Contents

Automated Shoreline Extraction and Analysis Model

User Manual

I   Introduction

Automated Shoreline Extraction and Analysis Model known as ASEA Model is a robust and user-friendly model capable of extracting the shoreline from Landsat satellite imagery at a high accuracy and calculating the shoreline change between the past and present condition. The model (figure 1) is fully operated in a cloud platform connecting to Google Earth Engine (GEE) so that the complicated environment setup is not needed in local computer to utilize this model. By giving the target area and date range as input information, the model will automatically collect all Landsat satellite images at the given area of interest (AOI) during high and low tide period, process them, and download the post-processed images directly from GEE to user's Google drive. From post-processed images, the model analyzes the sub-pixel values of Near-Infrared Band and classify them into land and water area by using an unsupervised classification algorithm known as K-Means. The boundary dividing land and water area is determined as preliminary shoreline, which basically has stair-like shape. This shoreline is then converted to a smooth shoreline through shape-correction process in the model. The shape-corrected shoreline is treated as the main shoreline for calculating growth and retreat distance and rate per year between the past and present time. By using ASEA Model, several kinds of output will be produced in various format ranging from images in raster file (.tif) to shorelines in geojson file (.json) as well as the analysis results in static and interactive maps.
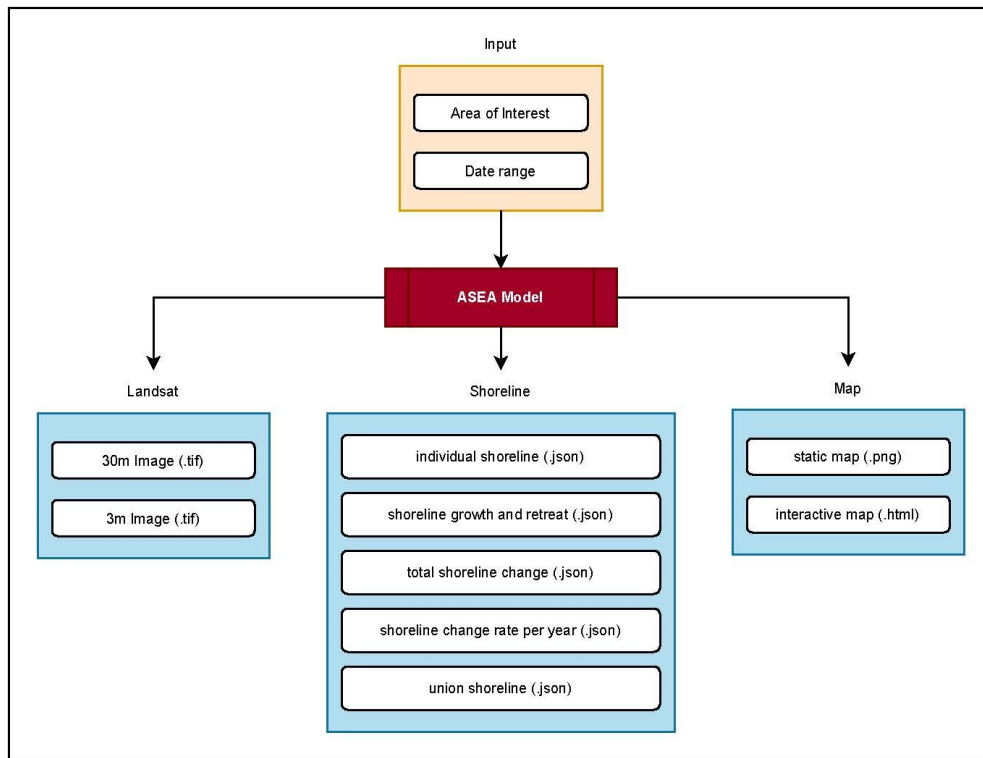
Figure 1: Schematic diagram of Automated Shoreline Extraction and Analysis (ASEA) Model.

II   Requirement

To use ASEA Model, Google Colaboratory and Google Earth Engine are required to implement the execution codes. GC and GEE are two completely different platforms. Google Colab is a place where execution codes of ASEA model are executed, while GEE is a place where geometry of AOI is generated and also where all Landsat satellite imageries are stored and downloaded by the model for analysis.
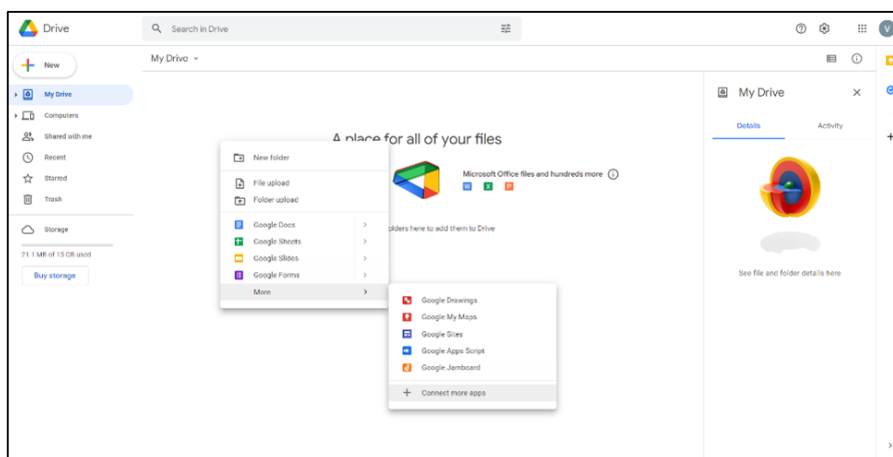
1   Install Google Colab

Google Colaboratory also known as "Colab" is a product from Google Research. Colab allows us to write and execute Python code through web browser for free, and it uses Google drive as the main storage. Since Colab is not pre-installed in Google drive, it is necessary to install it for first user. The process to install Colab is as follows:
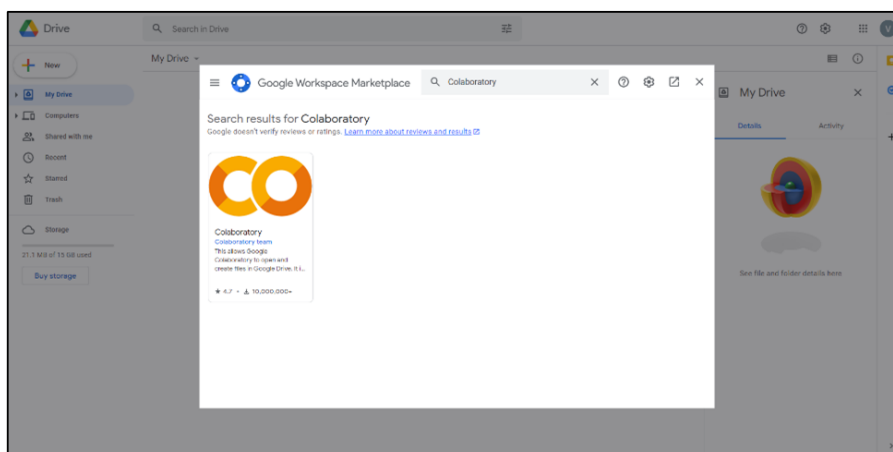
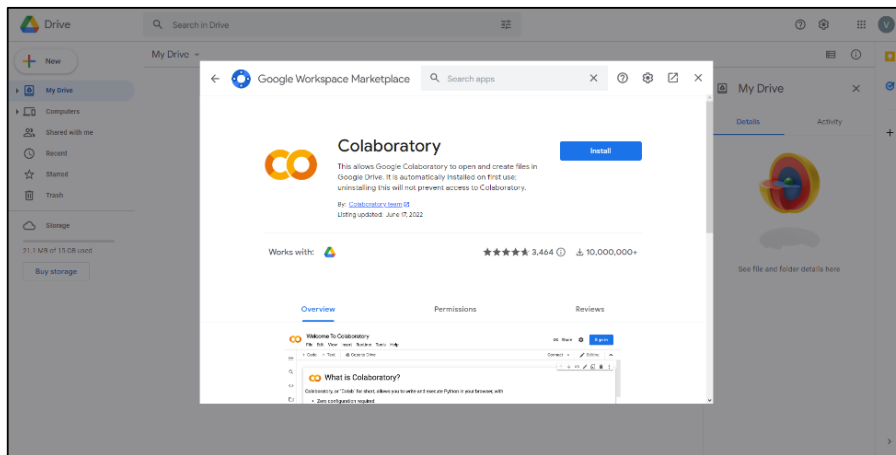**Step 1:** Open Google drive with Gmail account
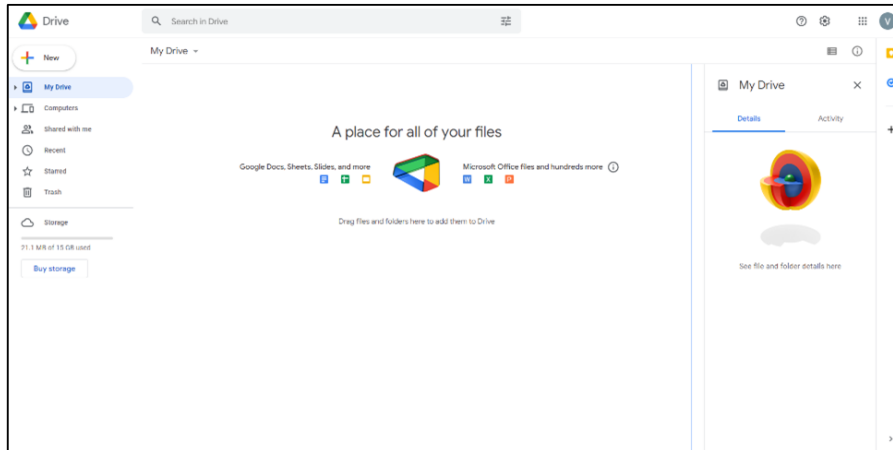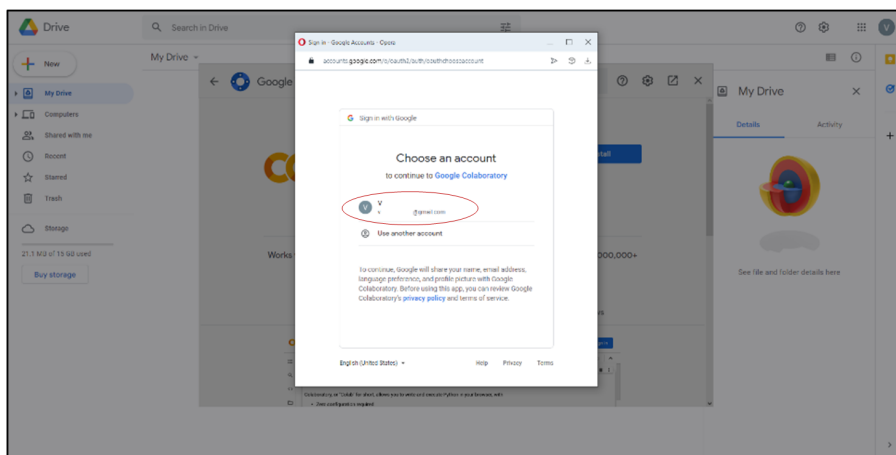

Step 2: Right-click and choose "Connect more apps".

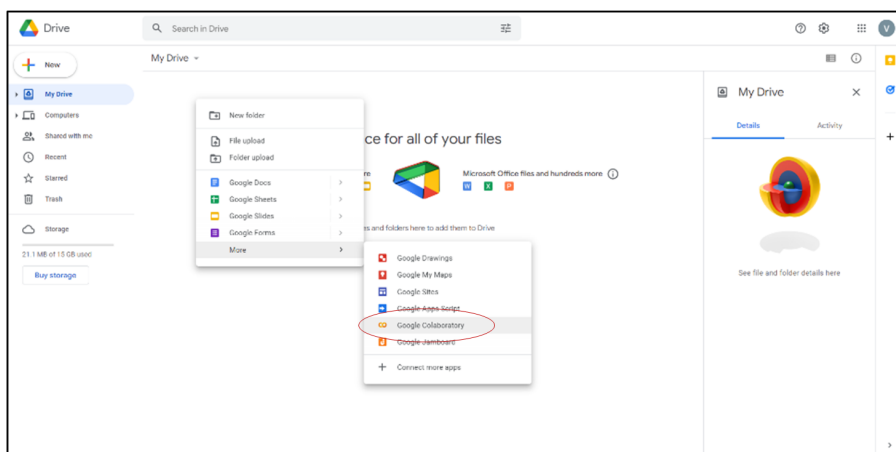**Step 3:** Search for "Colaboratory" and click "Install" to install it.

Step 4: Choose Gmail account to use Colab

Step 5: Confirm by Right-click in drive and check the list for "Google Colaboratory"

If you see "Google Colaboratory" in the option list, it means you can open any Python code (.ipynb) file and run it with your Gmail account in Colab.

2   Create Google Earth Engine account

Google Earth Engine(GEE) is a computing platform that allows users to run geospatial analysis on Google's infrastructure. GEE contains a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities. To interact with the platform, the Code Editor at code.earthengine.google.com which is a web-based IDE for writing and running scripts is used, and it requires log in with a Google Account that's been enabled for Earth Engine access. The Code Editor has the following elements (illustrated in the figure 2):
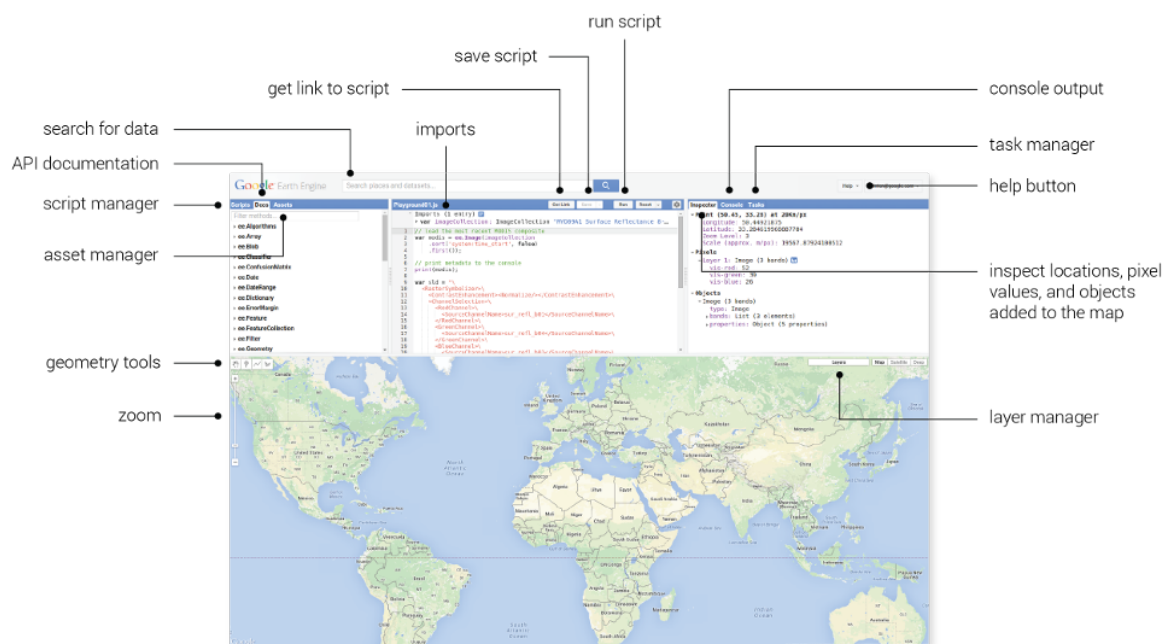

Figure 2: Interface of Google Earth Engine Code Editor.

ASEA Model does not require users to interact with GEE code editor using JavaScript API; however, the users needs to have an account and a cloud project in GEE for model authentication in Colab every time the model is used. The process to setup an account in GEE is as follows:
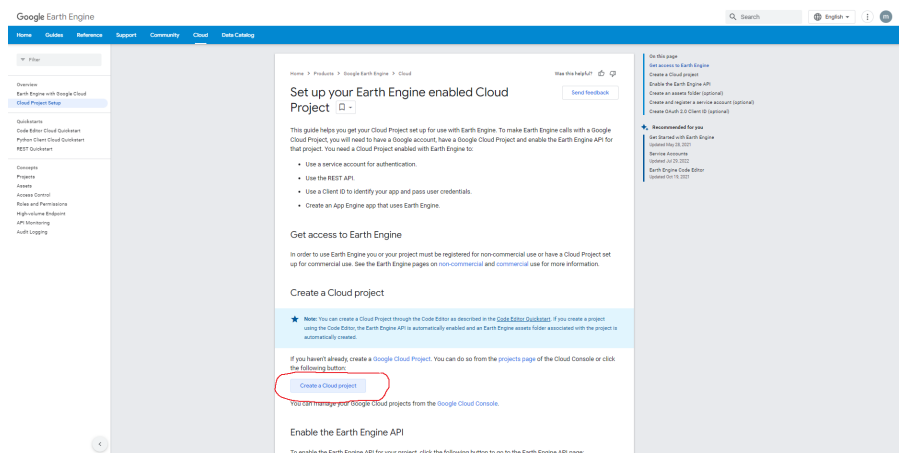
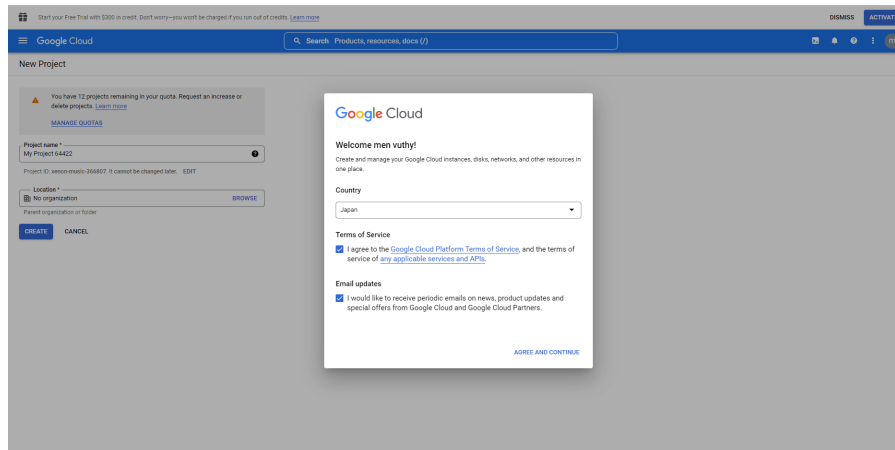Step 1: Open Google Earth Engine Explorer and sign in with your Gmail account.
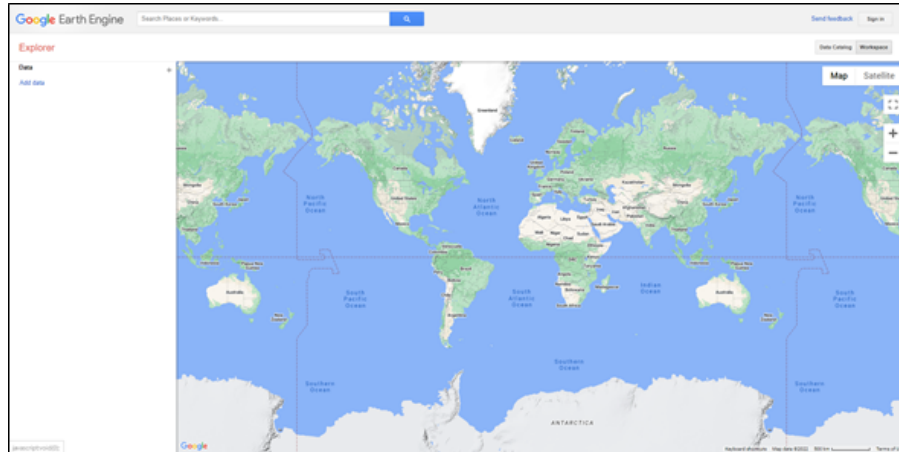
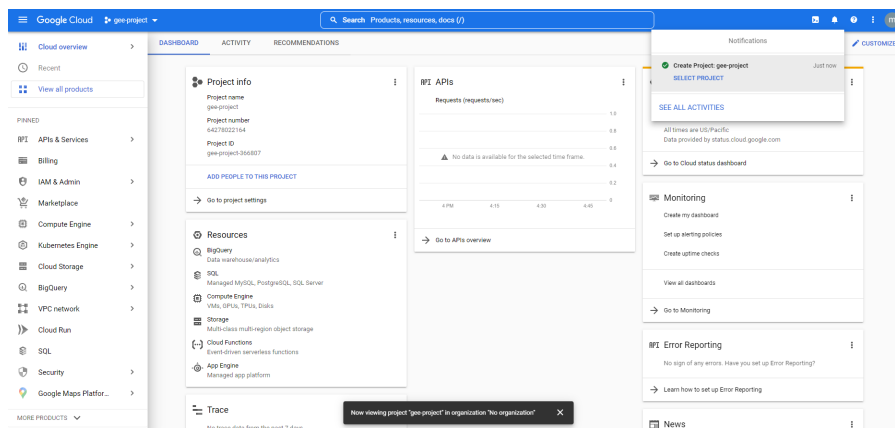Step 2: After signing in, confirm your Gmail which appears in the top right corner.
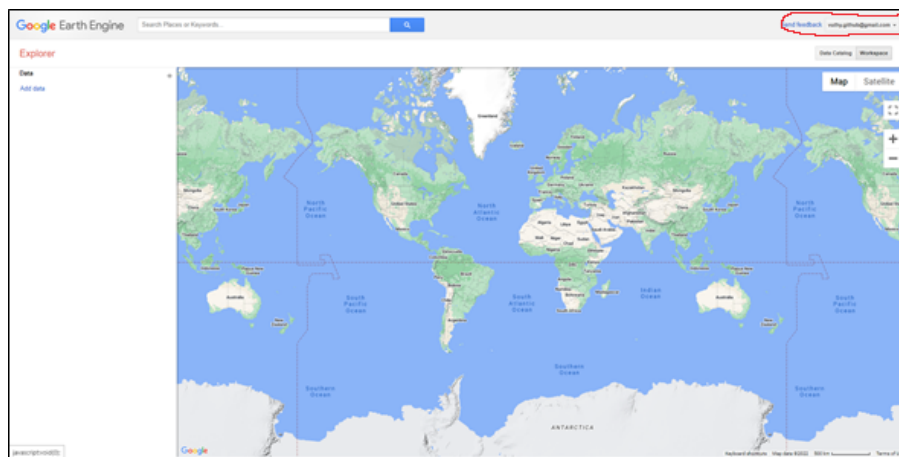
Step 3: Open Cloud Project Setup and create a cloud project by clicking on "Create a Cloud Project" button.
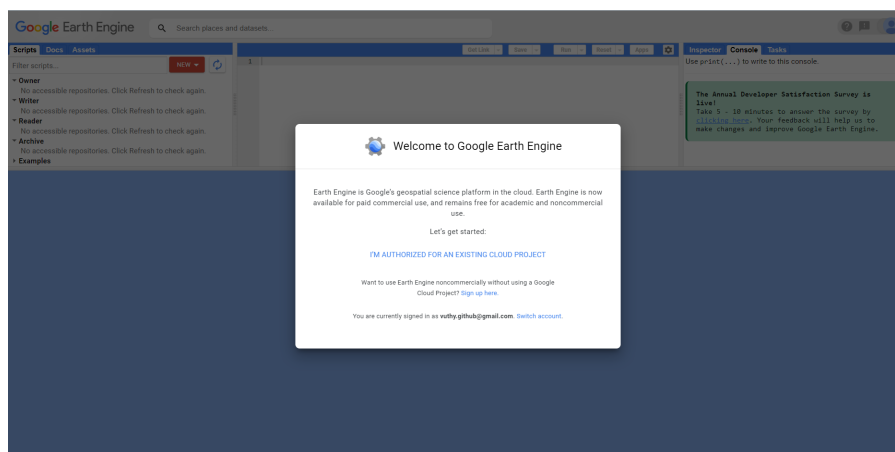
Step 4: Agree to the terms and continue. After that, write the name of project and click
"Create" button.

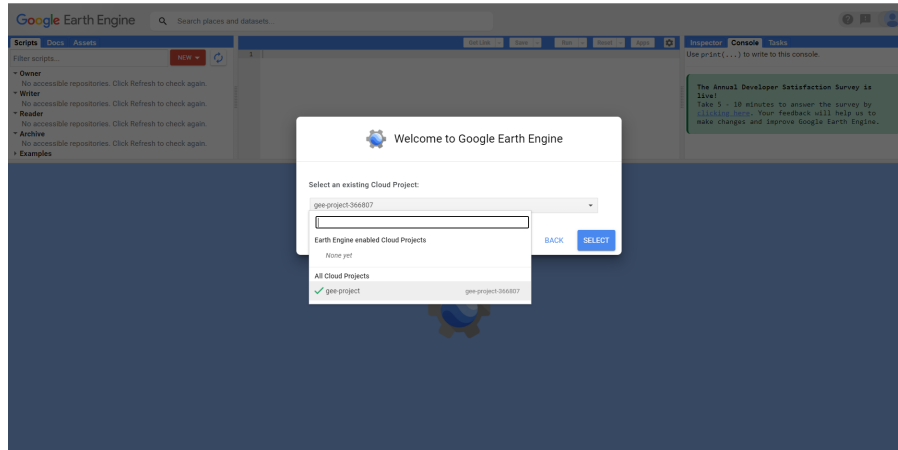Step 5: Confirm this dashboard after creating the cloud project.

Step 6: Open Code Editor and sign in with the same Gmail account, then you will be welcomed by Google Earth Engine. Then click on "I'm authorized for an existing cloud project"
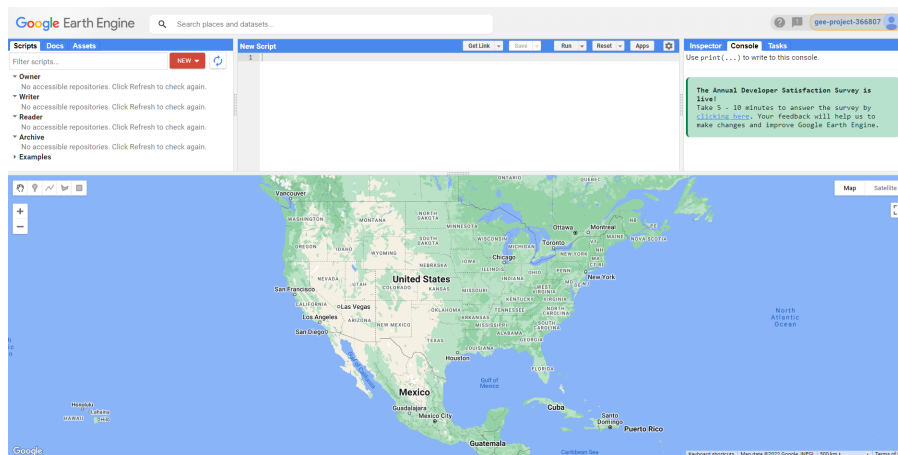button.

Step 7: Choose cloud project that you have just created, and click "Select".

Step 8: If you see this interface, it means you have successfully created a GEE account and a cloud project for using GEE.

III Model structure