PTRL5014 Take-home Assignment

General Information

This assignment consists of two parts, each requiring a separate submission. Part 1 submission is a single word file, while in part 2, you must combine all matlab files and the word file (containing the figures) into a zip file and upload that. The assignment is marked out of 100 and the relative weights are shown below.

Part 1

Introduction

In part 1, you answer questions related to a case study presented in the paper by Van Horn, J., 2001[1], found in the resources section of the take-home assignment 1. However, it is expected that you will draw on other resources in answering the questions, such as the (online at UNSW library) textbooks, *Exploration Geophysics* and *Elements of 3D Seismology,* readings provided during the course as well as internet resources to answer the questions. All material drawn from other resources must be referenced properly.

Zotero

I advise the use of Zotero (available free from Zotero.org) which has both web browser plugins and Microsoft word plugins so that you can, with a click, save a reference from scholar.google.com for example to your Zotero database and then from work simply add citation from the new Zotero tab in work and (after choosing a journal style format) type the title or author and add the citation. At the end, use create bibliography to add all the references to the end of your answers. There is plenty of help about Zotero available from the web.

Assignment Questions

Submit a referenced word document with answers to the following questions (word limits in brackets):

a) What information was provided by the delineation wells, and how useful was it? (150 words, 5 marks)

b) Figure 8 shows the wavelet. How would you characterise the wavelet? In your own words, explain how the wavelet improved in the 1999 2-D reprocessing over the 1998 poststack reprocessing (200 words, 10 marks).

c) What information does the stratigraphic model contain and why was it convolved with the wavelet? (200 words, 10 marks)

d) In Figure 5, the well-log cross-section is 'flattened' on the Top of the Upper Sendji. What does this mean? Describe the general process (not specific to this paper), comment on the

[1] Van Horn, J., 2001, Sendji Formation reservoir delineation based on 2-D and 3-D inversion, Yombo Field, offshore Congo. The Leading Edge 20, 435-441.

uncertainties and how this is different from flattening a seismic horizon, as shown in Figure 9 (300 words, 15 marks).

e) From p. 441, it says: “Mean acoustic impedance was found to be the volume attribute that best delineated the extent of the productive facies.” Explain this statement and how the author concluded it from the data available in your own words (200 words, 10 marks).

Part 2

Introduction

Use the data: well_log.mat and wavelet.mat to solve this problem.

Submit your commented MATLAB code (explaining what you are doing at each stage) and a word file with your figures from MATLAB together in a zip file (use the free 7zip or equivalent).

Key to the Data

well_log.mat contains three columns of data: Depth, the sonic log (slowness) and the formation density.

wavelet.mat contains a single column of data: the wavelet amplitudes as a function of time.

Assignment Questions

1. Plot the slowness and density functions with the y-axis as depth (increasing depth downwards, 0 at the top) in two figures and explain what the sonic log and density log measure (2 figures, 100 words, 10 marks).

2. Using the slowness, convert depth to two-way time. Plot depth as a function of time. Comment briefly on the function (1 figure, 50 words, 5 marks).

3. Create an acoustic impedance plot from the provided well logs. Plot vs TWT (increasing depth downwards). Explain what acoustic impedance is (1 figure, 100 words, 10 marks).

4. Convolve the acoustic impedance from 3. with the wavelet and plot vs TWT (increasing downwards). Explain what the result is and what it is a measure of (1 figure, 150 words, 15 marks).

5. Autocorrelate the reflectivity and plot the result shifted so as to overlap the original wavelet as close as possible. Remark on the similarity and difference (1 figure, 100 words, 10 marks).