

**NAME:**

October 11, 2006

**EAS-4300/6124 Oceanography Midterm Exam**

**There are 4 questions and you have 60 minutes.**

**Remember: this exam is not to test your ability to memorize things. Use the concepts you learned in the class to give answers and reasonable explanations to the questions. The questions may have more than one answer so it is important that you explain when asked to do so.**

**If you have questions during the exam, ask Vincent.**

**Figure 1 shows a map of SST anomalies.**

a) Label the El Nino and La Nina condition.

b) Draw the winds anomalies in the equatorial region for case A and B.

c) In panel C draw the thermocline along the equator associated with the SST anomalies in case B. Also indicate the approximate depth of the Ekman spiral.

d) If you were located along the equator at Longitude -120, where would you expect higher sea level anomalies (A or B) ? Explain why?

e) Label three major upwelling systems in map B (UP1, UP2, UP3). Below list how these upwelling systems experience changes during El Nino and La Nina conditions. M = more upwelling. L= less upwelling. U = unchanged.

	During El Nino conditions	During La Nina conditions
UPW1		
UPW2		
UPW3		

h) Draw the Kuroshio Current on map B.

g) When do you expect the California Current to be stronger, during case A or case B? Explain and don't be scared of being wrong, just give some reasoning!

a) List and describe at least 4 processes that contribute to sea level change on timescale greater than 100 years. For each process tell what is the size of change in sea level and over which timescale it takes place.

**Figure 2 Panel A: shows an hypothetical configuration of continental crust, oceanic crust and ocean layer above the mantle.**

b) Panel A: Using the isostasy or buoyancy principle find the thickness  $h_C$  of the oceanic crust. (NOTE: write down how you compute it, show your logic and derivation clearly so that if the answer is incorrect you still get credits. Use additional page if needed.)

c) Panel A: What is the height above sea level  $h_A$  at the top of the continental crust?

**Figure 2 Panel B: the continental crust is now lighter than in Panel A and rises more above the mantle.**

d) Panel B: The density of the continental crust has now changed due to the melting of ice in the mountains. Assuming that the volume of ocean water does not change, what is the change in the height above sea level  $dh_A$ ? (HINT: note that the distance  $dh_A = dh_L$ , the size of change is not necessarily consistent with reality)

e) Suppose you had a coastal tide gauge that measured the change  $dh_A$  in sea level from Panel A to Panel B. Would this measurement  $dh_A$  agree with the change in sea level inferred by a satellite? Explain your answer. (You can write on the next page).

**Question # 3 (10 min)**

**ATMOSPHERIC WINDS and UPWELLING**

**Figure 3 shows a map of the atmospheric pressure at the ocean sea surface in the Indian Ocean during August 1998**

- a) Label the centers of High and Low pressure.
- b) Draw the direction of the winds in the Southern Indian Ocean (Box A in the figure). Explain how you determine that.

c) Indicate where you expect to find the stronger winds (based on this map) and explain why.

d) Indicate if the winds induce ocean upwelling or downwelling at locations

Pt.1 \_\_\_\_\_

Pt. 2 \_\_\_\_\_

Pt. 3 \_\_\_\_\_

e) Is Pt. 3 a region of convergence or divergence of surface waters? Would you expect this to be warmer or colder than the surrounding? Explain how you determine your answer.

**Figure 4 shows three vertical profiles of oceanic basins**

Label on the map the most likely type of sediments found at the location A through P. Sediments type you can choose from are: Volcanic, Terrigenous, Red Clays and Biogenic (Siliceous and Calcareous Ooze)