observations have been continuously providing the TEC data over the global 'ocean' from the launch of the satellite in 1992. On the other hand, the GPS TEC data are based on the world-wide network of the ground receiver stations, which are mostly distributed over the 'continent' but scarce in the ocean. It seems to be very plausible that these discrepancies in the spatial coverage of the two can make them a perfect global TEC data set if they are combined. However, they have been hardly merged in the study of the ionosphere since there are additional differences in the data sets: the altitudes of the satellites are very different. The TOPEX/Jason satellites are orbiting at about 1330 km altitude, an approximate boundary between the topside ionosphere and plasmasphere at mid-latitudes, while the GPS satellites circle around the Earth at about 20,200 km altitude. This large discrepancy of the satellite orbit can yield significant differences in their TEC data. In this study, we perform a comprehensive comparison between the two data sets in order to quantify the differences in various geophysical conditions. The resulting TEC differences between 1330 and 20200 km altitudes may also provide an indication of the electron densities of the plasmasphere in the various geophysical conditions. The preliminary results of this study will be presented.

[ATM-04] Behavior of the NmF2 and hmF2 over Anynag station (37.4N, 127.0E, Geomag = 27.7N, 196.9E)

Eojin Kim[1], Jong-Kyun Chung[2], Yong Ha Kim[1], Geon-Hwa Jee[3], and Jung-Ho Cho[2]

[1]*Department of Astronomy and Space science, Chungnam National University*
[2]*Korean Astronomy and Space science Institute*
[3]*Korean Ocean and Polar Research Institute*

The peak density of the F2 layer of ionosphere (NmF2) and the height of the maximum density of the F2 layer (hmF2) have been used as key ionospheric parameters for GPS signal time delay correction. It is well known that the trends of the NmF2 and hmF2 variation are different with the region since the work of Torr et al. (1970). A comprehensive database of the NmF2 and hmF2 over the local area is thus needed to be analyzed, in order to develop an accurate ionospheric correction model for the local area GPS receiver. For the purpose of improving time delay correction models of GPS radio signals propagating through the ionosphere over Korean Peninsula, we study the ionospheric climatology using NmF2 and hmF2 data over south Korea by analyzing the ion density profile measured by the digisonde at the Anyang station (37.4N, 127.0E, Geomag = 27.7N, 196.9E) during the period of April 1998 through December 2008. Anynag digisonde data cover one complete solar cycle period with various solar activities and geomagnetic activity conditions. We sorted the data for the solar activities, geomagnetic activities, local times, and seasons to analyze the variation of the NmF2 and hmF2 for each condition. Local time variations of NmF2 and hmF2 were probed for each case of three (strong, medium, low) solar and geomagnetic activities, and each months. The NmF2 and hmF2 variations were compared with those derived from IRI-2007 model. In our results, the response of the noon time NmF2 to the solar flux indices (F10.7) is much higher in January than July and the hmF2 does not show seasonal dependences significantly, as reported by Bremer (2000). The NmF2 and hmF2 at Anyang vary little with geomagnetic activities, but the hmF2 data were higher by at least 50 km than the values of IRI-2007 for high solar activity in the moderate and high geomagnetic conditions. We classified the data in the cases of low, moderate and high solar activities for the low, moderate and high geomagnetic activities, 9 combined conditions. The semi-annual variations of NmF2 and hmF2 are dominant during daytime but not during nighttime. Annual anomaly of the NmF2 (higher in winter than summer) is clearly seen for 6 combined conditions. Semi-diurnal variations of the hmF2 were apparent for most seasons as reported by Oliver et al. (2008).

[ATM-05] Mean winds and tidal variabilities in the mesopause region above King Sejong Station(62.1°S, 58.5°W), Antarctica

Chang-Sup Lee[1], Jeong-Han Kim[1], Yong Ha Kim[1], Geonhwa Jee[2]

[1]*Department of Astronomy and Space Science, Chungnam National University*
[2]*Korean Ocean and Polar Research Institute*

The meteor radar at King Sejong Station have provided wind profiles in the mesopause region (80-100 km) since its installation in March 2007. Winds are determined from meteor trail evolution every hour from 80 to 100 km with 2 km height resolution. Monthly mean winds are mostly westward below 90 km during Austral summer months (November, December), while eastward winds appeared dominant between 80 and 100 km during winter (July, August), In addition to the mean wind fields, tidal variation, especially semi-diurnal tides are apparent in the measured wind profiles. A simple Fourier analysis of the measured winds shows various tidal components (diurnal, semidiurnal and others) and planetary waves that have period longer than a day. The monthly means of tidal parameters such as amplitudes and phases are obtained using a curve fitting

method. We plan to investigate variation of tidal parameters with seasons that could be related to interaction between tides and gravity wave from lower atmosphere since the interaction might cause the variability of tidal amplitudes and energies. The obtained tidal characteristics over the KSS are expected to be very unique when compared with other Antarctic sites, because gravity waves in the lower atmosphere are very active near the Antarctic peninsula.

■ Session : 태양 및 우주환경 II
4월 29일(수) 16:25 - 17:55 제2발표장

[SE-07] Prospects of empirical space weather forecast based on solar information

Yong-Jae Moon[1], Rok-Soon Kim[2], Kyung Suk Cho[2]
[1]Department of Astronomy and Space science, Kyunghee University, [2]Solar and Space Weather Group, Korea Astronomy and Space Science Institute

In this talk I will review our recent progress of space weather forecast based on solar information. Major findings can be summarized as follows. First, we presented a concept of storm probability map depending on CME parameters. Second, we suggested a CME earthward direction parameter and demonstrated its importance in terms of the forecast of geomagnetic storms. Third, the importance of solar magnetic field orientation for storm occurrence in terms of ICME classification was examined. Fourth, the relationship among coronal hole-CIR-storm relationship has been investigated. Fifth, the storm forecast based on coronal hole information is in progress but challenging. Sixth, a new proton event forecast method including helio-longitudinal dependence has been suggested. We are attempting to apply machine learning technology to space weather forecast. I will discuss the importance of these works and their future prospects.

[SE-08]Forecast of Geomagnetic Storm based on CME and Interplanetary Condition

Rok-Soon Kim[1,2], Kyung-Suk Cho[1], Khan-Hyuk Kim[1], Yong-Jae Moon[3], and Yu Yi[2]
[1]Solar and Space Weather Research Group, Korea Astronomy and Space Science Institute
[2]Department of Astronomy and Space Science, Chungnam National University
[3]Department of Astronomy and Space science, Kyunghee University

In our previous studies, we already examined the CME properties that control the CME geoeffectiveness and suggested the geomagnetic storm prediction formula based on only initially-observed CME parameters. However, there are some limitations for the forecast using only CME parameters, since geomagnetic storms are directly affected not only by solar source events but also by near Earth interplanetary conditions. In addition to this, the initially-observed CME characteristics can be changed during its transit to the Earth. For this reason, we have to consider real time solar and interplanetary conditions together to improve the forecast capability of geomagnetic storms. In this study, we examine near Earth interplanetary conditions for 64 CME-Dst pairs from 1997 to 2003, which were associated with M and X class solar flares and whose source regions were clearly identified. We ensure that the peak Bz and Ey prior to Dst minimum value are strongly related with Dst index. By carefully investigating the interplanetary condition for moderate geomagnetic storms (Dst $\leq$ 50 nT), we suggest an empirical criteria: Bz = −5 nT or Ey = 3 mV/m for t = 2 hr. As a result, most of the storms (90 %) satisfy the interplanetary criteria. Among 20 exceptional eventsunsatisfying the CME-storm forecast, 15 misses can be explained by the interplanetary condition, but we couldn't find the cause of 5 false alarms. By considering both conditions, all geomagnetic storms (Dst $\leq$ 50 nT) are found to occur when the CME conditions or interplanetary conditions (Bz $\leq$ −5 nT or Ey $\geq$ 3 mV/m for t $\geq$ 2 h) are satisfied.

[SE-09] Application of Support Vector Machine to Space Weather Prediction: Geo-effectiveness of CMEs

Seonghwan Choi[1,2], Yong-Jae Moon[2], Ngo Anh Vien[3], and Rok-Soon Kim[1,4]
[1]Korea Astronomy and Space Science Institute (KASI),
[2]Department of Astronomy and Space Science, Kyunghee University
[3]Department of Computer Engineering, Kyunghee University
[4]Department of Astronomy and Space Science, Chungnam National University

Support vector machine is a powerful machine learning method in classification and regression. Generally machine learning has been greatly applied in image processing, data classification, and data mining. It is very helpful to automatically produce models from data which are not clearly understood. Very recently, researchers started to apply it to space weather forecast. In this study, we apply it to the forecast of geo-effective CMEs using 488 CME-Dst pairs that Kim et al. (2008) used. Here we assume that the occurrence of a geomagnetic storm is governed by CME speed, longitude, and earthward direction parameter. We