

R-factor: Visualize geomechanical changes as a movie

Introduction

Several models were generated with COMSOL

- Model 5 - Homogeneous model
- Model 6 - Groningen model, different permeability on top and bottom of the reservoir
- Model 7 - Groningen model, the same permeability on top and bottom of the reservoir

This script visualize changes due to fluid production for Model 5

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```
clear; close all; clc;
mllibfolder = '/home/ivan/Desktop/MLIB';
path(path, mllibfolder);
add_mlib_path;
```

Load G-file and consol data

```
Results = MLD('/home/ivan/Desktop/Consol/My_model_7_results.mat');
G = MLD('/home/ivan/Desktop/Consol/My_model_7_G_file.mat');
```

```
%loops = 101;
%F(loops) = struct('cdata',[],'colormap',[]);
```

```
%for tt = 1:1:loops
tt = 1
```

```
tt = 1
```

```
figure(223)
fig = figure('Position', [1 1 1000 500]);

subplot(2,2,1)
imagesc(G.xx/1e3, G.zz/1e3, Results.pressure(:,:,tt)'/1e6)
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle', '-', 'LineWidth',1)
plot(linspace(0,10,100), linspace(800,800,100)/1e3, '--k', 'LineWidth',1)
plot(linspace(0,10,100), linspace(1750,1750,100)/1e3, '--k', 'LineWidth',1)
plot(linspace(0,10,100), linspace(1750,1750,100)/1e3, '--k', 'LineWidth',1)
```

```

plot(linspace(0,10,100), linspace(2000,2000,100)/1e3, '--k', 'LineWidth',1)
plot(linspace(0,10,100), linspace(2850,2850,100)/1e3, '--k', 'LineWidth',1)
colormap jet
colorbar
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Pore pressure [MPa]')
caxis([0 60])

subplot(2,2,2)
imagesc(G.xx/1e3, G.zz/1e3, (Results.pressure(:, :, tt)' - Results.pressure(:, :, 1))' / 1e6)
hold on
rectangle('Position', [0.0, 2.85, 3, 0.3], 'LineStyle', '-', 'LineWidth', 1)
plot(linspace(0,10,100), linspace(800,800,100)/1e3, '--k', 'LineWidth', 1)
plot(linspace(0,10,100), linspace(1750,1750,100)/1e3, '--k', 'LineWidth', 1)
plot(linspace(0,10,100), linspace(1750,1750,100)/1e3, '--k', 'LineWidth', 1)
plot(linspace(0,10,100), linspace(2000,2000,100)/1e3, '--k', 'LineWidth', 1)
plot(linspace(0,10,100), linspace(2850,2850,100)/1e3, '--k', 'LineWidth', 1)
colormap jet
colorbar
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Pore pressure change [MPa]')
caxis([-15 0])

subplot(2,2,3)
% 92% of natural gas is methane
% methanes density is 0.717 kg/m³ (in normac conditions T = 0 C, p = 1 atm)

Density = 0.717;
Production_rate = 31.4; % kg/s
Production_per_year = Production_rate*60*60*24*365;
Volume_per_year = Production_per_year/Density;
years = 1:round(tt/2);
production = Volume_per_year*ones(size(years));
bar(years, production/1e9)
axis([0 50 0 1.5])
ticks()
title('Natural gas production')
xlabel('Year')
ylabel('10^9 Cubic metres per year')

subplot(2,2,4)
plot(G.xx/1e3, (Results.pressure(:, 1, tt)' - Results.pressure(:, 1, 1))' / 1e6, 'b')
hold on
plot(G.xx/1e3, (Results.pressure(:, 286, tt)' - Results.pressure(:, 286, 1))' / 1e6, 'r')

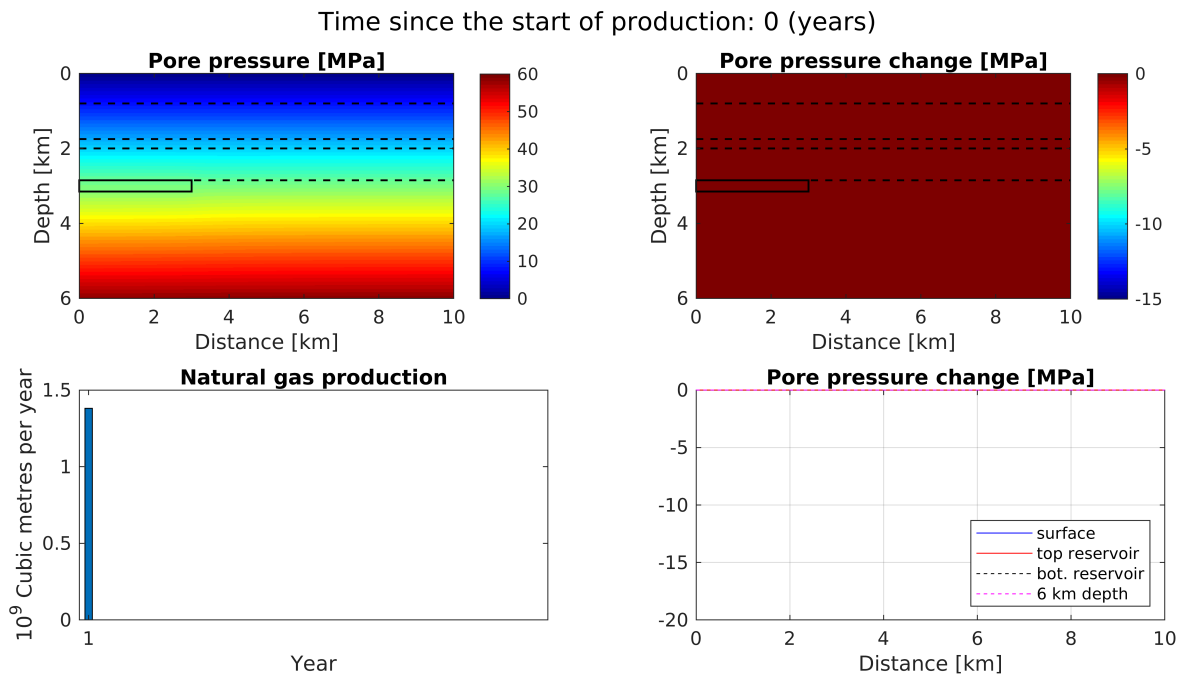
```

```

plot(G.xx/1e3, (Results.pressure(:,316,tt)-Results.pressure(:,316,1))/1e6, 'k--')
plot(G.xx/1e3, (Results.pressure(:,601,tt)-Results.pressure(:,601,1))/1e6, 'm--')
xlabel('Distance [km]')
grid on
title('Pore pressure change [MPa]')
legend('surface','top reservoir','bot. reservoir', '6 km depth', 'Location', 'south')
axis([0 10 -20 0])

sgtitle(['Time since the start of production: ' num2str(G.tt(tt),2) ' (years)'])

```



```

% F(tt) = getframe(gcf);
% pause(0.03);
% disp(tt)
%end

```

Save Movie

```

%v = VideoWriter('/home/ivan/Desktop/test3','Motion JPEG AVI');
%v.FrameRate = 5;
%v.Quality = 100;
%open(v);
%writeVideo(v,F);
%close(v);

```