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1 Satellite Thermal Infrared Radiation before major earthquakes

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This work describes our search for a relationship between tectonic stresses and an increase in the thermal infrared (TIR) flux as part of an ensemble of electromagnetic (EM) phenomena that may be related to earthquake activity. We present and discuss recorded variations in TIR transients and overall radiation fields prior to three earthquakes:

Colima, Mexico (M6.7) on Jan 22, 2003, Parkfield, California (M6.0) on Sept. 28 .2004, and Northern Sumatra (M9) on Dec. 26, 2004.

Previous study of earthquake events has indicated the presence of a TIR anomaly, when, during the night, observed increase in TIR signal by the spacecraft sensor or did not return to its usual nighttime value.

Our procedures analyze nighttime satellite data that records the general condition of the ground after sunset. In the case of the Colima earthquake we found from MODIS data that five days before the event the nighttime LST rose up to +4 degrees C in an area with a 100 km radius around the impending epicenter. The area was cloud-free

during this time. A remarkable drop in relative humidity occurred.

In the case of Parkfield MODIS recorded a TIR transient around +1 degree C in the vicinity of the epicenter, also in a cloud-free environment, clearly smaller than before the Colima event. Ground surface temperatures near the Parkfield epicenter showed a steady increase during four days prior to the earthquake. During the nights preceding the event, the relative humidity dropped significantly.

Recent analysis of the continuous outgoing long-wavelength radiation (OLR) from the Earth surface indicates an anomalous variability prior to a number of medium to large earthquakes. The cause of these anomalies is not well understood but could be triggered by interactions between lithosphere-hydrosphere and atmosphere that are related to changes in the near-surface electrical field and/or in the near-surface gas composition prior to the earthquake. The OLR anomaly usually covers large areas surrounding the main epicenter.

In the case of Northern Sumatra, compared to the reference fields for the months of December between 2001 and 2004, we found strongly anomalous signals (two sigma) along the epicentral area on Dec 21, 2004 five days before the event.

Our results support the hypothesis of a relationship between a thermodynamic processes produced by increasing tectonic stresses in the Earth's crust and attendant electro-chemical interactions between the crust and the atmosphere/ionosphere.