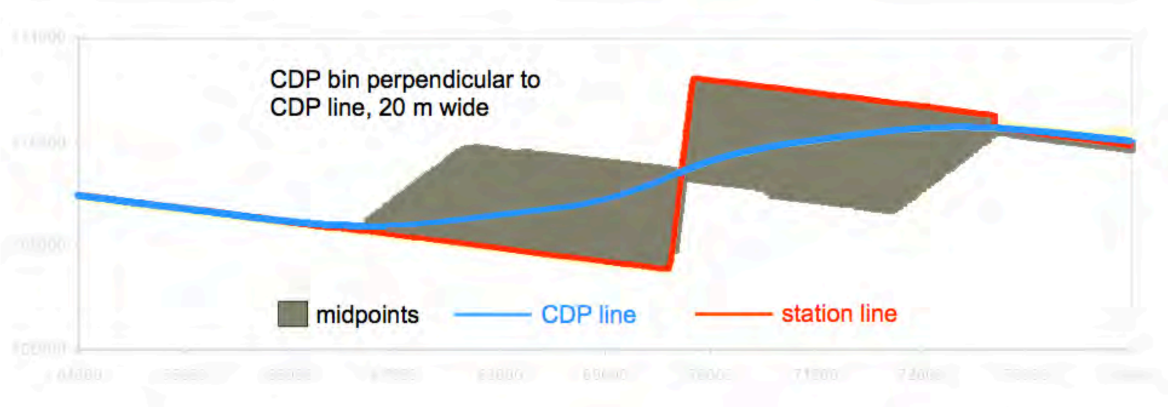
Stacking and Migration

Common Depth Point (CDP) Stacking

Seismic lines follow the available access routes and hence frequently are by no means as straight as desirable. The processing is therefore based on a line of section that smooths out the variations in the line. This CDP line is a curve of best fit through the midpoints between sources and receivers, which optimises the fold of the data while minimising the subsurface area of reflections contributing to each nominal CDP. Each trace (source-receiver pair) is allocated to the nearest CDP bin to its midpoint. Typically the CDP points are at 20 or 40 metre intervals along the line.

The relation of the CDP line to the actual configuration of the original line of stations is indicated in the figure for the case of a sharp bend in the line, as e.g. when following a set of fences.



The effect of the bin size and midpoint scatter within the bin is most critical at shallow depths. Where the line has sharp bends as in the figure, there is likely to be smearing and poor resolution of shallow data. The effect of bends on deeper data can also be significant, depending of the relative directions of the seismic line and the dip of the structures to be imaged. The data in each gather are stacked together with corrections for the vertical variations in velocity, and for more recent sections with corrections for dip at depth. This produces a single stacked trace as a function of two-way time for each CDP point.

The CDP lines are processed as if they were straight, ignoring the effects of changing azimuth along the line. This simplification of the processing to a 2D geometry at the start of the processing sequence is reasonable for large sections of the line that are relatively straight, although, it is not possible to correctly migrate reflections and, therefore, correctly image reflectors at significant bends in the line.

Post stack time migration

Migration is the final processing step and attempts to move dipping reflections to their most likely lateral positions based on an assumed velocity distribution. Reflectors that appear as dipping on a stacked section will be moved up dip, and shortened after migration. Diffraction hyperbolas which result from discontinuities, such as terminations of reflectors at faults, and which are visible on a stacked section, should collapse to a small region after migration.

The migration process is applied to the stacked record section for a line and brings together information from many CDP traces to build up the response at an individual time point. The resulting time-migrated trace is plotted for each CDP point.

Areas of poor signal to noise ratio, and sharp bends in the line, can produce artefacts in the data, which will not migrate successfully. 2-D migration is only fully-effective on a dip-section, and does not move reflections lying along strike. This can cause complications in lines with sharp bends.

The main parameters that need to be selected when performing post-stack time migration are the velocity field and dip ranges to process. The velocity field is normally derived from the stacking velocities, typically 70-80% of these velocities. This choice tends to minimise the complexities associated with interferences due to mild 3-D structure.

Depth conversion

An approximate depth conversion is plotted to the right of each of the display panels based on a conversion for an r.m.s. crustal velocity of 6 km/s. It should be noted that apparent depth will tend to be exaggerated for the shallow sedimentary parts of the section where the seismic velocity is much lower, and might be underestimated for large two-way times.

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