarding the following scope, and has agreed to elaborate the consideration of these topics along the lines of what is indicated below: (a) Collection, sharing and dissemination of data, model and forecasts; The expert group will collect information on the current practices of States and organizations in terms of space weather observation and the various models and tools being used for space weather forecasts. The expert group has noted that this is the first attempt to collect and consolidate information of this nature from around the world. Thus the information collected will be useful information for all organizations related to space weather. (b) Capabilities to provide a comprehensive and sustainable network of sources of key data in order to observe and measure phenomena related to space weather in real or near-real time; It is important to form a network that continuously provides key data related to space weather in real time or near-real time. Further discussion is necessary to identify which are the key data to provide. Collecting information on data provision and the available networks will be the first step. (c) Open sharing of established practices and guidelines to mitigate the impact of space weather phenomena on operational space systems; Established practices to mitigate the impact of space weather phenomena on space systems vary from State to State, and even basic standards for the designing of satellites are different. The expert group has noted that as the situation concerning the sharing of knowledge and practices differs in each State, it may be difficult to compile information from all States. This expert group will work toward improving standards by eventually expanding the sharing of related information. (d) Coordination among States on ground-based and space-based space weather observations in order to safeguard space activities; The expert group recognizes the importance of coordination among States in space weather observations. The expert group will consider the possible modalities of sharing data. The expert group will also consider the risks arising from space weather, with a view to proposing which types of key data ought to be shared in order to safeguard space activities from detrimental effects of space weather

K-06: Regional Ionospheric Monitoring and Forecasting Using GNSS Techniques

Zahra Bouya, Michael Terkildsen, Matthew Francis, David Neudegg (IPS Radio & Space Services, Bureau of Meteorology, Sydney, Australia)
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Keywords: Regional Modeling, Forecasting SCHA, EOF, TEC, GPS, Australia.

Abstract

This paper proposes a new approach for monitoring and forecasting the Total Electron Content (TEC) over Australia using Spherical Cap Harmonic Analysis (SCHA) and Empirical Orthogonal Function (EOF) techniques. The SCHA method was firstly used to estimate TEC at evenly distributed grid points from GPS data collected from the Australian Regional GPS Network. The SCHA model is based on longitudinal expansion in Fourier series and fractional Legendre co-latitudinal functions over a spherical cap-like region including the Australian continent. This harmonic expansion requires less coefficients to represent the fine structure of regional ionospheric features than global Spherical Harmonic Analysis (SHA). EOF analysis was then used to decompose the TEC dataset into a series of orthogonal Eigen functions (EOF base functions) and associated coefficients, Principal Components (PCs). The base function represents the variation in TEC with latitude and longitude. The PCs represent the variation with time. The goal is to construct a regional model using the leading statistically significant (and predictable) components of the regional TEC and quantify the extent to which the reduced model can be used for the prediction on different time scales. Preliminary results show that modeling and forecasting on the lower-dimensional feature space (EOFs and PCs) is simpler, more efficient than the original TEC datasets.

K-07: The Activity and Supporting Facility Related to Space Weather Program in Indonesia

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Keywords: Space Weather, Observation Network

Abstract

Space weather monitoring program is the program of monitoring, assessment, and forecasting of the space environment, and describes the condition in space that affect earth and its technological systems as well. As government institution that conducts space research in Indonesia, Space Science Center of National Institute of Aeronautics and Space (LAPAN) conducts several activities in building information about space weather, which is consist of integrated monitoring, research and development on changes of space environment including solar activity, geomagnetic variation, and ionospheric variation, ionospheric modeling, as well as the impact on satellites orbit and earth environment. In supporting to the activities, an observation network has been established in Indonesia, operates several optical and radio-based observation equipments located in Indonesia archipelago. Lapan also conducts inter agency coordination for information of space weather, and also cooperates with some foreign institutions in terms of development of observational equipments, capacity buildings and data exchanges. Lapan is carrying out disseminations and public lectures regarding space research actively. On 2012 Lapan successfully hosted the international programs such as ISWI and MAGDAS School 2012, and recently ISYA 2013. In this paper, the current status as well as the future plan of the space weather program in Indonesia will be presented.

Oral Session Abstracts

RE

Space Environment Research and Exploration

November 5 (Tuesday) 13:30-15:30

Meeting Room 4, 2/F

RE-01: New Science Results from Van Allen Probes (aka Radiation Belt Storm Probes) Mission

Xinlin Li (University of Colorado, USA)
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Keywords: Radiation Belt, Dynamics, Van Allen Probes

Abstract

NASA/Van Allen Probes have been up and running for over a year, great sciences results have been obtained. Before showing some high lights of new science results from Van Allen Probes Mission, I would like to put Van Allen Probes Mission into historic perspective: the science motivation, community support, and practicality for such an unprecedented mission.

RE-02: The Research of Middle Upper Atmosphere by LIDAR Observations

Xiankang Dou (University of Science and Technology of China, China)
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Abstract

This talk covers the recent progress on wind lidar development and scientific research on sodium layer of our group in University of Science and Technology of China (USTC). In the recent years, we have established three lidar systems, which are aimed at the the measurements for the upper atmospheric wind fields, i.e., a 5-40 km mobile wind lidar, a 10-60 km ground-based wind lidar, and a 80-110 km narrow-band Na temperature and wind lidar. With the combination of these lidar systems, we can give a continuous wind detection from ground to the mesopause region. The basic feature, ability and the initial observational result are given in this talk. Based on the USTC sodium lidar together with adjacent radars located at Lijiang, China (26N, 100E), an observational campaign for the sodium layer was carried during March, 2012 to April, 2012. The thermospheric enhanced sodium layers (TeSLs) were detected and the formation process associated with these layers was suggested as an "Es - TeSLs (SSLs)" chain formed through the tidal wind shear mechanism. Further, based on the sodium lidars of the Chinese Meridian Project along 120E, the statistical features of sporadic sodium layers (SSLs) and the TeSLs, as well as the relationship between SSLs/TeSLs and the ionospheric sporadic-E (Es), at Beijing (40N, 116E), Hefei (31.8N, 117.3E), Wuhan (30.5N, 114.4E), and Haikou (19.5N, 109.1E) are shown in this talk.

RE-03: PC Index as a Proxy of the Solar Wind Energy that Entered and Accumulated in the Magnetosphere

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Keywords: Polar Cap, Magnetic Activity, Space Weather Monitoring

Abstract

Space weather monitoring basically rests on data on the solar wind parameters measured outside of the magnetosphere. These parameters are used to derive a hypothetic "coupling function", which is designed to monitor the solar wind geoefficiency and, correspondingly, the state of magnetosphere (i.e.space weather). The coupling function is determined as one or other combination of the solar wind parameters which provides the best correlation of "function" with the magnetosphere state, which is commonly evaluated either by magnetic activity in the auroral zone (AE index) or intensity of magnetic storm (Dst index). A number of "coupling functions" designed to monitor the solar wind geoefficiency is over 15 by now, but none of the "functions" is based on any experimental evidences of physical processes determining the solar wind-magnetosphere interaction. As a result, none of coupling functions is universal, i.e. suitable for adequate evaluation of quite different states of magnetosphere affected by the permanently varying solar wind. Estimation of the solar wind energy coming into the magnetosphere seems to be more straightforward and reliable way to resolve the problem. We demonstrate that the PC index, characterizing the polar cap magnetic activity, appears as an adequate indicator of the solar wind energy that entered into the magnetosphere this moment. Being calibrated for interplanetary electric field EKL [Kan and Lee, 1979], the PC index varies in conformity with the solar wind geoefficiency irrespective of UT time, season and point of observation. On the other hand, the following experimental facts make it clear that the PC index is steadily related to such space weather indicators, as AL and Dst indices: the substorm onsets are preceded and accompanied in all cases by the PC index growth; the substorms and storms start only if the PC index reaches the threshold value ~ 1.5 mV/m; the substorm intensity and growth phase duration are determined by the PCgrowth rate; substorms start to decay as soon as the PC index firmly falls below 1 mV/m; the substorms occurring under the northward IMF conditions are related to PC $\geq$ 2 mV/m; the PC index adequately responds to impulses in the solar wind dynamic pressure.

In addition, the magnetic storm duration and intensity are strictly controlled by such parameter as an accumulated-mean PCAM index (PCAM = ΣPC/ΔT, where values PC, summarized for running time of storm development ΔT, are divided by ΔT). Maximal storm intensity (maximal depression) is observed when PCAM approaches to maximum, and storm proceeds to recovery phase as soon as PCAM index ceases to grow. All these experimental facts are indicative for PC index as a proxy of the solar wind energy that entered into the magnetosphere, and for PCAM index as a proxy of the solar wind energy that accumulates in the magnetosphere. Therein lies the principal distinction of the PC index from various coupling functions (which are characteristics of the solar wind arriving to magnetopause) and from AL and Dst indices (which are characteristics of the energy that realized in magnetosphere in form of substorm and magnetic storms. The PC index in this charge can be successfully used to inspect different magnetospheric processes and to realize the quantitative space weather nowcasting and monitoring.

RE-04: Precursors, Similar Cycles and Prospects for Cycles 24 and 25

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Keywords: Solar Cycle, Solar Activity

Abstract

About two years ago the smoothed sunspot number curve has reached a plateau around a level of 65 or so. There are still no signs of a clear decay phase so the possibility that the official peak of cycle 24 is still ahead of us cannot be discarded. After presenting the current situation I will review what various forecasting methods predict for the ongoing cycle as well as for the upcoming cycle 25; how the prediction made at or before the last minimum have fared; chances for an upcoming grand minimum; and how the current and expected solar activity trends will affect the terrestrial environment.

RE-05: Introduction to the 1m New Vacuum Solar Telescope

Zhong Liu (Yunnan Astronomical Observatory, China)
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Abstract

The science goal of NVST is to observe the sun in the range from 0.3 to 2.5 micron by high resolution imaging devices and spectrometers combining with a polarization analyzer. The science cases are mainly focus on the fine structure of solar magnetic field and its evolution. NVST is an Alt-Az mounting telescope with 1200mm vacuum window and 980mm pure aperture. The focal length at F3 is 45m. The FOV is about 3 arc minute. The main instruments include the Multi-channel High Resolution Imaging System, the Multi-bands Spectrometer, the High Dispersion Near-infrared Spectrometer and the AO system.

RE-06: Prediction Method for High-Energy Solar Energetic Particle Events

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Keywords: Solar Energetic Particles, Space Radiation Environments

Abstract

Solar energetic particle (SEP) event is one of the most important topics in space weather research and prediction since SEPs cause severe radiation hazards such as satellite malfunctions, radiation exposure for astronaut, high radiation doses of aircrew, and loss of communications by high-frequency radio waves. Although our understandings of a nature of an SEP events has not been enough, a lot of researchers have tried to predict SEP event occurrence. However, all of them are empirical, statistical, or probabilistic predictions. A physics-based definitive prediction is quite difficult in the present status. On the other hand, predicting a temporal evolution of SEP intensity is also important, for example, to predict total radiation dose and to alert high radiation exposure level for astronaut and aircrew. As a temporal evolution of SEP intensity is roughly determined by SEP transport condition in interplanetary space, the temporal evolution of SEP intensity will be predicted by simulating interplanetary SEP transport. I focus this study on predicting high-energy SEP having energy over 100 MeV, which is highly important for astronaut radiation exposure. High-energy SEPs are hardly accelerated in normal interplanetary shock wave, only accelerated at reconnection region in solar flare and/or shock wave in solar corona, that is, high-energy SEPs are accelerated near the Sun followed by transported to the Earth in interplanetary space. The interplanetary SEP transport can be described by focused transport equation. In this study, I propose a new method to predict a decay phase of high-energy SEP event by using numerical simulation of SEP transport and observation data for initial phase of SEP event. The simulation is solving the focused transport equation by using a set of stochastic differential equations. The result of the simulation is fit to an initial phase of observed SEP event data obtained with GOES P6 channel by adjusting SEP injection profile near the Sun. The decay phase of the SEP event is calculated by using the adjusted SEP injection profile. This decay phase profile is truly prediction of the temporal evolution of the SEP intensity. I introduce the newly proposed prediction method and some results in this presentation.

RE-07: Operational Relativistic Electron Flux Forecast at GEO Satellite

[1]Tsutomu Nagatsuma, [1]Kaori Sakaguchi, [1]Yasubumi Kubota, [2]Shinji Saito, [3]Yoshizumi Miyoshi, and [3]Kanako Seki

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Keywords: Radiation Belt, Space Weather Forecast

Abstract

Dynamic changes of the Earth's Radiation belt are one of the well-known but still unsolved issue of solar terrestrial physics. This is also important for the practical point of view because relativistic electron can penetrate into a satellite body and causes deep dielectric charging. This phenomenon is one of the major reasons of satellite anomaly. For prediction of space environment around GEO, we will proceed to develop 1) near real time prediction model of relativistic electron environment, 2) high precision global MHD simulation in this 5-year term from 2011. As for the prediction model of relativistic electron environment, we plan to develop two types of models. One is near real time prediction model based on the AR model that is a kind of the parametric analysis methods for the time-series data. The product of this model is for daily operation of geosynchronous satellite. Based on the product, we are currently operating web pages of relativistic electron forecast for space weather users. The other is high time and spatial resolution numerical forecast model based on combination between global MHD simulation code and particle tracing code and others. The product of this model is for post analysis of satellite anomalies. In this presentation, we will introduce current status and future perspective of our project.

RE-08: Direct LET Measurement in Space

[1]Hongfei Chen, [1]Xiangqian Yu, and [2]Sipei Shao

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Keywords: Linear Energy Transfer, Single Event Effect, Space Radiation

Abstract

The single event effect (SEE) is important to electronic devices in space environment. It can lead to abnormal of spacecraft. The linear energy transfer (LET) of ions is a commonly value to study SEE. Using a thin detector is a valid and economic way to measure the LET directly in space since the measurement of heavy ions is restricted in cost and technology. The thin detector as a front detector (D1) along with a back detector that indicates ions penetrating D1 constructs a LET telescope. The thickness of D1 is 100 microns that may cause the highest LET boundary of some ions about four MeVcm2/mg lower according to Geant4 analysis. Though the LET of lower energy ion is non-uniform along the path, this error may be acceptable for engineering applications. The thickness of D1 should be ideally towards 5 microns to improve accurate for researches.

Oral Session Abstracts

FM

Space Weather Forecasting and Modeling

November 5 (Tuesday) 15:45-17:45

Meeting Room 4, 2/F

FM-01: Solar Eruptions: Numerical Simulation of the Coronal Plasma Dynamics Based on Photospheric Magnetic Field Observations

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Keywords: Solar Eruptions, CMEs, Numerical Simulation, Photospheric Magnetic Field Evolution

Abstract

For the construction of space weather forecast models it is important first to understand what mechanism triggers solar storms, Flares, CME eruptions. We take typical photospheric magnetic field observations observed prior to eruptions in combination with observed signatures of eruptions like CMEs. Then we carried out numerical simulations of the coronal plasma starting with the extrapolated to the corona photospheric magnetic fields observed prior to the observed CME eruptions to test hypotheses of what is causing their release.

FM-02: Predicting the Onset of Coronal Mass Ejections

Terry Forbes (University of New Hampshire, USA)
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Keywords: Coronal Mass Ejection, Initiation Mechanisms

Abstract

At the present time there is no reliable way to predict a day ahead of time when a coronal mass ejection (CME) will occur. In order to make reliable predictions a much better understanding is needed of the physical processes that lead to CMEs. Large solar eruptions, including those which produce CMEs, are most likely the result of a rapid release of magnetic energy that has been previously stored in the corona. A primary puzzle regarding such a process is the identity of the mechanism that triggers the energy release and initiates the eruption. One possibility is the onset of an ideal-MHD instability or, more generally, a sudden loss of an ideal-MHD equilibrium. A mechanism of this type would easily account for the fact that large eruptions typically occur on the Alfvén timescale in the corona. Another possibility is the onset of a resistive instability that involves magnetic reconnection, for example, the tearing mode. Models of both types have recently been developed as well as hybrid models that involve ideal and resistive processes acting in tandem.

FM-03: Questions that We are Facing in Forecasting CME's Arrival

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Keywords: Coronal Mass Ejection, Space Weather

Abstract

Whether or when a CME will hit the Earth are the two key questions in forecasting CME's arrival. For the first question, the size and propagation direction are two parameters determining if a CME can hit the Earth. For the second question, the propagation direction and velocity are two factors controlling its arrival time. Expansion, deflected propagation and acceleration of CMEs will make these parameters, the size, direction and velocity, changed during their way to 1 AU. In practice, how to get these parameters from 2D coronagraphic images are key questions that we need to solve before we can make an accurate forecasting. Various models have been developed to improve the accuracy of forecasting. In this presentation, we will review these questions and show you what have been solved and what still remain. Meanwhile, our recently statistical study of full halo CMEs during the solar cycle 24 are presented.

FM-04: Present Status and Future Perspective of AE/Dst Index Derivation

[1]Masahito Nose, [1]Toshihiko Iyemori, [2]Alexander Janzhura, [2]Oleg Troshichev, [3]Juergen Matzka, [4]Gunnlaugur Bjornsson, [4]Thorsteinn Saemundsson, [5]Gerhard Schwarz, [6]Yoshiki Ishii, [7]Pieter Kotze, and [7]Herman Theron

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Keywords: AE index, Dst index

Abstract

The AE index has been used to identify substorms or to estimate magnitude of ionospheric convection for more than three decades. This index is derived from the horizontal component of the magnetic field variations from 12 stations in auroral/subauroral latitude (61-70 degrees geomagnetic latitude (GMLAT)). These stations are Abisko [operated by SGU, Sweden], Dixon Island, Cape Chelyuskin, Tixie, Pebek [AARI, Russia], Barrow, College [USGS, USA], Yellowknife, Fort Churchill, Sanikiluaq (Poste-de-la-Baleine) [CGS, Canada], Narsarsuaq [DTU Space, Denmark], and Leirvogur [U. Iceland, Iceland]. Most of the stations are operated rather well and keep sending data to Kyoto University in quasi-real-time, which make it possible to provide the real-time AE index with science community. However, Russian stations had problems in operation since 1995. To solve the problems, we have been working in international partnership project, RapidMAG (Realtime Acquisition of Polar International Data from Magnetometers), which follows the PURAES (Project for Upgrading Russian AE Stations) project. These projects succeeded in resuming observations in most of Russian stations. At present, the provisional AE index is calculated by a few month delay, because it takes time to receive definitive data or visually check artificial noises with baseline correction. The provisional AE index is available by digital data from our WWW page (http://wdc.kugi.kyoto-u.ac.jp). The Dst index has been widely used to identify geomagnetic disturbances in low- and mid-latitude, in particular, development of geomagnetic storms. This index is derived from the horizontal component of the magnetic field variations from 4 stations in mid-latitude (|GMLAT|=21-34 degrees), which include Kakioka [KMO, Japan], Honolulu, San Juan [USGS, USA], and Hermanus [SANSA, South Africa]. Quasi-real-time data have been transferred from these observatories to Kyoto University with little problems, resulting in continuous derivation of the real-time Dst index and supply from our WWW page. The provisional Dst index is calculated after the definitive data are released from all of stations, thus it delays about 1-1.5 years. In the talk, we will review the present status and future perspective of AE/Dst index derivation.

FM-05: Global Simulation of the Solar Wind-Magnetosphere Interfaces: Magnetopause and Open-Closed Boundary

Jianyong Lv (Nanjing University of Information Science and Technology, China)
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Abstract

This presentation will introduce some of our new results on the global simulation of the solar wind-magnetosphere interfaces (the magnetopause and open-closed boundary). Using the numerical data from a physics-based global MHD model, we first construct a new function which is applicable for approximating global magnetopause locations at both low and high magnetospheric latitudes. This new model allows description of the cusp geometry as well as the azimuthal asymmetry, and is a function of interplanetary magnetic fields (BY and BZ), solar wind dynamic pressure (Pd), and dipole tilt. Model results agree well with empirical models from observation data, and effects of IMF BY, BZ, Pd, and dipole tilt on the magnetopause configuration parameters are analyzed. Then we look at a relatively unusual interval on 5th June 1998, where open/closed field line boundary can be determined in the ionosphere using a combination of instruments during a period encompassing northward to southward interplanetary field turning. It is shown that when the inner magnetospheric module (Rice Convection model) is incorporated, the modeling both qualitatively and quantitatively reproduces many elements of the studied interval prior to an observed substorm onset. These studies show the global modeling is able to provide a valuable and reliable tool for global magnetospheric topology, and suitable for the purpose of space weather.

FM-06: A Three-Dimensional Asymmetric Magnetopause Model

[1]Ruilin lin, [2]Xiaoxin Zhang, [1]Siqing Liu, [3]Yongli Wang, [1]Jiancun Gong

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Keywords: Magnetopause Model, Solar Wind

Abstract

Considering the asymmetries of the global structure of the magnetopause and indentations nearby the cusps, a new three asymmetric global model of the magnetopause is presented in this talk. Based on the magnetopause crossings from Geotail, IMP8, Interball, TC1, THEMIS, Wind, Cluster, 14 Polar, LANL, GOES and Hawkeye, and the corresponding upstream solar wind parameters from ACE, Wind or OMNI, this new model is parameterized by solar wind dynamic pressure and magnetic pressure (Dp+Bp), interplanetary magnetic field (IMF) Bz, and dipole tilt, and is constructed by the Levenberg-Marquardt method for nonlinear multi-parameter fitting step by step over the divided regions from the global system point of view. It is demonstrated that this model can be used to quantitatively study how Dp+Bp compresses the magnetopause, how IMF Bz erodes the magnetopause, how large the asymmetries of the magnetopause are, and how the dipole tilt influences the indentations and the asymmetries of the global magnetopause. In addition, the extrapolation for the distant tail magnetopause and for the extreme solar wind conditions is also considered for modeling magnetopause size and shape. Comparison with previous models implies that the standard deviation and the absolute deviation of the new model are obviously decreased. It is shown that this new model is not only appropriate to predict the magnetopause size and shape for the various solar wind conditions, but also can provide a reasonable estimation of the distant tail magnetopause shape. It is implied that this new model can be used to predict the magnetopause size and shape not only for theoretical research and numerical simulation, but also for space weather applications.

FM-07: Ensemble Prediction Model of Solar Proton Events associated with Solar Flares and Coronal Mass Ejections

Xin Huang and Huaning Wang (National Astronomical Observatories, China)
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Keywords: Solar Proton Events, Machine Learning

Abstract

An ensemble predictionmodel of solar proton events (SPEs), combining the information of solar flares and coronal mass ejections (CMEs), is built. In this model, solar flares are parameterized by the peak flux, the duration and the longitude. In addition, CMEs are parameterized by the width, the speed and the measurement position angle. The importance of each parameter for the occurrence of SPEs is estimated by the information gain ratio. We find that the CME width and speed are more informative than the flare's peak flux and duration. As the physical mechanism of SPEs is not very clear, a hidden naive Bayes approach, which is a probability-based calculation method from the field of machine learning, is used to build the prediction model from the observational data. As is known, SPEs originate from solar flares and/or shock waves associated with CMEs. Hence, we first build two base prediction models using the properties of solar flares and CMEs, respectively. Then the outputs of these models are combined to generate the ensemble prediction model of SPEs. The ensemble prediction model incorporating the complementary information of solar flares and CMEs achieves better performance than each base prediction model taken separately.

FM-08: Geomagnetic Indices Forecast Models in SEPC

[1]Bingxian Luo, [1]Siqing Liu, [1]Qiuzhen Zhong, [1]Jiancun Gong, [2]Xinlin Li, and [1]Yang Liu

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Keywords: Geomagnetic Indices, Forecast

Abstract

Geomagnetic storms and substorms are severe space environment events which can lead to many other geo-space environment disturbances such as the relativistic electron flux enhancement and upper atmosphere density enhancement. The forecast of geomagnetic indices is of important operational requirement. In this presentation, the forecasting models on geomagnetic indices such as Ap, Kp, Dst, and AU/AL/AE in SEPC/NSSC will be introduced. The Ap model, which was developed using auto-regressive method, gives the 27-day outlook of Ap using the historical Ap data as model input. The Kp, Dst, and AU/AL/AE models forecast the near real time geomagnetic condition using the ACE solar wind parameters. The Kp model was developed by neutral network method and can forecast the Kp index 1-3.5 hours in advance The Dst model was developed based on physical mechanism and forecasts the Dst index 2 hours in advance. The AU/AL/AE models forecast the indices about 1 hour in advance, which reflects the auroral electrojet activities in pole regions.

Oral Session Abstracts

RO

Space Weather: Research to Operations (R2O)

November 6 (Wednesday) 08:00-10:00

Meeting Room 4, 2/F

RO-01: NICT Science Cloud: A new approach to regional collaboration in space weather research and operation

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Keywords: NICT Science Cloud, Virtual Laboratory

Abstract

This paper is to propose a cloud system for data-intensive science, which has been developed at NICT (National Institute of Information and Communications Technology), Japan. The NICT science cloud is one of the cloud systems for scientists who are going to carry out their research works and operations for their own science including space weather. The science cloud is not for simple uses. Many functions are expected to the science cloud; such as data standardization, data collection and crawling, large and distributed data storage system, security and reliability, database and meta-database, data stewardship, long-term data preservation, data rescue and preservation, data mining, parallel processing, data publication and provision, semantic web, 3D and 4D visualization, out-reach and in-reach, and capacity buildings.

In the present talk, we introduce and demonstrate the efficiency of the science cloud, showing several space weather research and operation achievement with this cloud system. Special attempt is addressed on our future visions of regional collaborations on space weather research and operation.

RO-02: Space Weather Operations in China Meteorological Administration

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Keywords: Space Weather Operation, Observations, Warning and Forecast Service Products

Abstract

This presentation discusses the space weather activities in CMA in associated with the space weather observation, forecast and services. The activities of space weather operation is conducted by the National Center for space weather (NCSW) acting as a national level agency authorized by the national Council, to carry out the space weather operation and provide monitoring, warning, forecasting and services products for the different space weather users. The talk first introduces the current status of space weather activities in CMA that focuses on establishing the abilities in space weather observations, forecast and services. The observing facilities of space weather in CMA are then discussed including the spaced-based payloads onboard FENGYUN meteorological satellites, the ground-based instruments for monitoring the solar upper atmospheric and ionospheric activities, as well as the GPS/MET network. This talk also briefly introduce the Meteorological Monitoring and Forecasting Project and the Meridian Circle Program that design to build the observation networks over China to monitor the space weather disasters for research and operation. The WMO related space weather activities will be finally discussed in associated with defining the basic observing requirements for space weather with the goal of integrating the space weather observations into the WMO Information System.

RO-03: Operation of Two Solar Wind Prediction Models at Korean Space Weather Center: ENLIL and IPS Tomography

Jung-Hoon Kim, Sae-ho Yoo, and Ji-Hye Lee (SETsystem, Inc., Korea)
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Keywords: Solar wind model, ENLIL IPS

Abstract

From 2013, two different forecasting models are currently in operation at Korean Space Weather Center (KSWC) for the prediction of solar wind and CME. One is the WSA-ENLIL-CONE model which is developed by Dr. Dusan Odstrcil (JMU). and the other is Time-dependent 3D IPS Tomography model developed by Dr. Bernard Jackson (UCSD). Both models are works for the prediction of solar wind, especially the propagation of the CME. These two models works for the same purpose but different techniques are used. One is MHY physics based, the other is Kinematic model based on ground observation of IPS sources. As the KSWC start to run both models for operational purpose from this year, we would like to introduce the status of the model operation and lessons learned from the both model. In addition, possible way of combine two models to provide more realistic solar wind forecast are discussed.

RO-04: Space Anomalies and Space Weather: Relationship, Alarms and Countermeasure

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Keywords: Space Environments, Space Weather, Anomalies, Alarm, Countermeasure

Abstract

Spacecrafts operating in orbits interact with space environments inevitably. The relationship between space anomalies and space weather is analyzed here proceeding with spatial-temporal phenomenon and inherent mechanism. Rules of alarms for space weather events are also discussed subsequently. Finally the author introduces the countermeasures considered in design and lash-up scheme in operating management.

Many of the numerous spacecraft anomalies were caused by space environments. Some anomalies were commendably corresponding with space weather events for spatial and temporal characteristic. Further more, the way and interacting mechanism that space environments affect spacecrafts were relatively clear. For example, increasing of hot plasma intensity may lead spacecraft surface charging, and sola proton events can cause SEE probability ascend. Scientific and engineering departments such as NOAA-SWPC and CAS-SEPC are all through developing monitoring, prediction and alarms of space weather, which have effectively supported the design and management of spacecrafts. Scientists have definited the criterion of some space weather events such as flux of proton with energy large than 10 MeV exceeding 10 pfu for solar proton events, and Kp index reaching up to 5 for geomagnetic storm. Even so, the criterion for space weather events causing anomalies needs further discussion because it must be considered synthetically by combining space science and actual aerospace industry level. At the end of the paper, defending measures against space environment effects are presented which are adopted by space engineering departments, also including treatments for emergency in orbits.

RO-05: Automatic Solar Synoptic Analyzer, the Analog-to-Digital Converter for SWx Prediction

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Keywords: Solar active region, Flare prediction

Abstract

The Korean Space Weather Center, Radio Research Agency and SELab has developed the unmanned, fully digitized, and real-time operational system for the sunspot and magnetic field classification, which is named ASSA(Automatic Solar Sunspot Analyzer) The system has 3 functionalities of the detection or classification: 1. Solar active region 2. filament 3. coronal hole, and it is now producing the results of physical parameters with 1 hour cadence. The pipeline of procedures for ASSA system include various kinds of image processing techniques including algorithms for intensity thresholding, morphological open/close, region growing and grouping based on the separation of each sunspot. Afterwards, each identified sunspot group is further processed to determine its McIntosh and Wilson magnetic class through estimation of quantitative parameters such as existence and maturity of penumbra, longitudinal coverage extent, compactness of sunspots aggregation, complexity of magnetic neutral lines, etc.. The basic theory of classification scheme is based on SIDC user guide on sunspot group classification. The resultant images and text data can be accessed at the official website of Korean Space Weather Center (http://www.spaceweather.go.kr/models/assa). Additionally, a standalone application program for ordinary users called ASSA GUI is being distributed at its official website (http://www.spaceweather.go.kr/assa), with which users can experience the same procedures of ASSA on their own computers. Since the derived physical quantitative parameters are the inherited product from ASSA as a proxy of flare prediction, we are on the way to apply the algorithms to the past archive of SOHO MDI images during 1996-2011.

RO-06: The Development of Operational Models for Space Weather Forecasting at SEPC

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Abstract

The development of operational models is very important for improving the capabilities of space weather forecasting. Although a number of research models have been developed, their utilization in space weather forecasting is still limited. Currently, the transitioning of research models to operational models is still a difficult work. In this presentation, the differences between research models and operational models are analyzed, based on the experience of space weather forecasting services and application of models at SEPC. Two ways are recommended for developing operational models: one is transition of research models, the other is developing operational models directly according to space weather forecasting needs. Furthermore, the requirements of research models for potential transitions to operational models and the basic transitioning process are discussed. A platform for model transitioning and some operational forecasting models developed and used at SEPC are also introduced in the presentation.

RO-07: The Discussion on Space Weather Forecast Verification

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Keywords: Forecast Verification, Space Weather

Abstract

If we take the term forecast to mean a prediction of the future space weather, then forecast verification is the process of assessing the quality of a forecast. The forecast is compared, or verified, against a corresponding observation of what actually occurred, or some good estimate of the true outcome. The verification can be qualitative or quantitative. In either case it should give us information about the nature of the forecast errors. This report introduced the world's major space environment forecast organization. There are many categories of forecasts, each of which calls for different methods of verification, such as space weather event probability forecast, solar activity index and geomagnetic activity index forecast. We compare the verification methods from the different forecasting organization. At last, we discuss the suited verification methods for different forecast products.

RO-08: The Operational Space Weather Data System in NSSC, CAS

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Keywords: Space Weather Data System, Observing Network

Abstract

Data is the driver of an integrated space weather system from monitor to service. Building the operational space weather data system is very important. Working 24/7, running automatically, collecting and providing real-time, accurate and stable data are the characteristics of operational data system. Under this background, an associated project, which is funded by National High-tech R&D Program of China (863 Program), is initiated in September 2011, leaded by National Space Science Center (NSSC) and joined by other 7 institutes from Chinese Academy of Sciences (CAS). The purpose of the project is to achieve an active, synergistic, interagency data system which provides data base for operational weather service. In the project, a set of domestic ground-based space weather observing instruments located all around the whole country were integrated, and a ground-based space weather observing network was built, consisting of 39 instruments for monitoring five aspects of the space weather: Sun/Solar, cosmic rays, geomagnetic field, ionosphere, and the upper atmosphere, at 17 monitoring stations. The different data of particular space weather environmental parameters from the observing network and international website, standardized at aspects of sampling frequency, format, and file naming rules as well as transport protocols, was automatically collected and processed in NSSC with the daily dataset size of around 25 GB. It is the first operational data system in China that has functions of space weather monitoring and data transferring, pretreatment, and analyzing. Therefore, data from the system can be utilized for space weather modeling and relevant forecasting applications, such as Kp index modeling, Solar Proton Event Warning, Geomagnetic Storms warning and so on

Oral Session Abstracts

SA

The Research on Solar Cycle Activity

November 7 (Thursday) 08:00-11:45

Meeting Room 4, 2/F

SA-01: Empirical Approach to Predicting Key Parameters for a Sunspot Number Cycle

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Keywords: Sunspot Cycle Prediction

Abstract

The common methodologies used to predict the smooth sunspot numbers (SSNs) at peak (Rmax) and the rise time (Tr) for a cycle are noted. The estimates based on geomagnetic indices gave the best prediction of Rmax for five SSN cycles (20-24). In particular, an empirical technique invoking three-cycle quasiperiodicity (TCQP) in Ap index has made accurate predictions of Rmax and Tr for two consecutive SSN cycles (23 and 24). The dynamo theories are unable to account for TCQP, if it endures in the 21st century we shall enter a Dalton-like Grand minima. Earth was cooler then. The current status of the ascending phase of cycle 24 activity is described and discussed.

SA-02: Solar Cycles Amplitudes

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Keywords: Solar Cycle, Amplitudes

Abstract

Observations constrain both the systematic non-linear and random causes of the variation in the strengths of different cycles. Here we outline the major effects and their physical causes. We will then discuss predictions and their associated error bars.

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SA-03: A New Sunspot Number: Diagnostics of Recent and Past Trends in Sunspot Statistics.

Laure Lefevre, Frédéric Clette (Royal Observatory of Belgium, Belgium)
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Keywords: Sunspots Diagnostics, Long-term

Abstract

The international sunspot number (often referred to as the SSN series), based on visual sunspot counts, is widely used as the main reference index characterizing the long-term evolution of solar activity over time-scales of decades to centuries. It has been maintained at the World Data Center (WDC) in Brussels, since its transition from Zürich in 1981. Given the recent unexpected changes in cycles 23 and 24, it has become even more important to better understand the historical evolution in the production of this prime index and to assess the long-term stability of its absolute scale. Therefore, we first review the properties of this series, the past and present calculation methods as well as the relation between the sunspot number and other solar indices and standard fluxes available over the last decades. Using such comparisons, a few possible disruptions and biases have recently been identified in this historical sunspot series over the 19th and 20th century, with magnitudes of 10 to 20%. We report recent progresses in the identification of possible causes and we outline the proposed corrections to the standard sunspot number based on those diagnostics. By providing a 400-year perspective, the sunspot index also helps us to better put the recent anomalies of the cycle 23-24 transition in a secular perspective. We will consider here how recent global trends in detailed sunspot properties, like the decline of the average spot core magnetic field (Penn-Livingston effect) or a scale-dependent small-spot deficit, could explain the reported divergence between the sunspot number and several other solar activity indices, like the F10.7cm radio flux. We interpret the current change in the sunspot number as a genuine evolution in the sunspot production. With cycle 24, the Sun is apparently returning to an average activity regime that prevailed during most of the last 300 years, before the tight succession of 5 strong cycles marking the last 60 years. Given this unique "grand-maximum" episode and the observed scale-dependent changes in sunspots, the current solar proxies may need to be re-calibrated to match past weaker solar cycles, using more than a simple linear rescaling. We conclude on the prospects of an end-to-end correction of the original pre-1981 Zürich SSN series as well as an extension of the sunspot number record, with the extraction of detailed sunspot information from archives of past sunspot drawings and imagery, and inevitably the future transition to CCD-based indices. Early applications support e.g. the existence of a deficit of the smallest spots during cycle 23, as well as a strongly reduced difference between the high activity of the late 20th century and earlier historical levels. This updated SSN will thus mark a major step forward in a long history and will likely lead to significant adjustments and revisions in various models, indices and interpretations.

SA-04: Flowing Features in the CME/Flare Current Sheet Shown in GHz band

Jun Lin (Yunnan Astronomical Observatory, China)
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Abstract:
We investigate the spectral fine structure of a solar radio burst observed by the Solar Broadband Radio Spectrometer (SBRS) at the Huairou Solar Observing Station in a CME/flare event on December 1, 2004. The data display various patterns of plasma motions, suggestive of the interaction between sunward moving plasmoids and the flare loop system during the impulsive phase of the event. By comparing with the observational consequences of the standard model of two-ribbon flares, we identify several typical motions that are expected to occur in the reconnecting current sheet and in the cusp region on top of the flare loops. These include the sunward motion of plasma on reconnected field lines in the CME/flare current sheet, the reconnection outflow and embedded plasmoids, emission stripes of zero frequency drift as an indicator of the termination shock on the loop top, and the growth of the flare loop system together with the shrinkage of individual flare loops. In addition to the radio data, we also studied data in white-light, H, EUV, soft and hard X-rays. These data show a fast CME at a speed exceeding 800 km/s and the separation of footpoints of the flare loops in agreement with the height of the flare loop system estimated from the radio data.

SA-05: Research about the Real Time Flare Onset Detection Algorithm

Jiaben Lin, Juan Guo, and Yuanyong Deng (National Astronomical Observatories, Chinese Academy of Sciences, China)
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Keywords: Flare Intelligent Detection, Space Weather

Abstract

Flare is one of the most explosive activities on the solar surface and it's believed the source of many fierce space weather events. Detecting the onset of the H-alpha flare and alert relative staffs are very important. The Full-disk H-alpha telescope in Huairou Solar Observing Station could get high resolution data of the solar chromosphere. According to the features of the full disk H-alpha image, we developed a real time flare on-set detection method for it. During the first week of test observation, our system captured all the two flares above C5.0, the onset time from our system is close to the GOES X-Ray's results, and the alert message were sent in 20 seconds.

SA-06: Sunspot Monitoring at Langkawi National Observatory

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Keywords: Relative Sunspot Number (RSN), Langkawi National Observatory (LNO)

Abstract

The atmosphere of sun is full with hot gases, charged particle and magnetic fields. Earth is affected not only by light from the sun but also by the ejection of the solar wind and huge masses of energetic particles that buffet Earth's magnetosphere. Variations in the Sun's cycle also influence Earth's weather. Langkawi National Observatory (LNO) observed the sunspot through the use of TMB 152 and a SBIG STL4020M camera. This paper will discuss the consistency between RSN values obtain through LNO digital images but goes through the same sunspot counting as determined by SIDC visual sunspot method.

SA-07: The 24th Solar Cycle--A Very Small Cycle

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Keywords: Sunspot Number, Sunspot Area

Abstract

Base on several fields, such as sunspot numbers, spotless days, sunspot areas and solar 10.7 cm flux, we can see that the 24th solar cycle is very small cycle. Does the solar activity reach to the maximum of 24th solar cycle by now? From different space environment events, compared with last several cycles, how infrequent is the 24th solar cycle? What about the activity of 24th solar cycle in the next few years?

SA-08: A New Concept of Solar Activity Forecast

Huaning Wang, Xin Huang, Xinhua Dai, Xiaoshuai Zhu, Zhanle Du, Han He, and Yan Yan
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Keywords: Solar Activity, Solar Eruption

Abstract

It is well known that the information of solar eruptions impacting on the Earth can hardly be provided with the normal solar activity forecast focusing on probability of solar flares and solar energetic particle events. A new concept of solar activity forecast is introduced in which the erupting frequency and the main attack direction of major solar eruptions will be considered.

SA-09: Solar Cycle Predictions

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Keywords: Solar Activity, Solar Cycle

Abstract

It is important to predict the level of solar activity well advance, because solar activity affects us. While solar flares and coronal mass ejections pose a serious hazard to astronauts, satellites, polar air-traffic, electric power grids and telecommunications facilities on short time-scales ranging from hours to days, the solar radioactive output affects planetary and global climate on much longer time-scales (from decades to stellar evolutionary time-scales). In addition, the prediction may also provide an important clue for understanding the basic mechanism of solar cycle, i.e. models of the dynamo are validated by their ability to predict solar activity over short and long time-scales. Many attempts have been made to predict the amplitude of solar cycle 24. A majority of them are based on different precursors. The basic principle behind the method of precursors is that the solar magnetic field persists for quite some time and hence a cycle will have a relationship with the one or two preceding cycles. The magnetic fields at different heliographic latitudes during different time-intervals of a solar cycle might contribute (/related) to the activity at the same or different heliographic latitudes during its following cycle(s). These different latitude bands of activity could produce correlations useful in predictions. With this hypothesis we analyzed a large set of sunspot group data and predicted the amplitudes of solar cycles 24 and 25 (qualitatively). In the proposed invited report the summary of our work and the analysis of our method will be presented, and the predictions of cycle 24 will be updated.

SA-10: Some Results of Research on Solar Cycle Activity using Vietnamese Geomagnetic and Ionospheric Date

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Keywords: Solar Cycle Activity, Geomagnetic and Ionospheric Data Collaboration, Space Weather Studying and Forecasting

Abstract

Vietnam maintains a network of four magnetic observatories: Chapa, installed from 1957, Phu Thuy, from 1967, Da Lat, created in 1981 and Bac Lieu, built from 1988 in the magnetic equator region, and two ionospheric stations: one in Phu Thuy from 1961, and the other in Bac Lieu from 2005. From 1995, thanks to the cooperation with the French CNRS, Phu Thuy has become a member of INTERMAGNET (International Real-time Magnetic Observatory Network) program. Also, from May 2013, the Intermagnet Executive Council has certified that Da Lat observatory is recognized as a full participating member of INTERMAGNET. From 1998, thanks to the cooperation with the SERC (Space Environment Research Center), Kyushu University, Japan, Bac Lieu has become a member of MAGDAS (MAGnetic Data Acqusition System) network. From 2005, thanks to the cooperation with the NICT (National Institute of Information and Technology) of Japan, the ionosondes at Phu Thuy and Bac Lieu have become the members of the SEALION (SouthEast Asia Low-latitude IOnospheric Network) program. The data from these observatories were and are very useful to the space weather researches in Vietnam and in the World. The integration of these data into the scientific community is more active, when Vietnam become a member of the Asia-Oceania Space Weather Alliance-AOSWA in the beginning of 2012. In Vietnam, the study of the space weather has a special features due to the existence of the Equatorial ElectroJet, which passes through the Southern part of Vietnam territory, making the geomagnetic−ionospheric field to bear the special characteristics in comparison with the others regions of the World. From the research on these data, one has obtained important results on the normal magnetic fields, secular variation, magnetic variations, Equatorial ElectroJet, Equatorial Anomaly, solar eclipse, magnetic impulsations, ionosphere, plasma bubble, especially magnetic storms and their impacts on the high electric power transmission lines 500-220kV , petrol and gas pipe-lines… in Vietnam. In this presentation, we present some results of research on the solar cycle activity using these geomagnetic and ionospheric data. From the studies using the geomagnetic data of Vietnam from 1957, the first International Geophysical Year, and ionospheric ones from 1962, one shows that many features of geomagnetic and ionospheric fields manifest the 11-year solar cycle activity, such as diurnal solar quiet Sq variation, Equatorial Electrojet, equatorial counter electrojet, especially magnetic storms, and various parameters of the ionosphere, like critical frequencies of ionosphere's various layers foF2, foF1, foE, fmin, foEs…, theirs apparent heights h'Es, h'E, h'F, h'F2… Also, one shows that the strong Geomagnetic Induced Currents GIC obtained in the power line 500-220kV in Vietnam appeared almost in the maximum solar activity (2001-2002). We discuss also about the collaboration of Vietnam with the other members of AOSWA on space weather studying and forecasting, in the frame of this AOSWA.

SA-11: Maximum of Solar Cycle 24

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Keywords: Solar Cycle, Sunspot Number

Abstract

It is important for space weather to forecast of amplitude of a solar cycle because occurrence numbers of solar flares and geomagnetic storms depend on solar activity level. Signatures of declining or minimum phase of the cycle 23 suggests lower maximum of cycle 24. For example, there are 265 no-sunspot days in 2008. Present maximum sunspot number of cycle 24 is 66.9 recorded in February, 2012 according to monthly smoothed sunspot number by the SIDC. This value is smaller one since cycle 14. Yearly average of geomagnetic aa-index in 2012 is 16.38 and this value is also small comparing with resent several cycles. However, solar proton events with flux exceeding 6,000 pfu occurred in January and March, 2012 and air lines enrooted from polar route to lower latitude at these moments. Minimum of cycle 23 occurred between November and December in 2008 according to the monthly smoothed sunspot number. Rise time of cycle 24 is 39 months from the minimum to the maximum if we assume that the maximum occurred in February, 2012. There is a positive correlation between rise time and maximum sunspot number. Cycles with shorter rise time usually tend to have larger maximum sunspot number. On cycle 24, the rise time is shorter comparing with past cycles although maximum sunspot number is small. We will report the result of our statistical analysis on activity of cycle 24.

SA-12: Solar Bi-dynamo Model

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Keywords: Sun: dynamo, Solar cycle, Sunspots, Solar Flares

Abstract

The solar cycle is found to be governed substantially by a bi-dynamo model forming two stochastic processes depicted by a bimodal Gaussian function with a time gap of about two years. The first one describes the usual properties of the cycle dominated by the current solar dynamo models, and the second one occurs either in the rising phase as a short-weak explosive perturbation or in the declining phase as a long stochastic perturbation. We find that the secondary process is closely associated with complicated sunspot groups. In addition, the recent cycles 23 and 24 are found to have unusual shorter decay times and shorter durations but longer rise times for major flares (M, X) than the past cycles 21 and 22.

SA-13: Solar Observation Based on Atomic Frequency Discriminator

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Keywords: Solar Observation, Dopplergram Atomic Filter

Abstract

The atomic frequency discriminator (AFD) is of ultra narrow bandwidth optical frequency discriminator with high stability and wide field of view. The solar observation based on AFD offered high spectral resolution images for solar physics and space weather. In this paper, the AFD and its application in solar observation were reported. The theory and experimental technology of AFD was discussed. Then a solar telescope with a special sodium AFD was designed to observe solar chromospheres and Doppler image. And the active region structures in chromosphere were observed by solar telescope with the atomic discriminator. The preliminary observational results of chromosphere were analyzed

SA-14: A Three Dimensional Self-similar Expansion Model and 3 April 2010 Coronal Mass Ejection Case Study

Jingjing Wang, Bingxian Luo, Siqing Liu, and Jiancun Gong (National Space Science Center, Chinese Academy of Sciences, China)
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Keywords: Coronal Mass Ejections, STEREO

Abstract

Various models that can forecast the speed, direction, width of the interplanetary coronal mass ejections (ICME) in the ecliptic plane from outside the Sun-Earth line have been developed based on the observations from the Heliospheric Imager (HI) on board a single spacecraft of the Solar TErrestrial Relations Observatory (STEREO), such as Fixed-Φ (FΦ), Harmonic-Mean (HM), and Self-Similar Expansion (SSE) fitting. SSE fitting assumes that the ICME front is a self-similar expansion circle with a fixed propagation direction and angular width. The propagation direction, speed, and angular width on a selected position angle can be calculated based on the time-elongation profile of a given position angle constructed by the HI observation. FΦ and HM fitting can be regarded as particular cases of SSE fitting with 0 degree and 180 degree angular width, respectively. In this paper, we further develop the SSE fitting to three dimensions (3D-SSE) by fitting the time-elongation profiles constructed from a collection of position angles (PAs) from single-spacecraft with respect to the former methods based on only one position angle. This enables us to forecast the propagation parameters of ICME in three dimensional space. Using the 3D-SSE fitting, assuming that the ICME might be slow-varying in structure and propagation direction but can still be regarded as a self-similar expansion sphere in a short time period, the variations of 3D parameters of the ICME such as the direction and angular half-width can be fitted and studied. By this method, the 3 April 2010 CME is investigated and the propagation should be called practically radial shown within HI's field-of-view.

Oral Session Abstracts

IT

The Research on Ionosphere and Thermosphere

November 7 (Thursday) 08:00-11:45

Meeting Room 1, 2/F

IT-01: The Thailand Ionospheric and GNSS Data Center Project

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Keywords: GPS TEC, Ionosphere

Abstract

This work presents the setup of ionospheric and GNSS monitoring networks and the efforts to create a GNSS and ionospheric database in Thailand. These data are important for the study of ionosphere and its effects on the space weather, aeronautical navigation and satellite communication. At present, NICT and KMITL have cooperated to implement GNSS receivers at several provinces of Thailand such as Chiangmai, Chumphon, Bangkok and Phuket. In addition, other GNSS receivers in 4 more provinces have been added. These data are now sent the KMITL Data Center. Current research efforts are the analysis of bottomside ionospheric parameters based on ionosonde measurements, the delay gradient analysis for the aeronautical applications as well as 2-D TEC maps. In the presentation, we will discuss some of the research results utilizing the collected data.

IT-02: GPS Monitoring of Ionospheric Disturbances

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Keywords: GPS TEC, Ionospheric Disturbances

Abstract
The global navigation satellite system GPS and ground-based networks of GPS receivers constitute a powerful tool for remote diagnostics of the ionosphere and ionospheric disturbances. The Institute of Solar-Terrestrial Physics of Siberian Branch of Russian Academy of Sciences began using GPS signals for studying ionospheric disturbances in 1996. We have developed a new technology for global detection (GLOBDET) of ionospheric disturbances on the basis of GPS phase measurements of total electron content (TEC). During 15 years, we have investigated a large number of ionospheric disturbances from different sources: magnetic storms, solar eclipses and solar flares, solar terminator, earthquakes, and tropical cyclones. Our most interesting results are presented in this report. Analyses of dynamics of TEC disturbances during geomagnetic storms allowed us to reveal two types of TEC disturbances appearing in an auroral zone, to determine characteristics of storm induced large-scale TEC waves, and to show that these waves are followed by an increase in intensity of smaller-scale TEC irregularities. A coherent integration technique provides assured detection of ionospheric response to strong (X-class) and weak (C-class) solar flares. Ionospheric response intensity was demonstrated to depend on a class of a flare, its emission spectrum, and on its position on the Sun's disk. The analysis of ionospheric effects of the solar terminator revealed that there are disturbances caused by terminator passage through a region at a magnetic conjugated point. Studies of TEC responses to more than 25 earthquakes of various intensities over a period of 1999–2012 revealed a threshold magnitude of Mw~6.5 below which no earthquake-induced significant TEC wave disturbances are observed. After severe earthquakes (Mw>7), we detected several modes of TEC disturbances and noted different behavior of mode propagation in various directions from an epicenter. It was found that over a tropical cyclone (TC) trajectory there is a region of ionospheric plasma irregularities which is formed when the cyclone becomes a hurricane. The amplitude of an ionospheric response to a TC is subject to the height distribution of meteorological parameters over the TC. We have developed a method for determining global electron content (GEC). GEC can be used as a state index of near-Earth space.

IT-03: Development of a Whole Atmosphere-Ionosphere Coupled Model for Space Weather Forecast

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Keywords: Atmosphere, Ionosphere, Model

Abstract

Space near the Earth, called geospace, is a highly complex system, consisting of the solar wind, the magnetosphere, the ionosphere, and the neutral atmosphere. Those regions have different physical characteristics with different temporal and spatial scales. In particular, the magnetosphere, the ionosphere, and the neutral atmosphere are strongly coupled with each other, and interaction between the regions is nonlinear and extremely complicated. Even within each region, there are strong interactions between physical processes with different temporal and spatial scales. Furthermore, the geospace environment significantly varies as electromagnetic energy and particles from the sun vary. In order to quantitatively understand such a complicated system, it is necessary to model the entire region by including all fundamental processes self-consistently. Various types of global numerical models of geospace have been constructed and used to study space weather disturbances in many institutions in the world. At the National Institute of Information and Communications Technology (NICT) of Japan, a solar wind model, magnetosphere model, and ionosphere-thermosphere model were constructed. However, recent observations have revealed that atmospheric waves generated in the lower atmosphere significantly influence the upper atmosphere, the ionosphere, and possibly the magnetosphere. In order to quantitatively study the effects of the lower atmosphere on the ionosphere, we have recently developed an atmosphere-ionosphere coupled model, which includes the whole neutral atmosphere and the ionosphere. The model is called GAIA (Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy). Using GAIA, relationship between the ionosphere and the atmosphere is being studied. We are also incorporating magnetospheric inputs to the polar ionosphere. We will report the status and future plan of the space environment study using GAIA.

IT-04: A New Data Format to Promote International Exchange and Share of GNSS-TEC Data

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Keywords: GPS TEC Format, Data Share

Abstract
Several 100 km to 1,000 km scale ionospheric variations caused by equatorial plasma bubble and/or travelling ionospheric disturbances can degrade singlefrequency GNSS positioning and differential GNSS positioning. However, these ionospheric disturbances have not been monitored enough due to the lack of dense wide-coverage ionospheric observations. One of the most effective methods for such dense and wide-coverage ionospheric observations is twodimensional TEC observations using a dense GNSS receiver network. Dense GNSS receiver networks are now available only limited areas such as Japan, North America, and Europe. It is needed to expand the GNSS-TEC observation area using all the available GNSS receiver networks with international collaboration of ionosphere and space weather researchers in the world. We propose a new data format, GNSS-TEC Exchange format (GTEX), to promote international exchange and share of GNSS-TEC data. The main concept of the GTEX is to include slant TEC data from each GNSS receiver. By sharing slant TEC data which are not converted to vertical TEC, various ionospheric studies may be possible without affected by specific analysis procedures such as satellite/receiver bias estimation, or different mapping heights. The structure of GTEX is designed to be as close to the format of GNSS observation data (RINEX) as possible, because RINEX is a de facto standard in exchanging GNSS observation data and potential users of GTEX would be familiar with RINEX. We will present recent activities related with GTEX in AOSWA, ICAO/ISTF, and ITU-R.

IT-05: Modeling and Prediction of Global Ionospheric Delay with IGS Ground-based GNSS Observations

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Keywords: Ionosphere Modeling Prediction

Abstract

IGS ground-based GNSS observations provide large quantity of data with high temporal and spatial resolution which are needed in ionospheric delay modeling and forecast. Here, we use the data from many GPS/GLONASS sites of the IGS to generate the Global Ionosphere Maps and obtain the time series of the spherical harmonic coefficients. Then, with the Two-Variable regression analysis, we find the periodic trend of the time series and use the AR model to predict the time series of the spherical harmonic coefficients. Finally, we get a global ionosphere forecast model, and give the accuracy assessment of the result.

IT-06: A Statistical Analysis of Occurrence Characteristics of Spread-F Irregularities over Indian Region

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Keywords: Equatorial Spread-F, Low-latitude Ionosphere, Geomagnetic Storms, Ionospheric Irregularities

Abstract

In this study, we investigate the regularities of a change in spread F probability during the sunrise, sunset, latitudinal behavior and their response to geomagnetic storm in equatorial and low-mid latitude stations. The occurrence characteristics of spread-F irregularities, is obtained from daily hourly ionosonde data from a low-mid latitude station, Delhi (28.6N, 77.2E), for about half a solar cycle (2001 to 2007). The latitudinal behavior of spread-F is studied using ionosonde data from anomaly crest station, Ahmedabad (23.01N, 72.36E) and equatorial station, Kodaikanal (10.2N, 77.5E) for low, moderate and high solar activity periods, namely 1986,1988 and 1989 respectively. The maximum percentage occurrences of spread-F were observed during the low solar activity year 2007, which may be attributed due to the existence of gravity waves. An anti-solar activity correlation to Spread F occurrence is reported during winter and equinox seasons at different stations which are because of instability generated by the trans-equatorial meridional wind. There is a substantial variation during pre and post midnight hours in h'F from equatorial to low latititudes in response to magnetic disturbances. The established irregularities are qualitatively interpreted and discussed.

IT-07: Ionospheric Response to CIR-induced Recurrent Geomagnetic Activity during the Declining Phase of Solar Cycle 23

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Keywords: Ionospheric Response, CIR-produced Geomagnetic Activity

Abstract

Based on GPS-TEC data from the Madrigal Database at the MIT Haystack Observatory and electron density data obtained by CHAMP PLP observations, we investigated ionosphere responses to recurrent geomagnetic activity during 79 CIR events from 2004-2009. The results show that global ionosphere responses to CIR events have some common features. At high latitudes, TEC and Ne data show a significant positive response (increased electron densities) after CIR events starting during local daytime. This response is possibly related to the electron density enhancement in the topside ionosphere during CIR induced geomagnetic activity. At middle to low latitudes, a positive effect always starts 2-4h after the CIR starting during local daytime and 12-15h later for CIR onset during local nighttime. Case studies indicate the TEC positive response has a strong dependence on the southward component (Bz) of the interplanetary magnetic field and solar wind speed. This means that penetration electric fields are an important process in causing the positive ionospheric response. During the recovery time of the CIR-produced geomagnetic activity, the TEC disturbance at low latitudes sometimes could last for 2-4 days, whereas that at middle to high latitudes occurred only for 1 day in most cases. A comparison of the ionospheric responses between the American, European and Asian sectors shows that the ionosphere response in the North American sector is stronger than that in the other two regions.

IT-08: Space Weather and Space Climate: Ionospheric F2-region variability and sudden stratospheric warmings

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Keywords: Ionospheric Variability, SSW, Space weather, Space Climate

Abstract

The ionospheric F2−region is known to show a large day- to-day and hour-to-hour variability. Some of this variability has recently being linked to sudden stratospheric warmings (SSWs). The extent of ionospheric changes following SSWs of 2007, 2008 and 2009 using ionosonde data from six different stations in the Asian zone thus covering a broad latitudinal range from 23.2°N to 45.1°N is been investigated. It has been found that ionospheric F2-region shows some significant perturbations soon after the start of the warming. However characteristics of these perturbations vary from event to event and from station to station. We also examine the data on equatorial electrojet strength (EEJ) during these warmings and find there are significant changes in the EEJ strength during the SSW events. A counter electrojet (CEJ) coincident with the start of warming was observed for the SSW event of 2008. We then compare this SSWs linked variability observed by us to the normal day-to-day and hour-to-hour variability seen in the ionospheric data. It is been observed that even during times when there are no SSWs and solar and magnetic indices are quite stable and close to their minimum values, the ionospheric variability is comparable to the variability attributed to these warmings. Further, it seems that it is difficult to quantify with precision the changes in foF2, as well as in the ionospheric response times involved, following these events.

IT-09: An Investigation on Ionospheric Spread-F and Scintillation in Low Latitude Region

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Keywords: Ionosphere Spread F, Scintillation

Abstract

The data from Digisondes and ionospheric scintillation monitors co-located both at low latitude station Hainan in Northern hemisphere (109.1° E, dip lat. 9° N) from 2003 to 2007 and station Vanimo in Southern hemisphere (141.3° E, dip lat. 11° S) in 2006 are used to study spread F (SF) and its correlation with the scintillation. The SF is divided into four types: frequency SF (F-SF), mixed SF (M-SF), range SF (R-SF), and strong range SF (S-SF). The S-SF is characterized by extended range spread on F layer echo traces that significantly extend beyond the foF2. For the Hainan station, the variation of the S-SF occurrence was similar to that of the scintillation. From 2003 to 2007, both the S-SF and scintillation occurrences had the same variation trend from the high to the low solar activity year. The correlation coefficient between the occurrences of the S-SF and the scintillation was as high as 0.93. For the Vanimo station, the occurrence variation of the S-SF was also similar to that of the scintillation. The correlation coefficient between the two phenomena was as high as 0.88. These suggest associated mechanisms producing S-SF and scintillation. Two cases of the simultaneously observations of the S-SF, scintillation and the electron density depletion (obtained with satellite) are shown in this study. It supports that the equatorial plasma bubbles extending from bottomside to topside ionosphere are the most likely cause explaining the high correlation between the S-SF and scintillation.

IT-10: Atmosphere-Ionosphere Coupling via Atmospheric Waves and its Possible Application to Ionospheric Forecasting

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Abstract

The ionosphere is that part of the earth's space environment where air is partially ionized with sufficient number of electrons thus to influence seriously radio wave propagation, so high-techs such as telecommunication, navigation and so on, are affected, particularly when ionosphere is severely disturbed. On the other side, ionopsheric disturbances are dynamically driven from both lower atmosphere and magnetosphere as well. In recent a few decades, ionosphere-atmosphere coupling draw more and more attention of the scientists in the field of space weather. A number of surface sources such as severe weather, volcanic eruption and great earthquakes are some of such sources. In this report, based on observations, we show some ionospheric responses to atmospheric waves originated at ground and troposphere. Special focus is put on ionospheric spread-F possibly triggered by such waves. Since spread-F is the main cause of scintillations affecting navigation and in SAR application, after an analysis of spread-F exciting mechanism, it is concluded that in modeling Spread-F occurrence, severe ground weather should be considered as an important factor.

IT-11: Variations of Thermospheric Density from CHAMP and GRACE

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Keywords: Thermosphere, Satellite drag

Abstract

The thermosphere is the outer gaseous shell of a planet's atmosphere that exchanges energy with the space plasma environment. The energy deposition of solar irradiation and magnetospheric inputs into the upper atmosphere can change the thermospheric density significantly. From a practical standpoint, unanticipated changes in the density of the thermosphere cause satellites to deviate from their anticipated paths, or ephemerides. Observations from CHAMP and GRACE during 2002-2010 are used to study the seasonal variations of thermospheric density by characterizing the dominant modes of thermospheric density variability as empirical orthogonal functions (EOFs). Our results showed that the first three EOFs captured most of the density variability, which can be as large as 98% of total density variability. Subsequently, the obtained mean field, first three EOFs and the corresponding amplitudes of three EOFs are applied to construct a thermospheric density model at 400 km to study seasonal variations of thermospheric density. In this talk, we will present the variations of thermospheric density from the EOF model and also comparison with other empirical and theoretical models.

IT-12: GPS/GLONASS Operation Quality Deterioration Caused by Solar and Geophysical Activity

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Keywords: GPS/GLONASS, Ionosphere Irregularities, Solar Radio Emission

Abstract

Ionosphere, that is propagation medium, can considerably affect the GPS/GLONASS signal parameters. Rapid fluctuations of the electron density may cause losses-of-phaselock. So may very rapid fluctuations in the signal strength, ionospheric scintillations. Under the 2001-2012 magnetic storms and solar flares the stability of global navigation satellite system operation was found to deteriorate. In the report we present data on GPS/GLONASS losses-of-phaselock. It was found that total number of GPS slips depends on a magnitude of geomagnetic storm: stronger storms stronger affect the GNSS receivers. During storms slips occur mostly on the dayside, in the local noon and afternoon sectors. Solar radio noises of more than 1000 sfu can have a negative influence on the GPS/GLONASSS performance. Theoretical calculations shown, that GLONASS was more stable to the solar radio emission adverse action than GPS was. The work was partly supported by Russian Foundation for Basic Research (under grant No 12-05-33032-a), and by Russian Federation president grant MK-3771.2013.5.

IT-13: Introduction of Newly Developing and Setting Tri-band Beacon Receivers For Ionosphere Study In Eastern China

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Keywords: Radio Beacon, Ionosphere Tomography, Beacon Receiver, Ionospheric CT

Abstract

Tri-band radio beacon is useful and independent method to measure total content of electron, and to support ionospheric tomography by means of a ground receiver network at certain longitude zone. Using software radio technique, we developed new receiver units. The new units have been set at Shanghai and Beijing. Together with two ITS30 receivers setted at Shanghai and Wenzhou, a proto-type of beacon receiver network have started to record the ionospheric data since this year. Currently, beacon signals from 4~6 beacon satellites can be observed. The progress about the development of the unit and network, as well as the preliminary applications of the tri-band beacon network is introduced. Beyond this, we also fixed the bug and improved the analysis algorithm for tradional method for TEC retrieving by using self phase lock loop dual frequency beacon receivers. Additionally, a suitable inversion algorithm has been developed for modeling and simulating the ionospheric electron density distribution using configuration of the newly network. The technique developed here will benefit the ionospheric observation and modeling in China.

IT-14: Analyzing the Asymmetric Thermospheric/Ionospheric Response to External Driving

[1,2,3] Ercha Aa, [2]A.J.Ridley, [3]Donghe Zhang, and [3]Zuo Xiao

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Abstract

The thermospheric densities derived by CHAMP/STAR accelerometer within the time period from 01 May 2001 to 31 December 2007 are utilized to investigate the hemispheric asymmetry in response to strong storm driving conditions. The geomagnetic storms of 03–07 April 2004 are first studied since the storms occurred close to the vernal equinox, allowing the seasonal asymmetry to be eliminated to the greatest extent. The averaged density enhancements in the southern polar region were much larger than that in the northern polar region. The comparisons of density versus Dst and Ap index indicate a strong linear dependence with the slopes of the fitted lines in the southern hemisphere being 50% greater than that in the northern hemisphere. This effect can possibly be attributed to the non-symmetric geomagnetic field. 102 storm events are used to conduct a statistical analysis. For each storm, a linear fit is made between the averaged mass density and the Dst and Ap indices independently in each hemisphere. The seasonal variation of the intercepts and the slopes of the fitted lines are further explored. The baseline is strongly dependent on season, with the hemisphere receiving the larger amount of sunlight having larger density. The slopes showed considerable hemispheric differences around the vernal equinox yet no statistical differences around other seasons. It is speculated that competing mechanisms cancel each other during the solstices, while during the equinoxes, the lower magnetic field in the southern hemisphere may allow stronger ion flows, thereby causing more Joule heating. It is uncertain why the vernal equinox would be favored in this explanation though.

Poster Session Abstracts

November 6 (Wednesday) 10:15-12:15

November 6 (Wednesday) 20:00-21:00 (Optional)

2/F, Lobby

PRE-01: Analysis of Particle Radiation Environment on Middle-Earth and Geosynchronous Orbits

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Keywords: Middle-Earth Orbit, Geosynchronous Orbit, Energetic Particle Radiation

Abstract

An analysis of particle radiation environment on middle-Earth and geosynchronous orbits in solar minimum is performed by using data from Chinese middle-Earth and geosynchronous satellites. On the middle-Earth orbit, energetic electron populations vary on variable timescales. While geomagnetic storms occur, energetic electron populations disturb violently with fluxes enhancing over orders of magnitude on the middle-Earth orbit. Being due to the rough particle radiation environment, satellites suffer the hazard of deep charge on the middle-Earth orbit. On this orbit, the dose rate corresponds with energetic electron population variations. On geosynchronous orbit, periodic variations of relativistic electron populations on daily and solar-cycle timescales are prominent. Geomagnetic storms may excite relativistic electrons enhancing over several orders of magnitude on geosynchronous orbit, then increase the deep charge risk of satellites on this orbit.

PRE-02: Downward Motions of Plasmoids in the CME-Flare Current Sheet Observed in the GHz Band

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Keywords: CME, Solar Radio Bursts, Magnetic Reconnection, Current Sheet

Abstract

We investigate the spectral fine structure of a solar radio burst observed by the Solar Broadband Radio Spectrometer (SBRS) at the Huairou Solar Observing Station in a CME/flare event on December 1, 2004. The data display various patterns of plasma motions, suggestive of the interaction between sunward moving plasmoids and the flare loop system during the impulsive phase of the event. By comparing with the observational consequences of the standard model of two-ribbon flares, we identify several typical motions that are expected to occur in the reconnecting current sheet and in the cusp region on top of the flare loops. These include the sunward motion of plasma on reconnected field lines in the CME/flare current sheet, the reconnection outflow and embedded plasmoids, emission stripes of zero frequency drift as an indicator of the termination shock on the loop top, and the growth of the flare loop system together with the shrinkage of individual flare loops. In addition to the radio data, we also studied data in white-light, H-alpha, EUV, soft and hard X-rays. These data show a fast CME at a speed exceeding 800 km s−1 and the seperation of footpoints of the flare loops in agreement with the height of the flare loop system estimated from the radio data.

PRE-03: Dramatic Decrease of the Relativistic Electron Fluxes in the Outer Radiation Belt during Two Geomagnetic Storms

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Keywords: Relativistic Electron, Radiation Belt, Geomagnetic Storm

Abstract

Geomagnetic storms can either increase or decrease relativistic electron flux in the outer radiation belt [Reeves et al., 2003]. In this work, we analyze two storm events observed by both SAMPEX and POES/NOAA satellites. In both events, the relativistic electron fluxes have significant dropout during the main phase, especially in two high energy channels (1.5~6.0MeV and 2.5~14MeV), and the fluxes never recover to their pre-storm level during the recovery phase. Our analysis suggests that the decrease of relativistic electron fluxes can be explained by the shortage of the 'seed' electrons (10~200keV) and no effective local energization mechanism to accelerate the 'seed' population of electrons to MeV level.

PRE-04: Acceleration of Electrons and Protons in Reconnecting Current Sheets Including Single or Multiple X-points

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Keywords: Magnetic Reconnection, Particle Acceleration

Abstract

Electron and proton acceleration by a super-Dreicer electric field is investigated in a reconnecting current sheet in the presence of a guide field. The electric field is assumed to vary in space. Electrons and protons are accelerated from initial positions randomly distributed over the whole acceleration region. The energy spectrum eventually obtained is consistent with a power-law spectrum. The spectral index of electrons increases rapidly with increasing guide field, but the index for the protons does not vary significantly. The relation of the final energy to the initial position is also studied. The results indicate that the addition of a guide field not only allows the reconnecting electric field to selectively accelerate electrons and protons from different initial positions, but also increases the number of accelerated electrons and reduces the number of protons. Meanwhile, kinematic characteristics of the accelerated particles in the current sheet including multiple X-points and O-points were also investigated. The result indicates that the existence of the multiple X- and O-points helps particles trapped in the accelerating region to gain more energy, and yields the double or multiple power-law feature.

PRE-05: Secondary Fast Reconnection with Radiation Cooling in Solar Chromosphere

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Keywords: Magnetic Reconnection, Radiation Cooling

Abstract

Magnetic reconnection in partially ionized plasmas with radiation cooling is studied through 2.5-dimensional numerical MHD simulations, using the Spitzer resistivity in the low solar atmosphere.Though the magnetic Reynolds number is high (~10^5-10^6), fast magnetic reconnection still can happen because of multiple levels of the plasmoid instability occurring inside the current sheet. As secondary instabilities start to appear, slow-mode shocks are detected between secondary plasmoids and secondary fragments of the current sheet. Our numerical simulations also indicate that the radiation cooling is important. The radiation cooling can make the secondary plasmoids appear earlier and the maximum current density reach a value more than two times higher than in the case without radiation cooling; the resulting maximum reconnection rate during the secondary instability is five times higher in the case with radiation cooling included. The upward out-flow velocity in our simulations approaches the velocity of chromospheric jets, with the maximum velocity reaching ~24km/s. The temperature enhancement in the case with radiation cooling is about 1000 K, which is close to the temperature enhancement of Ellerman bombs and micro-flares in the chromosphere. We conclude that the plasmoid instability with radiation cooling can be a very important mechanism to study various dynamic phenomena in the low solar atmosphere.

PRE-06: L-band Solar Radio Burst Events-A Potential Interference for Navigation Signal and its pre-alarm Method Research

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Most navigation satellites transmit navigation signals within L band, such as GPS, Galileo, BeiDou and so on. Solar radio bursts frequently occurred also have strong emission in L band, which are potential interferences for the navigation service. During the most intense solar radio bursts, the obviously decreasing performance of navigation systems was found. In this work, we get the threshold values for the three communication frequency points by theoretical arithmetic. At the same time, we will set up the real-time solar radio flux monitor system for test and verify the real threshold value in natural space based on 10m solar radio telescope. At last, we will try to build the pre-alarm system combining multi bands observation data.

PFM-01: The Analysis of Correlation between the Variation of the Absolute Solar Flux and Degradation in the SNR of the GPS Satellites Reception on Solar Radio Burst

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Keywords: SNR of GPS, Absolute Solar Flux

Abstract

Utilization of the GPS satellite is getting higher in contemporary era so that common or important communication channels need to be protected not to be cut. In this paper, SNR criteria of GPS system is established by analyzing the SNR of the GPS satellites and compared with its general performance as a wireless communication equipment. For confirming the similarity of the variation of the SNR value of the GPS satellites and the variation of absolute solar flux, the degradation of the SNR value of the GPS satellites in the case of solar burst is compared with the increase in absolute solar flux. Correlation between variation of the SNR value of the GPS satellites and the variation of absolute solar flux has been identified will be used as a method to prevent cutting down of the GPS satellites communication under the solar radio burst for convenience of GPS system users.

PFM-02: Development of Long-term Solar Activity Forecast System using 2.8GHz Solar Radio Data of Korea Space Weather Center (KSWC)

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Keywords: Solar Cycle Prediction, Sunspot Number, Solar Radio Flux, Modified McNish-Lincoln method

Abstract

In order to provide forecasting information of solar activity using domestic data, the forecast system of long-term solar activity monitoring using solar flux data of KSWC is developed. It is well known that more data gives more accurate result. Thus three observed data are used as input value of the prediction model. First, solar flux data at 2.8GHz of KSWC (Korea Space Weather Center) from 2004 to 2013 is used. Second, 2.8GHz data of Canada from 2004 to 2003 is used for fill up the gap between KSWC data and Sunspot numbers. Lastly, Sunspot numbers of NOAA from 1749 to 2004 is also used for increasing the total number of data. Using the Modified version of the McNish-Lincoln method, solar cycle 23-24 prediction is carried out and compared to the result of NOAA's Solar Cycle Prediction. Sunspot numbers and solar radio flux data mentioned above can be used in combination with various other forecasting model.

PFM-03: Development of Automatic Detection Software of type II/III Solar Radio Burst

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Keywords: Solar Radio Burst, Type II, Type III, Automatic Detection

Abstract

In an attempt to warn the solar radio burst promptly and in an unmanned manner, we developed S/W detecting the type II/III radio bursts automatically. First, the data produced every four seconds and stacked over one hour in the form of I(t,f) are divided by a burst-free template I(t_0, f) so that RFI is eliminated and differences of gain among frequency channels are corrected. Next, using the fact that type II and III burst appear like straight lines in t-1/f and t-f diagrams, respectively, we perform Radon transformations, which are simply the measures of coincidence of a straight line with the observed events as functions of its slope, a, and intercept, b. Local maxima in the a-b diagrams well above noise level are identified as burst events. The larger one of the two transformation values occurring at about the same (a,b) from (t,1/f) and (t,f) spaces determines the type of burst. Then we estimate a few parameters like the starting time of the events and the arrival time on Earth. We validated the algorithm using data logged for last two years at Icheon site of Radio Research Agency, Korea.

PFM-04: Global MHD Simulation of the Magnetospheric Response to Large and Sudden Enhancement of the Solar Wind Dynamic Pressure

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Keywords: Sudden Commencement, Global MHD Simulation

Abstract

A large and sudden enhancement of the dynamic pressure in the solar wind generates a geomagnetic sudden commencement (SC). The magnetic field variation of SC at auroral latitudes shows a bipolar change which consists of preliminary impulse (PI) and main impulse (MI). Fujita et al. [2003a, 2003b] reproduced the PI/MI magnetic field variation using a magnetosphere-ionosphere coupling simulation and clarified the fundamental mechanisms. Interestingly, Araki et al. [1997] reported an anomalously large-amplitude SC of more than 200 nT with an unusually spiky waveform at low latitude, which occurred when the magnetopause was pushed inside geostationary orbit. Such a super SC is the target of this study. We investigate the large-amplitude SC at auroral latitudes when a large solar wind dynamic pressure impinges on the magnetosphere using a newly developed magnetosphere-ionosphere coupling simulation which has advanced robustness. We simulate two SC events of dynamic pressure enhancement of 16 times larger than the standard value, caused by the density enhancement and velocity enhancement, respectively. As an initial result of the comparison with the SC events, it is found that magnetic field variation of PI/MI is larger and sharper in the case of velocity rise than the case of density rise. It is therefore suggested that high-speed solar wind may be needed to create large and sharp SC. It is also found that a magnetic field variation similar to so-called Psc appears after PI/MI only in the case of velocity rise. When the high-speed solar wind impinges on magnetosphere, vortices are repeatedly formed at the equatorial magnetopause, probably due to the KH instability. It seems that the high pressure of the vortices play an essential role as a current generator to drive the field-aligned currents and the magnetic field oscillation. In this presentation, we discuss the mechanisms of super SC in more detail, combining the other interesting simulation results.

PFM-05: Full Halo Coronal Mass Ejections: Do we need to Correct the Projection Effect in terms of Velocity?

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Keywords: CME Projection Effect

Abstract

The projection effect is one of the biggest obstacles in learning the real properties of coronal mass ejections (CMEs) and forecasting their geoeffectiveness. To evaluate the projection effect, 86 full halo CMEs (FHCMEs) listed in the CDAW CME catalog from 2007 March 1 to 2012 May 31 are investigated. By applying the Graduated Cylindrical Shell (GCS) model, we obtain the de-projected values of the propagation velocity, direction and angular width of these FHCMEs, and compare them with the projected values measured in the plane-of-sky. Although these CMEs look full halo in the view angle of SOHO, it is found that their propagation directions and angular widths could vary in a large range, implying projection effect is a major reason causing a CME being halo, but not the only one. Furthermore, the comparison of the de-projected and projected velocities reveals that most FHCMEs originating within 45^{o} of the Sun-Earth line with a projected speed slower than 900 km s−1 suffer from large projection effect, while the FHCMEs originating far from the vicinity of solar disk center or moving faster than 900 km s−1 have small projection effect. The results suggest that not all of FHCMEs need to correct projection effect for their velocities.

PFM-06: Classification of Ambiguity in Polarimetric CMEs Reconstruction

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Keywords: Sun, Corona Sun, Coronal mass ejections (CMEs) techniques, Polarimetric

Abstract

The Thomson scattering theory indicates that there exist explicit and implicit ambiguities in polarimetric analyses of CME observations. We suggest a classification for these ambiguities in the CME reconstruction. Three samples including double explicit, mixed and double implicit ambiguity are exhibited with the polarimetric analysis of STEREO CME observations. These samples demonstrate that this classification is helpful to improve polarimetric reconstruction.

PFM-07: What Time Will the Solar Proton Event Arrive?

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Keywords: SPE Delay Time

Abstract

Solar protons are accelerated to very high velocities when a solar flare produced. How long will a SPE be observed at the Earth's orbit after the flare? This delay time is correlated with many factors, such as the flare's size, CME's speed, etc. In this paper, the relationship between the delay time and the flares' size and longitude is discussed, and the fitting function for the delay time is made. According the fitting function, we can forecast the arrival time of SPE in advance.

PFM-08: Development of International Cooperation System for Analysis of WSA-ENLIL Model

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Keywords: WSA-ENLIL, ENLIL Cooperation

Abstract

To meet the growing demands of solar wind prediction, Korean Space Weather Center (KSWC) introduced WSA-ENLIL model in 2012 which is known to have relatively high accuracy in estimation of solar wind arrival time on Earth. However, it also has limitation of being influenced by operator's training proficiency. Many analytical methods have been proposed to reduce such a manual calculation error. Basically, most methods require considerable operating time to obtain result. Therefore, cooperation and exchange of analyzed data between agencies are essential. Since the introduction of WSA-ENLIL model, KSWC has made efforts on international cooperation. Application software has been developed to analysis WSA-ENLIL results of different agencies and data exchange system is being established step by step. In this paper, a successful process of KSWC's international cooperation and its consecutive activities are reported.

PFM-09: Fine Structures inside the Reconnecting Flare/CME CS

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Keywords: Solar Flare, Coronal Mass Ejection, Magnetic Reconnection Turbulence, Current Sheet

Abstract

Magnetic reconnection plays a critical role in energy conversion during a solar flare/coronal mass ejection (CME) event. This paper presents a twodimensional magnetohydrodynamic experiment for the reconnection process operated inside the current sheet (CS) which is embedded into an overall large-scale eruptive magnetic structure. In order to study the fine structure and micro processes inside the CS, mesh refinement is used to reduce the numerical diffusion. Benefiting from it, some high-resolution features are captured, such as plasmoids from the tearing mode and plasmoid instability regions of turbulence and slow-mode shocks. These different high nonlinearly turbulent components cooperate with each other to achieve fast release of magnetic release. The behaviors of these fine structures inside the flare/CME CS in the eruption were studied in this work in detail.

PFM-10: Modeling of Energetic Electrons in Outer Radiation Belt

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Keywords: Outer Radiation Belt, Energetic Electron

Abstract

Variations of geomagnetic field structure and solar wind bulk speed will influence the distribution of energetic electron in outer radiation belt. The distribution of 0.3-2.5 MeV electrons was studied based on SEM/NOAA-POES16 observations. By comparing distributions of 0.3-2.5 MeV electrons with different solar wind velocities and different geomagnetic activities, contributions of solar wind and geomagnetic field to 0.3-2.5MeV electrons distribution were discussed. Results of those observational studies indicate that variation of geomagnetic field dominates the distribution of 0.3-2.5MeV electrons at the inner region of the electron radiation belt while the distribution at the outer region is quite sensitive to the solar wind velocity. Based on previous analyses and discussions, a statistical model of the >0.3MeV electron distribution in outer radiation belt was established.

PRO-01: Correlation Study between Ensemble Parameter of CME Analysis and Estimated Arrival Time of CME via ENLIL Model

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Keywords: ENLIL Forecasting, Solar Wind

Abstract

In 2013, Korea Space Weather Center (KSWC) established the ENLIL model system for forecasting arrival time and propagation of CME. The model results in KSWC include arrival time, velocity and density of CME. In order to study the variation in the results of ENLIL model due to alteration in the initial input variables, it was analyzed that the arrival time of the solar wind in ENLIL model correlates with analysis results of CME through ensemble model technique. The CME parameters such as initial velocity, angle width and position are determined through analysis of satellite images by operator. Errors could happen easily when operator manually determine the CME parameters. To reduce the errors, the sensitivity of CME parameters need to be analyzed that the results of ENLIL mode corresponding to initial CME parameters are compared with observation data of the ACE satellite for reference to evaluate the performance.

PRO-02: The Possibility of Pre-alarm Health Events Based on Low Frequency Solar Observation during the Hazard Space Weather Period

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Keywords: space weather, pre-alarm health events

Abstract

Scientists have researched the impact of geomagnetic activity for human health for a long time and got some meaningful results. In general speaking, there exist some correlations between cardiovascular and cerebrovascular events and geomagnetic activity. The solar activities such as flares, CMEs (Coronal Mass Ejection) and so on are some direct drivers for geomagnetic activity. The radio solar bursts are always detected by solar radio telescopes ahead of the time that the plasma arrive earth and influence the geomagnetic environments 2-3 days, so we can get the alert information based on solar radio burst observations. In our work, we analyzed the total number of cardiovascular and cerebrovascular events which are supplied by the First affiliated hospital of Kunming medical university in solar radio burst period during 2012 March and May. We find that the number of cardiovascular and cerebrovascular events increased after the radio solar burst events 2-3 days. This result proves that the solar radio burst events can be as an alert method for cardiovascular and cerebrovascular events in extremely space weather. We can get alert information for cardiovascular and cerebrovascular events based on solar radio observations for taking place of the existing methods based on Ap index. In another hand, based on some results of extremely low frequency-health experiments, we analyzed total patients number of Permeability of pleural effusion during the month of 5th March 2012 events, and then we found a obviously increasing comparing with total patients number in the same period the other years. So it seems that there may be a possibility early warning method for Permeability of pleural effusion based on low frequency observation.

PRO-03: SEPC Alert Scales for Major Space Weather Events

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Keywords: Major Space Weather Events, Alert Scales

Abstract

Space environment prediction center (SEPC), NSSC, has developed alert scales for major space weather events to improve understanding of space weather events among various users and the general public. These alert scales have been used in space weather operational practices for 3 years. The alert scales correlate space weather events with their likely effects on satellite, communication systems. To many who have a limited acquaintance with space weather, the SEPC alert scales can convey useful and intelligible information. The four categories of descriptive scales for space weather events devised by SEPC, which are most relevant to the possible effects on satellite and communication system, are solar X-ray event, solar proton event, geomagnetic storm and Relativistic electron flux enhancement. The alert scales were divided into three levels: red alert, orange alert and yellow alert. The red alert is the top level.

PRO-04: Web-based Software for Space Environment Forecast Analysis

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Keywords: Web-based, Space Environment

Abstract

In the last few years, Web-based network technologies have become widely used, which can provide more convenience with real-time interaction between user and application. In order to better serve all types of space environment users including aerospace, researchers, and public with space environment services, Space Environment Prediction Center (SEPC) of National Space Science Center, the first established operational space environment forecasting institution in China, developed a series of web-based software for space environment forecasting analysis, such as space environment analysis software, data visualization software, android phone software, SEPC's web portal. SEPC provides the online space environment services through the web-based software, which enhance the international cooperation in the sharing of data, models and forecasts. Domestic and international users can use the software via the Internet directly to obtain the latest space environment monitoring data, the model calculation results, event alerts and other information. For example, the space environment analysis software provides default functional modules as well as user-defined modules used to systematically analyze the space environment quickly.

PRO-05: The Renewal of ISES Website

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Keywords: ISES, Space Weather

Abstract

To improve outreach to worldwide users of space weather information and to enhance communication among all ISES members, the ISES website has been renewed. It has been open to the public since August 1, 2013 (www.ises-spaceweather.org) with a new design and new content. The "Space Weather Now" page provides the past and current space weather status with R, S, and G scale indicators. The "Members" page describes a brief introduction of Regional Warning Centers (RWCs) and Associate Warning Centers (AWCs). The most notable change is that discussions pages have been added, which enable information sharing among ISES members. In this menu, the "Latest Forecasts" page provides a forecast portal of space weather by adopting new technology which directly brings each RWC's forecast to the ISES site. The "Space Weather Discussions" page provides a Social Network Service (SNS) based upon a bulletin board to discuss specific topics for space weather among ISES members. The "Enlil Discussions" page gives results from the Enlil model and analyses of the results by SWPC, KSWC, and other partners. The Enlil model is used to predict the properties of the solar wind, which is a fast-moving stream of charged particles emanating from the sun, and can give long lead-time warning of geomagnetic storms. It is expected that this new ISES website will be helpful to share information and to inform the public of space weather.

PRO-06: Virtual-Sun: A New-generation 3-D Computer Platform for Space Weather Service

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Keywords: 3-D computer Platform, Operational Space Weather Service

Abstract

A new-generation computer platform with 3-D interface for operational space weather service (from solar perspective) is developed at National Astronomical Observatories, Chinese Academy of Sciences (NAOC). This platform is named as Virtual-Sun. The Virtual-Sun is a Client-Server (C-S) system, the Server part provide the solar activity data, the Client part is installed on the user's computer. The Virtual-Sun Client obtains the solar data from the Server through the Internet connection, and displays the 3-D virtual image of the Sun as well as various solar activity components (e.g., sunspots, magnetograms, active region numbers, flares, warning or forecasting information, etc) on the virtual sun. The 3-D virtual sun can be rotated and zoomed freely by using computer mouse or keyboard. A test version of the Virtual-Sun Client is available on the website of the platform.

PRO-07: Space Weather Concerns in Spacecraft Design

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Keywords: Space Weather, Spacecraft, Design

Abstract

In general, space weather can be considered as solar-induced short-term variability of space environment. Space weather will exert effects on spacecraft that vary according to the orbit and the position of the spacecraft. For spacecraft engineering, design measures must be carried out to avoid space weather problems. In design phase, the key issue for space weather concern is using various space environment models to define what environmental conditions a given spacecraft may encounter. For cumulative long term effects, such as total ionizing dose and displacement damage, climagtological models (e.g. AP-8/AE-8 trapped radiation belt model) based on historical space weather data are used to define long-time average environment. In addition, due to the dynamic nature of the space environment, appropriate design margin must be specified to reflect the uncertainties arising from the models as well as other factors. For transient or short term effects, such as single event effect or charging effect, a worst-case environment model which defines large space weather events (e.g. October-November 2003 extreme solar storm) is used for spacecraft engineer to do a worst case analysis, and then countermeasures are carried out to make sure the spacecraft can withstand severe space environment disturbance.

PSA-01: The Magnetic Field Extrapolation of AR11158

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Keywords: relaxation, extrapolation

Abstract
We reconstruct the magnetic field of NOAA active region 11158 by our relaxation method based on a vector magnetogram series from the Helioseismic and Magnetic Imager (HMI) on board the Solar Dynamic Observatory (SDO).

PIT-01: A Study of Solar X Class Flare Effects on the Ionosphere

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Keywords: Solar Flare, Ionosphere, Ionosonde

Abstract

It has been known that intense solar flux of EUV and X-ray during solar flares causes the ionosphere to change abruptly to the level of interfering radio communication. Now that more accurate observations of solar EUV and X-ray fluxes are available, we study the effect of solar flares on the ionosphere by comparing a physic-based model results with ionosonde data. In order to simulate the effects of a solar flare, we have revised the SAMI2 model by including both photoionization of X-ray spectral range (below 50 A) and photoelectron impact ionization. In this revision, we adopted x-ray fluxes measured by the TIMED/SEE instrument, and scale factors of photoionization cross sections of N2, O2, and O for taking into account photoelectron impact ionization effects. For the largest 7 X class flare events over the last decade, we have searched ionosonde data that contain critical frequencies of E and F2 layers (foE, foF2) with appropriate confidence levels. From the global network of ionosonde stations, 16 and 25 of ionosonde data sets were found that have corresponding variations of foE and foF2, respectively, to the selected flares. We find that enhancements of electron density from the revised SAMI2 are a little higher than those from the ionosonde data for both E and F2 peaks after the flare events. It seems that the revised SAMI2 model calculates larger electron densities due to overestimation of photo-electron effect in its parameterization process. However, the revised SAMI2 model results in F2 electron densities significantly lower than the ionosonde data observed in the morning. This may be due to the fact that the SAMI2 model does not include zonal transport of plasma by neutral wind and electric field. When compared with the ionosonde foE data, the revised SAMI2 model seems to predict E region electron densities for both pre-flare and flare events relatively well.

PIT-02: Electron Density Profiles Derived from Obliquely Sounded Ionogram

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Keywords: Electron Density Profiles, Obliquely Sounded Ionogram

Abstract

The conventional ionosondes are used to collect data of ionosphere right above the ionosonde location and to provide a picture of the ionospheric properties. Although these ionosonde stations are located worldwide, there are locations where it is not easy to operate one, like oceans, deserts and other remote places. Knowing the ionospheric properties and behaviors at these parts of the world is also very important to know. The oblique sounding technique is one method to achieve this and reach those locations. With oblique sounding the transmitter and the receiver locations are far apart from each other, even thousands of kilometers or miles. The oblique ionospheric sounding technique have some advantages in terms of that the obliquely sounded HF signal have the abilities to monitor the ionosphere of some places where it is not deployed vertical sounder between transmitter and receiver and of course, to vertically detect the ionosphere of area where it is deployed itself. It allows obtaining more information of ionosphere, such as critical frequency, vertical height and electronden sity, MUF (maximum usable frequency) over a wider area with no additional ionosonde. We present the results of experimental studies of oblique sounding for research purpose between Jeju and Icheon stations in Korea which are about 420km apart. The extraction algorithm of electron density profiles after conversion of the oblique to vertical ionogram which should be considered the incidence angle, the Doppler frequency, the influence of traveling ionospheric disturbances (TIDs), the multipath propagation, and the error probability are mainly focused in this paper. This paper is also concerned with the autoscaling of oblique sounding ionogram for analysis of propagation conditions on a fixed point-to-point measurement as a near term activity.

PIT-03: Nowcast and Forecast of GPS Total Electron Content in Japan

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Keywords: GPS TEC Forecast Ionosphere

Abstract

We are developing a data-base for total electron content (TEC) over Japan utilizing RINEX data which is provided by Geospatial Information Authority of Japan. We serve two-dimensional maps of TEC, de-trended TEC, and indices of TEC disturbances through http://seg-web.nict.go.jp/GPS/GEONET/. Our database consists of three versions of data-base, that is, real-time, quasi-real-time, and final versions. In addition to the two-dimensional map of TEC derived from 1,200 ground-based GPS stations' data, we provide two-dimension maps of de-trended TEC and indices of TEC. In real-time and quasi-real-time versions, the TEC maps are provided with a time lag of less than one hour and four hours, respectively. We also develop TEC models to forecast TEC in Japan using Artificial Neural Network. Current state of nowcasting and forecasting system of TEC in Japan will be shown in the presentation.

PIT-04: TEC Variation and Comparison with NeQuick Model during Low Solar Activity Phase

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Keywords: Total Electron Content, NeQuick, Ionosphere Semiannual Anomaly

Abstract

Total electron content (TEC) is an important descriptive quantity for ionosphere of the earth and is significant in determining the scintillation and group delay of a radio wave through a medium as well. Measurements of GPS STEC carried out at Hainan station (Geog.Lat. 19.5° N, Geog.Long. 109.1° E, Geomag. Lat. 9.0° N), are used to derive vertical total electron content (VTEC). The ionospheric variation pattern for different seasons during the lowest solar activity phase (2007-2008, R12 is 7.5 and 2.9 respectively) is studied, such as diurnal and seasonal variations, “winter anomaly” and “semiannual anomaly”; Results of diurnal and seasonal variations have been compared with that of the NeQuick model. The main conclusions can be drawn as follows: (a) The diurnal variation of TEC for different seasons obviously shows semiannual anomaly, it is due to semiannual changes in neutral composition, in general the diurnal maximum is the highest in equinox months and about 34 TECU, the least in summer months and about 25 TECU. (b) TEC is higher in winter (about 30 TECU) compared to summer (about 25 TECU), vertical winds are downward in the winter resulting in increase of the O/N_2 ratio, which causes the winter anomaly. (c) “Winter anomaly” is not only a phenomenon of daytime, also can be seen during nighttime. (d) NeQuick model underestimates the TEC during nighttime and overestimates it during daytime independent of the season for low solar activity.

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Tours Information

Fuxian Solar Observatory

November 6 (Wednesday) 13:30-18:00

The Stone Forest

November 7 (Thursday) 13:30-18:00

Fuxian Solar Observatory

Fuxian Solar Observatory (FSO) is located at the northeast side of Fuxian Lake, Yunnan, China. It is at 24°34'48"N and 102°57'01"E. The altitude is 1720m above the sea level. FSO is operated by Yunnan Astronomical Observatory, Chinese Academy of Sciences.

The 1m New Vacuum Solar Telescope (NVST), formerly known as 1m Yunnan Solar Telescope (YNST), is the primary facility of FSO. The science task of NVST is the high resolution observations of the sun. The task of NVST is to observe the sun in the range from 0.3 to 2.5 micron by high resolution imaging devices and spectrometers combining with a polarization analyzer. The science cases are mainly focus on the fine structure of solar magnetic field and its evolution. NVST is an Alt-Az mounting telescope with 1200mm vacuum window and 980mm pure aperture. The focal length at F3 is 45m. The FOV is about 3 arc minute. The main instruments include the Multi-channel High Resolution Imaging System, the Multi-wave Spectrometer, the High Dispersion Near-infrared Spectrometer and the AO system.

The Optical &. Near-Infrared Solar Eruption Tracer (ONSET, Nanjing University) and the Solar Radio Dynamic Spectrometer with 11-m dish are the other two important solar facilities. The ONSET is a three-tube telescope working in Halpha, continuum and the near infrared He-I 10830. The range of observation bands of Solar Radio Dynamics Spectrometer is 70-700MHz. The temporal resolution is 2ms and the spectral resolution is 0.2MHz/Channel.

The Stone Forest

The Stone Forest lies about 80 miles to the southeast of Kunming. A geological phenomenon, the Stone Forest was a vast expanse of sea during the Paleozoic era-some 270 million years ago. Later, the movement of tectonic plates altered the earth's crust, causing the sea to recede and its limestone bottom to appear, thereby forming land. Due to the constant seeping of rain through the cracks in the limestone, some of the stone formation dissolved and the fissures broadened, producing a group of great sculptures of different shapes, all molded by nature.

In the midst of the forest, there is a huge rock screen on which two words-Stone Forest-are engraved in official script (in a calligraphic style typical of the Han Dynasty, 206 B.C.-220 A.D.). Among the scenic sights is the "Sword Peak Pond" with jadeite-colored water so clear that one can see the bottom of the pond. Other astonishing sights include "Figure of Ashima," "Shi Ba Xiang Song" (its name originating in the Chinese love story, "Liang Shanbo and Zhu Yingtai"), and "Lotus Peak."

The splendor of the Stone Forest is enhanced by the local customs of the native Sani people (who are part of the Yi minority). Sani people are industrious and hospitable——and unconstrained. Sani women are expert at spinning, weaving, and embroidering. They like to wear rainbow-colored headgear and bright-colored dresses. The young people especially are very good singers and dancers. Every day at sunset, under the moonlight, boys and girls gather at the village platform. While the boys play the three-stringed plucked instruments, the girls clap their hands and dance the strong-rhythmed traditional "A'Xi (Ah-shi) Dance in the Moon" with great enthusiasm. If you happen to witness the event, you will be invited to join in the festivity.

General Information

Workshop Venue

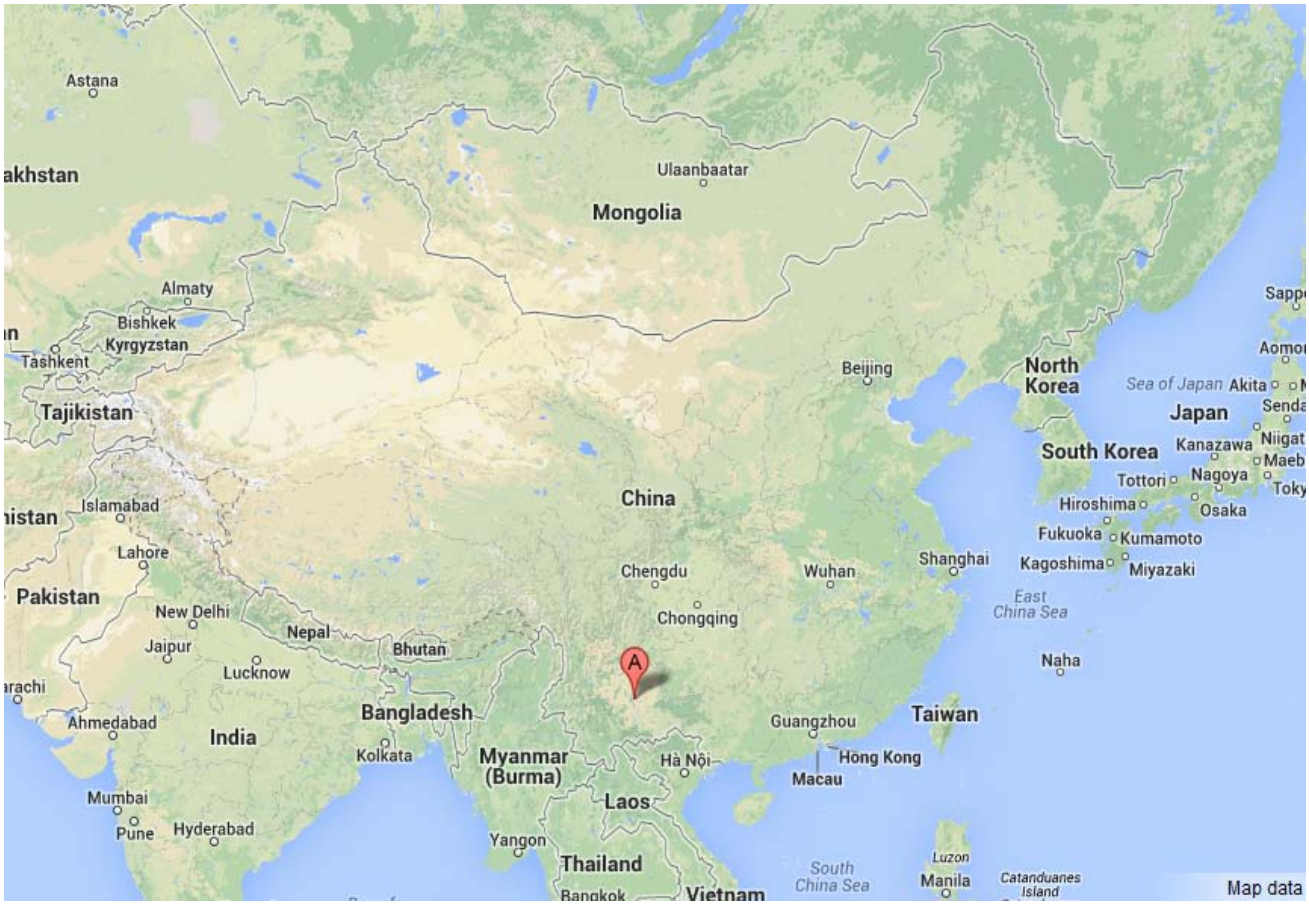
Useful Information

Workshop Venue

1. Kunming, China

Kunming is the capital and largest city of Yunnan Province in Southwest China. It is the political, economic, communications and cultural centre of Yunnan. Located at an elevation of 1,950 meters on the Yungui Plateau with low latitude and high elevation, Kunming has one of the mildest climates in China. The weather never gets very hot in summer. With its perpetual spring-like weather which provides the ideal climate for plants and flowers, Kunming is known as the "City of Eternal Spring". The city is covered with blossoms and lush vegetation all-year round.

Its economic importance derives from its geographical position. It is positioned near the border with Southeastern Asian countries, serving as a transportation hub in Southwest China, linking by rail to Vietnam and by road to Burma and Laos. This positioning also makes it an important trade center in this region of the nation. Kunming has been designated a special tourism center and as such sports a proliferation of high-rises and luxury hotels.

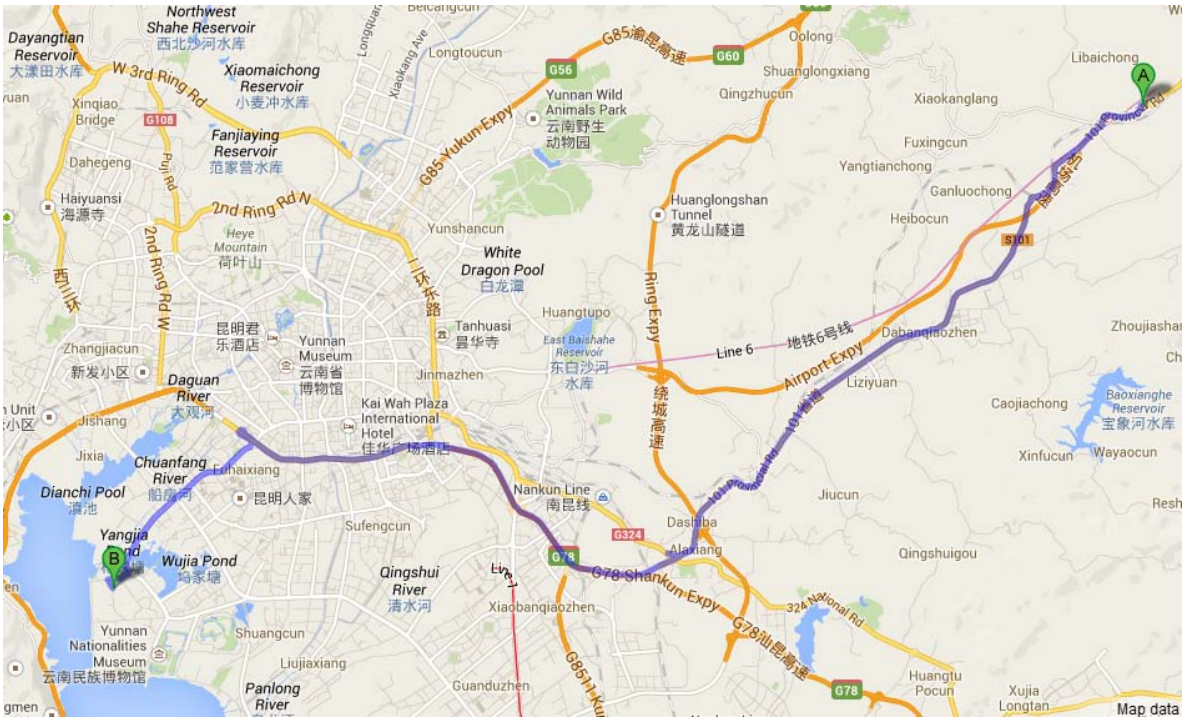


Point A in the map: Kunming, Yunnan, China

2. Hotel: Yunnan Dianchi Hotel (http://www.dianchihotel.com)

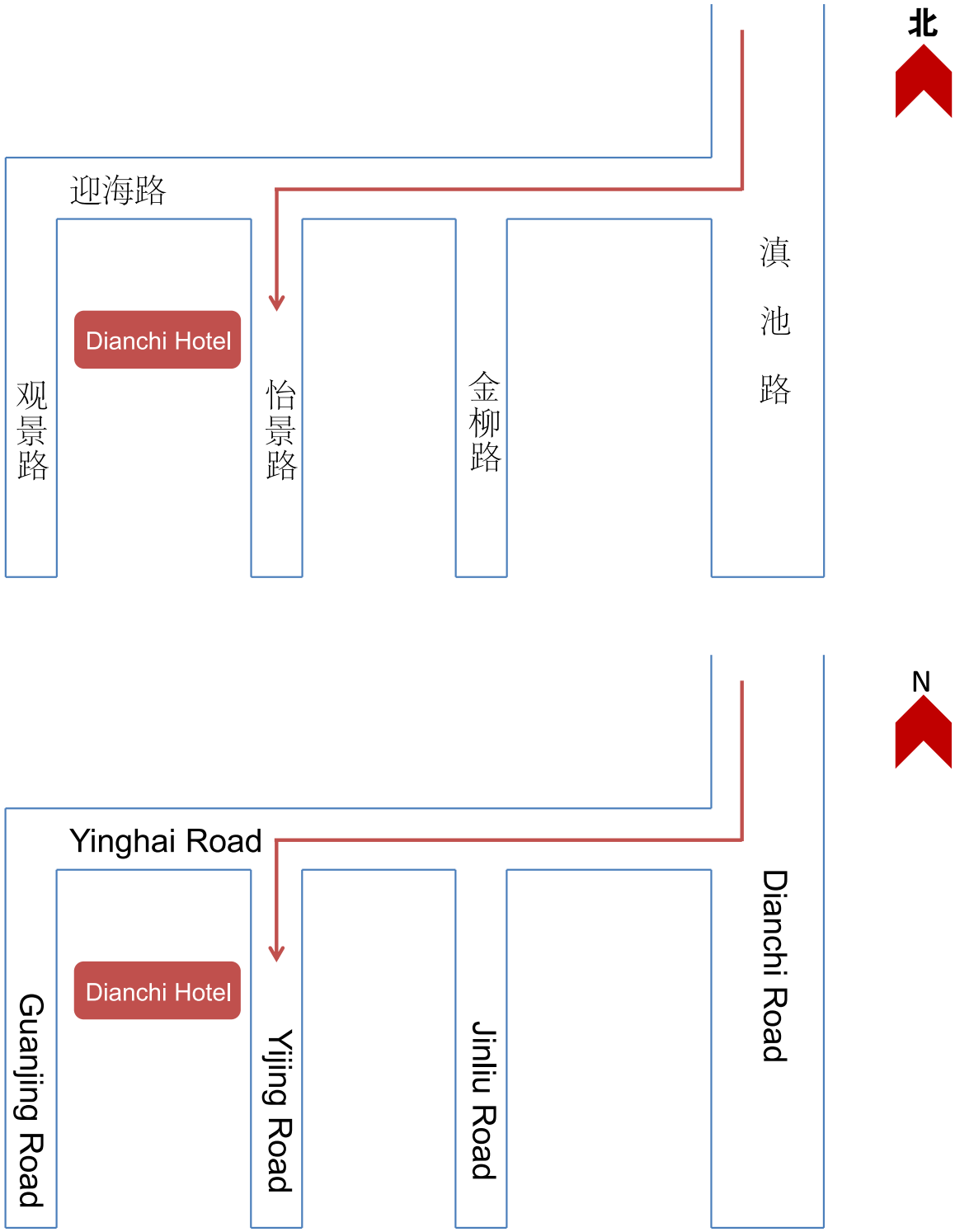
Address: 9 Yijing Road, Dianchi National Tourism Resort, Kunming, Yunnan Province, China
Postal Code: 650228
Telephone: +86 871 433 4888
Fax: +86 871 431 2067

Invested by Civil Aviation Administration of China, Yunnan Dianchi Hotel was completed and put into use in August 1998. The hotel is constructed to the national four-star standard, and it is located in Kunming National Tourist Resort, near Dianchi Lake, "the peal of the plateau". The weather is neither too cold in winter nor too hot in summer. The sea gulls come here in winter, and the fresh flowers grow everywhere in summer. The underground hot spring is directly led to the hotel rooms, and free broadband internet service is provided. With convenient transportation, it only takes a 15-minute drive from downtown and an about 20-minute drive from the railway station and airport. The hotel is like a garden. With complete ancillary facilities, it has 217 guest rooms of various types (367 beds); 29 large and small conference rooms and classrooms; and Western restaurant and Chinese restaurant, which can accommodate 500 people dining at the same time. In addition, the spots and recreation places are also arranged, like swimming pool, ball hall, entertainment hall and chess & card game rooms.



Point A in the map: Kunming Changshui International Airport
Point B in the map: Dianchi hotel
Route Distance: 41.2 km (25.7 miles)

Route Map


北
迎海路
Dianchi Hotel
观景路
怡景路
金柳路
滇池路
N
Yinghai Road
Dianchi Hotel
Guanjing Road
Yijing Road
Jinliu Road
Dianchi Road

Useful Information

1. Airport Transportation

***Taxi**

Taxi service is available at the Kunming Changshui International Airport the whole day. The fare from the airport to the conference venue is about 25 USD, or RMB 150 Yuan including the highway fee of 10 Yuan/car. Please do ask for a receipt from the driver. Payment should be made in RMB cash. You can use the ATM or bank offices at the airport to get change. It is not customary to tip drivers. Please pay strictly according to the meter in the taxi, plus 3 Yuan for fuel consumption tax.

***Conference shuttle bus**

Local conference committee will arrange shuttle bus from airport to conference venue.

2. Local Weather

Located at an elevation of 1,950 meters on the Yungui Plateau with low latitude and high elevation, Kunming has one of the mildest climates in China, characterized by short, cool dry winters with mild days and crisp nights, and long, warm and humid summers, but much cooler than the lowlands. The weather never gets very hot in summer; the temperature has exceeded 30 °C only on a handful of occasions. With its perpetual spring-like weather which provides the ideal climate for plants and flowers, Kunming is known as the "City of Eternal Spring". The city is covered with blossoms and lush vegetation all-year round. The period from May to October is the rainy season and the rest of the year is dry. The city has a mean annual rainfall of 1,010 millimeters, with an annual sunshine period of 2,250 hours and an annual frost-free period of 230 days. Extreme temperatures in the city have ranged from −7.8 °C to 32.2 °C.

3. Insurance

The Conference Organizers recommends participants to possess travel, property medical or other necessary insurances before coming to China. The AOSWA 2013 Conference Organizers cannot be held responsible for the costs resulting from personal accidents or property loss during the Congress.

4. Currency Exchange

The currency in circulation in China is the Chinese Yuan, or RMB Yuan, which is not a free convertible currency. There are also certain rules on restriction of foreign exchange which should be available in the information of Chinese Customs on entry and exit. The international standard abbreviation sign of RMB Yuan is CNY. 1 CNY consists of 10 Jiao (dimes) or 100 fen (cents). The denominations of the Chinese Yuan in bank notes are 1, 5, 10, 20, 50 and 100. Participants can exchange major free convertible foreign currencies for RMB Yuan at airports, major hotels and banks in China. Currently, 1 USD can be exchanged for about 6.3 CNY. All currency exchange receipts should be saved in case participants want to exchange RMB back to their own currency. Banks may demand to see the original exchange receipt.

5. Credit Cards & ATM

Major credit cards are acceptable in the conference hotels (and other hotels) and in most department stores. ATMs of major banks are widely spread all over the major cities and can be used in drawing RMB yuan with your credit card/debit card. Please check with your bank as to the bank charges.

6. Workshop Working Language

The Conference working language is English.

7. Food

Kunming's cuisine combines fresh ingredients afforded by the moderate climate with mild herbs and spices giving its cooked dishes sufficient flavor but lacking the pungency associated with food from other regions of the country. The city's climate fosters the growth of literally hundreds of species of mushroom which are consequently a predominant feature of many dishes.

8. Smoking Policy

Please note that smoking is prohibited within the conference premises. Smoking is also banned in public areas like airports, hospitals and restaurants.

9. Water

It is recommended not to drink tap water. If you want to drink cold water, it is better to order or buy bottled water, mineral or distilled. Avoiding the ice cubes being made from tap water is also recommended. Upon request, hotels will provide containers of hot or chilled drinking water in the sleeping rooms at no extra cost. Hotels will also provide an electrically heated kettle to boil water from the tap in your room. The boiled water can then be stored in a vacuum thermos for drinking. Some hotels also provide a special tap in the lavatory that delivers a flow of purified water for drinking or taking medications. This advice also applies to your pre-conference or post-conference travel in others cities in China.

10. Voltage, Socket, and Plugs

The electrical current in China is 220-volts, 50Hz A/C. Hotels generally provide wall sockets in every room, accommodating both the standard “Flat blade attachment plug (Type A)” and common “Oblique flat blades with ground (inverted V) plug (Type I)” as well as the not-so-common “Round pin attachment plug (Type C)”as shown in following photographs.

Wall socket | Type A plug | Type I plug | • Type C plug

11. Projectors

Overhead projectors and computer-aided projectors (for Microsoft PowerPoint presentations only) will be available. Mac computers will not be available for PowerPoint presentations. Mac users can connect to the computer-aided projectors if they bring their own computer and connecting cord.

12. Duplication and Recording

Without permission from authors, taking photographs, audio-taping, video-recording, digital taping and any other form of duplication are strictly prohibited in the session rooms and poster areas.

13. Cell Phones

Participants are kindly requested to turn off their cell phones or keep the cell phones in vibration state when entering the meeting rooms and in the poster areas.

14. Children Accompanying

For safety reasons children under the age of 12 are not permitted in poster zones, or conference rooms.

15. Hotlines

Phone Number

- 110 Police
- 114 Local Telephone Number Inquiry
- 116 Domestic Long Distance Inquiry
- 117 Time Inquiry
- 119 Fire
- 120 Ambulance
- 121 Weather Forecast
- 122 Traffic Police

Telephone Codes

- Telephone Code for China: 0086
- Area Code for Kunming: 0871