Geophysical Geodesy GEOL 495/695
Course Notes: Week 1: Day 1

Introductions

Why this course?
History.
What is this course about?

What is this course really about?
The relationship between data and models

Course outline

Problem sets
- one per week for first 6 weeks, possibly more after.

Projects
- will start later in term
- presented orally to the class in last week.

Grading
- Problem sets 40%
  Due one week from assignment. Graded at -10% on week later.
- One midterm 30%
- One project 30%

Field Trip
- Slide Mountain, unless group decision to change.

Schedule
Do we need to change?

Office Hours
Do I need to have them?

Prerequisites
Listed as: PHYS 180 (Physics I), MATH 182 (Calculus II)
Geophysical Inverse Theory a plus
Programming (matlab, c-shell or perl) a plus

email addresses

web page

Bill's schedule. Out Thursday, Nov. 10. Switch to Friday

Syllabus

Outline how the course will flow.

We will cover some basic geodesy because currently there is no other place to get this at UNR. This could change in the future, but for now we will touch on it in this class.

Lecture 1

What is geodesy?

Some call it the oldest branch of geophysics.

Modern View:
• Three pillars, gravity, shape, rotation, and thus there is overlap with some other disciplines in geophysics.
• It is its own section of AGU.

What we will learn in this class will not be pure geodesy.
But for the first few class periods we'll focus on some of the basics of terminology that are frequently encountered when learning about geodetics.

In this class: Emphasis on change of Earth shape over time. That means Earthquakes, Plate motions, Plate boundary deformation, long term and short term tectonics, etc.

In short we focus on quantifying motions, deformations, and their geophysical ramifications.

Story of Eratosthenes (Pythagoras too).

Basics of Earth Shape

Earth *Figure*
The basic outline of the shape of the Earth is called its Figure.
Important to distinguish between figure, shape, mass distribution, etc. since much can change without changing Earth figure. For example, the tectonic plates can slide across the surface without changing the figure.

The Earth is (pretty close to) an oblate ellipsoid (sometime called spheroid) with a mean equatorial radius of R=6378 km. The polar radius is 6356 km.

Eccentricity is about 1/300 (more precisely flattening = 1/298.257223563 in WGS 84)

and is smoother than an egg to scale.

The exact description of the ellipsoid used to approximate the figure depends on how you go about doing it, the differences in different methods are small but can be significant. The importance of these differences will depend on your particular applications.

It rotates at a rate of $= 7.292115 \times 10^{-5}$ rad s^{-1}
i.e. about once per day.

An ellipsoid is a relatively simple geometric representation of the shape of the Earth.

Datums

The foundation of a reference system.

WE WILL NOT LEARN ABOUT ALL THESE DIFFERENT KINDS OF DATUMS IN THIS CLASS. For that you need a surveying, GIS or map making class.

Different datums have different uses, e.g. some are designed for use in specific places on the Earth. Other uses might be navigation specific. Some (e.g. WGS 84) is designed for use around the entire Earth.

Essentially a theoretical reference for coordinates of lat,lon,height.

Can have horizontal or vertical datums.
Horizontal might be referenced to certain benchmarks on the ground.

WGS 84, an ellipsoid that roughly approximates the shape of the surface of the earth at zero elevation. It is a *geometric* entity, with center at the Earth's center of mass.

In practice, in practice, in the sort of geodesy that we do, datums are not of such critical importance since we are often interested in small differences of positions, rather than an “absolute” globally referenced position. For example, I am not really interested in how many millimeters it is from Venice, Italy to the Earth Center of Mass., however I might really like to know how fast the city of Venice, Italy is subsiding with respect to Earth Center of Mass.

A datum is also a relatively simple geometric object, e.g. the surface of an ellipsoid.