Facultad de Ingeniería Marítima y Ciencias del Mar

OCEG1029 – MARINE BIOGEOCHEMISTRY

II PAO 2025 – EXAM 2 (final)

NAME: _____ Date: _____

I hereby declare that during this exam I have fulfilled the Code of Ethics of our University.

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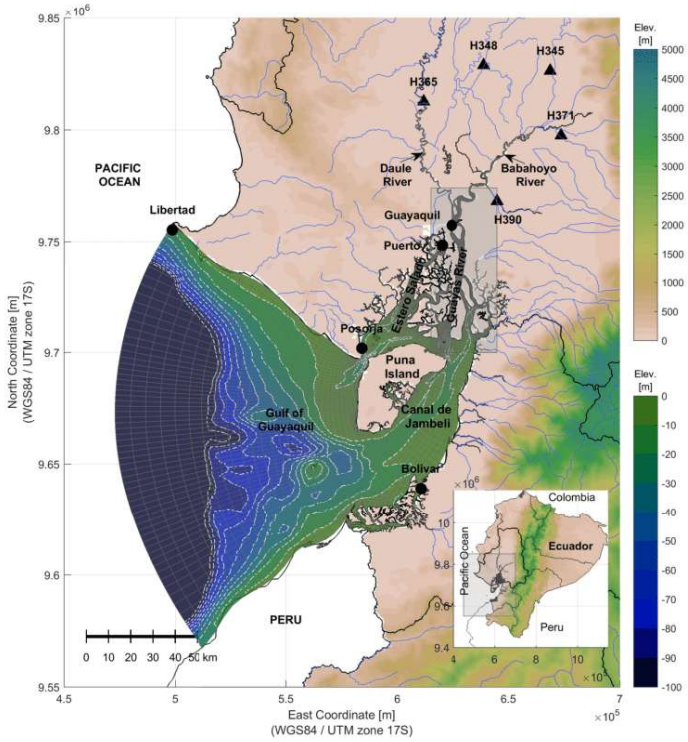
1. (12 pts) Biological oceanography
    a. What's the difference between pelagic and neritic?
    b. What's the difference between Critical Depth and Mixed Layer Depth?
    c. Name and explain at least 2 adaptations of organisms in the ocean environment: one viscosity-related, and one related to osmosis.

2. (12 pts) Geological oceanography
    a. What type of sediments would you expect to find in the estuarine region of the Gulf of Guayaquil? See map below.
    b. What <u>processes</u> would cause this?
    c. Why and where do you find Abyssal Clay in the world?



Map of the study area, covering the Gulf of Guayaquil, its estuary and the Guayas River. The map also includes the numerical grid of the Delft3D FM model. Tidal stations are indicated by circles, river gauging stations by triangles, while the area of interest is enclosed in the rectangle. The bathymetry is indicated as contour lines mapping depths every 10 m, with contour lines deeper than 100 m omitted from the map.

Barrera Crespo, P. D., Mosselman, E., Giardino, A., Becker, A., Ottevanger, W., Nabi, M., & Arias-Hidalgo, M. (2019). Sediment budget analysis of the Guayas River using a process-based model. *Hydrology and Earth System Sciences*, *23*(6), 2763-2778.

3. (11 pts) Marine Biogeochemistry
    a. Draw and describe the processes of the Biological Carbon Pump.
    b. With the changes implied in the abstract of Paltan et al. (2023) shown below, what changes can we expect in the biogeochemistry of the Galapagos Islands in the near future?

OPEN

Climate and sea surface trends in the Galapagos Islands

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The Galapagos Islands are a global hotspot of environmental change. However, despite their potentially major repercussions, little is known about current and expected changes in regional terrestrial climate variables and sea surface temperatures (SST). Here, by analysing existing meteorological observations and secondary datasets, we find that the Islands have warmed by about 0.6 °C since the early 1980s, while at the same time becoming drier. In fact, the onset of the wet season is currently delayed 20 days. This drying trend may reverse, however, given that future climate projections for the region suggest mean annual precipitation may increase between 20 and 70%. This would also be accompanied by more extreme wet and hot conditions. Further, we find that regional SST has increased by 1.2 °C over the last two decades. These changes will, in turn, translate into deterioration of marine ecosystems and coral, proliferation of invasive species, and damages to human water, food, and infrastructure systems. Future projections, however, may be overestimated due to the poor capacity of climatic models to capture Eastern-Pacific ENSO dynamics. Our findings emphasize the need to design resilient climate adaptation policies that will remain robust in the face of a wide range of uncertain and changing climatic futures.