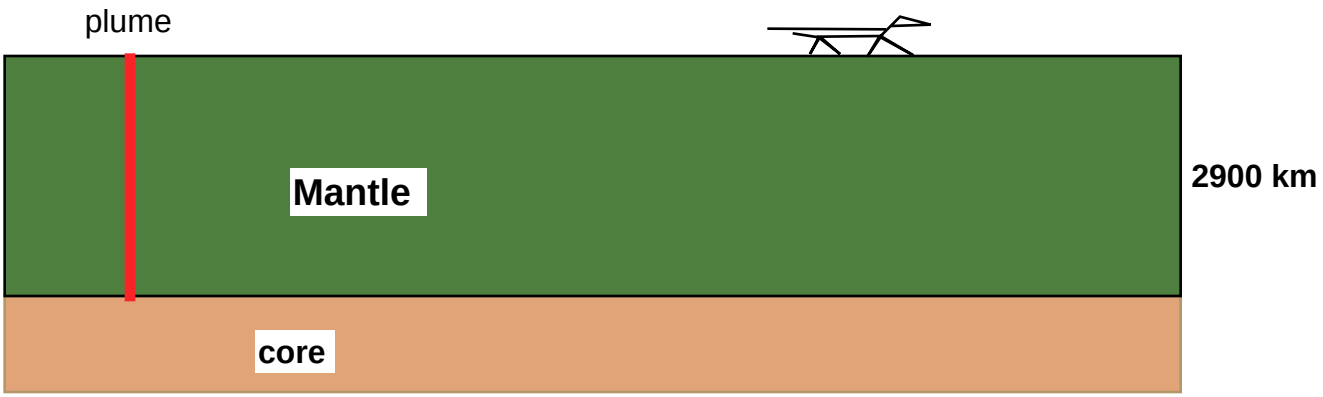
Geophysics 150: Home set due Oct. 18, 2000

2. The problem is homologous to that of mantle plume going through the mantle. Assume that the plume material is 300K hotter than the surrounding mantle . The thermal conductivity of the mantle is 3 W m $^{-1}$ K^{-1}. The volume specific heat of the plume and mantle is 4 MJ m $^{-3}$ K^{-1} .



Repeat the logic in the last problem to get the minimum volume flux of a plume that does not cool on the way up?

The buoyancy flux of plumes is defined as the volume flux times the density times the temperature excess times the thermal expansion coefficient ~3x10 $^{-5}$ K^{-1}. It is obtained from the topography of hotspot swells. Letting the density be 3400 kg m $^{-3}$ and the temperature excess by 300K, find the buoyancy flux associated with your estimate above.

The buoyancy flux of Hawaii is 8000 kg s $^{-1}$. Do you expect this material cooled a lot on the way up.