

Criticality features in ultra-low frequency magnetic fields prior to the 2013 M6.3 Kobe earthquake

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ABSTRACT

The nonlinear criticality of ultra-low frequency (ULF) magnetic variations is investigated before a particular earthquake (EQ) occurred in Kobe on April 12, 2013, by applying the “natural time” analysis on a few ULF parameters: F_h , F_z and D_h . The first two refer to radiation from the lithosphere, and the last parameter corresponds to depression of horizontal component as a signature of ionospheric perturbation. A recent paper of our team has indicated, using the same data as in this paper but by means of conventional statistical analysis, a clear effect of depression in the horizontal component as an ionospheric signature. But there seems to be no convincing signature of lithospheric ULF radiation according to the spe-

(EQ) [Hayakawa and Molchanov 2002, Pulinetts and Boyarchuk 2004, Molchanov and Hayakawa 2008, Hayakawa 2009, Hayakawa 2012, Hayakawa 2013, Eftaxias and Potirakis 2013, Eftaxias et al. 2013]. Such possible EQ precursors include lithospheric phenomena such as DC geoelectric field, ultra-low-frequency (ULF) radiation, fracto-EM MHz - kHz emissions, and seismo-atmospheric and -ionospheric perturbations. There are already a few EQ precursor signatures, which seem to be statistically correlated with EQs. One is geoelectric signals, for which Varotsos [2005] found a close corre-