Receiver statics of converted waves without stack: test with real data

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ABSTRACT

- A commonly used method for estimating the receiver statics correction for converted wave (PS-wave) uses a Common Receiver Stack (CRS), which requires stacked data and a stacking velocity model (V_C). A new method that does not require V_C has been proposed. It obtains the differential receiver statics *R* between two Common Receiver Gathers (CRG)automatically by crosscorrelations. This report presents a test of this new method on real data. The method requires of editing of outliers to obtain *R*. A meaningful receiver statics correction is obtained, which improves the stack section, and generates better data for velocity analysis.

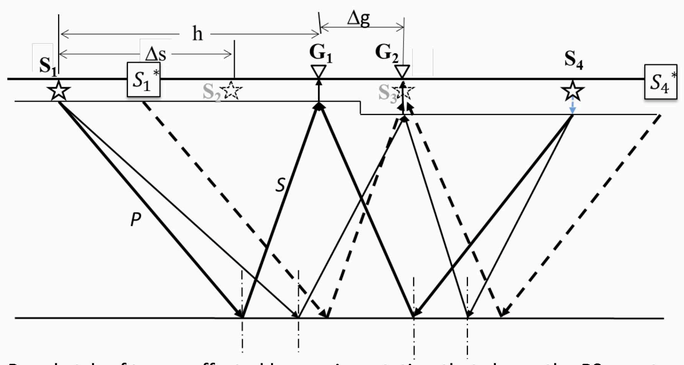

FIGURE 1. Ray sketch of traces affected by receiver statics, that shows the PS events used for crosscorrelation in the receiver statics algorithm.

THEORY

The traces of a CRG have the same R_i delay. The time delay between traces corresponds to the differential source and receiver time delays in the Near Surface –Low Velocity Layer, plus the offset and geological time delays. According to the surface consistent equation, the delay time between the two adjacent CRGs is:

$\delta t_{ijk} = \delta R_i + \delta S_j + \delta G_k + \delta M_k$

where R_i= receiver statics at the ith receiver position. S_j= source statics at jth source position. G_k= time shift caused by the geology for the kth reflection. M_k= Move Out delay corresponding to the kth reflection gather.

The surface consistent equation is simplified if traces of the same source are related:

Thus,

- Apply the source statics S_j processing
- Assume that the delay caused by the geology G_k is negligible,
- The delay caused by the offset, Mk, is not negligible. A new trace with the same offset is obtained by interpolation of traces, or equivalently generating a virtual source, S_1*.

Then: *Each trace of a CRG is crosscorrelated with the trace of the adjacent CRG corresponding to the same offset to obtain R_i.*

CALCULATION

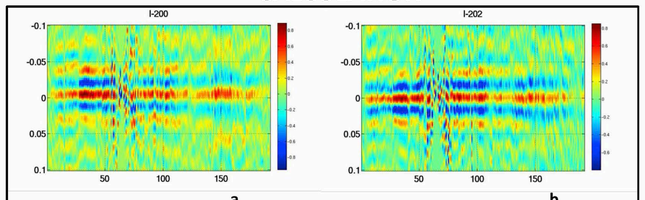

FIGURE 2. Crosscorrelations results of the traces in two CRG, 200 and 202, in the direction left to right.

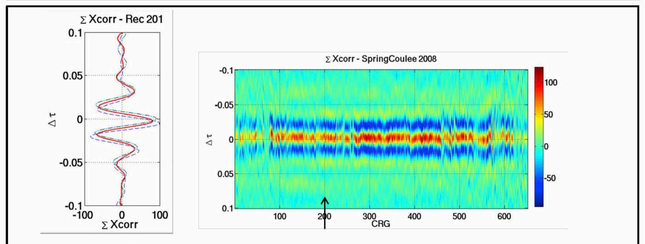

FIGURE 3. Crosscorrelation stacks for all receivers. (a) Individual stacks for CRGs 200 , 201 and 202. (b) Stacks for each one of the CRGs; the location of CRG 200 is shown by an arrow.

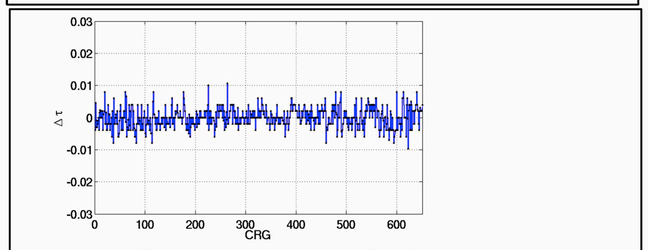

FIGURE 4. Differential receiver statics δR after edition of outliers..

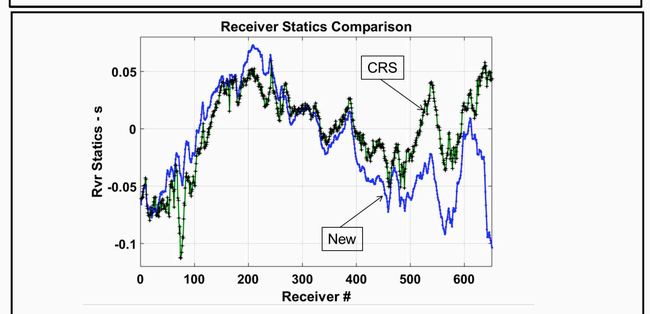

FIGURE 5. Comparison of receiver statics delays using the CRS method (green) and the new method (blue).

APPLICATION

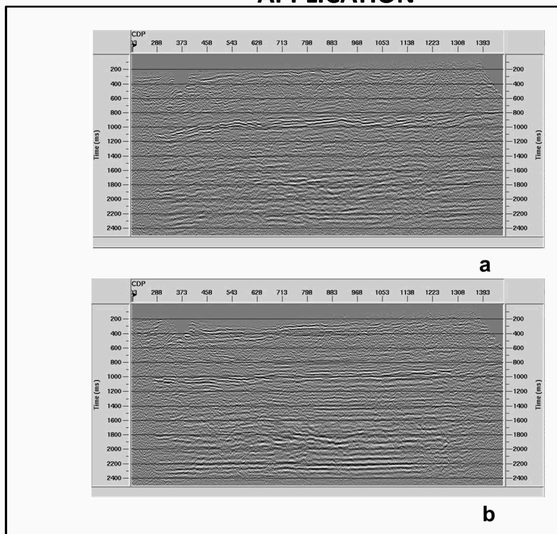

FIGURE 6. (a) Stack section using elevation statics. (b) Stack section using the receiver statics result. Notice the better continuity in (b).

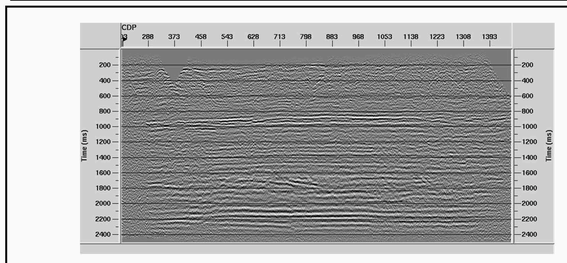

FIGURE 7. Stack section using the receiver statics obtained with the CRS method.

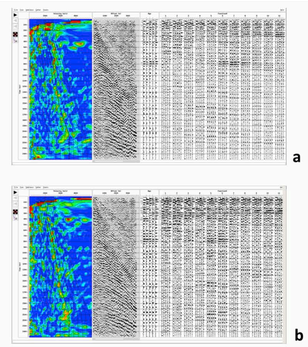

FIGURE 8. Comparison of the receiver statics effect on Velocity analysis of a CDP. (a) Without the receiver statics correction. (b) With the receiver statics correction: the events are easier to follow.

CONCLUSIONS

- The new method does not require stacking velocity V_C, or a horizon to flatten, which are required by the CRS method.
- The new method is automatic (less laborious than other methods).
- The maximum picking of the crosscorrelation stacks shows outliers, which can be related to low quality CRGs. It is required to edit them.
- There is more continuity of the events on a stacked section after application of the new method, compared to a section with elevation statics alone.
- On the velocity analysis, the semblance shows better continuity and stronger picks with the CRG method, which allows easier picking of stacking velocities.
- The stacked section using the final receiver statics from the CRS method appears more continuous.

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