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A significant electromagnetic process controls earthquake activity

G. Duma

Central Institute for Meteorology and Geodynamics, Vienna, Austria
(gerald.duma@zamg.ac.at / Fax: +43 1 368 66 21 / Phone: +43 1 36026-2503)

The presentation focuses on the significance of a geophysical process, which plays an important role in earthquake activity, but which to this day has rarely been considered in scientific work. The results are based on an 8 year research programme performed at the Central Institute for Meteorology and Geodynamics (ZAMG), Vienna, and on several international co-operations (e.g. Duma, 1996; Duma, Vilardo, 1998; Duma, Ruzhin, 2003).

Involved in this process are the regional telluric currents, induced in the lithosphere by the varying parts of the geomagnetic field in three time domains, the daily, the seasonal and the long term range. Thereby, the magnetic variations are routinely measured at the geomagnetic observatories. The daily and seasonal variations originate externally from the ionospheric current system, as sufficiently described already in the mid 20^{th} century, whereas the long term geomagnetic variations ('secular variations') mainly result from the geomagnetic dynamo itself, situated in the deep earth interior, in the core-mantle zone. Since the conductive lithosphere is also exposed to the Earth's main magnetic field, Lorentz forces [I . B] result, which act on the current layers and superimpose the tectonic stress field.

The investigations show that this process, named 'Magneto-Seismic Effect MSE', obviously act as a major trigger mechanism for seismic activity, including strong earthquake seismicity. The corresponding geophysical model reveals that the energy involved in the MSE is unexpectedly high, comparable to tectonic deformation energy itself, e.g. it is equivalent to the energy of a magnitude 4 earthquake, for an area of 200 km times 200 km.

The strong influence of the effect in several main seismic regions in Europe, Asia

and California, in all three time ranges, is demonstrated. In particular, the seismic performance of the region Sumatra, which was recently hit by a giant earthquake, can be well interpreted to follow this electromagnetic effect.

Since the effect MSE also applies to strong earthquake activity with events $M \geq 6$, it may be of high relevance for preventive safety measures and disaster mitigation.