Input file

In this file the parameters are listed in two columns corresponding, when rock-specific, to country rock and magma. The parameters are:

- *k*, thermal conductivities in W/m K;
- *ro*, densities in kg/m^3;
- *c*, specific heats in J/kg K;
- *A*, radiogenic heat production in W/m^3;
- *Thickness* of the sill in m (value in second column);
- *Zmin*, the depth of the numerical domain upper limit in m (value in first column);
- *Zmax*, the depth of the numerical domain lower limit in m (value in first column);
- *dx*, the dimension of the grid cells (distance between nodes) in m (value in first column);
- *Tmagma*, the emplacement temperature of magma (value in first column);
- *Geotherm*, the geothermal gradient in °C/km (value in first column);
- *Injection depth*, the depth of the fist sill in m (value in first column);
- *Injection Time Interval*, time between two injections in years (value in first column);
- *Duration* of magmatism in years (value in first column) and of relaxing period (second column);
- *k-T dependency*, which is how the thermal conductivity varies with temperatures. If 1, the conductivity is constant and as given on first row. If 2, conductivity is as in first row at room temperature and decreases with temperature as described in Chapman and Furlong (1992). If 3, k is a function of temperature and inferred from diffusivity using equation given by Whittington et al. (2009). In this case the value of row 1 is irrelevant but we assume a constant specific heat unlike in Whittington et al. (2009).
- *Geometry,* which determines if sills are emplaced by over-, under-, or intra-accretion.
- *latent heat* in J/kg;
- *Lateral extension* is the horizontal dimension of the numerical domain in m (value in first column) and the radius of the sill in m (fourth column);

Example of input file:

```
,Country rock,Magma
k,2,2
ro,2700,2700
c,1265,1265
A,0.00E+00,0.00E+00
latent heat,3.13E+05,3.13E+05
Thickness,30000,200
Zmin,0,0
Zmax,15000,0
```

```
dx,50,0
Tmagma,930,0
Geotherm,25,0
Injection Depth,5000,0
Injection Time Interval,2000,0
Duration,5e4,5e4
T dependancy (1 (none) 2 (Chapman and Furlong) 3 (Whittington)),3,0
Geometry (1 (overaccretion) 2 (underaccertion) 3 (intraaccretion) 4
(random),2,0
Lateral extension,2750,2500
```

Output files and variables

1. temp.csv: Snapshot of temperatures at the end of the simulation. First column is X coordinate, second column is Z coordinate (depth), third column is temperature.
2. melt.csv: same as above for melt fractions.

3. tempMelt0.csv: Snapshots of temperatures when melt reservoirs coalesce, i.e. first melt appears on the right boundary of the numerical domain.
4. meltMelt0.csv: same as above for melt fractions.

5. MaxSym.csv: Evolution of maximum values on the boundary of numerical domain (i.e. midway between intrusions). First column is time, second column maximum melt fraction, third column is maximum temperature, fourth column is the depth of the maximum values, fifth column is viscosity at this depth.

6. Tsym.csv: Evolution of temperature on the right boundary of the numerical domain. First row is depth, first column is time. The other cells are temperatures at the corresponding depth and time.

7. MeltSym.csv and: as above with melt fraction instead of temperature.

8. Viscsym.csv: as above with viscosities instead of temperature.

9. time.csv: record the time in years of reservoir and magma chamber coalescence. Note the if the simulation ends before coalescence the final time is recorded, which is of no siginificance.

10. TempSnapshot.mat: matrix of temperatures at regular time interval (recorded in the name of the variable). Snapshot at the corresponding times can be plotted with MATLAB function contourf:
    contourf(coordX, -depth1D, tempXXX)

11. MelSnapshot.mat: as above for melt fractions.

Reférences:

Chapman, D.S., Furlong, K.P., 1992. Thermal state of the continental lower crust. in Continental lower crust ed. By D.M. Fountain, R.Arculus, R.W. Kay, Developments in Geotectonics, Elsevier 23, 179–199.

Whittington, A.G., Hofmeister, A.M., Nabelek, P.I., 2009. Temperature-dependent thermal diffusivity of the Earth's crust and implications for magmatism. Nature 458, 319–321. https://doi.org/10.1038/nature07818