Discipline Assessment 1 - Reef

DATA3888

2025

Instructions

1. You only need to complete ONE of the two Tasks, either Reef or Biomedical. It is your choice which Task to complete.

2. There are two Canvas assignment submission pages, one for each Task. Please make sure you submit your work to the correct Canvas Assignment page.

3. Your assignment submission needs to be a HTML document that you have compiled using R Markdown or Quarto. Name your file as SIDXXX_Assessment1.html" where XXX is your Student ID.

4. Under author, put your Student ID at the top of the Rmd or Qmd file (NOT your name).

5. For your assignment, please use set.seed(3888) at the start of each chunk (where required).

6. Do not upload the code file (i.e. the Rmd or qmd file).

7. Ensure you submit a self-contained HTML file, e.g. by putting 'embed-resources = true' in the YAML part of your Rmd/Qmd file.

8. You must use code folding so that the marker can inspect your code where required.

9. Your assignment should make sense and provide all the relevant information in the text when the code is hidden. Do not rely on the marker to interpret your code.

10. Any output that you include needs to be explained in the text of the document. If your code chunk generates unnecessary output, please suppress it by specifying chunk options like message = FALSE.

11. Start each of the XXXX questions in a separate section. The parts of each question should be in the same section.

12. You may be penalised for excessive or poorly formatted output.

13. You are allowed to use AI tools to help you in this assessment, but as with any other source of information, any usage must be properly acknowledged and cited. You cannot use AI to generate all or part of your assessment tasks for you. Doing this would be a breach the University Academic Integrity Policy 2022.

Part 1

Between 2014-2017, marine scientists recorded an unprecedented global coral bleaching event. Your friend Wei is a marine science expert who wants to study the environmental variables that may have triggered this event. To do this, we will use a public dataset, curated by Sully and colleagues. This dataset records coral bleaching events at 3351 locations in 81 countries from 1998 to 2017 with a suite of environmental and temperature metrics. The data is in the file "Reef_Check_with_cortad_variables_with_annual_rate_of_SST_change.csv" and the full description of the variables can be found in the supplementary table of the study.

In the paper, the authors claim "*the highest probability of coral bleaching occurred at tropical midlatitude sites (15–20 degrees north and south of the Equator)*". Create an informative map visualisation to explore this claim. Justify your choice of visualisation and comment on what you can learn from your visualisation. In particular, examine whether this claim is supported over all years of the global coral bleaching event.

Part 2

Another marine scientist, Farhan, has a special interest in the Great Barrier Reef (GBR) region, and he wants to use the "bleachingSurveys.csv" dataset to know whether he would be able to predict coral bleaching into the future. He wonders if environmental variables measured four years prior are worse, just as good, or better, at predicting coral bleaching as the environmental variables captured at present.

Using the eReefs database to collect variables on total nitrogen, pH, salt, algae and temperature, devise a data science strategy to compare the performance of predicting coral bleaching using the variables from four years prior against the contemporary (i.e. same year) variables.

Ensure that you justify and discuss the potential limitations of each of your choices in the analysis, such as the choice of model and any parameters, any transformations of variables/outcomes, the strategy to evaluate performance, and any visualisations you present.

Hint: the following command will retrieve the environmental variable data from the eReefs database.

```
eReefs_nc = ncdf4::nc_open(
"https://thredds.ereefs.aims.gov.au/thredds/dodsC/
GBR4_H2p0_B3p1_Cq3b_Dhnd/annual.nc?zc[1],
latitude[0:1:722],longitude[0:1:490],
temp[0:1:9][1][0:1:722][0:1:490],
TOTAL_NITROGEN[0:1:9][1][0:1:722][0:1:490],
MA_N[0:1:9][0:1:722][0:1:490],
PH[0:1:9][1][0:1:722][0:1:490],
salt[0:1:9][1][0:1:722][0:1:490],
time[0:1:9]")
```

The eReefs_assessment.nc file is also shared and can be read in using the next line of code.

```
eReefs_nc = ncdf4::nc_open("eReefs_assessment.nc")
```