Manual: Interactive visualization of Finnmaid pCO_2 observations

A R-shiny app by Lara S. Burchardt and Jens D. Müller

In Short:

Since 2003, surface pCO2, salinity, and temperature were recorded on the voluntary observing ship (VOS) Finnmaid. The VOS mainly commuted between Finnland/Helsinki in the north and Germany/Travemünde in the South, thereby crossing the 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 Poland/Gydnia and Russia/St. Petersburg are labeled as route "G" and "P", respectively. With a temporal measurement resolution of one minute corresponding to a spatial resolution of roughly 0.3 nautical miles, the obtained dataset comprises more than 3 million observations in 2019. This app allows the user to interactively subset the dataset in space and time. Individualized outputs are visualized 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).

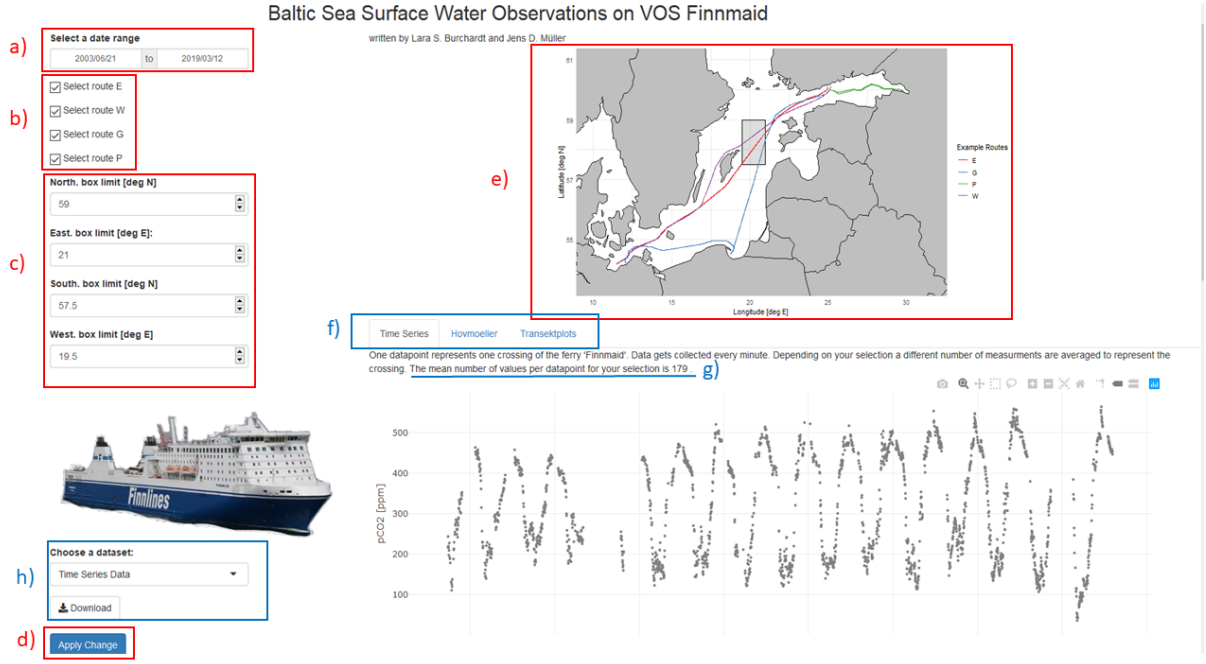

Figure 1: Overview of the App. Marked in red are subsetting options and how to check which routes are taken into account. Indicated in blue are data outputs.

How to subset the dataset?

You can specify the date range in in a dropdown calendar under "Select a date range" (Fig.1, a). Further, you can subset the data by geographic information: First, you can choose, which routes to select (Fig.1, b). Second, you can specify the area to be analyzed by defining latitude and longitude limits (Fig.1, c). After changing the default settings, you need to press the "Apply Change" button (Fig.1, d), which will refresh the data subsetting and therefore the plots and output files. In the map, you will see your chosen routes and area (Fig1, e).

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

How to access generated outputs?

Plots

The data is first filtered for the chosen conditions (data range, route, area) and then further processed in three different ways, leading to three types of visualization. The type of visualization is to be chosen over the tabs under the map (Fig.1, f).

For the **time series** plot, subsetted data is averaged for each individual crossing of the selected area. The interactive plots show mean values calculated for the date and all four parameters pCO_2, salinity, temperature and O_2. In addition, the downloadable output files also report minimum and maximum values as well as standard deviation per crossing. The mean number of observations per crossing is given in the text above the time series plot (Fig.1, g).

The second visualization type are **Hovmöller** plots. To generate those plots, the distance to Travemünde is calculated for each observation. Mean values of each parameter are calculated for intervals of one week and 50 kilometer and indicated by color in the Hovmöller plots.

As a third representation **transect plots** are generated. No averaging is done for this representation. In contrast, raw values for the four different parameters are shown in dependence of the distance to Travemünde. 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.

Data file

Subsetted and averaged data sets underlying all three plot options can also be downloaded as csv-file. The wanted dataset needs to be chosen in the drop down menu (Time Series Data; Hovmoeller Data, Transect Data, Fig.1, h). After that the "Apply Change" Button (Fig.1, d) needs to be pressed in order to get the data by clicking the "Download" Button (Fig.1, h). Information about the chosen dataset type, specified date range and area are indicated in the file name.