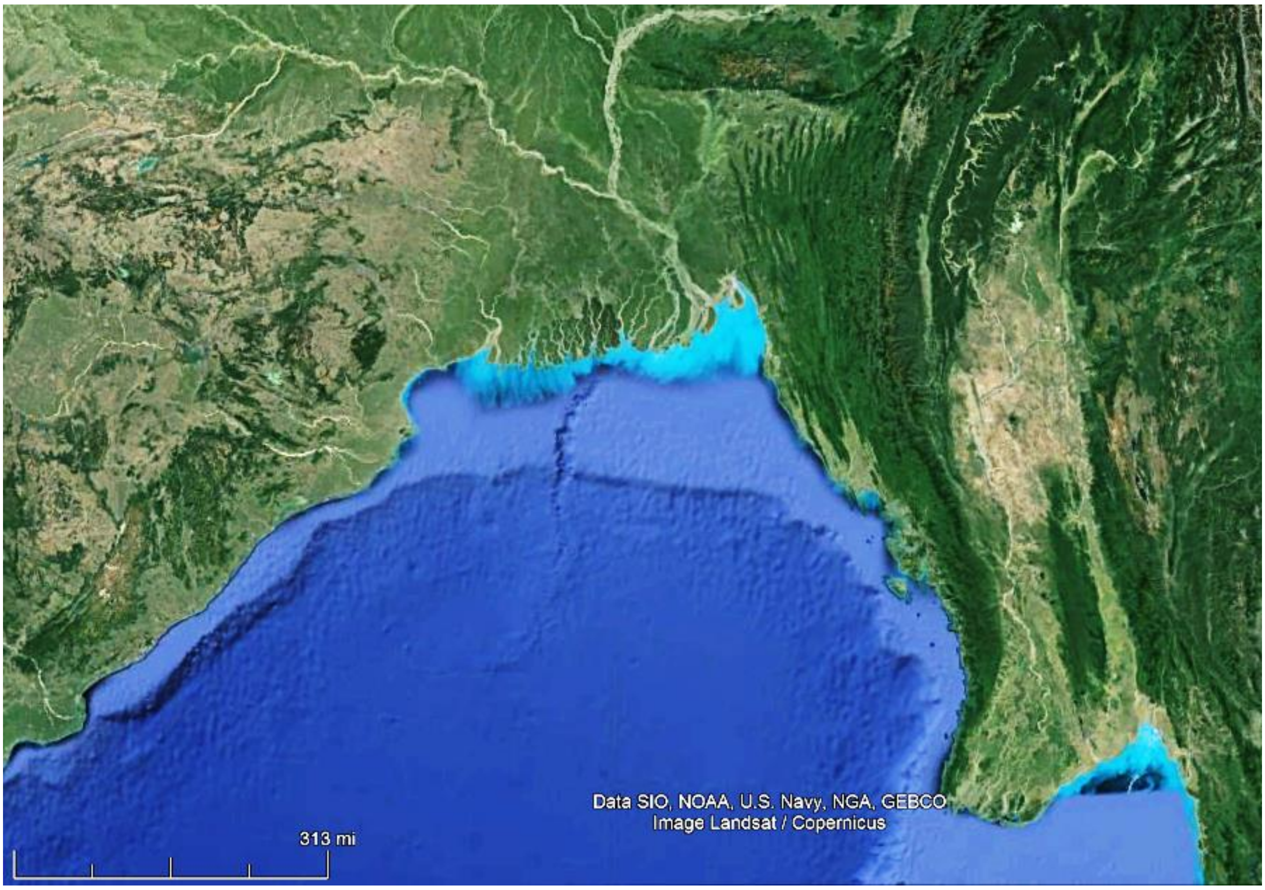
Humanitarian Masterclass: Earth Observation and Natural Hazards
Analytic Hierarchal Process (AHP) Risk Assessment Exercise
Cyclone Hazard Risk in SE Bangladesh



Bay of Bengal

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GROUP ACTIVITY

Aim

The objective of this activity is to simulate the spatial patterns of cyclone risk with a manual procedure.

Basically, the exercise imitates the complementary use of Earth Observation (EO) technology, Geographic Information System (GIS) and Analytic Hierarchy (AHP).

This would be followed by similar exercise on landslide hazard analysis using digital data in ArcGIS 10.3.1 software during the lab-based session.

Background

Risk assessment is a core concern of Disaster Risk Reduction (DRR) and essential for devising the mitigation strategies at various levels. By combining the possible role of the hazard, exposure, and vulnerability (Fig. 1), the pre-event risk assessment illustrates how a system or system component is expected to be effected in future.

It is important to note that the process of risk assessment is conceptually complex and challenging to execute. In this activity, we will come across the complexities related to the approach, selection of data, and uncertainties and limitations of the risk assessment process.

The data needed for the risk assessments comes in different formats and varied units of measurement; thus, in order to make the data comparable and operational for a manual exercise we are making use of numbers in this activity. Various matrixes (pixels) are given as an example of standardized raster data layers representing different input layers for the cyclone risk assessment of any coastal area.

It is important to note that the fundamental principle behind the depiction of the risk scenario in this exercise is based on the spatial overlap of the causative factors i.e., with the increasing spatial intersection of the factors that have a positive correlation with the risk, the probability of losses (degree of risk) would enhance and vice versa.

Fig.1 Conceptual Structure of the risk

1. Selected data layers

HAZARD

2	3	1	5
3	3	4	4
3	2	4	5
1	3	2	1

Intensity

1	2	4	5
1	2	5	5
1	1	2	4
2	2	3	3

Surge

3	2	2	4
3	2	5	5
4	3	2	2
1	1	4	4

Frequency

EXPOSURE

2	4	4	5
2	4	4	5
1	2	3	4
1	1	3	4

Proximity (coast)

5	4	4	4
4	2	3	4
3	1	5	5
4	3	2	1

Population

3	3	3	4
2	2	4	4
4	5	2	2
4	4	2	3

Infrastructure

VULNERABILITY

2	4	4	3
4	1	5	2
1	4	3	2
2	3	4	5

Demography characteristics (density, age extremes, gender, and population with special needs)

4	2	5	4
1	2	3	2
4	5	4	4
1	3	2	2

Early Warning System and shelters

2	4	2	3
4	5	3	5
4	1	4	3
3	2	3	3

Response System (Resources and healthcare)

Note: On the uniform evaluation scale, the relative cyclone risk increases from 1 to 5.

2. Develop a pairwise comparison matrix for deriving weights (W):

	Int	Sur	Fre	pro	pop	Inf	Dem	Ear	Res	W
Int										
Sur										
Fre										
pro										
pop										
Inf										
Dem										
Ear										
Res										

Use the scale below for determining the relative importance (weight) of the selected parameters.

Intensity of Importance	Definition	Explanation
1	Equal importance	Two variables contribute equally to the objective
3	Moderate importance	Experience and judgement slightly favour one variable over another
5	Strong importance	Experience and judgement strongly favour one variable over another
7	Very strong or demonstrated importance	A variable is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favouring one variable over another is of the highest possible order of affirmation
2, 4, 6,8	Intermediate Importance	When compromise is needed

Analytic Hierarchy Process (AHP), Saaty, 2008

Note: Alternatively, without developing a pairwise comparison matrix you can directly use the scale from 1 to 9 for deciding the relative importance of a parameter, where 1 represents least important and 9 most important.

Group Thinking

3. Assign weights [multiply the value in each cell by the corresponding weight of the layer]:

Intensity

Surge

Frequency

Proximity (coast)

Population

Infrastructure

Demography characteristics (age extremes, gender, and population with special needs)

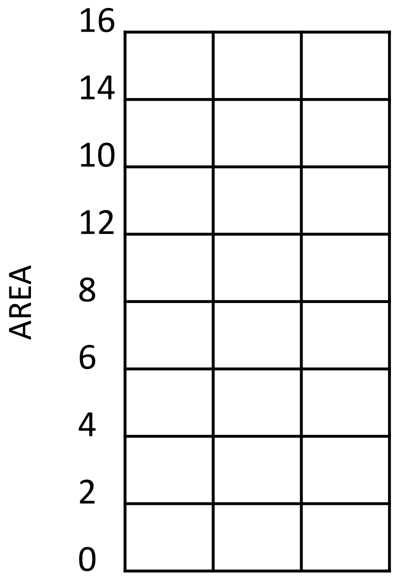
Early Warning System and shelters

Response System (private and public)

4. Add the data layers:

5. Classify (by dividing the range into three classes):

6. Map and quantify (depict spatial patterns of the risk):
Note: please do not use numbers in the final map, instead create a color index.



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- [ ] **High**
- [ ] **Moderate**
- [ ] **Low**

Comments:
1.

2.

3.

Group representative presents the comments

Suggested reading:

Science of the Total Environment 704 (2020) 135360

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Cyclone risk assessment of the Cox's Bazar district and Rohingya refugee camps in southeast Bangladesh

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HIGHLIGHTS

- Relative cyclone risk was assessed at two spatial scales in southeastern Bangladesh.
- Conceptual structure of general risk model was brought to practice for the assessment.
- Diverse data representing the cyclone hazard, exposure, and vulnerability was analyzed and integrated.
- Complementary use of AHP and GIS has been valuable for projecting the cyclone risk.
- A reasonable consistency was noticed between the simulated risk and experiential impacts.

GRAPHICAL ABSTRACT