



## A • Introduction

The scope of the following exercise is to quickly build a simplified model representative of two oil bearing pools produced in commingle, establishing hydraulic trough the wells.

The exercise will consist in:

- ✓ build the reservoir geometry;
- ✓ generates the two layers with different initial conditions;
- ✓ verify whether the initial equilibrium is ensured or not;
- ✓ define the wells and induce hydraulic communication between the regions.

Simplified production history and data are adopted in order to make the example focused on the target.

## B • General description

The considered reservoir consists in two oil bearing separates pools surrounded by an aquifer and intercepted by two producing wells: well1; well2 (see Fig.1). The formation is divided in three geological layers (one is dead), having different thickness, properties and fluids contacts. The geometry and all the petrophysical properties are known.

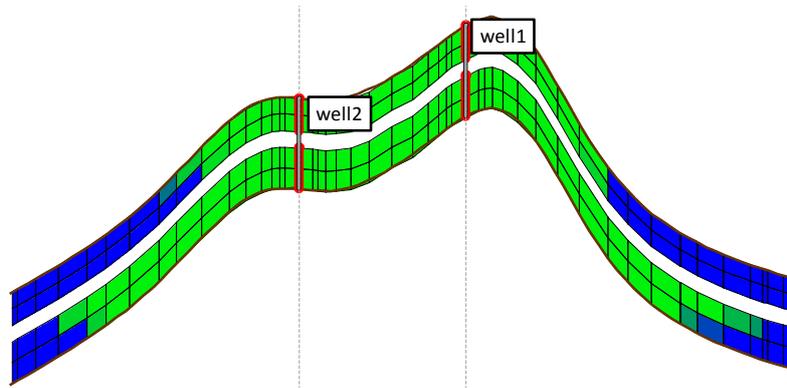


Fig. 1: side view of the model

## C • Scope of the exercise

The scope of the exercise consists in: building the reservoir model by using all the available information; define and connect to the model an aquifer; define the two equilibration regions (and verify the static equilibrium of the system); define the two wells; get familiarity with the PLT tool.

## D • Exercise workflow

The exercise workflow is summarized in the following items. All the necessary information are provided in the following paragraphs and in the attached folders.

### ➤ Step 1: build the reservoir model

- generate a new Rubis file and save it in your folder.
- assign the default PVT properties for a dead oil plus water system.
- build the reservoir geometry and assign the properties:
  - load contour and maps file
  - use all the data provided (see next paragraph) to define thickness and properties for the two pools (three layers one of which is dead).
- define the initial state for each pool of the reservoir using the information provided in the next paragraph.
- connect the aquifers (using information provide in the next paragraph) to the two pools. The aquifer should be connected along the entire reservoir boundary reservoir (360°).
- define well and completion using the information from the next paragraph. generate the grid:
  - use the default values for the horizontal gridding
  - Uncheck the automatic option and divide each geological active layer in 2 numerical layers.
- initialize the model.
- Impose a zero rate production history for a time period of two years in order to check if the system is in equilibrium. (pressure variation lower than 0.1 bar are negligible and the system has to be considered at the equilibrium).

### ➤ Step 2: test the reservoir model

- Impose the production history.
- run the simulation by using the suggested permeability values.
- visualize the results logs.
- run sensitivity analyses by changing the values of permeability in the producing pools.

## E • Available data

### E1 • PVT

Consider a dead oil and water reservoir. Use the default value available in RUBIS for both dead oil and water.

### E2 • Reservoir geometry

The reservoir evergreen is an anticline having two geological pools characterized by different properties.

In order to build the reservoir geometry use the two files (available in the folder "geometry"):

- "Boundary.dat": containing the x, y coordinates (in m) of the boundary polygon;
- "TOP-layer1.dat": containing the x, y, z (in m) coordinates for defining the top surface of the first layer. For the top surface linear interpolation method is suggested.

**Note : Take care with the unit system.**

The thickness of the three geological layers are shown in:

Layer	Thickness (m)
1	8
2	4
3	10

### E3 • Petrophysical properties:

Select the "layered" option.

For each layer constant value of porosity and permeability are:

Layer	Porosity (-)	Permeability (mD)
1	0.22	150
2	Dead	Dead
3	0.15	10

## E4 • Initial state

The data for definition of the initial state are summarized in:

Data	Pool 1 (layer 1)	Pool 2 (layer 3 – deeper layer)	Units
Reference depth (datum)	2900	2900	m
Initial pressure	290	290	bara
Reservoir temperature	90	90	°C
WOC	2905	2940	m

## E5 • Rock fluid interaction properties

Generate the relative permeability curves by adopting the information provided in table 4 and the power low model.

Parameter	Value
Swr	0.1
Sorw	0.1
krwo	0.3
krow	0.6
exponent	2
exponent	2

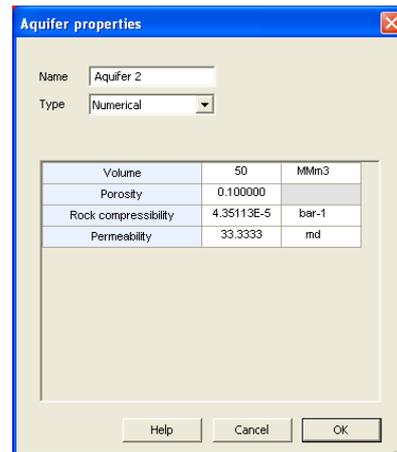
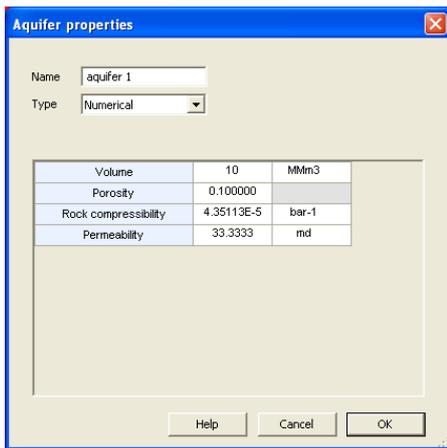
Generate the capillary pressure curves by adopting the default value provided in rubis and changing the max Pc to 0.1 bara

## E6 • Grid

Select 2 sub layers for layer 1 and 3.

## E7 • Aquifers connection

Connect to layer 1 on 360 ° the numerical aquifer:



and layer 3 to:

### E8 • Well definition and data

The two wells intercepting the formation are vertical. The information necessary to define well geometry are:

Parameter	Well 1	Well 2	Units
<b>x</b>	2265.34	1828.72	m
<b>y</b>	1818.25	2152.5	m
<b>Gauge depth</b>	2865.99	2883.57	m
<b>Completed layers</b>	1, 3	1, 3	m

The production control data are:

Well name	Starting Date	Target surface liquid rate (stbbl/day)	Min THP (bara)
<b>well 1</b>	1/1/2009	0	20
<b>well 2</b>	1/1/2009	200	20

Date of end of simulation: 1/1/2011