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[*Invited Lecture*]

## **Earth Observations and VLF: an integrated Approach to powerful Solar Flare Events**

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**Abstract:** Powerful solar flare events across last three solar cycles were analyzed through their geo-effectiveness, based upon remote sensing technique, using ground-based receiving system for registration of Very Low Frequency (VLF, 3-30 kHz) radio signals located at the Institute of Physics Belgrade, in Serbia, and solar soft X-ray flux (0.1-0.8 nm) data from Geostationary Operational Environmental Satellite (GOES) archive database. Earth's lower ionospheric perturbations of mid-latitudinal region over Europe were examined, based on amplitude and phase delay disturbances simultaneously monitored and recorded on several VLF signals recorded by Belgrade receiver (BEL; 44.85° N, 20.38° E). In order to obtain electron density height profiles throughout entire lower ionospheric region related to selected solar flare events of significant geo-effectiveness, three independent approaches of numerical simulations were applied, and not only to the moments of selected solar flare events' maximal X-ray flux irradiances, but also their entire time evolution intervals were analyzed and modeled, with main results presented in this research.

**Key words:** Solar activity, X-class flares, lower ionosphere, VLF perturbations