

Spatiotemporal rasters in R terra

Anna Stroh
Cullen PhD student

Atlantic Technological University, Marine Institute

January 30, 2025



Ollscoil
Teicneolaíochta
an Atlantaigh

Atlantic
Technological
University



*Foras na Mara
Marine Institute*

A bit about me

- ▶ BSc in Biology (Freie Universität Berlin, Germany), MSc in Management of Marine Biological Resources (Uni Ghent, Belgium)
- ▶ 3rd-year Cullen PhD student in survey-based abundance index modelling (VAST, sdmTMB)
- ▶ I routinely work with raster/vector data to extrapolate, manipulate and extract environmental data for fish samples



Contents

Objective for this workshop

What are rasters?

The terra package

Objective for this workshop

Loading ERDDAP™ data using R

Importing trawl/pelagic trawl data from DATRAS

Questions

R code

Further material

Objective for this workshop

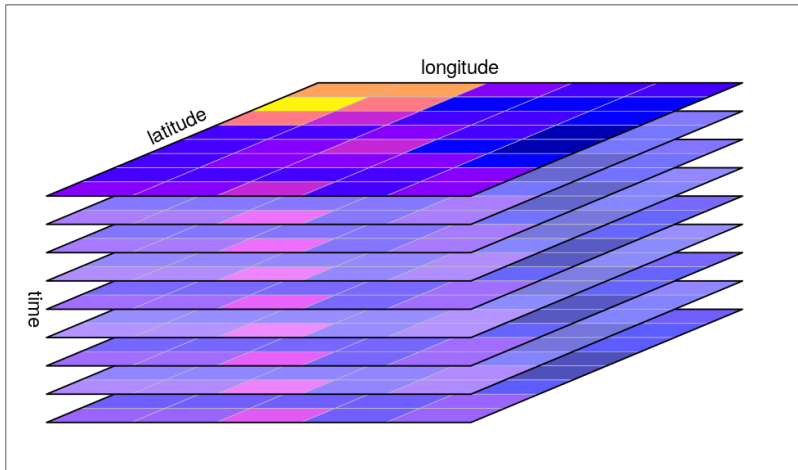
I will demonstrate a common workflow from loading raster data into an R session to manipulating and extracting raster values for a set of trawl survey hauls.

By the end of this workshop, you will be able to

- ▶ import ERDDAP™ within a R session,
- ▶ import ICES trawl survey data (DATRAS) within a R session,
- ▶ load and visualise rasters using terra,
- ▶ manipulate (crop, subset) and extract raster data from spatiotemporal rasters in terra.

What are rasters?

- ▶ Typically used to store spatially continuous phenomena
- ▶ Spatiotemporal rasters include a time dimension, storing spatial phenomena that vary over a period of time (i.e., hour, day, month, year)
- ▶ Raster data is aligned on a grid of equally sized rectangles or squares ("cells")
- ▶ Cells are aligned on the x and y axes (Easting and Northing, respectively)



Raster data cube

Reference: <https://r-spatial.github.io/stars/>

The terra package

- ▶ Successor of the raster package
- ▶ Provides methods for spatial data analysis with raster (grid) and vector (points, lines, polygons) data
- ▶ Unites many relevant functions in a singular package
- ▶ Compatible with other popular R packages for spatial data analysis (i.e. sf)
- ▶ Supports large raster files through optimised raster file storage: terra stores a raster on the disc, and only loads parameters that describe the raster file into memory - cell values loaded when needed

Comparison terra vs stars

When working with (spatiotemporal) rasters in R, you will find two popular packages: `terra` and `stars`. Both are excellent packages and have their advantages. A full comparison can be found [here](#) and [here](#).

Personally, I find `terra` more efficient, easier to understand if you are new to spatial data, and sufficient for common spatiotemporal raster processing.

Objective for this workshop

I will demonstrate a common workflow from loading raster data into an R session to manipulating and extracting raster values for a set of trawl survey hauls.

By the end of this workshop, you will be able to

- ▶ import ERDDAP™ within a R session,
- ▶ import ICES trawl survey data (DATRAS) within a R session,
- ▶ load and visualise rasters using terra,
- ▶ manipulate (crop, subset) and extract raster data from spatiotemporal rasters in terra.

Loading ERDDAP™ data using R

ERDDAP archives environmental, meteorological, oceanographic and biological data. Data stored on public ERDDAP™ servers can be accessed within R using the **rerddap R package**.

`rerddap` acts as an R interface to browse data stored on ERDDAP™ servers world-wide. It builds URLs to load gridded data (`griddap`) and data in tabulated format (`tabledap`, as of version 1.2.0) into the R session.

The use of `rerddap` can be limited depending on the research project if data in a given range (time or space) is not readily available on the MI ERDDAP™ server. A manual request may be necessary.

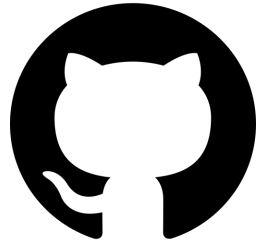
Importing trawl/acoustic trawl data from DATRAS

DATRAS (the Database of Trawl Surveys) is an online database of trawl surveys with standard data products:

- ▶ Haul information (HH)
- ▶ age-based catch (CA)
- ▶ length-based catch (HL)
- ▶ calculated products (i.e. indices)

`icesDATRAS` is a package acting as an R interface to access and import DATRAS survey products within R

Any questions?



Please download the zip file in the repository, or just the
SWHdata.nc and Rmd file at [https:
//github.com/AnnaStroh/terratutorial/tree/main/MI](https://github.com/AnnaStroh/terratutorial/tree/main/MI)

Further material

For basic functionality see the remaining **GitHub repository**:

- ▶ [lecture slides](#) introduce basic operations in terra with example code - ATU folder
- ▶ [R markdown for spatiotemporal rasters](#) with more code on raster manipulation - ATU folder
- ▶ [GetDATRASurveys](#) with examples on how to make multi-annual queries in icesDatras - MI folder