Milestone 5

Milestone 5: Results and Analysis

Results and analysis for the isoviscous McKenzie equations (with melting) driven by a corner flow velocity BC.

Problem Description

This model describes the full isoviscous McKenzie equations (with melting), for a system driven by a corner flow velocity boundary condition for the solid phase. These equations couple a Stokes system for the solid phase with a Darcy flow for the melt moving through the permeable solid, and an advection term for the porosity field. The flow is driven by a corner flow boundary condition for the solid, which creates a region of low dynamic pressure about the area of discontinuity, and a linear ramp in the melting function.

Running the Simulation

The model is run from the directory:

```
Magma/Models/Milestone5/IsoviscousMcKenzieRidge2D/
```

and executing as:

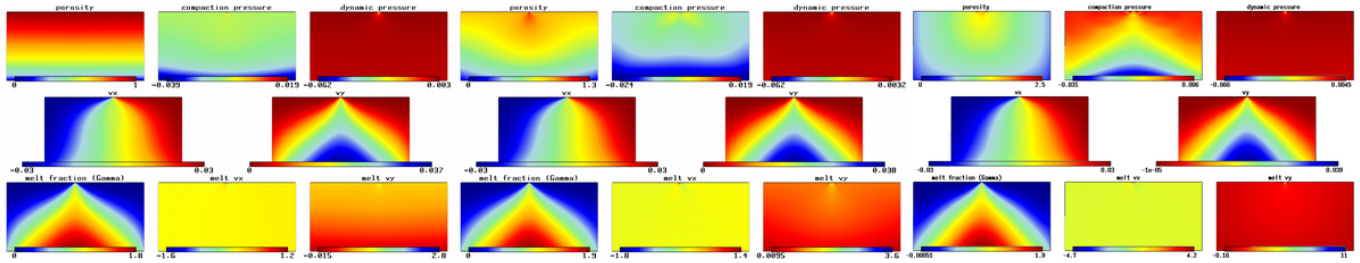
```
./StGermain IsoviscousMcKenzieRidge2D.xml
```

taking care to create a soft link to the StGermain binary in the build directory as before.

3D Model with Ridge Velocity Boundary Conditions A 3D model was also implemented, which is driven by Dirichlet BCs on the velocity field, which are interpolated onto the prescribed domain from an input file (the same one as for Milestone 1). The directory and execution command for running this model are given as:

```
Magma/Models/Milestone5/IsoviscousMcKenzieRidge3D/
./StGermain IsoviscousMcKenzieRidge3D.xml
```

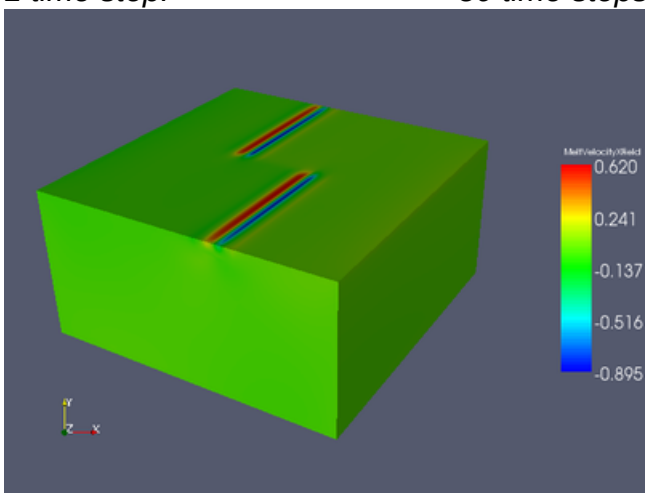
Some images for the x and y velocity components, the dynamic and compaction pressures, the porosity, the melt fraction and the x and y melt velocity components are attached below.



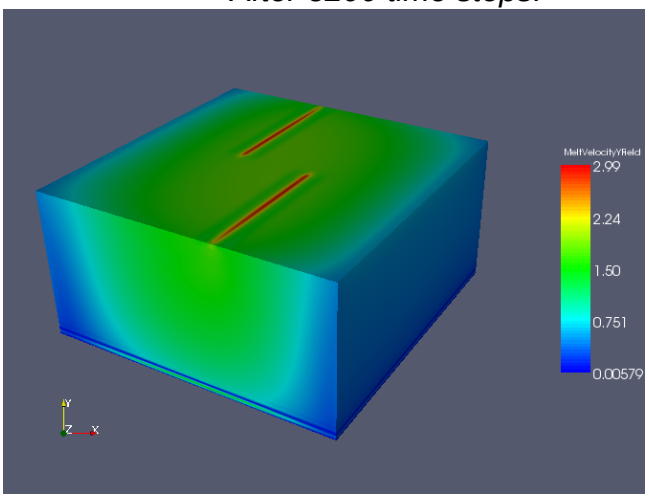
Isoviscous McKenzie System with Corner Flow BC – 1. After 1 time step.''

Isoviscous McKenzie System with Corner Flow BC – 50. After 50 time steps.

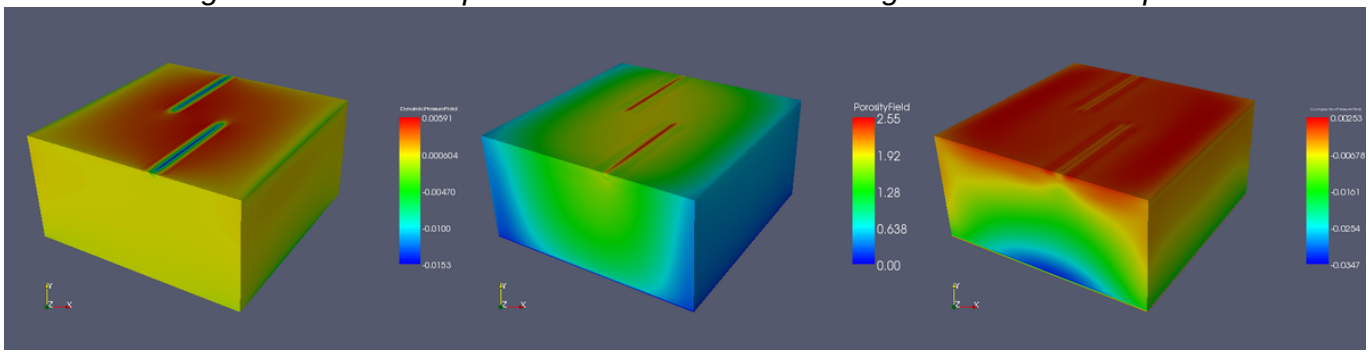
Isoviscous McKenzie System with Corner Flow BC – 3200. After 3200 time steps.



Velocity – x component. x component of the velocity field for the 3D isoviscous McKenzie model with ridge BCs at time step 150.



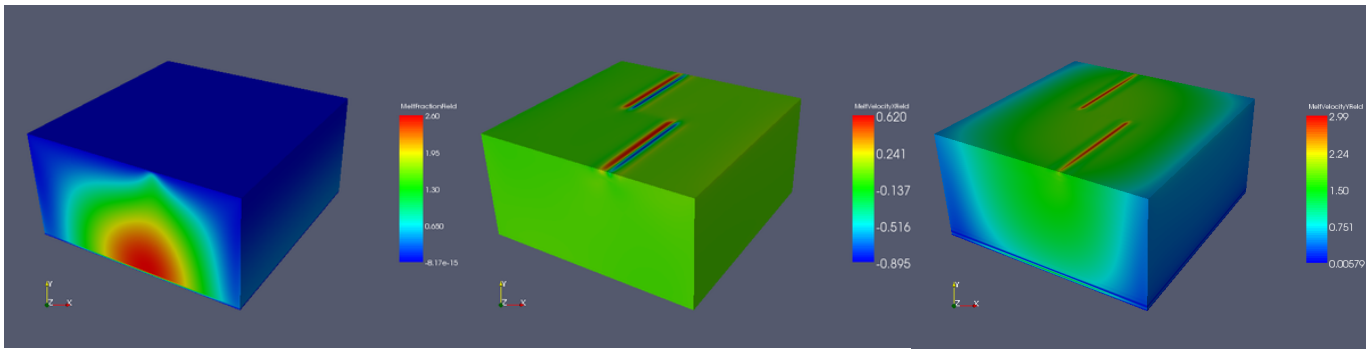
Velocity – y component. y component of the velocity field for the 3D isoviscous McKenzie model with ridge BCs at time step 150.



Dynamic (Stokes) pressure, Dynamic pressure due to viscous shear for the 3D isoviscous McKenzie model with ridge BCs at time step 150.

Porosity. Porosity field for the 3D isoviscous McKenzie model with ridge BCs at time step 150.Compaction pressure.

Compaction pressure due to compressibility of the solid phase for the 3D isoviscous McKenzie model with ridge BCs at time step 150.



Melt fraction. Melt fraction field representing the melt to solid phase of the 3D isoviscous McKenzie model with ridge BCs at time step 150.

Melt velocity – x component. x component of the melt velocity field for the 3D isoviscous McKenzie model with ridge BCs at time step 150.

Melt velocity – y component. y component of the Melt velocity field for the 3D isoviscous McKenzie model with ridge BCs at time step 150.