Earthquake Precursor from Satellite Imagery: Signals or Just Noise?

Shattri Mansor and Habibeh Valizadeh Alvan (Malaysia)

Key words: Remote sensing; Earthquake precursor, disaster management

SUMMARY

Pre-earthquake physical and chemical interactions in the Earth's ground may cause anomalies in latent heat flux, air and surface temperature. Changes in latent heat flux and temperature, on and above the earth's surface can be detected with thermal infrared sensors such as NOAA-AVHRR, MODIS and Landsat TM. Geophysicists developed theories about the earthquake mechanisms and the underground geophysical and geochemical interactions involved in the process of ground shakes, and the related phenomena that might be detected as pre-earthquake signals. Earthquakes are triggered when the energy accumulated in rocks releases causing ruptures in place of faults. Elastic strain in rocks, formation of micro-cracks, gas releases and other chemical or physical activities in the earth's crust before and during earthquakes has been reported to cause rises in sea surface temperature (SST), surface latent heat flux (SLHF), and sea surface height (SSH). Spatio-temporal distributions of SLHF, SST and SSH before and after recent earthquakes in Indonesia have been studied. Anomalous patterns of higher SLHF formed few days before the earthquakes of 20 Feb 2008 (7.4M) and 25 Feb 2008 (7.2M) occurred in Simeulue and Kepulauan disappeared after the main events. These changes were also in accordance with the abnormal relative humidity over the region. Data analyses revealed at least 1–3°C rises in air temperature along the nearby fault zone, as well. The anomalous patterns started developing two weeks to a few days before the earthquakes and disappeared after the main shocks. Significant rises in SLHF and air temperature may lead us to understand the energy exchange mechanism during the earthquakes. These anomalies prior to impending earthquakes can be attributed to the thermodynamic, the tectonic blocks and micro-fracturing in the rocks especially along area's active fault. Continuous monitoring of these potential pre-cursors helps in differentiating earthquake related variations (signals) from seasonal changes and atmospheric effects (noise).