بِسْمِ اللهِ الرَّحْمٰنِ الرَّحِيْمِ “

In the name of Allah, the Most Gracious, the Most Merciful

Revolutionizing Flood Monitoring: A Web-Based Application for Near-Real-Time Observation Using Satellite Imagery

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Background

- Problems
- World scenario-Pakistan, India, Libiya
- Bangladesh overview regarding latest researches

Monsoon in India: Floods leave nearly 200 dead in 4 states

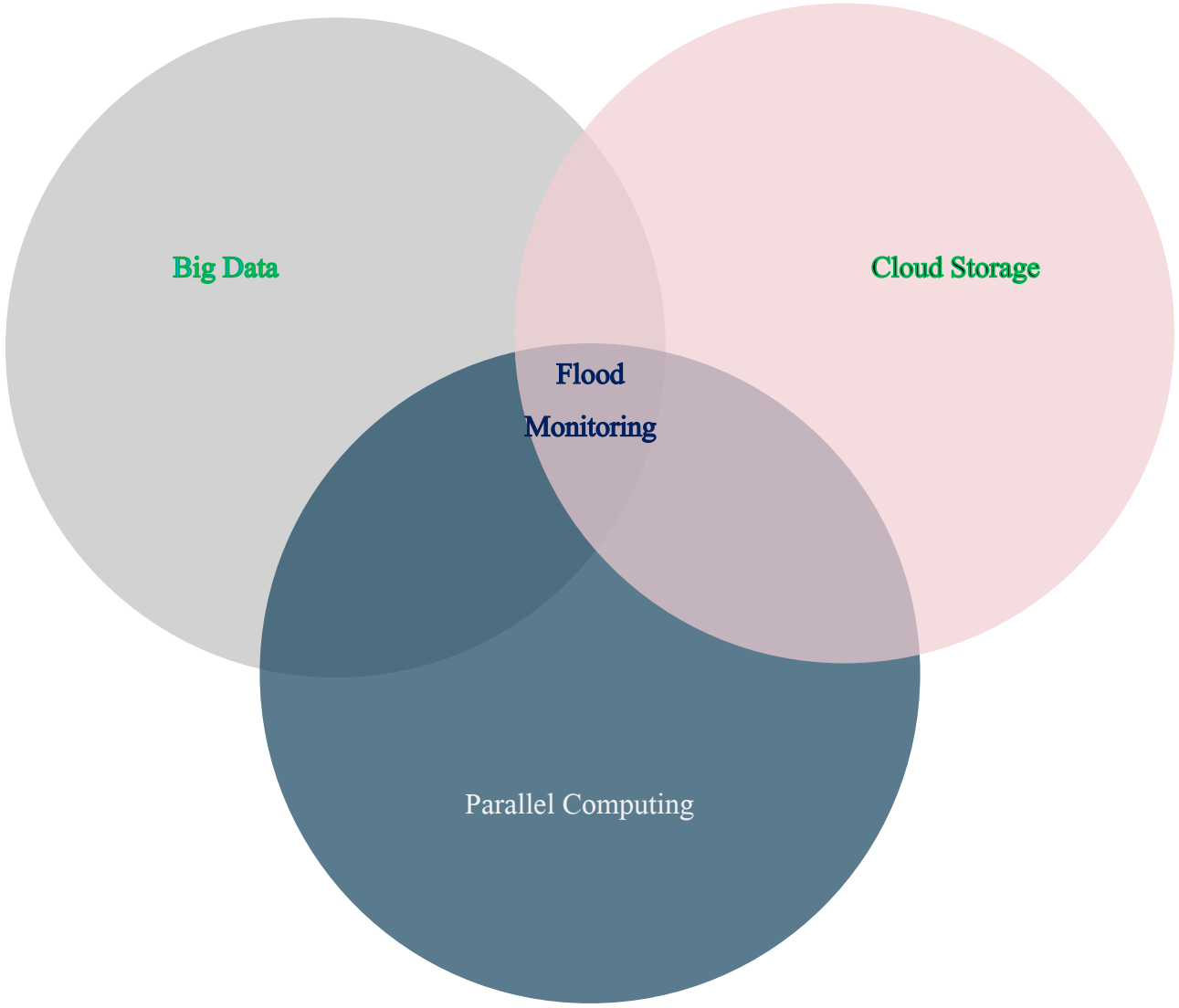
Pakistan's catastrophic floods

More than 5,000 presumed dead in Libya after catastrophic flooding breaks dams

Research gap with respect to critical analysis of literatures

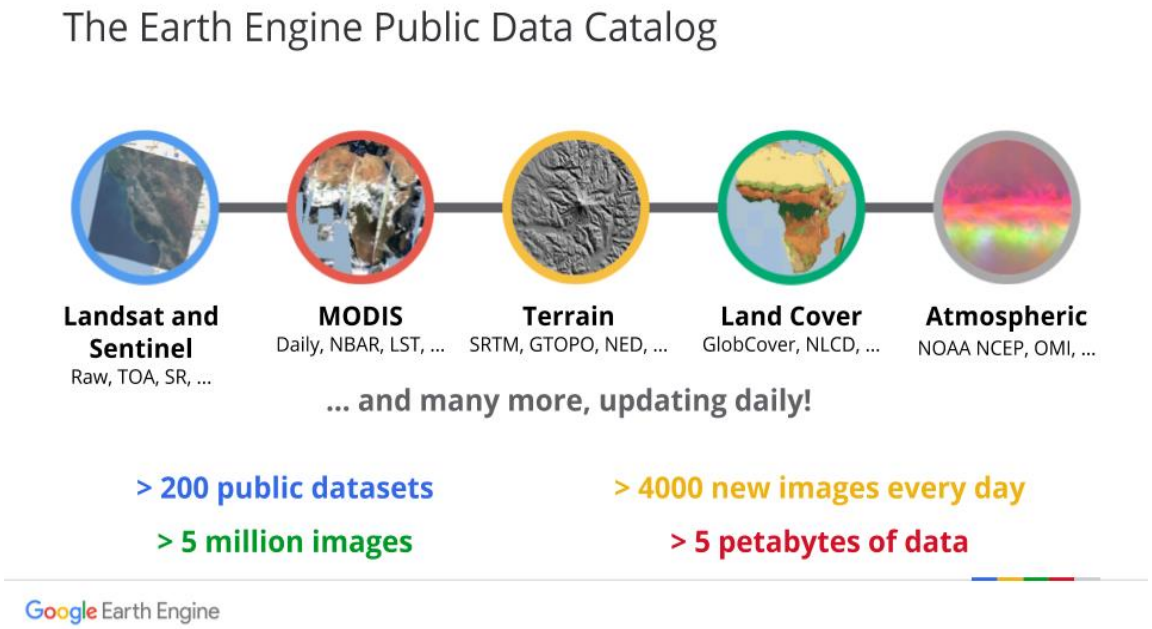
- Voluminous dataset store and analysis are tough in conventional way
- In fact, traditional analysis is done by trained analysts on high powered computers, which can create a resource barrier for fiscally strained communities or those without advanced training
- Moreover, flood monitoring in field based is expensive as well as time consuming
- Readily observable field evidence of the largest or most recent natural disasters are difficult
- For example, the timing and extent of a series of flooding events over many years will be difficult and expensive to determine with field methods alone
- Apart from that field-verified inventories of spatially extensive events may take many months

Research Opportunity



Research Opportunity

- **Game Changer**-Google Earth Engine is a remote sensing data analysis platform designed to take advantage of Google's infrastructure for data storage, access, processing, and visualization (Gorelick et al., 2017)



1 petabyte= 1024 TB= 1million GB

1. Gorelick et al., 2017. https://doi.org/10.1016/j.rse.2017.06.031, 2017

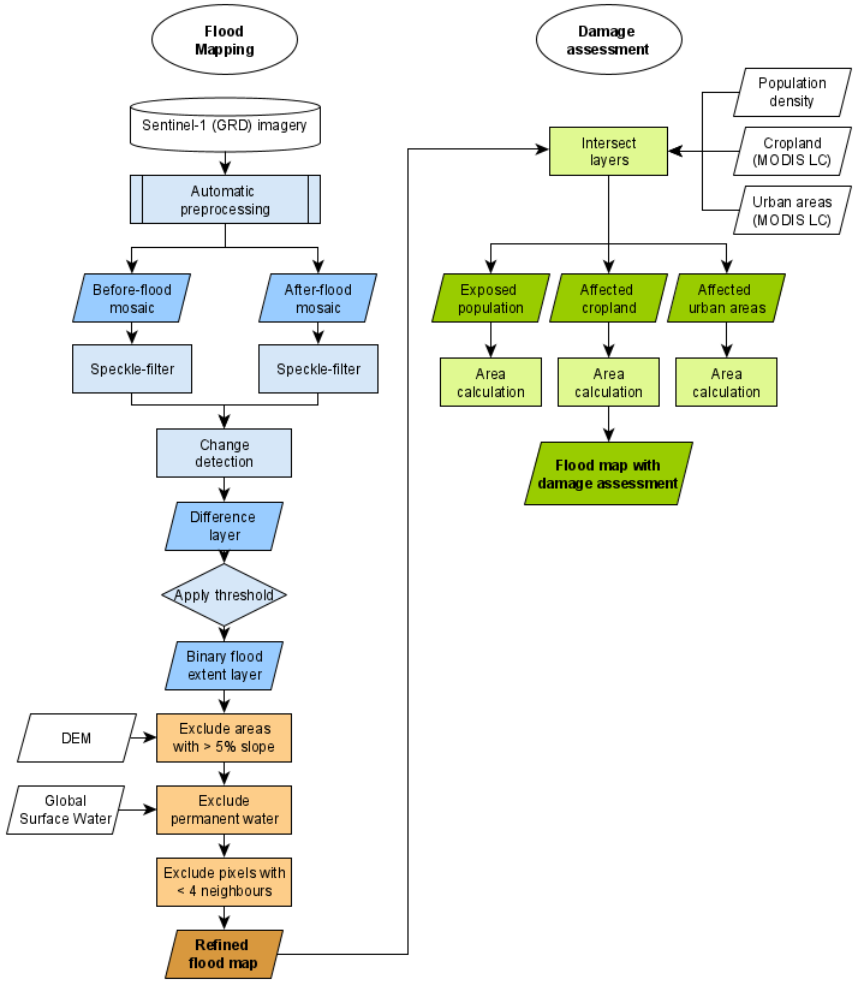
Objectives

- Develop an cloud based **application** which could fetch data continuously from voluminous data.
- **Fast and reproducible estimation** of the damage from local to regional scale regarding flood extent, population exposed, affected cropland and urban areas
- **Map** flooded affected areas, croplands, populations and urban areas in near real time using Sentinel-1 SAR data, the GEE cloud computing platform

Open a platform for scientists and non scientists to explore and characterize the spatial pattern of flood by making it **open source**. The power of parallel computing will **save** our time for **understanding** the flood dynamics and spatial pattern for **predicting** future hazards and eventually **decision** making.

Methodology

- **Image differencing**
- Before and during/ after flood
- Data used
- Human settlement 2015, Modis 2015



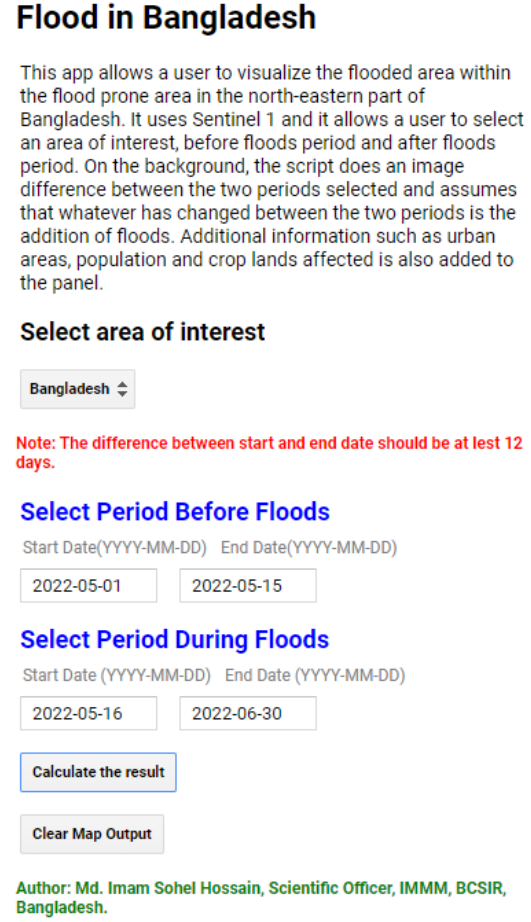
Reference: UN Spider

Findings-Cloud-Based App Development

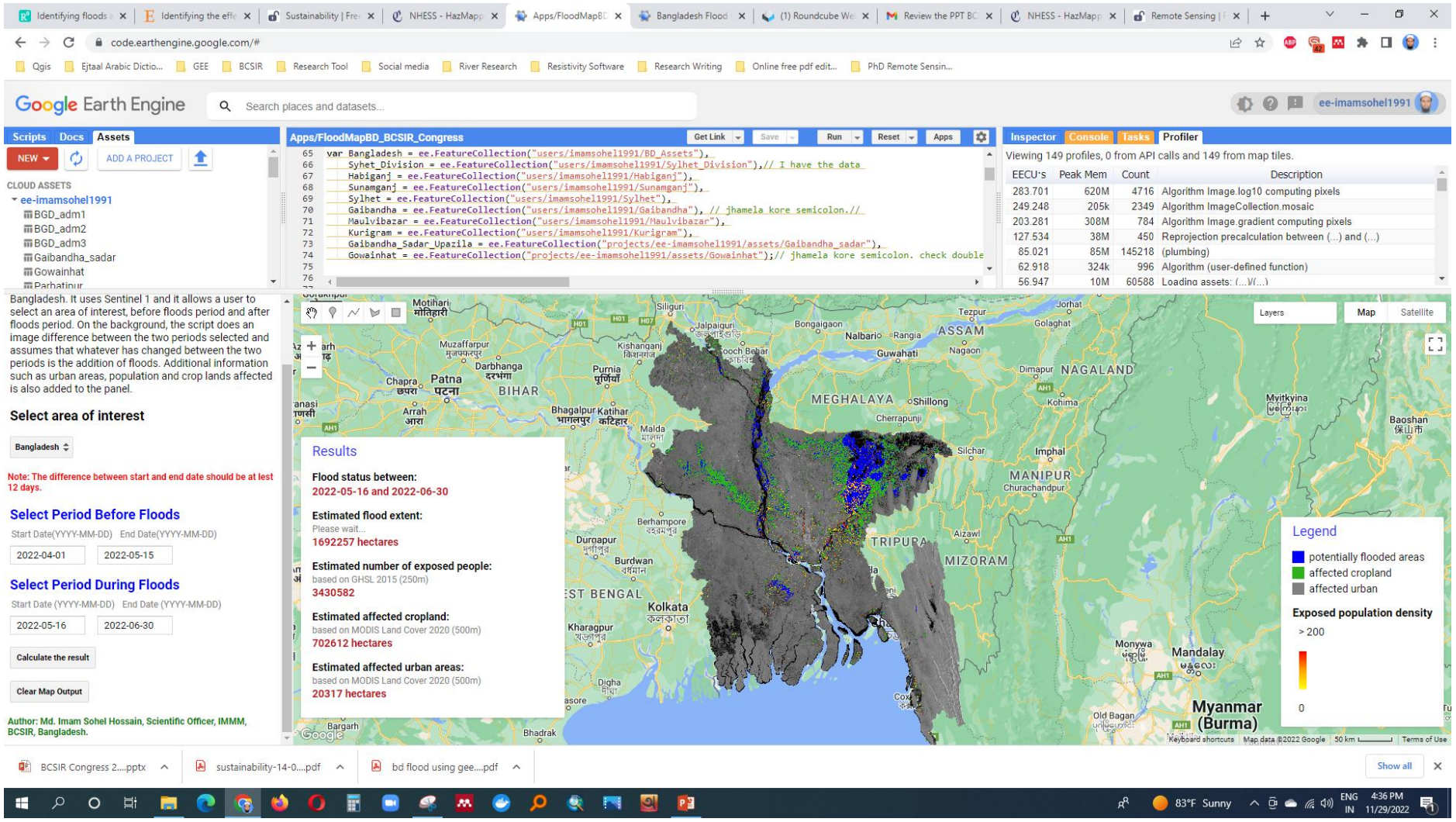
https://imamsohel1991.users.earthengine.app/view/bangladesh-flood-cloud-computing

Input Variables	Definition	Example
Select area of interest	Choose an area to observe the flood condition	Sylhet, Gaibandha
Select Period Before Floods (start date, end date)	The range of date prior to the event	01 May 2022, 15 May 2022
Select Period During Floods (start date, end date)	The range of date during the event	16 May 2022, 30 May 2022
Calculate the result	Click to show the result	
Clear map output	Click to clear the output	

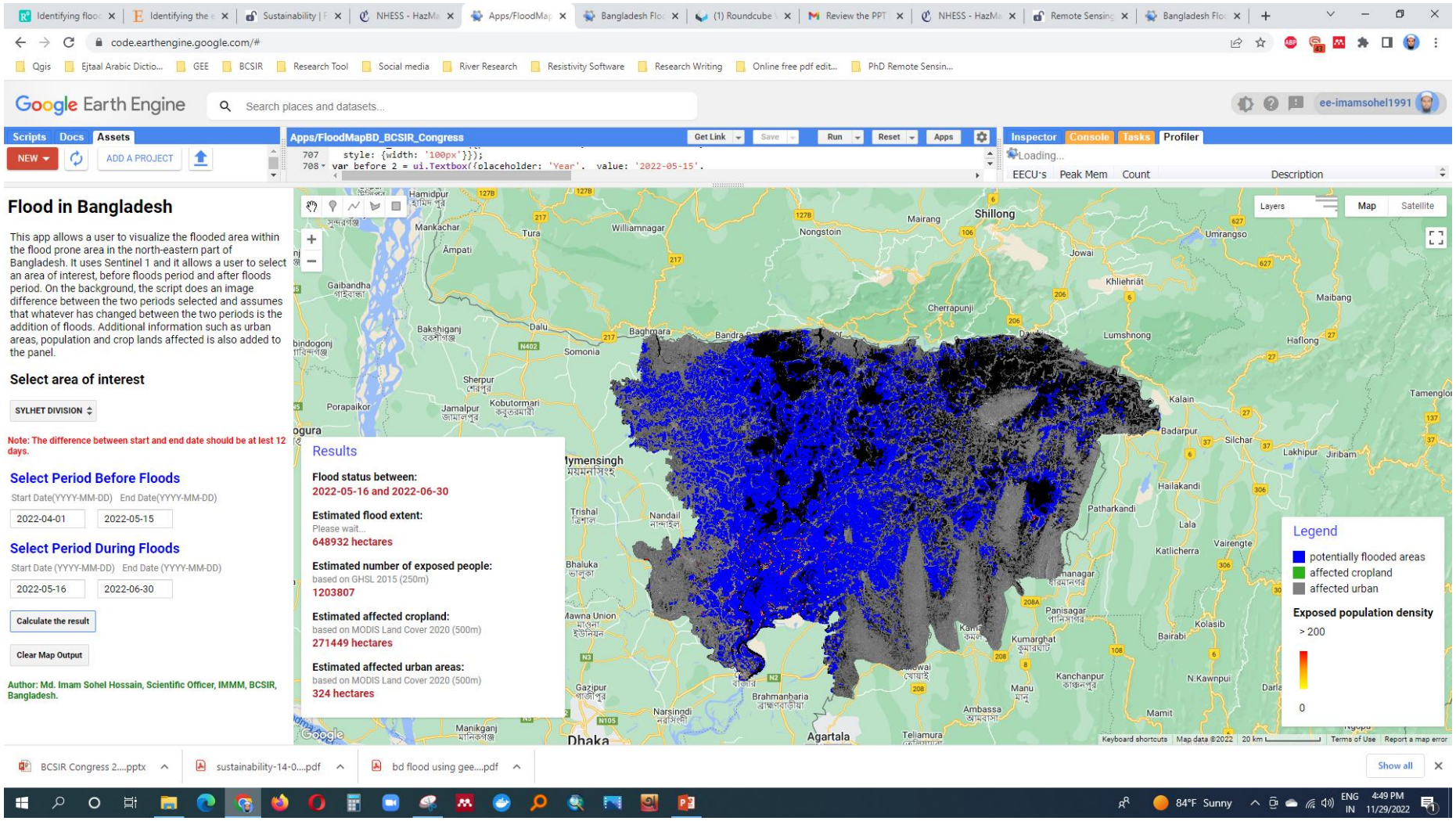
Dataset	Sentinel-1, Revisit time 6-12 days	Copernicus SAR(GRD) dataset



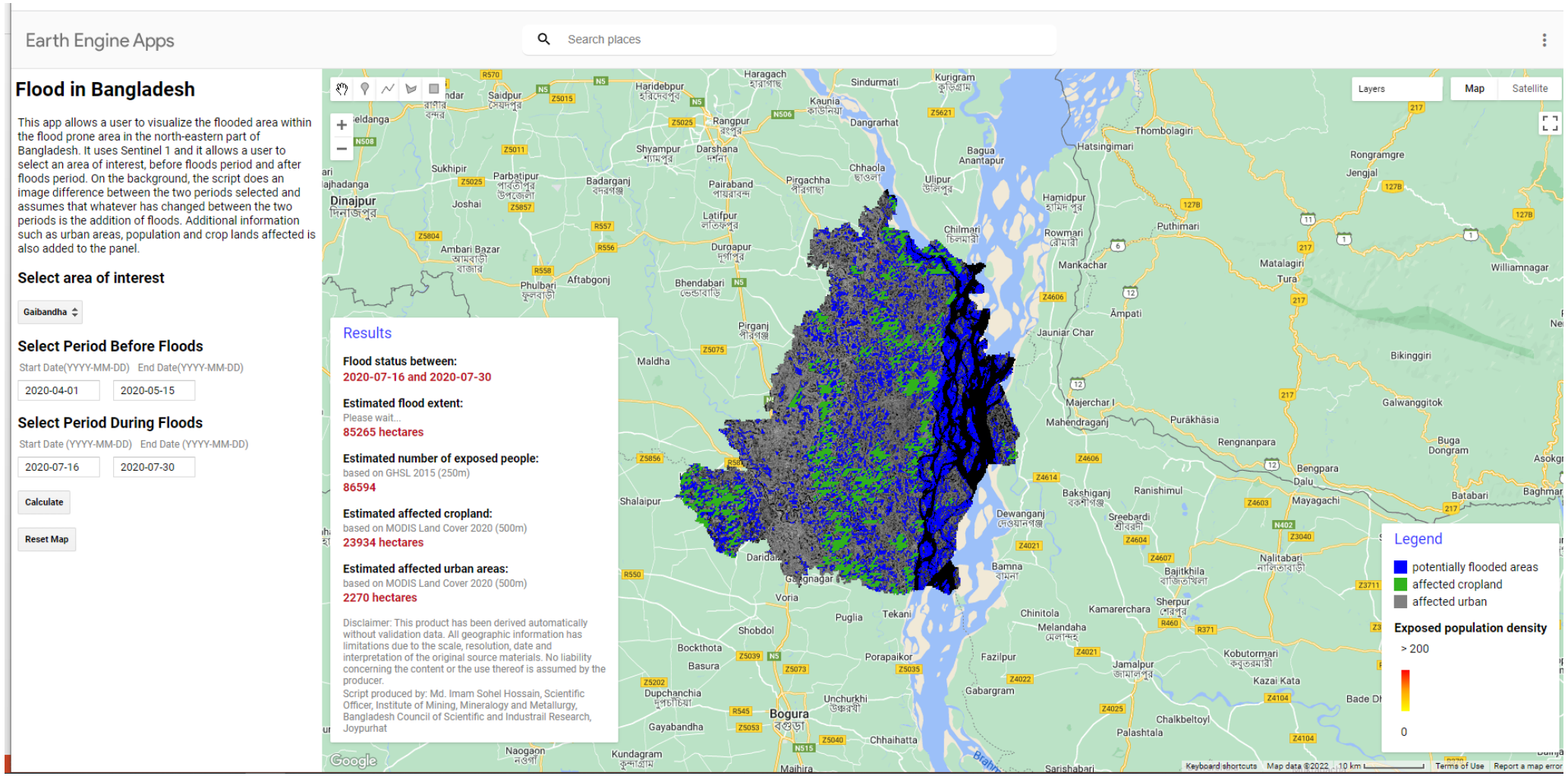
Findings-Regional Scale Flood Mapping and Estimation



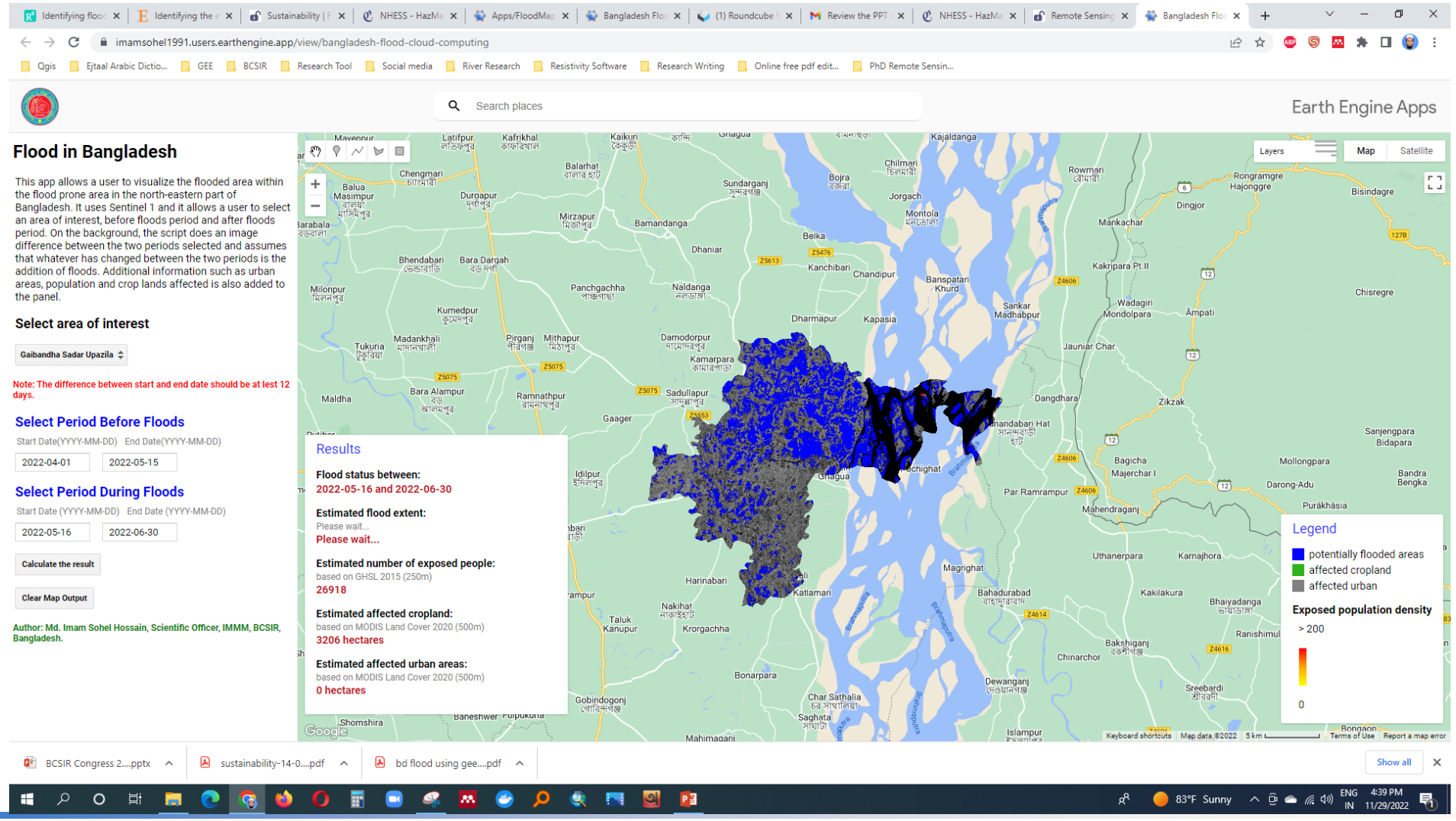
Findings-Divisional Scale



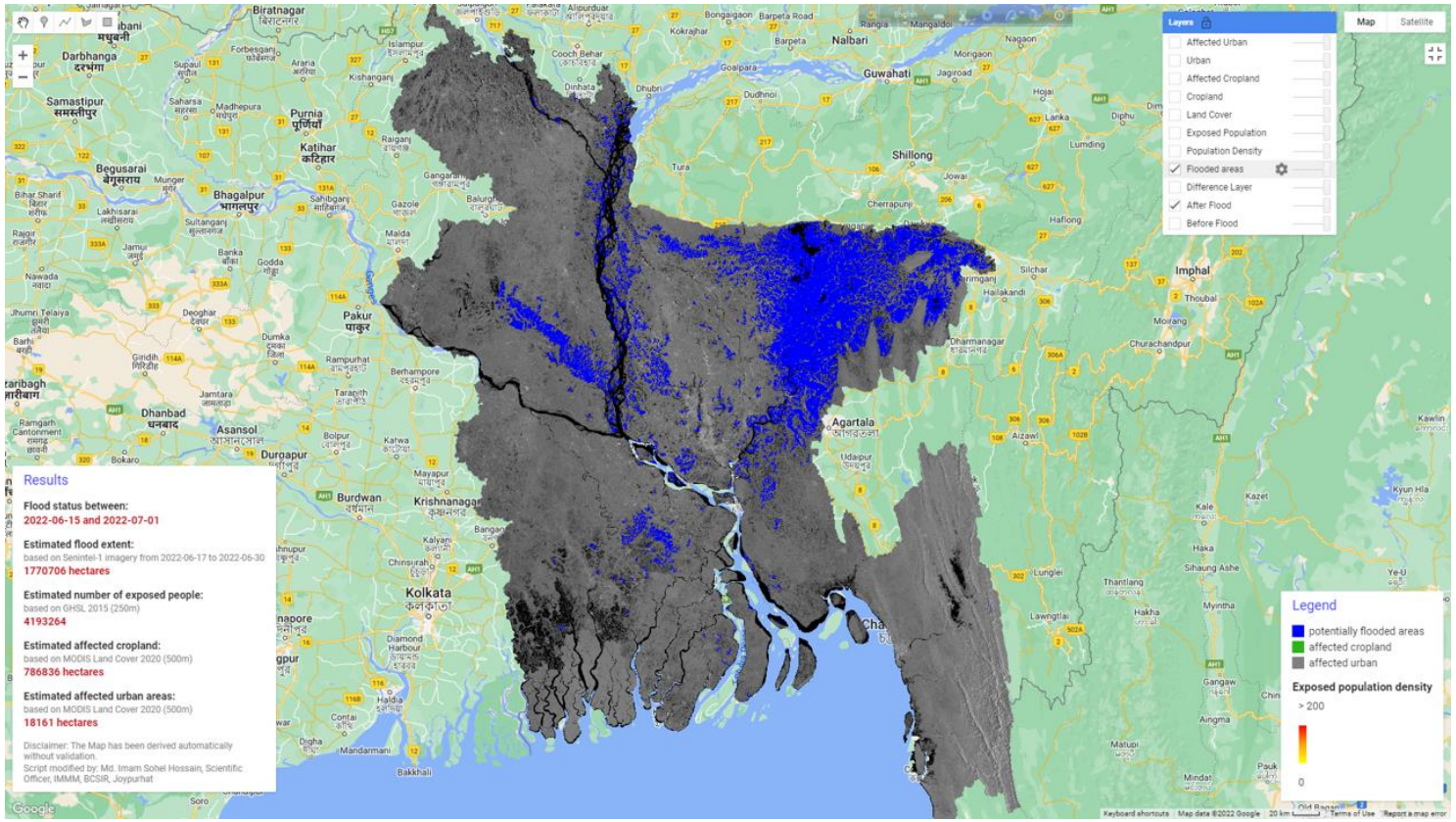
Findings-District Scale

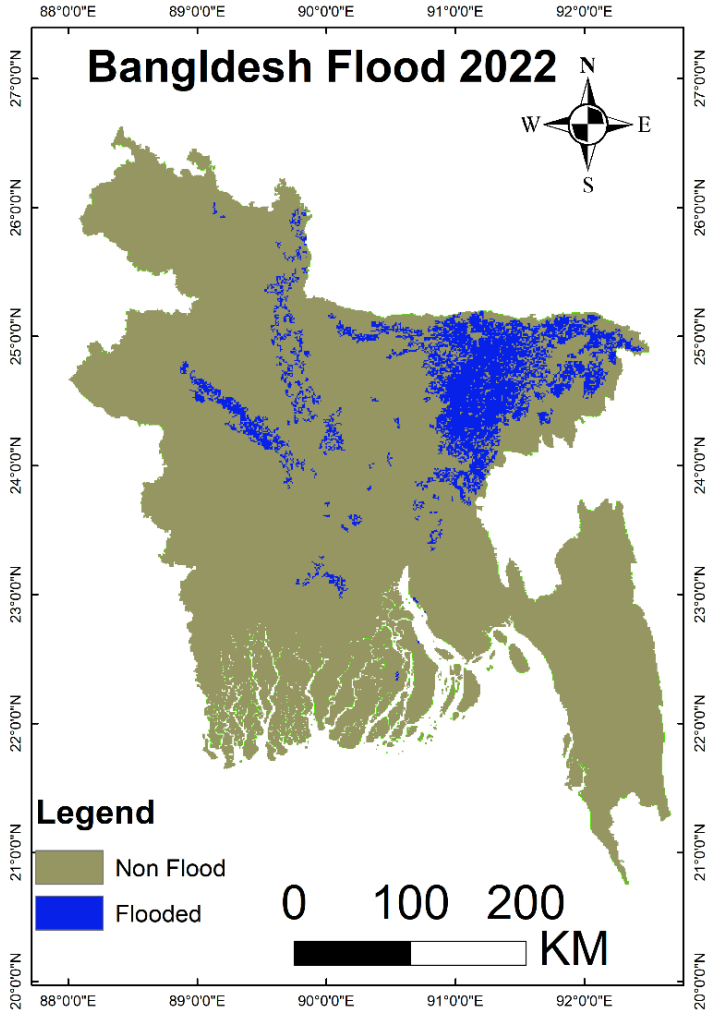


Findings-Subdistrict/Upazila Scale



Findings-Future Flood Mapping and Modelling





Discussion

- We **developed** the App and it is designed in an effective and efficient way to analyze big data
- It is designed to **map** local to regional level flood which is aligned with the previous researches
- However, our app is designed to **estimate fast and reproducible** flood areal extent, exposed population, cropland and urban area than other studies (Key Contribution)
- Open a **platform** for future research -Technical and non technical
- Specifically, aid to **understand** natural disaster occurrences and their spatial pattern
- Thus, increase **predictive** capabilities for natural hazard events.
- In the era of big data and cloud computing, our cloud based application will **increase** the pace at which researchers, policy makers can **evaluate** flood hazard in Bangladesh

Limitations and Future Recommendations

- The tool **only** accesses datasets publicly hosted within the Google Earth Engine Data Catalog. While many researchers have the funding to pursue the use of datasets acquired on a **near-daily** basis (e.g., from Planet Labs, Inc.), it currently does not have a mechanism for ingesting these data
- **Validation** of estimated data sets
- With all of these limitations, it is important to recognize that Google is regularly making **improvements and modifications** to Earth Engine. We intend to monitor these activities and **update** the our application as needed to develop with **future** changes to Earth Engine

Conclusion

Revolutionizing Flood Monitoring using Cloud Computing

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