



Creation and Analysis of vegetation index time series in



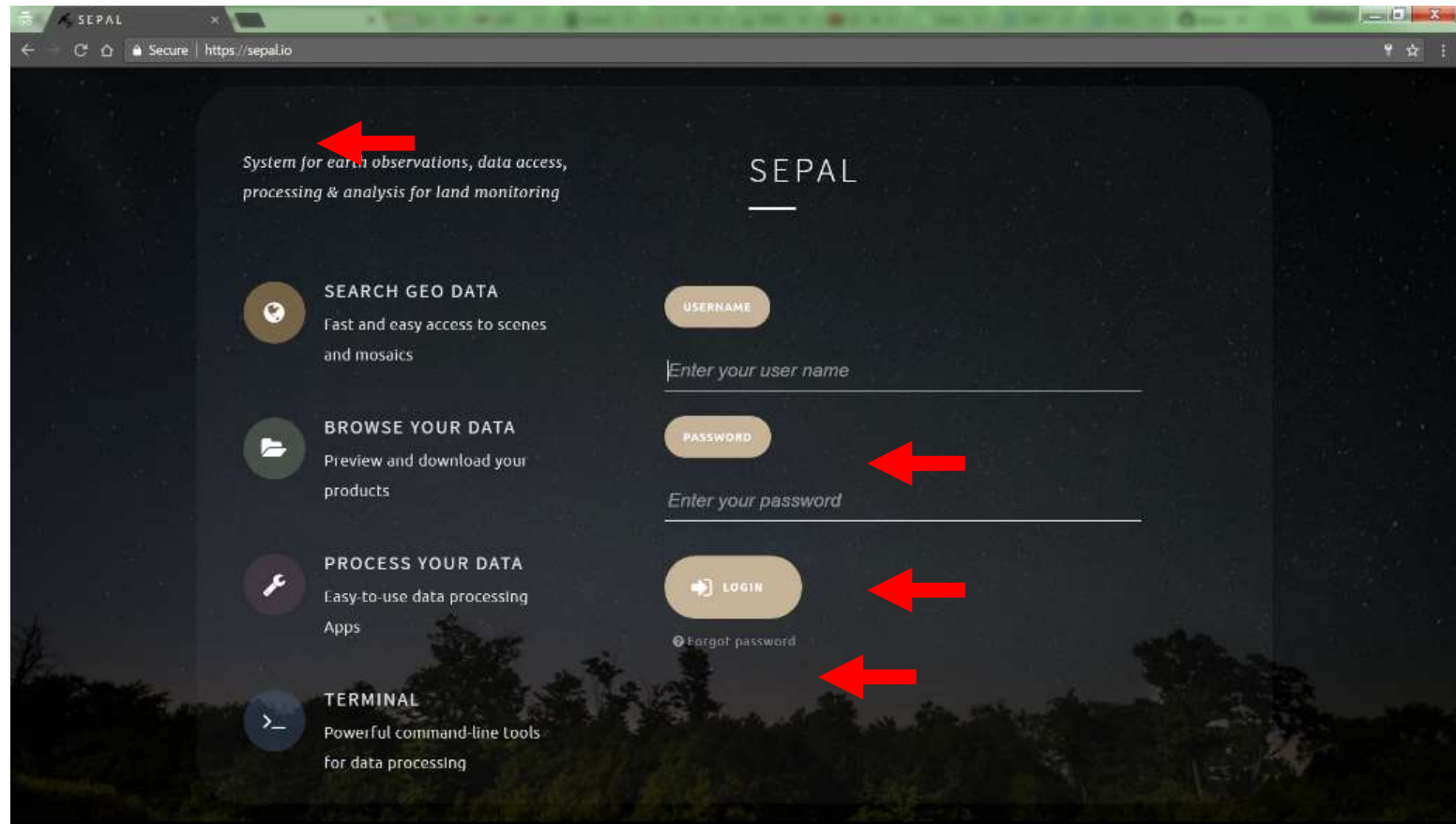
Methodological approach

Create time series of vegetation index

Analyze the time series with BFAST

Test different parameters and compare

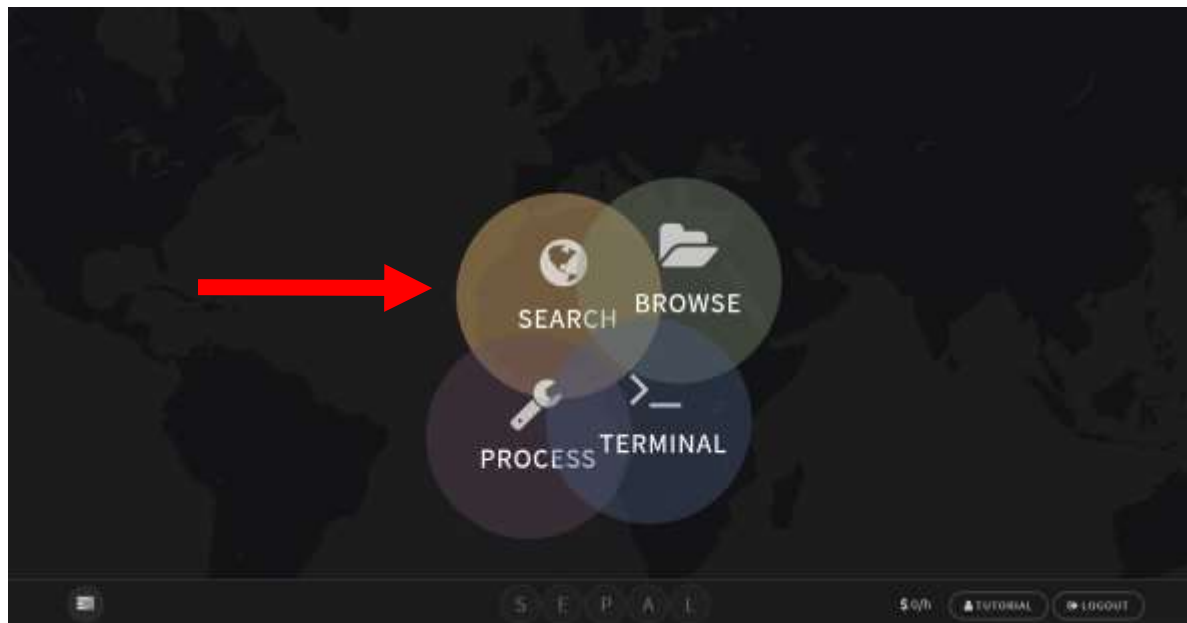
Go to sepal.io and login



Start the SEARCH tab

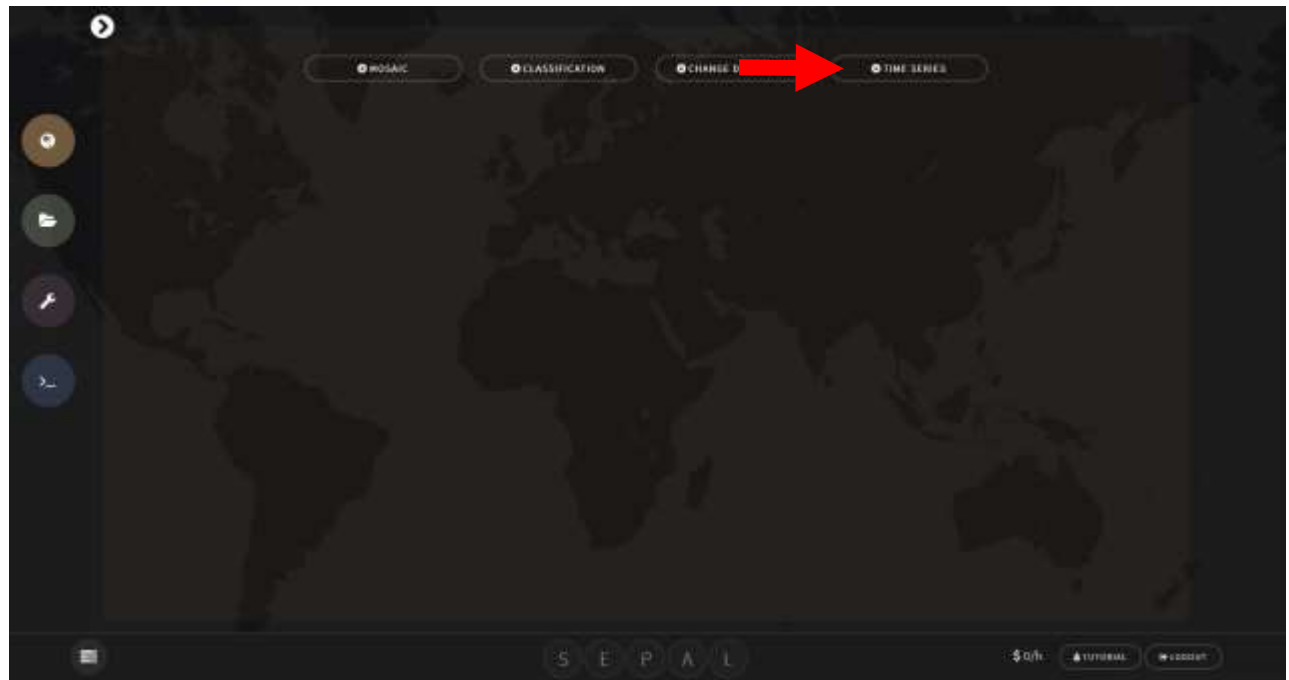
There are four fields in SEPAL

SEARCH	for imagery and creating mosaics
BROWSE	through your personal folders and visualize your data
TERMINAL	to access all the command line possibilities of the LINUX server
PROCESS	access pre-loaded tools and chains of processing



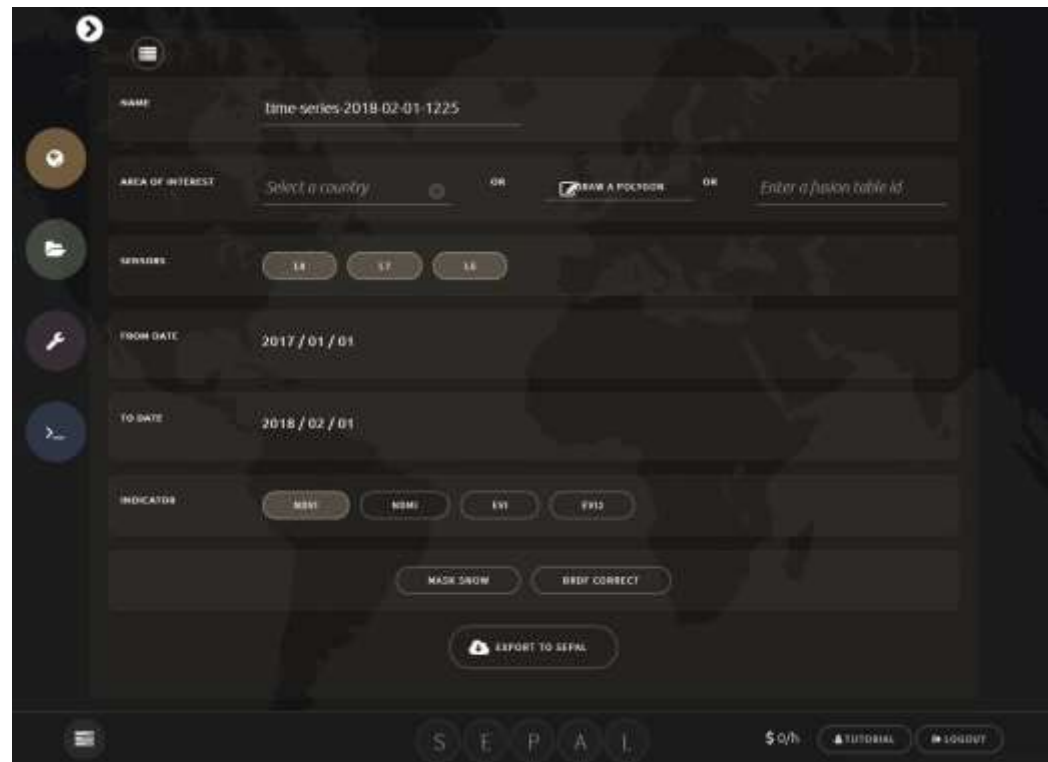
Open the time series stacker

Use the time series module to create a time series stack for an area of interest



Use SEPAL to create a time series stack

- The time series tab creates a stack of images for the chosen indicator and time span for the area of interest.
- In the result each band in the image represents a unique date



The screenshot displays the SEPAL web interface for creating a time series stack. The form includes the following fields and options:

- NAME:** time series 2018-02-01-1225
- AREA OF INTEREST:** Select a country (with a dropdown arrow) OR Draw a polygon OR Enter a fusion table id.
- SERIES:** Three buttons labeled L1, L2, and L3.
- FROM DATE:** 2017 / 01 / 01
- TO DATE:** 2018 / 02 / 01
- INDICATOR:** Four buttons labeled NDVI, NDMI, EVI, and EVI2.
- Buttons:** MAKE SURE, BUILD CORRECT, and EXPORT TO SEPAL.
- Footer:** A navigation bar with the letters S, E, P, A, L, a currency symbol \$ 0/h, and links for TUTORIAL and LOGIN.

Parameters of the Time Series stacker

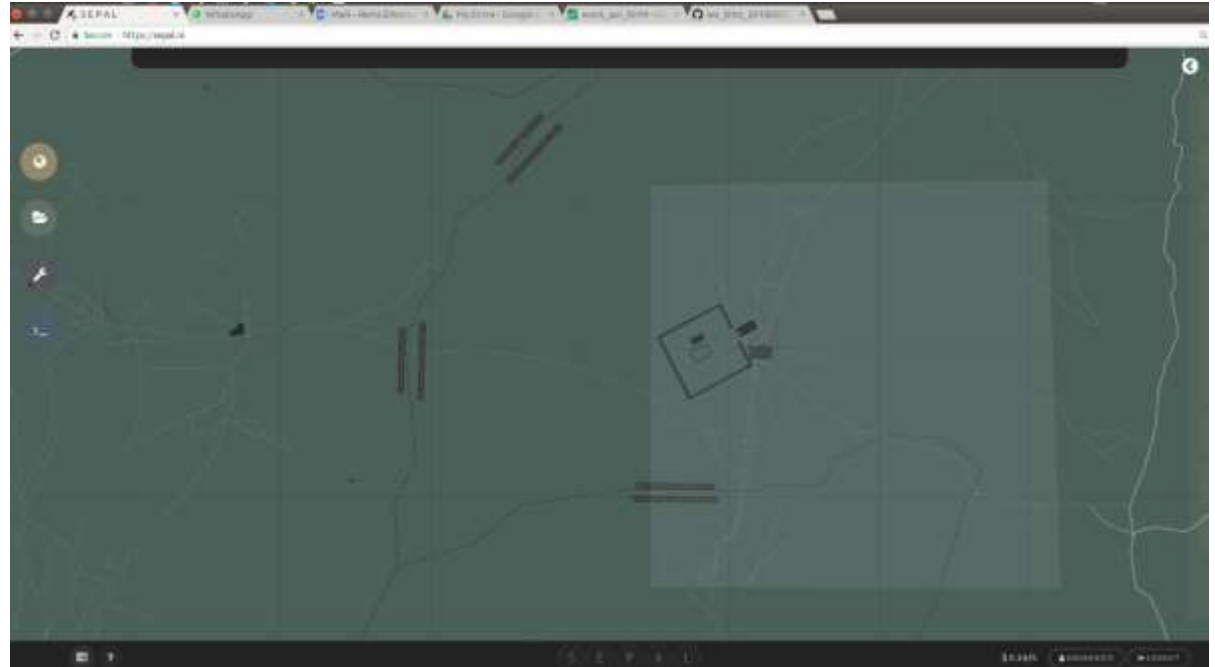
1. First give the time series a custom name, this will be the name of the folder in the downloads folder where you can find the downloaded time series
2. Country boundaries, a custom polygon or a fusion table ID can be used as the area of interest.
3. Landsat 5, 7 and/or 8 can be included in the time series
4. Choose the 'from' and 'to' dates. The time series will start at the from date and end at the to data
5. The indicator is the vegetation index that is calculated for each date.
 - NDVI= normalized vegetation index
 - NDMI= normalized moisture index
 - EVI= enhanced vegetation index
 - EVI2= enhanced vegetation index (2 bands)
6. Options to mask snow and correct for view and illumination angle effects using BRDF
7. Final step is to export the time series stack to SEPAL

The screenshot shows the 'Time Series stacker' web application interface. It features a dark theme with various input fields and buttons. Red boxes and numbers 1 through 7 are overlaid on the interface to highlight specific parameters:

- 1:** Points to the 'NAME' input field, which contains the text 'tutorial_time_series'.
- 2:** Points to the 'AREA OF INTEREST' section, which includes a 'Select a country' dropdown, a 'Draw a Polygon' button, and a 'Enter a Fusion Table ID' field.
- 3:** Points to the 'SENSORS' section, which has three buttons labeled 'L5', 'L7', and 'L8'.
- 4:** Points to the date selection section, which includes 'FROM DATE' (2010/01/01) and 'TO DATE' (2010/02/01) fields, along with a calendar interface for selecting year, month, and day.
- 5:** Points to the 'INDICATOR' section, which has four buttons labeled 'NDVI', 'NDMI', 'EVI', and 'EVI2'.
- 6:** Points to the 'MASK SNOW' and 'BRDF CORRECT' buttons.
- 7:** Points to the 'EXPORT TO SEPAL' button, which is highlighted with a red arrow.

Draw an Area of Interest

- Define an AOI by drawing a polygon over a zone with known disturbances
- Choose ~10x10 km to start with



Check parameters and budget

The screenshot shows the SEPAL web interface in a browser window. The URL is <https://sepal.io>. The interface is divided into two main sections: USER and USED RESOURCES.

USER

NAME	Remi D'Annunzio
USERNAME	dannunzio
PASSWORD	CHANGE
EMAIL	remi.dannunzio@fao.org
ORGANIZATION	UN-FAO
GOOGLE ACCOUNT	USE MY ACCOUNT

USED RESOURCES

	Quota	Used
Monthly Instance Budget	100 USD	4.77 USD
Monthly Storage Budget	50 USD	3.5 USD
Storage	100 GB	21.03 GB

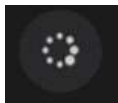
SESSIONS

Type of instance	Time	Cost
m4.xlarge	a few seconds ago	0 USD

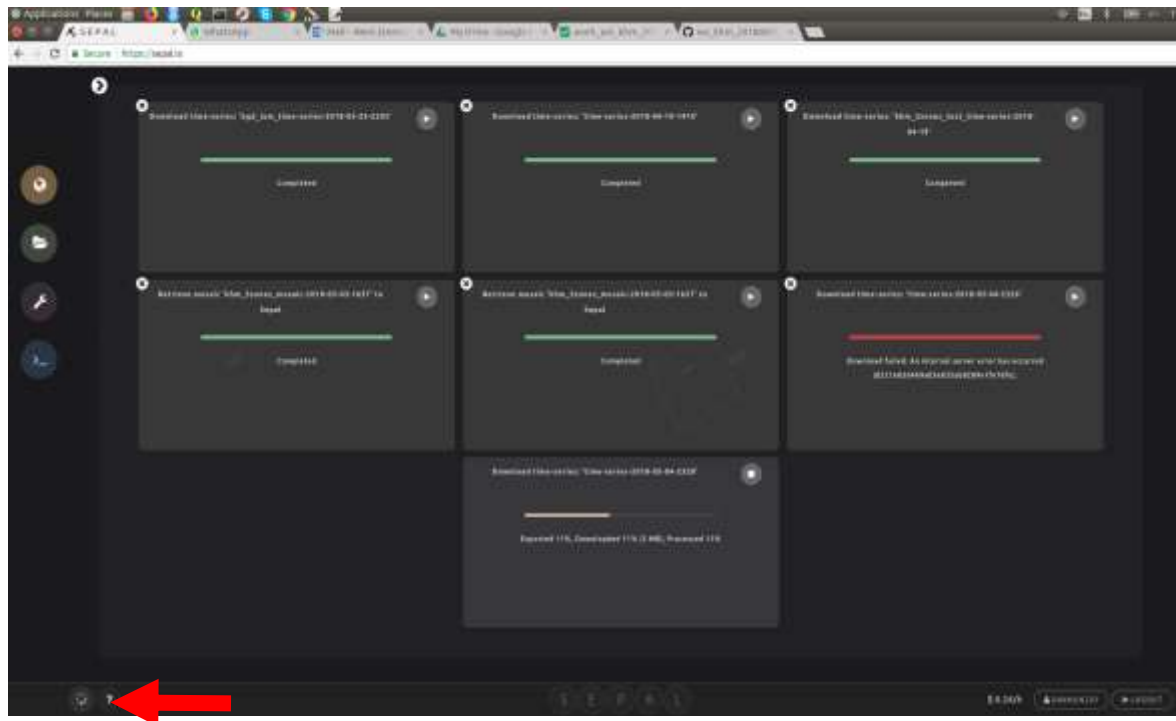
At the bottom of the interface, there is a navigation bar with the text "S E P A L" and a price indicator "\$ 0.24/h". A red arrow points to the user name "DANNUNZIO" in the navigation bar.

Download time series

- Once the download is initiated you can monitor the progress of the download by clicking on the spinning wheel

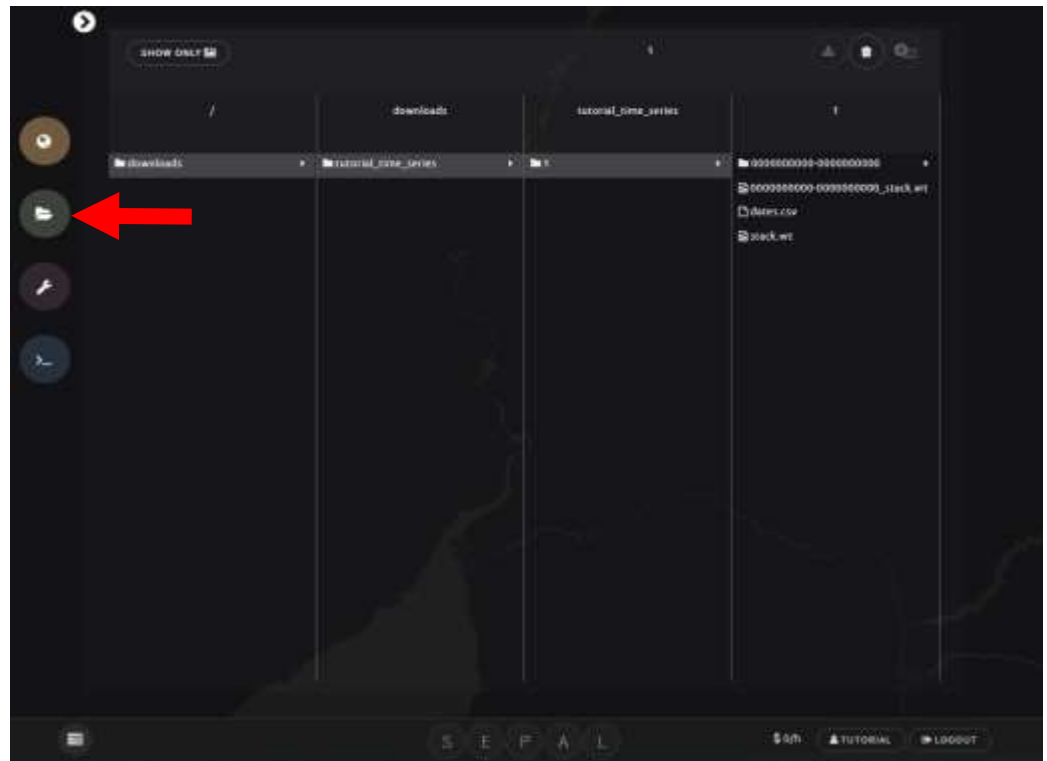


- The time series stack will download into the download folder in your SEPAL account



Check that download produced data

- When the download is complete the time series stack is saved as a .vrt file in the downloads folder with the same name specified in the download parameters (1)
- The two main outputs are stack.vrt and dates.csv
 - stack.vrt stores the vegetation index for each date in the bands
 - dates.csv stores the date corresponding to each band

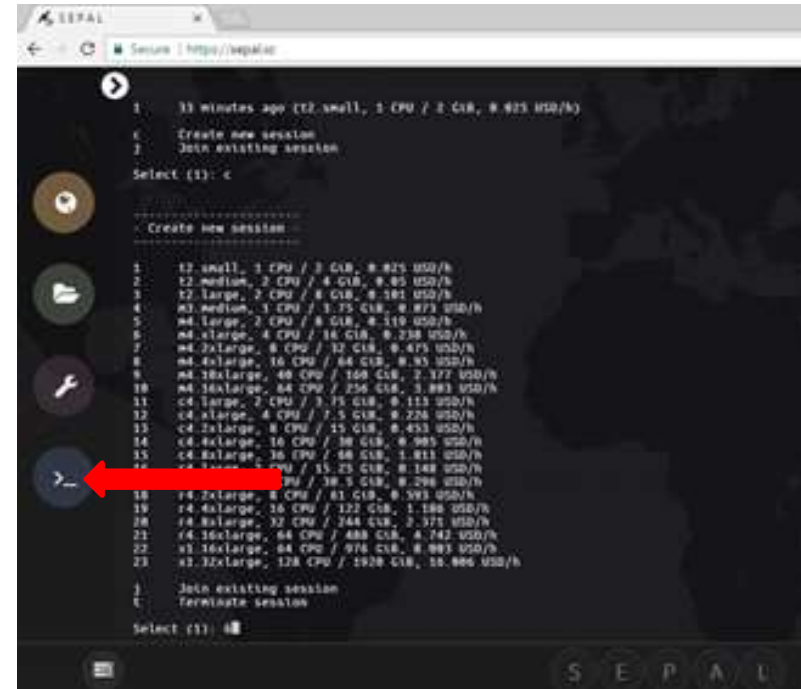


Start a terminal and Select a large instance

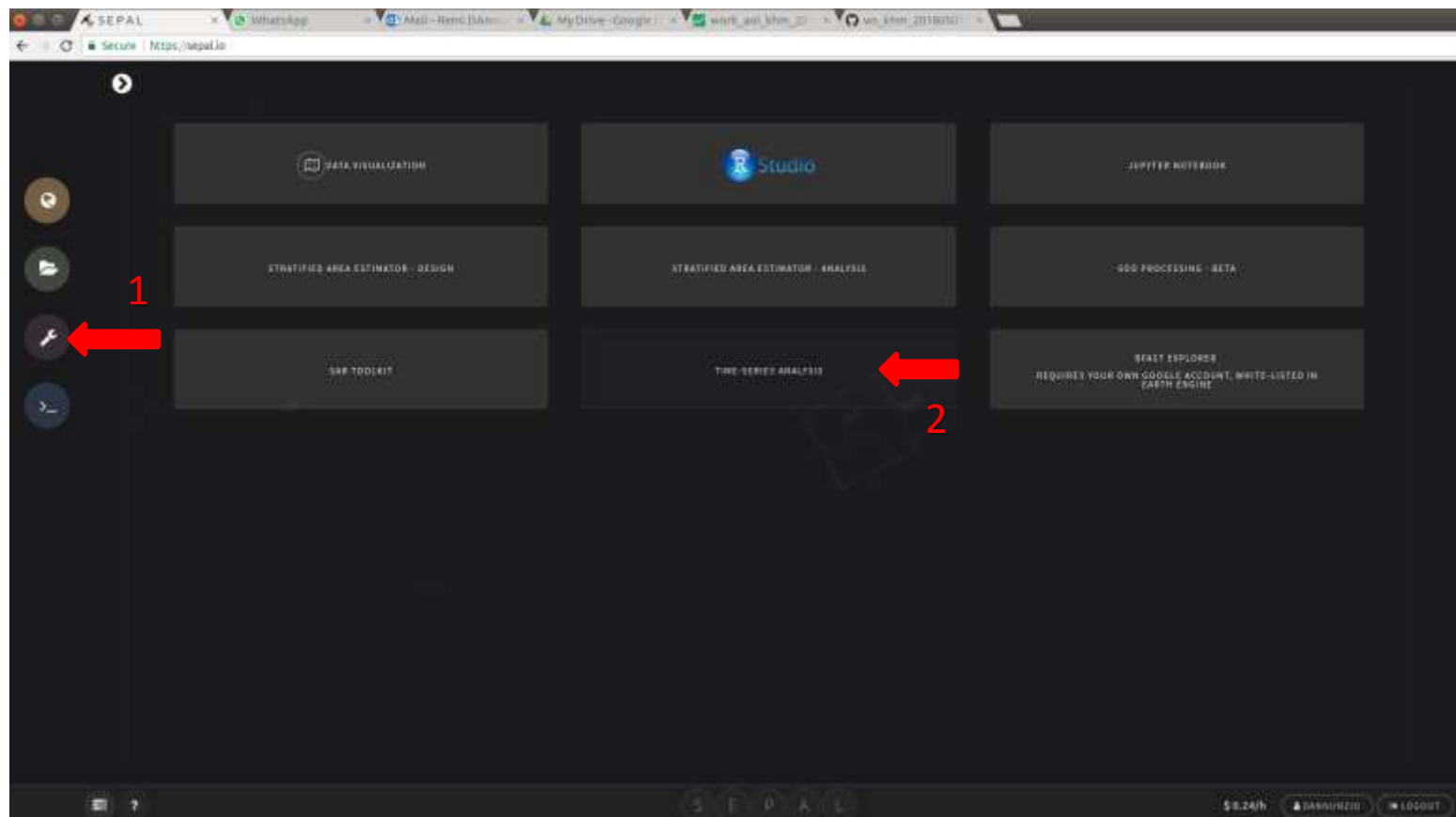
Start a large instance in the terminal, time series analysis is very heavy.

Choose an instance with more CPUs and less memory, such as the c4.4xlarge.

Running a larger instance saves time, depending on the size of the area, with a smaller instance the same process can take days to complete.



Select Process / Time Series Analysis



Select Time Series folder, choose parameters

The screenshot shows the SEPAL BFAST analysis web interface. The main panel is titled "BFAST analysis" and contains several sections:

- Language:** A dropdown menu set to "English".
- Description:** Text explaining the BFAST analysis process and providing a link to the SEPAL BROWSE time-series browser.
- Download test data:** A button labeled "Download test dataset".
- Time series input:** A section for selecting the folder where time series were downloaded. It includes a "Time Series Folder" button and a text input field for the folder path.
- Historical / Monitoring break point:** A slider control for selecting a break point.
- Order parameter:** A dropdown menu set to "3".
- History parameter:** A dropdown menu set to "ROC".
- Type parameter:** A dropdown menu set to "OLS-CUSUM".
- Elements of the formula:** A dropdown menu set to "formula".
- Computation mode:** A dropdown menu set to "Overall".

A "Browse" dialog box is overlaid on the "Time series input" section, showing a file explorer view. The "Downloads" directory is selected, and the folder "time-series-2018-05-04-2342" is highlighted. The "Content" pane shows a single file "1".

At the bottom right, a status bar indicates "BFAST running for 1".



Presentation adapted from Yelena Finegold & Erik Lindquist

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