Prediction Center: VHF Coherent Scatter Radar

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Korea space weather prediction center (KSWPC) in Korea Astronomy and Space Science Institute (KASI) has been constructing several facilities to observe mid- to low-latitude upper atmospheric/ionospheric phenomena; VHF coherent scattering radar, All-sky Imager, and Scintmon. Those new ionospheric facilities can be integrated to produce more reliable space weather forecast and nowcast with the existing facilities; Solar Flare Telescope (SOFT), Solar Optical Observatory's sunspot telescope and solar imaging spectrograph, and Magnetometer. The specification of KASI VHF coherent scattering radar is 40.8 MHz of target frequency, 200 kHz of bandwidth, 24 kW of peak power. The science goal of this radar is to measure the irregularities in E- and F-layers over Korea, especially sporadic-E, spread-F, and traveling ionospheric disturbance (TID). The radar will be installed at Gyerong in a territory of Korean Air force by early 2009.

[Ⅷ-1-5] Construction of Korean Space Weather Prediction Center: SCINTMON and All-Sky Camera

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As a part of the construction of Korean Space Weather Prediction Center (K-SWPC), Korea Astronomy and Space Science Institute (KASI) installed a Scintillation Monitor (SCINTMON) and an All-Sky Camera to observe upper atmospheric/ionospheric phenomena. The SCINTMON is installed in KASI building in Daejeon in cooperation with Cornell university and is monitoring the ionospheric scintillations on GPS L-band signals. All-Sky Camera is installed at Mt. Bohyun in Youngcheon in cooperation with Korea Polar Research Institute. It is used to take the photograph for upper atmospheric layer through appropriate filters with specific airglow or auroral emission wavelengths and to observe upper atmospheric disturbance, propagation of gravity wave and aurora. The integrated data from the instruments including SCINTMON and All-Sky Camera will be used for giving nowcast on the space weather and making confidential forecast based on some space weather prediction models.

[Ⅷ-1-6] Construction of Korean Space Weather Prediction Center: Storm Prediction Model

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Korea Astronomy and Space Science Institute (KASI) is developing an empirical model for Korean Space Weather Prediction Center (KSWPC). This model predicts the geomagnetic storm strength (Dst minimum) by using only CME parameters, such as the source location (L), speed (V), earthward direction (D), and magnetic field orientation of an overlaying potential field at CME source region. To derive an empirical formula, we considered that (1) the direction parameter has best correlation with the storm strength (2) west 15° offset from the central meridian gives best correlation between the source location and the storm strength (3) consideration of two groups of CMEs according to their magnetic field orientation (southward or northward) provide better forecast. In this talk, we introduce current status of the empirical storm prediction model development.

[Ⅷ-1-7] Construction of Korean Space Weather Prediction Center: Space radiation effect

Jaejin Lee, Kyung-Suk Cho, Jung A Hwang, Young-Sil Kwak, Khan-Hyuk Kim, Su-Chan Bong, Yeon-Han Kim, Young-Deuk Park, and Seonghwan Choi

Korea Astronomy and Space Science Institute

As an activity of building Korean Space Weather Prediction Center (KSWPC), we has studied of radiation effect on the spacecraft components. High energy charged particles trapped by geomagnetic field in the region named Van Allen Belt can move to low altitude along magnetic field and threaten even low altitude spacecraft. Space Radiation can cause equipment failures and on occasions can even destroy operations of satellites in orbit. Sun sensors aboard Science and Technology Satellite (STSAT-1) was designed to detect sun light with silicon solar cells which performance was degraded during satellite operation. In this study, we try to identify which particle contribute to the solar cell degradation with ground based radiation facilities. We measured the short circuit current after bombarding electrons and protons on the solar cells same as STSAT-1 sun sensors. Also we estimated particle flux on the STSAT-1 orbit with analyzing NOAA POES particle data. Our result clearly shows STSAT-1 solar cell degradation was caused by energetic protons which energy is about 700 keV

to 1.5 MeV. Our result can be applied to estimate solar cell conditions of other satellites.

[Ⅷ-1-8] Neutron Monitor as a New Instrument for KSWPC

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Cosmic ray (CR)s are energetic particles that are found in space and filter through our atmosphere. They are classified with galactic cosmic ray (GCR)s and solar cosmic ray (SCR)s from their origins. The process of a CR particle colliding with particles in our atmosphere and disintegrating into smaller pions, muons, neutrons, and the like, is called a cosmic ray shower. These particles can be measured on the Earth's surface by neutron monitor (NM)s. Regarding with the space weather, there are common types of short term variation called a Forbush decrease (FD) and a Ground Level Enhancement (GLE). In this talk, we will briefly introduce our recent studies on CRs observed by NM: (1) simultaneity of FD depending on solar wind interaction, (2) an association between GLE and solar proton events, and (3) diurnal variation of the GCR depending on geomagnetic cutoff rigidity. NM will provide a crucial information for the Korea Space Weather Prediction Center (KSWPC).

■ Session Ⅴ-2 : Orbit 2 / Payloads 2
Thursday, 23 October [10:00-11:15]

[V-2-1] Batch Unscented Transformation for Satellite Orbit Determination Using A Satellite Laser Ranging (SLR)

Kyoung-Seok Seo, Sang-Young Park, Eun-Seo Park, Young-Rok Kim, and Kyu-Hong Choi

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The batch least square filter is widely used for ground estimations. However, in orbit determination (OD) under inaccurate initial conditions and few measurement data the performance by the batch least square filter can lead an unstable results. To complement weak part of the batch filter, the batch unscented transformation without any linearization process is developed by ACL (Astrodynamics and Control Laboratory) in YONSEI University. In this paper, the batch unscented transformation is introduced and applied to satellite orbit determination using Satellite Laser Ranging (SLR) data. Only range of the satellite measured from ground tracking stations is used for measurement data. The results of simulation test are compared with those of the weighted batch least square filter for various initial states errors (position and velocity). Simulation results show that the batch unscented transformation is comparable or slightly superior to batch least square filter in the orbit determination.

[V-2-2] Real-Time Relative Navigation with Integer Ambiguity

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Relative navigation system is presented using measurements from a single-channel global positioning system (GPS) simulator. The objective of this study is to provide real-time relative navigation results as well as absolute navigation results for two formation flying satellites separated about 1km in low earth orbit. To improve the performance, more accurate dynamic model and modified relative measurement model are developed. This modified method prevents non-linearity of the measurement model from degrading precision by applying linearization about the states from absolute navigation algorithm not about a priori states. Furthermore, absolute states are obtained using ion-free GRAPHIC pseudo-ranges and precise relative states are provided using double differential carrier-phase data based on Extended Kalman Filter. The software-based simulation is performed and achieved meter-level precision for absolute navigation and millimeter-level precision for relative navigation. The absolute and relative accuracies at steady state are about 0.77m and 4mm respectively (3D, r.m.s.). In addition, Integer ambiguity algorithm (LAMBDA method) improves simulation performances.

[V-2-3] Improved Differential Wavefront Sampling algorithm for efficient alignment of Space optical system

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The significant I&T process gain represented by reduction in overall budget expenditure can be obtained from the use of efficient alignment technique for large space optical systems. Such process gain tends to increase rapidly with