Assignment P4

Scientific Computing and Data Management

Date: March 30, 2025
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Region chosen: Coastline surrounding southern Vancouver Island

he maps below explore the bathymetry and chlorophyll-a levels in the Cascadia region of Canada, more specifically the coastal areas surrounding southern Vancouver Island. Vancouver Island lies on the pacific shore, with vast natural forests and mountain ranges and islands along with medium a few cities dotted throughout. I thought it would be interesting to see how urban areas, mountains, scattered islands, multiple rivers, and the Strait of Georgia interact with and compare to the open ocean regarding chlorophyll levels.

The chosen coordinate frame is:

lat_max, lat_min = 50.3, 47.7
lon_min, lon_max = -128.9, -121.6

The region is around 500 kilometers wide and 200 kilometers high.

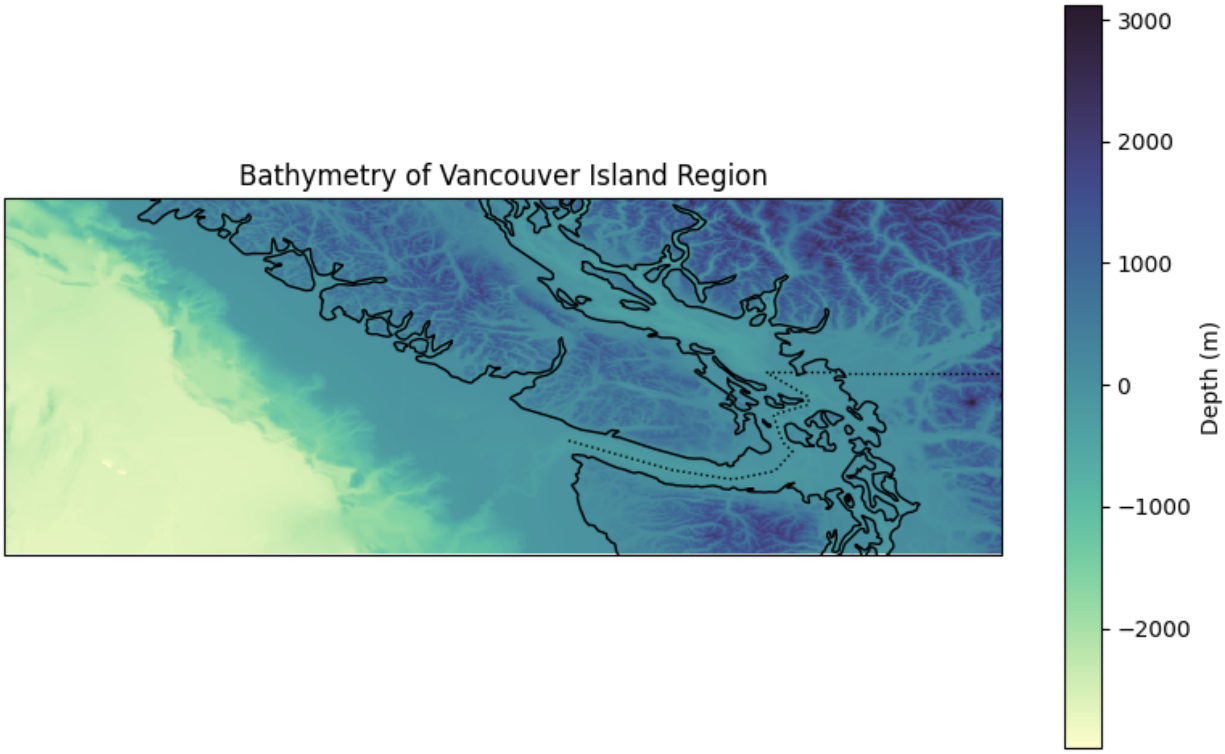

Figure 1: *Bathymetry of chosen Vancouver Island Region*

Figure 1 shows the bathymetry across the chosen region around south Vancouver island. There is a stark depth gradient, with depths near the open coastline staying around -500 meters in depth, dropping rapidly to -2000 meters approximately 60 kilometers parallel to Vancouver Island, indicating that Vancouver island lies on a plateau. The mountains on the mainland can be seen in dark blue, reaching heights of up to 3000 meters.

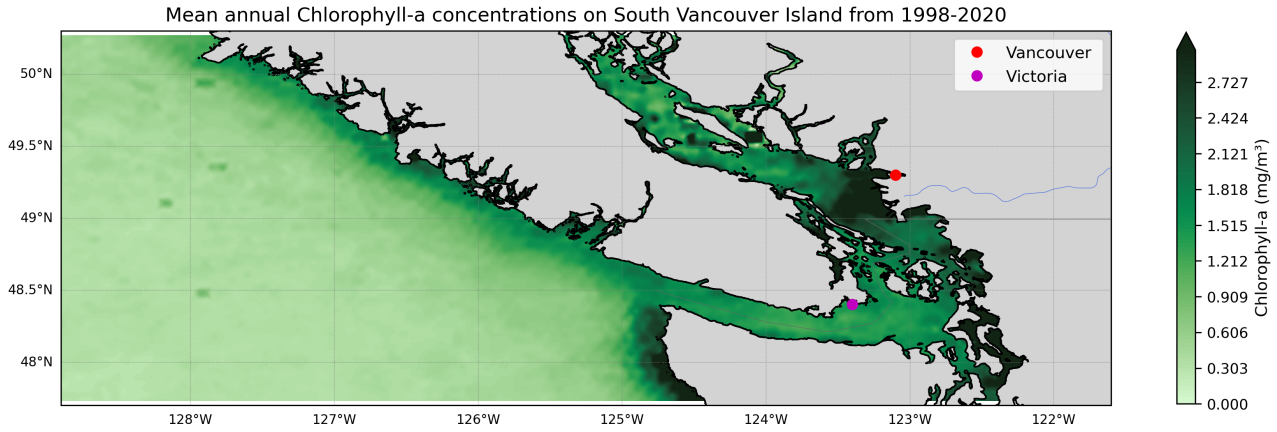

Figure 2: *Mean annual chlorophyll-a concentrations on South Vancouver Island from 1998-2020.*

Figure 2 displays the mean annual chllorophyll-a concentrations in the chosen region between 1998 and 2020, pulled from the NetCDF file. The figure was plotted on a PlateCarree projection, and the cities of Vancouver on the mainland, and Victoria on Vancouver Island, were plotted for geographic reference. As can be seen in the dark green area off the coast of Vancouver, the mean chlorophyll-a levels are significantly higher than the rest of the frame, possibly due to higher pollution levels emanating from the city, leading to eutrophic conditions. The delta/river area overall has higher chlorophyll-a levels than the open ocean, and the areas close to the coastline have considerably higher levels than the open ocean. The chlorophyll-a levels thus follow a similar pattern to the bathymetry map - an increase in ocean depth relates to a decrease in mean chlorophyll-a levels.

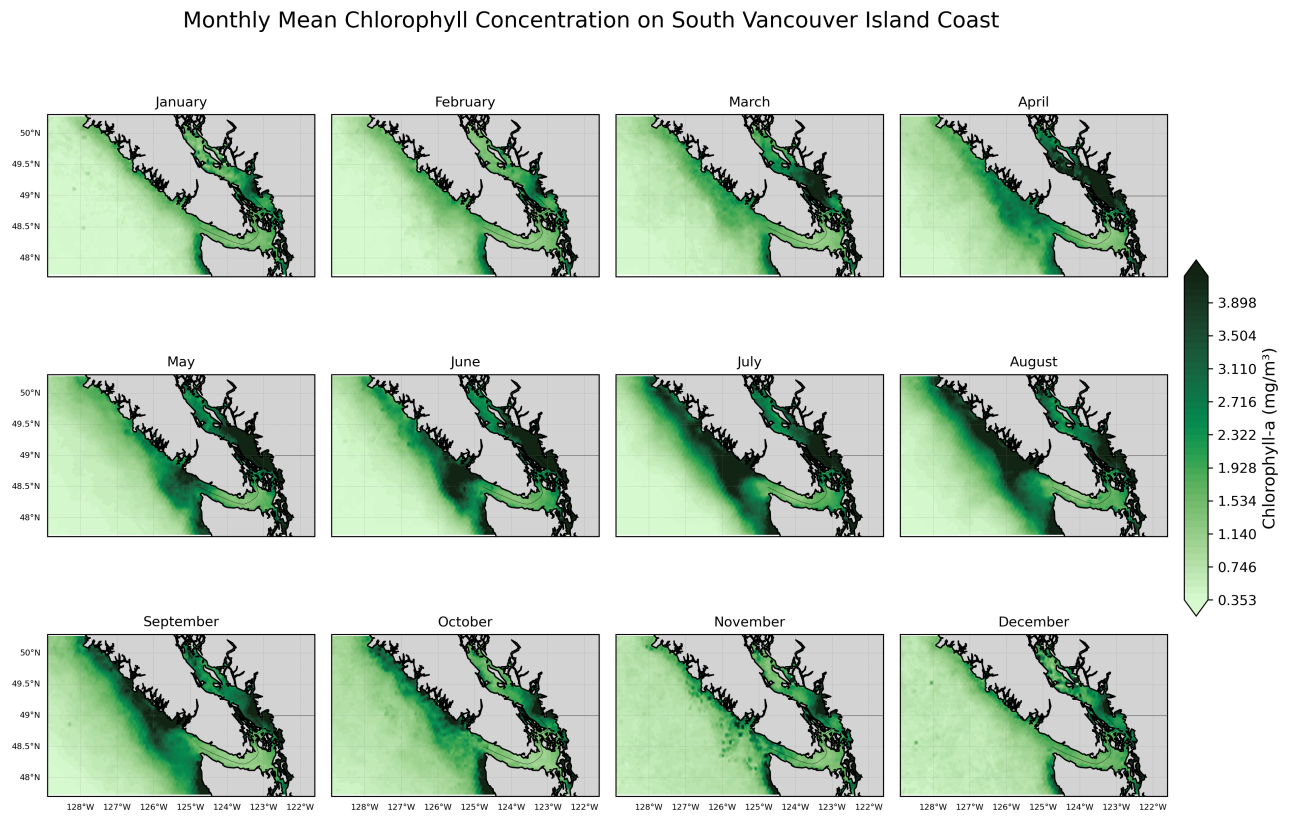

Figure 3: *Monthly mean annual chlorophyll-a concentrations on South Vancouver Island from 1998-2020.*

Figure 3 displays the mean monthly chlorophyll a levels between 1998 and 2020. Maximum mean levels chlorophyll-a levels can be seen in June July, August, and September, whereas December, January, and February have the lowest mean levels of chlorophyll-a. These differences in mean levels are most clearly visible on the Strait of Georgia, whereas they are more stable on the open ocean. As the region is located in the northern latitudes, this shows that chlorophyll-a levels are higher in the summer and lower in the winter, although these maps do not show extremes, only averages.

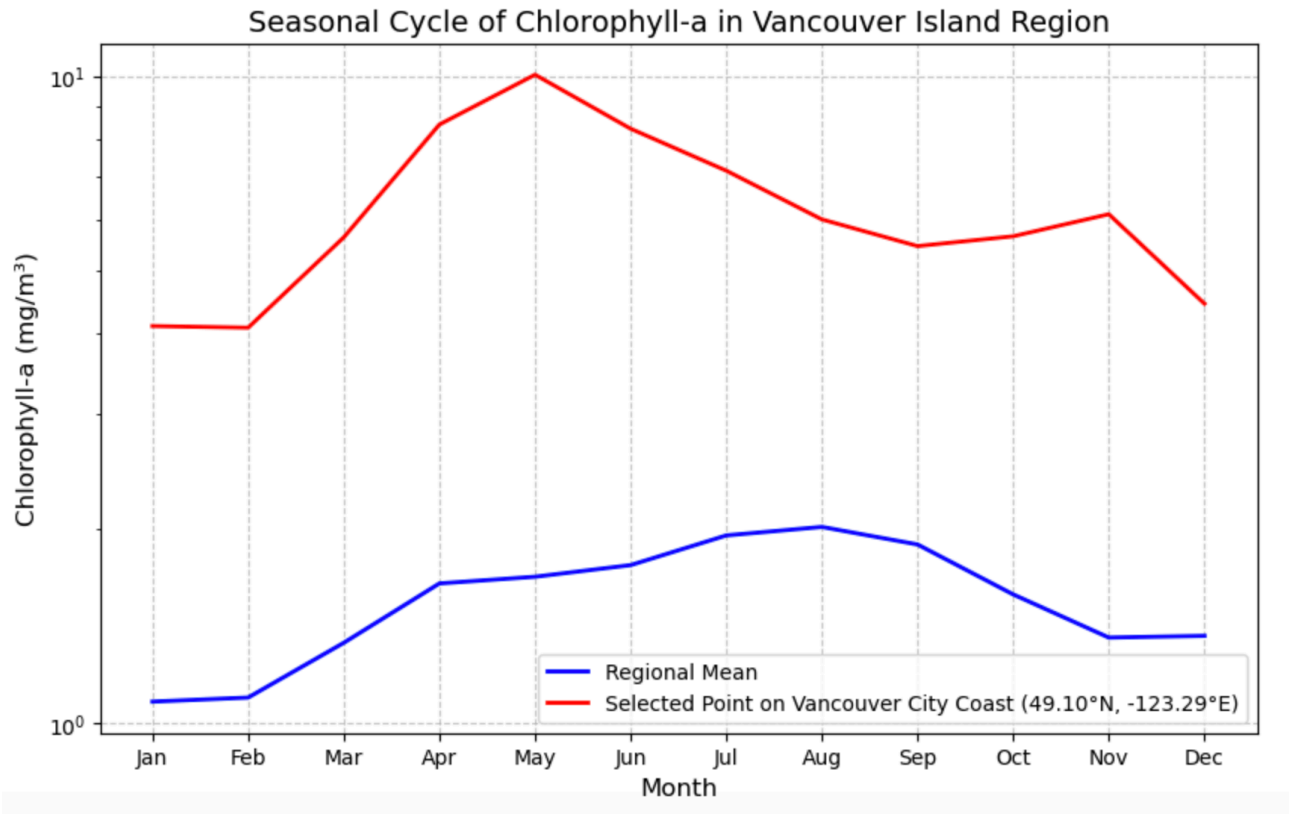

Figure 3: *Regional mean plotted on a logarithmic scale of chlorophyll-a levels compared to selected point in region off the coast of Vancouver.*

Figure 4 shows a line graph comparing mean chlorophyll-a levels across the entire region compared to the mean chlorophyll levels at a specific spot on the map. The specific point chosen was within the dark green area previously described under figure 2, just off the coast of the city of Vancouver, with the coordinates 49.10 and -123.3. This was to further examine the high chlorophyll levels identified here, and the line graph confirms that the area off the coast of Vancouver has much higher levels of chlorophyll-a throughout the year.