

Delta-X Applications Workshop Instructions

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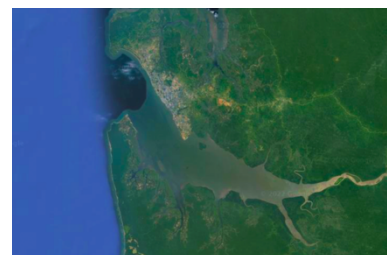
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Section 1: Introduction

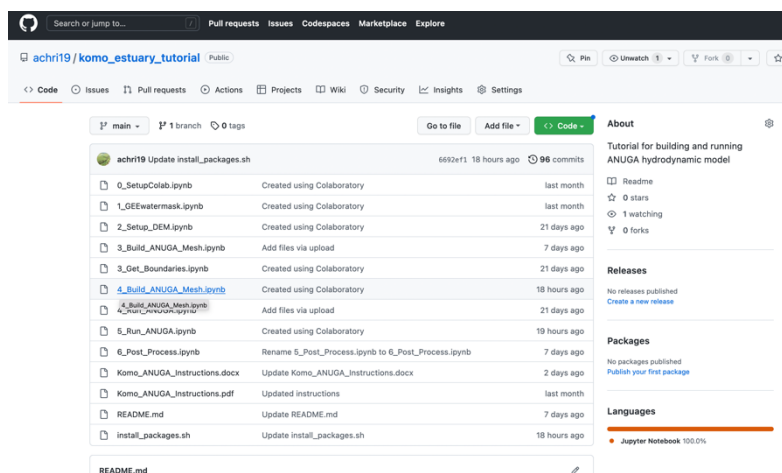
This tutorial introduces the ANUGA modeling software for hydrodynamic modeling. The software was developed by Australian National University and Geoscience Australia. You can find more information on source code, development, and community at https://github.com/GeoscienceAustralia/anuga_core.

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The tutorials will give an overview of building and running **ANUGA** models, using the Komo River Estuary in Gabon as an example. There are 6 tutorials presented as **Python Jupyter Notebooks** and run within **Google Collaboratory**, an online platform. By using **Google Colab**, we reduce the amount of preparation needed for the tutorials and ensure all participants have a working version of Python.



These instructions will give a brief overview of using **Google Colab** and installing **QGIS**, an open-source software for visualizing geospatial datasets.



https://github.com/achri19/komo_estuary_tutorial

Software:

QGIS – Open-source GIS software for visualizing and processing geospatial data

Python – Open-source software for installing multiple Python tools

ANUGA – Open-source python-based modeling software

Google Earth Engine - Cloud-based geospatial analysis platform

Affiliation: Jet Propulsion Laboratory, California Institute of Technology

Acknowledgement: The research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration (80NM0018D0004)

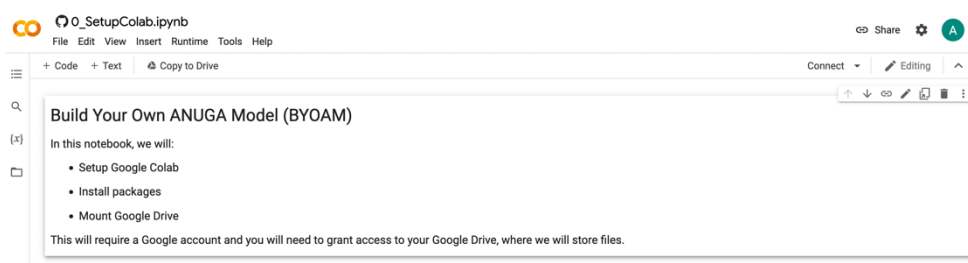
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Section 2: Tutorials

There are 6 tutorials in the workshop. The links to the notebooks for this workshop at this Github page. (https://github.com/achri19/komo_estuary_tutorial). All tutorials are designed to run in **Google Colab**, which can be setup using instructions in **Section 4**.

Tutorial 0: Setup Colab

Summary: This notebook will walk through the process of installing packages, connecting to your Google Drive, signing up for **Google Earth Engine**, and using **Google Colab** (a free, online platform for running Python Jupyter Notebooks)



Tutorial 1: GEE Water Masks

Summary: This notebook will introduce **Google Earth Engine** (via **Python**) and produce water masks for the study area. This is a very time-intensive step so all output files will be provided

Tutorial 2: Build Digital Elevation Model

Summary: This notebook will walk through steps to build a DEM for the study area using open-source/publicly available datasets.

Tutorial 3: Boundary Conditions

Summary: This notebook will look at options for setting boundary conditions

Tutorial 4: Mesh Generator

Summary: This notebook will use the **ANUGA** mesh generator to build a uniform, unstructured mesh for the model domain

Tutorial 5: Run ANUGA

Summary: This notebook will run a short **ANUGA** simulation

Tutorial 6: Post-Processing

Summary: This notebook will introduce ways to visualize the model output. We will also use **QGIS** to create animations.

Section 3: QGIS

Installing QGIS



QGIS is a great tool for processing remote sensing data and especially useful for visualizing data quickly and effectively. It is open-source and can be downloaded here:

<https://qgis.org/en/site/forusers/download.html>

For Windows:

Download for Windows

QGIS in OSGeo4W (recommended for regular users):

 **OSGeo4W Network Installer** 




In the installer choose **Express Install** and select **QGIS** to install the *latest release* or **QGIS LTR** to install the *long term release*. The express installations have several optional packages including non-free software. To avoid those you have to use the **Advanced Install** and choose **qgis** and/or **qgis-ltr** in the desktop section.

CAUTION: Upgrades of old setups from OSGeo4W v1 using this repository are not supported. You need to do a fresh install or use a different directory.




CAUTION: 32 bit binaries are not produced anymore. Also Windows 7 no longer works as we are now using Python 3.9, which dropped support for it.

Standalone installers (MSI) from OSGeo4W packages (recommended for new users)

Latest release (richest on features):

 **QGIS Standalone Installer Version 3.24** 
[sha256](#) 

Long term release (most stable):

 **QGIS Standalone Installer Version 3.22** 
[sha256](#) 

Note that the MSI installers are much bigger than the previous installers. This is because they include significant larger packages (eg. PROJ 8). The main reason for the switch to MSI were the size limits previously used NSIS has, which was blocking updates of dependencies.

We recommend the standalone installers, specifically Version 3.22

For Mac:


Download for macOS

Official All-in-one, signed installers

Mac Installer Packages for macOS High Sierra (10.13) and newer.


QGIS is not yet notarized as required by macOS Catalina (10.15) security rules. On first launch, please right-click on the QGIS app icon, hold down the Option key, then choose Open.

Latest release (richest on features):



QGIS macOS Installer Version 3.24

Long term release (most stable):




QGIS macOS Installer Version 3.22

Alternative build

Mac Installer Packages for macOS High Sierra (10.13) and newer.

Installation instructions are in the Read Me on the disk image. GDAL and Python (both included on the disk image) are installed separately and outside the QGIS app so they are usable on their own. These packages use the python.org Python 3 - other distributions are not supported.



macOS Installers

We recommend Version 3.22

For Linux:

Download for Linux

For many flavors of GNU/Linux binary packages (rpm and deb) or software repositories (to add to your installation manager) are available. Please select your choice of distro below:

- [Debian/Ubuntu](#)
- [Fedora](#)
- [openSUSE](#)
- [RHEL, CentOS, Scientific Linux, ...](#)
- [Mandriva](#)
- [Slackware](#)
- [Arch Linux](#)
- [Flatpak](#)

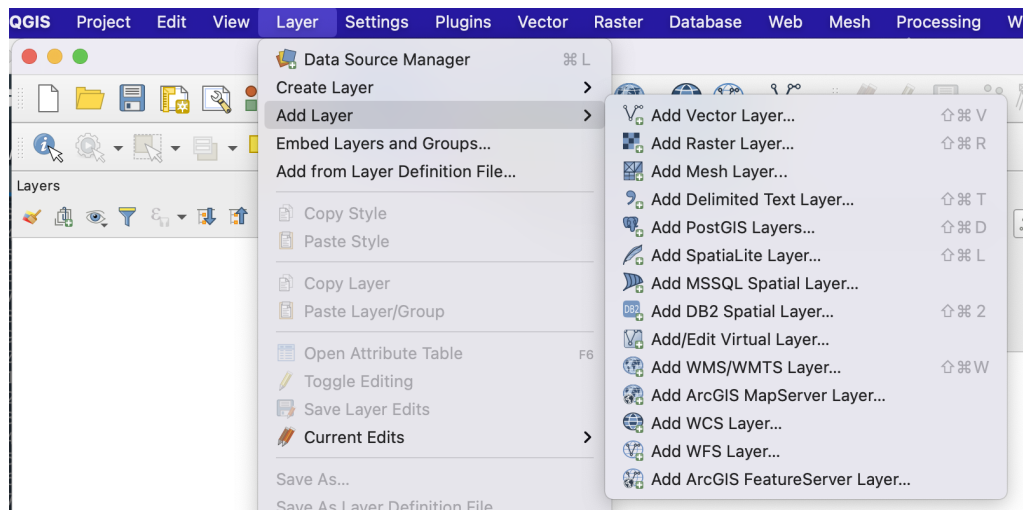
[Linux Installation Instructions](#)

Common issues:

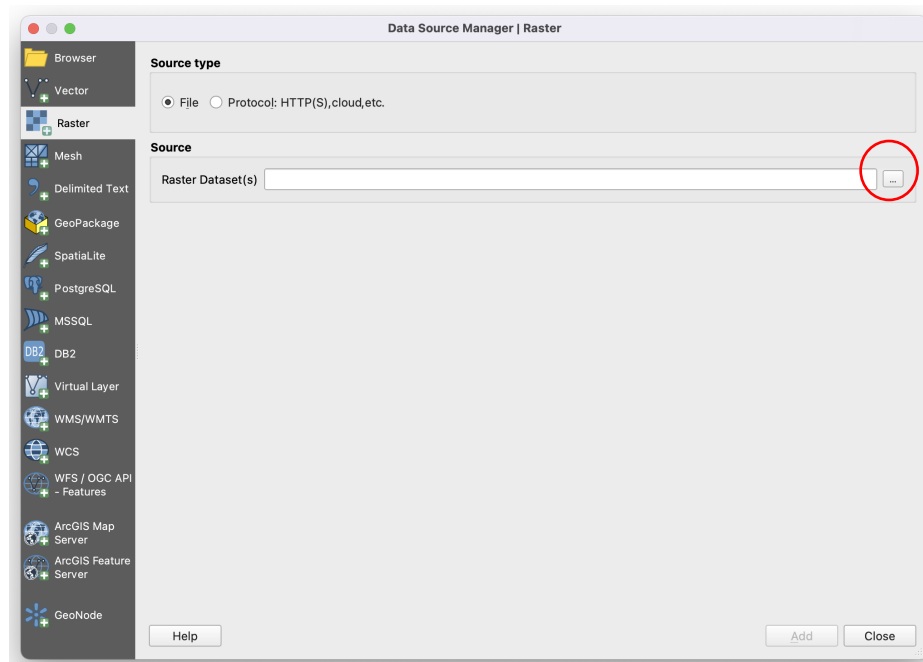
- If you're using a PC and get error 2503 or 2503, you need to set permissions on C:\\WINDOWS\\TEMP to Authenticated users = Full Control
 - More info [here](#)

Testing QGIS

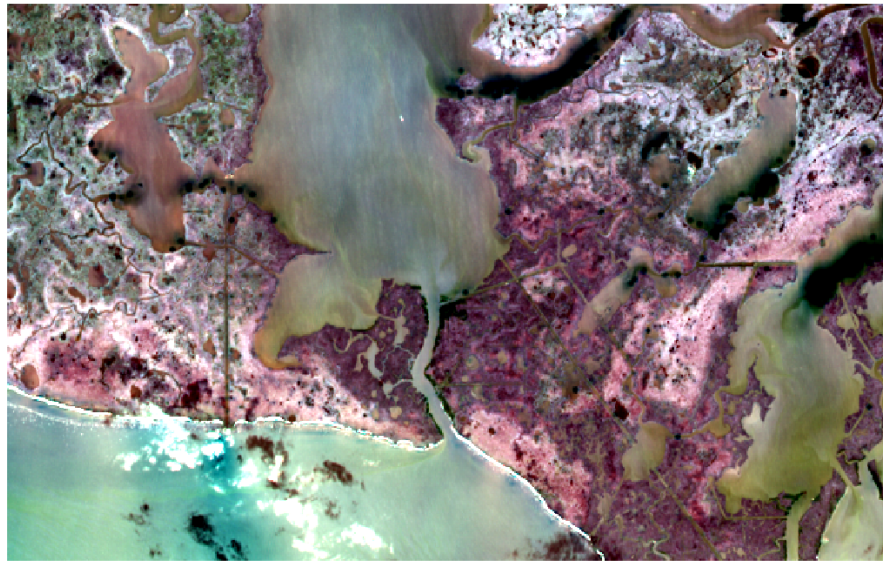
Once you have installed QGIS, run the application. Find the **Layer** tab, select **Add Layer**, and then select **Add Raster Layer ...**



When the Data Source Manager window opens, browse through your files (click the button with three small dots) to find the **DeltaX_Workshop/Installation_Files/QGIS/Test_Raster.tif** file and click **Open**. Then click **Add** at the bottom of the Data Source Manager window.



If you have no issues visualizing the file and it looks similar to the image below (but maybe different colors), then QGIS is ready to go.



Section 4: Google Colab

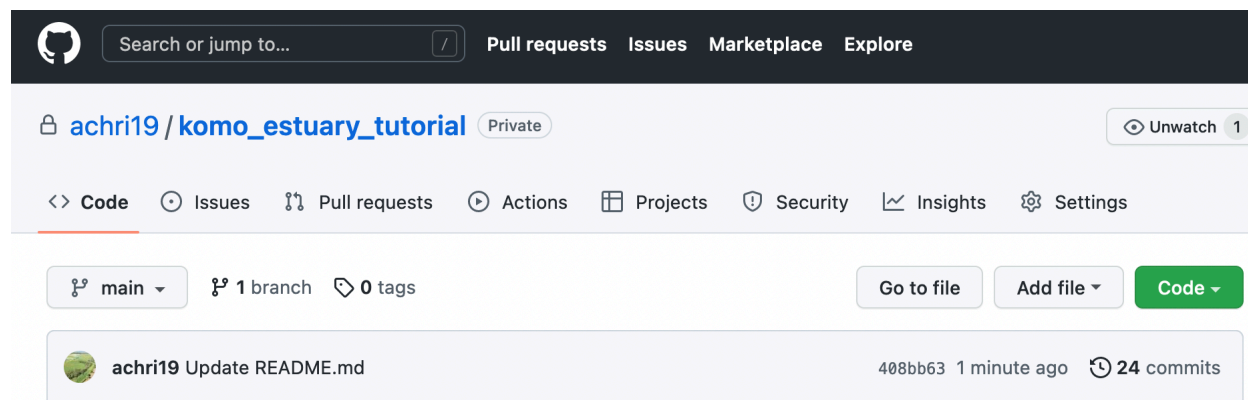
Setting up Colab

For this tutorial, we will be using Google Collaboratory, which allows us to run Python Jupyter Notebooks online without installing complicated software.

Google Colab is similar to Jupyter Notebooks, but is run on the Google cloud and comes with many packages already installed. Therefore, it's a great way to teach tutorials for this workshop. The only requirement will be allowing Colab access to your Google Drive. Unfortunately, Colab cannot access the files on your computer, so we will be accessing data through the shared Google Drive.

Please go through the following steps to practice using Colab.

- 1) Go to https://github.com/achri19/komo_estuary_tutorial to find the Github site where we are hosting the test notebook.

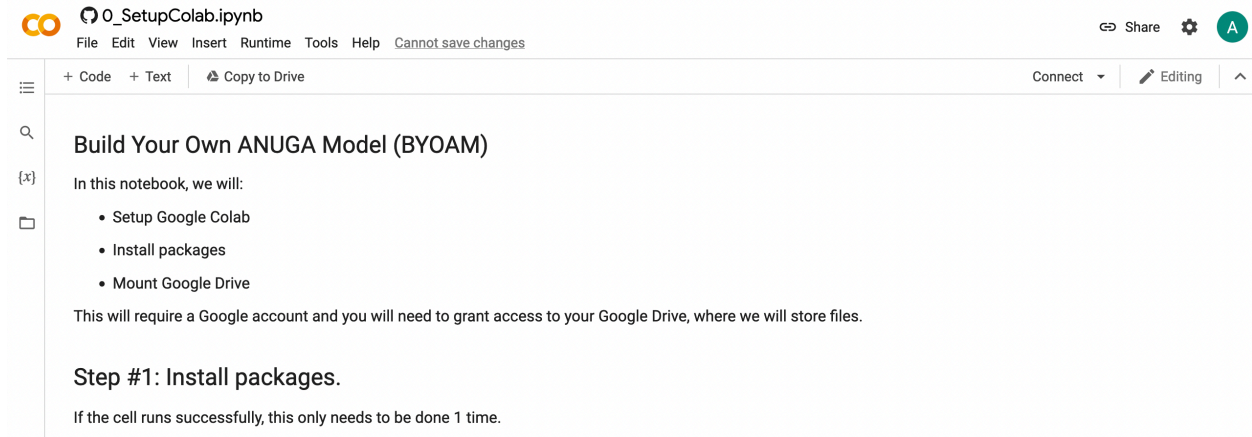


You do not need a Github account to access this repository.

- 2) Click on the “Open in Colab” button within the README section.



- 3) This will open a new window and a beautiful test notebook.



The screenshot shows a Google Colab notebook interface. The title bar reads '0_SetupColab.ipynb'. The menu bar includes 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', 'Help', and 'Cannot save changes'. The toolbar shows '+ Code', '+ Text', 'Copy to Drive', 'Connect', 'Editing', and a user profile icon. The notebook content is titled 'Build Your Own ANUGA Model (BYOAM)'. It includes a search icon, a list icon, and a text area with the following content:

In this notebook, we will:

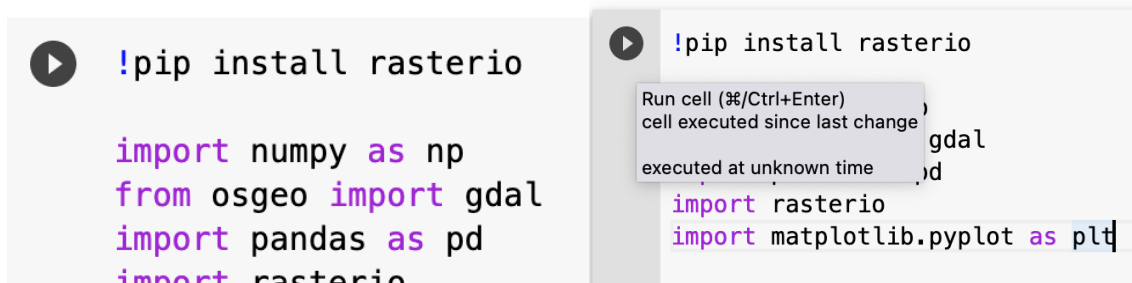
- Setup Google Colab
- Install packages
- Mount Google Drive

This will require a Google account and you will need to grant access to your Google Drive, where we will store files.

Step #1: Install packages.

If the cell runs successfully, this only needs to be done 1 time.

- 4) Read the instructions and run through each cell (snippet of code separated into boxes)
- 5) When you hover over the first gray box, you will see a “play” button in the upper left corner. **Click it** to run the first cell. You can also use a command to run this cell, often it's SHIFT + ENTER or CTRL+ENTER, depending on your system. If you hover over the “play” button, it will tell you what the command is.



The image shows two code cells from the notebook. The left cell has a play button icon in the top left corner and contains the following code:

```
!pip install rasterio

import numpy as np
from osgeo import gdal
import pandas as pd
import rasterio
```

The right cell also has a play button icon and contains the following code:

```
!pip install rasterio

import rasterio
import matplotlib.pyplot as plt
```

A tooltip is visible over the play button of the right cell, displaying the text: 'Run cell (⌘/Ctrl+Enter) cell executed since last change', 'gdal', 'd', and 'executed at unknown time'.

If you run into any problems with this process, please reach out to alexandra.l.christensen@jpl.nasa.gov

Section 5: Data Access

All data used in this tutorial are publicly available. Some data are provided in the Google Drive and some are downloaded within the notebooks. Due to the long processing time of some steps, we are providing some pre-processed datasets.

More coming soon...