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Modeling the Earth-ionosphere cavity. Effects of hypothetical earthquake precursors over the Schumann resonance

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Schumann resonances (SR) are global phenomena which occur within the Earth-ionosphere cavity. They are the result of waves propagating several turns around the Earth. Due to the dimensions of the cavity, SR belong to the ELF spectra. The main source of excitation is lightning, and several natural processes do modify the geometry of the cavity and its parameters, like for instance seismo-electromagnetic activity, atmospheric aerosols, solar radiation, etc. Therefore, SR are a promising tool for monitoring (and even forecasting) these natural events.

Although several measurements seem to confirm the link between electromagnetic activity and earthquake precursors, the physical mechanisms which produce them are still not clear, and several possibilities have been proposed, like for instance piezoelectric effects on the rocks in the lithosphere, emanation of ionizing gasses like radon, or acoustic gravity waves modifying the properties of the ionosphere in the earthquake preparation zone. However, further measurements combined with analytical models and/or numerical simulations are required in order to better understand the seismo-electromagnetic activity.

In this work, the whole Earth-ionosphere electromagnetic cavity has been modeled with 10 km accuracy, by means of Transmission-Line Modeling (TLM) method. Since Schumann resonance parameters depend primarily on the geometry of such cavity, electromagnetic changes produced by earthquake precursors can modify the properties of SR. There is not much quantitative information available about the changes produced by the precursors, either in the lithosphere, atmosphere, or ionosphere. Therefore, different models of the precursors are proposed and their consequences over the SR are evaluated. The so-called Chi-Chi earthquake is employed as a case of study.