LF帯標準電波を用いた台風に関連する下部電離圏反射高度変動

Variations in the reflection height in the lower ionosphere associated with typhoons using LF transmitter signals

*大矢 浩代[1]、淺田 圭佑[2]、土屋 史紀[3]、塩川 和夫[4]、中田 裕之[1]、山下 幸三[5]、高橋 幸弘[6]
*Hiroyo Ohya[1], Keisuke Asada[2], Fuminori Tsuchiya[3], Kazuo Shiokawa[4], Hiroyuki Nakata[1], Kozo Yamashita[5], Yukihiro Takahashi[6]

1.千葉大学大学院工学研究科、2.千葉大学工学部、3.東北大学大学院理学研究科、4.名古屋大学宇宙地球環境研究所、5.サレジオ工業高等専門学校電気工学科、6.北海道大学大学院理学研究院
1.Graduate School of Engineering, Chiba University, 2.Faculty of Engineering, Chiba University, 3.PPARC, Graduate School of Science, Tohoku University , 4.Institute for Space-Earth Environmental Research, Nagoya University, 5.Department of Electrical Engineering, Salesian Polytechnic, 6.Graduate School of Science, Hokkaido University

So far, several studies for gravity waves caused by typhoons have been reported, although there are few studies for the lower ionosphere variations associated with typhoons using LF transmitter signals. In this study, we investigate variations of the D-region height associated with a typhoon of 11-20 June, 2012 using phase data of LF transmitter signals. There were two magnetic storms (minimum Dst values:-51 nT on 12 June and -71 nT on 17 June) in these dates. The propagation paths were Fukushima-Pontianak (PTK, Indonesia, 40 kHz) and Saga-PTK (60 kHz). We converted the phase data to reflection heights based on Earth-ionosphere waveguide mode theory. The period of the reflection height variations was analyzed by wavelet transform. The reference days were 23, 24, and 29 June, 2012, which were also geomagnetically quiet days. We excluded the periods of the reflection height variations seen in these reference days from the periods during the typhoon. In daytime during the typhoon, several solar flares were identified by the GOES X-ray flux. When the solar flares occurred, the reflection heights were largely decreased. Only nighttime data of the reflection height were analyzed because the duration of the gravity waves is expected to be several hours. As a result, the common periods of the reflection height over both propagation paths were 45.3 minutes on 15 June, 2012, and 76.1 minutes on 16 June. The duration of the periods was about 50 minutes in nighttime. In the two nights, medium-scale traveling ionospheric disturbances were not observed in the GPS-TEC data over Japan. The horizontal wavelengths were calculated from the onset time difference of the oscillations between the two propagation paths, and difference of the distance between the source location (the typhoon) and the two propagation paths. The horizontal wavelengths were estimated to be 483 –662 km for the 45.3 minutes and 1222 –1346 km for the 76.1 minutes. The horizontal wavelengths were comparable or longer than previous studies.

