Historical Flood Index Tool

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“This tool uses historical flood frequency mapping and turns it into flood hazard and exposure analysis. It aims to support decision maker for planning and flood preparedness.”
Introduction

Flood hazard mapping approach

Modeling-based approach
RS data analysis approach
Flood modeling-based approach

Requirements:
• Modeling software
  • Hydrological model
  • Hydraulic model
• Data
  • Precipitation, discharge
  • Cross sections
• Land cover map
Introduction

Flood modeling-based approach

Result

• Flood inundation
• Flood depth
• Velocity/duration of the flood

To be Consider:
• Time
• Human resource (Hydrologist/Meteorologist)
• Software
Introduction

RS data analysis approach

Requirements:
- Satellite imagery
- RS analysis skill
- Programming skill
Introduction

RS data analysis approach

Process:
- Using Satellite imagery
- Extract water from each images
- Calculate the frequency of water occurrence
Introduction
Methodology

Percentage of water occurrence

2 times of water occurrence out of 5 observation layers

2/5 = 40%
Introduction

**RS data analysis approach**

**Result:**
- Flood frequency map
To be easier to use the data, we developed the tool
The tool provides:

- Flood frequency map
- Flood hazard index map
- Exposure result
GEE Analysis platform
JRC Global Surface Water Dataset
3,066,102 scenes analyzed

Landsat 5, 7, 8
From 1984 - 2015
30+ years of satellite data

380 layers of monthly surface water occurrence
• Surface water extraction
• Calculate the frequency of water occurrence
Flood hazard index map

JRC % frequency of surface water occurrence

Flood hazard index
Method: Flood Hazard Index

Monthly JRC water occurrence

% water occurrence based on selected time period

% Flood occurrence based on selected time period

Aggregate flood pixel to admin boundary

GEE code

Remove permanent water (Threshold)

Flood hazard index
To find the threshold to distinguish permanent water and flood:

- Use Pre flood water (permanent water) from UNOSAT flood 2015 as a base to extract JRC surface water as the same year.
- Use function “Extract by mask” of ArcGIS to do the process above.
- Once we got JRC surface water extracted we could assume that the water is permanent water.
- Average the pixel value of permanent water to be the threshold value to be used as a separator permanent water and flood in the next process.
Method: Flood Hazard Index

Monthly JRC water occurrence

% water occurrence based on selected time period

GIS software

Extracted JRC Permanent water

Layer Properties

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Method: Flood Hazard Index

Monthly JRC water occurrence

% water occurrence based on selected time period

Threshold = 82% frequency of occurrence
Method: Flood Hazard Index

- Monthly JRC water occurrence
- % water occurrence based on selected time period
- Remove permanent water (Threshold)
- % Flood occurrence based on selected time period
- Aggregate flood pixel to admin boundary
- Flood hazard index

GIS software

GEE code
To aggregate flood frequency into an admin. boundary:

- Township boundary is used for representing flood index.
- Aggregate by summing up all the pixel values in the township and then dividing by the township area.
- Find the maximum and minimum values in the range (0-100).
- Classify into low, moderate, and high flood index.
Method: Flood Hazard Index

JRC
% frequency of surface water occurrence

Flood hazard index
Flood index for Township A

\[
\text{Flood index for Township A} = \frac{(10 \times 4) + (30 \times 8) + (50 \times 4)}{30} = 16
\]

Flood index for Township B

\[
\text{Flood index for Township B} = \frac{(0 \times 4) + (30 \times 8) + (50 \times 5)}{80} = 6.13
\]

Township A has higher hazard level than Township B.
Flood index classification

- Low (<5)
- Moderate (5-10)
- High (>10)
Overall idea of the tool
Limitation of the tool

• The tool is not for flood emergency response or flood real-time monitoring

• The map represents flood frequency for entire selected time period not the individual flood event

• Landsat has revisit the same area every 16 days. Hence, some historical flood events might not be captured

• Observation might have been compromised by atmospheric conditions

• The color in the map represents the percentage of frequency not the depth of the water
Un-official link of the tool

http://dev.gymlog.co
Thank you