

User Manual

Introduction

This application (APP) is designed to compute the leaf chlorophyll content (LCC) for any global region and any time range, using an average value composite strategy. Users have the flexibility to adjust the spatial and temporal resolution according to their needs, with a maximum resolution of 10m/5days, corresponding to Sentinel-2 imagery. Key features of the APP include:

- Global Coverage: Calculate LCC products for any location worldwide.
- Customizable Time Range: Select any time frame after 2019 for analysis.
- Adjustable Spatial Resolution: Modify the spatial resolution based on user requirements, with the highest resolution being 10 meters.
- Adjustable Temporal Resolution: Users can modify the temporal resolution based on their needs. The app will automatically calculate the average value, allowing for flexibility in data analysis.
- Output Options: Export results as .tif format images directly to Google Drive for the easy download and offline analysis.
- Time Series Visualization: Generate time series curves for any pixel within the inversion area directly on the web interface

Usage Instructions

Click the link below to open the MuSyQ LCC APP:

<https://code.earthengine.google.com/a06dfc261ad8019e025153d5bd0e68ca>

1. Input the **Start Date**, **End Date**, and the **Temporal Resolution**.
2. If you do not have the shapefile of the ROI and would like to create one on the web interface, Click the rectangle on the top left of the page to create an ROI.

The screenshot displays the Google Earth Engine web interface. At the top, the Google Earth Engine logo and a search bar are visible. Below the search bar, there are tabs for 'Scripts', 'Docs', and 'Assets'. The 'Scripts' tab is active, showing a code editor with the following JavaScript code:

```
1 var center = ee.Geometry.Point([116.33, 39.93]);
2 Map.centerObject(center, 12);
3 var drawingTools = Map.drawingTools();
4 var LCC_Cal_Func = require('users/425490093/LCC:CalCSITest.js');
5 var collection = ee.FeatureCollection('projects/ee-425490093/assets/XiBei');
6 var resultImage = null;
7
```

Below the code editor, there are buttons for 'Get Link', 'Save', 'Run', 'Reset', and 'Apps'. To the right of the code editor, there are tabs for 'Inspector', 'Console', and 'Tasks'. The 'Console' tab is active, showing the text 'Use print(...) to write to this console.'

The main map area shows a satellite view of a region. A red rectangle is drawn on the map, representing the ROI. A red circle with the number '2' is placed over the 'Geometry Imports' button in the top left corner of the map. A red circle with the number '3' is placed over the red rectangle, with the text 'Drag and Draw an ROI' next to it. In the bottom right corner of the map, there is a form titled 'MuSyQ LCC APP' with the following fields:

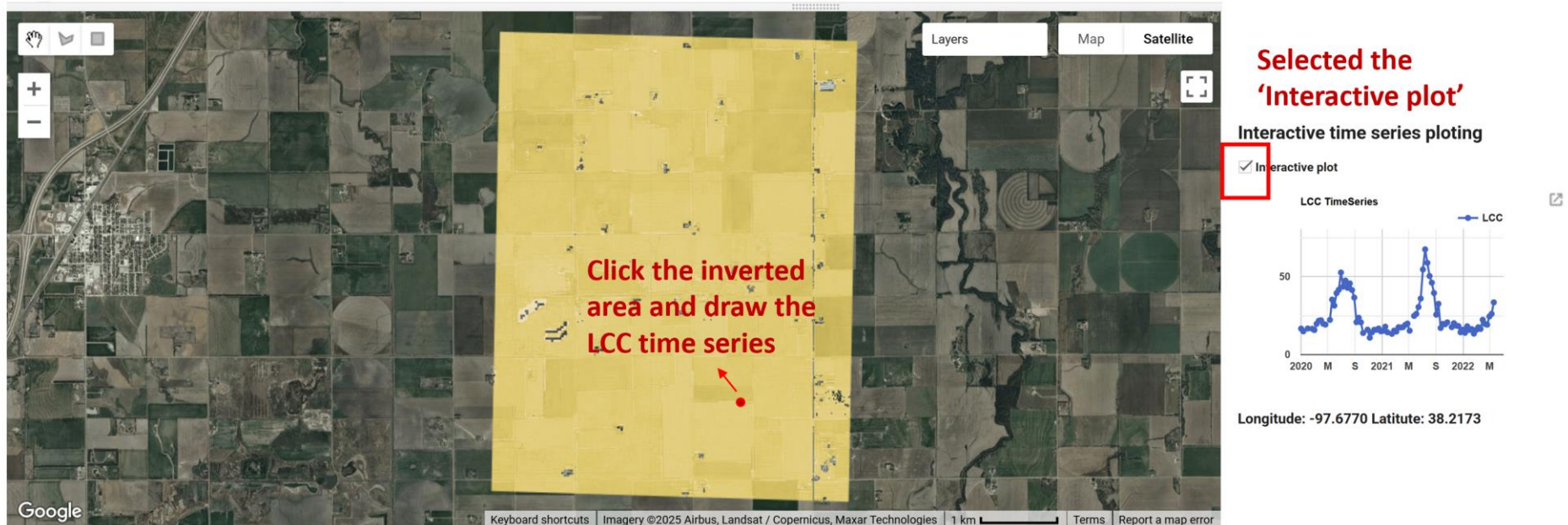
- Step 1. Select the DateRange
- Start Date(YYYY-MM-DD): 2020-01-01
- End Date(YYYY-MM-DD): 2022-05-31
- Temporal Resolution (day): 10

A red circle with the number '1' is placed over the 'End Date' field. The Google logo is visible in the bottom left corner of the map area. At the bottom of the page, there are links for 'Keyboard shortcuts', 'Imagery ©2025 NASA', '20 km', and 'Terms'.

If you have the shapefile of the ROI, you can upload it into the Assets as a *.zip file and input its ID in the blank box and then click 'Load ROI'. The ROI will be added into the web interface.

The screenshot displays the Google Earth Engine web interface. At the top, the 'Assets' tab is active, showing a tree view of cloud assets. A red box highlights the asset 'usa1' under the project 'ee-tigerpu1'. A red annotation '1 Upload your ROI as an Asset' points to this asset. The script editor shows a JavaScript code snippet for setting a center point and loading a collection. The map view shows a satellite image of a rural area with a large blue square overlaid, representing the ROI. A red annotation '3 ROI is labeled in the map' points to this square. On the right, the 'MuSyQ LCC APP' form is visible. A red box highlights the input field for the ROI Assets ID, which contains the text 'projects/ee-tigerpu1/assets/usa1'. A red annotation '2 Input Assets ID And click the button' points to this field. The 'Load ROI' button is also visible next to the input field.

3. Click **'Run'**, the LCC will be calculated. If the **'Interactive plot'** is selected, the LCC time series of selected pixel can be shown by clicking pixel within the ROI.



In Step 1 we set the date range from 2020-1-1 to 2022-5-31, thus the line chart shows the time series of during that period.

4. If you would like to download the product, you can set the **spatial resolution**, the **file name**, and then click the **'Export'** in the interface and **'Run'** in the 'Tasks' module; The product information will be displayed in a new dialog box. If everything is correct, please click **'Run'**. A few moments later, the new file is available in the Google Drive.

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6
```

Below the code editor, there is a map showing a satellite view of a landscape with a large yellow polygon overlaid. A text overlay on the map reads: "① Input File information and Spatial Resolution".

On the right side of the interface, there is a 'Tasks' panel. It contains a section for 'UNSUBMITTED TASKS' with a red box around the 'CSI_Export_Task' entry and a 'RUN' button. A circled '3' is next to this section. Below this, there are two task configuration panels:

- Step3.Run to Get LCC**: A panel with a 'Run' button.
- Step4.Export to Driver**: A panel with input fields for 'Folder' (Driver Folder), 'FileName' (CSI_LCC), and 'Scale (m)' (30). The 'Export' button is highlighted with a red box and a circled '2'. Below this panel is a 'Click Below to Reset' section with a 'Clear' button.

At the bottom of the interface, there is a footer with 'Keyboard shortcuts', 'Imagery ©2025 Airbus, Landsat / Copernicus, Maxar Technologies', a scale bar (1 km), 'Terms', and 'Report a map error'. There is also a checkbox for 'Interactive plot' which is checked.

Note: Due to limited computational resources, it is recommended that users avoid exporting images with extensive spatial and temporal ranges when a high spatial resolution is set. Large datasets may lead to increased processing times and potential performance issues.

5. Data for different dates are stored in different bands of the *.tif file. The first band represents the average synthesis value for days 1 to 10, the second band corresponds to the average synthesis value for days 11 to 20, and so on.

For example, the file exported through the above procedure has a time range from 2020-1-1, to 2022-5-31, covering a total of 881 days. The composition is conducted in 10-day intervals, resulting in a total of 88 bands. The following figure shows the inverted LCC in different dates.

