ESCI7355 Fall 2012 HW1a

Due 8/30/2010

1) Calculate the average density for a spherical earth from the force of gravity at the surface of the earth and the radius of the earth.

2) Using the average density found in 1 and a spherical earth that has a density anomaly as shown in the figure below

Use Matlab to calculate and plot the

a) Force of Gravity as a function of radius from -3Re to 3Re through the center of the earth along the z axis (use superposition). You don’t need to do the Potential (this is a change from the original).

b-i) Force of Gravity and Potential on the surface of this earth (use superposition again). You can plot g for the homogeneous earth and the earth with the anomaly as an x-y plot or you can plot it like the figure on P11 of the notes – but with the force of gravity not the potential. Use a circle representing g of the homogeneous earth and another curve with g of the actual earth.

b-ii) Use the potential on the surface of the homogeneous, spherical, earth without the anomaly to define the “geoid” of this earth. Plot the geoid for the homogeneous earth (a circle) and the geoid for the earth that has the anomaly with respect to the surface of the earth. (It will look like the figure on P11 of the notes. You will probably have to exaggerate the effect to make it visible.)

c) If you wanted to build a city with a water distribution system without pumps, where would you put the main water collection tank and where would you put your city? Why?

The water distribution system consists of a tank that is open on top to collect rain with a single pipe on the surface of the earth between the tank and the city. The pipe has a valve in it so you can turn the water flow on and off.

Assume rainfall is uniform on this imaginary earth, except for the location of the city where it does not rain! Also assume that the rainfall it absorbed by the earth and unavailable to you if you don’t catch it in your tank.

Ignore friction in the pipe.

There are a million potentially confusing details – ask me if you have problems with the statement of the question.

This size and density of the anomaly in this problem are set up so that the effect of the anomaly is large enough to be easily seen, and interpreted, in your figures.

