

# The morphological features of ionospheric response to typhoon

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Couplings between the ionosphere and meteorological events have been studied widely. However, most of them are individual case studies or correlation analyses, few are aiming at the full morphological features of the ionospheric response processes. In this paper, complete records of 24 strong typhoons from 1987 to 1992 were collected and comparison was made with corresponding ionospheric HF Doppler shift data. The main purpose of the present work is to find the temporal evolution of these responses and their common features by the merit of the continuities of HF Doppler shift observation in time. Based on the statistical analyses, this paper reveals firstly the common features of ionospheric responses to typhoon. A summary of these characteristics is as follows:

(1) During the existing time of Typhoon, there are almost always medium-scale TIDs in the ionosphere, especially, when strong typhoon was landing or near coast of the mainland. (2) These TIDs show quite clear periodicity and their periods vary with time and get longer gradually. (3) After sunset, the wave-like disturbances with large magnitudes often excite the mid-latitude Spread-F. (4)The very strong typhoon can cause the wave-like records of the Doppler shift to show the “S” shaped echo tracing, meaning the amplitudes of those waves are sufficiently large , and (5) the sunrise-like phenomena often appear in non-sunrise time during the typhoon existing period . The phenomena mentioned above are all in agreement with the linear propagation theories of the acoustic-gravity waves in the atmosphere. It is sure that typhoon is one of the important ground sources of the wave-like disturbances in troposphere, this source is much effective especially when typhoon is landing or near the mainland coast. Of course, the morphological details of ionospheric response to typhoon can by no means be completely identical every time. In this study, except TIDs that almost always appear during all the typhoon events, the other common features are not seen every time. However, it is sure that the above summarized phenomena are statistically true since they appear much more frequent during typhoon influenced periods.

**Keywords:** ionospheric response to typhoon, traveling ionospheric disturbances (TIDs), Spread-F,