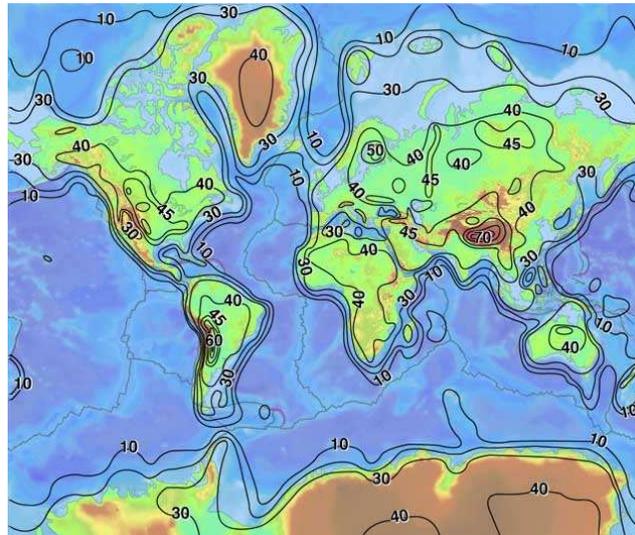


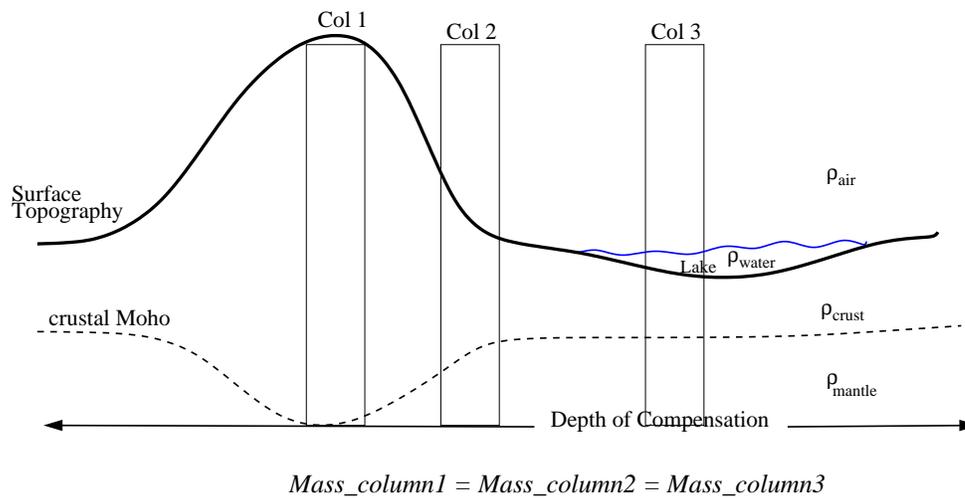
Isostasy: Mantle Support of Crustal Rocks



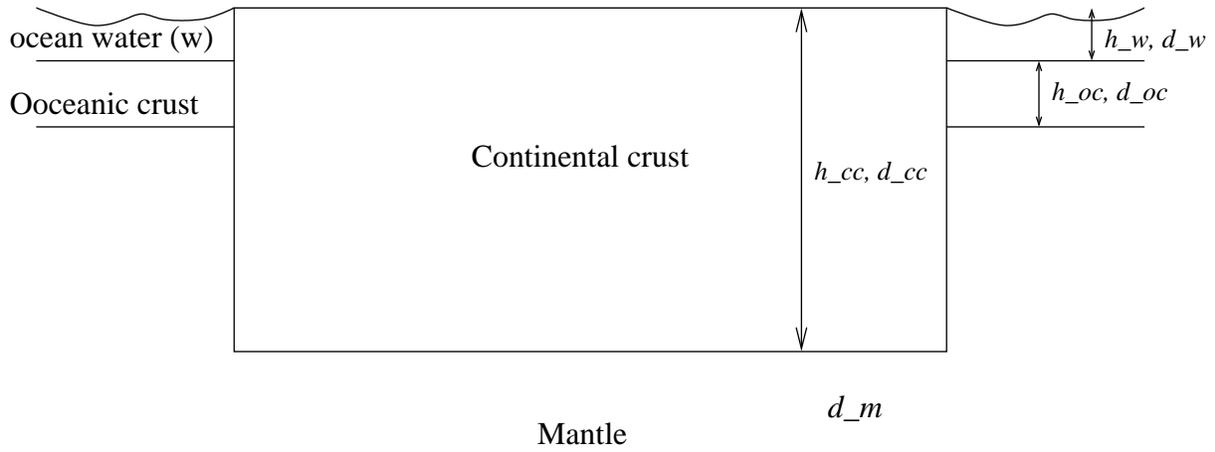
Archimedes principle of mass balance is also known as *hydrostatic equilibrium*. This concept describes the forces of buoyancy which support an object floating in a fluid box or tub. If the object is "floating" in the fluid, then the weight of the object is balanced by the buoyancy forces of the fluid beneath. The buoyancy force can be estimated by the volume of fluid displaced when the object is introduced.

When a system is in hydrostatic equilibrium, the forces acting along any drawn vertical column in the system will equal the forces within another adjacent column (of equal volume). as in the example below.

1. Rewrite the equation below in terms of density (ρ) and volume (*height \times width*). Be sure to consider the density and volume of each layer within each column.



2. Below you see a diagram of the continental crust (35 km thick), in isostatic (or hydrostatic) equilibrium with the oceanic crust and ocean water, all being supported by the Earth's mantle beneath. Use the principle of hydrostatic equilibrium described above to determine the thickness of the oceanic crust (h_{oc}). Assume these typical values of the Earth's materials: $\rho_{cc} = 2800 \text{ kg/m}^{-3}$, $\rho_w = 1000 \text{ kg/m}^{-3}$, $\rho_{oc} = 2900 \text{ kg/m}^{-3}$, $h_w = 4.5 \text{ km}$. (Note and check all units and necessary conversions!)



3. Now use the materials given you to create your version of Archimedes tub. Fill a plastic box partially with corn syrup. Draw a line at the location of the top of the fluid. Place the wooden block in the corn syrup medium. Mark, measure, and record the change in height of the fluid surface. Assuming the fluid density is 1.38 g/cm^3 and the density of the wooden block is 0.53 g/cm^3 , prove Archimedes principle that the mass of fluid displaced is equal to the mass of the block submerged in the fluid.

4. Place the plastic block in the corn syrup (next to the wooden block). Use the principle of isostasy used in problem #1 to determine the density of the plastic material.