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# Measurements of Natural and Man-Made Electromagnetic Noises for Disaster Risk Reduction and Management

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In this lecture, I will introduce several examples of both natural and man-made electromagnetic (EM) noise measurements potentially reducing damage from natural disasters. Three important topics will be paid attention to which are (1) atmospheric extreme events, (2) seismic activities, and (3) space weather. An interdisciplinary approach is highly required to tackle the above-mentioned problems, and so inter-commission collaboration in the URSI is extremely important.

(1) Atmospheric extreme events
Recent global climate change causes more hazardous meteorological events worldwide such as torrential rain causing flash floods, strong tropical cyclones, tornadoes, and gust wind, etc. Many of these events are associated with significant lightning discharges which radiate EM pulses received as sferics in wide frequency ranges. The first example is monitoring and short-term forecast of extreme meteorological events by using so-called Total Lightning (TL), which is a sum of the Cloud to Ground lightning discharges (CGs) and In-Cloud lightning discharges (ICs). The second example is remotely locating the very energetic lightning characterized by a large lightning charge Q by to identify the potential damage to the power grid systems renewable power generating systems from Extremely Low Frequency (ELF) EM radiation.

(2) Seismic activities
Significant progress has been made in this new scientific field, exploring the possibility of earthquake (EQ) prediction with EM effects in the last few decades. Various types of EM anomalies such as lower ionospheric anomalies detected by VLF/LF transmitter amplitude changes, ULF/ELF magnetic field anomalies, and atmospheric electric field (AEF) fluctuations, etc. around EQs will be mentioned.

(3) Space weather
Prediction of physical parameters in the space environment is extremely important for space weather. System identification technique is applied to build spatio-temporal models to predict VLF/LF transmitter amplitude indicating lower ionospheric condition.