

NAME:

November 24, 2008

EAS-4300 Oceanography MIDTERM Exam

There are 3 questions and you have up to 55 minutes.

The questions may have more than one answer so it is important that you explain when asked to do so. However try to be brief and succinct.

If you have questions during the exam, ask the French TA (and good luck with his accent!).

You have about 15 minutes for each question.

Figure 1 shows a vertical section of the atmosphere from equator to pole.

A) Draw the Hadley, Ferrel and Polar Cells. Label regions of convergence (CON) and divergence (D) both at the surface and top of the troposphere. Where do you expect more rain? Explain.

B) Label the latitudinal bands where you expect to find easterlies and westerlies. This needs to be consistent with how you draw the cells.

Figure 2 shows a map of the atmospheric pressure at the ocean sea surface in the Indian Ocean during August 1998

C) Label the centers of High and Low pressure.

D) Draw the direction of the winds in the Southern Indian Ocean (Box A in the figure). Explain how you determine that.

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

A) Figure 3 shows a map of the earth topography from satellite. Draw approximately the boundaries between plates. For each boundary area indicate if it is a constructive or destructive margin. Explain the differences between these two type of margins.

B) Indicate the relative age of the oceanic crust at locations A,B,C,D and E along the black lines drawn in the figure. Use the following labels: VO (very old oceanic crust), O (old oceanic crust) and Y (young oceanic crust). Is there a relationship between the age of the oceanic crust and the depth of the basin? Explain.

C) Label three regions where you would expect volcanic activity and explain why. Use the labels V1, V2 and V3.

D) How does plate tectonic affect changes in sea level? What is the size (in meters) of sea level change associated with plate tectonic and on what timescales does it occur? If you have two oceanic basins with mid-ocean ridges, the first one expanding very fast and the second one very slow, in which basin do you expect sea level to rise more? Explain.

E) What is Post Glacial Rebound (PGR)? How are changes in sea level associated with PGR different from those associated with 'steric' effects? Will global warming affect these two types of sea level change? If yes, how and with what speed?

Figure 4, shows a map of the mean pressure at 150 meters (yellow is high, blue is low).

A) Sketch on the map the direction of the geostrophic flow and label the centers of the Pacific and Atlantic subtropical gyres with the label SB. Are the regions inside the subtropical gyre upwelling or downwelling? How can you tell from the pressure?

B) Does this map also give you information of the Ekman currents? Do you expect the Ekman currents to be very important? (Explain your answers to both questions).

C) Label the major oceanic current system such as: the upwelling boundary currents, the Gulf Stream, the Antarctic circumpolar current and the Kuroshio Current.

Figure 5 shows a map of surface winds over the Indian Ocean.

D) According to what you have learned about the monsoon, is this the winter or summer monsoon? Is India experiencing heavy rain in Figure 4? Explain.

E) Indicate if you have upwelling or downwelling at locations a,b,c,d,e and f.

F) Sketch the surface currents correspondent to the wind pattern at locations a,b,c,d,e and f.

G) If the winds would suddenly stop which currents will disappear first a) the Ekman currents or b) the geostrophic currents? Explain.

Figure 6 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)