SIO229 Homework 2

For all problems, include a sketch (if it helps communicate what you are doing), reasonable mathematical detail, succinct explanations of your methods and results, and any code you used. Equations should be developed in symbolic form before being evaluated numerically. Good luck!

Problem 2.1

It is well known that gravity g on the surface of Earth is stronger at the poles than at the equator because of rotation. If the Earth stopped rotating but retained its present shape and interior structure, would this still be true? Use MacCullagh's Formula to find out.

Problem 2.2

Calculate the value of the geopotential U on the geoid.

Problem 2.3

In what direction and by how much would you have to change Earth's rotation rate to make the Mississippi River start to flow backwards, from south to north? Assume that Earth does not change shape when you change the rotation rate. You can also take the Mississippi source to be approximately located at $(47°N, 95°E)$ and the Mississippi delta at $(29°N, 89°E)$.

You can solve this problem either in closed form mathematically, or with a search of the relevant parameter space. As a starting point, perhaps you can think about why water flows downhill, then what conditions must be met for water *not* to flow.