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Anomalous Schumann resonance observed in China, possibly associated with Honshu, Japan Earthquake

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Schumann resonance (hereafter SR) occurs in the cavity between the Earth and the ionosphere, and it is originated by the global lightning activities [1]. Some recent publications showed that anomalous SR phenomena may occur before major earthquakes [2-4]. Considering good prospects for the application of SR in Earthquake monitoring, we have established four observatories in Yunnan province, a region with frequent seismicity in the southwest of China. Our instruments can provide three components of magnetic field in 0-30 Hz, including B_{NS}(North-South component), B_{EW}(East-West component) and B_V(Vertical component). The sample frequency is 100 Hz. In this research, we use high quality data recorded at Yongsheng observatory (geographic coordinates: 26.7°N, 100.77°E) to analyze SR phenomena to find out anomalous effects possibly related with the Ms9.0 Earthquake (epicenter: 38.297°N, 142.372°E) near the east coast of Honshu, Japan on 11 March 2011. We select the data 15 days before and after the earthquake.

SR in B_{NS} and SR in B_{EW} appear different in background characteristics. Frequencies of four SR modes in B_{NS} are generally higher than that in B_{EW}. Amplitude of SR in B_{NS} is strong at around 05:00 LT, 15:00 LT and 23:00 LT of the day, while amplitude of SR in B_{EW} is just intense around 16:00 LT, corresponding to about 08:00 UT. Because American, African and Asian thunderstorm centers play their dominant roles respectively in the intervals of 21:00UT$\pm$1h, 15:00UT$\pm$1h and 08:00UT$\pm$1h [1, 3], we can see that SR in B_{EW} is most sensitive to signals from Asian center and SR in B_{NS} is in good response to three centers.

SR in B_{NS} and SR in B_{EW} have presented different features in the aspect of anomalous effects related with earthquakes. B_{EW} component gives us a clear picture of anomalous SR phenomena, which are characterized by increase in amplitude of four SR modes and increase in frequency at first SR mode several days before the earthquake. The amplitude of four SR modes began to increase four days before Honshu earthquake (7^{th} March). And this continued to the day of the earthquake (11^{th} March). Then it fell to the usual intensity after the earthquake (12^{th} March). The frequency at first SR mode in B_{EW} unconventionally exceeded the first mode frequency in B_{NS} with an enhancement of 0.7 Hz on 8^{th} and 9^{th} March. We did not find similar anomalous effects in B_{NS}. The anomalous effects in B_{EW} may be caused by interference between direct path from Asian center to the observatory and disturbed path scattered by the perturbation in the ionosphere over Honshu. More detailed analysis is going on.

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