

# ENVIRONMENTAL PROGRAMMING


## ASSIGNMENT 11

### 11 – Environmental analysis using Remote Sensing data


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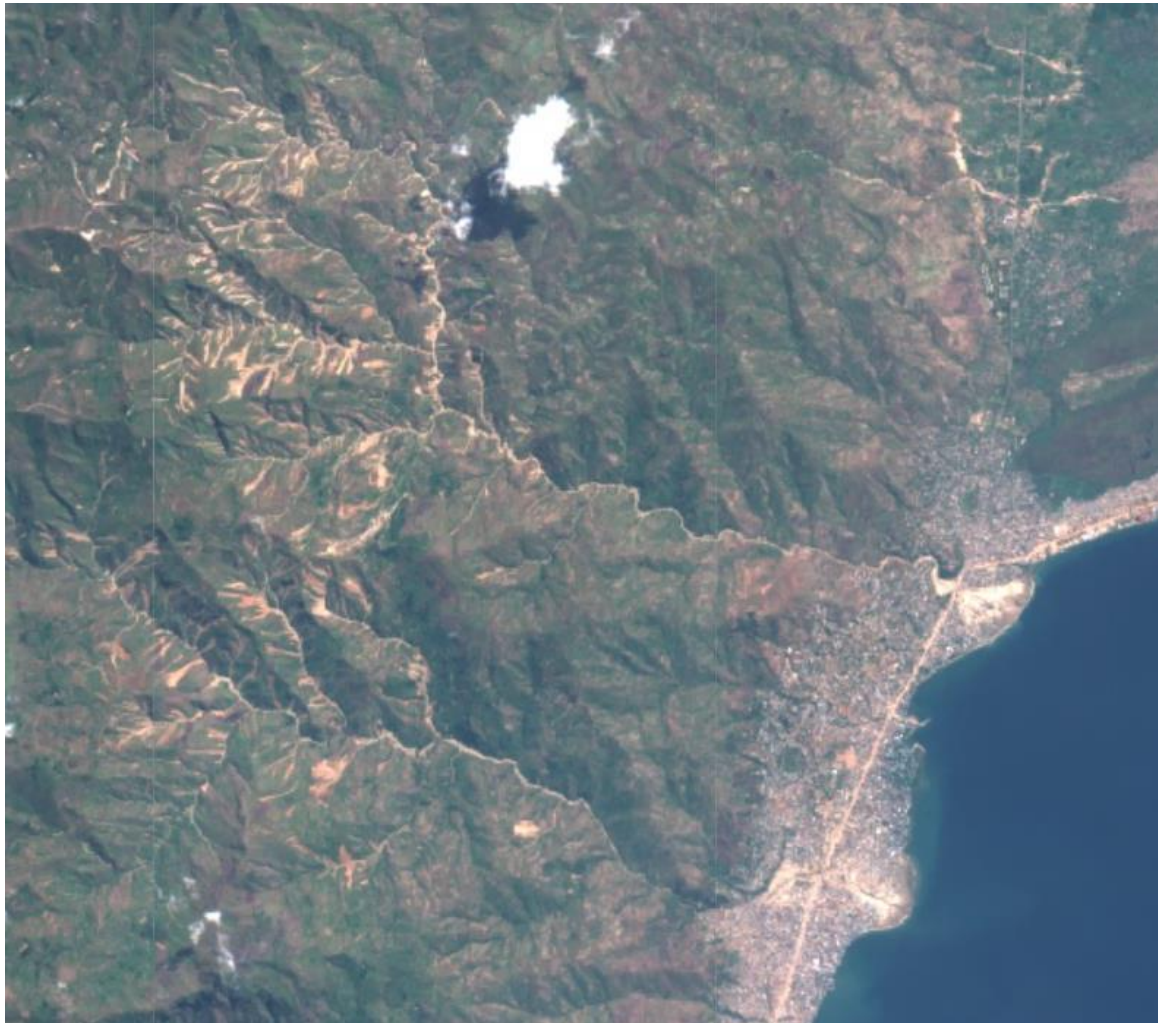


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# 1. INTRODUCTION

Remote sensing products can be valuable data products when analyzing natural hazards. The image below depicts the result of a disastrous event that occurred in Uvira in the Democratic Republic of the Congo. Here, landslides and flash flood co-occurred and interacted and eventually resulted in widespread flooding in the city of Uvira. Rainfall is often the primary trigger of these events. In this assignment, you will use an automatically detected natural hazard map, land surface data, and rainfall data to analyze this event. The data products are originally not in the same resolution. But for this exercise they are resampled to a common grid for a more straightforward processing in python.



## 2. ASSIGNMENT

### 2.1. Dataset

In the directory "DATA" you can find the following data:

- **'Natural\_hazard\_image'**: A folder containing one image indicating the likelihood of a natural hazard occurrence from 0 to 1 (3). Pixel resolution is 30 by 30 meter.

- **"Rainfall\_images"**: A folder containing multiple rainfall images (.tif files)  
The resolution of each pixel is originally 10 by 10 kilometer, but upscaled to be in line with the other data (30 x 30 meter)
- **"Land\_surface\_data"**: A folder containing a slope and a stream network image. The stream network image contains values from (0 to 8) indicating the gradation of the stream. Pixel resolution is 30 by 30 meter.

## 2.2. Tasks

1. Open the natural hazard, slope and stream network maps as numpy array.
2. Visualize the slope and stream network map and export them as 600 dpi image.
3. Create a function that ingests the NH map and makes a binary map 0/1 for non-affected area and affected area. The user should be able to choose the threshold.
4. Discriminate landslide and flash flood locations from the NH map using thresholds derived from the slope and stream network maps.
5. Create two maps, one showing only the landslide area, and one only showing the flash flood area, export them as 600 dpi image.
6. Read time series of rainfall maps.
7. Plot the spatially averaged daily rainfall as time series.
8. Create one functions that allows for the calculation of the following rainfall statistics for the entire area:
  - X-day average
  - X-day median
  - X-day max
  - X-day sum

The functions should be able to intake different X values, different starting dates, and the user should be able to make a decision if the statistic is calculated over the rainfall data prior or post this starting date. If it is prior, the starting date should be included in the calculation. Make it as user friendly as possible.
9. The event occurred on 17-04-2020. Calculate the statistics for X=1,2 and 3 prior and post event. Export all the results in one .csv file.

## 2.3. Optional Task

Develop a simple graphical user interface (GUI) to interactively execute your code.

Tip: You are free to use any open access Python package and free to design and create the layout of the interface. I suggest you to try Tkinter (<https://wiki.python.org/moin/TkInter>) but this is just a suggestion, many other options are available.

Internet is an incredible source of information (docs, videos, tutorials...).  
Just to list some websites and youtube videos...

<https://www.youtube.com/watch?v=eJRLftYo9A0&list=PLQVvvaa0QuDclKx-QpC9wntnURXVJqLyk&index=8>

<http://sebsauvage.net/python/gui/>

[https://www.tutorialspoint.com/python/python\\_gui\\_programming.htm](https://www.tutorialspoint.com/python/python_gui_programming.htm)

<https://docs.python.org/3/library/tkinter.html>

<http://www.tkdocks.com/tutorial/index.html>

## 2.4. Libraries

### 3. SUBMISSION AND REPORT

Develop a software that solves the steps described in the previous section and submit this together with a short report describing your software (objective, software structure, user manual like) by a week before the exam date.

#### 3.1. Do you need clarification on the assignment?

Please contact Axel Deijns and Elga Salvadore through the dedicated CANVAS forum. In the discussion forum you are able to post questions, share your code and request an appointment for an online session.

#### 3.2. How is the assignment evaluated?

EVALUATION MATRIX Assignment	Point
1) Does your software perform the required tasks providing the correct result(s)?	10 points
2) Is your code readable?	± 1 point
3) Are the name of the variables\functions\modules meaningful?	± 1 point
4) Are the data types appropriate for values the hold?	± 0.5 point
5) Are there too many code repetitions?	± 0.5 point
6) Does your code have a coherent structure?	± 0.5 point
7) Is the report clear, to the point and complete?	± 1 point
8) Is your code easy to use?	± 1 point
9) Is there a good balance of comments and code in the scripts?	± 0.5 point
10) Code reuse: are existing codes used appropriately?	± 1 point
11) Code reuse: Did you forget to properly citing the source of codes you are reusing?	- 2 point
12) How flexible is your code? For example, if I use a different data set with a different file name, would it still be working?	± 1 point
13) How easy would be for the next user to adapt/modify your code?	± 1 point
14) Is there any documentation? Installation steps (if additional libraries are used), flow chart	± 0.5 point
15) Did you develop a GUI for your code?	Up to 2 points