The Possibility of Earthquake Prediction by Combining Long Term Approaches and Short Term Precursory Events

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Abstract: The chain of underground events which are triggered by seismic activities and physical/chemical interactions prior to a shake in the earth's crust may produce surface and above surface phenomena. During the past decades many researches have been carried away to seek the possibility of short term earthquake prediction using remote sensing data. Currently, there are several theories about the preparation stages of earthquakes most of which stress on raises in heat and seismic waves as the main signs of an impending earthquakes. Their differences only lie in the secondary phenomena which are triggered by these events. In any case, with the recent advances in remote sensing sensors and techniques now we are able to provide wider, more accurate monitoring of land, ocean and atmosphere.

Among all theoretical factors, changes in Surface Latent Heat Flux (SLHF), air and land surface temperature (AT & LST) and surface chlorophyll-a are easier to record from earth observing satellites. SLHF is the amount of energy exchange in the form of water vapor between the earth's surface and atmosphere. Abnormal variations in this factor have been frequently reported as an earthquake precursor during the past years. The accumulated stress in the earth's crust during the preparation phase of earthquakes is said to be the main cause of temperature anomalies weeks to days before the main event and subsequent shakes. Chemical and physical interactions in the presence of underground water lead to higher water evaporation prior to inland earthquakes. In case of oceanic earthquakes, higher temperature at the ocean beds may lead to higher amount of Chl-a on the sea surface. On the other hand, it has been also said that the leak of Radon gas which occurs as rocks break during earthquake preparation causes the formation of airborne ions and higher Air Temperature (AT).

We have chosen to perform a statistical, long-term, and short-term approach by considering the reoccurrence intervals of past shakes, mapping foreshocks and aftershocks, and following changes in the above-mentioned precursors prior to past earthquake instances all over the globe. Our analyses also encompass the geographical location and extents of local and regional faults which are considered as important factors during earthquakes.

The co-analysis of direct and indirect observation for precursory events is considered as a promising method for possible future successful earthquake predictions. With proper and thorough knowledge about the geological setting, atmospheric factors and geodynamics of the earthquake-prone regions we will be able to identify anomalies due to seismic activity in the earth's crust.

Keyword: Seismic activities, Remote sensing, Earthquake precursors, Active faults, Early warning