

# البحث الأول

## Title

**Integration of multi earthquakes precursors before large earthquakes: A case study of 25 April 2015 in Nepal**

## Journal & year of publication

Journal of Atmospheric and Solar-Terrestrial Physics, November 2022.

ISSN 1364-6826

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## English Abstract

In this work, we analyze magnetic data, Land Surface Temperature (LST), Outgoing Longwave Radiation (OLR), Air Temperature (AT) and Relative Humidity (RH) around the epicenter before and after the large EQs occurred on April 25, 2015 in Nepal. Daytime and nighttime LST values were retrieved from Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Terra satellite. We used the magnetic data acquired by Swarm satellites in the top side ionosphere, and daily OLR data was obtained from the United States National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellites. Moreover, AT and RH values were provided from the nearest meteorological ground station to the epicenter located at Katmandu airport. As data analysis, short-term (15 days before and 5 days after the earthquakes) and medium-term (2 months before and 1 month after the earthquakes) evaluations were carried out. For short-term analysis, the results of the magnetic field in the topside ionosphere detected an interesting anomaly on April 12, 2015. Besides, nighttime LST anomaly was observed on April 13, 2015, 14 days before the earthquakes, which was also an anomalous day for AT and RH analysis. Moreover, in the OLR analysis, April 12, 2015 was anomalous day based on the time series of the epicentral pixel that coincides with the magnetic field anomaly. Concerning the medium-term nighttime LST analysis, 13th April was the day, which may be associated with the earthquakes. For the medium-term OLR analysis, April 12, 2015 was found to be related to the seismic activity based on the epicentral pixel. Besides, the RH anomaly on 13 April was the only mutual day with the anomalies of LST and OLR for the medium-term analysis. Based on the short-term and medium-term results, these two days, 12 and April 13, 2015, may be associated with the preparation for the earthquake occurrence. Overall, it is concluded that these methods

could be effective and reliable in detecting anomalies that precede upcoming EQs with further investigations.