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Interactive comment on “Complex noise suppression and reconstruction of seismic reflection data from fault structures using Space Lagged Singular Spectral Analysis” by R. K. Tiwari et al.

Anonymous Referee #3

Received and published: 23 May 2014

The paper “Complex noise suppression and hygienic reconstruction of seismic reflection data from fault structures using Space Lagged Singular Spectral Analysis” deals with the application of the SSA algorithm to a shallow reflection seismic data acquired over a coal field in India. The goal is to improve the S/N ratio of the seismic signal thus mapping the geological structures masked by various kinds of noise. The application could be interesting, but in my opinion, there are many issues that need to be addressed before the paper can be considered for publication, so I suggest a (very) major revision. I will list some of these issues here below.

C162

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1) This work concerns with an application of the SSA algorithm described in Golyandina et al. 2001 (or in many other books or papers), so it is not necessary to call it in a different way.

2) A description of the parameters used for the seismic acquisition is missing. More importantly, a flow chart describing the processing sequence applied to the seismic data is totally absent. There are many events on the stack section of Figure 3a) with strong lateral coherence that could be true reflections but also processing artifacts. A reader could be interested to compare a stack section without multichannel filtering operation with the results of the SSA algorithm.

3) I think that faults positioning should be better justified because I do not see such a clear evidence on both the original stack section and the SSA processed ones.

4) The convolutional synthetic example of Figure 1 is too simple for the problem you are describing. If there is a fault like the one in your example, there will also be diffractions at the edge of the layers in correspondence of the fault. Moreover you do not consider any interbed multiples that make the situation even worse. Diffractions and multiples constitute a type of coherent noise that you should model to test the efficacy of the algorithm you propose, especially in this case.

5) Please double check the formulas. It seems to me that there are some error/imprecisions (as examples see: lines 94 and 98, but also the ranges of eq (4)).

6) Line 166: “shot gather data was stacked to produce seismic section.” Data should be normal moveout common midpoint sorted to build the stack section. If this is what you mean, please modify the sentence.

7) Line 184: “The seismic sections show good correlation with nearest borehole data.” To write this sentence you must show the correspondence between borehole data and seismic data.

8) Line 186: “The geological information of the study region evidently agrees with the

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minor as well as major faults patterns as mapped on the SLSSA processed stack section.” Here a reference or a geological section is needed that describes the correspondence between geology and seismics you suggest.

- 9) Flow chart should be self consisting and not with description on different pages.
- 10) Figures must be labeled both horizontally and vertically. Just the trace index is not enough.
- 11) Finally, many terms are inappropriate or not used in reflection seismic context. For example: Line 1: “hygienic reconstruction” sounds inappropriate. “Complex noise” is a too wide characterization of noise. You should be more specific.

Line 11: what does you mean with “erratic noise”?

Line 17: “embedded with complex mixed noise” probably embedded is not the more appropriate term referred to noise.

Line 30: “real picture of the reflection amplitude” is not clear

Line 32: “unnecessary nonlinear noises” all noise is “unnecessary” in principle

Line 45: “...complex reflections along with the chaotically evolved high degree crustal noise modify...” Very unclear. Moreover, what is the meaning of “crustal” in this near surface context?

Line 53: “inescapable noise” unusual use

Line 68: “We also demonstrated the efficacy of the method for the reconstruction of scattered reflector amplitudes arising due to the nonlinear interaction of intrinsic coherent complex noises in the seismic reflection data from the coalfields” Rewrite the sentence.

Line 110: “Here G represents the group of eigen triples satisfying the criteria of variance and with systematic eigen vectors.” What do you mean with “variance” and “sys-

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tematic" in this context?

Line 121: "pure synthetic data" pure is unusual

Eigenvalue and eigentriple are usually used as single words.

Hope this could help to improve the paper Best Regards

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