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Hypocenter Depth Evaluations of Earthquakes Using Geomagnetic Data in Taiwan

CHEN, Chieh-Hung[1*], Han-Lun Hsu[2], Strong Wen[3], Katsumi Hattori[4]

[1]Institute of Earth Sciences, Academia Sinica, Taipei 115, Taiwan, [2]Institute of Geophysics, National Central University, Jhongli 320, Taiwan, [3]Institute of Seismology, National Chung Cheng University, Chiayi 621, Taiwan, [4]Graduate School of Science, Chiba University, Inage, Chiba 263-8522, Japan

When earthquakes with similar magnitudes occur at different depths, severe seismic hazards are generally in response to shallow ones. Although many studies report that timing, location and magnitude of forthcoming earthquakes could be forecasted, estimation of hypocenter depth should also be taken into account to achieve complete perception against seismic hazards. In this study, the Parkinson vectors, which tend to orient along materials with relatively-high conductivity, are computed by using 3-component geomagnetic data recorded in central Taiwan via the magnetic transfer function. The ”skin effect” is further incorporated into the analytical process to understand associated depths of the Parkinson vectors when they are computed by data filtering at distinct frequency bands. Orientations and magnitudes of the Parkinson vectors are compared with epicenter azimuths and hypocenter depths of 16 earthquakes (M >= 5.5) between 2002 and 2005, respectively. When effects of sea water and tectonic structure are removed, the results show that the azimuth distribution of the Parkinson vectors is mainly concentrated at directions of epicenter azimuths 15 days before earthquakes. Projection depths, which are determined by using the depth with the largest difference between the magnitude distribution of the Parkinson vectors 10 days before earthquakes and within an entire study period, generally yield a difference $<$ 30 km with hypocenter depths. This would be used to roughly evaluate hypocenter depths of forthcoming earthquakes.

Keywords: Hypocenter depth, Magnetic transform function, Skin effect, Parkinson vectors