Command-line usage

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Outline

Outline

Madagascar programs

- "sf" prefix
- 812 programs (2011-07-15)
- 30+ developers
- Developed using C, C++, Fortran, Python
- Applications
  - Numerical recipes
  - General data analysis
  - Seismic processing
  - Visualization

Madagascar programs

List of all programs

`sfdoc -k .` or `http://www.ahay.org/RSF`

```
bash $ sfdoc -k .
sfwave: Rice HPCSS seismic modeling and migration.
sfofpwd: Objective function of dip estimation with PWD filters.
sferf: Bandpass filtering using erf function.
sfinfill: Shot interpolation.
sfgbeamform: 2-D lateral smoothing.
...
```

Madagascar programs

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sfinfill: Shot interpolation.
sfgbeamform: 2-D lateral smoothing.
...
```

Look for specific programs

`sfdoc -k keyword`

```
bash $ sfdoc -k interpolation
sfinfill: Shot interpolation.
sflevint: Leveler inverse interpolation in 1-D.
sfmsmiss: Multiscale missing data interpolation (N-dimensional).
sffreqreg: Local frequency interpolation.
...
```

Self documentation

Print out documentation

sfprog without arguments

```
bash $ sfwindow
NAME
    sfwindow
DESCRIPTION
    Window a portion of a dataset.
SYNOPSIS
    sfwindow < in.rsf > out.rsf verb=n squeeze=y j#=(1,...) d#=(
        d1,d2,...) f#=(0,...) min#=(o1,o2,,...) n#=(0,...) max#=(
        o1+(n1-1)*d1,o2+(n1-1)*d2,,...)
PARAMETERS
    float   d#=(d1,d2,...)  sampling in #-th dimension
    largeint f#=(0,...)     window start in #-th dimension
    int     j#=(1,...)      jump in #-th dimension
    float   max#=(o1+(n1-1)*d1,o2+(n1-1)*d2,,...)   maximum in #-
        th dimension
    float   min#=(o1,o2,,...)       minimum in #-th dimension
    largeint n#=(0,...)     window size in #-th dimension
    bool    squeeze=y [y/n] if y, squeeze dimensions equal to 1
        to the end
...
```

Self documentation

```
USED IN
    bei/dpmv/krchdmo
    bei/dpmv/matt
    bei/dwnc/sigmoid
...
SOURCE
    system/main/window.c
DOCUMENTATION
    http://ahay.org/wiki/Guide_to_madagascar_programs#sfwindow
```

Self documentation

```
USED IN
     bei/dpmv/krchdmo
     bei/dpmv/matt
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...
SOURCE
     system/main/window.c
DOCUMENTATION
     http://ahay.org/wiki/Guide_to_madagascar_programs#sfwindow
```

Computation examples under USED IN section

```
bash $ cat $RSFSRC/book/bei/dpmv/krchdmo/SConstruct
...
def vscan(title):
  return '''
  window f3=174 n3=1 |
  vscan v0=%g nv=100 dv=%g half=n slowness=y |
  grey title="%s"
  ''' % (1/2.8,(1/1.7-1/2.8)/99,title)
...
```

Command-line usage

Single program

```
[< in.rsf] sfprog [par1=] [par2=] [...]  [> out.rsf]
```

- Single input `< in.rsf`
- Single output `> out.rsf`
- Multiple parameters `par=val`

Command-line usage

Single program

```
[< in.rsf] sfprog [par1=] [par2=] [...]  [> out.rsf]
```

- Single input `< in.rsf`
- Single output `> out.rsf`
- Multiple parameters `par=val`

Multiple programs

```
[< in.rsf] sfprog1 [par=] | ...  | sfprogn [par=] [>
out.rsf]
```

- ONE task per program
- Data passed through pipes

Example

Single program

```
bash $ sfspike n1=5 k1=2
```

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

Example

Single program

```
bash $ sfspike n1=5 k1=2
```

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

Multiple programs single parameter

```
bash $ sfspike n1=5 k1=2 | sfmath output="1-input"
```

$$\begin{bmatrix} 1 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Example

Single program

```
bash $ sfspike n1=5 k1=2
```

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$

Multiple programs single parameter

```
bash $ sfspike n1=5 k1=2 | sfmath output="1-input"
```

$$\begin{bmatrix} 1 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Multiple programs multiple parameters

```
bash $ sfspike n1=5 k1=2 > a.rsf
bash $ sfspike n1=5 k1=4 > b.rsf
bash $ < a.rsf sfadd scale=1,-2 b.rsf > c.rsf
```

$$a = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \end{bmatrix}$$
$$b = \begin{bmatrix} 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$
$$c = \begin{bmatrix} 0 & 1 & 0 & -2 & 0 \end{bmatrix}$$

SCons to shell

Extract shell script from SConstruct

`scons -n -Q > build.sh`

```
bash $ cat SConstruct
from rsf.proj import *

Flow('a',None,'''
  math n1=101 d1=0.01 o1=0 n2=4 d2=1 o2=1
  output="sin(x1*2*3.1415926*x2)"
  ''')
Result('a','graph screenratio=1 title=sin')
End()
```

```
bash $ scons -n -Q
/Users/maxu1/rsf/bin/sfmath n1=101 d1=0.01 o1=0 n2=4 d2=1 o2=1
    output="sin(x1*2*3.1415926*x2)" > a.rsf
< a.rsf /Users/maxu1/rsf/bin/sfgraph screenratio=1 title=sin >
    Fig/a.vpl
```

Outline

Regularly Sampled Format

- Discrete represntation of n-d functions
- Uniform sampling
- RSF dataset is n-d matrices with physical dimensions
- Data type `int`, `float`, `double`, `complex` ....

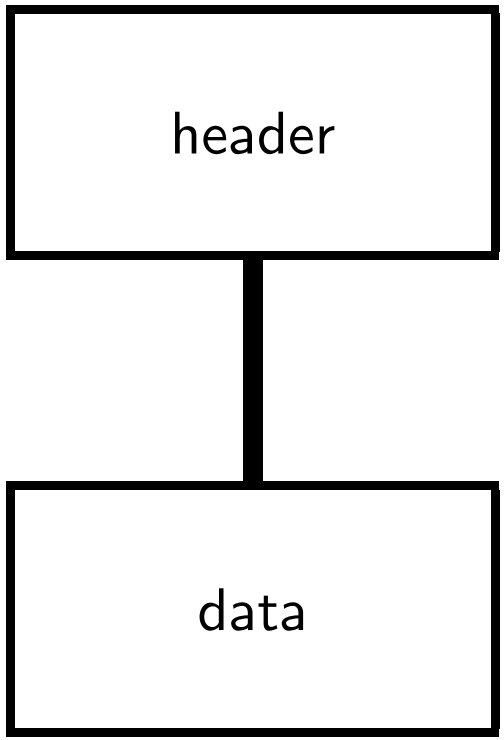
RSF components

Header file

- Text
- Small
- Portable

Data file

- ASCII or binary (native or XDR)
- Large (Huge)
- Path under $DATAPATH



Print data contents

Example: construct matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$$

Print out data

```
sfdisfil < in.rsf
```

```
bash $ sfmath n1=3 o1=1 n2=2 o2=1 output="x1*x2" > a.rsf
bash $ < a.rsf sfdisfil col=3
    0:              1              2              3
    3:              2              4              6
```

Header information

Print out header

```
sfin file0.rsf [file1.rsf] [file2.rsf] ...
```

```
bash $ sfin a.rsf
a.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3         d1=1         o1=1       label1="Time" unit1="sec"
  n2=2         d2=1         o2=1       label2="Distance" unit2="m"
  6 elements 24 bytes
```

- n: number of samples
- o: origin of samples
- d: sampling interval
- label: axis label
- unit: axis unit

Header information

Print out header

`sfin file0.rsf [file1.rsf] [file2.rsf] ...`

```
bash $ sfin a.rsf
a.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3         d1=1         o1=1       label1="Time" unit1="sec"
  n2=2         d2=1         o2=1       label2="Distance" unit2="m"
  6 elements 24 bytes
```

- n: number of samples
- o: origin of samples
- d: sampling interval
- label: axis label
- unit: axis unit

Data path under `in=""`

```
bash $ ls -l /var/tmp/a.rsf*
-rw-r--r--  1 maxu2  wheel  24 Jul 14 20:34 /var/tmp/a.rsf@
```

RSF dataset attributes

Print out data attributes

`sfattr < in.rsf`

```
bash $ < a.rsf sfattr
***************************************
    rms =         3.41565
   mean =               3
   2-norm =          8.3666
variance =             3.2
 std dev =         1.78885
    max =               6 at 3 2
    min =               1 at 1 1
nonzero samples = 6
  total samples = 6
***************************************
```

Modify header

Write header

```
sfput < in.rsf key1=val1 [...]  > out.rsf
```

```
bash $ sfin a.rsf
a.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3              d1=1              o1=1
  n2=2              d2=1              o2=1
  6 elements 24 bytes
bash $ < a.rsf sfput n1=6 n2=1 > a2.rsf
bash $ sfin a2.rsf
a2.rsf:
  in="/var/tmp/a2.rsf@"
  esize=4 type=float form=native
  n1=6              d1=1              o1=1
  n2=1              d2=1              o2=1
  6 elements 24 bytes
```

Moving RSF dataset

`mv` moves header ONLY

```
bash $ mv a.rsf b.rsf
bash $ sfin b.rsf
b.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3             d1=1             o1=1
  n2=2             d2=1             o2=1
  6 elements 24 bytes
```

Moving RSF dataset

`mv` moves header ONLY

```
bash $ mv a.rsf b.rsf
bash $ sfin b.rsf
b.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3              d1=1              o1=1
  n2=2              d2=1              o2=1
  6 elements 24 bytes
```

Move header and data

`sfmv in.rsf out.rsf`

```
bash $ sfmv a.rsf b.rsf
bash $ sfin b.rsf
b.rsf:
  in="/var/tmp/b.rsf@"
  esize=4 type=float form=native
  n1=3              d1=1              o1=1
  n2=2              d2=1              o2=1
  6 elements 24 bytes
```

Copying and deleting RSF

Copy header and data

`sfcp in.rsf out.rsf`

```
bash $ sfcp a.rsf b.rsf
bash $ sfin b.rsf
b.rsf:
  in="/var/tmp/b.rsf@"
  esize=4 type=float form=native
  n1=3             d1=1             o1=1
  n2=2             d2=1             o2=1
  6 elements 24 bytes
```

Delete header and data

`sfrm file1.rsf file2.rsf [...]`

```
bash $ rm a.rsf
bash $ ls /var/tmp/a.rsf@
/var/tmp/a.rsf@
bash $ sfrm a.rsf
bash $ l /var/tmp/a.rsf
ls: /var/tmp/a.rsf: No such file or directory
```

RSF dataset in a single file

Packing header and data

```
[< in.rsf] sfprog [> out.rsf] out=stdout
```

```
bash $ sfmath n1=3 o1=1 n2=2 o2=1 output="x1*x2" out=stdout > a.
    rsf
bash $ sfin a.rsf
a.rsf:
  in="stdin"
  esize=4 type=float form=native
  n1=3              d1=1              o1=1
  n2=2              d2=1              o2=1
  6 elements 24 bytes
```

`in="stdin"` indicates standalone RSF dataset

Exchange dataset between systems

```
< in.rsf sfdd form=xdr out=stdout > out.rsf
```

Conversion with ASCII

ASCII to RSF

```
echo in=in.asc data_format=ascii_float | sfdd form=native >
out.rsf
```

```
bash $ cat a.asc
1 2 3 2 4 6
bash $ echo in=a.asc n1=3 o1=1 d1=1 n2=2 o2=1 d2=1 data_format=
    ascii_int | sfdd form=native type=float > a.rsf
bash $ sfin a.rsf
a.rsf:
  in="/var/tmp/a.rsf@"
  esize=4 type=float form=native
  n1=3              d1=1              o1=1
  n2=2              d2=1              o2=1
  6 elements 24 bytes
bash $ < a.rsf sfdisfil col=3
0:              1              2              3
3:              2              4              6
```

RSF to ASCII

```
sfdd form=ascii out=out.asc < in.rsf > /dev/null
```

Conversion with SEG-Y

Conversion with SEG-Y

```
sfsegyread tape=in.segy tfile= hfile=hfile bfile= > out.rsf
sfsegywrite tape=out.segy tfile= hfile= bfile= < in.rsf
```

Conversion with SU

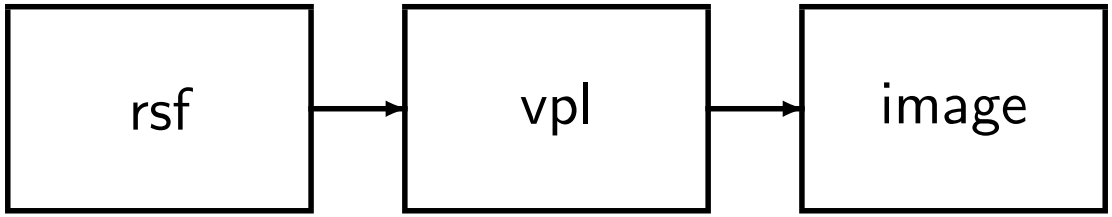
```
sfsegyread su=y tape=in.su tfile= > out.rsf
sfsegywrite su=y tape=out.su tfile= < in.rsf
```

Outline

VPLOT

- ".vpl" suffix
- Vector image can be scaled without affecting quality
- Displayed by *pen* programs
- Compact

VPLOT



MADAGASCAR plotting programs: `sfprog < in.rsf par= > out.vpl`

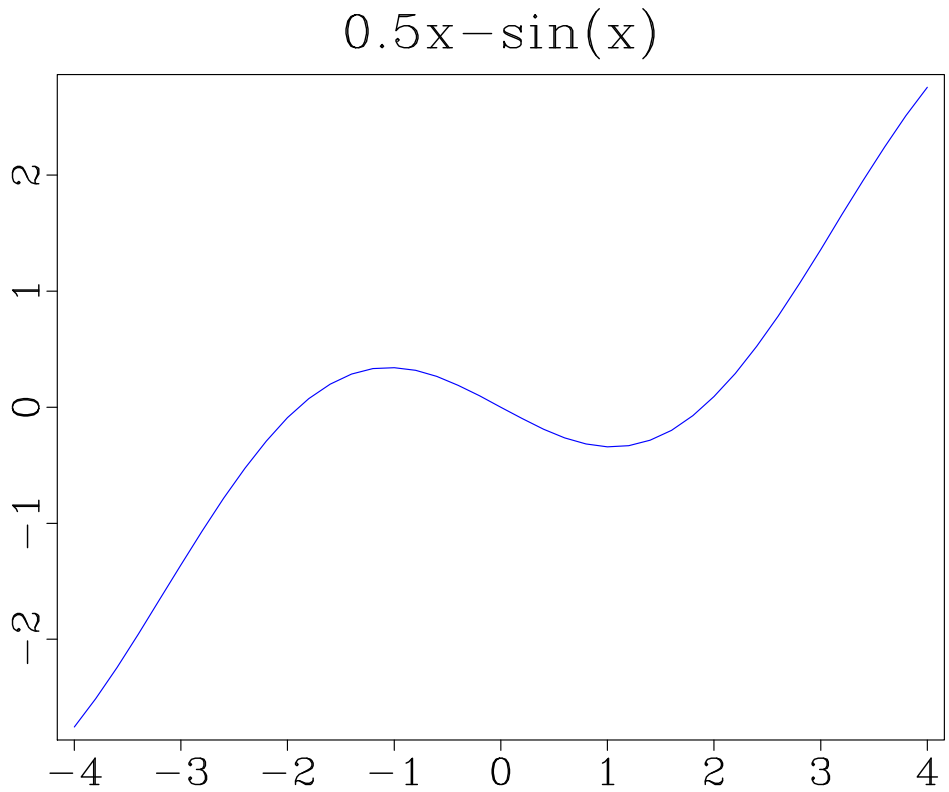
- `sfgraph`
- `sfgrey`
- `sfgrey3`
- `sfcontour`
- `sfdots`
- ...

pen progrms convert `.vpl` to images (`.eps`, `.gif`, `.png`, ...)

- `vppen`
- `xtpen`
- `pspen`
- ...

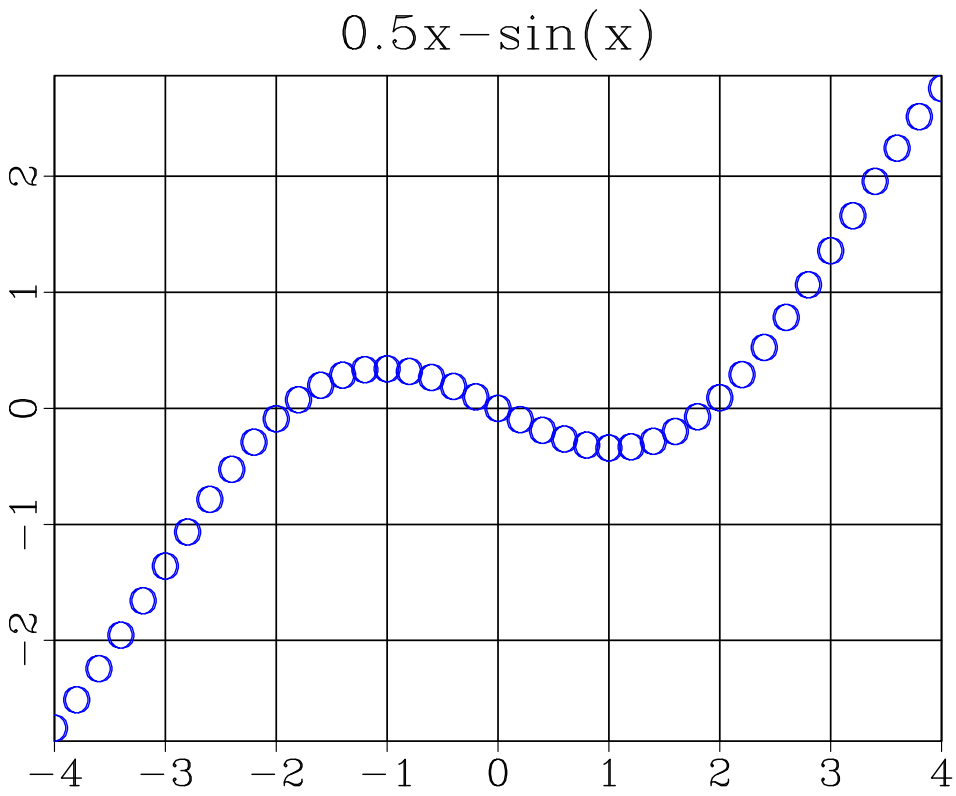
sfgraph

```
# Generated by scons -nQ > plot.sh
/Users/maxu1/rsf/bin/sfmath n1=41 o1=-4 d1=.2 output=".5*x1" > y1.
    rsf
< y1.rsf /Users/maxu1/rsf/bin/sfmath output="sin(x1)" > y2.rsf
< y1.rsf /Users/maxu1/rsf/bin/sfmath sin=y2.rsf output="input-sin"
    > y3.rsf
```



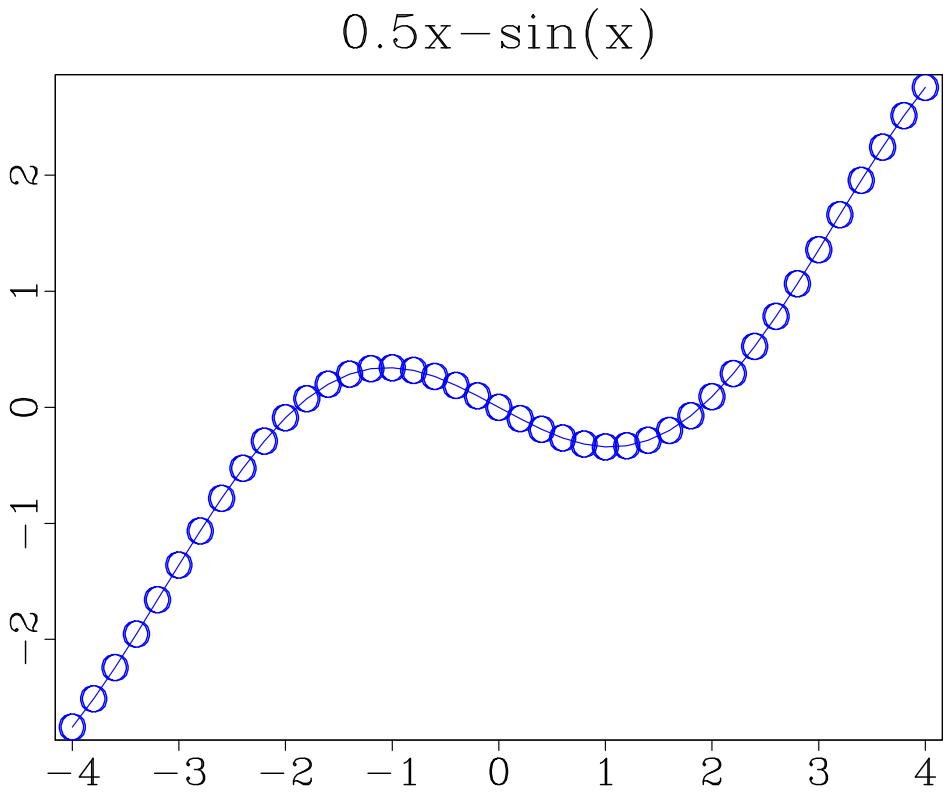
sfgraph

```
< y3.rsf /Users/maxu1/rsf/bin/sfgraph title="0.5x-sin(x)" symbol=o
    symbolsz=12 grid=y min1=-4 max1=4 > Fig/fig2.vpl
```



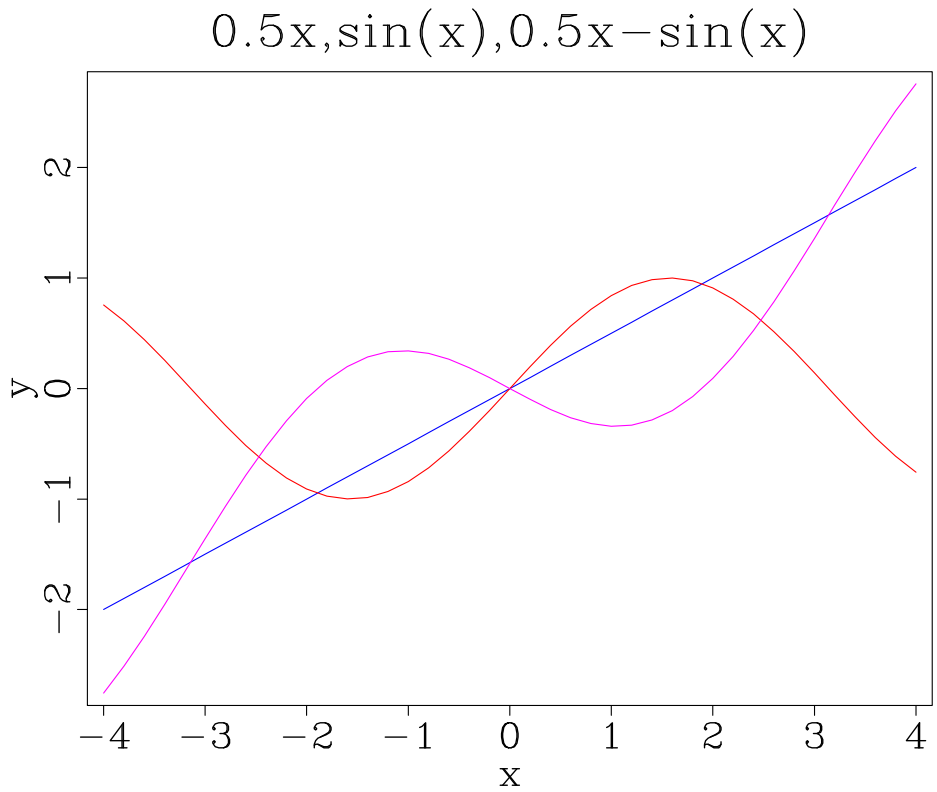
sfgraph

```
< y3.rsf /Users/maxu1/rsf/bin/sfgraph title="0.5x-sin(x)" symbol=o
    symbolsz=12 > dots.vpl
/Users/maxu1/rsf/bin/vppen erase=o vpstyle=n line.vpl dots.vpl >
    Fig/fig3.vpl
< y1.rsf /Users/maxu1/rsf/bin/sfcat y2.rsf y3.rsf axis=2 > y4.rsf
```



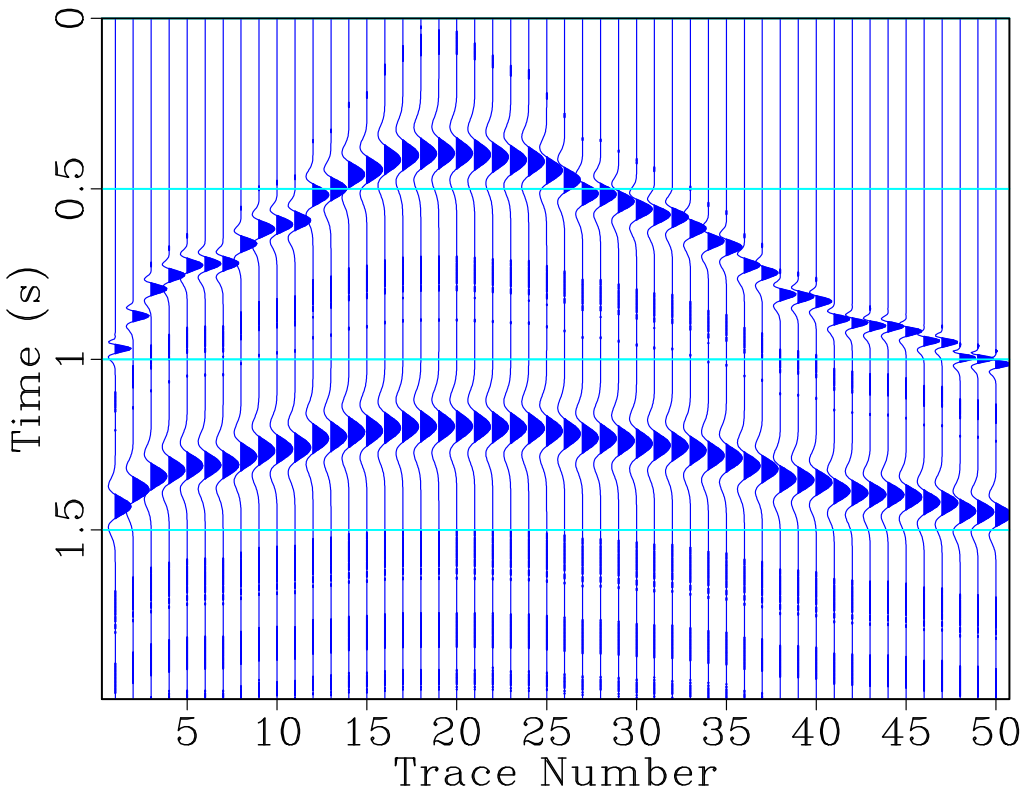
sfgraph

```
/Users/maxu1/rsf/bin/sfmath n1=101 d1=2 n2=201 d2=2 output="1500+5*
    x1" > vb.rsf
< vb.rsf /Users/maxu1/rsf/bin/sfmath output="-exp(-.002*((x1-100)*(
    x1-100)+(x2-200)*(x2-200)))*450" > v1.rsf
```



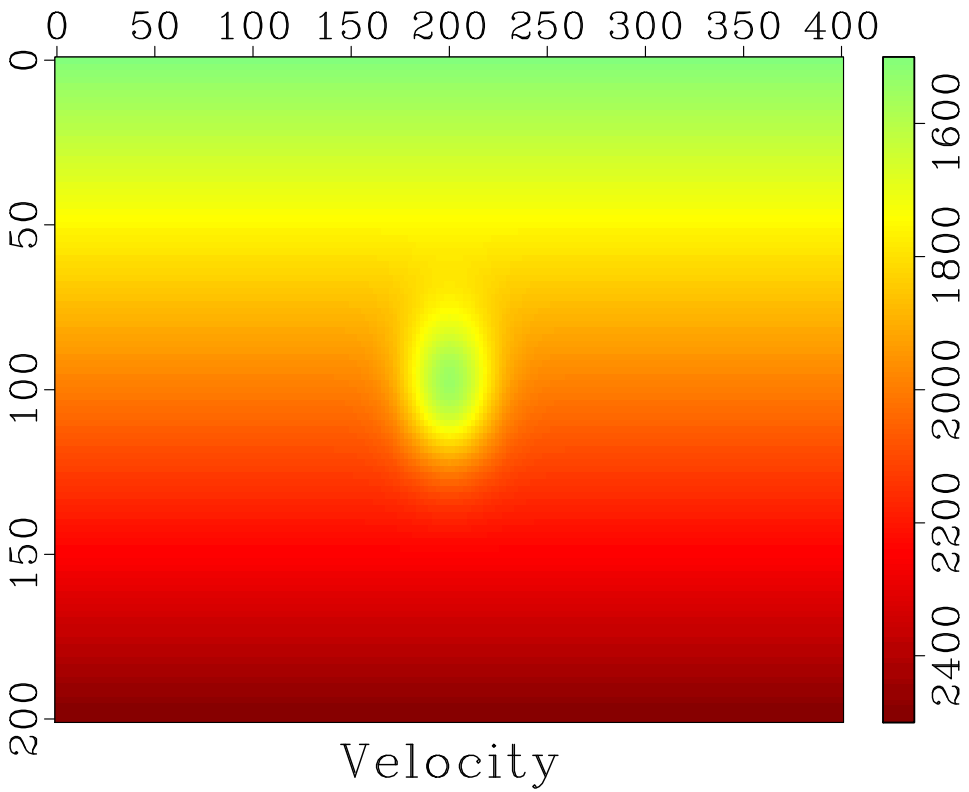
sfwiggle

```
< spike.rsf /Users/maxu1/rsf/bin/sfwindow n1=1 | /Users/maxu1/rsf/
    bin/sfnoise type=n rep=y seed=2005 range=3 > offset.rsf
```



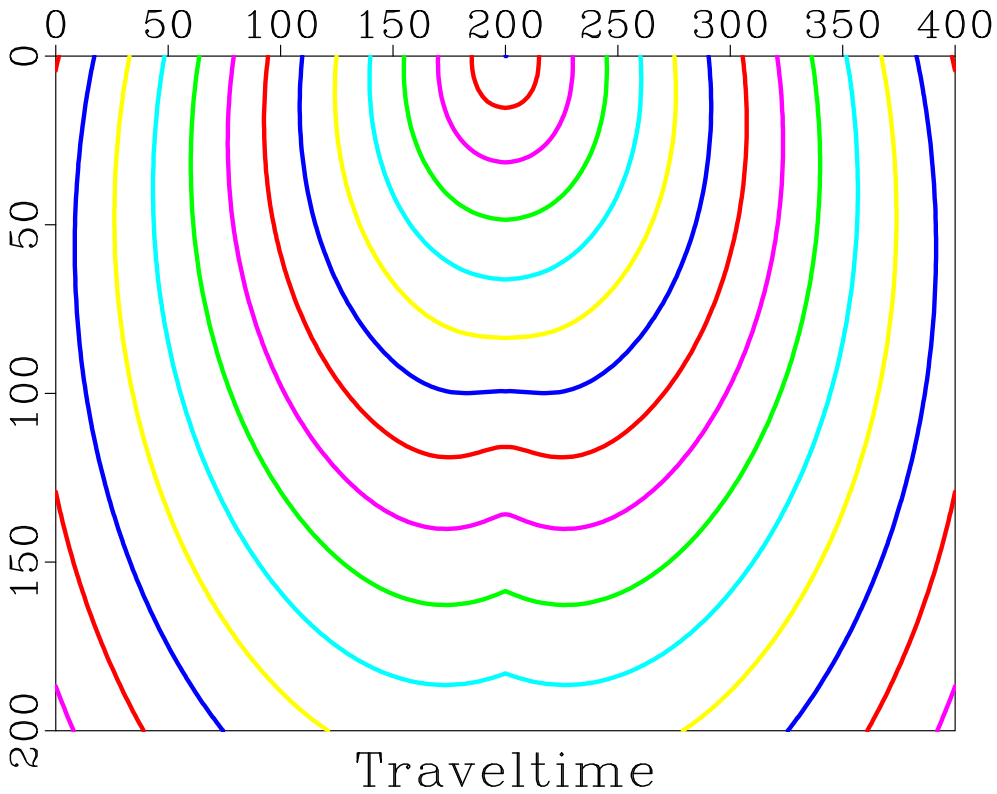
sfgrey

```
< v.rsf /Users/maxu1/rsf/bin/sfgrey title=Velocity color=j bias
    =1500 scalebar=y barreverse=y > Fig/fig5.vpl
```



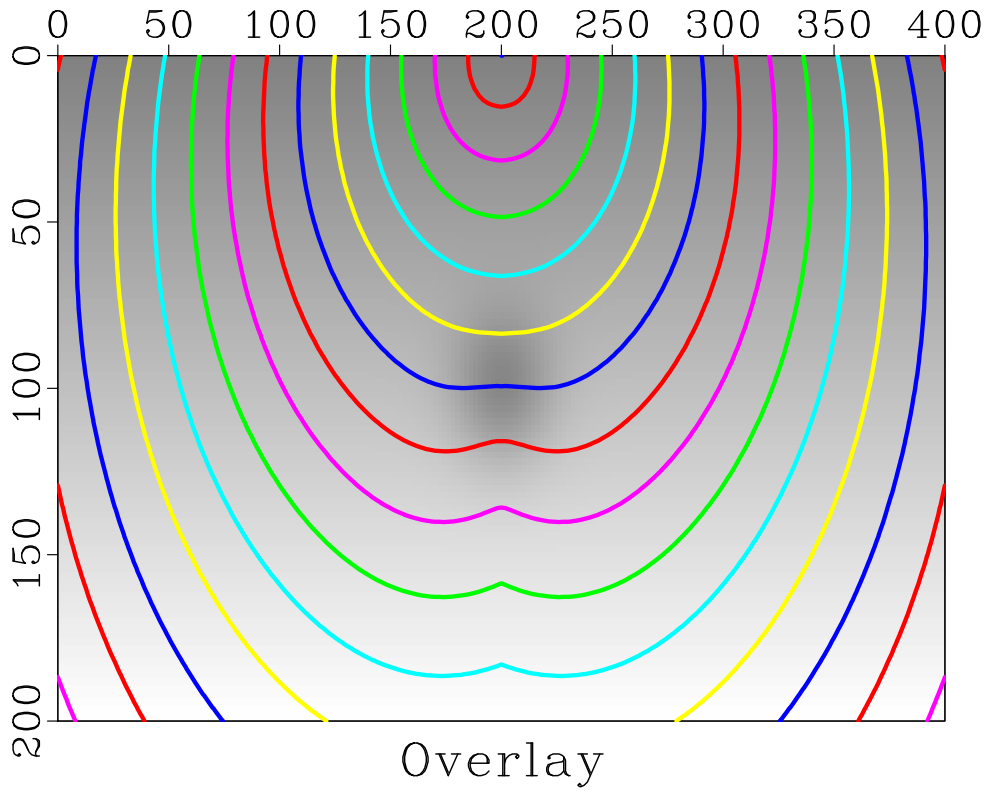
sfcontour

```
< eik.rsf /Users/maxu1/rsf/bin/sfcontour nc=45 title=Traveltime
    plotfat=5 > Fig/fig6.vpl
```



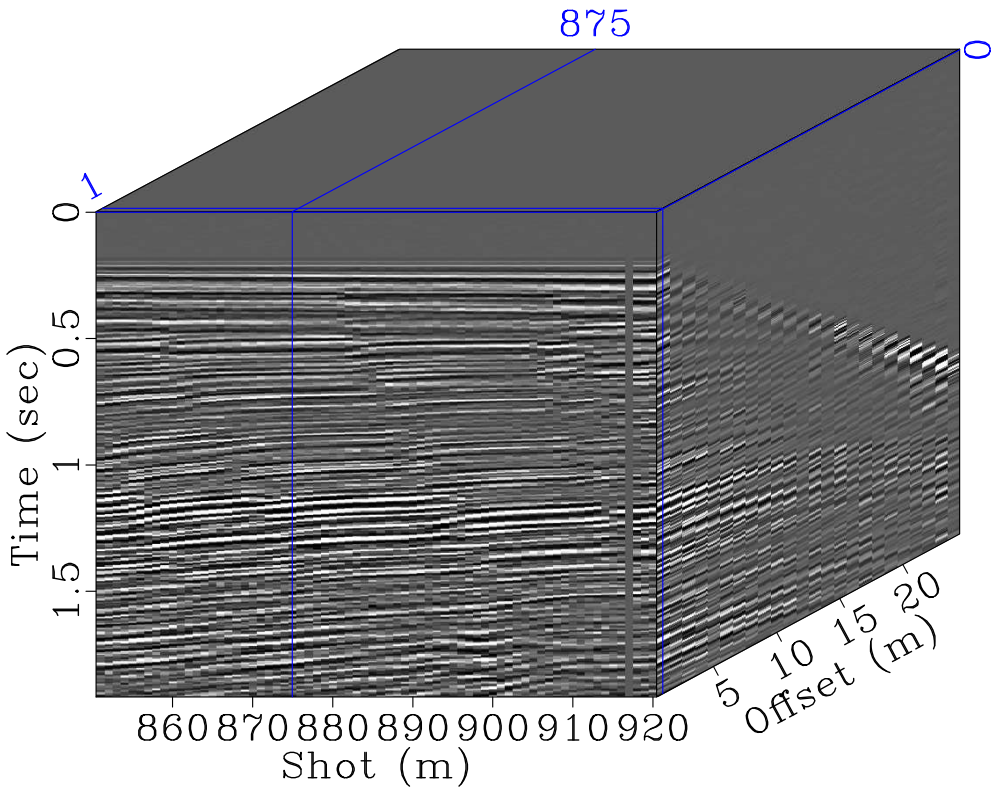
Overlay

```
< eik.rsf /Users/maxu1/rsf/bin/sfcontour title=Overlay nc=45
    plotfat=5 min1=0 max1=200 min2=0 max2=400 > eik.vpl
/Users/maxu1/rsf/bin/vppen erase=o vpstyle=n v.vpl eik.vpl > Fig/
    fig7.vpl
retrieve(["shots.hh"], [])
```



sfgrey3

```
< shots.rsf /Users/maxu1/rsf/bin/sfbyte | /Users/maxu1/rsf/bin/
    sfgrey3 frame1=0 frame2=24 frame3=0 point1=.75 point2=.65
    wanttitle=n flat=n title="Data" > Fig/fig8.vpl
```



http://www.ahay.org/

Seismic Wave Analysis Group

`http://swag.kaust.edu.sa`