the difference between Q1(t) and Q2(t). We have found this simple method successful enough to reproduce the observed Dst variations from the corresponding solar wind data. The present result provides a scheme to predict the development of Dst 30 minutes to 1 hour in advance by using the real time solar wind data from the ACE spacecraft.

[III-2-2] Origin of the Multiple Type II Solar Radio Bursts Observed on December 31 2007

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Solar type II radio burst is regarded as a signature of coronal shock. However its association with coronal mass ejections (CMEs)-driven shock and/or flare blast waves remains controversial. On December 31 2007, SOHO/LASCO and STEREO/COR observed a CME that occurred on the east limb of the Sun. Meanwhile, two type II bursts were observed sequently by KASI/E-Callisto and the Culgoora radio observatory during the CME apparence time. In this study, we estimate kinematics of the two coronal shocks from dynamic spectrum of the multiple type II bursts and compare with the kinematics of the CME derived from the space observations. An origin of the multiple type II bursts is inspected and discussed briefly.

[III-2-3] Dependence of solar proton events on X-ray flare peak flux, longitude, and impulsive time

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In this study, we present a new empirical forecasting method of solar proton events based on flare parameters. For this we used NOAA solar energetic particle (SEP) events from 1976 to 2006 and their associated X-ray flare data. As a result, we found that about only 3.5% (1.9% for M-class and 21.3% for X-class) of the flares are associated with the proton events. It is also found that this fraction strongly depends on longitude; for example, the fraction for 30W° < L < 90W° is about three times larger than that for 30°E < L < 90°E. The occurrence probability of solar proton events for flares with long duration (> 0.3 hours) is about 2 (X-class flare) to 7 (M-class flare) times larger than that for flares with short duration (< 0.3 hours). The relationship between X-ray flare peak flux and proton peak flux as well as its correlation coefficient are strongly dependent on longitude. Using these results for prediction of proton flux, we divided the data into 6 subgroups depending on two parameters: (1) 3 longitude ranges (east, center, and west) and (2) flare impulsive times (long and short). For each subgroup, we make a linear regression between the X-ray flare peak flux and the corresponding proton peak flux. The result shows that the proton flux in the eastern region is much better correlated with the X-ray flux than that in the western region.

[III-2-4] 태양간섭현상 예측을 위한 프로그램 개발

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태양물리연구실에서는 춘·추분기를 전후한 일정 기간 사이에 수 분 정도 발생하는 태양간섭 현상을 예측하기 위하여 프로그램을 개발하였다. TU 미디어에서 제공해준 3개의 통신위성 PAS-8, TELSTAR-10, MEASAT-1에 대한 2006, 2007년도 춘·추분기의 통신장애 자료와 계산한 자료를 비교 분석하였고, 이를 이용하여 2009년도 추분기의 태양간섭 현상 시간을 예측하였다. 태양위치 변화 계산은 NASA/JPL에서 발행하는 DE406 역서 자료를 이용하여 정밀도를 높였으며, 지구 타원체 모델을 통해 기지국에서의 정확한 태양 및 위성의 고도, 방위각을 구하였다. 또한 기지국 안테나 이득률을 계산하여 기지국 안테나에서 예상 되는 태양 간섭 시간을 얻어 냈다. 기지국 안테나의 빔 패턴은 안테나의 중심 부근에서 가장 강하게 나타나며, 중심에서 멀어질수록 특수한 감쇄 형태를 보인다. 이러한 빔 패턴은 안테나의 이득률과 관련이 있으며, 빔 패턴의 적분을 통해 얻어진 이득률과 태양 디스크가 얼마나 안테나의 범위에 들어오는가에 따라 안테나에 수신되는 전파의 강도가 달라진다. 이러한 강도 변화량을 계산함으로써 태양 간섭 시간을 계산할 수 있다. 본래 안테나 빔 패턴은 개개의 안테나에 따라 다르며 직접 측정하여 얻을 수 있다. 사용한 빔 패턴 모델은 ITU에서 채택된 WARC-79 모델을 이용하였고 모든 위성 기지국 안테나의 빔 패턴은 이 모델에서 벗어나지 않는다. 이 연구에서는 빔 패턴 모델을 적용하여 기존의 TU미디어 성수기지국에서의 태양간섭 시간을 다시 계산하였다. 또한 새롭게 KT 용인 위성 관제센터의 자료를 추가하여 태양 간섭시간을 계산하고 예측하였다. 위성데이터는 기존의 PAS-8, TELSTAR-10, MEASAT-1 통신위성과 KT에서 운용하고 있는 무궁화 3호와 무궁화 5호 통신위성 자료를 사용하였다. 이러한 계산 방법은 전국 임의의 지역에서 춘·추분기에 발생할 수 있는 태양간섭 시간을 예측하고 적용할 수 있다.

[III-2-5] Testing Capability of CME Eccentricity Parameter

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Rho et al.(2008) showed that the eccentricity parameter of a CME is an important indicator for forecasting CME geoeffectiveness. In this study we have tested a capability of the eccentricity parameter as an indicator of CME direction. For this work we considered 11 CMEs observed by both SOHO/LASCO and STEREO/SECCHI (2007-2008 from Temmer et al. 2009) coronagraphs. We have estimated earthward direction angles for these CMEs based on two different methods: (1) the eccentricity parameter from a single coronagraph SOHO/LASCO and (2) the triangulation technique using a pair of spacecrafts LASCO/STEREO-A and LASCO/STEREO-B. As a result, we have found that for 7 out of 11 CME events their direction angles are consistent with each other within 20°. This result demonstrates that the earthward direction based on the eccentricity parameter can be a good potential indicator for CME propagation direction.

■ Session : 전리층
10월 30일(금) 10:30 - 12:00 제2발표장

[Ⅳ-2-1] **Gadanki radar observations of F-region irregularities during June solstice of solar minimum: First results and preliminary analysis**

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In this paper we present the first results of summer-time F region irregularities during low solar condition observed using the Gadanki MST radar. Echoes were observed on all 20 nights of radar observations and were mostly confined to the post-midnight hours. Echo morphology is very different from the equinoxial post-sunset plume-like features reported earlier from Gadanki. Echo SNRs are lower by 25 dB than their equinoxial post-sunset counterpart, and are quite comparable to the equinoxial irregularities in the post-midnight hours, which are essentially the decaying post-sunset irregularities. The Doppler velocities, which lie in the range of ± 100 m s-1, show upward/northward motion of the irregularities during the initial phase in contrast to the observed predominant downward/southward velocities associated with the decaying equinoxial post-midnight F region irregularities. Spectral widths of the summer echoes, which are well below 50 m s-1 and are very similar to those of the decaying equinoxial irregularities, represent the presence of weak plasma turbulence. Simultaneous observations made using a collocated ionosonde show no ionogram trace during 2200-0530 LT except for a few occasions. Weak frequency type spread F observed during midnight hours occurred without prior occurrence of range spread F. Concurrent ionosonde observations made from magnetic equatorial location Trivandrum also show very similar result and thus no height rise of the F layer during the midnight hours could be monitored. The preliminary analysis suggests that the post-midnight irregularities reported here are mostly freshly generated ones. The observations are discussed in the light of other observational results reported earlier and the current under standing on the post-midnight occurrence F region irregularities in summer.

[Ⅳ-2-2] Ionospheric F2-Layer Variability in Mid Latitude Observed by Anyang Ionosonde

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The ionosphere displays variations on a wide variety of time-scales, ranging from few hours to days and up to solar cycles and even more. In this paper, we examine the ionospheric F2-layer variability in mid latitude by analyzing the foF2 and hmF2 from the Anyang ionosonde. Especially, we investigate how ionospheric semi-annual and seasonal anomalies vary with local time and solar activity. In addition to the characterization of the ionospheric semi-annual an seasonal anomalies, our study extends to the investigation of the relationship between ionospheric variability and geomagnetic activity. Finally we also discuss the coupling between ionospheric F2-layer variability and thermospheric neutral composition.

[Ⅳ-2-3] The One-to-one Comparison of the Pre-reversal Enhancement Characteristics with the Equatorial Plasma Bubble Occurrence using Multiple Satellite Data.

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