

# Chapter 7 – Several ideas of migration

- Migration as a space-time shift.
- Migration as a back-propagation.
- Migration as an inverse problem.
- Migration as an “imaging condition”
- Time versus depth output sections.
- Amplitude preserving migration.

# Different types of migration

- Claerbout (1970) – finite difference (FD)
- Schneider (1978) – Kirchhoff
- Gazdag (1978) – Phase-shift
- Stolt (1978) – Frequency-wavenumber (f,k)
- Gazdag (1984) – PS plus interpolation
- R. Hill (1990) – Gaussian beam migration
- Ristow and Rull (1994) – Fourier FD

# Velocity conversion with: velconv

- \$ velconv --- convert velocities
- Type: vintt - interval  $v(t)$
- Type: vintz - interval  $v(z)$
- Type: vrmst - RMS  $v(t)$

Why would we want  $v(t)$  or  $v(z)$ ?

# Simple data: simple.su

- `$ cd /scratch/yourusername`
- `$ mkdir Temp2`
- `$ pwd`
- `$ cp /cwpscratch/Data2/simple.su Temp2`
- `$ cd Temp2`
- `$ suxwigb < simple.su xcur=3  
title="simple"`

# Different “velocities”

- Time migration algorithms expect  $V(t)$  or  $V(t,x)$
- Depth Migrations expect  $V(z)$ ,  $V(x,z)$ , or  $V(x,y,z)$
- Some algorithms expect **RMS** velocities
- Some algorithms expect **interval** velocities

# Stolt migration: sustolt

- `$ sustolt`
- `$ surange < simple.su`
- `$ sustolt < simple.su cdpmin=1 cdpmax=80  
dxcdp=40 vmig=2000  
tmig=0.0 > stolt.simple.su`
- `$ suxwign < stolt.simple.su xcur=3  
title="Stolt migration of simple.su"`

# Gazdag's Phase shift migration

- \$ sugazmig < simple.su vmig=2000 dx=40  
tmig=0.0 > gaz.simple.su
- \$ suxwigb < gaz.simple.su xcur=2  
title="Gg migration"
- \$ sumigps < simple.su vmig=2000 dx=40  
tmig=0.0 > ps.simple.su

# Claerbout's 15° migration

- `$ cd /scratch/yourusername/Temp2`
- `$ cp /cwpscratch/Data2/vel.fdmig.simple .`
- `$ sumigfd < simple.su dx=40 dz=12  
nz=150 vfile=vel.fdmig.simple  
> fd.simple.su`
- `$ suxwigb < fd.simple.su title="fd`

# Ristow and Ruhl's Fourier FD

- `$ sumigfd < simple.su dx=40 dz=12  
nz=150 vfile=vel.fdmig.simple  
> ffd.simple.su`
- `$ suxwigb < ffd.simple.su`

# Stoffa et. al.'s Split Step

- `$ sumigsplit < simple.su dx=40 dz=12 nz=150`  
    `vfile=vel.fdmig.simple`  
    `> split.simple.su`
- `$ suxwigb < split.simple.su`

# Gazdag (1984) Phase shift plus interpolation

- \$ sumigpspi < simple.su dx=40 dz=12  
nz=150 vfile=vel.fdmig.simple  
> pspi.simple.su
- \$ suxwigb < pspi.simple.su

# Scheider's Kirchhoff migration

- `$ cd /scratch/yourusername`
- `$ cd Temp2`
- `$ cp /cwpscratch/Data2/Rayt2d.simple .`
- `$ cp /cwpscratch/Data2/Kdmig2d.simple .`
- `$ cp /cwpscratch/Data2/vel.kdmig.simple .`
- `$ cp /cwpscratch/Data2/simple.su .`

# Check the data and shell scripts

- `$ surange < simple.su`
- `$ more Rayt2d.simple`
- `$ more Kdmig2d.simple`
- `$ rayt2d`
- `$ sukdmig2d`

# Schneider's Kirchhoff migration

- \$ Rayt2d.simple
- \$ Kdmig2d.simple

# Spatial Aliasing

- `$ cd /scratch/yourusername/Temp2`
- `$ cp /cwpscratch/Data2/interp.su .`
- `$ suxwigg < simple.su title="simple" &`
- `$ suxwigg < interp.su title="interp" &`
- `$ surange < interp.su`

# Stolt migraton test

- `$ sustolt < simple.su cdpmin=1  
cdpmax=80 dxcdp=40  
| suxwignb xcur=3  
title=" Stolt simple" &`
- `$ sustolt < interp.su cdpmin=1  
cdpmax=159 dxcdp=20  
| suxwignb xcur=3  
title="Stolt interp" &`

# Recognizing Spatial Aliasing

- `$ suxwigb < simple.su xcur=2 interp=1  
title="simple" &`

zoom to  $1.05 < t < 1.18$      $10 < \text{traces} < 20$

- `$ suxwigb < interp.su xcur=2 interp=1  
title="interp" &`

zoom to  $1.05 < t < 1.18$      $20 < \text{traces} < 40$

# Chapter 8

## v(t) migration of real data

- `$ cd /scratch/yourusername`
- `$ mkdir Temp3`
- `$ cp /cwpscratch/Data3/Stoltmig Temp3`
- `$ cp /cwpscratch/Data3/PSmig Temp3`
- `$ cp /cwpscratch/Data3/seismic3.su Temp3`

- \$ cp /cwpscratch/Data3/Suttoz.stolt  
Temp3
- \$ cp /cwpscratch/Data3/Suttoz.psmig Temp3
- \$ cd Temp3
- \$ surange < seismic3.su
- \$ suximage < seismic3.su perc=99
- \$ suximage < seismic3.su perc=99  
verbose=1
- \$ suximage < seismic3.su clip=0.2  
verbose=1

# Stoltmig and PSmig

- \$ sustolt
- \$ more Stoltmig
- \$ supsmig
- \$ more Psmig
- \$ suintvel

# Suttoz.stolt and Suttoz.psmig

- \$ more Suttoz.stolt
- \$ more Suttoz.psmig
- \$ Stoltmig
- \$ Suttoz.stolt

# Viewing Stolt in time and depth

- `$ suximage < seismic3.su clip=.2  
title="Stacked data" &`
- `$ suximage < stolt.seis.su clip=.2  
title="Stolt time section" &`
- `$ suximage < stolt.depth.seis. Su  
clip=.2 title="Stolt depth section" &`

# Phaseshift Migration

- \$ PSmig
- \$ Suttoz.psmig
- \$ suximage < seismic3.su clip=.2  
title="Stacked data"
- \$ suximage < ps.seis.su clip=.2  
title="PS time section"
- \$ suximage < ps.depth.seis.su  
clip=.2 title="PS depth section"

# FD, FFD, PSPI, Split, GB $v(x,z)$ (depth) migrations

- `$ cd /scratch/yourusername`
- `$ mkdir Temp4`
- `$ cd Temp4`
- `$ cp /cwpscratch/Data4/seismic3.su .`
- `$ cp /cwpscratch/Data4/Migtest .`
- `$ cp /cwpscratch/Data4/newvel.bin .`

# Viewing velocity files

- `$ ximage < newvelzx.bin n1=1500  
legend=1 &`
- `$ ximage < newvelxz.bin n1=2142  
legend=1 &`
- `$ more Migtest.fd`
- `$ more Migtest.ffd`
- `$ more Migtest.split`
- `$ more Migtest.pspi`
- `$ more Migtest.gb`

# Timing the migrations

- \$ time Migtest.fd
- \$ time Migtest.ffd
- \$ time Migtest.split
- \$ time Migtest.split
- \$ time Migtest.gp