GOVERNMENT OF INDIA
MINISTRY OF JAL SHAKTI, DoWR, RD & GR
CENTRAL WATER COMMISSION
**NATIONAL WATER ACADEMY, PUNE**

# Tentative Plan

## Introduction to Google Earth Engine and its Applications in Water Resources Management

## (11th to 22nd, July 2022)

| Day | Module Details | Faculty |
|---|---|---|
| 11 July 2022<br>Monday | **Introduction to Remote Sensing**<br><br>*Basic Principles of Remote Sensing; Type of sensors; Electromagnetic spectrum; surface interactions, Spectral reflection characteristics; SRC of water, Soil, vegetation etc.; Spatial resolution, Spectral resolution. Radiometric resolution, temporal resolution of images; Bands of RS images; Image analysis; NDVI; NDWI*<br><br>**Overview of Google Earth Engine**<br><br>*Google Earth Engine Platform and its basic functionalities; Client & Server concept; Cloud computing; Basic data models in GEE; Public Data Catalog; Basic operations (mapping, reduce, filter etc); Introduction to GEE code Editor.* | NWA |
| 12 July 2022<br>Tuesday | **Introduction to Google Earth Engine Code Editor**<br><br>*Components of GEE Code Editor; Familiarization with working of GEE Code Editor; JavaScript for GEE;* Basic Java Scripts data types/variable types; Running the first script in GEE code editor; *EE Objects and Methods; User Defined functions* | NWA |
| 13 July 2022<br>Wednesday | **Working with Raster data using Google Earth Engine**<br><br>*Importing/loading of Raster Data/Image and its visualization; Applying a computation to an image; Working with Single band Image/Multi band Image; True and false colour composites; Filtering of Image Collection; Setting up of bounds /extent for analysis; Computing NDVI through expression; Mapping a function over an image collection; UI chart for NDVI time series; Statistics of an image region; Downloading/Exporting the data/results* | NWA |
| 14 July 2022<br>Thursday | **Working with Vector data using Google Earth Engine**<br><br>*Importing/Loading a Feature Collection; Feature Collection Visualization; Feature collection information & Metadata; Filtering a Feature Collection; Mapping over a Feature Collection & Adding a new Attribute; Reducing a Feature Collection; Raster to Vector conversion; Vector to Raster conversion* | NWA |
| 15 July 2022<br>Friday | **Applications of GEE:** Waterbodies Extraction using NDVI and NDWI in GEE; Semi-Supervised Landcover classification using GEE and other example scripts | NWA/<br>External<br>Faculty |

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| 18 July 2022<br>Monday | **Applications of GEE:** Time Series Analysis and Change Detection; Flood Mapping & Monitoring using GEE; Agricultural Water Management & Drought Monitoring and other example scripts | IIRS |
| 19 July 2022<br>Tuesday | **Introduction to GEE Apps**<br>UI Interface Overview; Widgets; Panels and Layouts; Building and Deploying EE Apps | IIRS |
| 20 July 2022<br>Wednesday<br>21 July 2022<br>Thursday<br>22 July 2022<br>Friday | **Workshop on Assessment of River Morphological Changes and Coastal Erosion using Remote Sensing** | Stockholm Environment Institute ( To be arranged by World Bank) |
| | **Feedback and Valedictory** | NWA |

## Training Workshop on Assessment of River Morphological Changes and Coastal Erosion using Remote Sensing

### 1. Date and Venue

- 20-22, July 2022, NWA, Pune, Maharashtra

### 2. Rational

Sustainable water resources management is a key towards India's development. The country's food, energy and economic security are directly dependent on the sustainable management of unequally distributed water resources in both space and time. Water-related extreme weather events such as floods and droughts can have tremendous impacts on lives and livelihoods. Even other river biophysical processes such as morphological change induced bank erosion risk threatens valuable built infrastructure along the river course subsequently aggravating local flood patterns. To ensure effective water resources management leading towards resilience from the biophysical extremes requires a good understanding of river dynamics at the spatio-temporal scale. Rivers and their floodplains have an inherent property to change over time which is mainly driven by intrinsic and extrinsic forces operating within the channel and as a result of changes in the wider catchment. By recognizing that rivers are dynamic, a temporal analysis of fluvial geomorphology can support river management and restoration by providing information.

Coastal erosion is a severe problem for coastal communities worldwide. The rise in sea level will accelerate this process in many coastal areas under climate change scenarios. Coastal erosion has become considered a critical issue because population concentration is high in coastal areas with many development activities, such as industrial activities and increased transportation and tourism activities. In India, nearly all coastal states have to deal with the problem of coastal erosion. Coastal erosion and accretion have always existed and contributed to the shaping of the present coastlines. However, coastal erosion now is largely intensified due to human activities.

Remote Sensing data from an expanding network of satellite-based observations is increasingly used to complement in-situ sources providing critical information in support of managing and monitoring the evolution of hazards and their impacts in river systems and coastal areas. The

arrival of cloud-based processing systems like Google Earth Engine (GEE) radically changed the remote sensing data landscape to access, process and derive meaningful results covering large spatial and temporal coverage in a short timeframe. Freely accessible long time series satellite imageries and along with other environmental data on a powerful cloud computing platform facilitates quicker analysis for the problem statements which are time and hardware intensive. Also design and infrastructure of such platform facilitates building Decision Support tools which are scalable and reproducible.

## 3. Objectives of the training

The purpose of this workshop will be to showcase and train participants with hands-on to:

- Determine seasonal changes in the riverbank/river course for a section of river Changes in riverbank will be determined in form of Erosion and Accretion,
- Assess coastal erosion for section of Indian coast and extract areas of erosion, and
- Perform spatial analysis like Estimation of land loss by each Land Cover class and generate area of erosion by unit.

The participant will gain more insights on the potential of using GEE for riverbank erosion, coastal erosion and developing project ideas for scaling up applications of the tool for decision-making and practice

## 4. Tentative Agenda

| Day 1 (20.07.22) | |
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| **Time** | **Agenda Item** |
| 9:30-10:15 | Opening Remarks by Hosting institute<br>Welcome Remarks by World Bank<br>Presentation of workshop objectives and details of training program by SEI Asia |
| 10:15-10:30 | Introduction to More Rivers and Riverbank erosion concepts and web-based platform |
| 10:30-11:00 | Tea/Coffee Break |
| 11:00-12:00 | Presentation by Indian participants/organizations on case studies related to River morphology and coastal erosion (max 3 presentations, 15 mins/each+5 mins Q&A) |
| 12:00-14:00 | Lunch Break |
| 14:00-14:30 | Familiarizing with<br>• Remote Sensing<br>• GEE<br>• Multispectral and Microwave datasets |
| 14:30-15:30 | Hands-on exercise: Estimation of river morphology and Riverbank erosion using Multispectral datasets |
| 15:30-16:00 | Tea/Coffee break |
| 16:00-17:30 | Hands-on exercise: Estimation of river morphology and Riverbank erosion using Multispectral datasets (contd.) |

| Day 2 (21.07.22) | |
|---|---|
| **Time** | **Agenda Item** |
| 9:00-9:15 | Refresher of Day 1 |
| 9:15-10:30 | Hands-on exercise: Estimation of river morphology and Riverbank erosion using SAR dataset |
| 10:30-11:00 | Tea/Coffee Break |
| 11:00-12:00 | Hands-on exercise: Estimation of river morphology and Riverbank erosion using SAR dataset (contd.) |
| 12:00-14:00 | Lunch Break |
| 14:00-15:30 | Hands-on exercise: Estimation of Coastal erosion using multi-spectral datasets |
| 15:30-16:00 | Tea/Coffee break |
| 16:00-17:30 | Hands-on exercise: Estimation of Coastal erosion using multi-spectral datasets (contd.) |

| Day 3 (22.07.22) | |
|---|---|
| **Time** | **Agenda Item** |
| 9:00-9:15 | Refresher of Day 2 |
| 9:15-10:30 | Hands-on exercise: Estimation of Coastal erosion using SAR dataset |
| 10:30-11:00 | Tea/Coffee Break |
| 11:00-12:00 | Hands-on exercise: Estimation of Coastal erosion using SAR dataset (contd.) |
| 12:00-14:00 | Lunch Break |
| 14:00-15:30 | Prepare project ideas for application |
| 15:30-16:00 | Tea/Coffee break |
| 16:00-17:30 | Closing Session:<br>Feedbacks on the training<br>Concluding remarks by NWA, World Bank and SEI |