Relationship between ionospheric and atmospheric perturbations associated with typhoons

Shinichiro Hirabayashi[1], *Hiroyuki Nakata[1], Toshiaki Takano[1], Ichiro Tomizawa[2], Hiromichi Nagao[3]

1.Graduate School of Engineering, Chiba University, 2.Center for Space Science and Radio Engineering, The University of Electro-Communications, 3.Earthquake Research Institute,The University of Tokyo

It is known that ionospheric disturbances are caused by extreme weather conditions, such as tornadoes and typhoons. In this study, we have examined the relationship between ionospheric and atmospheric disturbances caused by typhoons, using HF doppler (HFD) and a microbarometer. HFD observation system used in this study is maintained by The University of Electro-Communications (UEC). The receiver is located at Sugadaira, Nagano Prefecture and the transmitters are located at Chofu Campus of UEC and Nagara, Chiba Prefecture. The microbarometer is also located at Sugadaira, Nagano Prefecture. In examining typhoons which came closer to Japan since 2004, we have found ionospheric perturbations associated with 8 typhoons. In almost events, the amplitude of the doppler shift is about several hertz, which is much less than the cases for earthquakes. By dynamic spectral analyses, it is found that spectral intensity of both of ionospheric and atmospheric perturbations at frequency from 5 mHz to 50 mHz were enhanced. These results imply that the effect of the typhoon to the ionosphere is quite smaller and that the atmospheric waves propagated to the ionosphere drive the ionospheric perturbations. In this study, as a typical example, the perturbations asssociated with Typhoon WIPHA (No.18 in 2013) at 30 mHz are examined in detail. This is because the wind direction in the transmitter (Chofu), the receiver (Sugadaira), and the middle point (Chofu) is quite stable (eastward) when Typhoon WIPHA was closest to Japan for several tens of hours. The temporal variation of the spectral intensity of ionospheric perturbation is almost the same as the wind speed at Sugadaira, where is the windward of Chofu. This result shows that the ionospheric perturbations associated with typhoons is affected by the atmospheric perturbations windwardly below the ionosphere.

Keywords: Ionospheric perturbation, Atmospheric perturbation, Typhoon, HF Doppler, Microbarometer

©2016. Japan Geoscience Union. All Right Reserved.