

VHF anomalous transmission associated with lightning activity

Nozomi Ohno^{1*}, Masashi Kamogawa², Hironobu Fujiwara³, Yoshihiro Kakinami⁴

¹Geosys. and Biosys. Sci. Div., Chiba Uni, ²Dpt. of Phys., Tokyo Gakugei Univ., ³Joshiseigakuin High School,

⁴Nat. Central Univ., Taiwan

VHF electromagnetic (EM) waves cannot usually propagate long distance because they penetrate through the ionosphere. They can reach far away receivers beyond the line-of-sight only when reflection and scattering due to ionospheric or atmospheric disturbances happen. According to Fujiwara et al. (Geophys. Res. Lett., 2004), appearance of anomalies in the atmosphere before earthquakes (EQs) has been verified through observation of anomalous transmission of VHF EM waves beyond line-of-sight. The cross-correlation between the EQ occurrences and the anomalies shows that the appearance of anomalies was significantly enhanced within 5 days before EQs. Preliminary one-month observation has been done in Hualien, Taiwan, for observation of VHF anomalous transmission possibly associated with EQs. Taiwan is one of best place for the statistical study of EQ-related phenomena due to active seismicity. Suitable place for FM transmission observation is restricted due to FM radio station jam. In eastern Taiwan, less artificial noise may be expected because of only small city existence. Different allocation of FM radio in Taiwan and Japan contributes to less radio wave interference. In our observation, anomalous VHF propagation beyond line-of-sight during heavy thunderstorm activities was measured. Besides non-transient (the order of minutes to hours) anomalous VHF propagation caused by Es-layer reflection and radio duct, anomalous propagation lasting for a few hours during a heavy thunderstorm was found. A calculation of ray tracing supported this refraction was caused by thunderstorm-scale duct. On the other hand, an M5.6 EQ occurred under the transmission path 5-days after the anomalous transmission. Although this anomalous transmission might be associated with the EQ, there was no evidence of causal relationship between the EQ and the anomalous transmission.