GEOS 602 – Geophysical Fields
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Problem Set #5 Due Thu March 4

1. Do problem 5-12 in Turcotte and Schubert.

2. A sphere of density 3170 kgm^{-3} and radius 5 km is partially buried in a flat prairie so that the summit is 2 km above the surrounding prairie. The prairie is 2 km above sea level (neglect any difference between sea level and the ellipsoid for this problem). Assume that the average (normal) crustal density is 2670 kgm^{-3} and use the WGS-84 gravity formulae to sketch the following profiles along a traverse over the center of the sphere:
    a. Observed gravity anomaly ($g_{obs} - g_0$).
    b. Free-air anomaly
    c. Bouguer anomaly
    d. Isostatic residual anomaly (assuming Airy Isostasy)

3. A non-zero density distribution that produces no external field is called an *annihilator*. The annihilator quantatively describes the non-uniqueness of potential data because any amount of the annihilator can be added to a possible solution without changing the field. Find a simple annihilator $\Delta\rho(r)$ for a spherical mass of radius a, as viewed from outside the sphere. That is, if you have a subsurface region of radius a, find a density distribution $\Delta\rho(r) = \rho(r) - \rho_c$ within this region that would produce exactly the same gravity field outside the sphere as a sphere of density ρ_c and radius a. *HINT: Think about superposition and what it means to have a negative density* $\Delta\rho$.

4. Do Problem 5-15 in Turcotte and Schubert.

5. Do problem 5-22 in Turcotte and Schubert.