

Manual Finnmaid App

A shiny app compiled in R, written by Lara S. Burchardt and Jens Daniel Müller

In Short:

Since 2003, surface pCO₂, salinity, and temperature were recorded on the voluntary observing ship (VOS) Finnmaid. Within roughly 30 hours, the VOS mainly commutes between Finland/Helsinki in the north and Germany/Travemünde in the South, thereby crossing the entire Central Baltic Sea several times a week. Usually, the VOS sailed east of Gotland (route “E”), but sometimes also travelled along the western site of the island (route “W”). Occasional visits to Gdynia and St. Petersburg are labeled as route “G” and “P”, respectively. A temporal measurement resolution of one minute corresponds to a spatial resolution of roughly 0.3 nautical miles and results in a dataset comprising more than 3 million observations. This app allows the user to interactively subset the dataset in space and time, and calculate regional average values for each crossing of the VOS. Individualized outputs are presented in three types of graphs and can be downloaded as data file. A comprehensive biogeochemical interpretation of the observations is given in [Schneider and Müller \(2018\)](#).

How to subset the dataset?

Both space and time can be selected individually to generate the data subset for the outputs.

You can specify the date range in the option “Select a date range” (Fig1., 1)). Start date and end date can be chosen in a dropdown calendar (Fig1., 1)). It is not possible to select dates that no data is available for.

Apart from subsetting according to time, you can subset the data by geographic information. First, you can choose, which routes to depict (Fig1., 2)), as a default option, we incorporated data for all four routes into the analysis. Second, you can specify the exact coordinate window you want to analyze. For that, you can adjust the north, east, west and south limit of the coordinate box separately (Fig1., 3)). After changing any of the default option, you need to press the “Apply Change” button (Fig1., 4)), which will refresh the data input and therefore the plots and possible output files. In the map shown in the app, you will see your chosen routes depicted and your chosen coordinate box in grey (Fig1., 5)).

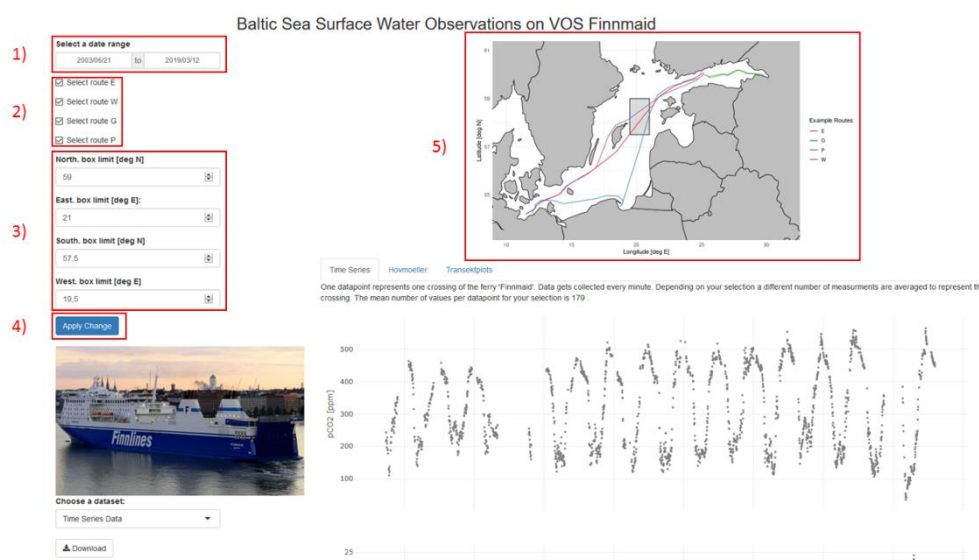


Figure 1: Overview of the App with indications for subsetting options.

For a specific time range, you chose not all routes might be included in the dataset, simply because the ship did not commute on that route in the specified time. All routes, you chose on the left, will be shown on the map in this case shiny.

Data Outputs

Plots

The data is processed in three different ways, leading to three types of visualization. The visualization is to be chosen over the three different tabs under the map (Fig. 2., 7)) For the first plot – a simple **time series** plot – data is preprocessed in the following way:

After being filtered for the chosen parameters (data range, route, coordinates) data is being averaged for each ID. One commute of the ship from for example Helsinki to Travemünde gets one ID even if it is spanning two days. The mean is calculated for the date, to be able to get insights into when the commute took place. Otherwise, the mean is calculated for all four parameters pCO₂, Salinity, temperature and O₂. Shown in the interactive plots as well as in the downloadable output files are also minimum and maximum as well as standard deviation per ID. Since a different number of data points might be going into the calculations, this number is given in the app above the time series plot (Fig. 2., 7)).

The second representation of the data are **Hovmöller** plots. For this the geographic information of each data point is used to calculate the distance to Travemünde in kilometers. The values are averaged over time and space, values are combined into weeks as well as into distance intervals of 50 kilometer values are then averaged for each interval per week.

In a third representation **transect plots** are shown. No averaging is done for this representation. In contrast to the other visualizations single transects of the VOS Finnmaid are given, showing values for the four different parameters in dependence of the distance to Travemünde in kilometers. Depicted are transects within a 14-day window after the start date you selected under “Select a date range”. Therefore, if there are no transects in a certain 14-day time range, an error message occurs and a different start date needs to be chosen. Eventually the app needs to be reloaded after this kind of error message.

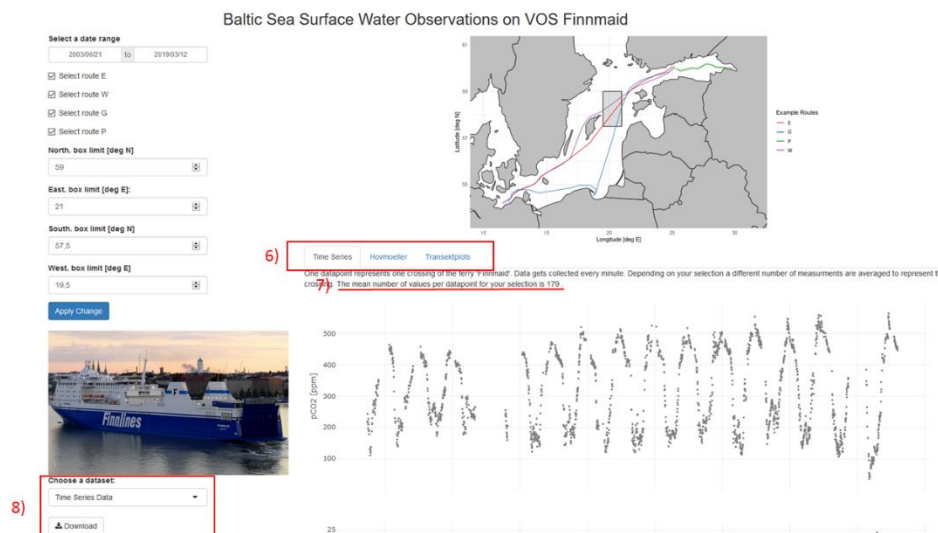


Figure 2: Overview of the app with indications on data outputs and download of raw data.

Raw Data

For all three plot options the raw data can be downloaded (Fig. 2., 8)). All data that is needed to reproduce the visualizations is available as a csv-file. The wanted dataset needs to be chosen in the drop down menu (Time Series Data; Hovmoeller Data, Transect Data, Fig. 2., 8)). After that the “Apply Change” Button (Fig. 1., 4)) needs to be pressed in order to get the data by clicking the “Download” Button (Fig. 2., 8)). The data is saved with the information in the chosen dataset, specified date range and coordinate space in the file title.