EARTH, PLANETARY, & SPACE SCIENCES 15
INTRODUCTION TO OCEANOGRAPHY

LABORATORY SESSION #1 Spring 2017

Introduction, Maps, Cross-Sections and Graphs

READING ASSIGNMENT: This Handout and Appendices I-III in the textbook.

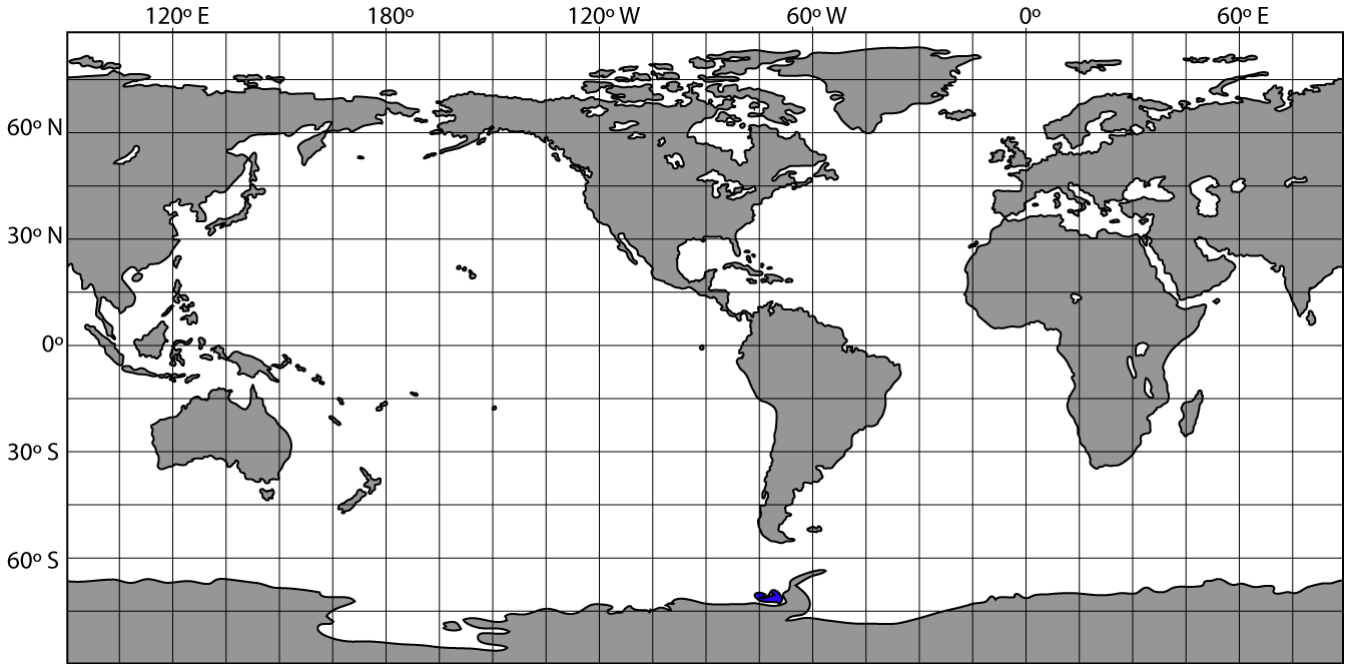
This week you will meet your teaching assistant and learn the basic rules and operations of the laboratory sessions.

There will also be a short exercise on Maps, Cross-Sections and Graphs. Each of these is a different method used to represent information in oceanography and in other sciences. You will need to understand and work with such projections throughout the quarter.

I. MAPS

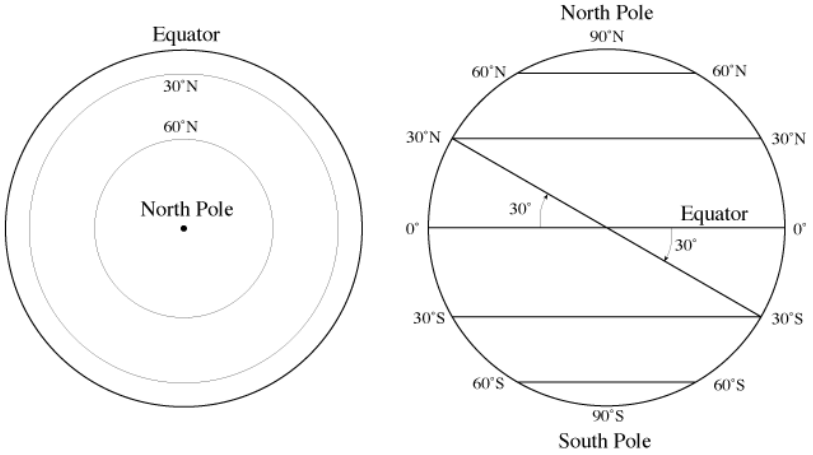
A map is a representation of information about the surface of an object. The maps we will use will show us information about the surface of the Earth, and in some cases about Earth's interior as well. Most often this will be geographic information, but maps can also be used to represent other kinds of data such as temperature or depth. The map below is a projection of the geography of continents and oceans on the Earth.

In order to describe the location of points on a map, relative to each other, we need a frame of reference. The most common frame of reference used in maps is a set of **spherical coordinates** that define a **grid** on the surface of the Earth. This coordinate system uses **latitude** and **longitude** to locate points of interest. Carefully read Appendix III of your textbook for a detailed explanation of this coordinate system. The map below shows a flat projection of the Earth's surface:

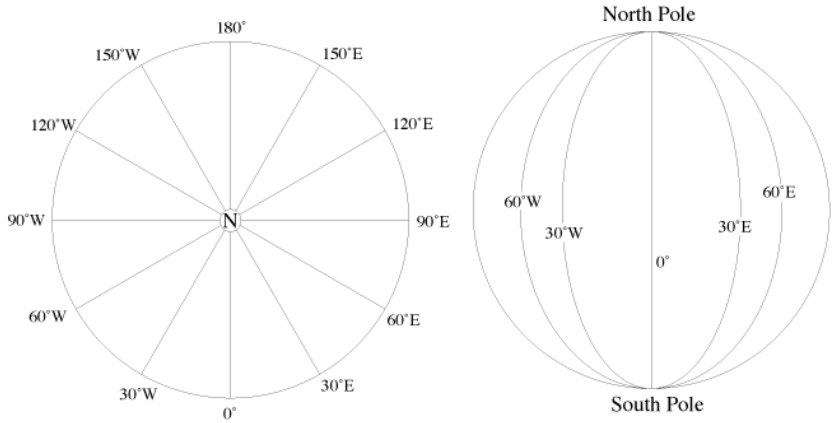


Geography - all students are expected to have a basic working knowledge of principal geographic features of the Earth. Try to find and label each ocean, each continent, the equator, and UCLA on this map.

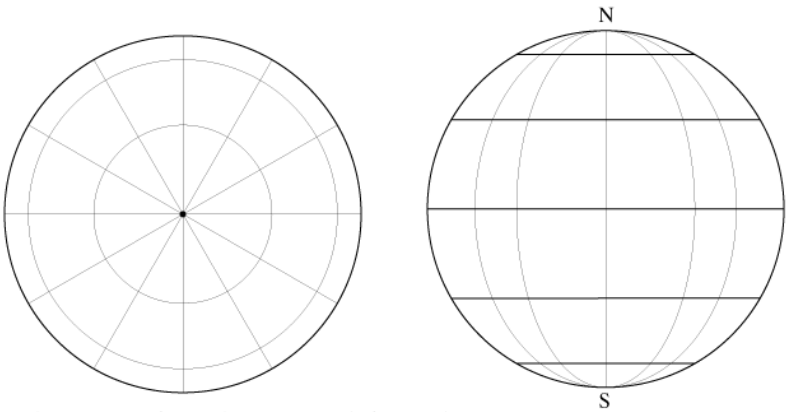
Equator - great circle around the Earth that includes all points equally distant from the poles.



Parallels of Latitude - small circles parallel to the Equator. These mark angles measured from the center of the Earth to points above and below the Equator(0°). The poles are at 90°N and 90°S.



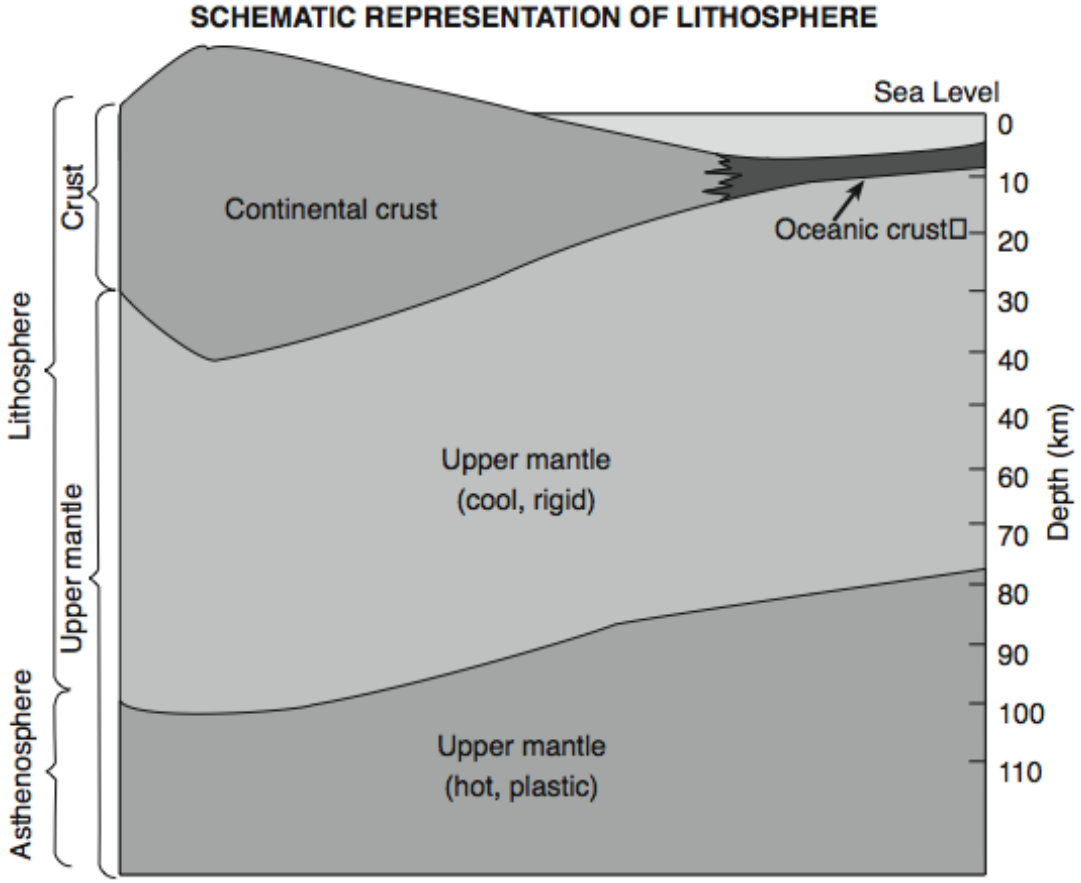
Meridians of Longitude - great circles perpendicular to the Equator that intersect at the poles. These measure angles east and west of the prime meridian which is at 0° longitude and is arbitrarily set to intersect the city of Greenwich, England. Measured from 0° to 180° (E or W).



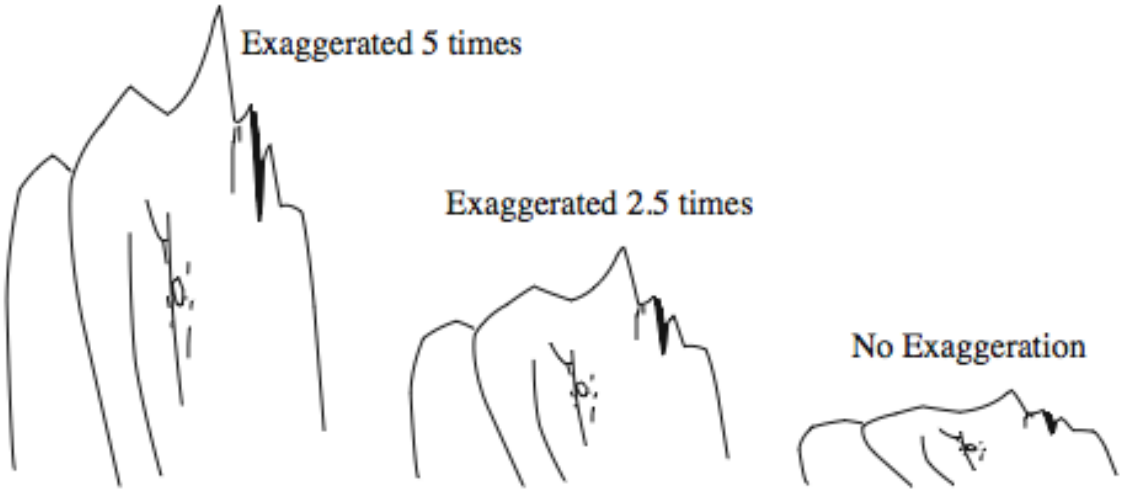
Latitude and Longitude combined - make a grid that can be used to define the location of points on the Earth's surface.

II CROSS-SECTIONS.

Sometimes we will use projections that are slices perpendicular to the surface of the earth – these are called cross-sections. Cross-sections allow us to view profiles of the Earth's surface from the side. In geology we use cross-sections to describe geological structures in the interior of the Earth. In oceanography, cross sections are useful in illustrating changes of water properties (e.g., temperature, salinity) across entire ocean basins. The cross-section below shows layers in the interior of the Earth, down to a depth of about 130 km.



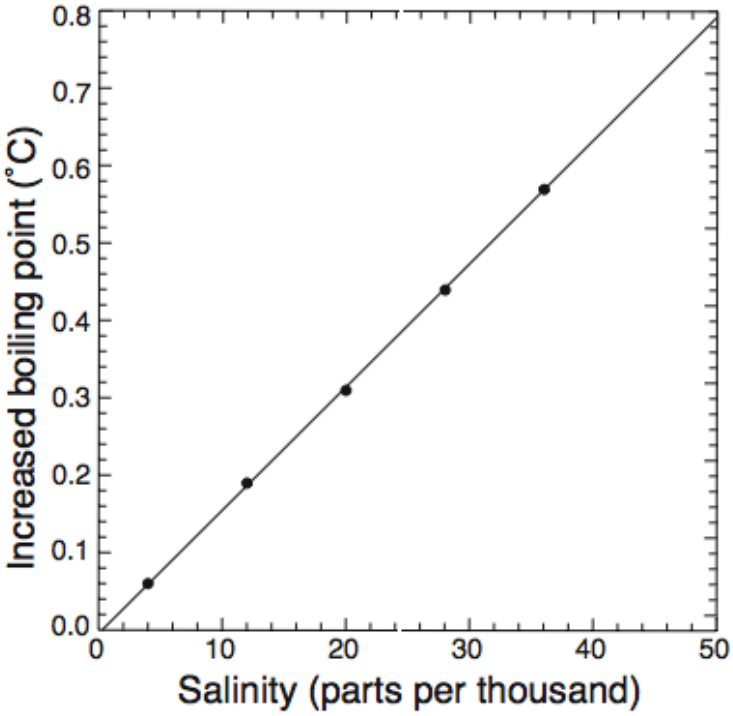
The surface of the Earth is extremely flat, and usually cross-sections employ a considerable amount of **vertical exaggeration** as illustrated below. With vertical exaggeration, the vertical scale is stretched out relative to the horizontal scale. The amount of vertical exaggeration is defined as the vertical scale divided by the horizontal scale (per unit length). The cross-section above has a very large vertical exaggeration, about 40x (The vertical scale is about 0.08 cm/km and the horizontal is about 0.002 cm/km).



III. GRAPHS

The relationship between two variables can be represented by comparing them in tables, but it is usually easier to understand their relationship when they are plotted on a graph as shown below. When data like these are plotted on a graph they may define a line, or a simple curve, that describes the relationship more fully than just a few points. Such lines or curves can be used to predict relationships at values that have not been measured. When we use this line to predict values between the plotted points, this is called **interpolation**. When we predict values outside the range of plotted points, this is **extrapolation**.

Salinity (parts per thousand)	Boiling Point Increase (°C)
4	0.06
12	0.19
20	0.31
28	0.44
36	0.57



IV. CONTOURS

Contours are another useful means of representing information that can be applied to Maps, Cross-sections, and Graphs. Contours are lines drawn on a figure that connect data of equal value. Just about any type of data can be connected by contours (i.e., "contoured"), such as temperature, depth, height, pressure, etc. The figure below has contours of equal temperature ("**isotherms**") used to represent the temperature of surface waters of the Oceans (in ºC).