Subjects for student presentations

EPS131, introduction to physical oceanography and climate

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Instructions, please read carefully

Please choose three subjects from the list below and email the TF your prioritized list. The sooner the better...

Prepare a *ten minute* presentation on descriptive/ dynamical aspects of one of the following topics, based on textbooks or other sources chosen with the help of the TF. Some topics include a suggested lab demo; see the list below for details. Meet with the TF to go over your presentation/demo prior to presenting, and email the final presentation file (in pdf or PowerPoint only) to the TF by 7am on the day of your presentation. Files will be posted to the course home page after your presentation. If you are interested in presenting a subject that's not listed, please write or come talk to us.

Guidelines for presentation: Concentrate on observations and phenomenology, do not discuss theoretical material/ equations. Use Google scholar (scholar.google.com) to find information from scientific papers in addition to a regular web search. Make your slides interesting and fun. Slide format: Use 24 points and above; avoid bullet points, minimize amount of text, include graphics on all slides; a typical slide should have a clear title noting what the main message of the slide is, some graphics, a caption explaining what exactly is shown in the graphics, and a summary sentence at the bottom providing the main take-home point.

Subjects

Subject are listed roughly in the order in which they will be presented in class, with the related section in the syllabus in red.

1. Water masses, regional oceanography (Temperature-Salinity)
   (a) Atlantic ocean, and North Atlantic Deep Water (NADW),
   (b) Southern ocean, Antarctic Intermediate Water (AAIW), Antarctic Bottom Water (AABW).

(c) Marginal seas, Mediterranean water in the Atlantic, Levantine Intermediate Water (LIW), Adriatic/ Ionian/ West Mediterranean deep water.

(d) MODE (18 degree) waters

2. Making observations (Temperature-Salinity, horizontal circulation I)

   (a) Satellites: SST, chlorophyll, scatterometer, altimeter, salinity

   (b) Ship-based observations: CTD, STD, Nansen bottles, inverting thermometers

   (c) Floats: ARGO, profiling floats, SOFAR, RAFOS, ALACE, PALACE, APEX

   (d) Moorings and current meters

   (e) Ocean Observatories Initiative

3. Major currents (Horizontal circulation I)

   (a) Gulf stream, including thermal wind, recirculation, other other western boundary layer currents (Demo 1)

   (b) The antarctic circumpolar current (ACC)

   (c) Somali current and the monsoons

   (d) Indonesian through-flow and Equatorial currents and undercurrents.

   (e) Abyssal circulation and deep western boundary currents (Horizontal circulation II)

4. Other physical processes

   (a) Diffusion (Demo 2)

   (b) Upwelling zones and fisheries (Friction)

   (c) Ekman pumping (Demo 3) (Friction)

5. Waves and tides (Waves I)

   (a) Tides

   (b) Tsunamis

   (c) Wind waves

   (d) Fundamental wave properties (Demo 5)

(e) Surface gravity waves (Demo 6)

(f) Internal waves (Demo 7)

6. The oceans and climate variability (Thermohaline circulation, El Niño)

   (a) El Nino's global teleconnections: African drought, South American floods, North American rains

   (b) Thermohaline circulation (Demo 4)

   (c) The oceans, anthropogenic CO_2 increase and ocean acidification

   (d) Atlantic multi-decadal oscillation and Hurricanes.

7. Sea ice

   (a) Antarctic Sea Ice and Polynyas

   (b) Thinning Arctic sea ice (and global warming)

8. Climate

   (a) The fate of Greenland ice under global warming

   (b) West Antarctica and the antarctic ice shelves

   (c) Sea level change (Temperature-salinity, Demo 8)

Lab Demos

Below are short descriptions of demos related to some of the presentation topics. Please email the TF with any questions.

1. Thermal wind
   Use a rotating tank, add a round metal container in the center filled with ice; use small floating particles and die near the bottom of the tank observe the vertical shear that forms due to the temperature-induced horizontal temperature gradient.

2. Diffusion / double-diffusion
   Use a divided tank to set up different combinations of salty/fresh, hot/cold layers, and observe the resulting diffusion by adding dye to one layer. Does any of the combinations produce "fingers"?

3. Ocean gyres/ Ekman pumping
   A rotating tank of fluid is equipped with fans which set up a wind at the surface. Add streaks of dye to illustrate the wind-induced circulation (reference).

4. Thermohaline circulation
   Fill a tank with water, add colored ice cubes to one end, and describe the resulting circulation. Compare this to the circulation that develops when the cubes are placed in the middle of the tank.

5. Fundamental wave properties
   Demonstrate wave propagation, reflection, diffraction, frequency, wavelength, and other basic properties using a ripple tank and wave generator.

6. Surface gravity waves
   Use a wave tank to show basic properties of surface gravity waves, e.g. wave speed, and their dependence on depth.

7. Internal waves
   Use a divided tank, each half filled with water of different densities. Add dye to the denser fluid, remove the divider, and allow the system to equilibrate. Try exciting waves at the density interface, describe the results.

8. Sea level rise/ thermal expansion
   Add dye to a flask filled with water. Seal the flask with a single-hole rubber stopper, with a glass tube running through it, such that the water level is visible part-way up the tube. Now immerse the flask in a bath of icy or hot water. What happens to the water level?