Looking for SS waves in conventional 3C data

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SUMMARY

This is an experiment with real data intended to identify the presence of pure S wave reflections (SS-waves) generated by conventional explosive sources, even though just PP and PS waves are usually expected on these surveys. The work has two stages: first the identification of feasible SS events, and second a test on source statics correction. The Hussard 2011 3C survey were used to this purpose. From the velocity information, it was found that the possible SS-wave arrival times concur with the highly energetic Ground Roll. Therefore noise attenuation for coherent surface waves and other events that preserves the expected SS-waves was required. After that, probable SS-events were identified, however relatively weak . As it is well known, S-wave statics is critical to obtain a stacked seismic section, therefore a source statics correction method is proposed and partially tested.

- **INTRODUCTION**
- It has been shown theoretically and by experiments that S waves can be generated by conventional explosive sources.
- However SS reflections have been hardly identified in real multicomponent seismic data.
- This is an experiment with real data intended to identify the presence of pure S wave reflections (SS-waves), using the horizontal components of the Hussard 2011 3C.

- **FIELD DATA ANALYSIS**
- From the velocity information, the possible SS-wave arrival times concur with the highly energetic Ground Roll. Therefore it was required noise attenuation for surface waves and other events preserving as much as possible the expected SS-waves. An example of the resulting records is shown in Figure 2. Notice that energy with the expected arrival time of SS-waves appears in both radial and transversal components, however not too strong and affected by PS-waves in the radial component (Fig. 2a), and perhaps easier to identify in the transversal component, even though mixed with some other events or artifacts (Fig. 2b).

Depth m	Vp m/s	Vs m/s	t_o PP s	V_{PP} RMS m/s	t_o PS s	V_{PS} RMS m/s	t_o SS s	V_{SS} RMS m/s
30	1500	200	0.040	1500	0.170	548	0.300	200
400	2900	1500	0.291	2844	0.599	1640	0.907	1207
520	3400	1100	0.362	3094	0.743	1701	1.125	1168
750	3300	1500	0.503	3179	0.960	1845	1.416	1399
1270	3250	1500	0.803	3392	1.472	2060	2.013	1645
1450	3900	1900	0.901	3454	1.623	2111	2.217	1664
1550	4400	2200	0.949	3585	1.694	2155	2.310	1745

Figure1: From the Sonic logs (shown at the left hand side) there were estimated the zero-offset arrival times and RMS velocities for PP, PS and SS waves, shown in the Table above. The yellow events are included in Figure 2.

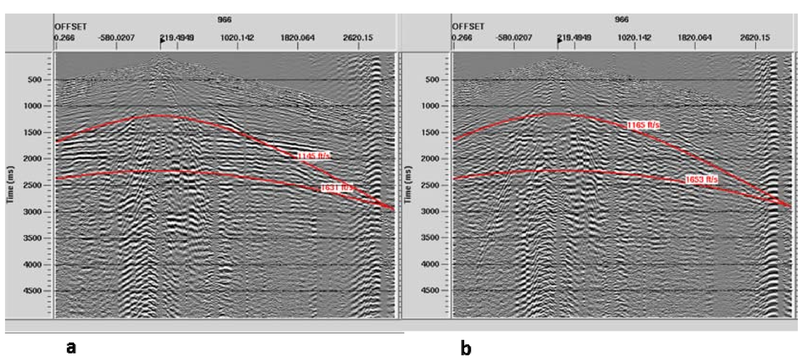

Figure2: Shot records after noise filtering. The red lines correspond to the expected arrival times for SS reflections of the yellow events in Fig. 1. (a) Radial component, (b) Transversal component.

- **SOURCE STATICS TEST**

The S-wave source statics correction method is based in the surface consistent equation, hence assumes normal incidence to the surface. After applying the receiver statics (obtained from PS data processing), the structural component is assumed neglilible, and analogous traces of adjacent Common Shot Gathers are cross-correlated, to obtain the differential delay between them. After that the differential delays are added together to obtain the statics.

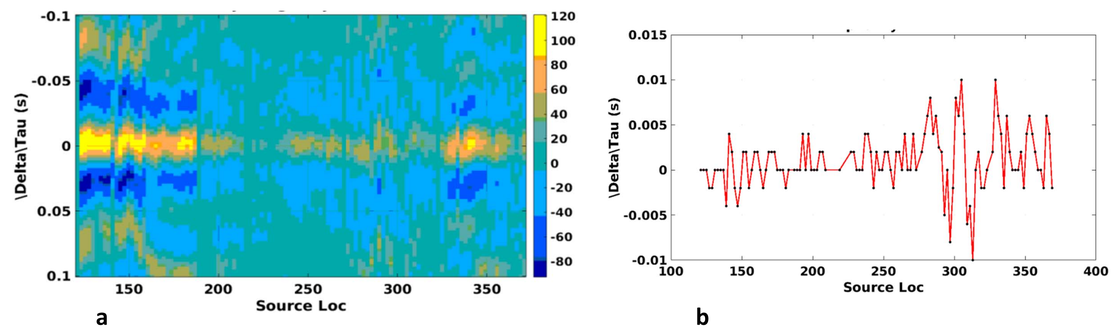

Figure 3: Some partial results in the source static corrections method proposed. (a) Cross-correlation between sources, (b) picking of the maximum cross-correlation, corresponding to the differential statics.

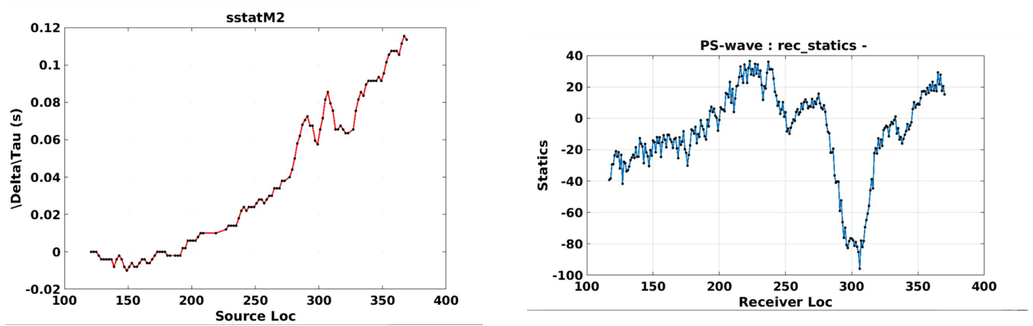

Figure 4: Source statics of the method proposed compared with the receiver statics obtained from the PS processing. Some sections keep resemblance, but at the center, which corresponds to a hill in the terrain.

- **CONCLUSIONS**
- The shots gathers after noise attenuation show events whose energy agree with the expected arrival time of SS waves. They appear easier to identify in the transversal component than in the radial.
- The crosscorrelations of the statics correction method proposed show energy that appears corresponding to the expected for the differential statics.
- The source S-wave statics correction obtained shows some features close to the receiver statics (from PS-processing), however noticeable differences at some places.

- **ACKNOWLEDGEMENTS**

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