# Ionisation density variation as precursor of earthquake: An analysis of simultaneous Topside and Ground based ionosonde observations

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ABSTRACT:
The paper describes pre earthquake variations in ioniosation density (basically foF2), received from top side and ground based ionosondes by analyzing data both in spatial and temporal modes and identifies the mode that appropriates best results in extraction of a precursor. The test case is so selected that ionosonde data from ground-based stations at epicenter position to off anomaly region are available, along with topside observation of the event. Further, to eliminate role of magnetic disturbances on ionization density variations if any, the DST and AE values are examined for the magnetically quiet-time events. Taking the case of August 15, 1963 earthquake, the temporal variations of foF2 are mapped prior to and during the event, both in diurnal (hourly) and monthly (median) basis, for stations La Paz, (near to the epicenter position), Huancayo (inside the "disturbed modified" zone), Talara (situated at the Eastern boundary of the disturbed area), Bogota (outside the disturbed area and at the northern crest of the anomaly) and finally Natal which is outside zone of the disturbed area. The days prior to the earthquake are very quiet and all the stations show a decrease in foF2 values, specially during day times (night time ionograms are difficult to scale for presence of spread –F) as reflected in respective temporal mappings; suggesting no pre earthquake effect on density all along the epicenter to off epicenter zones. The paper then describes how the "spatial mode of analysis" identifies significant depression in density at epicentral position (say in La Paz) with respect to off anomaly stations like Natal, indicating generation of pre earthquake induced E field at the epicenter and thereby activating the expected density depletion at station like La Paz, in this case. Topside ionogram profiling of density, which supports that the spatial mode of analysis gives a better view of identification of precursor of earthquake more so when epicenter lies near to equator, is also provided in the paper. The basic physics of density depression at the epicenter position is then discussed taking into view of results on analysis of ionisation density and total electron content profiles at or near anomaly crest stations prior to strong earthquakes.