Geog 3A: Ocean and Atmosphere
Lab1 Salinity and Scale

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Outline

• Review of salinity / density
• Introduction to Scale
• Optical refractometer
• Group work on measuring salinity and density
Units of Salinity

- parts per thousand (ppt)
- practical salinity units (psu)

Units of Density

- Grams per cubic centimeters \( g / cm^3 \)
- Kilograms per cubic meters \( kg / m^3 \)
- Conversion: \( 1 g / cm^3 = 1 \times 10^3 kg / m^3 \)

\[ \rho = \frac{\text{weight}}{\text{volume}} \]
Measurements of Salinity

1. From definition
Number of grams of dissolved material in 1 kilogram (1000 gm) of seawater

Input: weights of dissolved material and seawater
Measurements of Salinity

2. Dittmar’s Principle
In open ocean, total amount of dissolved materials may change, but ratios of the elements remain very nearly the same.

E.g. calculate salinity from chlorinity
Input: weight of Cl, and the ration
Formula: $S=1.8\times Cl$
Measurements of Salinity

3. Using tools:
   - **Refractometer**
     (can also measure density)
   - CTD
   - Salinometer
   - Satellite sensors using microwave energy
Scale (what, why and how?):

What?
The spatial and temporal ranges (or sizes) of a process (or an object)
http://htwins.net/scale2/?bordercolor=white

Why?
The scales differ largely for various process or objects.
E.g. ocean and atmosphere are vast, but also contain tiny organisms and particles.
How?
Scientific notation: is a way to writing numbers that are too big or too small.

Form: \[ a \times 10^b \]

a: is an real number (usually, 1 \leq |a| < 10)
b: is an integer
Optical Refractometer

How it works?

- Refractometers work because light travels at different velocities in different mediums.
- The light beam is bent at the interface of two adjoining material. This is called refraction.
- There is an angle of light propagation at which refraction no longer occurs, the light beam instead being reflected back to the original material. This is called the critical angle. Critical angle is the result of light interfacing at two mediums.
- Optical Refractometer measure the critical angle, and different material have different critical angle. Based on this measurement, the salinity could be inferred.
Optical Refractometer
Optical Refractometer
———How to use it?

Step 1: Clean the metal panel
Step 2: Rinse your pipette use your sample three times
Step 3: Squeeze your pipette first and get the seawater from your sample
Step 4: Drop your sample on the metal panel and cover it.
Step 5: Press “Read”
Step 6: Press “Range” for different measurements and units
   - Salinity: PSU and PPT
   - Density: S.G
Step 7: Clean the metal panel again (Remove the seawater from the panel)
Optical Refractometer
——How to use it?

IMPORTANT!
Do not press the middle button on the Optical Refractometer, or we need to re-calibrate the tool. It takes a lot of time!
Useful Info to Remember

The due for this lab is next week at the beginning of this section. Submit hard copy to me per group.