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Anomalous Deviations in Atmospheric Parameters as Pre-Earthquake Signals: A Case Study on Sumatra Region Earthquakes(M≥6.0)

Ramya Jeyaraman[1], Venkatanathan Natarajan[1]

[1]School of Electrical and Electronics Engineering, SASTRA Deemed to be University, Thanjavur, Tamil Nadu, India

Abstract

One of the most demanding disciplines in geoscience is earthquake forecasting, which is widely debated due to its heterogenetic nature. Several strategies for forecasting the destructive earthquake events have been developed in recent decades. This work focuses on exploring and understanding of the precursory signals which is associated with the occurrence of earthquakes. The earthquake precursors are identified by anomalous deviation in Out-going Longwave Radiation (OLR) and Relative Humidity (RH) before Strong magnitude earthquakes. This work concentrates to study the correlation of anomalous variations in atmospheric parameters such as relative humidity and OLR flux index associated with the earthquakes through Lithosphere-Atmosphere-Ionosphere coupling (LAIC) model. The retrospective analysis of temporal variations is done on the daily datasets of RH and OLR is carried out for eight earthquakes with magnitude ≥6.0 occurred during 1991–2021 within 75km radius of December 26, 2004. The exploratory data analysis is carried out based on the investigation of earthquake activity in the study region taken from United States Geological Survey (USGS), anomalous Outgoing longwave radiation (OLR) flux index, Anomalous Relative humidity index for the period of six months. According to our preliminary findings, the relationship among the anomalous drop of relative humidity and anomalous in-crease in OLR flux index anomalies with the occurrence of earthquakes were observed near epicentral region as proposed by the LAIC model. This anomalous behavior was observed 3 days to 3 months prior to the occurrence of earthquakes. Hence, the authors inferred that there exists a possible link between the abnormal deviations in atmospheric parameters and the occurrence of earthquakes. Further incorporation of various precursors along with OLR and RH studies can help us to develop an effective tool for forecasting the earthquake on a short-term basis.

Keywords: Earthquake precursors, Outgoing longwave radiation, Relative humidity, Earthquake forecasting