

Big Data analysis for visualizing GHG emissions

Your task is to develop a graphical user interface (GUI) which serves to display the global emission data of CO₂ vividly. For this purpose, we provide you the data from two different global emission inventories: EDGAR and ODIAC.

The recommended programming language is Python or R but any other programming language is also fine. In the end, we will only examine the frontend (GUI) and the output files that can be downloaded using the GUI.

Datasets provided

On the hard disk provided, you can find the two datasets that you should use:

- **EDGAR:** one NC file for each year since 1970 in a spectral resolution of $0.1^\circ \text{ latitude} \times 0.1^\circ \text{ longitude}$
- **ODIAC:** one zip folder for each year since 2000 containing TIF files in a spectral resolution of $1 \text{ km} \times 1 \text{ km}$

For the two file types, NC and TIF, there exist several libraries to read them. Please find a suited one in order to open and work with the data.

Afterwards, please convert the units of the two emission inventories to the common unit $\frac{\mu\text{g}}{\text{m}^2 \cdot \text{s}}$.

Detailed task description

With the help of the two datasets provided, you should develop an interactive and intuitive GUI that allows a user to display easily the emission values of any place (location or area) in the world as a map (cf. Figure 1 and Figure 2) or time series (cf. Figure 3) depending on the user inputs. Furthermore, there should be the possibility to download the data of the chosen area or time of interest to an ASCII file (e.g. csv, txt, etc.).

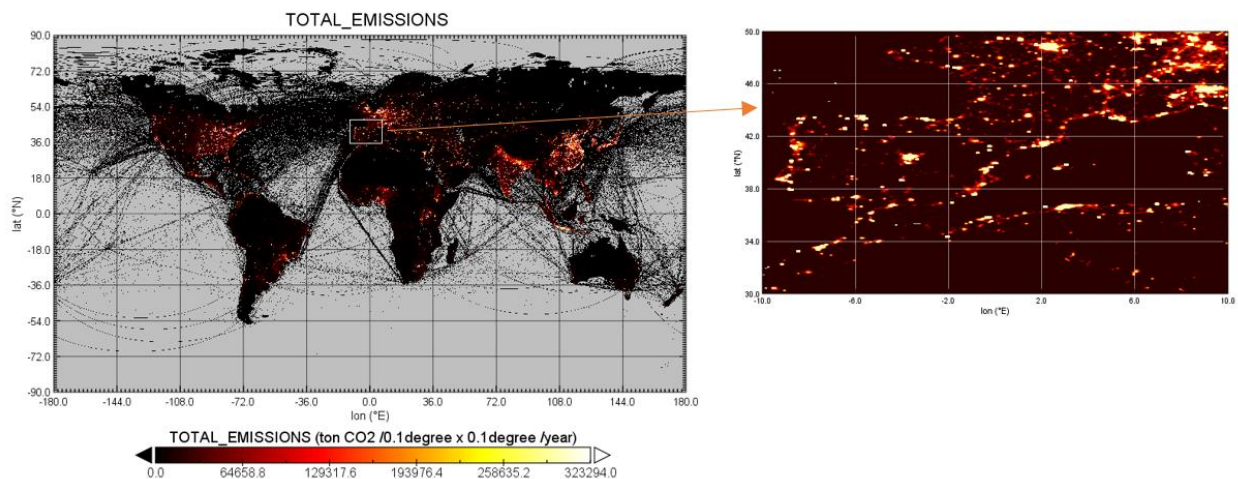


Figure 1: EDGAR CO₂ emission data global (left) and southern Europe (right).

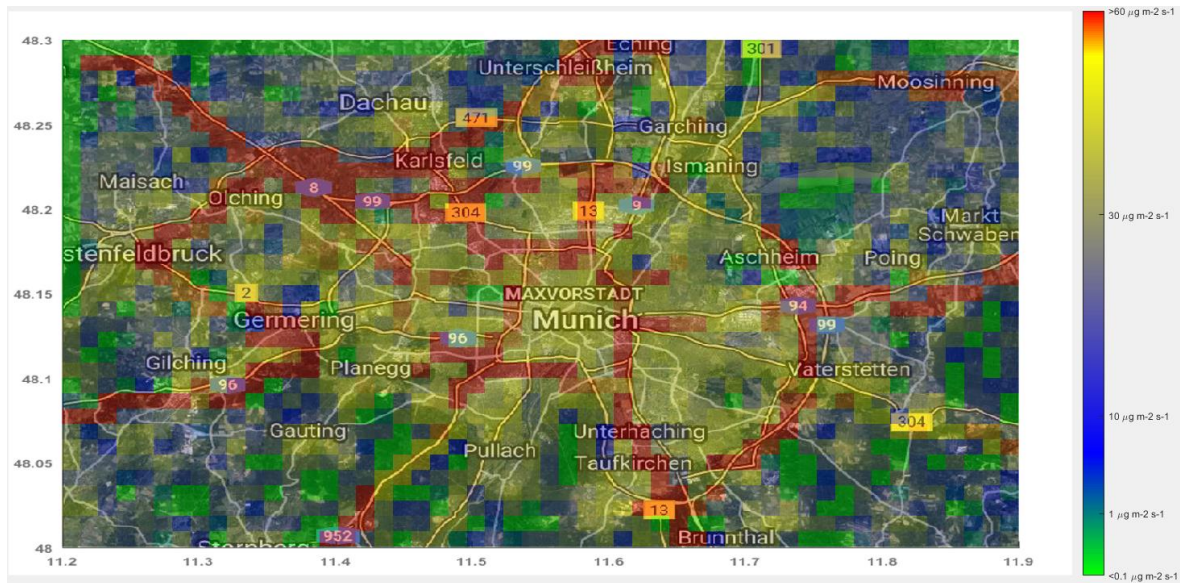


Figure 2: CO₂ emission map of Munich

Examination

At the end of the challenge, please upload all your source code to the hard disc. The following properties should be fulfilled and will be examined:

- The GUI should run on any computer without the need of installing additional packages. In case you are using a script language, such as Python or R, please consider to build an executable file (for Windows 10 64-bit OS)
- Although the input data is quite big, the GUI should react fast to a user input (max. 10 s)
- The GUI should at least provide the following outputs:
 - Creation of an emission map for a specific area and time
 - Creation of a timeline for a specific area of interest and time period (as in Figure 3)
 - Creation of an interactive map (e.g. in GIF format) illustrating the spatial variation of the emissions of a user-defined area through time.
 - Comparison between the two emission inventories for a specific location and time (conversion into the same unit is essential)
 - Possibility to download the emission data for the four described use cases to an ASCII file (e.g. *.csv), that allows to easily reconstruct the selected emissions (i.e. can be read into MATLAB, Python and further processed)
- The emission numbers must be correct. To check that, we will download the data for a specific area in the world using your GUI and compare it to an already prepared file containing the same information.
- Furthermore, the design of the GUI providing an intuitive way of using the interface are important aspects, too.

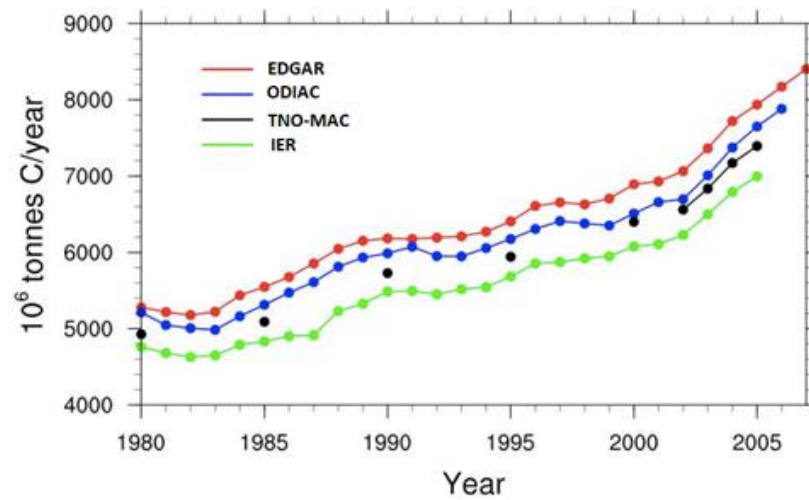
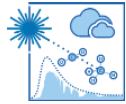


Figure 3: Time series of the emissions for an area of interest (AOI; here: 1980-2007).

Contact

If you have any questions regarding the task, you can always ask one of us. When we are not present at the Science Hack you can also contact us via email:

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