# CAMS Profile Plotter Tool

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## Introduction :

CAMS Profile Plotter Tool is GUI application designed for visualizing vertical profiles and heat maps of atmospheric pollutants using data from the CAMS Atmospheric Data Store (ADS). The tool simplifies the process of working with NetCDF files, providing streamlined options for viewing, cropping, and analyzing atmospheric data.

Its primary focus is on facilitating vertical profile analysis, making it easier to interpret pollutant distribution across different atmospheric layers.

## Instructions:

Features :-

1. Quick Check for NetCDF Dimensions
2. NetCDF Time Slicing
3. Crop NetCDF
4. Generate Vertical Plot
5. Generate Heat Map

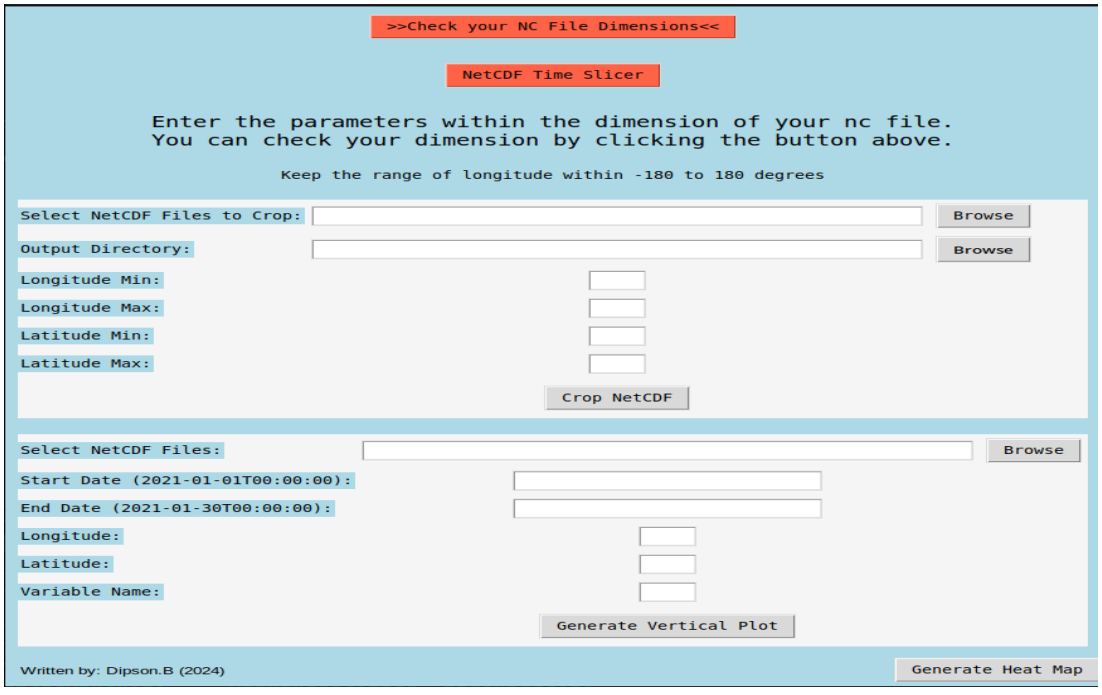



**Fig 1** : Main Graphical User Interface.

## 1.Quick Check For NetCDF Dimensions

Use the NetCDF file dimensions to quickly review the available variables, number of time steps, and the range of latitudes present after selecting a NetCDF (.nc) file.

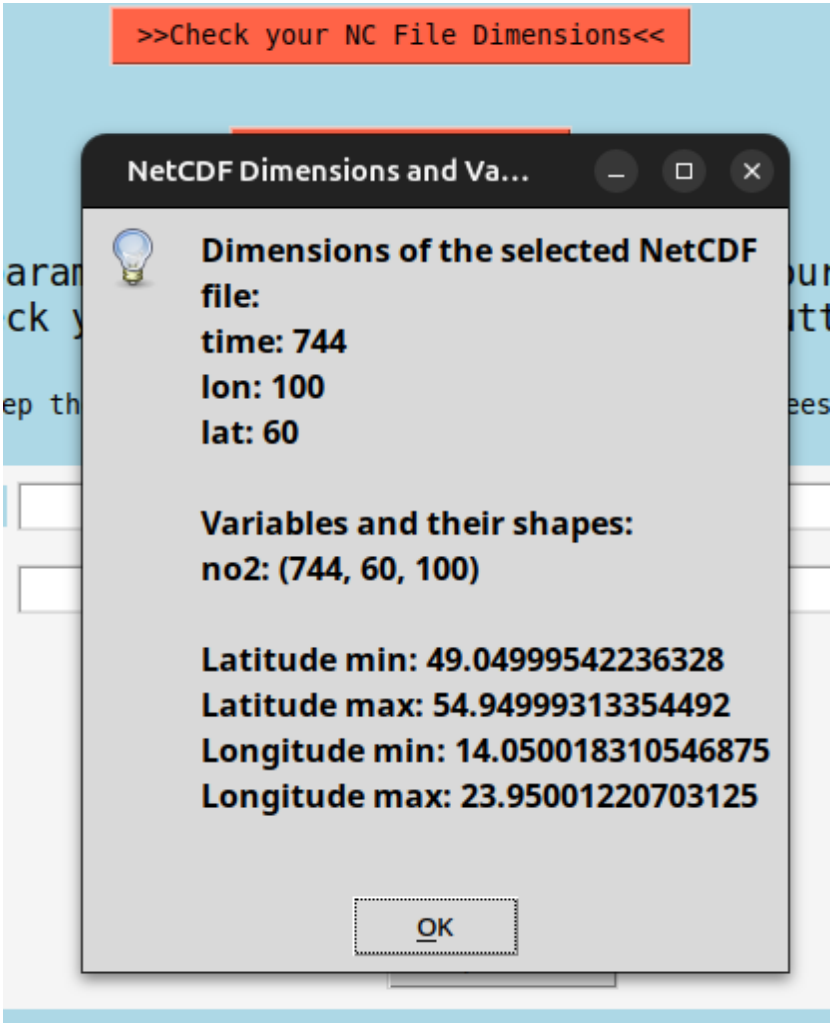



**Fig 2** : Check Dimension feature for quick review of NetCDF file.

## 2. Cropping NetCDF file

The 'Crop NetCDF' option allows users to extract a specific region from the NetCDF file by specifying the desired minimum and maximum latitude and longitude values. In this example, Germany has been cropped from (.nc) file.

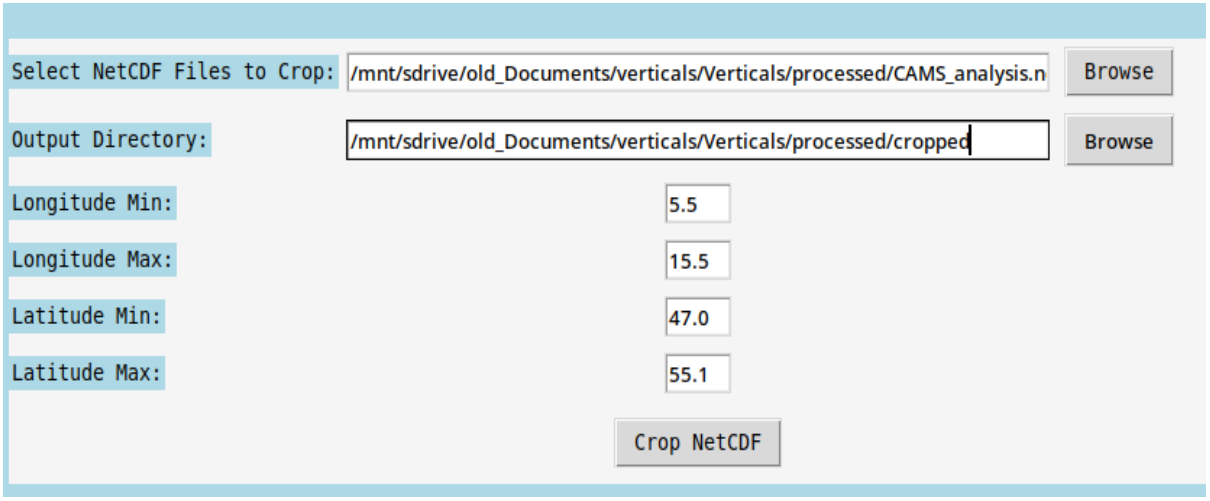



**Fig 3** : Interface to Crop NetCDF File.

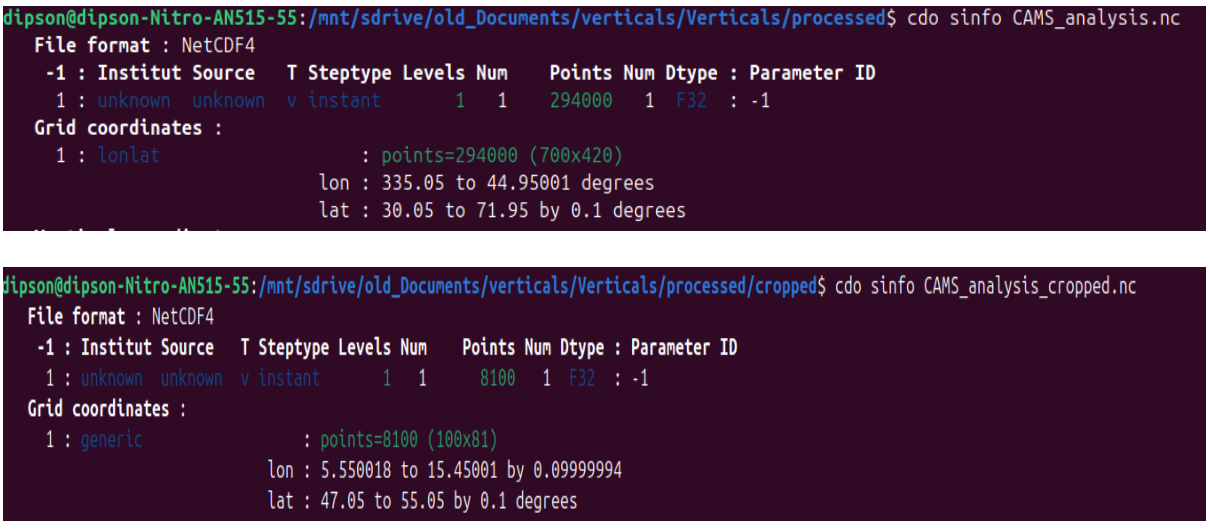



**Fig 4** : Results of Cropping tool displayed using Cliamte Data Operators(CDO) in the terminal.

## 2. NetCDF Time Slicer

The NetCDF Time Slicer is used to trim NetCDF files based on specified time ranges. Additionally, users can select specific variables, as well as define minimum and maximum latitude and longitude values for more precise variable-level slicing.

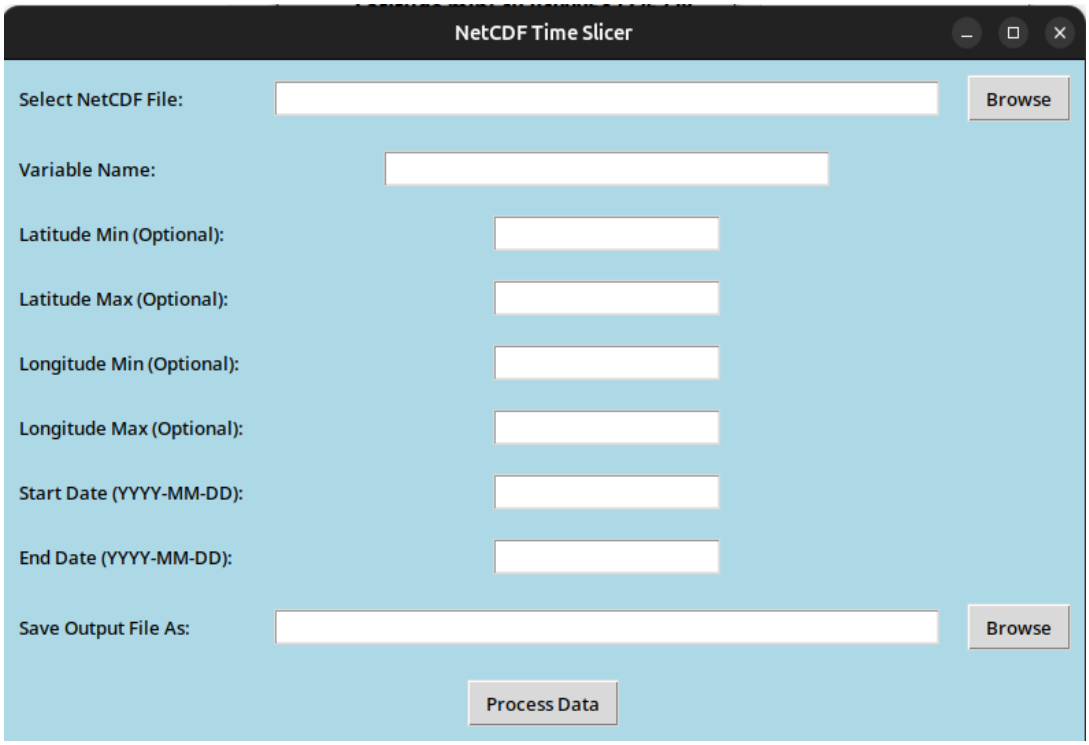



**Fig 5** : Interface for Slicing NetCDF file based on Time or Latitude and Longitude.

To begin, select the desired NetCDF file by clicking the "Browse" button. Then, enter the variable name you wish to extract (e.g., `no2`, `temperature`, etc.). You can optionally define the minimum and maximum latitude and longitude values to crop a specific geographical region; if left blank, the entire spatial extent will be used. Next, specify the start and end dates in the format `YYYY-MM-DD` to filter the data by time. Finally, provide a name and location to save the output file, and click "Process Data" to generate the trimmed NetCDF file based on your selections. This tool is useful for focusing on specific time periods, regions, or variables from large NetCDF datasets.

## Generating Vertical Plot

The 'Generate Vertical Plot' option allows user to visualize the vertical profile of a selected variable over a specified time range and location. In the examples mentioned below vertical plots of $NO_2$ have been generated for the periods 2021-01-01 to 2021-01-30 and 2021-01-01 to 2021-01-07.

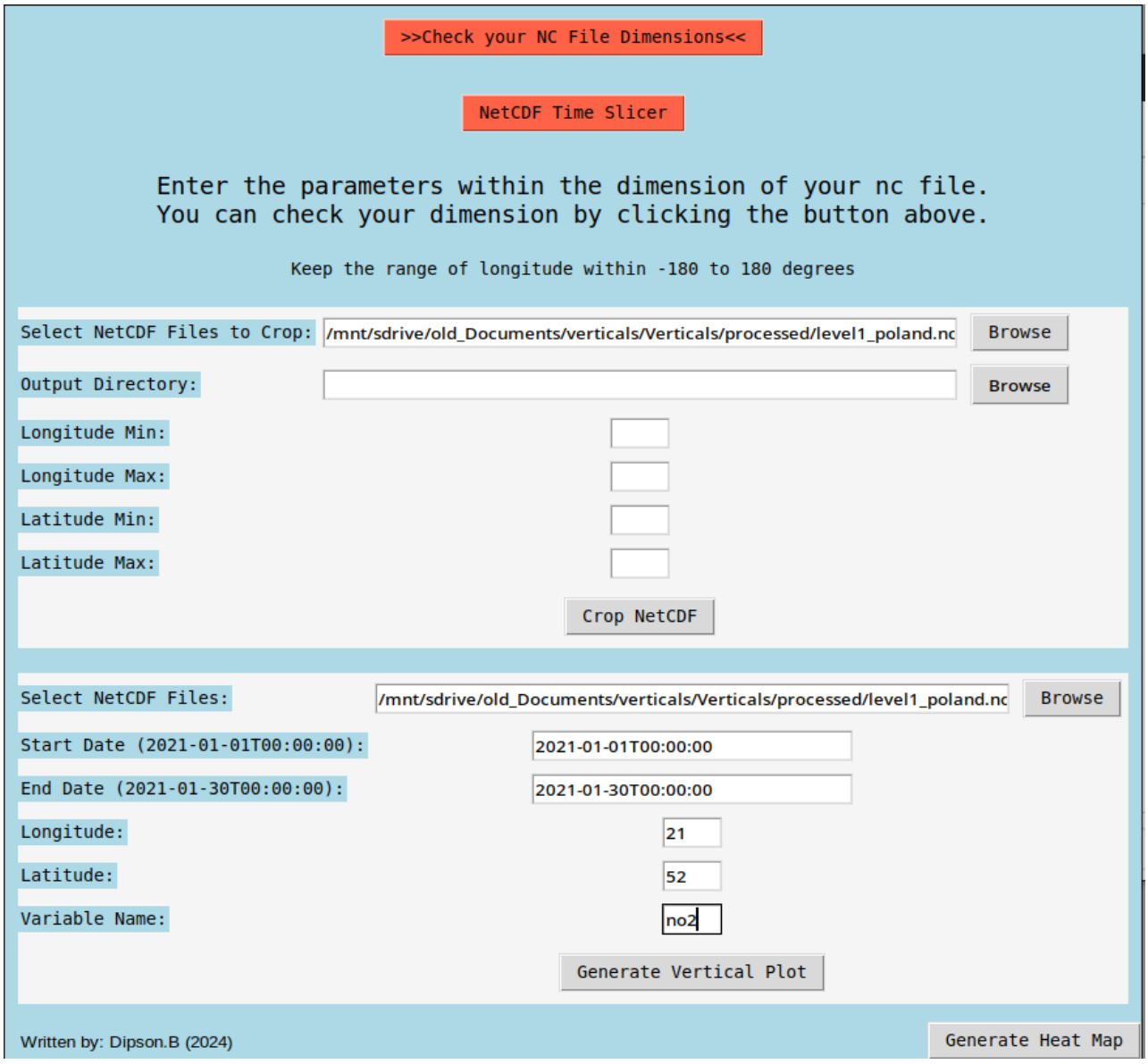



**Fig 6** : Interface for generating Vertical Plots based on time limits , coordinates and Pollutant.

To begin, click "Browse" to select a NetCDF file. Next, specify the start and end dates in the format `YYYY-MM-DDTHH:MM:SS` to define the time range of interest. Enter the longitude and latitude coordinates where the vertical profile should be extracted. Then, provide the variable name (e.g., `no2`) that you want to analyze. Once all fields are filled, click "Generate Vertical Plot" to create a plot showing how the variable behaves at different vertical levels over time at the selected location.

The examples below show vertical profiles of NO2 at the coordinates 21.0° longitude and 52.0°. latitude, generated for two different time periods: from January 1 to January 30, 2021, and from January 1 to January 7, 2021.

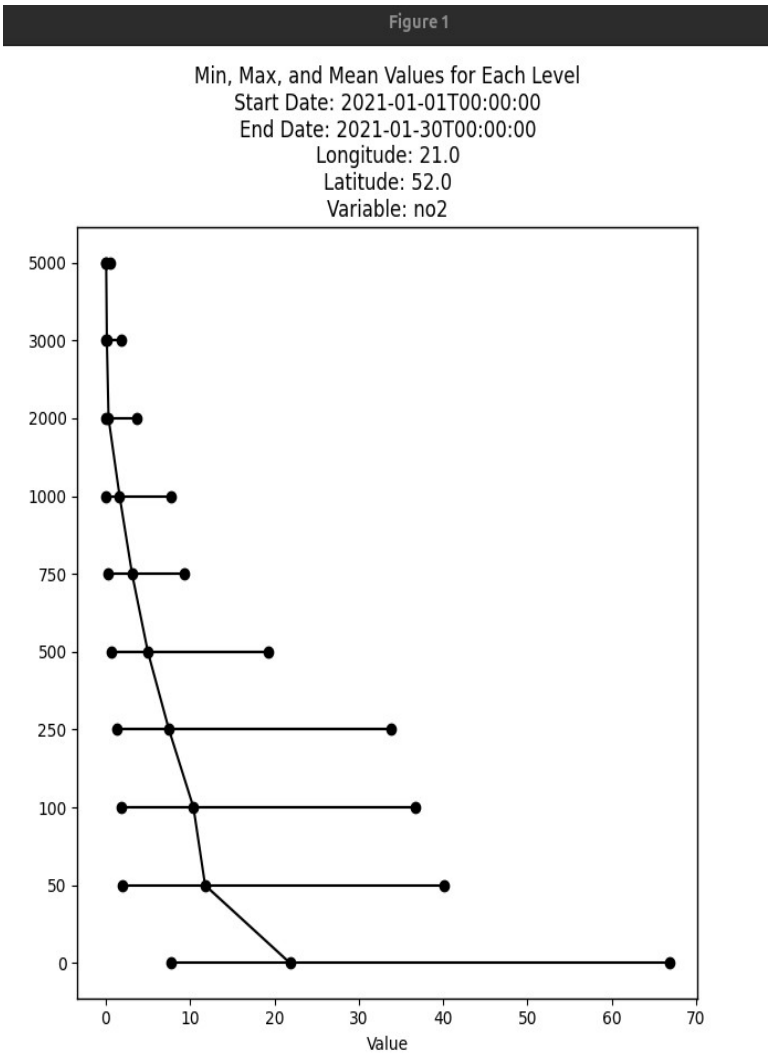



**Fig 7**: Vertical Plot for NO2 at different levels over a month at Specific coordinate

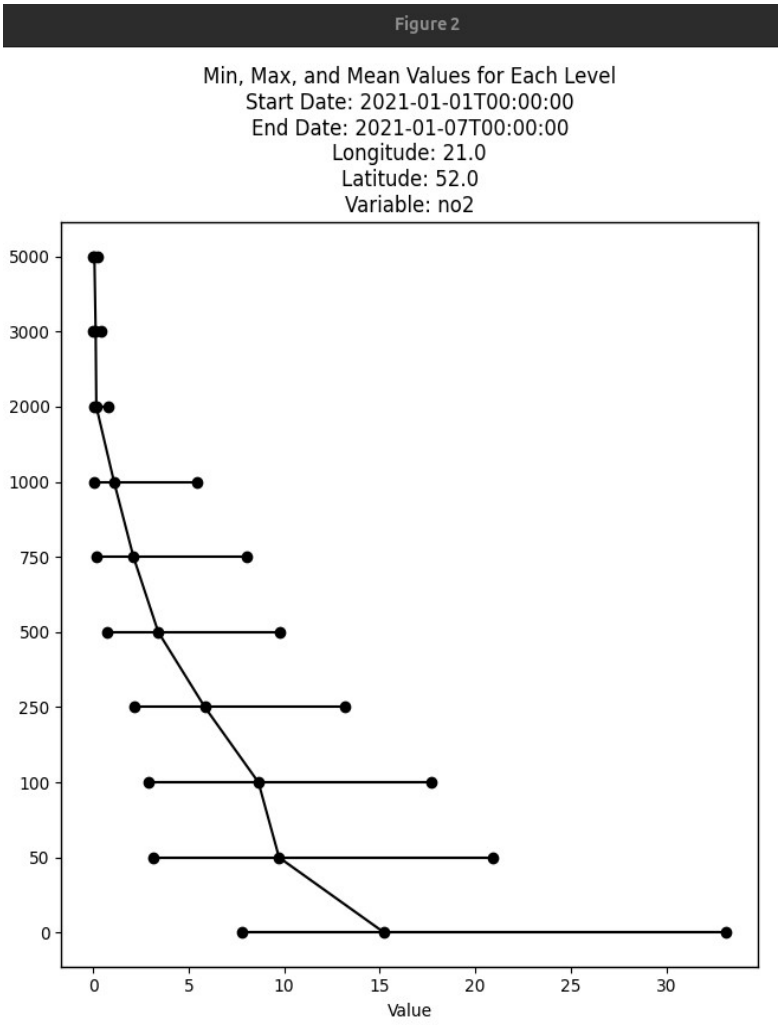



**Fig 8**: Vetical Plot for NO2 at different levels over a week at Specific coordinate

## 5. Generating Heat Maps .

The process of generating a heat map consists of two primary steps: initially transforming into a DataFrame, followed by creating the heat maps based on the refined data.

Steps:

- Select Generate HeatMap
- Click on Generate DataFrame
- Choose either Hourly Heat Map or Daily Heat Map

In the example below, both the Hourly and Daily Heat Maps were generated for the period from January 1, 2021, to January 30, 2021.

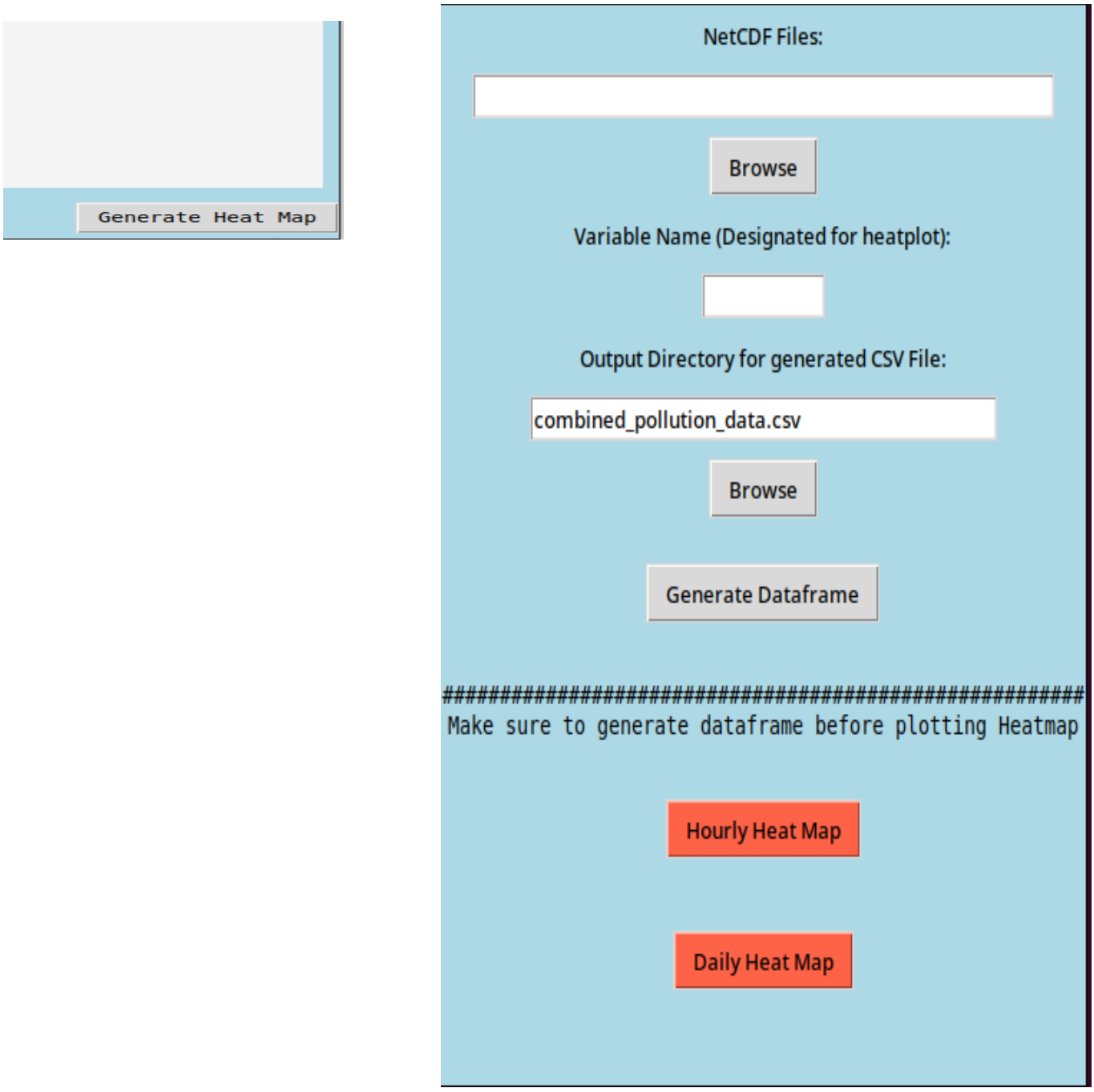
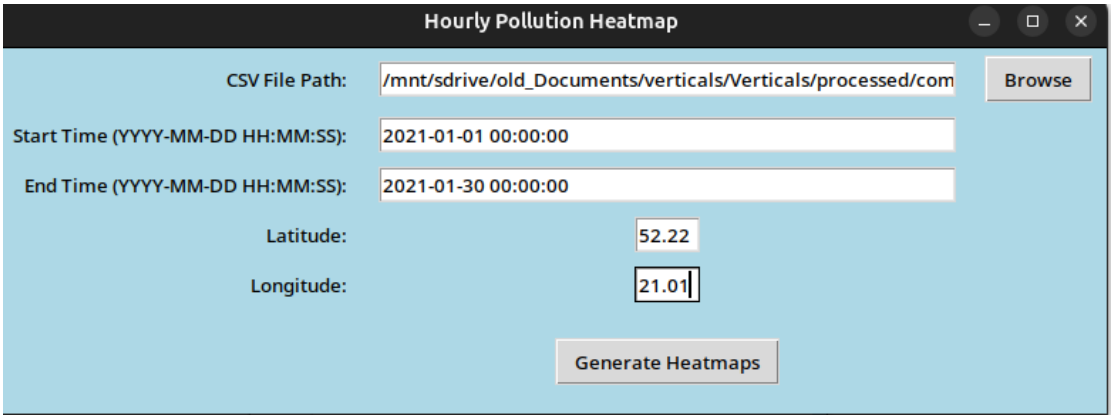



**Fig 9** : Interface for generating Heat Maps for Pollutants

## HOURLY HEAT MAP FOR POLLUTANT



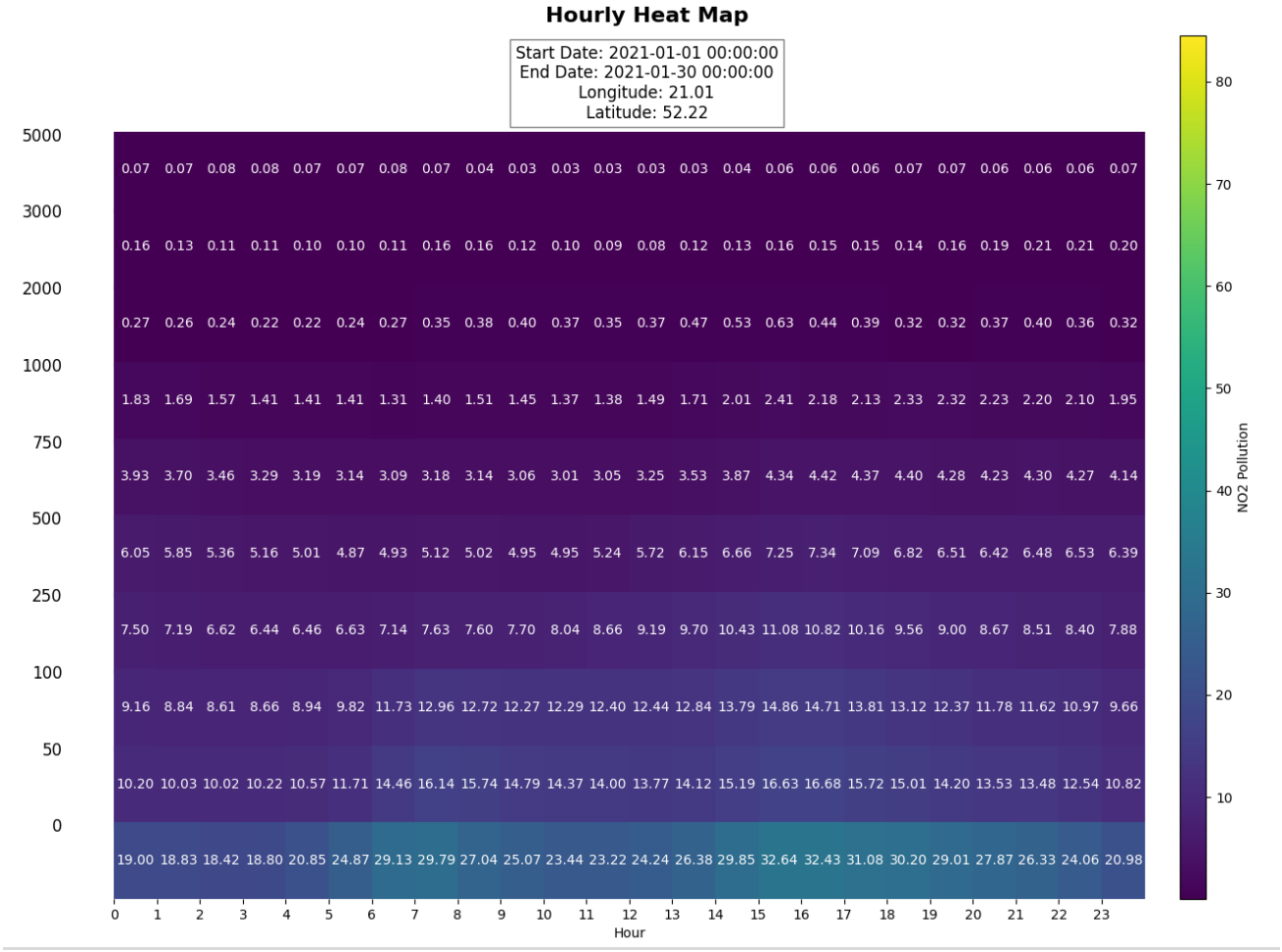
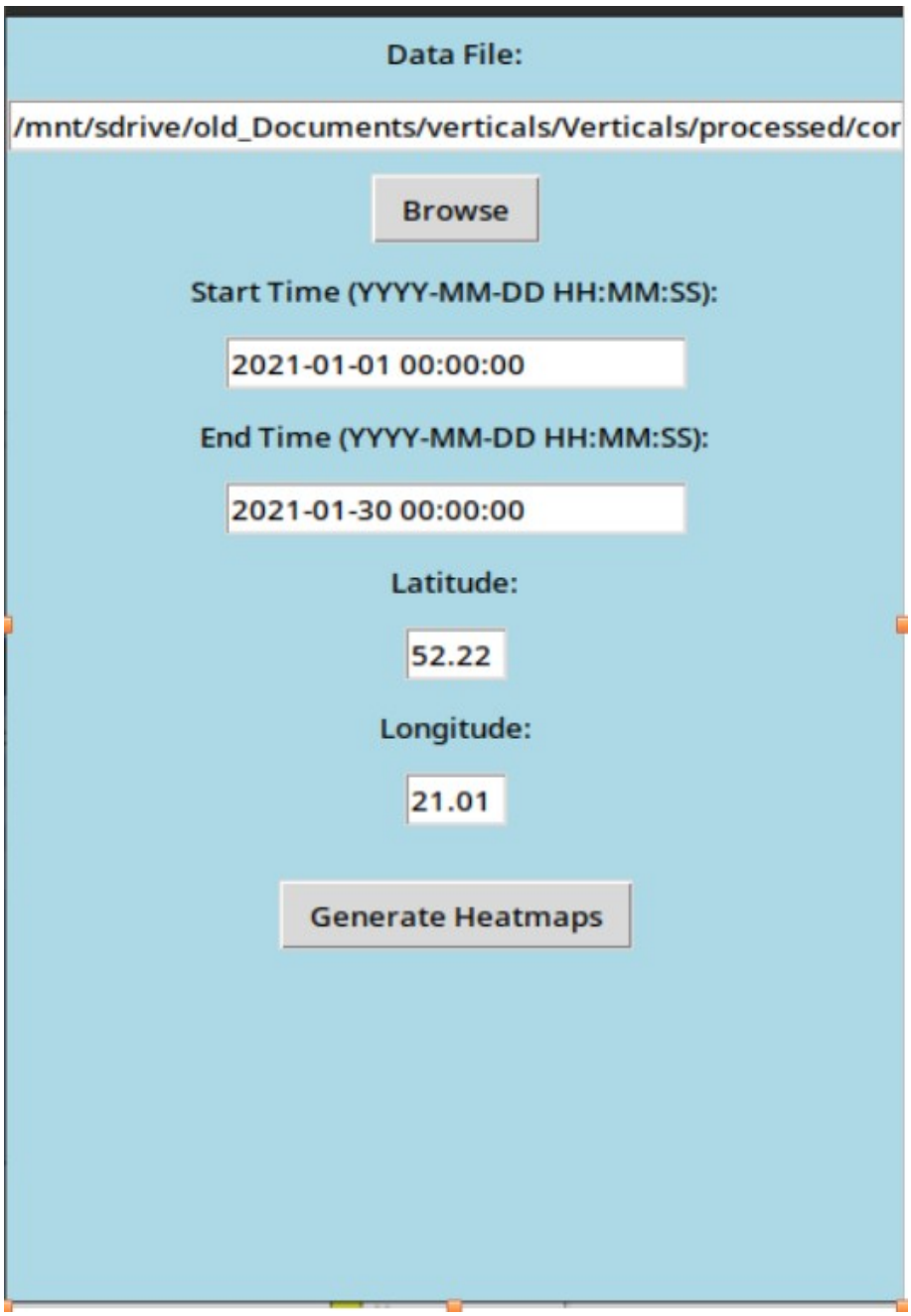




**Fig 10** : Hourly Heat Map for the given setting.

**DAILY HEAT MAP**

The Daily Heat Map displays the average concentration for each day within the selected timeframe at various levels.
In the given example, a Daily Heat Map for $NO_2$ has been generated for the month of January 2021.



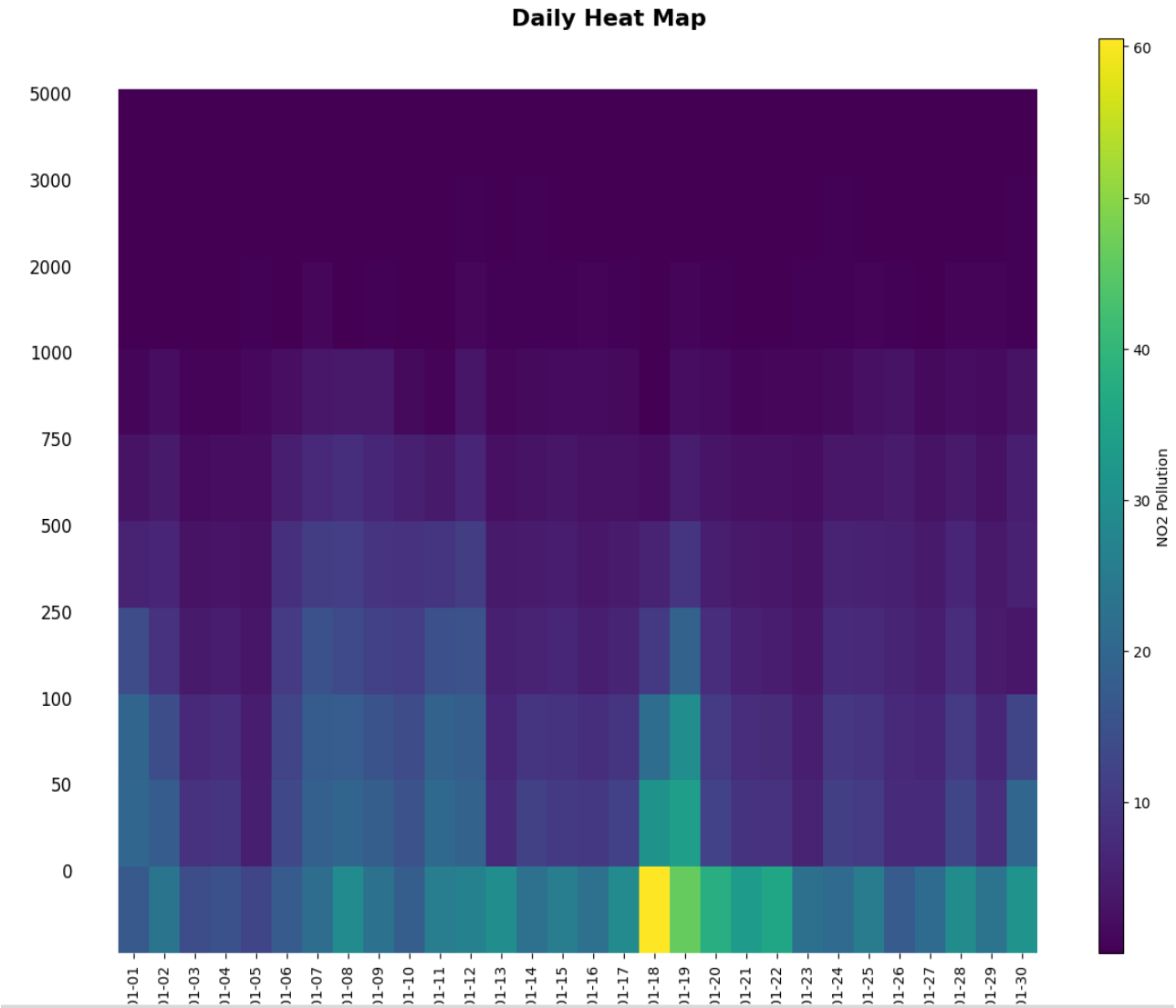



**Fig 11** : Daily Heat Map of Pollutant for given setting

**References :**

1. Copernicus Atmosphere Monitoring Service (CAMS). Atmosphere Data Store. (https://ads.atmosphere.copernicus.eu/)