國立中央大學太空科學與工程學系

Department of Space Science and Engineering, National Central University

專題演講

Ionospheric lunar phase effects observed by GNSS total electron content

Speaker： 吳宗祐

(本系畢業生)

Time： 111 年 8 月 5 日 星期五 11:00

Place： 健雄館(科四館) S4-807 教室

摘 要/Abstract：

Equatorial ionization anomaly (EIA) is the most pronounced low-latitude ionospheric structure, featured by two dense bands of electron density around ±15°N magnetic latitude straddling the magnetic equator. In this study, the total electron content (TEC) of global navigation satellite systems (GNSS) and global ionosphere map (GIM) in 2000–2017 is utilized to examine EIA crests' strength, appearance time, and latitude, as well as lunar phase effects during the stratospheric sudden warming (SSW) and the total solar eclipse. The 18-year statistical analysis shows that lunar phases can modulate EIA crests' appearance time and latitude with a 14.76-day periodicity. The EIA crests on the new moon or full moon lead those of the 18-year average by about 20–40 minutes. By contrast, the EIA crests on the first quarter or third quarter lag those of the 18-year average by about 20–40 minutes. Meanwhile, EIA crests move the furthest poleward and equatorward 2–5 days after the new moon or full moon and the first quarter or third quarter, respectively. The amplitude of 14.76-day appearance time and latitude variations reach the maximum around the perihelion, while the minimum is around the aphelion. Since the appearance time of EIA crests varies with a 14.76-day period, the TEC around the new moon or full moon yields a larger value after 08:00 solar local time (SLT) but a smaller value after 14:00 SLT. On the contrary, around the first quarter or third quarter, TEC decreases after 08:00 SLT and increases after 14:00 SLT. This study further employs the GIM TEC and 12 SSW events during 2000–2013 to examine the relation between lunar phases and SSWs. The statistical analysis shows that lunar phases can significantly modulate the appearance time of EIA crests and dominate the pattern of TEC increases/decreases. Meanwhile, SSWs can further advance EIA crests' appearance time by about 0.47 hours regardless of lunar phases. On the other hand, the GNSS TEC is utilized to analyze the 14.76-day signatures in the solar eclipse effects of the major depression (MD), pre-ascension (PA), sunset ascension (SA), and secondary depression (SD) on 21 August 2017. The results show that due to the lunar phase effects, PAs are enhanced and suppressed before and after 14:00 SLT, respectively; SAs and SDs are suppressed and enhanced during 14:00–20:00 SLT, respectively; and MDs have been underestimated before and overestimated after 14:00 SLT. In conclusion, lunar phases can significantly modulate EIA crests' appearance time, latitude, and pattern of daily TEC deviation, which should be considered when studying an SSW or a total solar eclipse.

※歡迎聽講※

~請聽講者提早入座~