

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

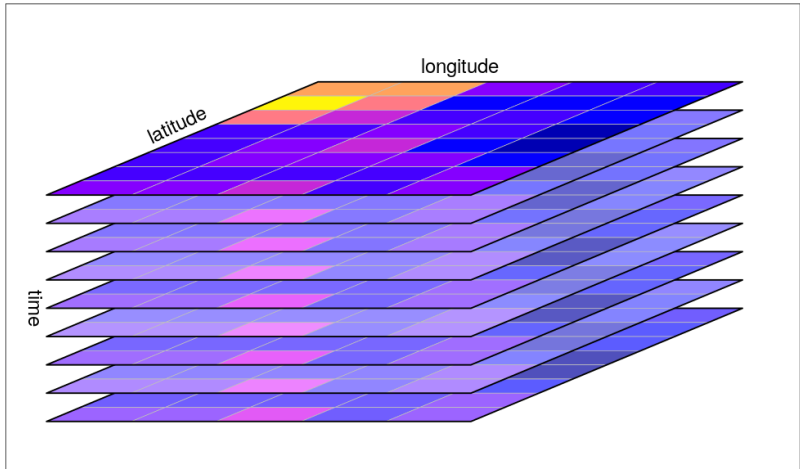
I will demonstrate a common workflow from loading raster data into an R session to manipulating and extracting raster values for a set of trawl survey hauls.

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, not the pixel values

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.

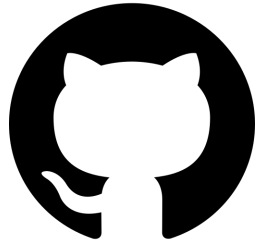
Importing trawl/acoustic trawl data from DATRAS

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