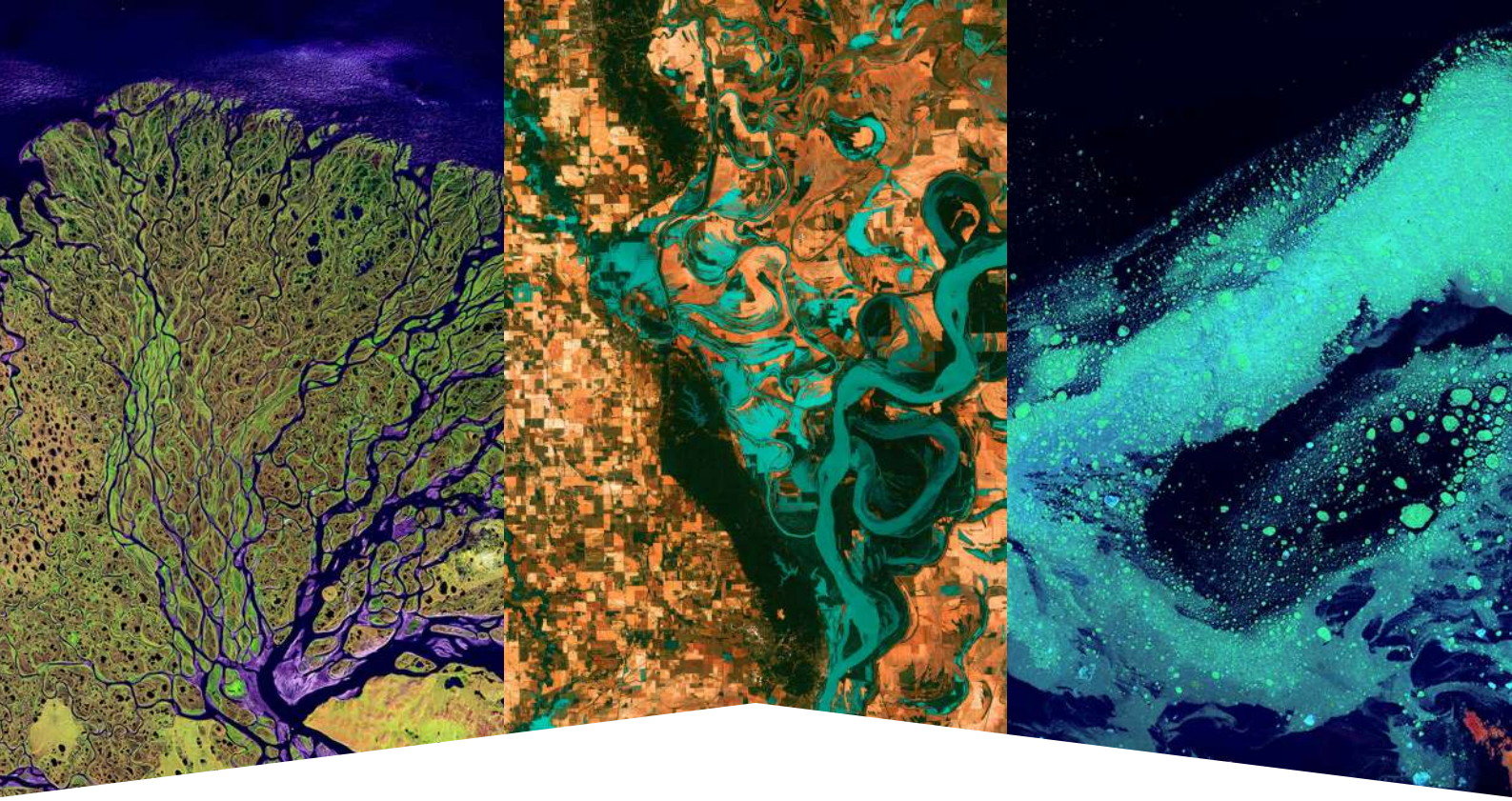


SG REMOTE SENSING WORKSHOP 2023

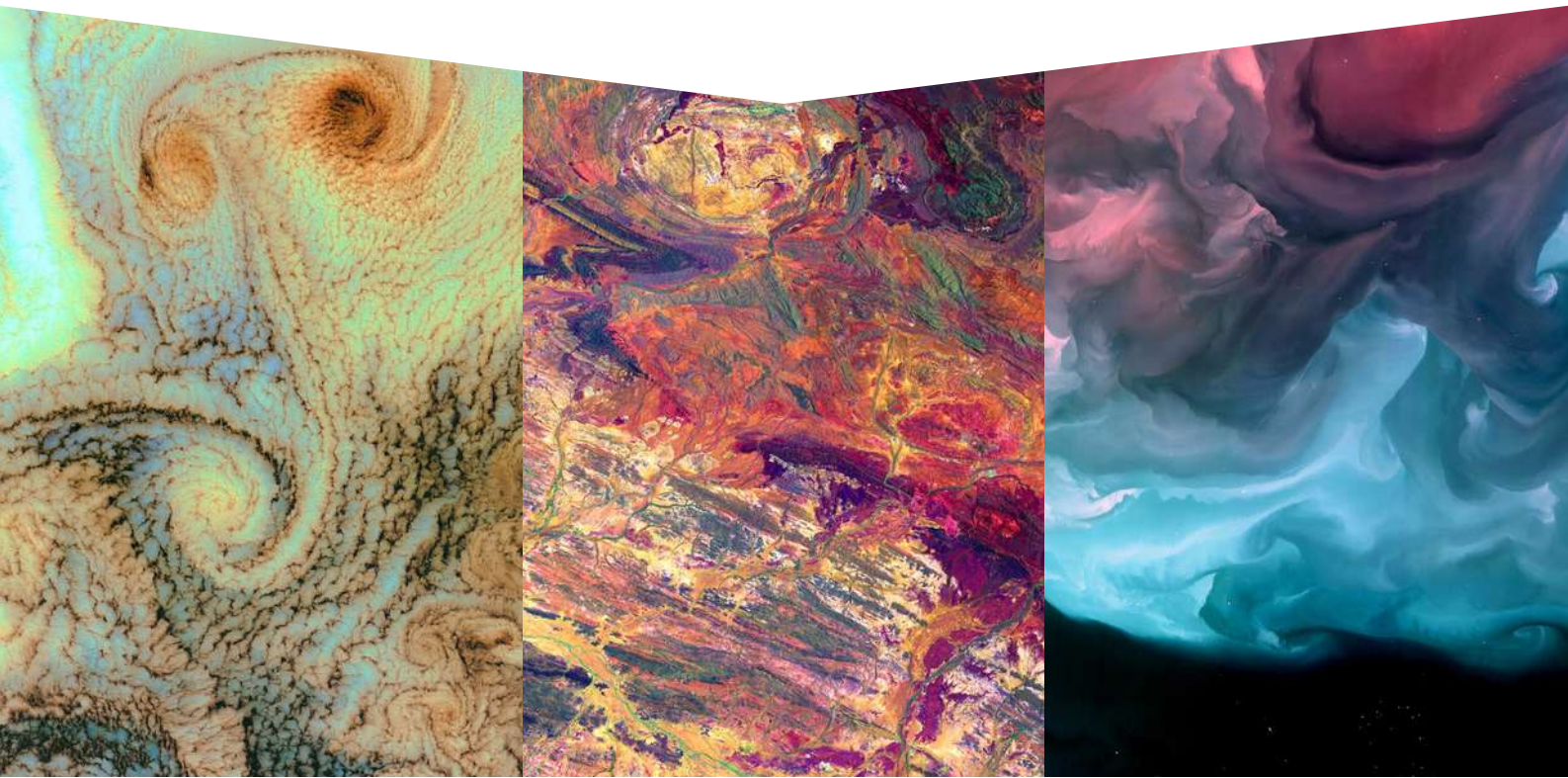
PROGRAM BOOKLET

27 November - 1 December 2023

SPACE FACULTY

Office for Space Technology & Industry, Singapore

CRISP
National University of Singapore



SCHEDULE OF ACTIVITIES

DAY	ACTIVITY
1	0830 to 0900 Registration 0900 to 1000 Opening Ceremony + Briefing for Google Earth Engine: Hands on Experience 1030 to 1230 S2S Site Visit 1230 to 1330 Lunch 1330 to 1500 Lecture 1: Introduction to Remote Sensing 1500 to 1530 Break 1530 to 1700 Lecture 2: Monitoring the atmospheric environment
2	0900 to 1030 Lecture 3: Monitoring the aquatic environment 1030 to 1100 Break 1100 to 1230 Lecture 4: Monitoring the terrestrial environment 1230 to 1330 Lunch 1330 to 1500 Lecture 5: Introduction and Applications of Synthetic Aperture Radar (SAR) 1500 to 1530 Break 1530 to 1700 Lecture 6: Introduction to Machine Learning in Remote Sensing

DAY	ACTIVITY
3	0900 to 1200 Introduction to Google Earth Engine 1200 to 1300 Lunch 1300 to 1400: Presentation by Dr James Kah 1400 to 1700 Google Earth Engine: Hands-on Experience
4	Google Earth Engine: Hands-on Experience
5	Presentation of their Google Earth Engine Hands-on Experience 0900 to 1130 AM Presentation Lunch 1230 to 1500 PM Presentation 1500 to 1600 Judging/ Break 1600 to 1630 Prize Giving Ceremony and Closing Speech

PROJECT 1 : FLOOD MAPPING AND ASSESSMENT

A flood is an overflow of water onto land that is normally dry. There are a few types of floods – river flood, coastal flood and flash flood. Flooding is a significant and recurring natural disaster with far-reaching consequences, affecting communities, infrastructure and ecosystems worldwide.

With global warming, the frequency and severity of flooding have increased. Having close to real time data on the flood extent is crucial for humanitarian efforts to be relevant, timely and effective.

Leveraging on the power of Google Earth Engine, this project focuses on utilising Synthetic Aperture Radar (SAR) images from Sentinel-1 and geospatial analytics to map flood extents and assess the resulting damages.

Flood in Zhuozhou, in northern China's Hebei Province on 02 August 2023

PROJECT 2 : WILDFIRE MONITORING

Wildfires in Attica, Greece. July 2023

Wildfires are a natural part of many ecosystems, but their increasing frequency and intensity pose significant challenges to our environment and communities. With the power of Google Earth Engine, you can harness the capabilities of remote sensing and geospatial data to analyze, predict, and respond to wildfire events.

In this tutorial, we will take you through the fundamental concepts and practical techniques to leverage Google Earth Engine's vast collection of satellite imagery, environmental data, and geospatial analysis tools. Data products from Sentinel-5P will be used for the purpose of quantifying and visualizing wildfire events.

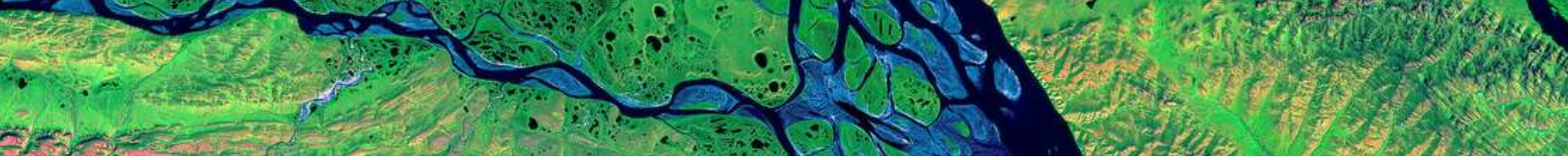
PROJECT 3 : DEFORESTATION

Deforestation is the process of clearing or removing large areas of forests or trees, typically for the purpose of converting the land for agricultural, industrial, or urban use. This often involves the complete removal of trees and vegetation, resulting in the transformation of forested areas into non-forested ones. Deforestation has resulted in habitat damage, biodiversity loss, and aridity. Deforestation also causes extinction, changes to climatic conditions, desertification, and displacement of populations.

Between 15 million to 18 million hectares of forest, an area the size of Bangladesh, are destroyed every year. On average 2,400 trees are cut down each minute.

Using Google Earth Engine, this project focuses on utilising Synthetic Aperture Radar (SAR) images from ALOS-2, optical data from Sentinel-2 and machine learning to identify deforestation and assess the impacts.

Aerial view showing a deforested area of the Amazonia rainforest in Lábrea, Brazil on September 15, 2021.



PROJECT 4 : MANGROVE MAPPING

Mangroves are salt-tolerant evergreen forests found in intertidal environments, at the interface between land and sea. Mostly found at tropical and sub-tropical latitudes, they grow in areas along sheltered coastlines, shallow-water lagoons, estuaries, rivers and deltas, where they experience and adapt to drastic changes in their environment. These lead to the development of adaptation mechanisms to survive in conditions of changing salinity, extreme tides, strong winds, temperature, and soils.

Wetlands including sea grass beds, mangroves, and salt marshes along our coast "capture and hold" carbon, acting as a carbon sink. Despite being a smaller area than terrestrial forests, these coastal ecosystems sequester carbon at a much faster rate and can continue to do so for millions of years.

When these systems are damaged, an enormous amount of carbon can be emitted back into the atmosphere, where it can further contribute to climate change. Efficiently mapping these habitats is key to understanding further changes in these environments, its subsequent effects on the ecosystem, and help us to plan out coastal habitat conservation and restoration efforts.

PROJECT 5 : MAPPING URBAN GREEN SPACE

Central Park in New York, USA

Urban green spaces are areas in an urban environment reserved for ‘green’ or ‘blue’ areas such as residential greenery, parks, water features. Defined by the World Health Organization as “all urban land covered by vegetation of any kind”, these landscapes can range from relatively natural landscapes to highly maintained environments.

Urban green spaces are of interest because it is recognized as a means for city dwellers to relieve stress, improve social cohesion, reducing the city’s air pollution, heat, traffic noise and emissions and improves a city’s aesthetics and ecology. The result of this is reduced morbidity and mortality of urban residents. There is thus an increased attention from policymakers and the public to actively plan for such spaces.

Leveraging on the power of Google Earth Engine, this project utilizes optical (multispectral band) images from the Sentinel 2 satellite and geospatial analytics to map urban green space locations. This is a simple tool to provide insight for land-use planning purposes.

PROJECT 6 : WATER QUALITY ESTIMATION

Images showing the variability in water colour based on variable water quality.

Water quality is a general term used to determine whether the water is fit for anthropogenic activities. Using ocean colour, we can use the optically active constituents (OACs) in the water water column to assess the quality of the water. These OACs include the concentration of suspended particulate matter, cholophyll-a and coloured dissolved organic matter.

In this session, we would try to estimate the suspended partculate matter concentration in and around the Singapore waters using ocean colour remote sensing. We will use Sentinel-2 Multi-Sprectal Imager (MSI) to compute this product.

PROJECT 7 : FIRE AND HOTSPOTS

Vegetation fires, caused by various human activities, are a yearly occurrence on the island of Sumatra in Indonesia.

High resolution satellites can be used to detect these fires, because the resulting smoke plumes can be seen on the satellite images when they are not obscured by clouds. This imagery is also useful for analyzing land cover, and thus may be used to investigate the land cover changes associated with burning. E.g. Plantations can be identified by their regular grid-like pattern, and newly burnt areas are visible as dark patches of unvegetated land, called burn scars.

Another method of satellite fire detection is by using sensors in the thermal infrared region of the electromagnetic spectrum. The thermal infrared measurements can be used to estimate the temperature on the ground, and thus areas where the estimated temperature is unusually high can be flagged as suspected fires, or ‘hotspots’.

In this project, we will use imagery and hotspot data from the NASA Terra and Aqua satellites, captured with the 36-band MODIS sensor. We will also use higher resolution from data the European Space Agency’s Sentinel-2 optical satellites. These datasets can be displayed and analyzed in the Google Earth Engine.

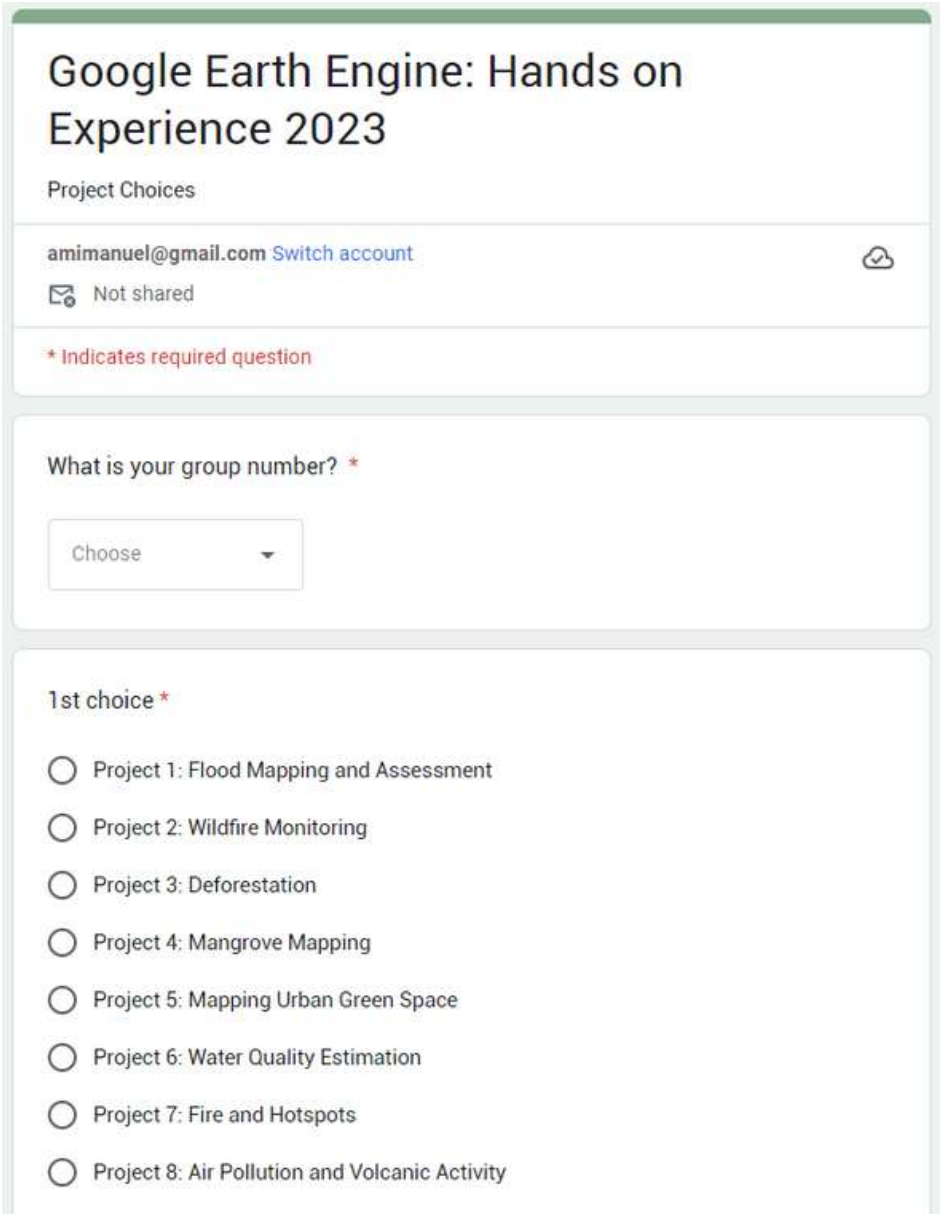
PROJECT 8 : AIR POLLUTION AND VOLCANIC ACTIVITY

Mount Merapi, Indonesia's most active volcano. January 2021

Volcanoes are geographical formations where lava, small rocks, and steam are released onto the surface of the earth. There are hundreds of active volcanoes around the world. Inhaling volcanic gases and ash can be harmful to your health. Breathing in volcanic gases at high concentrations can cause mild symptoms, such as irritation of the eyes, and more severe symptoms, such as difficulty breathing or even death.

In this instructional guide, we shall provide a comprehensive overview of essential principles and applied methodologies for harnessing the extensive repository of satellite imagery, environmental datasets, and geospatial analysis utilities available through Google Earth Engine. We will specifically employ data products sourced from satellites to facilitate the quantification and visualization of volcanic eruption incidents and its impact on air pollution.

PROJECT TOPIC OPTIONS



Google Earth Engine: Hands on Experience 2023

Project Choices

amimanuel@gmail.com Switch account

Not shared

* Indicates required question

What is your group number? *

Choose

1st choice *

- Project 1: Flood Mapping and Assessment
- Project 2: Wildfire Monitoring
- Project 3: Deforestation
- Project 4: Mangrove Mapping
- Project 5: Mapping Urban Green Space
- Project 6: Water Quality Estimation
- Project 7: Fire and Hotspots
- Project 8: Air Pollution and Volcanic Activity

- Do talk to your group members on your project choices.
- Each group should submit ONE response together
- Rank your project topic choices in the following Google Form:

https://forms.gle/FMyYdMqnRF68FhY79

Deadline: 27 Nov, Monday, 1800

PROJECT GUIDELINES

Presentation time limit: 10 minutes per group

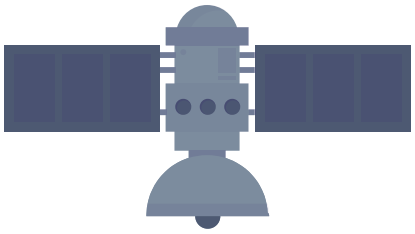
The following is a guideline to the format of your project that your group may wish to adopt:

- Background of your topic
- Data used
- Methodology
- Results
- Discussion

There will be a Q&A at the end of your presentation.

Do take a look at the rubrics to see how your group will be assessed.

Do ensure that every team member contributes to the project!



SUBMISSIONS

Presentation materials (slides or otherwise) needs to be submitted into the following google folder by
Thursday, 30 Nov, 2359.

https://drive.google.com/drive/folders/1Ol82iAsLoi2-p0zjRkaVb60adFNpjt2q?usp=sharing

Label the title of your file as follows:
Group x - Project Title

RUBRICS

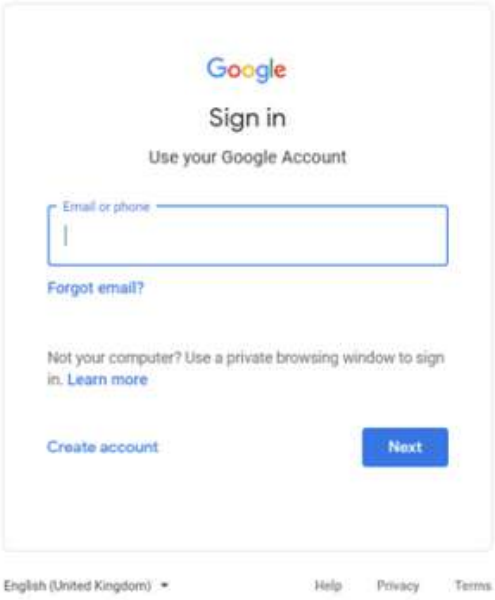
Criteria	Approaching	Meeting	Exceeding
Conceptual Understanding (60%)	Topic is too broad or not clearly defined. Demonstrates limited understanding of the provided source code. Unclear methodology Results/ images/ maps are shown with little explanation. Conducts basic data analysis, but interpretations lack depth and insights are not clearly presented.	Topic is focused but lacks direction. Demonstrates a reasonable understanding of the provided source code. Some gaps in explaining the methodology. Good use of results/ images/ maps with an attempt to explain most of them clearly. In-depth discussion and elaboration in most sections of the project.	Topic is focused. Demonstrates an exceptional understanding of the provided source code. Sound methodology that was well elaborated. Good and clear interpretation of results/ images/ maps. In-depth discussion and elaboration in all sections.
Novelty (20%)	Idea or approach is good but originality is very limited.	Application on the existing ideas. Attempts to create a novel or unique idea or approach	Demonstration of novel or unique and innovative idea or approach.
Presentation (10%)	Presentation is not polished. Slides interfere with the content. Missing many elements.	Presentation is polished for most parts. Missing 1 or 2 elements.	Presentation is polished. Effective slides with coherent and logical progression. Covers all key points.
Project Understanding and Teamwork (10%) [Assessed by mentors]	Difficulty understanding source code and identifying its structure and key functions. Requires a lot of prompting from mentors. Team lacks cohesion.	Able to understand source code and identify its structure and key functions. Requires some prompting from mentors Team has energy, varying contributions from different members.	Able to effectively understand source code and identify its structure and key functions. Requires little prompting from mentors and able to make modifications and customisations to the code on their own Team has energy and enthusiasm. Active participation from every member.

GOOGLE EARTH ENGINE ACCOUNT

Creating your Google Earth Engine Account

Please go through the following steps below and create a Google Earth Engine Account ***before*** Wednesday, 29 November 2023.

Step 1: Use your browser and go to this URL: https://code.earthengine.google.com
You will be prompted to sign in.



Step 2: If you have a Google account, sign in to your Google account. If you do not have a Google account, you would need to create one.

Refer to the step by step guide in the Google Drive on how to sign up for a Google Earth Engine Account

Please do so before Wednesday, 29 November 2023