Disaster Management
Project Phase 1

Team:
S V Samhita Kanaparthy - 2018121005
Shivani Chepuri - 2018122004

Flood risk modelling using QGIS

- Flood assessment is one of the many practical applications of GIS.
- **Purpose:** Flood risk assessments (modelling) can identify at-risk infrastructure and populations, and develop stronger preparedness measures for future flooding events, planning and evaluation of effective flood mitigation and control measures.
- **Software to be used**: QGis is an open-source cross-platform desktop geographic information system application that supports viewing, editing, and analysis of geospatial data.

Targets/Objectives of this work:

- To develop a prototype that focuses on generating a framework for flood risk modelling and provides the assessment of flood consequences.
- The main objective of this work is to do Vulnerability or Damage Analysis due to floods in a given area. This is done by **Risk Assessment**.
- We also provide a historical assessment of floods in that area.

Motivation:

- The intensity and damage created by **Floods** (esp. In 2010, a joint episode of flash and riverine floods) are unmatchable with any disaster previously.
- This clearly exposes the lack of capacity within institutions to respond to hydro-meteorological events in the country. Thus, for effective disaster management, there is a need for comprehensive disaster coping strategy and decision support system.
- For the sustainable planning of land and urban areas, protection of lives, properties, human activities, and for the preservation of ecohydrological and coastal corridors. This project involves a study of vulnerability and risk in particular to a geographical location.

Required Data:
Remote Sensing, Satellite imagery of a particular area which is used for analysis.
The area with a water body is chosen in accordance with the data availability.

Inputs and Outputs:

- Input will be a satellite image (clear-without clouds /usable /processable). The data format can be TIF images.

- The output will be the analysis of the processed input which can give us the structural and non-structural measure of risk in the disaster.
- Develops a framework for flood risk assessment.

Implementation:

- Calculation of Depth and Velocity parameters of floodwater.
- Calculate the extent of flood damage (like a heat map) in a given area - based on what depth and velocity parameters.
- Estimation of relations between damage/impact and different variables. Eg: Estimation of depth–damage curve/function.
- Generation of Flood Risk and Vulnerability maps (subjected to the availability of data). For example,
    - Based on economic damage
    - On the basis of land use data/buildings/population density/inhabitants and employees (life that can be affected)
- Historical development: No. of floods(& their severity) every year in a given area (Comparison of affected areas). No. of floods in a given area (or per 10,000 sq.km) in a year

Note: The last two points in the above Implementation depend on the data availability, and therefore their accuracy is also dependent on the correctness of the data.

FLOOD RISK ASSESSMENT AND MODELLING - FRAMEWORK

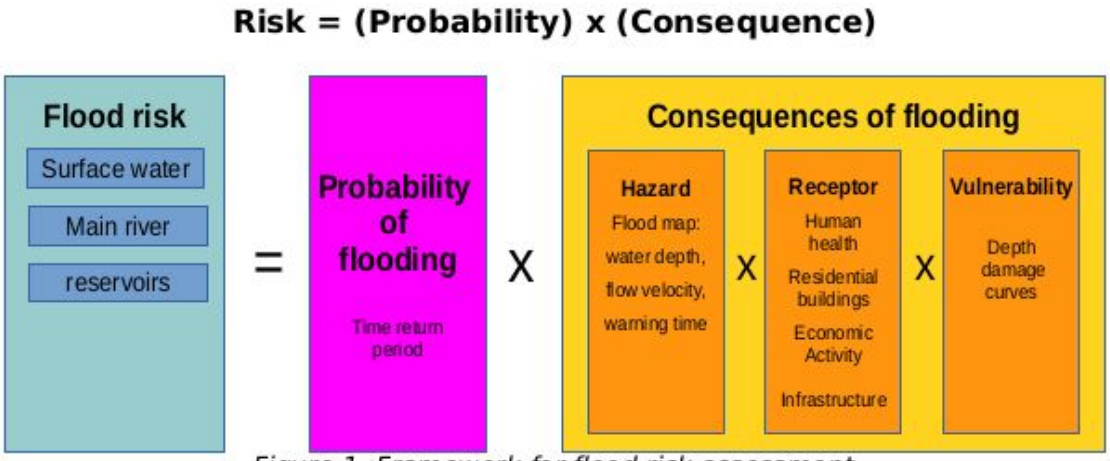

Figure 1 :Framework for flood risk assessment

<u>Required data for consequences estimation</u>

<u>Hazard Estimation Parameters - Data needed to quantify the flood hazard:</u>

Maximum Depth and Velocity Values - Possible values when a flood occurs.

<u>Warning Time Map</u> - The warning time indicates the amount of time between the reception of a warning and the instant in which the population of each structure could be affected by

the flood event, i.e. the amount of time in which the population of each structure can mobilize or adopt mitigation measurements.

Receptor:
The quantification of the receptors, called exposure, refers to people, assets and activities, threatened or potentially threatened by a hazard.

Vulnerability:
The most widely used tool for estimating damage before an event is the vulnerability curves/functions. Vulnerability is a characteristic of a system that describes its potential to be harmed.

Working Model:
The assessment of the consequences of flooding requires the analysis of the extent and distribution of intensity of the hazard (for example, depth of the water and its velocity) and the overlap with the spatial distribution of people and property exposed.

Using QGis we want to build a working model (with the above framework) which can estimate flood risk in an area (based on different parameters/factors, we have different types of risk maps)

References:
https://www.researchgate.net/publication/307739235_Flood_risk_assessment_concepts_modelling_applications

https://www.nat-hazards-earth-syst-sci.net/14/1361/2014/nhess-14-1361-2014.pdf

https://www.researchgate.net/publication/44902265_Flood_risk_modelling_based_on_tangible_and_intangible_urban_flood_damage_quantification

https://www.researchgate.net/publication/295626726_FloodRisk_a_QGIS_plugin_for_flood_consequences_estimation

https://www.researchgate.net/publication/310202575_An_Overview_of_Flood_Vulnerability_Mapping_Strategy_for_Disaster_Risk_Reduction_in_the_Niger_Delta_Region_Nigeria

https://www.researchgate.net/publication/257356474_Flood_Prediction_and_Disaster_Risk_Analysis_using_GIS_based_wireless_sensor_NetworksA_Review