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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Comment on "Ultra low frequency (ULF) electromagnetic anomalies associated with large earthquakes in Java Island, Indonesia by using wavelet transform and detrended fluctuation analysis", by Febriani et al. (2014)" *by* F. Masci and J. N. Thomas

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Comments on the paper "Comment on "Ultra low frequency (ULF) electromagnetic anomalies associated with large earthquakes in Java Island, Indonesia by using wavelet transform and detrended ïňĆuctuation analysis", by Febriani et al. (2014)" by F. Masci and J. N. Thomas

The criticism in Masci and Thomas paper can be reduced to the main two statements:

No evidence that a preparatory phase of earthquakes really exists. (P. 5667, lines 23-24). The DFA α exponent and the fractal dimension D of the ULF geomagnetic field are sensitive to global trends in geomagnetic activity. Namely, when the geomagnetic activity decreases, the reduction of the geomagnetic field horizontal component is usually larger than the reduction of the vertical component, therefore the spectral density ratio increases. (P. 5670, lines 21-26).

From these statements two consequences follow:

At present ULF magnetic disturbances cannot be considered a promising candidate for developing earthquake prediction capabilities. (P. 5668, lines 14-15). Or in the strong form: "... the notion of the preparatory phase of earthquakes has no physical basis.". (P. 5668, lines 3-4). The changes ... in the DFA α exponent of the geomagnetic field vertical component and the spectral density ratio SZ/SY are too closely related with the geomagnetic ΣKp index to be considered of seismogenic origin. Thus ... the pre-earthquake magnetic changes reported by Febriani et al. (2014) are an effect of the global geomagnetic activity. (P. 5672, lines 8-12).

The authors substantiated the first statement by a hypothesis that "Earthquakes ... appear to be chaotic, scale-invariant phenomena controlled by the local mechanical properties of the fault whose geometry and frictional characteristics determine the starting and stopping of the rupture .... Therefore, any small shock may grow into a stronger earthquake, and how big the quake will become is determined by how it is stopped, and not by how it starts.". (P. 5667, lines 24-26, p. 5668, lines 1-3). Such a hypothesis denies an EQ preparation phase and from our point of view is very controversial. (We consider the preparation phase as a cause and EQ as an effect). At first, the described lithospheric plates move in certain constant directions (see Fig.1 in Febriani et al., 2014) and mechanical tensions should arise at a fault area. At second, the stress growth to a critical value results in an unstable configuration which leads to a high

probability of the EQ occurrence. The scale of the EQ is determined by dimensions of a high stressed zone of the fault. A period when the noticeable stress growth to the critical value we just consider as a preparatory phase of an earthquake. Such a period can be attended by the growth of a piezoelectric or piezomagnetic activity, conductivity changes and other events accompanied by ULF electromagnetic disturbances. Naturally, at critical (or unstable) phase, we cannot predict exactly the EQ onset. (Probably the authors relate the first statement just to such a situation). However, the alarm of a corresponding emergency management about high probability of EQ occurrence can be provided. So, the pre-earthquake ULF EM activity is of great interest to geophysicists as a possible warning instrument for decreasing of an EQ impact on the populated areas.

Regarding the numerous cases of an erroneous EQ precursor finding, which are reported by the authors, it should be noted that pre-EQ ULF crustal magnetic activity is very weak and completely overlaps with Pc1-Pc5 signals from ionosphere or magnetosphere. It is a principal drawback of one point method of ULF magnetic precursor study. So the new methods for EQ precursor source localization based on multipoint measurements were developed, which allow discrimination of Pc1-Pc5 pulsation influence (see, for example, Dudkin et al., 2011 and references therein). Concerning the second statement and its consequence we agree with the authors' opinion that the pre-earthquake magnetic changes reported by Febriani et al. (2014) relate to the global geomagnetic activity.

Also, a small correction in the paper text should be done: P. 5667, line 10. It should be, at least, 0.001-5 Hz, instead of 0.001-10 Hz, because the frequency 10 Hz relates to the magnetometer sampling rate. (Usually the upper frequency should be less than 0.5*[sampling rate], because of anti-aliasing filtering).

Reference Dudkin, F., Korepanov, V., Yang, D., Li, Q., Leontyeva, O., Analysis of the local lithospheric magnetic activity before and after Panzhihua MW = 6.0 earthquake (30 August 2008, China), Nat. Hazards Earth Syst. Sci., 11, 3171–3180, 2011.

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