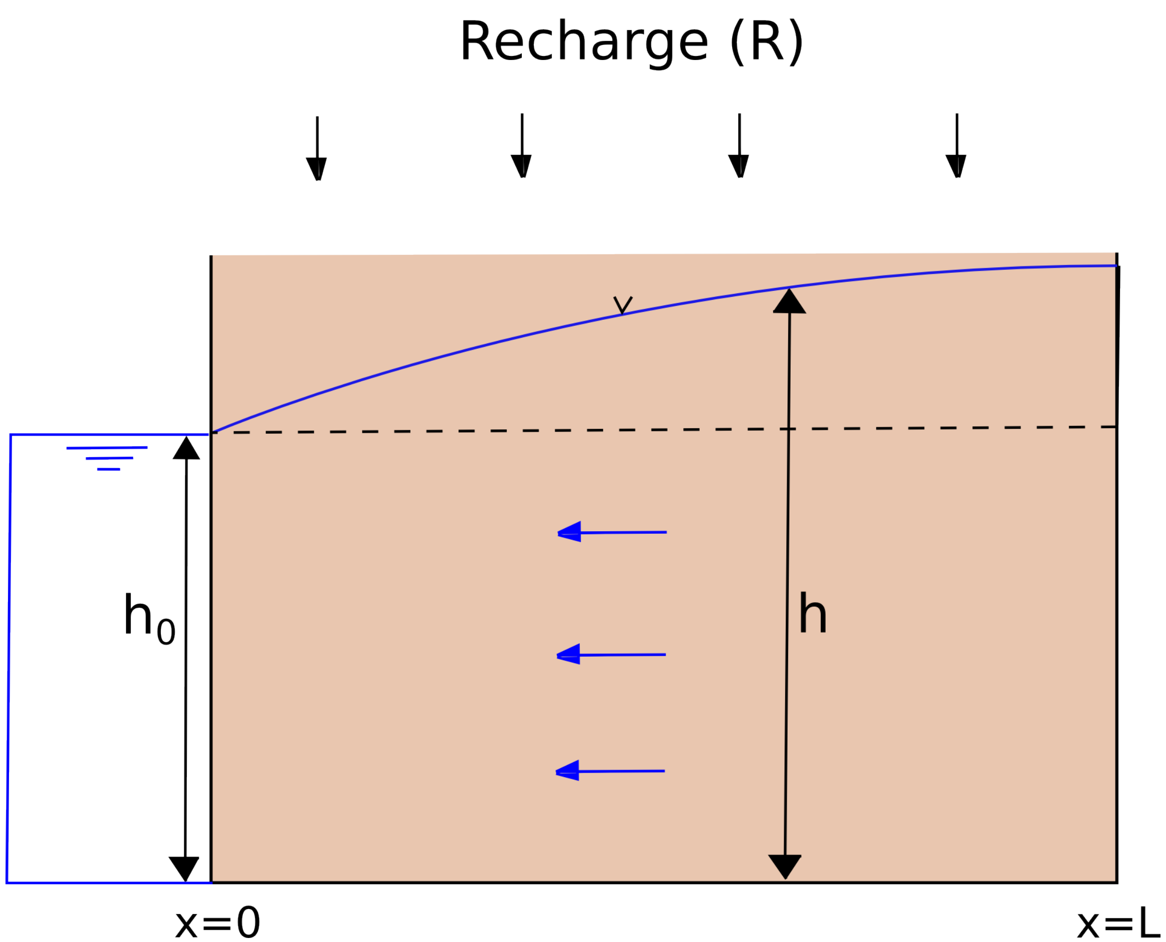
Exercise 2b: Modelling ~~fluid~~ heat flow in Python



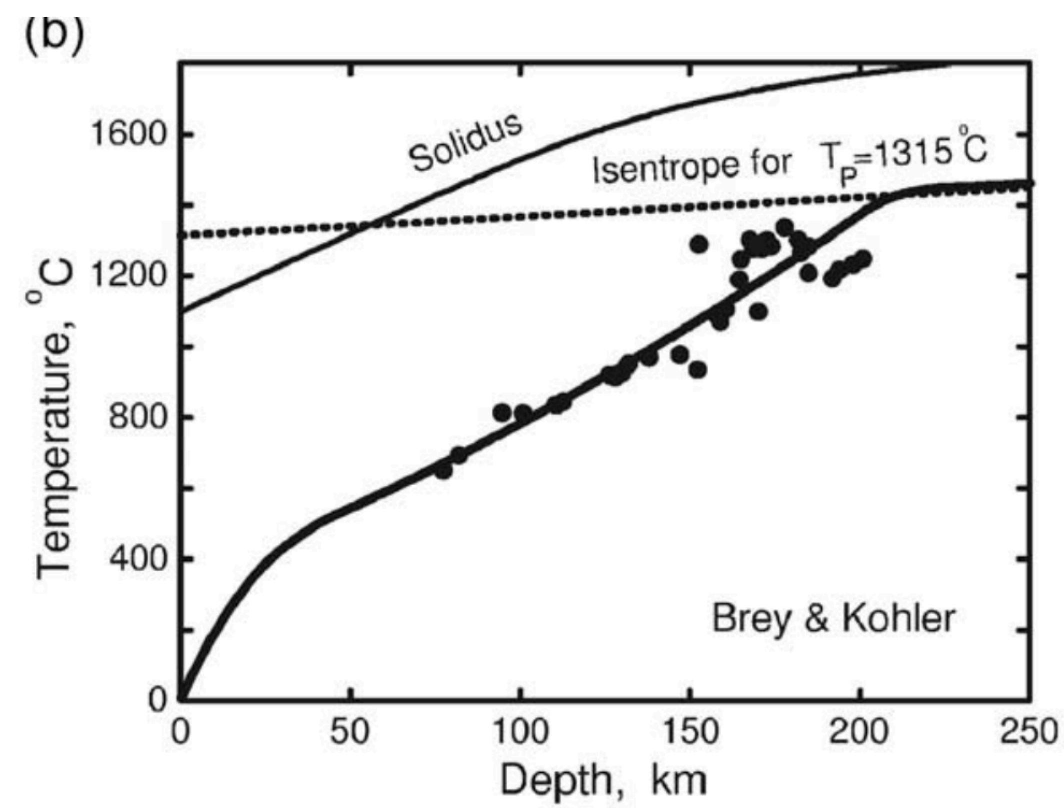


Fig. 8. Geotherms that best fit two sets of pressure and temperature estimates from the nodules from the Jericho kimberlite [32] in northern Canada. The total crustal thickness of 43 km was obtained

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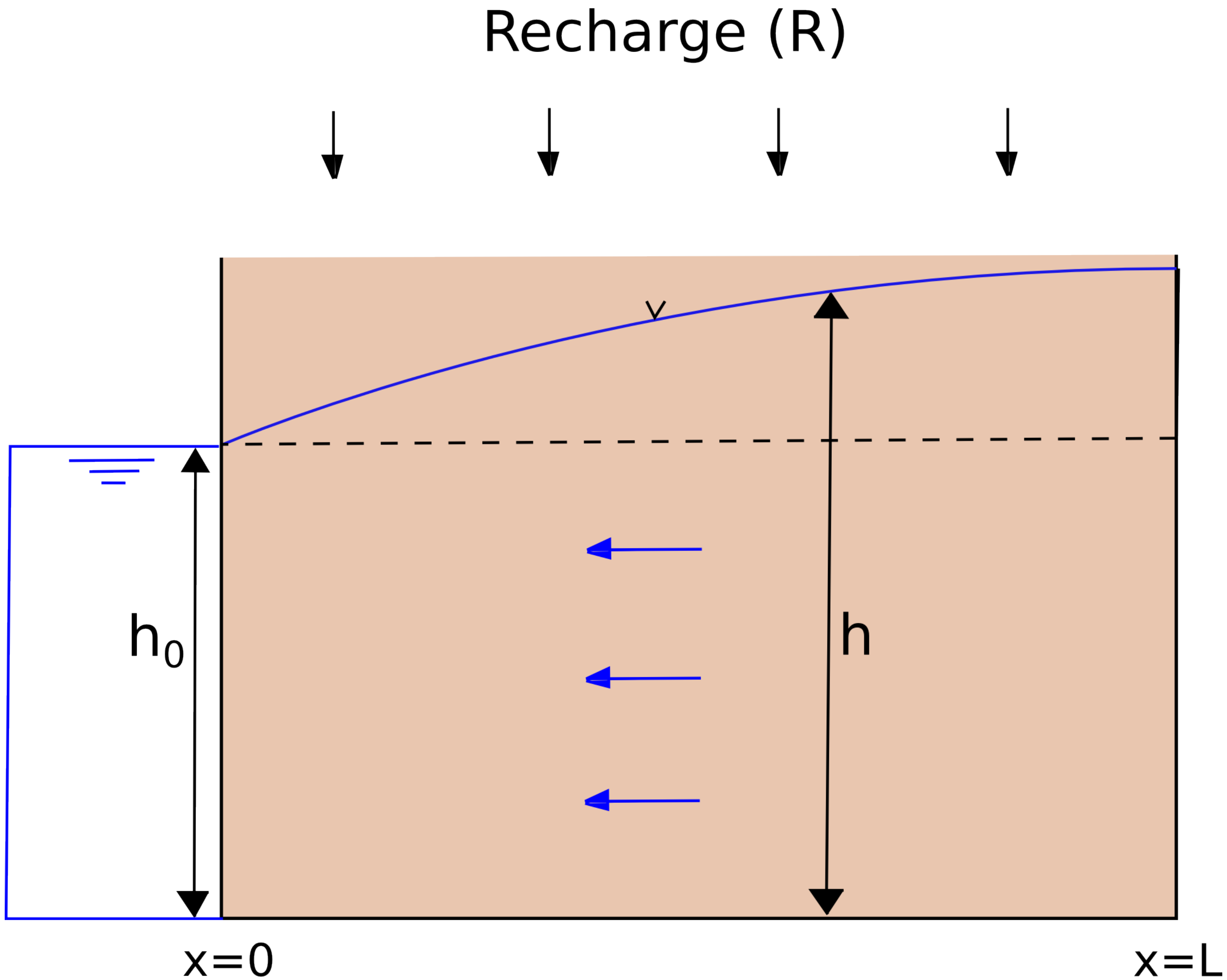
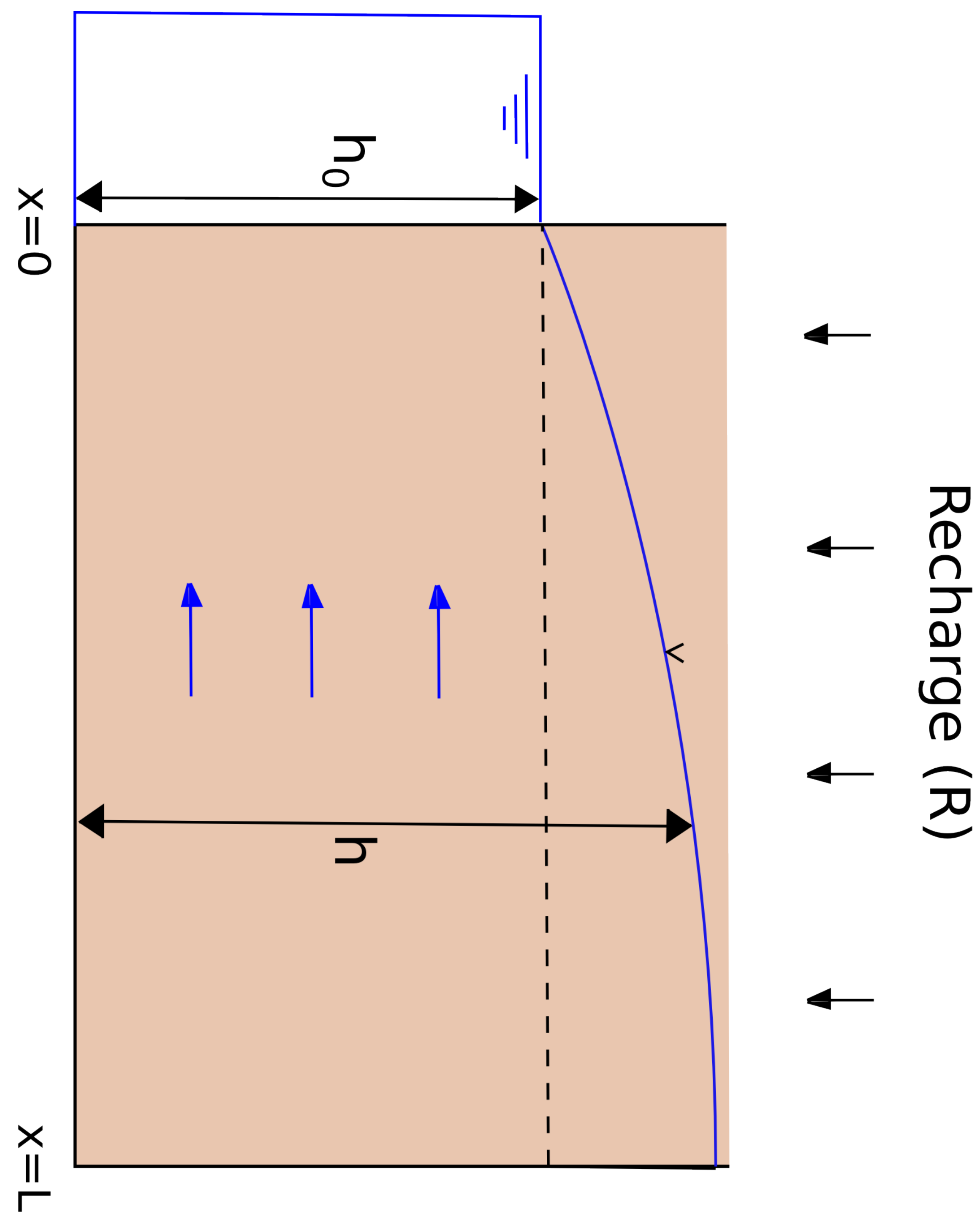
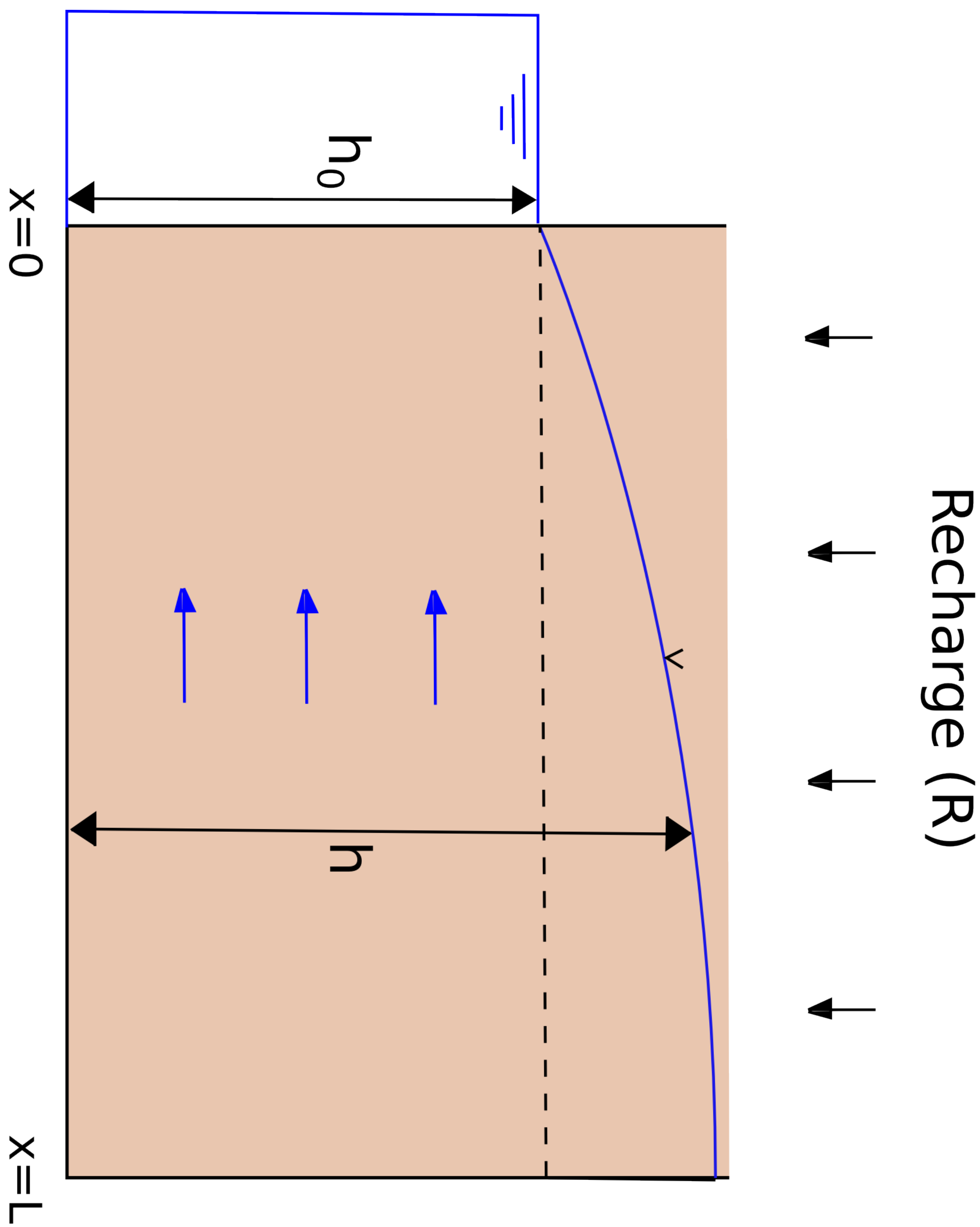
Numerical model of groundwater flow:



Numerical model of heat flow:

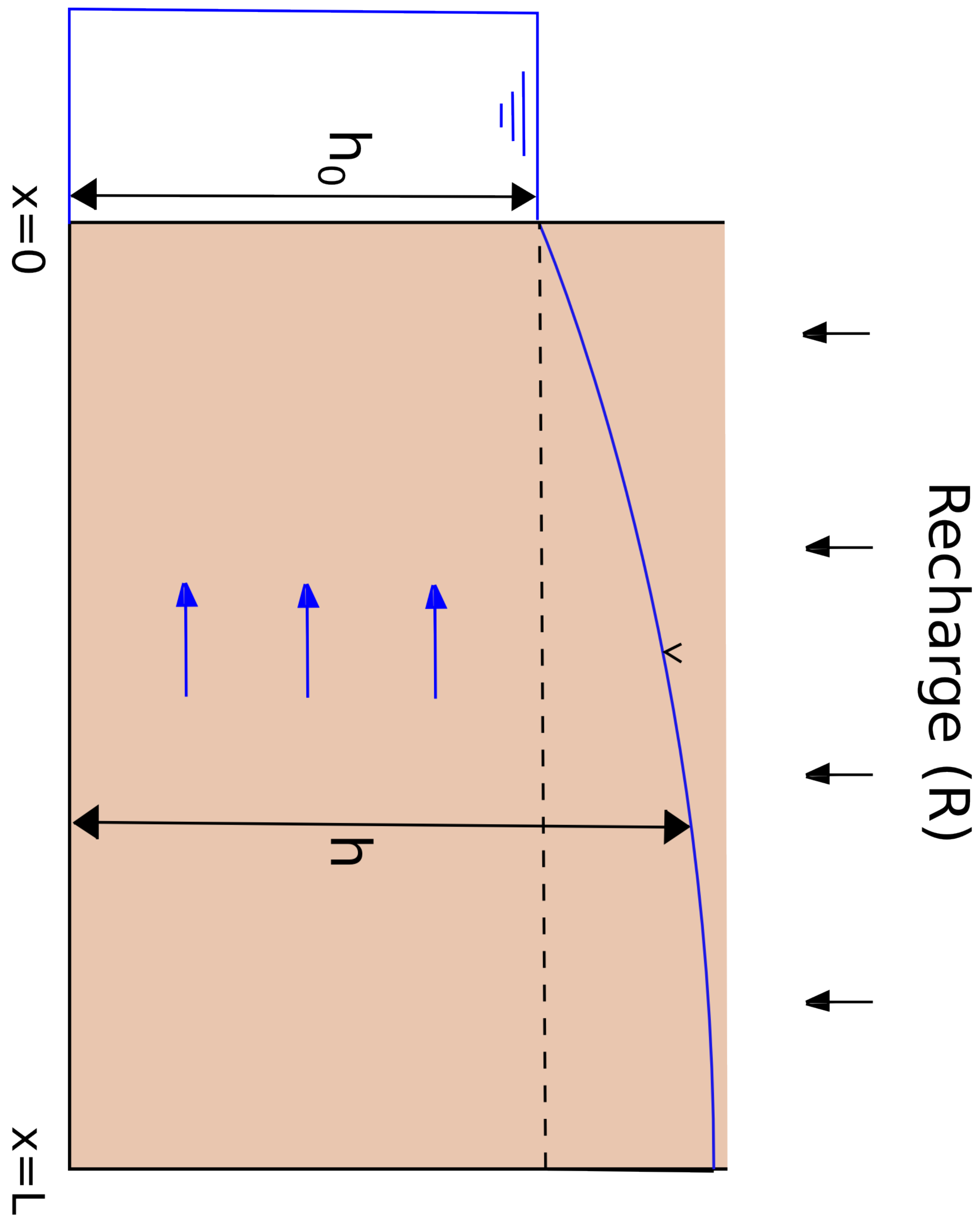


Numerical model of heat flow:



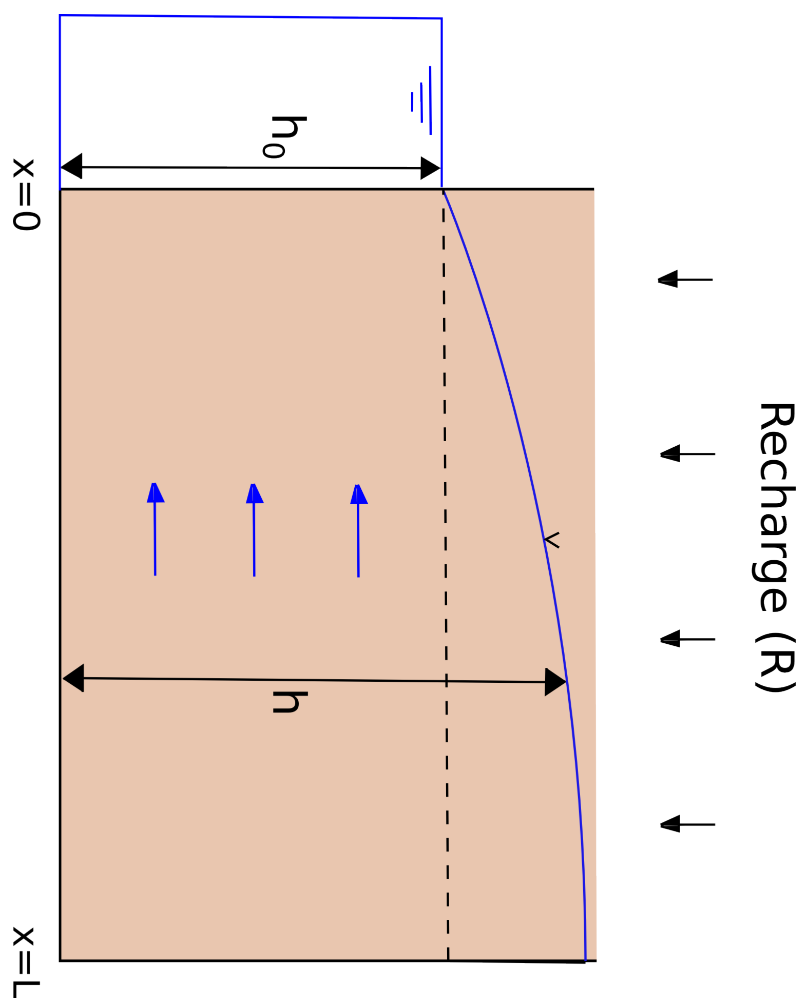
- ~~$q = K\, dh/dx$~~
- heat conduction: $q = K\, dT/dz$
- heat balance: $dq / dz = W$
- K = thermal conductivity ($W\ m^{-1}\ K^{-1}$), q has units of W (or J/sec)
- Boundary conditions?
    - Top: ?
    - Bottom: ?
    - Source term: ?

Numerical model of heat flow:



- ~~q = K dh/dx~~
- q = K dT/ dz
- heat balance: dq / dz = W
- K = thermal conductivity (W m^{-1} K^{-1}), q has units of W (or J/sec)
- Boundary conditions?
  - Top: Surface temperature (=~ average annual temperature, 10 ˚C)
  - Bottom: Lithosphere-astenosphere boundary, temperature = 1300 ˚C
  - Source term: Heat production (W m^{-3})

How to implement this in the notebook:



- Change variable h to T, h0 to T0, h_old to T_old, etc…
- Change values of W_array (source term) to zero for now, and later on to heat production of the crust and mantle
- Note: no more complicated recalculation needed for the source term like for recharge, the units for W_array are already the ones we need for heat production (W m^{-3})
- Change L to the thickness of the lithosphere, K to a value of thermal conductivity and T0 to the surface temperature.
- Change the grid size (dx) and increase the number of iterations (more needed for steady-state)
- Change the lower boundary condition, remove equation and fix temperature at 1300.0 ˚C
- More info in jupyter notebook
- Good luck!