Exercise 1 (Uncertainty model AVO)

1. Examine near stack seismic, well logs and event picks in 123DI. Also compare the near stack to the far stack.

2. Given accompanying details of the two wells and petrophysics decide how to block the 23 layers into the 16 layers picked on the seismic. Answer some questions. What facies will you call each layer? How will you describe the fluids and their uncertainties?

3. Build an initial 2D DepSim model with the assigned properties. Notice how the DepSim traverse can be communicated to 123DI. Save the model to an .arc file. Display the model in 123DI, the way an interpreter might examine it. Also compare the near stack to the far stack.

4. Do a quick FLINT interactive inversion.

5. Save a .jgrd file of the DepSim model. Create the PROMISE model and save it.

6. Experiment to set the seismic noise level.

7. Do a quick PROMISE run to examine the tie to the well. Does the PROMISE result agree with the well to within the error predicted by PROMISE? Examine the range of seismic synthetics and the error traces. What can you learn from these outputs?

8. Form the ensemble of prior models and bring the results back into DepSim. Examine several layer based properties.

9. Each workstation will do 1/4 of the PROMISE inversion overnight.

10. Bring the results of the inversion back into DepSim. Save to an .arc file. Form some interesting error based properties using the DepSim calculator. Import and display the error .grd file.

11. Look at the results of the inversion in 123DI. Compare the inverted seismic to the seismic data. Display the error as a background to the inverted seismic. Examine the inverted model.

12. How would you use the results of the neural network fluid estimation in the PROMISE inversion?

13. Look at the results of a full areal inversion. Open .arc file. Import .jgrd file to DepSim. Look at maps, traverses and quick fences of layer based properties.

Well and Petrophysical information for Exercise 1

Rock properties

Shale: (layers 2, 8, and 16)
Vp = 10284
Vs = 4866
Rho = 2.44
Soft Shale: (layer 1)
Vp = 8000
Vs = 3037
Rho = 2.18
Oil Sand: (15% brine)
Vp = 8659
Vs = 4647
Rho = 2.067
Phi(%) = 29.2
Wet Sand: (a portion of layers 9, 100% brine)
Vp = 9526
Vs = 4520
Rho = 2.185
Phi(%) = 29.2
Gas Sand: (a portion of layer 9, 15% brine)
Vp = 8559
Vs = 4746
Rho = 1.981
Phi(%) = 29.2

Fluid properties

Brine: (100%)
Vp = 5289
Rho = 1.056
Oil: (100%)
Vp = 3051
Rho = 0.584
Gas: (100%)
Vp = 2795
Rho = 0.237
Live oil: (85%)
Vp = 3076
Rho = 0.6548

Results from the discovery well at bin 400 (live oil in G sand):

tbase	ln(rv/1000)	rhob	vp	vs	layer	ttop	dt	phi	n/g	name
3057.0	2.85877	2.180	8000.	3037.	1	3021.6	35.4	0.00	0.000	Top shale-02
3127.8	3.22259	2.440	10284.	4866.	2	3057.0	70.8	0.00	0.000	Top shale-01
3133.4	3.15347	2.374	9863.	4810.	3	3127.8	5.6	29.20	0.176	E ThBeds
3148.4	3.00061	2.209	9097.	4703.	4	3133.4	15.0	29.20	0.619	E2 ChnSand
3153.4	3.10133	2.321	9577.	4770.	5	3148.4	5.1	29.20	0.319	F2 LamSand
3153.7	3.21207	2.430	10217.	4857.	6	3153.4	0.3	29.20	0.026	F ThBeds (18)
3179.9	3.22259	2.440	10284.	4866.	7	3153.7	26.2	0.00	0.000	Middle shale
3200.6	2.94347	2.141	8866.	4673.	8	3179.9	20.7	29.20	0.802	G Sand
3204.6	3.16471	2.385	9928.	4819.	9	3200.6	4.0	29.20	0.147	G2 ThBeds
3221.3	2.98669	2.193	9038.	4695.	10	3204.6	16.8	29.20	0.662	G2 LamSand
3225.1	3.22259	2.440	10284.	4866.	11	3221.3	3.8	29.20	0.000	G ThBeds (8)
3237.4	3.12289	2.343	9692.	4786.	12	3225.1	12.3	29.20	0.259	G3 LamSand
3239.4	3.16883	2.389	9952.	4822.	13	3237.4	2.0	29.20	0.136	G ThBeds (6)
3247.8	3.08040	2.299	9469.	4755.	14	3239.4	8.4	29.20	0.379	G4 LamSand
3250.5	3.17437	2.395	9985.	4826.	15	3247.8	2.7	29.20	0.121	G ThBeds (4)
3323.7	3.22259	2.440	10284.	4866.	16	3250.5	73.2	0.00	0.000	Base Shale

Results from a well at the crest of the structure at bin 660 (gas in G sand):

tbase	ln(rv/1000)	rhob	vp	vs	layer	ttop	dt	phi	n/g	name
2990.8	2.85877	2.180	8000.	3037.	1	2957.6	33.2	0.00	0.000	Top shale-02
3057.2	3.22259	2.440	10284.	4866.	2	2990.8	66.4	0.00	0.000	Top shale-01
3069.0	3.18367	2.404	10041.	4834.	3	3057.2	11.8	29.20	0.097	F ThBeds (22)
3076.4	2.91212	2.102	8752.	4658.	4	3069.0	7.5	29.20	0.906	F Sand
3078.9	3.22259	2.440	10284.	4866.	5	3076.4	2.5	29.20	0.000	F ThBeds (20)
3086.9	3.12194	2.342	9687.	4785.	6	3078.9	8.0	29.20	0.262	F2 LamSand
3090.8	3.22259	2.440	10284.	4866.	7	3086.9	3.9	29.20	0.000	F ThBeds (18)
3098.5	2.88760	2.071	8669.	4648.	8	3090.8	7.7	29.20	0.990	F3 Sand
3099.6	3.21934	2.437	10263.	4863.	9	3098.5	1.1	29.20	0.008	F ThBeds (16)
3102.3	3.07685	2.295	9452.	4753.	10	3099.6	2.7	29.20	0.389	F4 ThBeds
3128.0	3.22259	2.440	10284.	4866.	11	3102.3	25.7	0.00	0.000	Middle shale
3136.2	2.90884	2.098	8740.	4657.	12	3128.0	8.2	29.20	0.918	G Sand
3140.0	3.22259	2.440	10284.	4866.	13	3136.2	3.8	29.20	0.000	G ThBeds (8)
3145.8	3.04986	2.265	9320.	4734.	14	3140.0	5.8	29.20	0.468	G4 LamSand
3214.2	3.22259	2.440	10284.	4866.	15	3145.8	68.4	0.00	0.000	Base Shale

Base shale has a lateral gradient in properties:

bin	tbase	ln(rv/1000)	rhob	vp	vs	ttop	dt	name
400	3323.7	3.20680	2.433	10152.	4761.	3250.3	73.4	Base Shale
660	3214.2	3.17864	2.420	9923.	4577.	3145.6	68.6	Base Shale

Some statistics on the net_to_gross ratios from regional well studies:

	Layer		Minimum	Maximum	Average	Max-Min	Std Dev
1	Top shale-02	N/G	0.0000	0.0000	0.0000	0.0000	0.0000
2	Top shale-01	N/G	0.0000	0.0000	0.0000	0.0000	0.0000
3	E ThBeds	N/G	0.1000	0.3832	0.2015	0.2832	0.0765
4	E2 ChnSand	N/G	0.3000	0.7724	0.5462	0.4724	0.1636
5	F ThBeds (22)	N/G	0.0000	0.2000	0.0806	0.2000	0.0543
6	F Sand	N/G	0.7992	1.0000	0.9238	0.2008	0.0793
7	F ThBeds (20)	N/G	0.0000	0.1950	0.0456	0.1950	0.0463
8	F2 LamSand	N/G	0.1000	0.5000	0.2791	0.4000	0.1197
9	F ThBeds (18)	N/G	0.0000	0.2000	0.0718	0.2000	0.0571
10	F3 Sand	N/G	0.6400	1.0000	0.8647	0.3600	0.0934
11	F ThBeds (16)	N/G	0.0000	0.2000	0.0798	0.2000	0.0816
12	F4 ThBeds	N/G	0.1022	0.5000	0.3636	0.3978	0.1134
13	Middle shale	N/G	0.0000	0.0000	0.0000	0.0000	0.0000
14	G Sand	N/G	0.5563	0.9958	0.8007	0.4395	0.6133
15	G2 ThBeds	N/G	0.0000	0.2000	0.1186	0.2000	0.0932
16	G2 LamSand	N/G	0.3247	0.8329	0.6190	0.5082	0.4729
17	G ThBeds (8)	N/G	0.0000	0.2000	0.0726	0.2000	0.0539
18	G3 LamSand	N/G	0.1000	0.5000	0.3694	0.4000	0.1038
19	G ThBeds (6)	N/G	0.0000	0.2000	0.1305	0.2000	0.0717
20	G4 LamSand	N/G	0.3000	0.7078	0.4397	0.4078	0.0764
21	G ThBeds (4)	N/G	0.0000	0.2000	0.0700	0.2000	0.0755
22	G5 ThBeds	N/G	0.1000	0.3604	0.2341	0.2604	0.2387
23	Base Shale	N/G	0.0000	0.0000	0.0000	0.0000	0.0000

Exercise 2 (scenario testing lens model)

1. Examine the three initial DepSim models, synthetic seismic, and petrophysics.

2. Generate .jgrd files and make PROMISE models.

3. Do the PROMISE inversions.

4. Compare the results using PROMISE. Display the imported .grd file of the probability of the model versus the inverted model in DepSim.

5. What are some other possibilities for this PROMISE functionality?

Geological and Petrophyscial Information for Exercise 2

Geology

Two relatively uniform sand layers with a variable thickness sand layer in between them.

Rock properties

```
  Shale
        Vp = 9000 +- 150
        Rho = 2.3 +- 0.03
  Sand:
        Vp = 8500 +- 150
        Rho = 2.1 +- 0.03
```

PROMISE via command lines

Edit and Create a PROMISE model

```
RUN_COMMAND D2P
```

Run PROMISE batch inversion

```
RUN_COMMAND Promisebatch
```

or

```
RUN_COMMAND Promisebatch <*.deck>
```

Evaluate statistics

```
RUN_COMMAND Evaluate
```

or

```
RUN_COMMAND Evaluate <*.diag> <*.prg> <*.eval>
```

Export from PROMISE

```
RUN_COMMAND P2D
```

Examine the contents of a *.jgrd file

```
RUN_COMMAND ExamineGrid
```

Append one *.eval file to another

```
RUN_COMMAND EvalFileAppend <file_to_append.eval> <composite.eval>
```

For EXPERTS only (make sure you have logged into UNIRAS before executing)

Quickly plot some sipmap traces

```
RUN_COMMAND PlotTraces
```

Run the old interactive PROMISE prototype with Domus GUI

```
RUN_COMMAND PromiseProt
```