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

Authors: Ivan Abakumov

Publication date: 28th of October 2019

E-mail: ivan.abakumov@fu-berlin.de

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

Load G-file and comsol data

```
Results = MLD('/home/ivan/Desktop/Comsol/My_model_5_results.mat');
G = MLD('/home/ivan/Desktop/Comsol/My_model_5_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 1280 720]);


    subplot(2,3,1)
    imagesc(G.xx/1e3, G.zz/1e3, Results.stress_y(:,:,tt)'/1e6)
    hold on
    rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
    plot(linspace(0,0,101),linspace(0,3,101),'w-')
    plot(linspace(0,0,101),linspace(0,3,101),'w-')
    colormap jet
```

```matlab
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Effective stress S_{zz} [MPa]')
caxis([-100 0])

subplot(2,3,2)
imagesc(G.xx/1e3, G.zz/1e3, Results.stress_x(:,:,tt)'/1e6)
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
plot(linspace(0,0,101),linspace(0,3,101),'w-')
colormap jet
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Effective stress S_{xx} [MPa]')
caxis([-50 0])

subplot(2,3,3)
imagesc(G.xx/1e3, G.zz/1e3, Results.stress_xy(:,:,tt)'/1e6)
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
plot(linspace(0,0,101),linspace(0,3,101),'w-')
colormap jet
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Stress S_{xz} [MPa]')
caxis([-1 1])

subplot(2,3,4)
imagesc(G.xx/1e3, G.zz/1e3, (Results.stress_y(:,:,tt)'-Results.stress_y(:,:,1)')/1e
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
plot(linspace(0,0,101),linspace(0,3,101),'w-')
colormap jet
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title(['Effective stress change \DeltaS_{zz} [MPa]'])
caxis([-10 0])
```

```matlab
subplot(2,3,5)
imagesc(G.xx/1e3, G.zz/1e3, (Results.stress_x(:,:,tt)'-Results.stress_x(:,:,1)'))/1e
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
plot(linspace(0,0,101),linspace(0,3,101),'w-')
colormap jet
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Effective stress change \DeltaS_{xx} [MPa]')
caxis([-10 0])

subplot(2,3,6)
imagesc(G.xx/1e3, G.zz/1e3, (Results.stress_xy(:,:,tt)'-Results.stress_xy(:,:,1)')
hold on
rectangle('Position', [0.0,2.85,3,0.3], 'LineStyle',  '-', 'LineWidth',1)
plot(linspace(0,0,101),linspace(0,3,101),'w-')
colormap jet
c = colorbar;
c.Location = 'southoutside';
axis('equal')
axis([0 10 0 6])
xlabel('Distance [km]')
ylabel('Depth [km]')
title('Stress change \DeltaS_{xz} [MPa]')
caxis([-1 1])

sgtitle(['Time since the start of production: ' num2str(G.tt(tt),2) ' (years)'] )
```
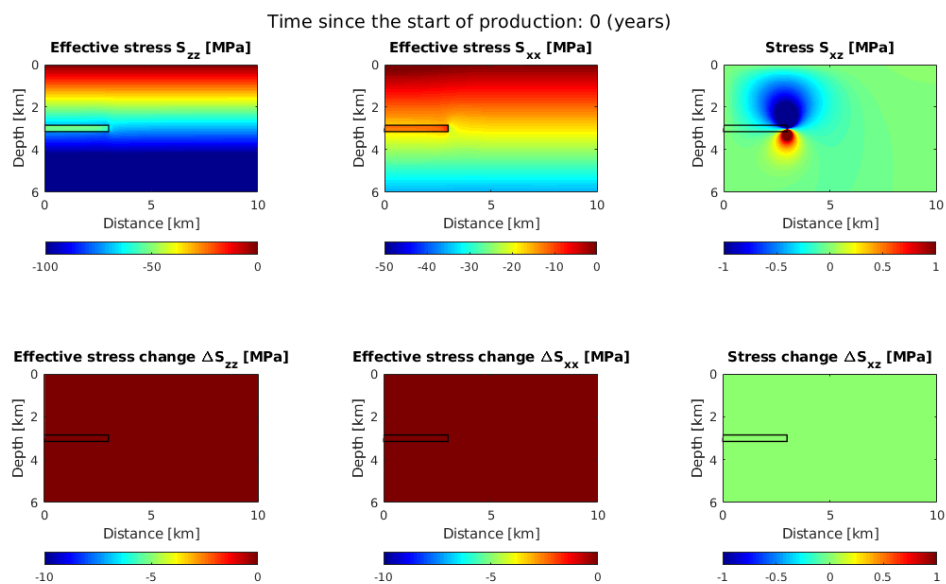
```
%    F(tt) = getframe(gcf);
%    pause(0.03);
%    disp(tt)
%end
```

Save Movie

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