S5D – Mi.,10.3.,10:30-10:50 Uhr · H0112

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A seismic reflection imaging workflow based on the CRS stack: a data example from the Oberrheingraben

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Introduction. The Common-Reflection-Surface (CRS) stack method is a generalized multi-dimensional and multi-parameter stacking velocity analysis tool based on coherence measures. In its application, emphasis has so far mainly been put on its ability to produce simulated zero-offset (ZO) sections of high signal-to-noise (S/N) ratio. However, the method also yields additional information in terms of wavefield attributes with which an entire seismic reflection imaging workflow can be established (see Figure 1). This includes the CRS stack itself, the determination of a velocity model, and a depth migration process. The involved methods are presented and the workflow is demonstrated on a seismic 2D data example, starting from the preprocessed multicoverage data and leading to the final depth image. The measurements were conducted in the Oberrheingraben near Karlsruhe along two seismic lines of about 12 km length each. Three vibrator sources (source spacing 50 m) were used to generate a seismic signal with frequencies in the range 12 - 100 Hz.

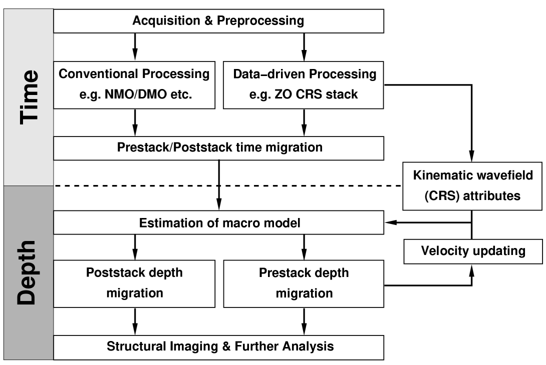

Figure 1: Integration of the CRS stack into the seismic reflection imaging workflow.

Applied methods. The CRS stack (see, e. g., Mann, 2002) was applied to the preprocessed multicoverage dataset in order to simulate a ZO section in a completely automated and data-driven manner. That way, the method can be seen as an alternative to the conventional normal moveout (NMO)/dip moveout (DMO)/stack approach. However, instead of the usual stacking velocity, the process yields an entire set of kinematic wavefield attributes. These attributes can be utilized for several purposes, one of these being a tomographic inversion to determine a velocity model, see Duveneck (2004) for details. The input for the inversion is obtained by picking in the CRS-stacked section and extraction of the associated wavefield attributes. Neither picking in the prestack data nor picking along reflection events over adjacent traces is required. The tomographic inversion yields a smooth interval velocity model that is well suited for ray-tracing applications. The models derived in this way for the data examples were subsequently used to determine traveltime tables for a Kirchhoff depth migration process. One of the prestack depth migration results is shown in Figure 2. This image was obtained by stacking individually migrated common-offset sections in the depth domain.

Discussion. For the above-mentioned data examples, the CRS-stack-based imaging

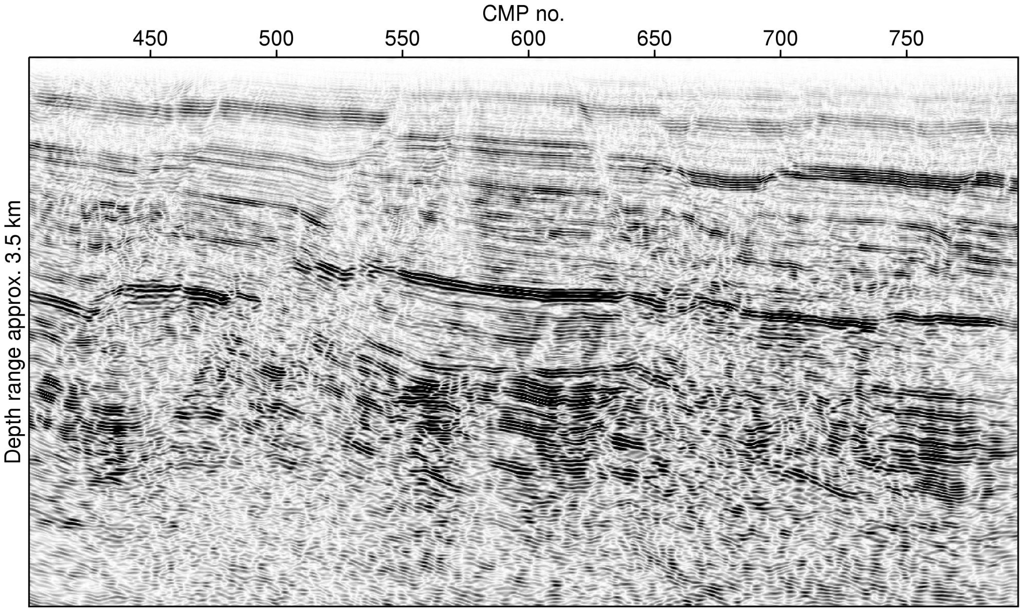

Figure 2: Stack of prestack depth-migrated common-offset sections. The shading has been chosen to emphasize the fault structures. The horizontal extent is about 12 km.

workflow demonstrated its potential to provide all information required to successfully transform prestack data in the time domain into a structural image in the depth domain. The approach was applied in a highly automated manner with minimum human interaction. The migrated sections show much more structural details than the geological map that has been available so far, especially concerning the number of faults observed in this region of the Oberrheingraben.

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References

Duveneck, E. (2004). Velocity model estimation with data-derived wavefront attributes. *Geophysics*, 69(1). In print.

Mann, J. (2002). *Extensions and Applications of the Common-Reflection-Surface Stack Method*. Logos Verlag, Berlin.