SCDM P4 Assignment:

I originally chose a different area but had difficulties with the chlorophyll data in that area and so decided to change to the West Coast, and when I did the code worked well with the data. The area of the West Coast is not as well known to me as others within the course and so it is good for me to get to know more about it. My thesis topic also involves False Bay and so any knowledge I pick up on the area could prove useful. It is very interesting to see the bathymetry of the West Coast after the USV workshop as the goal for the sailbouy was to get to the drop off area to collect data from where there is a 'special' jet stream current that not much is known about and so I have been looking at this area and its topography and characteristics a lot this week.

To get the bathymetry of the area, the GMRT mapping tool (version 4.5.7.) was used to get a xarray dataset containing geographical and altitude data. The file has the following characteristics: Size: 13 MB, Dimensions: Longitude: 1590 points and Latitude: 992 points, Coordinates: 15.42 to 18.91 and -34,5 to 32.69, Data variables: Altitude (2D array with dimensions lat and lon) as well as the following attributes: Title: GMRT Grid, History: Projection is cylindrical equidistant with the data being extracted from the Global Marine Regional Grid Conventions, Conventions: COARDS and CF-16 for netCDF data format.

The dataset used for the chlorophyll analysis is a monthly climatology report of chlorophyll-a concentration. It contains global data at 4 km resolution from January 1998 to December 1997. The data comes from NASA SeaWiFs extracted from satellite observations and has been processed by Plymouth Marine Laboratory. It has a file size of around 2 GB and is CF-compliant NetCDF formatting.

Figure 1:

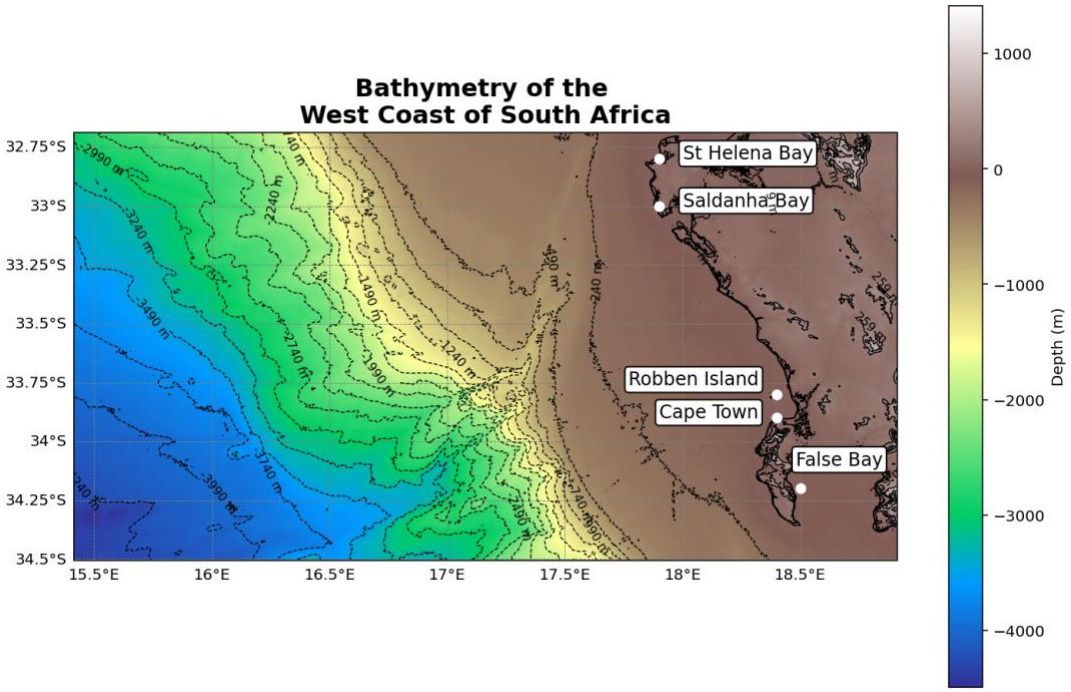

Figure 1: Map to show the bathymetry of the West Coast of South Africa with contour lines every 250 m, a colour bar to show the depth as well as points of interest: St Helena Bay, Saldanha Bay, Robben Island, Cape Town and False bay. The map shows the continental shelf steadily getting deeper the further away it is from the coastline, until it reaches the continental shelf break where the shelf then descends towards the deep ocean floor, creating a continental slope.

Figure 2:

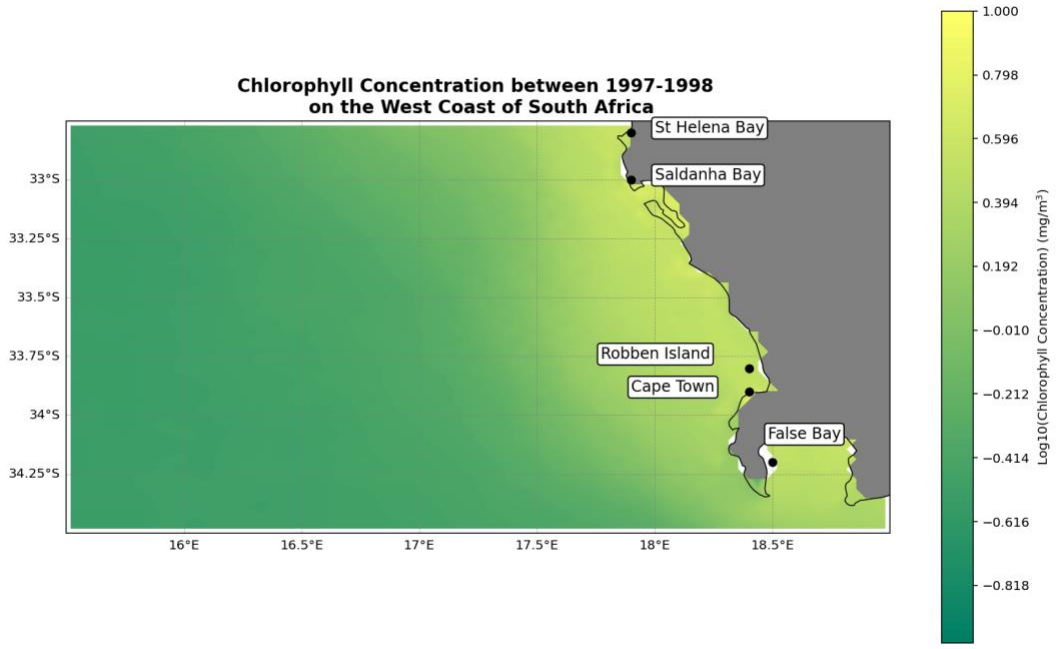

Figure 2: Map to show the Chlorophyll concentration between 1997-1998 on the West Coast of South Africa with points of interest: St Helena Bay, Saldanha Bay, Robben Island, Cape Town and False Bay and a logarithmic scale to show the chlorophyll level with the use of a colour bar ranging for green (low concentration) to yellow (high concentration). The highest concentrations of chlorophyll appear along the coastline, showing high phytoplankton activity, which then decreases the further it gets from the coastline. The high productivity along the coastline if most likely caused by upwelling events.

Figure 3:

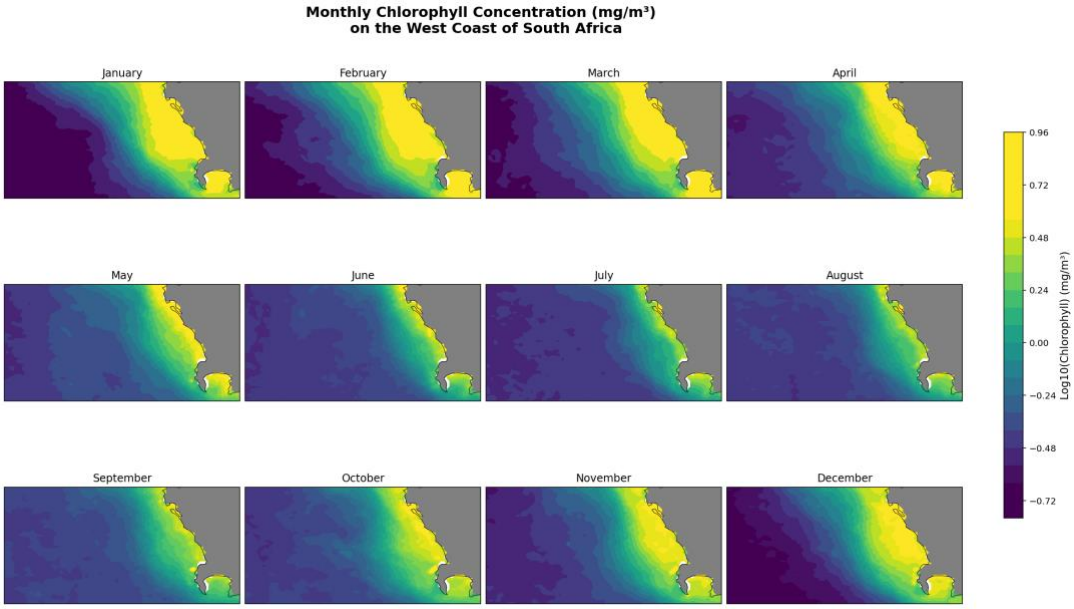

Figure 3: Map to show the monthly chlorophyll concentration (mg/m^3) on the West Coast of South Africa over a period of 12 months. The logarithmic colour bar ranges from purple (low concentrations) to yellow (high concentrations). During the summer (December to February), there is high chlorophyll concentrations along the coastline and very low concentration levels offshore, which shows reduced upwelling. During Autumn (March to May), the chlorophyll levels peak around the coastline during March and May with strong upwellings occurring and then a decline in May. During winter (June-August), there is

the lowest overall levels seen with weak upwelling events occurring, although there is still high nearshore productivity. During spring (September-November), there is a gradual increase in productivity beginning with upwelling strengthening as it gets closer to the higher productivity seen in the area during the summer season.

Figure 4:

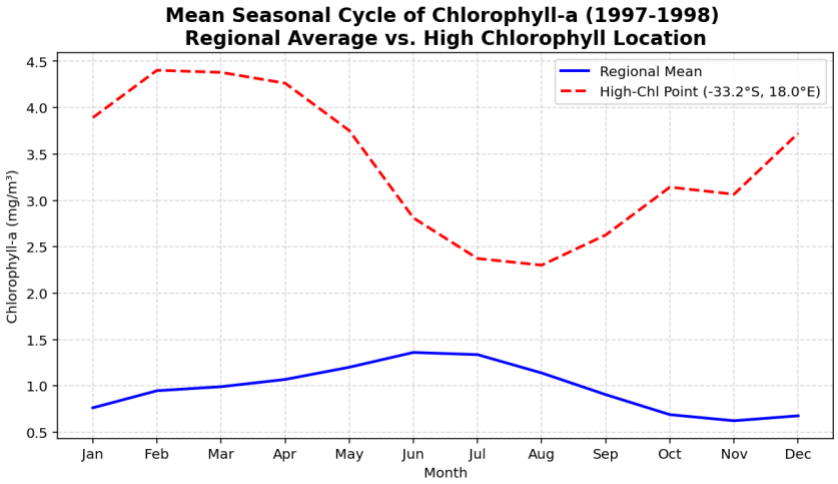

Figure 4: Graph to show the mean seasonal cycle of chlorophyll-a between 1997-1998, comparing the regional average to a high concentration area (-33.2°S, 18.0°E). The high chlorophyll-a at the highest chlorophyll point consistently shows much higher chlorophyll concentrations than the regional average. The graph shows that during January to April, the high chlorophyll concentration point is at its highest concentration levels with the average being at low levels. During May to August, the high chlorophyll point reaches its lowest chlorophyll levels whereas the regional average is at its highest levels. During September to December, the high chlorophyll concentration point levels then increase again while the regional average decreases. This could be due to plankton blooms, winter reduction and/or variability between regional and local areas.

References:

Global Marine Research Tool (GMRT) MapTool. (n.d.). GMRT MapTool. Retrieved March 27, 2025, from https://www.gmrt.org/GMRTMapTool/

European Space Agency (ESA) Climate Change Initiative - Ocean Colour. (2021). *ESACCI-OC-MAPPED-CLIMATOLOGY-1M_MONTHLY_4km_PML_CHL-fv5.0* [NetCDF file]. Plymouth Marine Laboratory. Retrieved from https://esa-oceancolour-cci.org

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