Appendix 1: Step-by-step walkthrough of the process for synthetic seismic

Step 1: generate 3D cubes for each scenario

The initial step of the project is to create different versions of the geocellular model. This can be done using the "geophysical modeling" function in Petrel's "property modeling" tab. The attributes should be taken from tables 4.1 and 4.2.

Note that in the "contrast" case, all the values for non-dolomite lithologies have been reduced by 10%

Step 2: Prepare the data for export

An essential preparation before exporting the data is to separate all the layers in Petrel. Otherwise, Seisrox will consolidate the upper and lower part of the lower Thebes Formation into single layers. This separation can be done by activating all layers in the "zone remapping" feature of the 2D cubes. It is essential to do this for all the 3D cubes generated.

Step 3: Export the data into Seisrox

Using the Seisrox link plug-in in Petrel, the 3D cubes can be exported to Seisrox.

Step 4: Generate Synthetic seismic

Seisrox uses the 3D cubes to generate synthetic seismic for the scenarios listed in table 4.3.

Step 5: Calibrate the seismic cube

Calibrate the amplitude of the seismic cubes. The provided MatLab script will perform this task almost entirely automatically.

Step 6: Import the seismic cubes into Petrel

Import the seismic cubes into Petrel using the NorSar link plug-in.

Step 7: Generate random noise

Use a provided MatLab script to generate random noise for the synthetic seismic. The script requires the size of the seismic cube as an input. Otherwise, errors will occur when adding the noise to the synthetic seismic. The size of the seismic cube is specified in Seisrox.

Step 8: Add random noise to the synthetic seismic

In Petrel, use the calculator to add the noise to the synthetic seismic. This can be done using the calculator function in the "Seismic interpretation" tab.

Step 9: Take select horizons

These horizons can be found in the model and correspond to the layers of "cells" in the geocellular model.

Step 10: Compare attributes along the horizons

Save a view to reproduce the same image for different cases.