

## **LABORATORY 9 - INTERPRETATION OF GRAVITY DATA FOR CASCADIA**

**OBJECTIVES:** Examine gravity data that have bearing on understanding processes shaping the Cascadia subduction zone. In particular:

1. Undertake a 2-D gravity interpretation to determine the extent and depth of a sedimentary basin below Seattle
2. Investigate features of the gravity field in the Cascadia Subduction region to increase your understanding of the tectonic environment of the Northwest

**BACKGROUND:** As a result of interactions between North American, the Pacific plate, and the Juan de Fuca plate, Cascadia exhibits complex geology and geological processes. The fore-arc basin is experiencing N-S compression as well as the normal subduction-related W-E compression. As a result, different trends for stress accumulation and seismogenic release are possible.

Gravity modeling efforts require some geologic “insight” in choosing appropriate densities for subsurface rock layers. One can either postulate what rocks are found at depth and use appropriate densities for those rock types or one can use the seismically determined variation of velocity with depth and “empirical” relationships between velocities and densities of rocks. In the Seattle area the velocities of compressional waves increase from 3 to about 5 km/s from the near surface to 10 km down. A relationship between  $V_p$  and density for sedimentary rocks is frequently used:  $\text{density}(\text{gm/cc}) = 1.74 * (V_p(\text{km/s}))^{0.25}$  This is known as the “Gardner Equation”

### **EXERCISE:**

1. Interpret the Bouguer Anomaly determined in Lab. 8 using the application available through: <http://www.gravity.uni-kiel.de/Software/Mod2D.htm>  
  
Find a reasonable geologic structure that predicts the observed anomaly. You need to make a plot of the data and the model prediction. You need to discuss features of the model (location, how deep, density contrasts) in a geologically plausible context.
2. Get all gravity data for a region of Cascadia defined by longitudes of 125 W to 121 W and latitudes of 46 to 49 N. The internet site is:  
<http://irpsrvgis00.utep.edu/repositorywebsite/>

This will be a very large text file that needs to be processed through MATLAB

Make images of the gravity anomaly data and describe features in the geologic context of the Cascadia Subduction region. Include a base plot showing where the gravity data were measured. Include several perspective plots that allow you to visualize the behavior of gravity anomalies.

***Be sure to consider and discuss the consequences of uncertainties in data***

