Nat. Hazards Earth Syst. Sci. Discuss., 3, C1922–C1925, 2015
www.nat-hazards-earth-syst-sci-discuss.net/3/C1922/2015/


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

**F. Masci and J. N. Thomas**

fabrizio.masci@ingv.it

Received and published: 7 October 2015

Dear Referee,

We appreciate that you agree that preeathquake magnetic changes reported by Febriani et al. (2014) are related to global geomagnetic activity and not seismogenic disturbances. In any case, we want to clarify some points highlighted in your review.



1) In the introduction section of our manuscript we intend to briefly introduce the state-of-the-art in the search for electromagnetic precursors of earthquakes.

As you state, the idea that electromagnetic precursors may appear before earthquakes is based on a hypothesis that earthquakes have a preparatory phase. However, the existence of a preparatory phase of earthquakes is controversial within the scientific community, and many seismologists and geologists disagree because:

- The movement of tectonic plates is slow, and moreover, stress increases very slowly also during the period preceding the earthquake (Lay and Wallace, 1995). There is experimental evidence that at the hypocentral depth, the level of the local stress does not significantly change during the days to minutes before the earthquake. Johnston et al. (2006) by means of high-resolution borehole strain and pore pressure measurements do not identify in the days to minutes before the 28 September 2004 M6.0 Parkfield earthquake a significant crustal stress increase that might indicate the start of the fault failure.

- The physical phenomena leading the fault in the critical state act in a very small volume whose dimension does not scale with final moment release. The magnitude of an earthquake seems not to scale with the level of stress, but it seems to be controlled by the physical properties of the fault (e.g., geometry and frictional characteristics). As a consequence, the size of an earthquake is determined, not by how it starts, but by how it is stopped (Johnston, 2015).

- A recent laboratory experiment on gabbro samples saturated with electrically conductive fluid similar to those observed in active earthquake fault zones have shown that neither transients nor stress-stimulated currents were observed during several cycles of stress loading (Dahlgren et al., 2014). Because the Earth's crust is fluid saturated, they conclude that significant electric currents are not expected to be generated during the slow stress accumulation prior to earthquakes or during any slow stress release

that may occur in the region of earthquake nucleation. As a consequence, no electric and magnetic signals are expected to be observed on the Earth's surface.

These results casts serious doubts on the existence of a preparatory phase of an earthquake, and consequently on the possible occurrence of electromagnetic precursors of earthquakes.

Maybe our aim to briefly introduce the state-of-the-art in the search for electromagnetic precursors is not really clear. We may change this part (P.5667, line 18 – P.5668, line 4) of the introduction section.

2) Let us say that our statement "At present ULF magnetic disturbances cannot be considered a promising candidate for developing earthquake prediction capabilities" is supported by the huge number erroneous ULF precursors that in the last 20 years has been reported (and that continue to be reported) in the scientific literature by conventional methods of analysis (see the reference section and the Supplement of our manuscript). In these papers, a careful demonstration of causality between reported precursory signals and earthquakes is not provided. On the contrary, clear Pcs pulsation signals are reported as seismogenic disturbances.

3) Thanks for correcting the ULF range investigated by Febriani et al. (2014)

---

References

Dahlgren et al. (2014), Comparison of the Stress Stimulated Current of Dry and Fluid Saturated Gabbro Samples, Bull. Seismol. Soc. Am., 104(6), 2662–2672, doi: 10.1785/0120140144.

Johnston, et al. (2006), Continuous Borehole strain and pore pressure in the near field of the 28 September M 6.0 Parkfield, California Earthquake: Implications for nucleation, fault response, earthquake prediction, and tremor, Bull. Seismol. Soc. Am., 96, S56–S72, doi:10.1785/0120050822, 2006.



Johnston, M. J. S. (2015), On earthquake fault failure, 26th IUGG General Assembly, Prague, Czech Republic, June 22-July 2, 2015.

Lay, T. and Wallace, T. C.: Modern global seismology, Accademic Press, 521 pp., 1995.

---

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 5665, 2015.