GEO302: Exercises IV – Gravity and isostasy

1. Calculate the mass of the Earth.

2. a) Calculate the radius of orbit of a geostationary satellite (a satellite whose orbit is such that it remains above the same point on the Earth’s surface).
   b) Calculate the period of a satellite orbiting 200 km above the Earth.
   c) Calculate the period of a satellite orbiting 200 km above the Moon (Moon mass = 7.4x10^{22} kg and radius = 1738 km).

3. Explain (qualitatively and quantitatively) how the source of the Mississippi River can be about 5 km closer to the center of the Earth than its mouth.

4. A mountain range 4 km high is in isostatic equilibrium.
   a) During a period of erosion, a 2 km thickness of material is removed from the mountains. When the new Isostatic equilibrium is achieved how high are the mountains?
   b) How high would they be if 10 km of material were eroded away?
   c) How much material must be eroded to bring the mountains down to sea level? [Use crustal and mantle densities of 2.8x10^3 kg/m^3 and 3.3x10^3 kg/m^3]

5. Calculate the depression of the land surface beneath the Wisconsin ice sheet assuming that prior to and after the emplacement of the ice sheet it was in isostatic equilibrium?

6. Before plate tectonics was widely accepted it was believed that the ocean basins formed when huge continental areas sunk beneath the sea. What gravitational arguments can you put forward to counter this suggestion?