

## Anomalous phenomena of Schumann resonances in possible association with earthquakes

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The anomalous behaviour in Schumann resonances was observed at a Japanese station, Nakatsugawa (geographic coordinates: 35.45 degree N, 137.3 degree E), which appeared as an enhancement in the fourth harmonic about one week before the 1999 Chi-chi earthquake (EQ) in Taiwan (Hayakawa et al., 2005). Schumann resonance is a global resonance phenomenon triggered by global lightning activity in the tropic (Nickolaenko and Hayakawa, 2014). A mechanism to explain this anomaly has been proposed with a model in terms of the wave interference between the direct ELF signal from one of the world-lightning centers and that scattered by the seismo-ionospheric perturbation above Taiwan (Hayakawa et al., 2005; Nickolaenko et al., 2006). This case study was extended statistically by using the ELF data observed at Nakatsugawa during 6 years (1999 to 2004) with special reference to EQs in Taiwan (Ohta et al. (2006)). With the criterion of magnitude greater than 5.0, there were observed 33 EQs in and around Taiwan, and the Schumann resonance anomaly is observed for 9 EQs (so that the anomaly percentage is 9/29 (because no observation at Nakatsugawa due to some malfunction of the equipment for 4 EQs)). 29 EQs included 7 EQs in the land, while other 22 EQs took place in the sea. As the result of analysis, anomalous Schumann resonances are observed for all inland EQs. 2 sea EQs from the 22, had the anomalous Schumann resonances, but these two EQs had the following characteristics: one was the largest magnitude and the other the shallowest. This paper discloses the causative link between EQs in Taiwan and anomalous behaviour in Schumann resonance in Japan, and also suggests the land/sea asymmetry in generating the seismo-ionospheric perturbation closely associated with the mechanism of lithosphere-atmosphere-ionosphere coupling.

### References

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