

Stolt Demigration

Stolt Demigration demigrates either common offset or stacked seismic sections, using Stolt's F-K method. It has been superseded by **Stolt** or **Phase Shift 2D Migration**. Formerly, it was called **Stolt Inverse Migration**.

Theory

A demigration inputs a migrated section and outputs an unmigrated section. The uses of this tool are:

- To closely approximate a prestack depth migration when used in conjunction with prestack time migration and poststack depth migration.
- To go back to the unmigrated domain after filtering in the migrated domain.
- To perform quick modeling to test migrations.

Like Stolt forward migration, this process cannot handle severe lateral velocity variations and may not properly image very steep reflectors when velocity varies significantly with depth.

Usage

This implementation of the Stolt algorithm has high enough fidelity that a forward Stolt migration followed by demigration should very nearly reproduce the original data, accounting for tapering and energy lost off the bottom and sides of the section. However, for this to be the case, the Stolt obliquity factor must not be applied in the forward migration.

This process can be combined with prestack time migration and a poststack depth migration to efficiently and closely

approximate a prestack depth migration. The process works as follows:

Pick optimal stacking velocities

Perform a prestack time migration but don't stack the data

Perform an inverse NMO

Pick better stacking velocities

Possibly redo the prestack time migration or just reapply NMO using the new velocities

Stack the data

Perform a demigration using the same velocity and other parameters as in the prestack time migration

Perform a poststack depth migration

This process is effective because prestack depth migration performs two processes: stacking the data in the presence of complex structure, and properly positioning the data. With this pseudo prestack depth migration using prestack time migration, we are separating these two processes into two steps. Use a velocity picking method to produce an optimal stack and then a poststack depth migration to properly position the data. A prestack time migration will perform most of what the prestack depth migration will do. However, there is likely some residual moveout on the CMP gathers. We can then remove the residual moveout. In fact, by separating these processes into two steps, we can use a different velocity function for each step, possibly producing an improved result. However, prestack depth migration has the advantage of correcting for non-hyperbolic moveout. Running prestack time migration can significantly help pick stacking velocities because you are much less likely to have crossing events on the migrated data. Crossing events coming from different dips are likely to have different stacking velocities. As a result one event or the other will not be optimally stacked. After prestack time migration, stacking velocities are likely more accurate and properly represent the true vertical RMS velocity function at a CDP. Consequentially, using the stacking velocities to determine interval velocities should produce more accurate results.

References

Claerbout, J. F., 1985, Imaging the Earth's interior: Blackwell Scientific Publications.

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Deregowski, S. M., 1990, Common-offset migrations and velocity analysis: First Break, 8, 6, 225-233.

Stolt, R. H., 1978, Migration by Fourier transform: Geophysics, 43, 23-48.

Parameters

Minimum CDP to migrate

Enter the minimum CDP bin to migrate. The default is the minimum CDP bin in the line. You can enter a larger bin number if you do not want to migrate the entire line. If no line database exists for this line, you must enter a value in this field.

Maximum CDP to migrate

Enter the maximum CDP bin to migrate. The default is the maximum CDP bin in the line. You can enter a smaller bin number if you do not want to migrate the entire line. If no line database exists for this line, you must enter a value in this field.

CDP interval (ft. or meters)

Enter the CDP spacing, in ft. or m, whichever is consistent in the headers.

Maximum frequency to migrate (in Hz)

Enter the maximum usable frequency in the data. A value less than the Nyquist frequency for the dataset will speed up computations. If the input data has frequencies above this maximum, it should be bandpass filtered before migration to avoid artifacts caused by abruptly truncating the frequency band.

Get RMS velocities from database?

Select **Yes** to use RMS velocities stored in a velocity file in the database. Select **No** to manually enter the RMS velocities.

Select velocity file

This appears if **Yes** to **Get RMS velocities from database**. Select an RMS velocity in time file from the database.

RMS velocities for migration

This appears if **No** to **Get RMS velocities from database**. Enter the time-velocity pairs.

Number of traces to smooth velocity field over

This appears if **Yes** to **Change velocity smoothing**. Enter the number of traces to laterally smooth velocities with a triangular weighting function. Non-smooth velocity fields can introduce migration noise. Enter **0** for no lateral velocity smoothing.

Percent velocity scale factor

Enter a percentage to multiply all velocities. Normally, a value of **100%** should be used. However, you may choose a scale factor less than or greater than 100% to under or over migrate. Entering a scale factor of 0% will result in no migration. **Velocity Field Manipulation** also allows you to time and space vary these velocity reduction factors.

Stolt stretch factor

Enter the W factor to use together with time stretching, to make the constant-velocity Stolt migration algorithm more accurately handle velocity variations with depth. The default value of **0.6** seems to work well for young, uncompacted sediments, for which velocity increases gradually with depth. Decreasing the stretch factor tends to lessen the effect of over-migration of steep dips. For a constant-velocity section, use **1.0**.

Change maximum memory usage?

Select **Yes** to change the maximum memory that the migration can use.

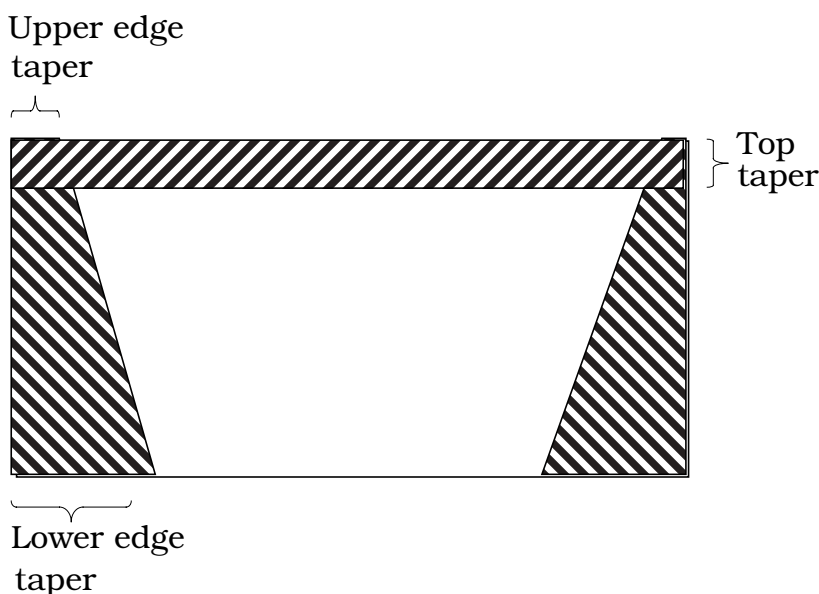
Maximum memory reserved for migration in megabytes

This appears if **Yes** to **Change maximum memory usage**. Enter an upper limit on the amount of computer memory. If the memory needed for migration of the whole line is more than this amount, the migration will be performed in overlapping panels. **Note:** For large marine lines with many CDPs, small CDP spacing, long traces, and large differences between the minimum and maximum velocity, memory usage

is large. In some cases, the padding needed to avoid FFT wrap around can itself be significant.

Change the default tapering?

Select **Yes** to change the edge tapering defaults. Tapering is performed on the section before migration in order to reduce edge effects. Select **No** for a bottom taper of 200 ms to be applied. The edge taper will vary from 2 traces at the top of the section to 20 traces at the bottom of the section. Because migration artifacts originating deeper in the section tend to move a longer distance, the magnitude of the edge taper should normally increase with depth.



A Hamming taper is used, which consists of a cosine weighting that varies from 100% to 8% over the length of the taper.

Top taper (in ms)

This appears if **Yes** to **Change the default tapering**. Enter the length of the taper, in ms, between the first sample of each trace set to 0 amplitude and the untapered data. The top of all traces is tapered to avoid data truncation artifacts when padded with zeros.

Upper edge taper (in traces)

This appears if **Yes** to **Change the default tapering**. Enter the upper edge taper in traces. Generally this will be smaller than the lower edge taper because of the increase in migration aperture with depth.

Lower edge taper (in traces)

This appears if **Yes** to **Change the default tapering**. Enter the lower edge taper in traces. Generally this will be larger than the upper edge taper because of the increase in migration aperture with depth. The taper will be varied linearly with time between the upper and lower edges of the section. **Note:** If the specified taper width is more than half the total number of traces in the seismic section, taper width will be set to half the total number of traces in the seismic section.

Reapply trace mutes?

Select **Yes** to reapply the trace mutes after migration. Select **No** to adjust mutes based on the first and last non-zero samples after migration. In either case, if tapered mutes were used before migration, the same taper length will be used after migration.

Rekill dead traces?

Select **Yes** to rekill dead traces after migration. Select **No** to leave previously dead trace alive, and mutes will be determined from the first and last nonzero samples.