Pluto Model

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Data Type: *Synthetic*
Source: *SMAART Consortium*
Location: *http://www.delphi.tudelft.nl/SMAART/pluto15.htm*
Format: *SEGY and Native*
Date of origin: *Publicly released November 2000*

INTRODUCTION

The Pluto dataset is one of several that The Subsalt Multiples Attenuation and Reduction Technology Joint Venture (SMAART JV) publicly released between September 2001 and November 2002. Additional information may be found at:
http://www.delphi.tudelft.nl/SMAART/. The data remain the property of SMAART and are used under the agreement found at the aforementioned web address.

The Pluto 1.5 dataset is a 2D elastic dataset released in November 2000, designed to emulate deep water subsalt prospects as found in the Gulf of Mexico. It contains realistic free surface and internal multiples over a structure that is relatively easy to image. Table 1 shows the files contained within the Pluto repository of Madagascar.

```
1  -rwxr-xr-x    1 root     root     1094022346 2005-04-20 07:46 pluto.shot.hh
2  -rwxr-xr-x    1 root     root     35109840 2005-04-20 07:46 int_depth_vp.sgy
3  -rwxr-xr-x    1 root     root     576162400 2005-04-20 07:47 P15shots150f_endon_0ph-1stHlf.SEGY
4  -rwxr-xr-x    1 root     root     576162400 2005-04-20 07:48 P15shots150f_endon_0ph-2ndHlf.SEGY
5  -rwxr-xr-x    1 root     root         3067 2005-04-20 07:48 readme.txt
6  -rwxr-xr-x    1 root     root       473944 2005-04-20 07:48 Pluto1.5_rc_series.gif
7  -rwxr-xr-x    1 root     root        35328 2005-04-20 07:48 Pluto15_Header_Coordinates.xls
8  -rwxr-xr-x    1 root     root        26112 2005-04-20 07:48 Pluto1.5Const.doc
9  -rwxr-xr-x    1 root     root        22016 2005-04-20 07:48 Pluto_1.5_Acq_parameters.doc
10 -rwxr-xr-x    1 root     root     40677840 2005-04-20 07:48 P15VPint_25f_padded.SEGY
11 -rwxr-xr-x    1 root     root     39004355 2005-04-20 07:48 pluto.velo.hh
12 -rw-r--r--    1 root     root     947523094 2005-12-13 18:55 data.H
13 -rw-r--r--    1 root     root     564007299 2005-12-13 18:56 data.art.H
14 -rw-r--r--    1 root     root     947536358 2005-12-13 18:57 mult.H
15 -rw-r--r--    1 root     root         1983 2005-12-13 18:57 pluto-shot.H
16 -rw-r--r--    1 root     root     1094021600 2005-12-13 18:59 pluto-shot.H@
17 -rw-r--r--    1 root     root         2086 2005-12-13 18:59 pluto_cmps.H
18 -rw-r--r--    1 root     root          146 2005-12-13 19:02 readme-antoine.txt
19 -rw-r--r--    1 root     root     1340390400 2005-12-13 19:02 pluto_cmps.H@
20 -rw-r--r--    1 root     root     947523393 2005-12-13 19:04 sign.H
21 -rw-r--r--    1 root     root     947523699 2005-12-13 19:07 sign.imp.H
```

Table 1: A list of all files contained in the *Pluto* repository

VELOCITY MODELS

The Pluto model was designed to offer a complex environment to test multiple attenuation algorithms. The model is 32 km (105,000 ft) long and 9.14 km (30,000 ft) in deep.

The velocity model file *int_depth_vp.sgy* has 1201 datapoints in the vertical direction and 6960 datums in the horizontal direction. The actual synthetic surveys were conducted on a padded model which contains constant velocity cells outside of the model boundaries.

To assure the proper geometry Pluto velocity model headers should be formatted as shown in table 2. Values are listed for both metric and standard units. This article will display metric units exclusively.

Standard					
n1=1201	n2=6960	d1=0.025	d2=0.025	o1=0	o2=-34.875
Metric					
n1=1201	n2=6960	d1=.0076	d2=.0076	o1=0	o2=-10.629
Padded					
n1=1401	n2=6960	d1=.025 or .0076	d2=.025 or .0076	o1=0	o2=-34.875 or -10.629

Table 2: Header information for Pluto velocity models

The*SConstruct* file found within *rsf/book/data/pluto* is shown in table 3. This *SConstruct* file produces both metric and standard plots of the velocity model. However, only the metric one is presented here in figure 1. Additionally, the padded model found in file *P15VPint_25f_padded.SEGY*, is displayed in figure 2 for reference.

Typing command 1 within the *pluto* directory runs the script.

```
bash-3.1$ scons view
```
(1)

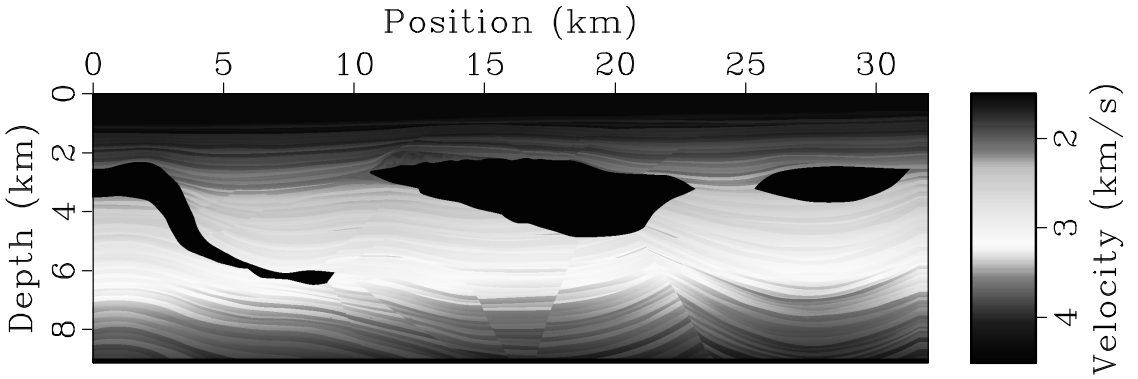

Figure 1: Pluto P-wave velocity model in metric units

SHOT RECORDS

BP performed a fourth order finite differencing modeling code on the padded velocity model. Madagascar can easily be used to display and manipulate the data. The script *pluto/shot/SConstruct* presented in table 4 fetches the dataset and constructs the *RSF* formatted dataset *plutoShots.rsf*.

As written this script outputs two images; figure 3 shows the Pluto zero offset shot gather while figure 4 shows shot 30.

```
from rsf.proj import *
# Fetch Files from repository
Fetch("int_depth_vp.sgy","pluto")
Fetch("P15VPint_25f_padded.SEGY","pluto")

# Convert Files to RSF
Flow('velocityProfileStd','int_depth_vp.sgy',
     '''
     segyread read=d |
     put  d2=.025 label1=Depth o2=-34.875
     label2=Position unit1=kft unit2=kft
     label=Velocity unit=kft/s |
     scale rscale=0.001
     ''')

Flow('velocityProfileMetric','int_depth_vp.sgy',
     '''
     segyread read=d |
     put d1=.00760 d2=.00760 o2=-10.629
     label1=Depth label2=Position label=Velocity
     unit1=km unit2=km unit=km/s |
     scale rscale=.0003048
     ''')

Flow('velocityProfilePadded','P15VPint_25f_padded.SEGY',
     '''
     segyread read=d |
     put  d1=.0076 d2=.00760 o2=-10.629 label1=Depth
     label2=Position unit1=km unit2=km label=Velocity |
     scale rscale=.0003048
     ''')

# Plotting Section
mins=[0,0,-10.5]
maxs=['105','32','42.5']

counter=0
for item in ['Std','Metric']:
    Result('velocityProfile' + item,
           '''
           window j1=2 j2=2 |
           grey scalebar=y color=j allpos=y bias=1 title=P-Wave\ Velocity\ Profile
           max2=%s min2=0 screenratio=.28125 screenht=2
           labelsz=4 wanttitle=n barreverse=y
           ''' % maxs[counter])
    counter=counter+1

Result('velocityProfilePadded',
       '''
       window j1=2 j2=2 |
       grey scalebar=y color=j allpos=y bias=1 gainpanel=a title=P-Wave\ Velocity\ Profile
       screenratio=.28 125 screenht=2 labelsz=4 wanttitle=n barreverse=y
       ''')

End()
```

Table 3: *SConstruct* script generating the velocity model images

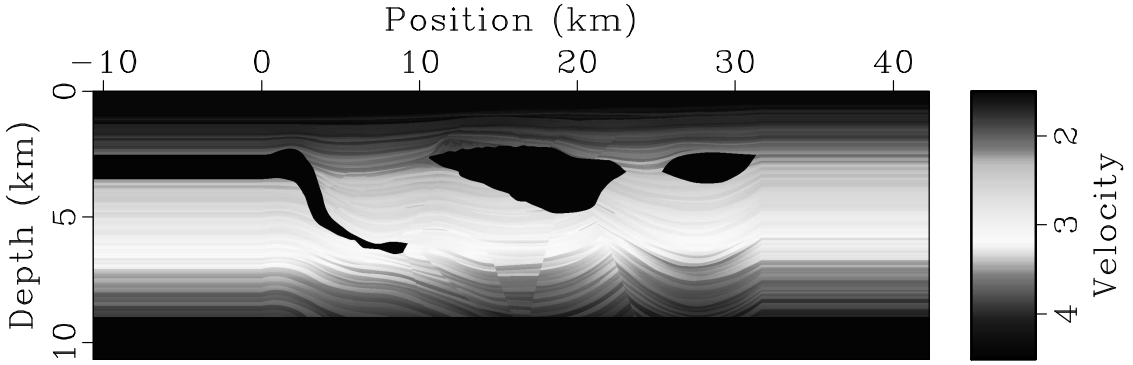

Figure 2: Padded velocity model that surveys were conducted on

```
from rsf.proj import *

# Fetch Files from repository
Fetch("P15shots150f_endon_0ph-1stHlf.SEGY","pluto")
Fetch("P15shots150f_endon_0ph-2ndHlf.SEGY","pluto")

# Convert Files to RSF and append headers
files = ['P15shots150f_endon_0ph-1stHlf.SEGY','P15shots150f_endon_0ph-2ndHlf.SEGY']
counter=0  #o2=360
for item in ['rsf1','rsf2']:
    Flow(item,files[counter], '''
            segyread tape=$SOURCE | put
            o1=0 o2=0 o3=0 d2=.02286 d3=.0457 n2=350 n3=347
            label1=Time  label2=Position unit1=s unit2=km
            label3=Shot''',stdin=0)
    counter = counter + 1

# Concatinate Files
Flow('plutoShots',['rsf1', 'rsf2'],'''
            cat ${SOURCES[0:2]} axis=3''',stdin=0)

# Plotting Section
Result('zero','plutoShots','''window $SOURCE  min2=0 max2=0 size2=1 |
               grey  color=I gainpanel=a label2=Position\ X unit2=km
               title=Zero\ Offset\ Data label2=Distance''')
Result('shot30','plutoShots','''window $SOURCE  min3=1.371
               max3=1.371 size3=1 | grey color=I wantframenum=y
               gainpanel=a title=Shot\ \#\ 30 label2=Offset''')
End()
```

Table 4: *Scons* script that generates *RSF* formatted pluto shot data

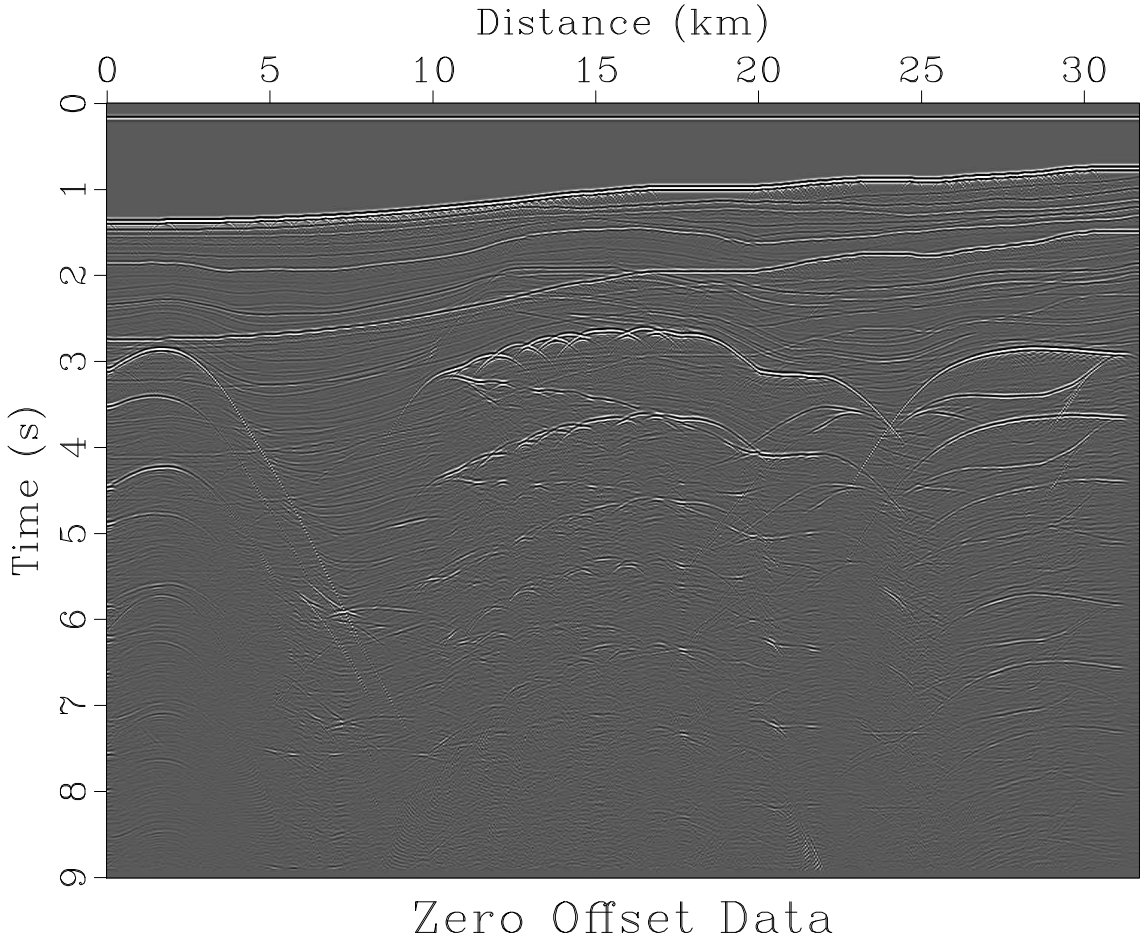

Figure 3: Zero offset data for Pluto synthetic dataset

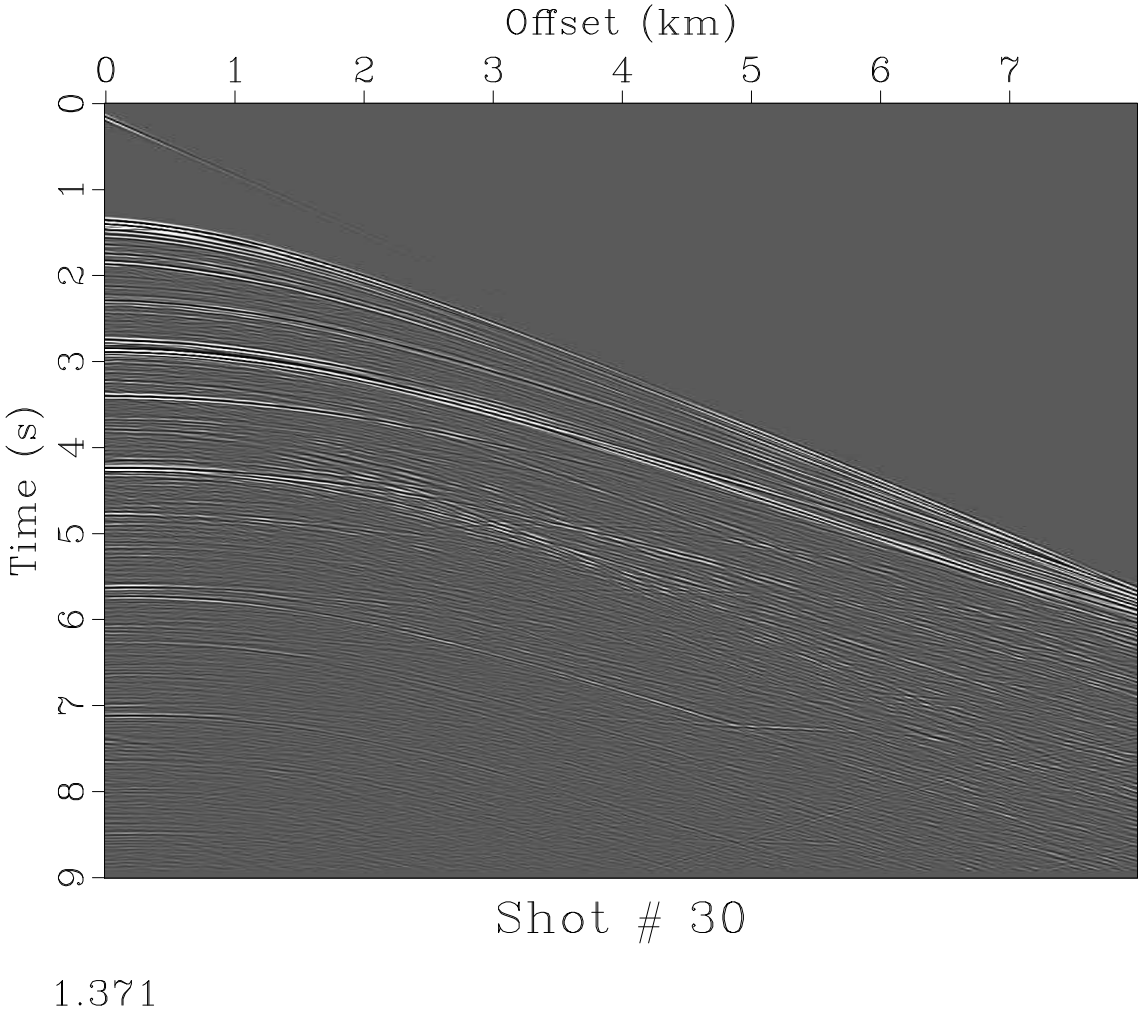

Figure 4: Shot 30 of Pluto dataset

Shot data should be formatted as shown in table 5. Again both metric and standard units are shown.

Standard				
n1=1126	d1=.008	o1=0	label1=Z Depth	unit1=s
n2=350	d2=75	o2=0	label2=X	unit2=ft
n3=694	d3=150	o3=0	label3=Shot	
Metric				
n1=1126	d1=0.008	o1=0	label1="Depth"	unit1=s
n2=350	d2=0.02286	o2=0	label2="Position"	unit2=km
n3=694	d3=0.0457	o3=0	label3="Shot"	

Table 5: Header information for Pluto velocity models