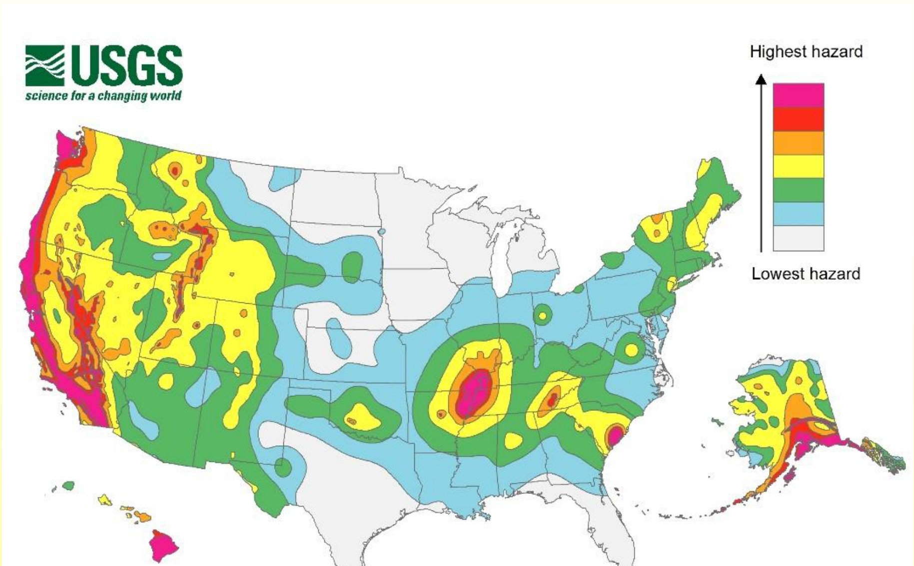
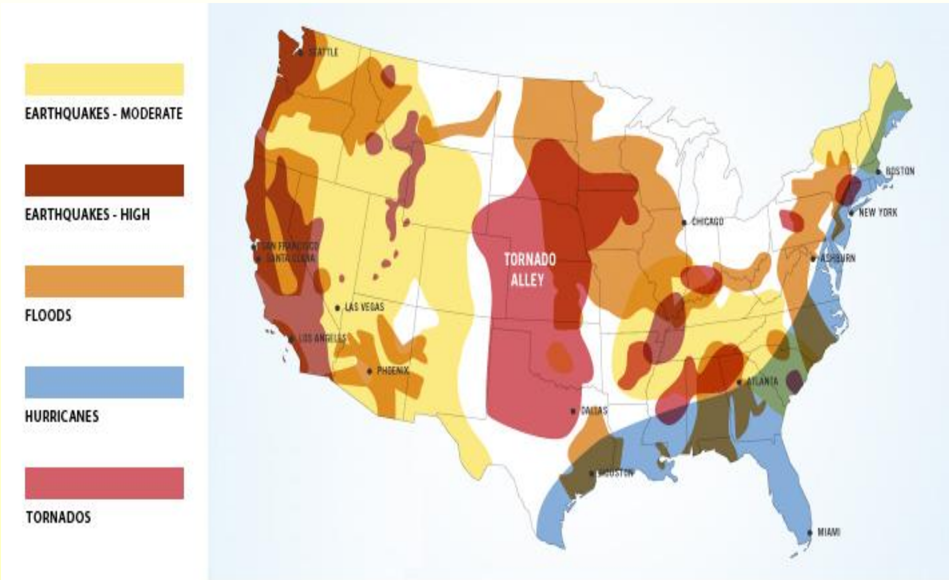
Use of Geospatial data for disaster managements





Source: http://alertsystemsgroup.com

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What is GIS ?

A powerful set of tools for collecting, storing, retrieving, transforming and displaying spatial data for the real world

(Burrough,1986)

An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture store, update, manipulate, analyze and display all forms geographically referenced information

(Understanding GIS - ESRI)

What is Disaster

- Disaster can be defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources

(UNISDR, 2009)

What is Risk Assessment ?

- Risk assessment is a systematic process for collecting and analyzing information for determining and addressing needs, or gaps between current conditions or existing problems for determining priorities, preparing plans and allocating funds and resources to bring about the desired changes or behaviors, based on the strengths and capacities of the community. Risk assessment includes hazard, vulnerability and capacity assessments during pre and post disaster situations in a particular community

  (UNISDR, 2009)

- Geospatial data plays an important role in disaster risk assessment and management

Use of Geospatial Data for Disaster Management

- Satellite image classification helps to identify the extent of damages due to disasters (pre-disaster and post-disaster)
- Time-series images analysis provides to identify the level of risk and damages
- Tracking hurricanes and storm
- Locating temporally shelter for victims
- Identifying population changes in disaster areas
- Monitoring construction after disasters
- Identifying the protected roads for evacuation
- Helping to develop effective disaster management plans
- Contributing to hazard and vulnerability assessments

Geo-spatial Data

landslide

- Damage assessments
- Landslide hazards mapping
- Rainfall mapping
- Land use and land cover changes
- Landslide vulnerability mapping
- Find location for resettlement
- Evacuation path

Drought

- Drought impact assessments
- Land use cover change analysis
- Risk and vulnerability assessment
- Early waning
- Weather forecasting
- Mapping crop damages

Cyclone

- Risk modeling
- Early warning
- Identify escape routs
- Damage assessments
- Cyclone monitoring

Sea level rise

- Damage assessments
- Sea level rise mapping
- Coastal belt changes mapping
- Sea level rise vulnerability mapping
- Identification of the spatial and temporal changes of sea level rise

Tsunami

- Early warnings
- Tsunami damage assessments
- Tsunami vulnerability assessments
- Tsunami risk mapping
- Tsunami inundation mapping
- Vertical and horizontal Evacuation plans
- Effected population mapping

Flood

- Early warnings
- Flood damage assessments
- Flood vulnerability assessments
- Rainfall mapping
- Flood routing model
- Evacuation models
- Rainfall monitoring

Use of Geospatial Data

- GIS and remote sensing data helps to prepare effective disaster management plans
- Spatial data can be used to develop a disaster framework for disaster managers and planners in different stages in disaster management cycle
- It contributes to minimize the damage of disasters to the community

Disaster management cycle

Source: www.quora.com/What-is-disaster-management-cycle

Use of Geospatial Data for Disaster Management Stages

Stages	Contribution of geospatial data for disaster management
Preparation	• Identifying emergency areas • Positioning relevant resources (physical and Human) • Developing short term and long term strategies • Developing early warning systems • Conducting disaster education for community • Developing evacuation plans, hospital disaster plans (participatory approaches) • Conducting disaster drills to identify the response of community and relevant agencies
Response	• Providing accurate information on disaster emergency location • Using already developing evacuation plains to action • Managing resource effectively • Distributing basic needs without delay (food, medicine, temporally salters)
Recovery	• Restoring, rebuilding and reshaping the disaster areas • Preparing short and long terms recovery plans • Preparing damage maps • Keeping records of information about the deaths, injured people, impact to ecosystems and damage infrastructure (houses, roads, schools, hospitals, etc.) • Providing life support systems (temporally housing, health care, counseling programs) • Conducting socio-economic impact studies • Updating hazard, vulnerability and risk databases
Mitigation	• Preventing future threat of disaster • Minimizing the damage of future disasters • Conducting hazard and vulnerability assessments • Developing or shaping mitigation plans and policies

Case Study 1

Title:

Flood hazard mapping and damage assessment in lower basin of Kelani river

Introduction

- Flood Hazard Mapping is a vital component for appropriate planning in flood-prone areas. It creates easily-read, rapidly-accessible charts and maps. It will help administrators and planners to identify areas of risk
- According to the World Methodological Organization (WMO), hazard area mapping is a important event in the disaster mitigation process
- Damage assessment is also vitally important in the disaster management process

Objectives

- Preparation of flood hazard maps for different elevation ranges in the lower basin of Kelani river

- Demarcating the inundation area and calculating damage assessment in different elevation ranges

Importance of Study

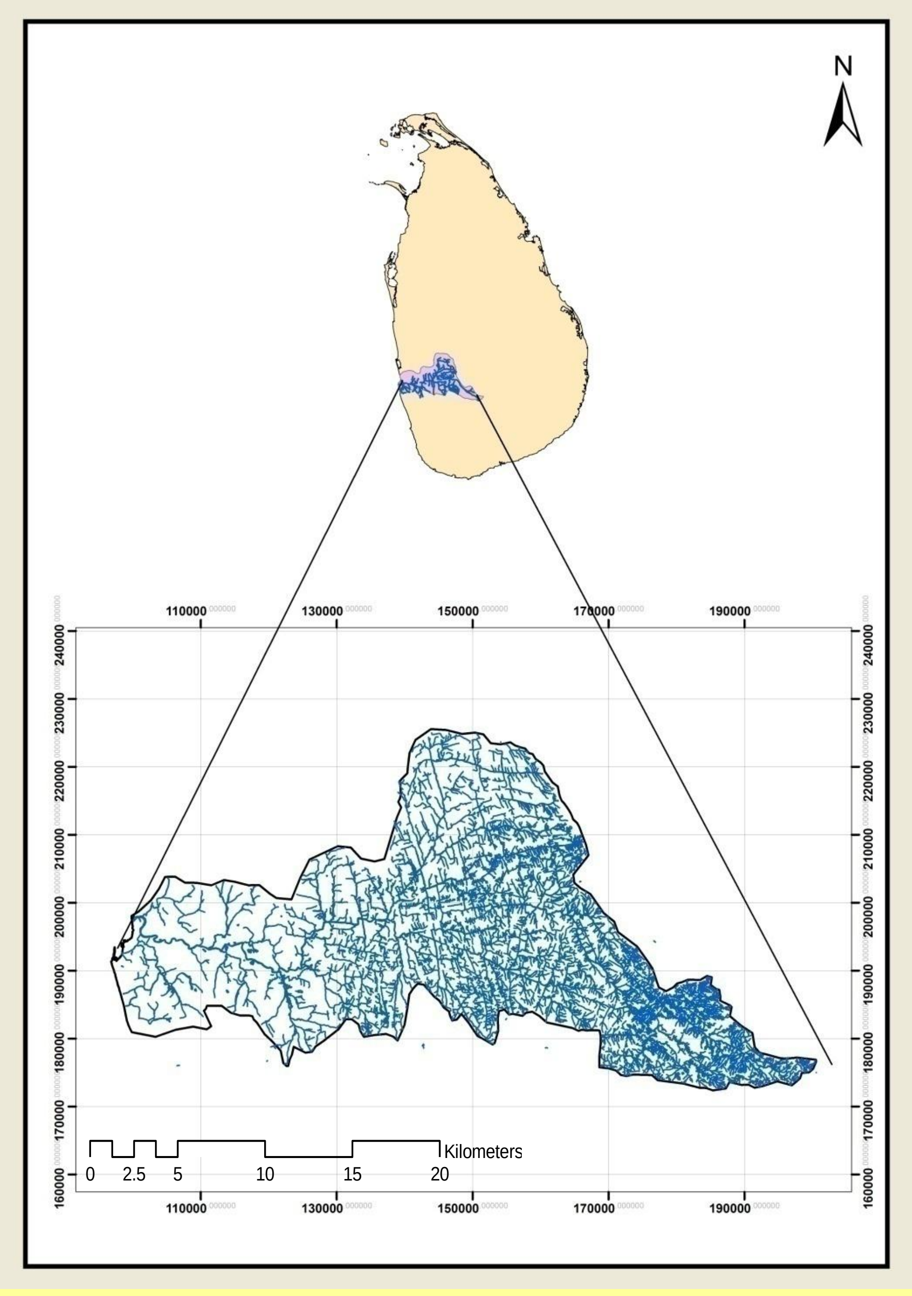
- Floods in Kelani river are important due to its outfall being near the capital City of Colombo. It covers two densely populated districts of the country. Colombo and Gampaha districts which are frequently and considerably affected by flood events

- According to the history, floods in 1930 reached a level of 10.9 feet msl. In 1940 floods reached a level of 11.06 feet MSL. In 1947, flood level reached 12.05 feet MSL

- Identification of different levels of inundation areas is essential in the flood management process. This study was carried out for hazard mapping and damage assessment of the lower basin of Kelani River

Study Area

- Length – 145 km
- Forth longest river in the country
- Catchment area – 2230 km²
- water discharge to sea –
  - ✓ Dry seasons - 20 m^3/s to 25 m^3/s
  - ✓ Monsoon season - 800 m^3/s to 1,500 m^3/s
- The average annual rainfall in the basin - 2400 mm



Flood Limit in Kelani basin at Colombo

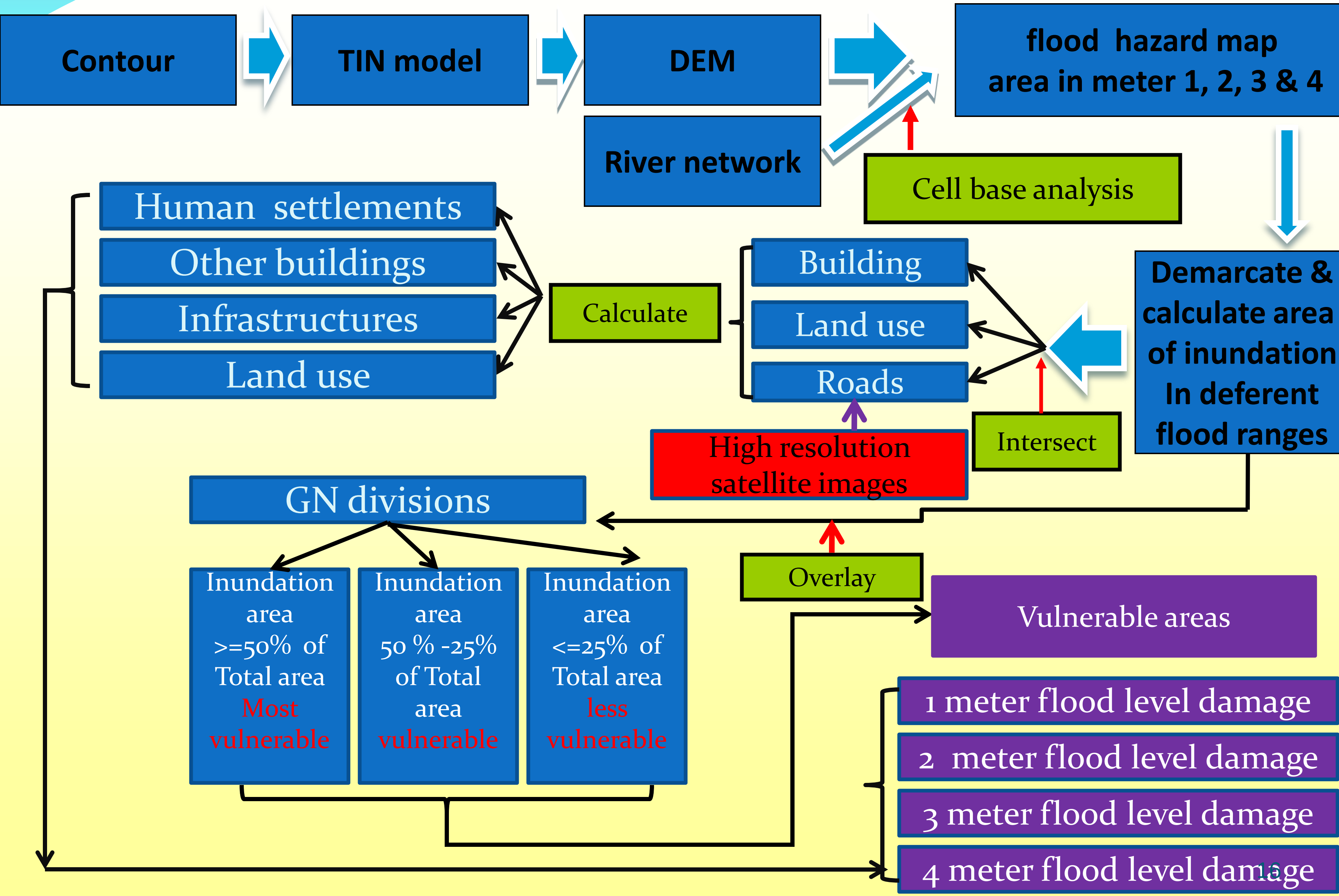
• Minor flood	=	5 – 7 feet	(1.5 -2.1 meter)
• Major flood	=	7 – 9 feet	(2.1- 2.7 meter)
• Dangerous flood	=	9 – 12 feet	(2.7 – 3.7 meter)
• Critical flood	=	above 12 feet	(above 3.7 meter)

Source: Irrigation Department, 2004

Required Data

Maps	Scale	Source
River network	1:10000	Survey department
Land use	1:10000	Survey department
Buildings	1:10000	Survey department
Roads	1:10000	Survey department
Contour	1:10000	Survey department
GN divisions		Census and statistics department
High resolution satellite images	One meter	

Methodology



Cont…

Flood level

- 1 meter flood level
- 2 meter flood level
- 3 meter flood level
- 4 meter flood level

Flood distribution maps

Damage assessment

- Human dettlements
- Other buildings
- Infrastructures
- Land use

Maps & tables

Vulnerable GN divisions

- Most vulnerable
- vulnerable
- Less vulnerable

Output - Tables

Damage of roads

Flood level	Length of main road	Length of miner road	Length of jeep & cart track	Length of railway
1 meter				
2 meter				
3 meter				
4 meter				

Damage of buildings

Flood level	No of buildings
1 meter	
2 meter	
3 meter	
4 meter	

Damage of land use

Flood level	Home garden	Forest	Build up area	Paddy	Other plantations
1 meter					
2 meter					
3 meter					
4 meter					

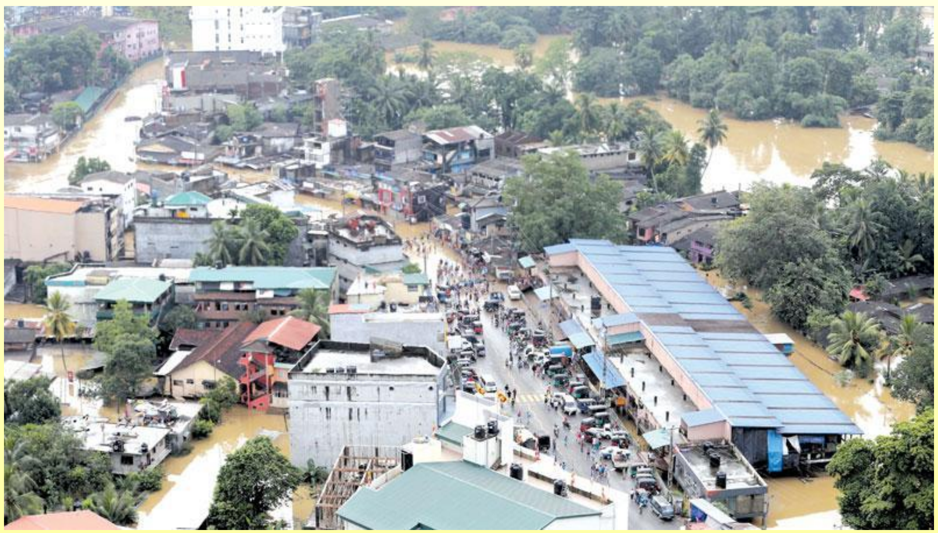
Case Study 2

Title:

Flood routing model: A case study of Rathnapura town area, Sri Lanka

Introduction

• Floods along the Kalu river from the most upstream major town. Ratnapura City makes great inconvenience to the people economically and socially



Source: www.sundayobserver.lk

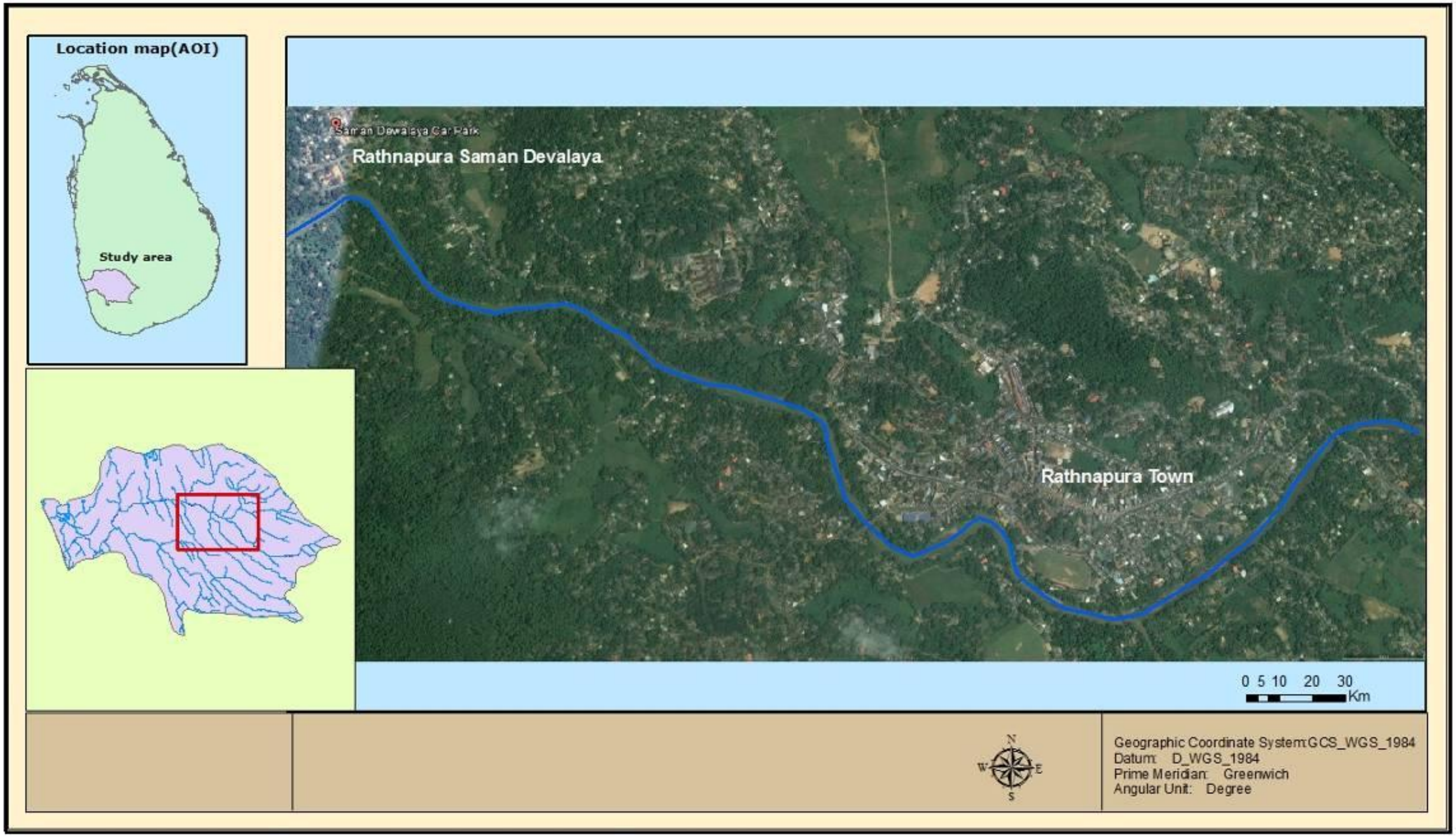
Source: www.redcross.lk

Objectives

- Developing the flood routing model around Ratnapura City area based on Kalu river

- Predicting flood levels along the river to minimize the damages

Study Area

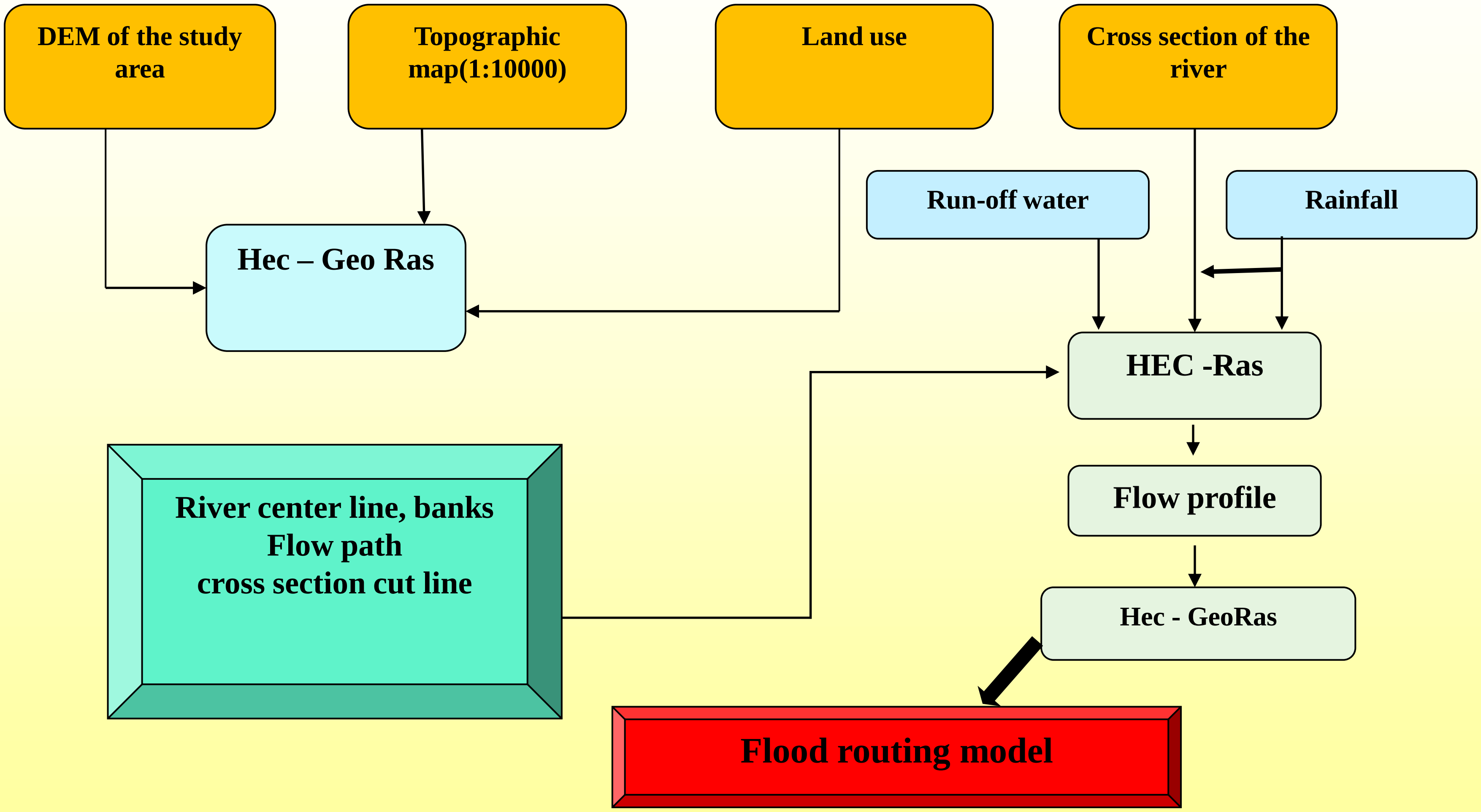


Location map(AOI)
Study area
Saman Dewalaya Car Park
Rathnapura Saman Devalaya
Rathnapura Town
0 5 10 20 30
Km
N
W
E
S
Geographic Coordinate System:GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

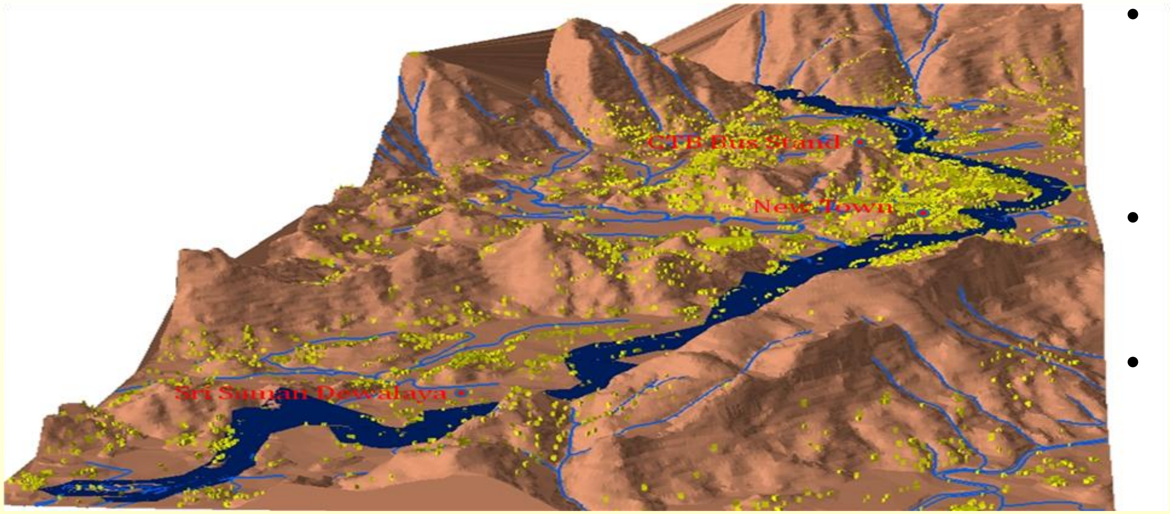
Required Data

Data	Source	Year
Contour map (1:10000), (1:5000)	Survey department	2010
Spot height	Survey department	2010
Land use data	Survey department	2010
Soil type data	Agriculture department	2010
Rainfall data	Meteorological department	1989-2009
Runoff data	Irrigation department	1989-2009
Cross section data	Irrigation department	2007

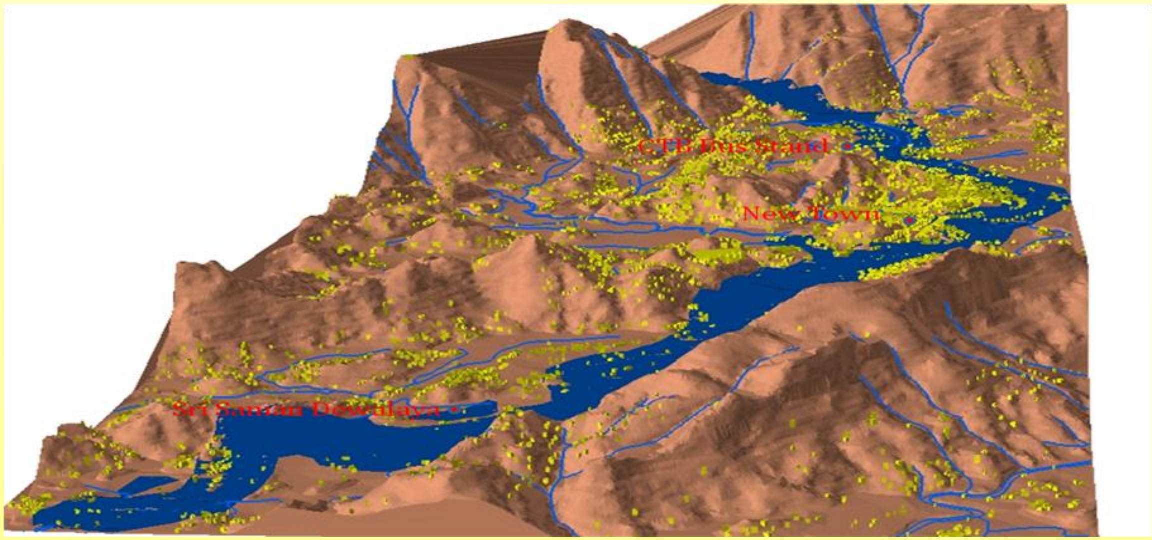
Methodology



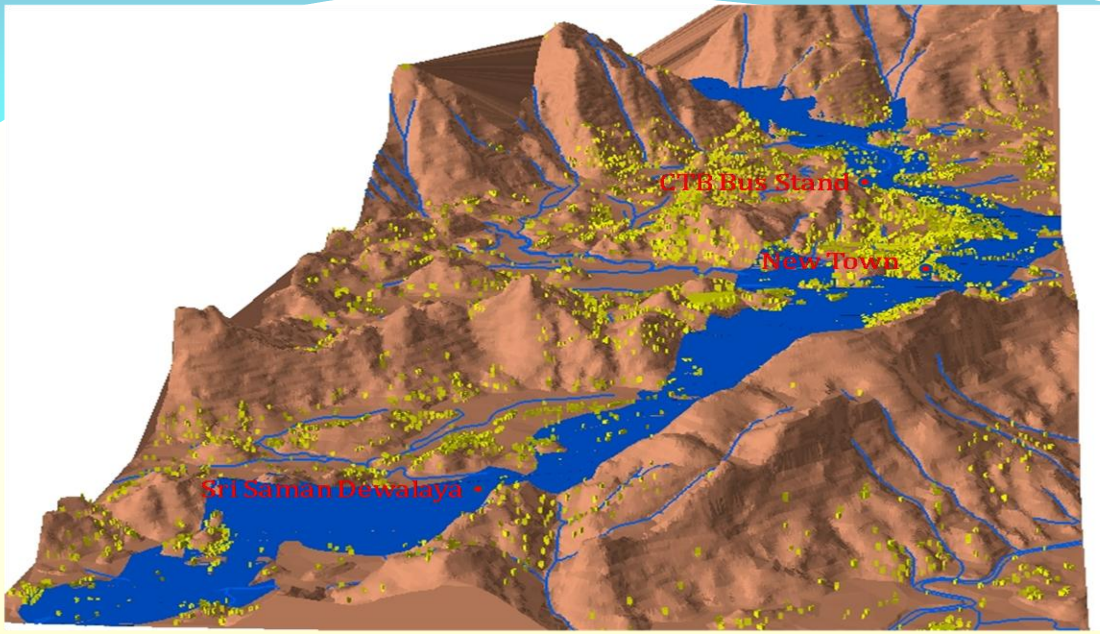
Results



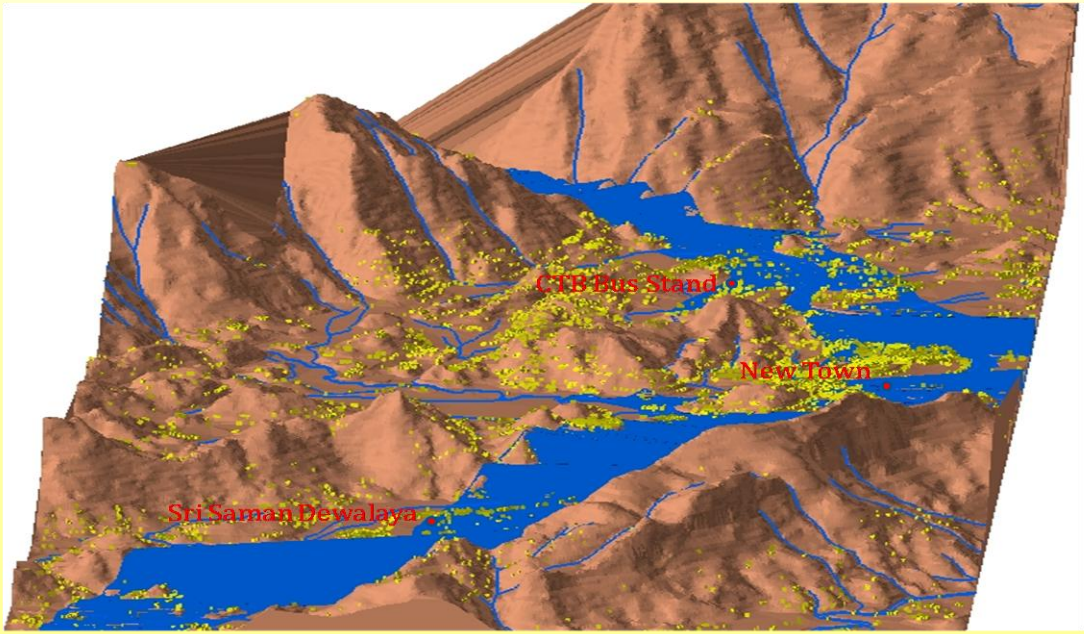
- Rainfall data is 250 – 350mm, Result of Runoff is 105- 150 mcm.
- Flood was gone to 13m Mean Sea Level (MSL) contour level
- “0” Flood level river is started to flood.



- Rainfall data is 350 – 400mm, result of runoff is 150- 170 mcm.
- Flood was gone to 19m MSL contour level
- Blue area is risk area



- Rainfall data is 400 – 500mm and result of runoff is 170-220mcm.
- Flood is gone to 21m MSL contour level
- Blue area is risk area
- Intermediate flood level



- Rainfall data is more than 500mm and result of runoff is more than 220 mcm.
- Flood is gone to 24m MSL contour level
- High flood level

Recommendation for Future Developments

- It is recommended to use additional rainfall stations around the catchment area so that the aerial distribution of rainfall can be represented well

- This study uses only 20 years of hourly rainfall and water level data. It is recommended to use a longer time series data for calibration and validation of this model

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