# Appendix B: Environmental covariates

Table B-1: Description of environmental covariates included in this study

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Covariate** | **Unit** | **Product name and source** | **Product distributor** | **Original spatial resolution** | **Original temporal resolution** | **Ecological relevance to tropical pelagic fishes** |
| Depth | m | ETOPO1 1 Arc-Minute Global Relief Model1 | NOAA | 1 arc minute (1/60°) | . | Seafloor depth does not have a direct biological influence on pelagic fishes, but it reflects the coastal-offshore gradients in the study regions. Depth also reflect the variations of the seafloor (such as shelf edges and seamounts) that can affect surface oceanography. |
| Chlorophyll-a concentration (CHL) | mg.m-3 | Global Ocean Biogeochemistry Analysis and weekly forecast2 | CMEMS | 0.5° | Weekly | CHL is an indicator of the biomass of phytoplankton, and—through trophic relationships—of zooplankton and micronekton, which constitute potential prey resources of our study species. |
| Sea surface temperature (SST) | °C | MODIS-A Level-3 Standard Mapped SST3 | NASA | 9 km | Monthly | SST affects fish distributions via direct physiological effects on metabolism (high SST causes metabolic stress). |
| Mixed layer depth (MLD) | m | Global Ocean Physics Reanalysis GLORYS12V14 | CMEMS | 1/12° | Monthly | Variations in the depth of the mixed layer affect the vertical distribution of our study species, as they mostly use waters above the thermocline. |
| Surface salinity (SAL) | Practical salinity unit | Global Ocean Physics Reanalysis GLORYS12V14 | CMEMS | 1/12° | Monthly | Salinity affects fish distributions via physiological effects on osmoregulation processes. Low salinity may also indicate the proximity of a large river associated with high productivity and thus potentially favorable foraging areas. |
| Total kinetic energy (TKE) | m-2.s-2 | Global ocean gridded L4 sea surface heights and derived variables reprocessed5 | CMEMS | 1/4° | Daily | Geostrophic currents drive the formation of eddies associated with enhanced primary production and prey aggregation, potentially providing foraging opportunities for our study species. |
| Floating objects density (FOBs\_DENS) | . | See main text for processing details | . | . | . | Floating objects aggregate epipelagic fishes through behaviourally-mediated processes. |

Product sources :

1 : https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.ngdc.mgg.dem:316

2 : http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com\_csw&view=details&product\_id=GLOBAL\_ANALYSIS\_FORECAST\_BIO\_001\_014

3 : <https://oceancolor.gsfc.nasa.gov/atbd/sst/>

4 : <http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&amp;view=details&amp;product_id=GLOBAL_REANALYSIS_PHY_001_030>(from January 2014 to June 2018) and [http://marine.copernicus.eu/services-portfolio/access-to products/?option=com\_csw&view=details&product\_id=GLOBAL\_ANALYSIS\_FORECAST\_PHY\_001\_024](http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=GLOBAL_ANALYSIS_FORECAST_PHY_001_024) (from July 2018 to December 2018)

5 : <http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=SEALEVEL_GLO_PHY_L4_REP_OBSERVATIONS_008_047>

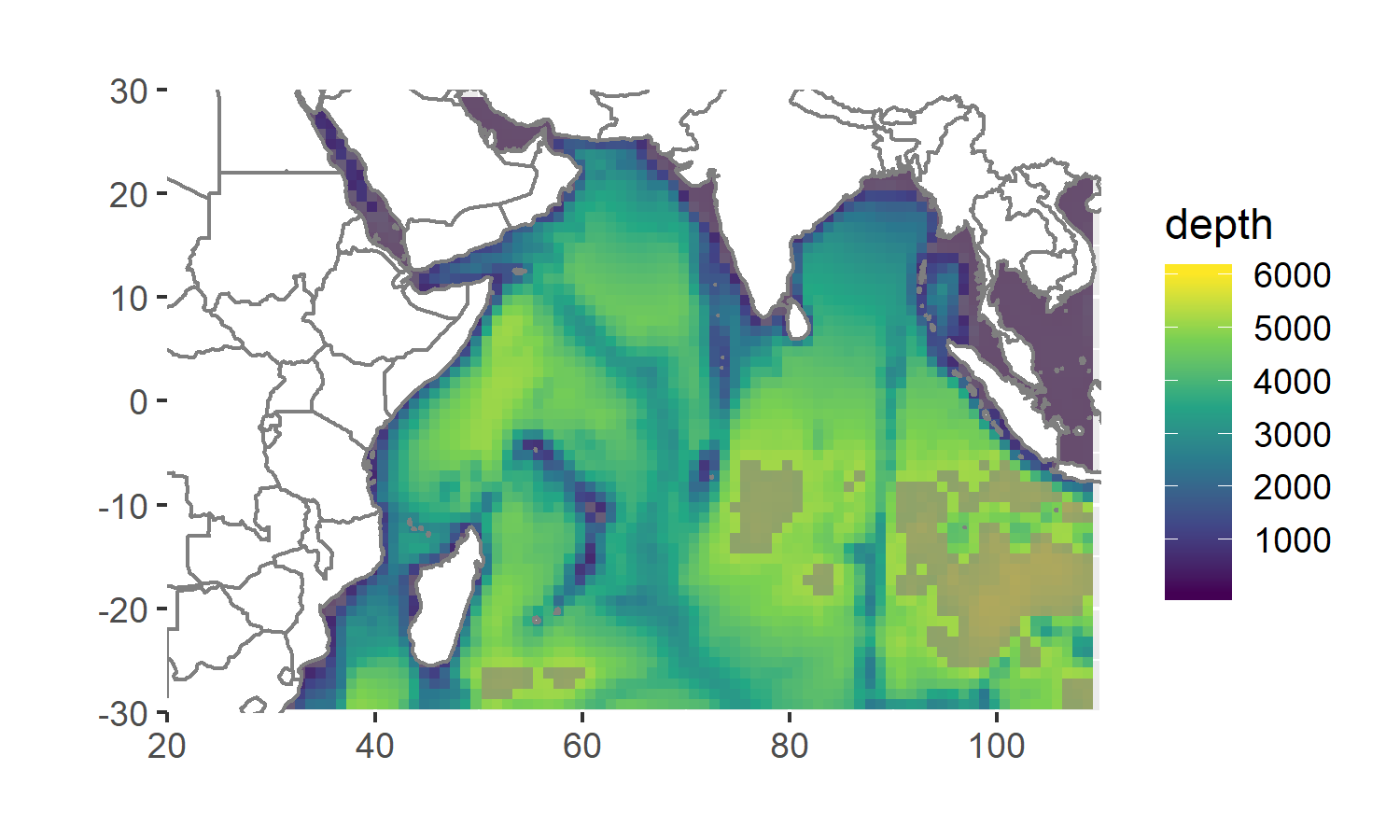
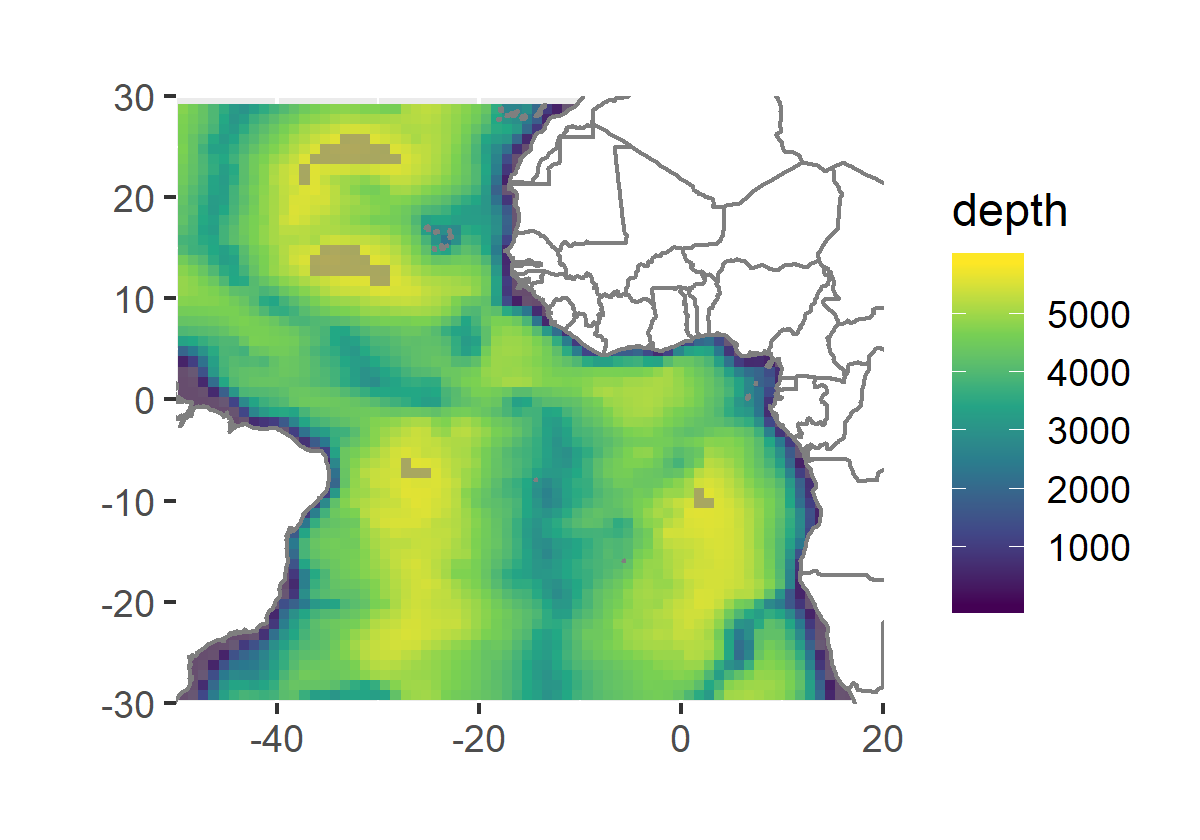
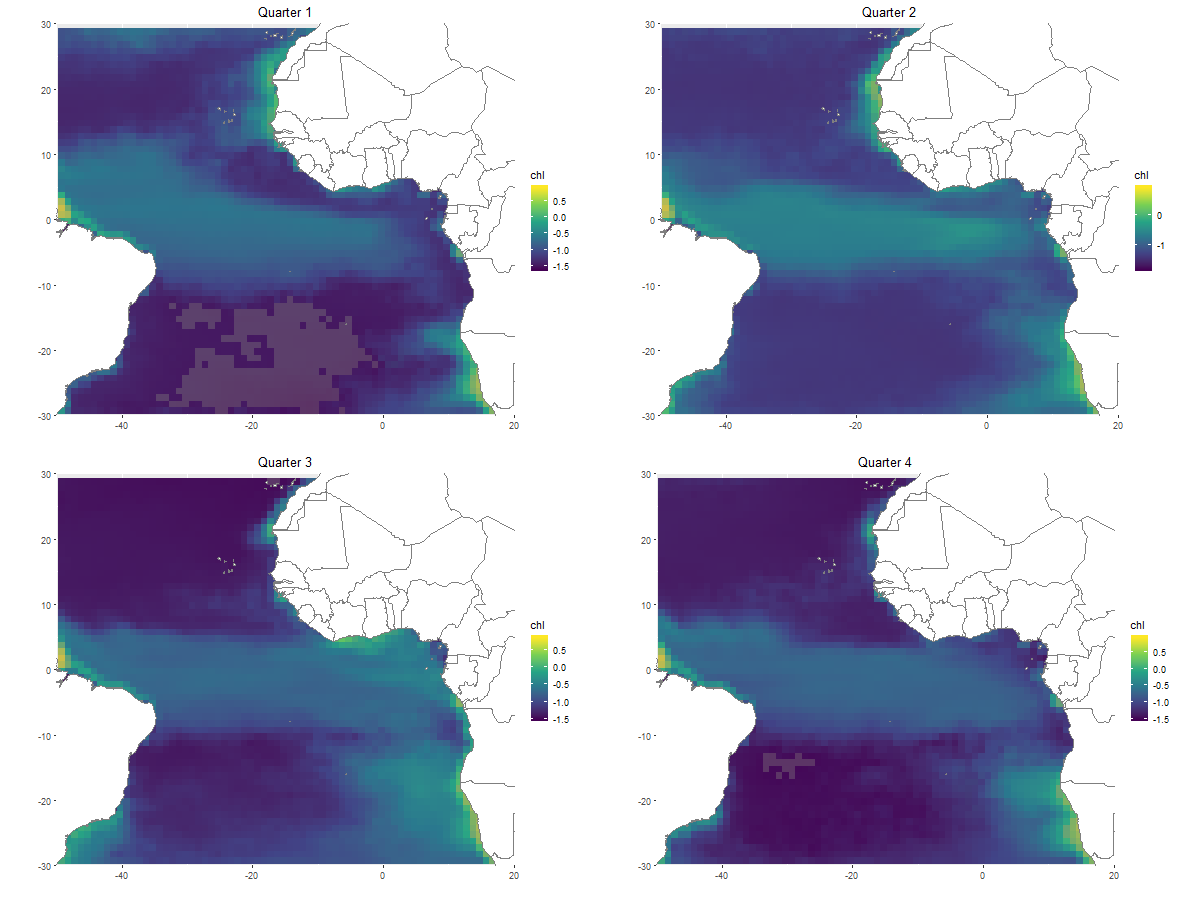


Figure B-1: Maps of depth in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. Areas where depth values lie beyond the range of depth values associated with the observed sets appear in transparent grey.



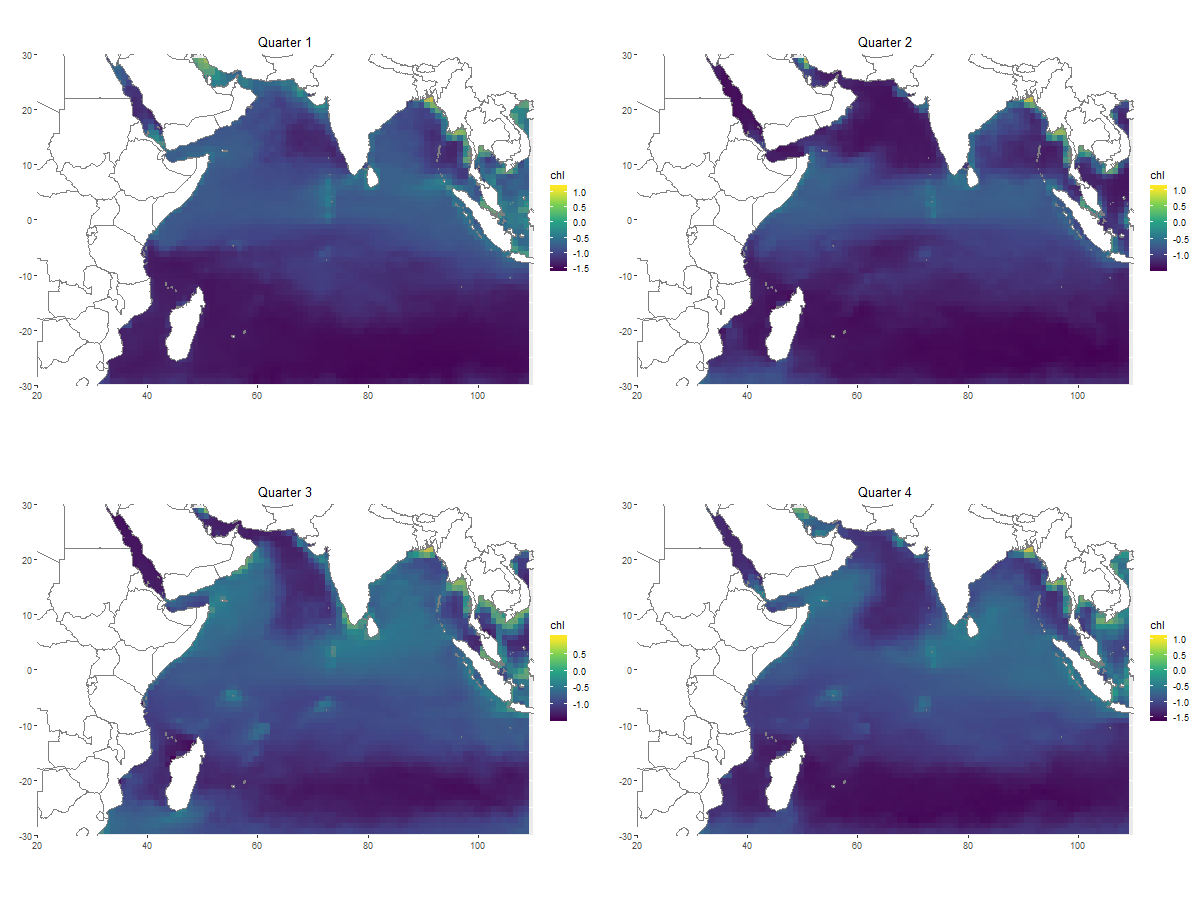
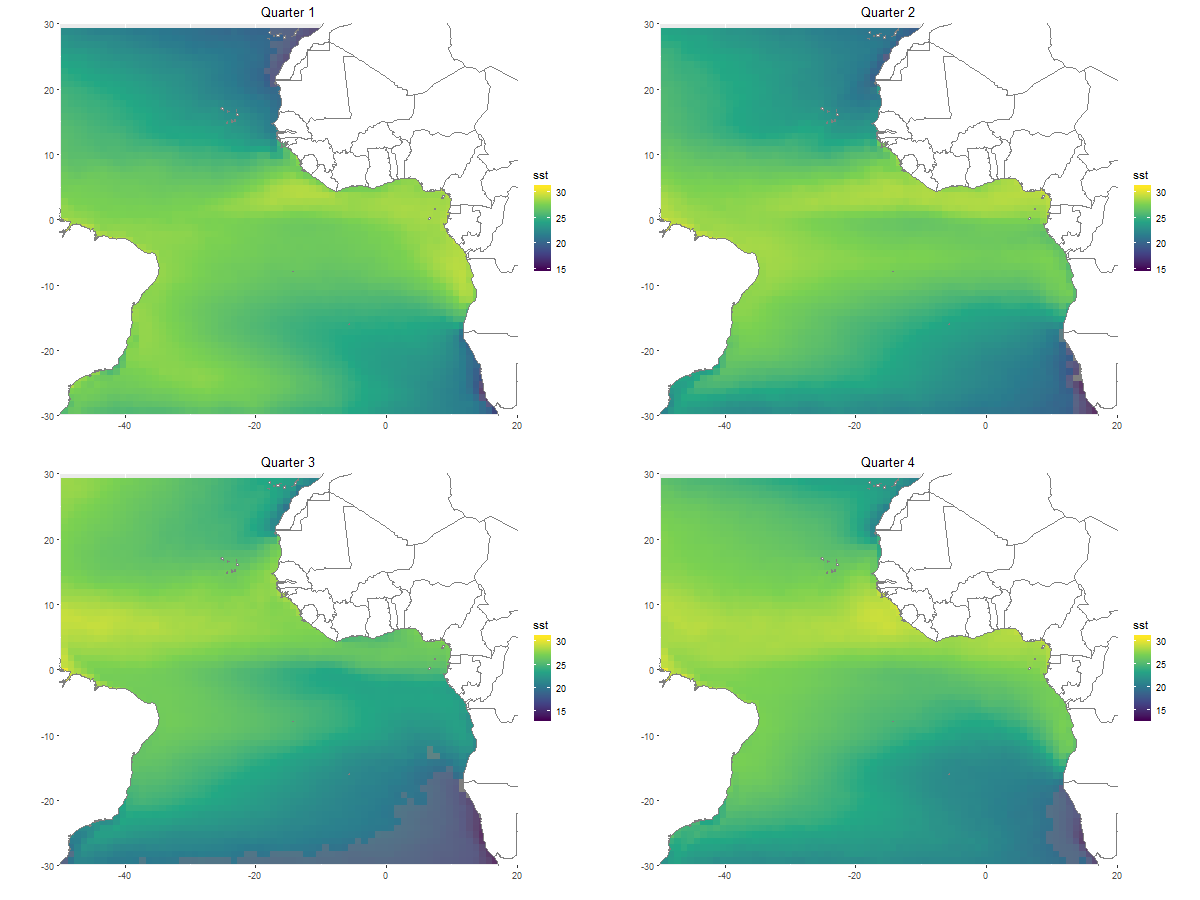


Figure B-2: Maps of chlorophyll-a concentration (CHL) (log-transformed) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where CHL values lie beyond the range of CHL values associated with the observed sets appear in transparent grey.



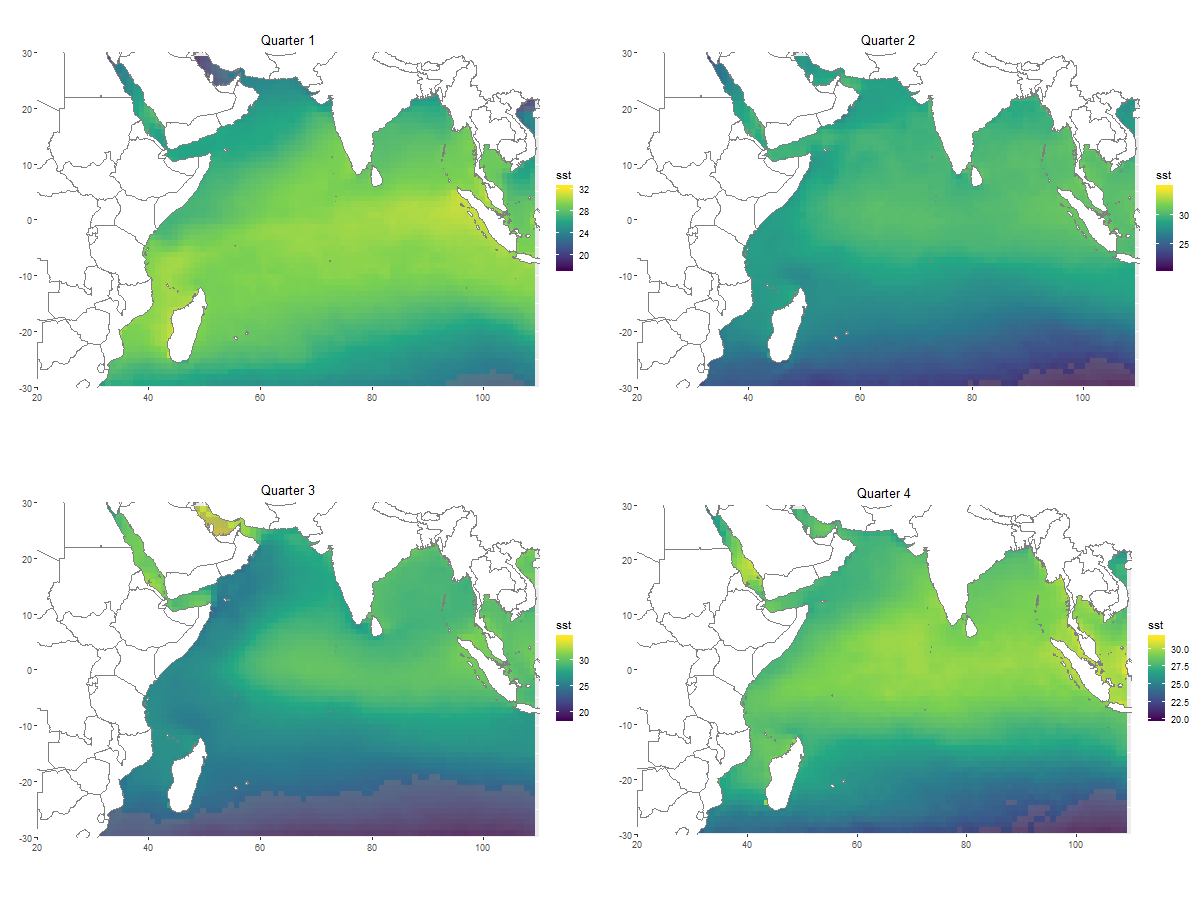


Figure B-3: Maps of sea surface temperature (SST) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where SST values lie beyond the range of SST values associated with the observed sets appear in transparent grey.

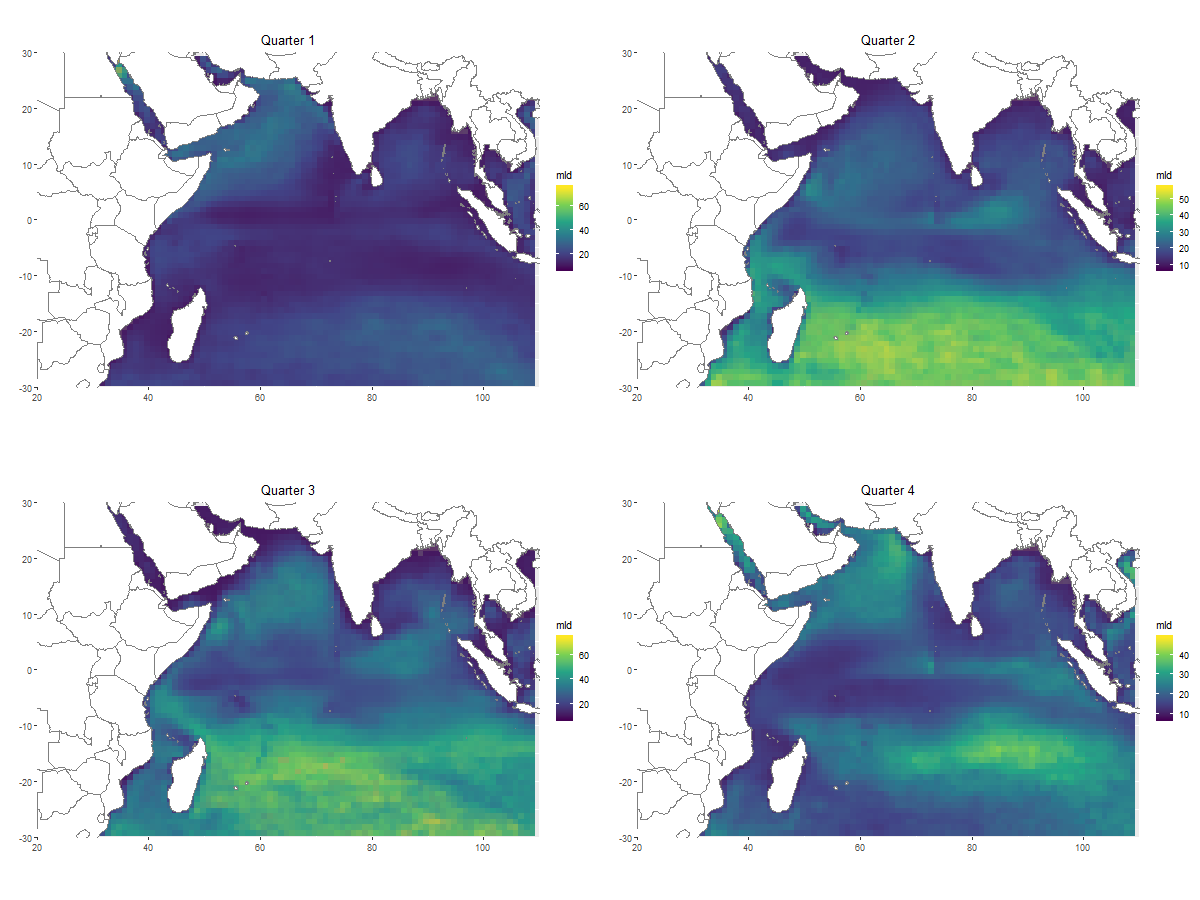
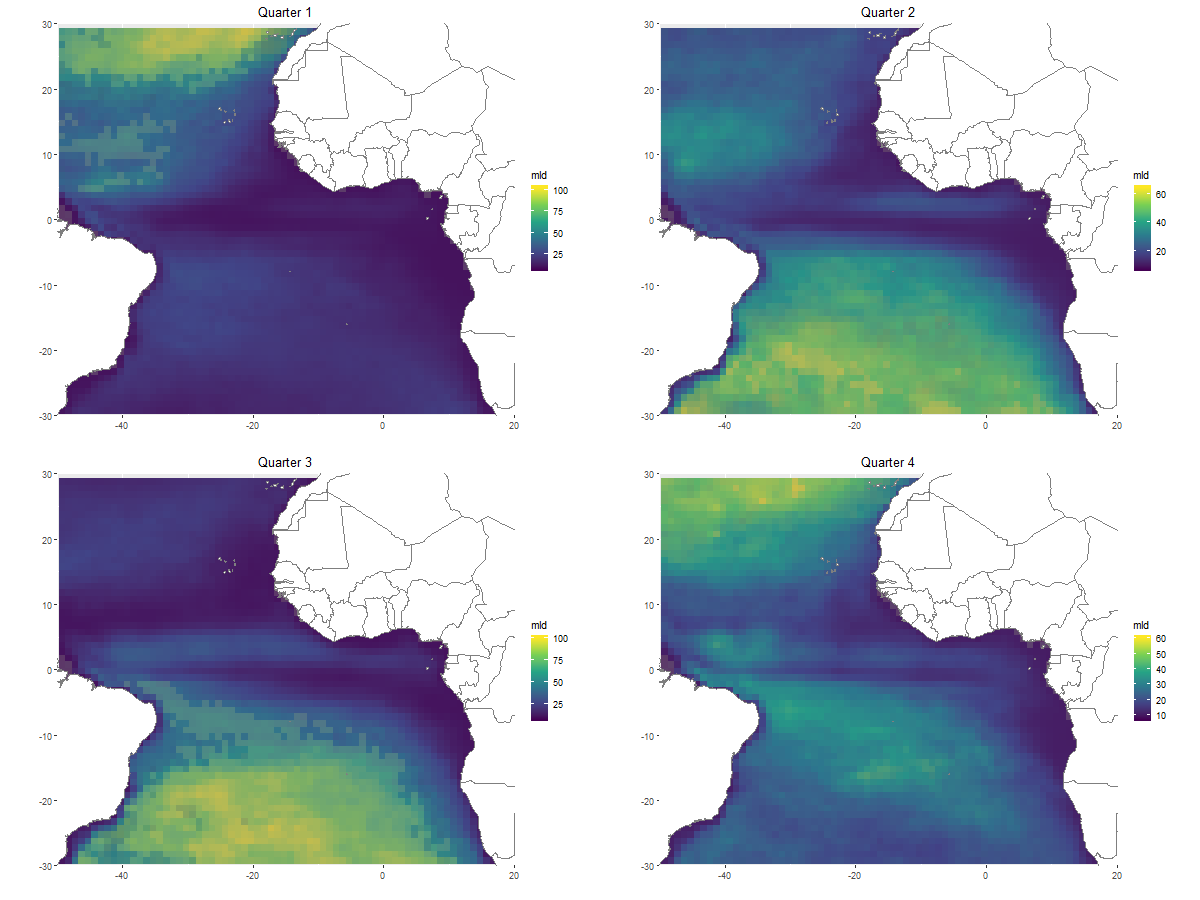
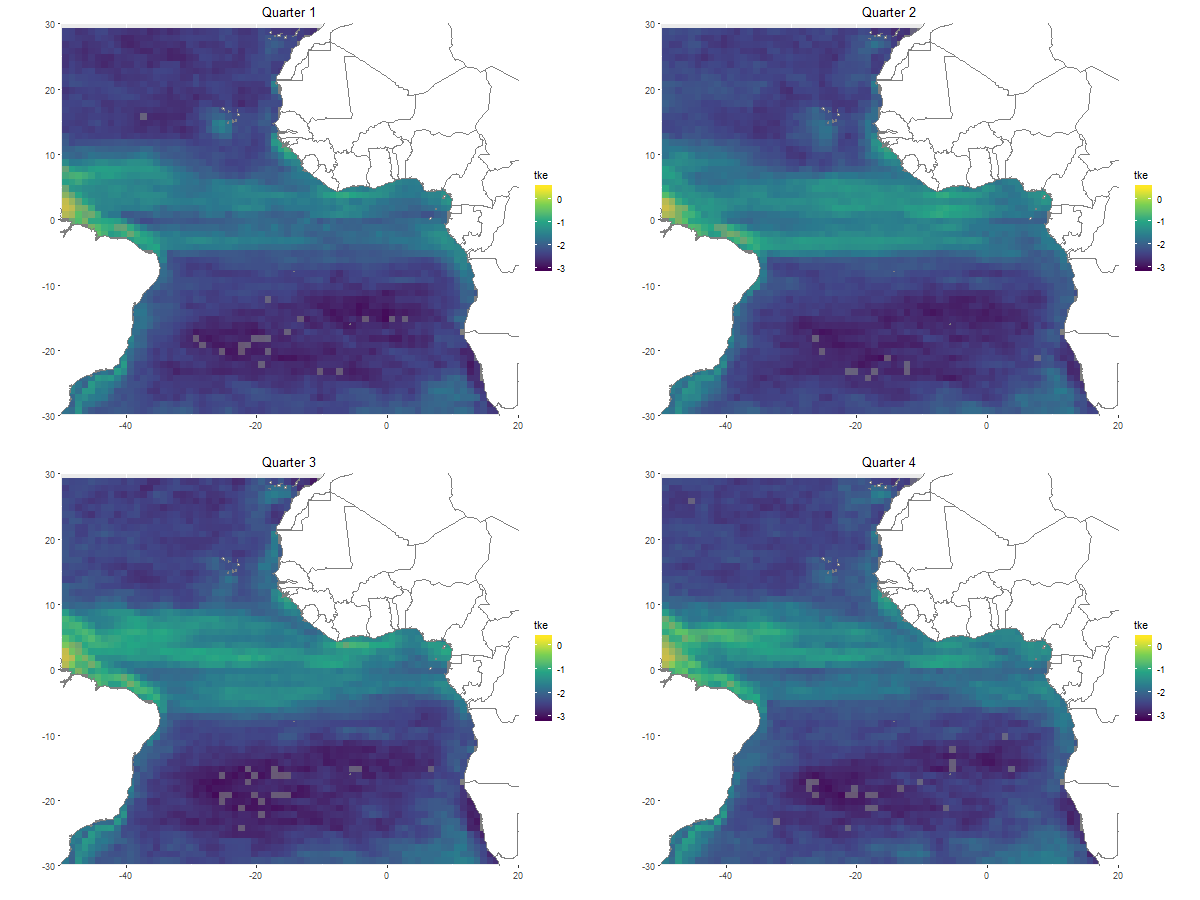


Figure B-4: Maps of mixed layer depth (MLD) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where MLD values lie beyond the range of MLD values associated with the observed sets appear in transparent grey.



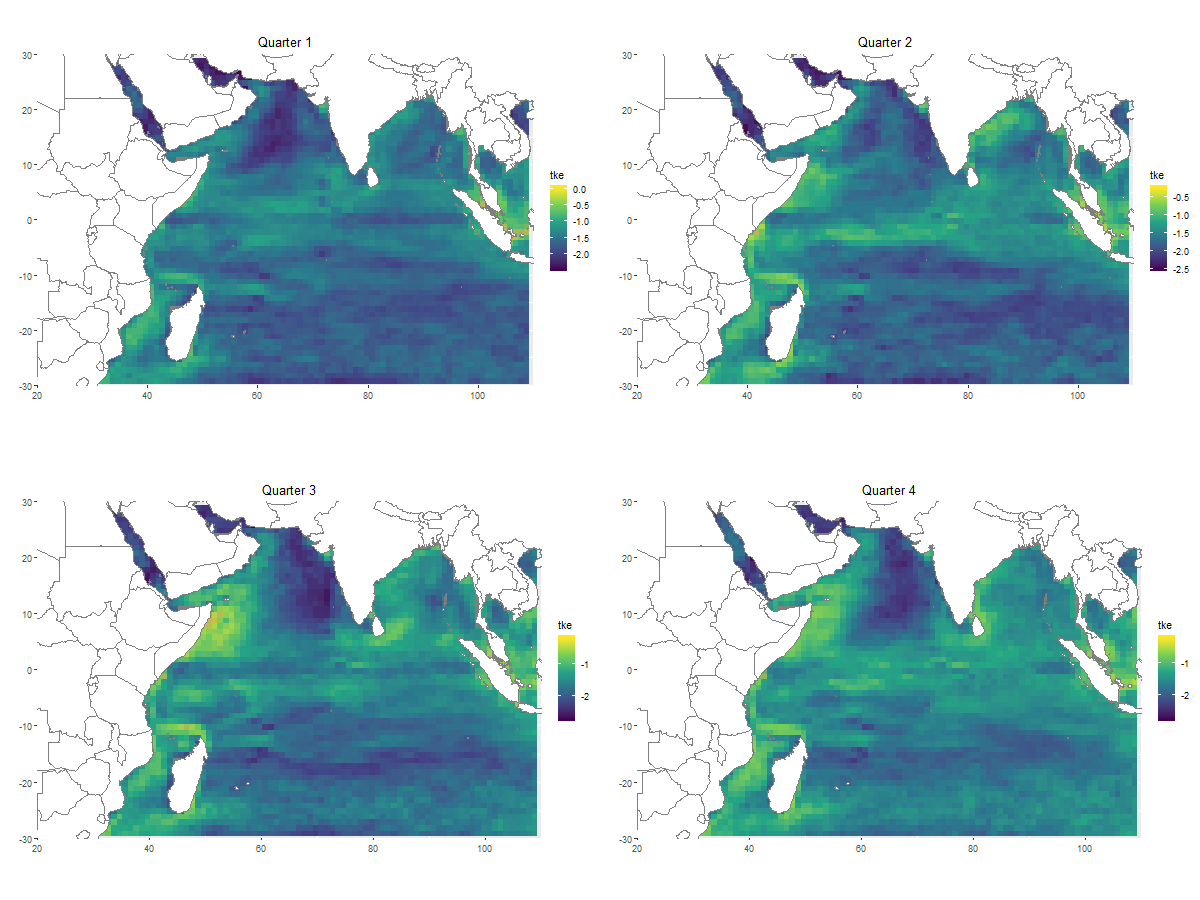


Figure B-5: Maps of total kinetic energy (log-transformed) (TKE) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where TKE values lie beyond the range of TKE values associated with the observed sets appear in transparent grey.



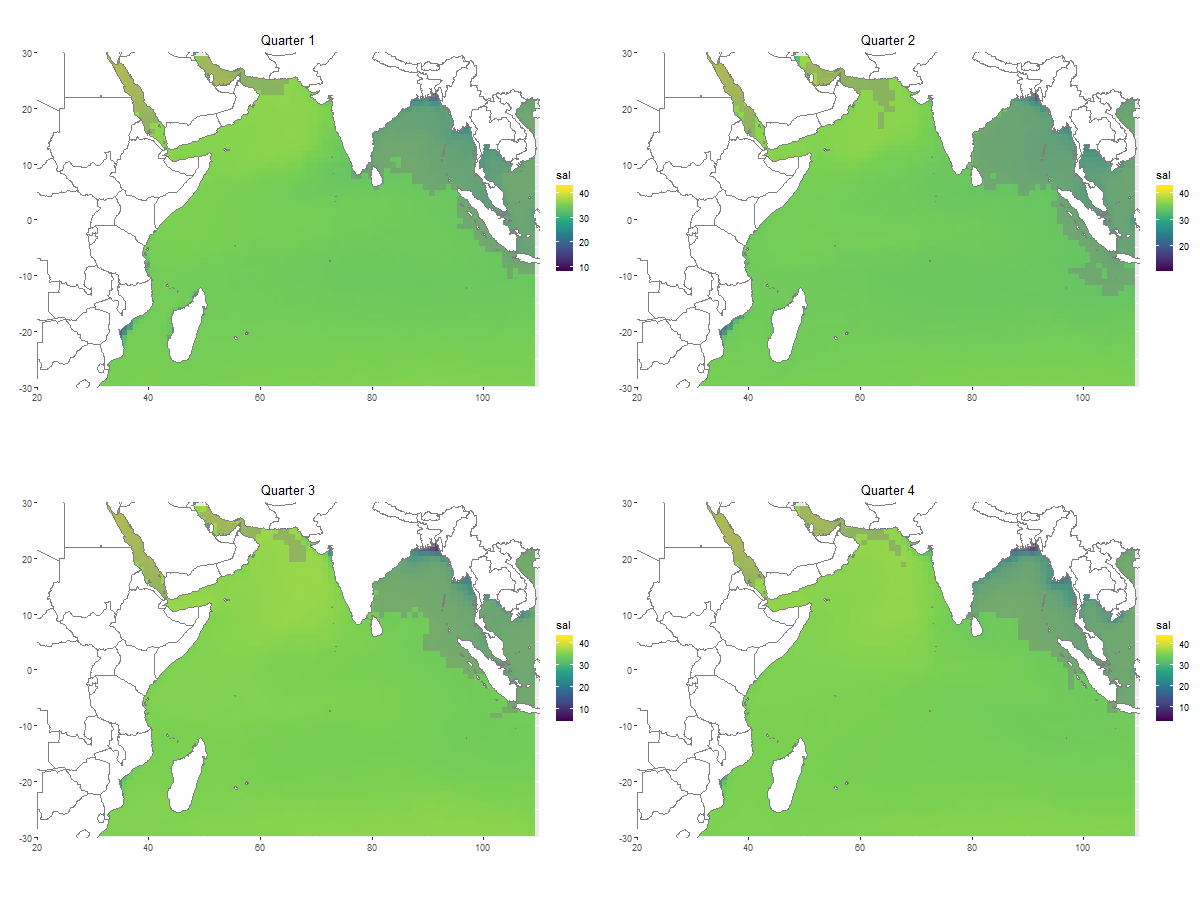
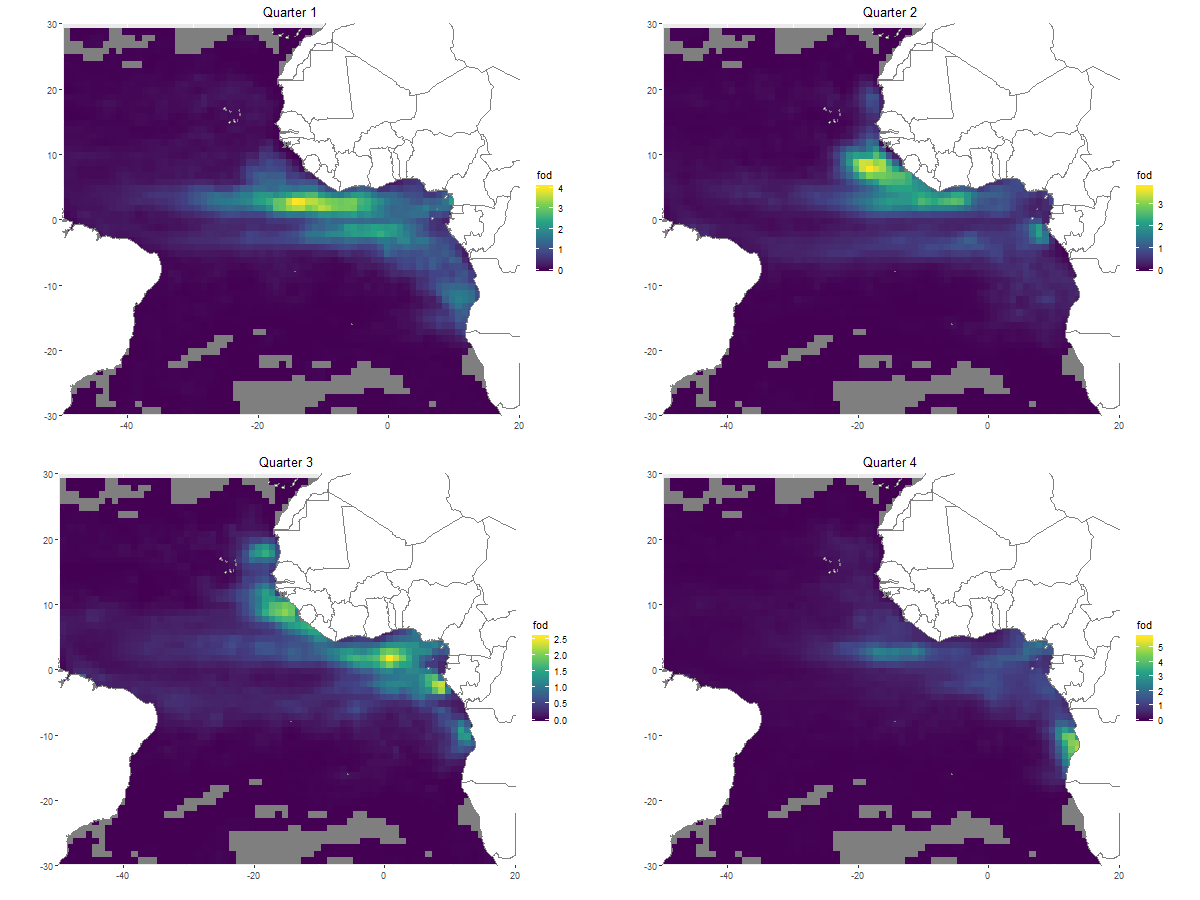


Figure B-6: Maps of salinity (SAL) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where SAL values lie beyond the range of SAL values associated with the observed sets appear in transparent grey.



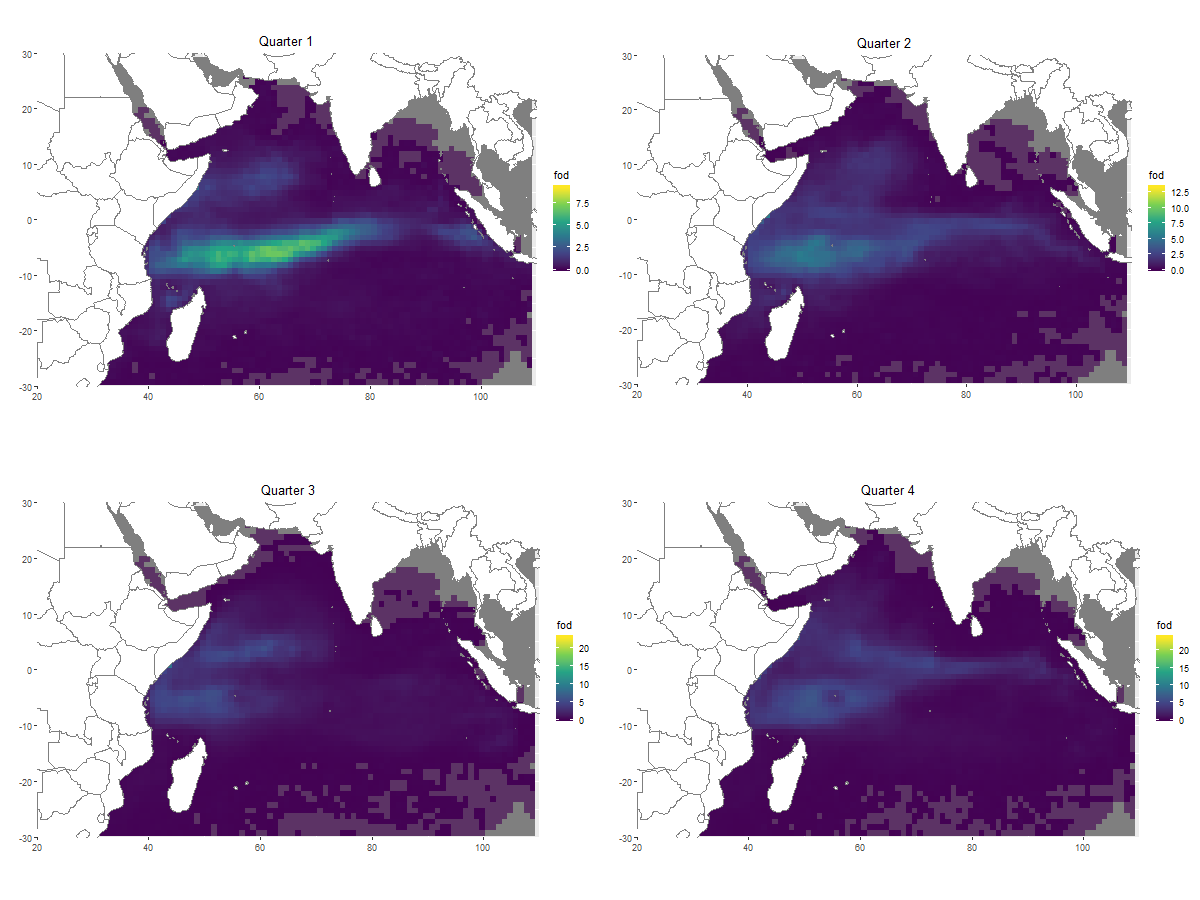


Figure B-7: Maps of floating objects density (FOBs\_DENS) in the Atlantic and Indian oceans at a 1° x 1° spatial resolution. For vizualization, maps are presented at a quarterly climatological resolution. Areas where FOBs\_DENS values lie beyond the range of FOBs\_DENS values associated with the observed sets appear in transparent grey.

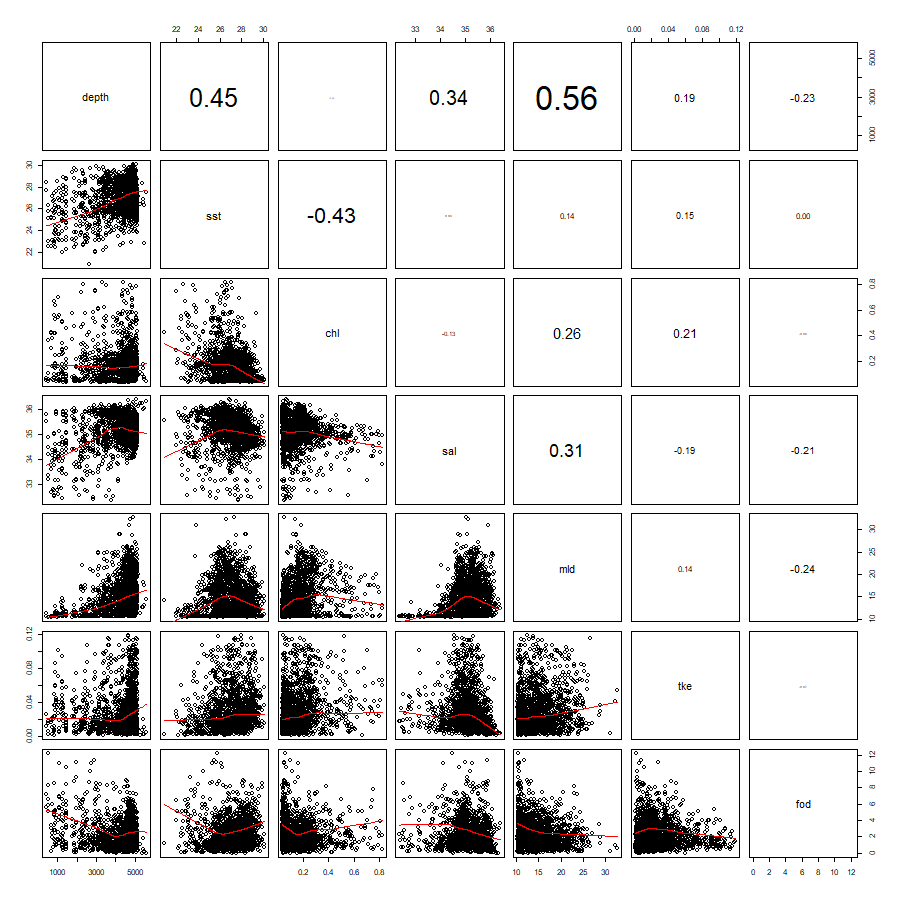


Figure B-8: Spearman’s rank correlation coefficients with text size proportional to correlations (upper panels) and scatterplots (lower panels) between all pairs of environmental covariates in Atlantic Ocean fishing sets.

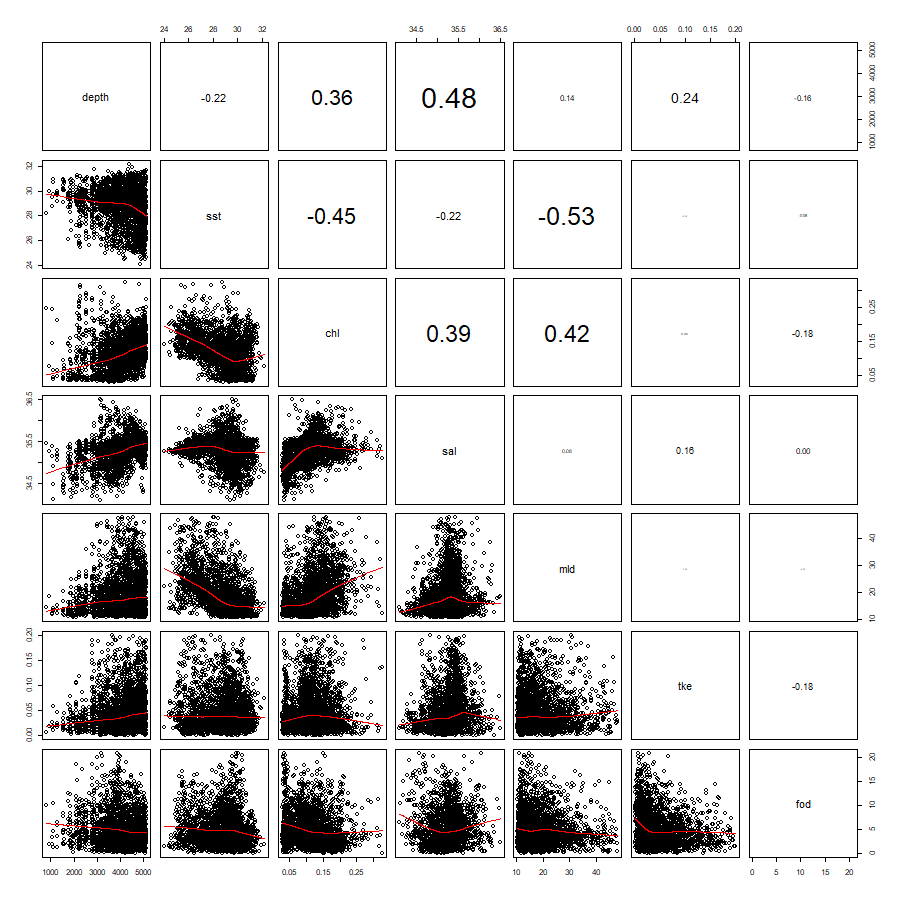


Figure B-9: Spearman’s rank correlation coefficients with text size proportional to correlations (upper panels) and scatterplots (lower panels) between all pairs of environmental covariates in Indian Ocean fishing sets.