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Discussions

Interactive comment on "Physical laws for precursory phenomena of impending large earthquakes and their applications to predictions" *by* Fumihide Takeda

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This work introduces some functions called by the author "physical wavelets" that are applied to the spatial coordinates (latitude, longitude and depth) of the earthquake hypocenter, inter-event time and magnitude. The strict meaning of them is different from the conventional wavelets, although appear some similarities between the two entities.

Analysing the evolution in time of these physical wavelets the author extracts some

properties that are extrapolated in time in order to make a prediction of time of occurrence, magnitude and location of the 1995 Kobe earthquake from previous data. I admit that the paper is not completely clear to me in some passages, and most of the cited references are not accessible (many of them are in Japanese, some are in proceedings of conferences; see below) so I had to base my understanding on this sole article.

This approach reminds me that of nonlinear forecasting approach in a reconstructed phase space for a chaotic time series (e.g. Farmer and Sidorovich, 1987; Barraclough and De Santis, 1997). However what is missing in this paper is the preliminary analysis of the possible chaotic properties of the time series, which is fundamental before to arrive to any conclusion. In particular, in the present case study the prediction is advanced by 19 events with respect to the impending retrospectively predicted earthquake, but this number could be misleading in case, e.g., the time window of predictability (the reverse of the Kolmogorov entropy) could be smaller than the corresponding time (see e.g., De Santis et al. 2010). Also some other entropic analyses (e.g. De Santis et al., 2011) could be of some help, because they can provide an indication of the complexity of the corresponding time series.

Finally, a case study alone cannot establish the strength of a method, that can be locally dependent, where the fluctuations in the results could be due to some local/regional tectonics or by chance. I would suggest to show some other case studies to support the most general finding of the application of the author's method.

In the present version the article cannot be published. In summary, it requires certainly a major revision, with more clarification in some passages, estimation of some entropic properties of the time series in the reconstructed phase space, and some other case studies to see similarities or differences.

Some other minor points.

Pag.8 Lines 8-9. "The NCI(m, 2s) is proportional to seismic activity. If it is large,

the activity is quiet..” From the second sentence it seems that NCI(m,2s) is inversely proportional to seismic activity.

Pag.8 Lines 15-16 “The AMR’s in the large region generally start a few days before a large event occurs somewhere in the region as well as before a large aftershock occurs (Takeda, 2015).” Generally AMR does not start a few days before a large event but starts months or even years before (Mignan et al., 2007).

In the references some articles are not easily accessible. For instance:

Takeda, F. and Okada, S.: Time Series Analysis with Physical Wavelets, 20 http://adsabs.harvard.edu/abs/2001APS.MARX23005T, 2001.

when I attempt to reach this document I have the following message: No valid abstract selected for retrieval or not yet indexed in ADS

In addition all below references are in Japanese:

TEC21 website: Crustal movement that caused the 2011 M9 Event, http://www.tec21.jp/g_eq_tohoku_crust_m.htm, 2017a.

TEC21 website: The 2011 M9 Event and Earthquake Prediction, http://www.tec21.jp/News_EQ_forecasting_j.htm, 2017b.

TEC21 website: Cycle of strain energy density accumulation, http://www.tec21.jp/critical_cycles.htm, 2017c.

TEC21 website: Predictions and Diagnostics–Industrial Systems, http://www.tec21.jp/Indust_sys_j.htm, 2017d.

TEC21 website: Precursors and Predictions, http://www.tec21.jp/pr_CQK_CQT_model_1.htn 2017e.

References indicated in my review but not present in the article under scrutiny

Barraclough D. R. and A. De Santis, Some possible evidence for a chaotic geomagnetic

field from observational data, PEPI, 99, 207-220, 1997.

De Santis A., Cianchini G., Qamili E., Frepoli A.. The 2009 L’Aquila (Central Italy) seismic sequence as a chaotic process, Tectonophysics, 496 44–52, 2010.

De Santis A., Cianchini G., Beranzoli L., Favali P., Boschi E., The Gutenberg-Richter law and Entropy of earthquakes: two case studies in Central Italy, BSSA, v.101, 1386-1395, 2011.

Farmer J.D. and Sidorovich J.J., Predicting chaotic time series, Phys. Rev. Lett., 59. 845-848, 1987.

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