

Module VII

Hazard and Disaster

Disasters in Bangladesh

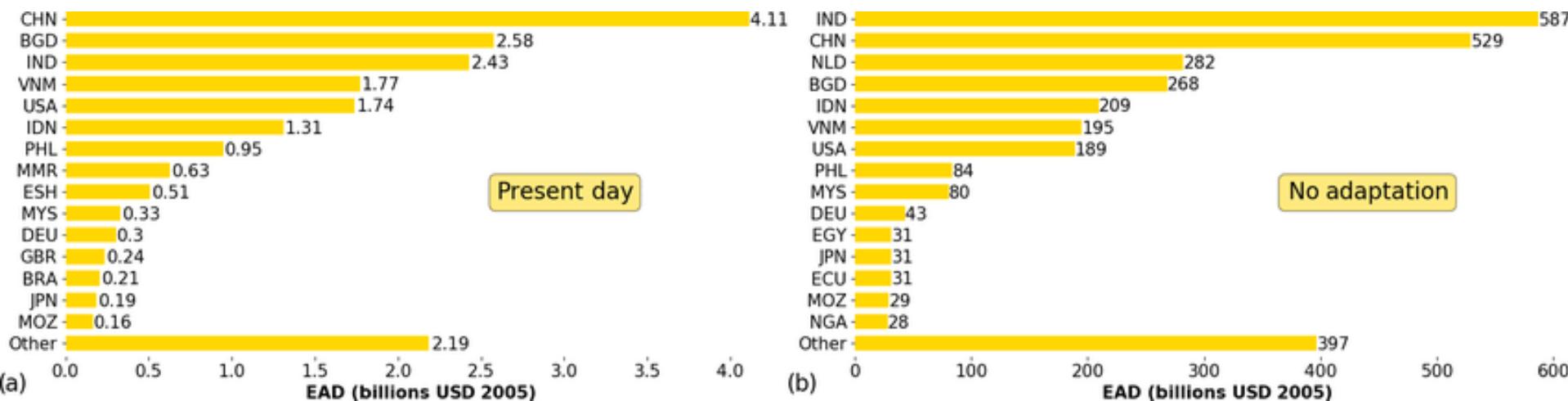


Lecture 9 (27 August 2024)
Dr. Asib Ahmed

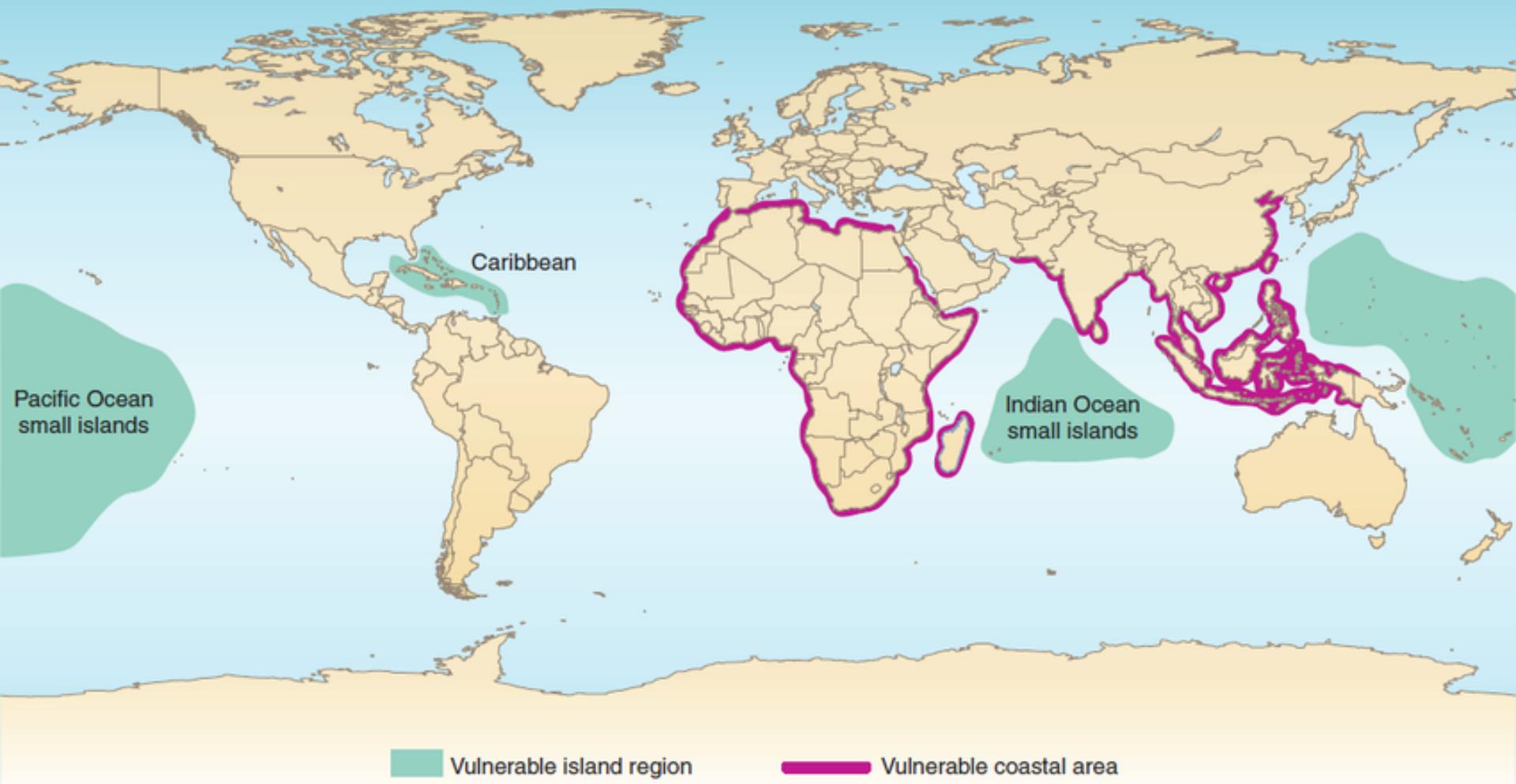


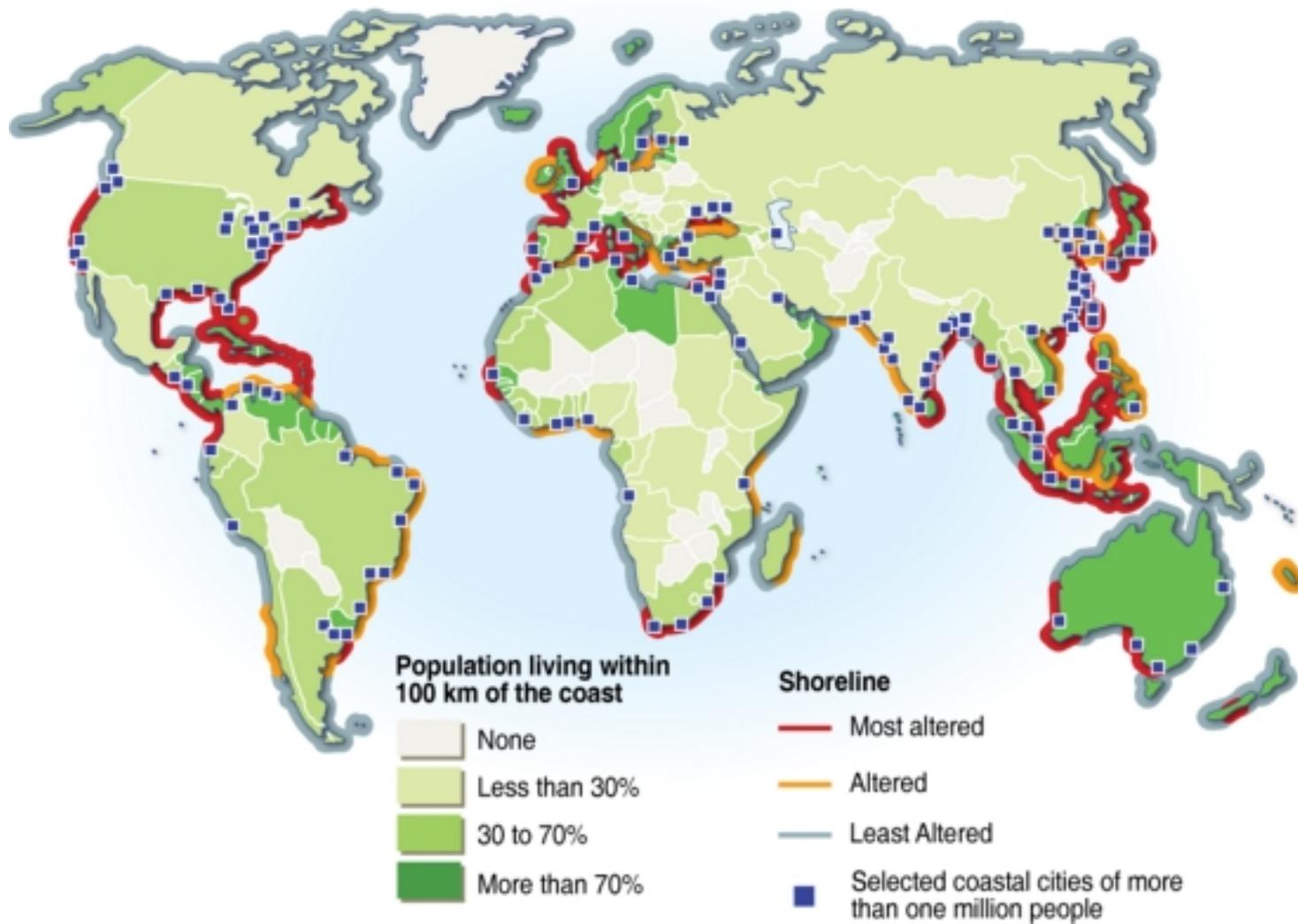
Department of Social Relations
EAST WEST UNIVERSITY

Top 15 countries with coastal flood risk



Vulnerable coastal areas due to sea level change



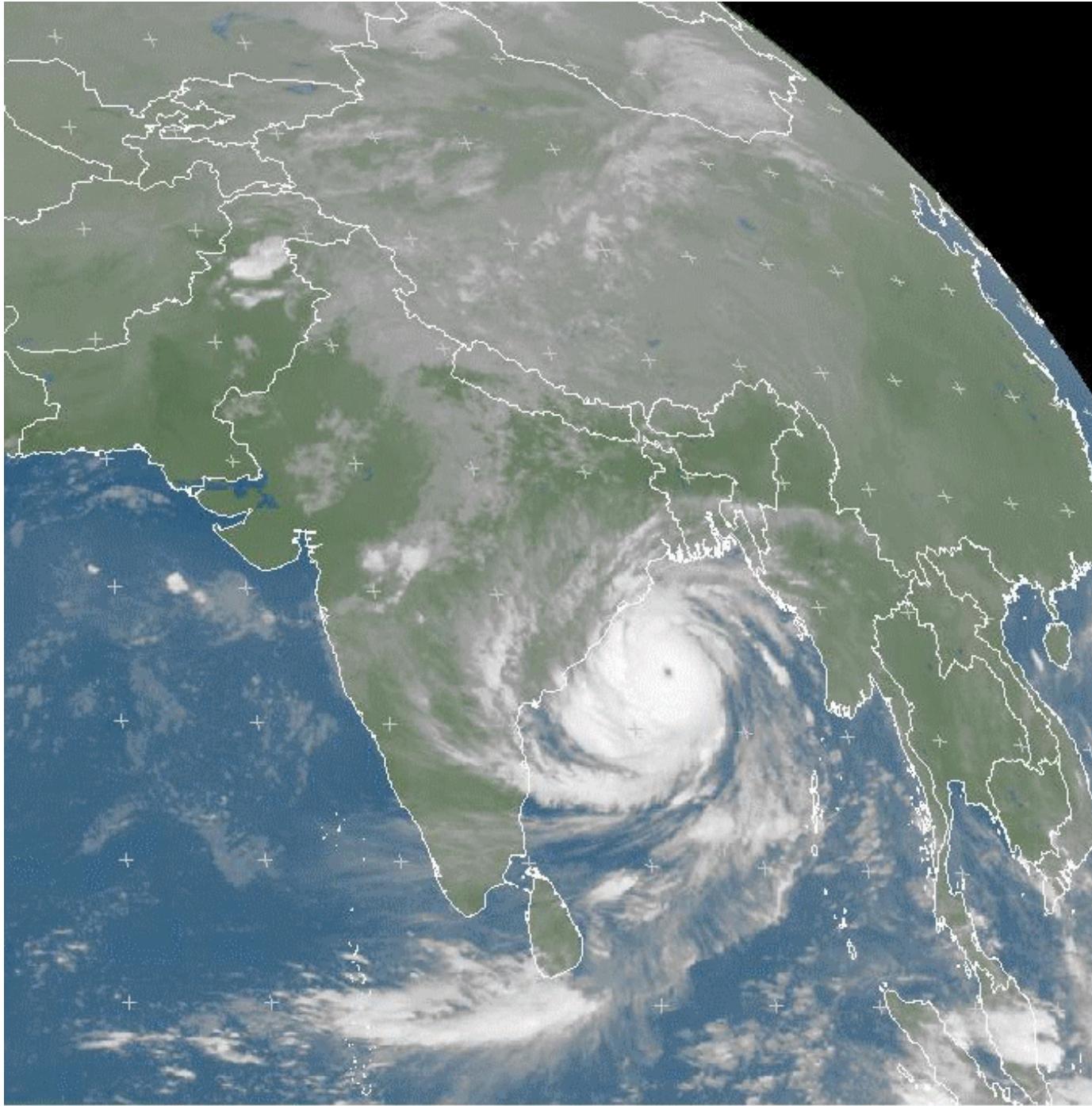


Cyclone

Is an area of closed, circular fluid motion. This is usually characterized by inward spiraling winds that rotate **counter clockwise in the Northern Hemisphere** and **clockwise in the Southern Hemisphere** of the Earth. Most large-scale cyclonic circulations are centered on areas of low atmospheric pressure.

The terms "**hurricane**" and "**typhoon**" are regionally specific names for a strong "**cyclone**".

Cyclone Phailin

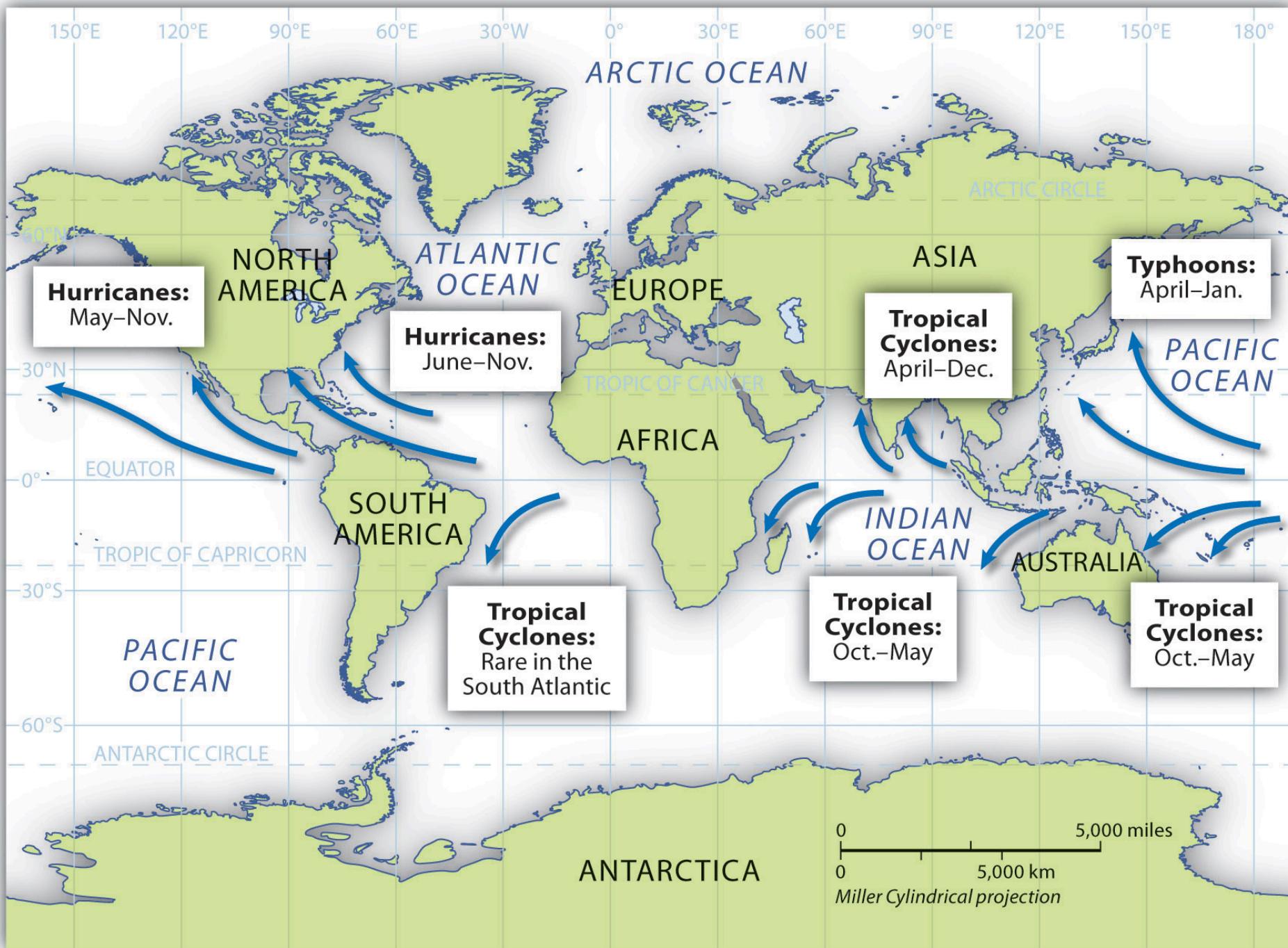


MET7-IODC IR115 2013-10-11 20:00 UTC

EUMETSAT

Different names of cyclone over the world

- "hurricane" (the North Atlantic Ocean, the Northeast Pacific Ocean -east of the dateline, or the South Pacific Ocean)
- "typhoon" (the Northwest Pacific Ocean -west of the dateline)
- "severe tropical cyclone" (the Southwest Pacific Ocean or Southeast Indian Ocean)
- "severe cyclonic storm" (the North Indian Ocean)
- "tropical cyclone" (the Southwest Indian Ocean)

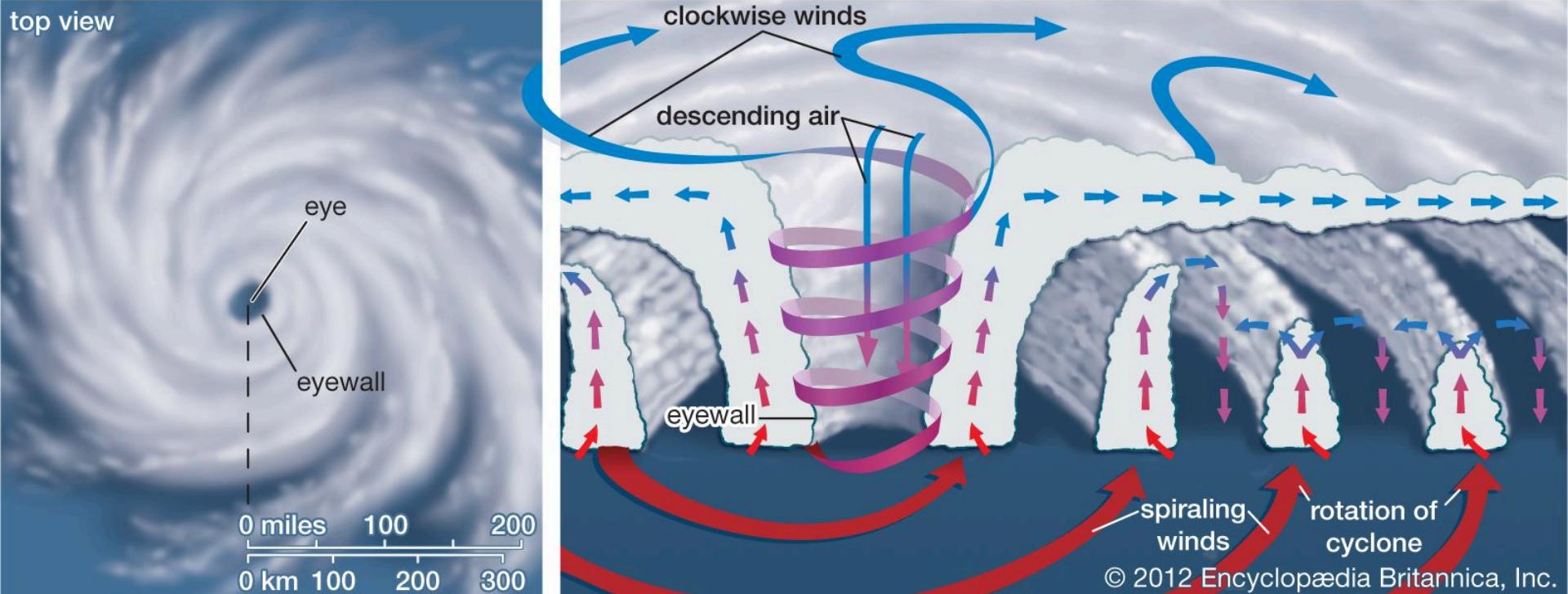
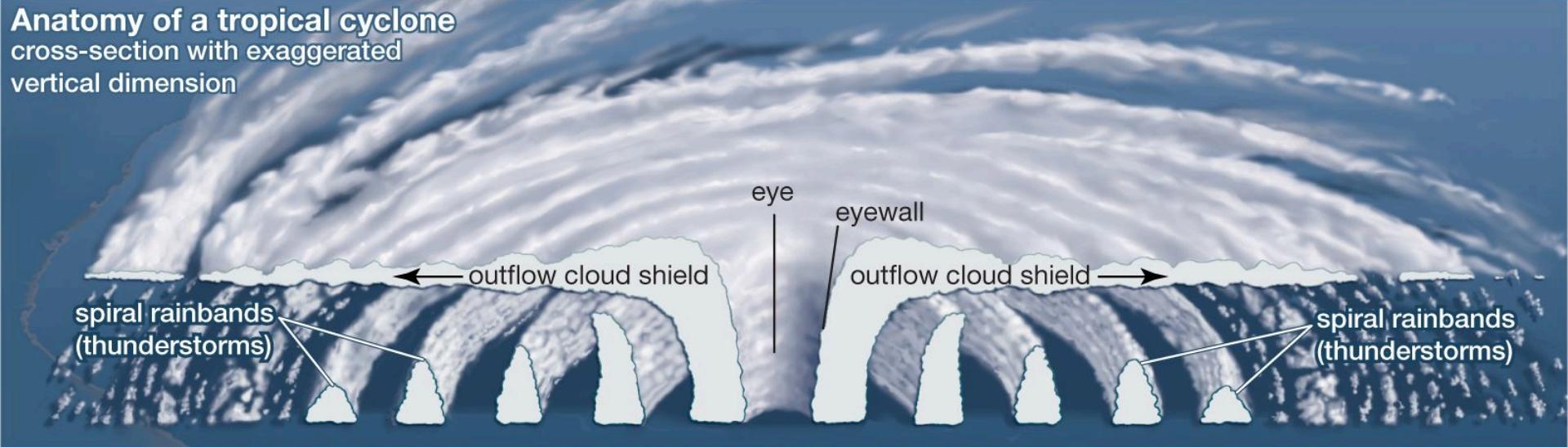


Formation of cyclone

- Storms that originate in oceans or seas.
- Formed when the sea temperature is 27^0 or above
- Air above the sea surface is heated and the warm moist air starts to rise.
- A deep centre of low pressure develops
- Wind speeds around the centre of the cyclone increase to $150 - 200\text{km/h}$
- Huge circular swirl of cloud which may be up to 600km or more
- Torrential rain falls from cumulo-nimbus cloud
- Weather is calm and dry in the centre which is known as eye

Anatomy of a tropical cyclone

cross-section with exaggerated vertical dimension



Category 1	Category 2	Category 3	Category 4	Category 5
Minimal damage	Moderate damage	Extensive damage	Extreme damage	Catastrophic
				
Winds 119-153 kph	Winds 154-177 kph	Winds 178-208 kph	Winds 209-251 kph	Winds 252 kph and more

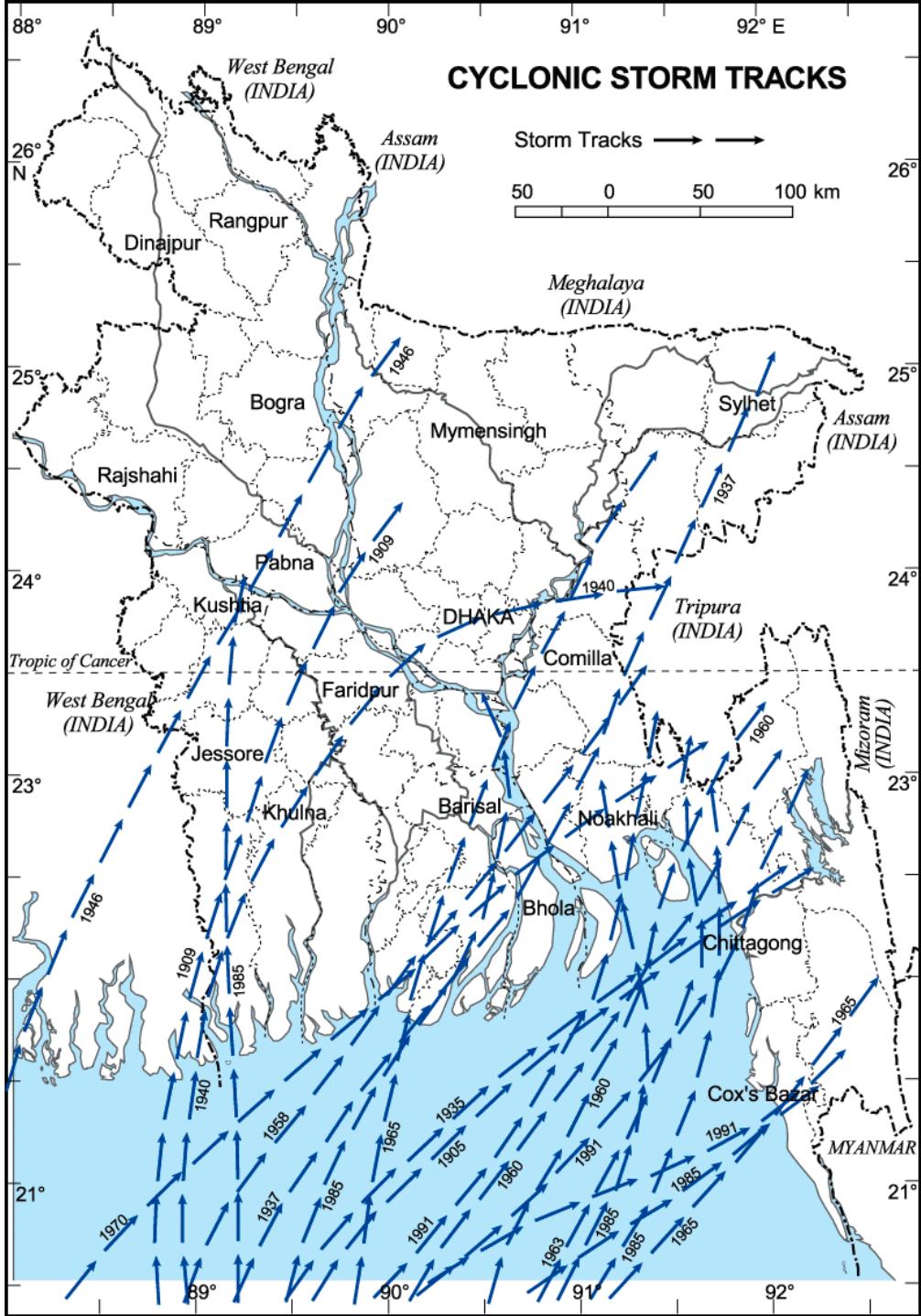
Cyclone Category	Wind Speed in Km/h	Damage Capacity
01	120-150	Minimal
02	150-180	Moderate
03	180-210	Extensive
04	210-250	Extreme
05	250 +	Catastrophic

Type of Disturbances	Wind Speed in Km/h
Low Pressure	Less than 31
Depression	31-49
Deep Depression	49-61
Cyclonic Storm	61-88
Severe Cyclonic Storm	88-117
Very Severe Cyclone	118-221
Super Cyclone	More than 221

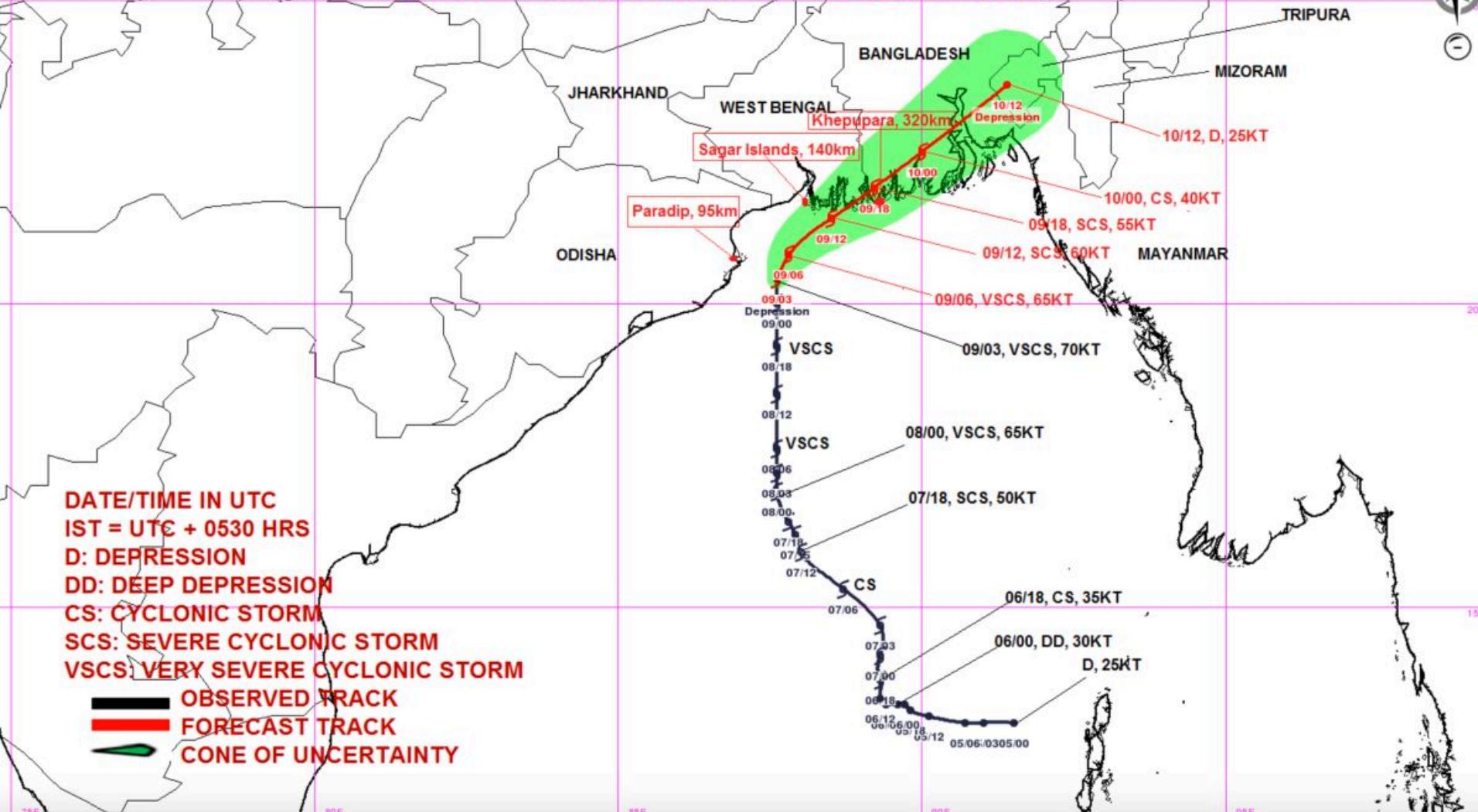
Cyclone Categories

Category	Wind Speed (mph)	Damage at Landfall	Storm Surge (feet)
1	74-95	Minimal	4-5
2	96-110	Moderate	6-8
3	111-130	Extensive	9-12
4	131-155	Extreme	13-18
5	> 155	Catastrophic	19+

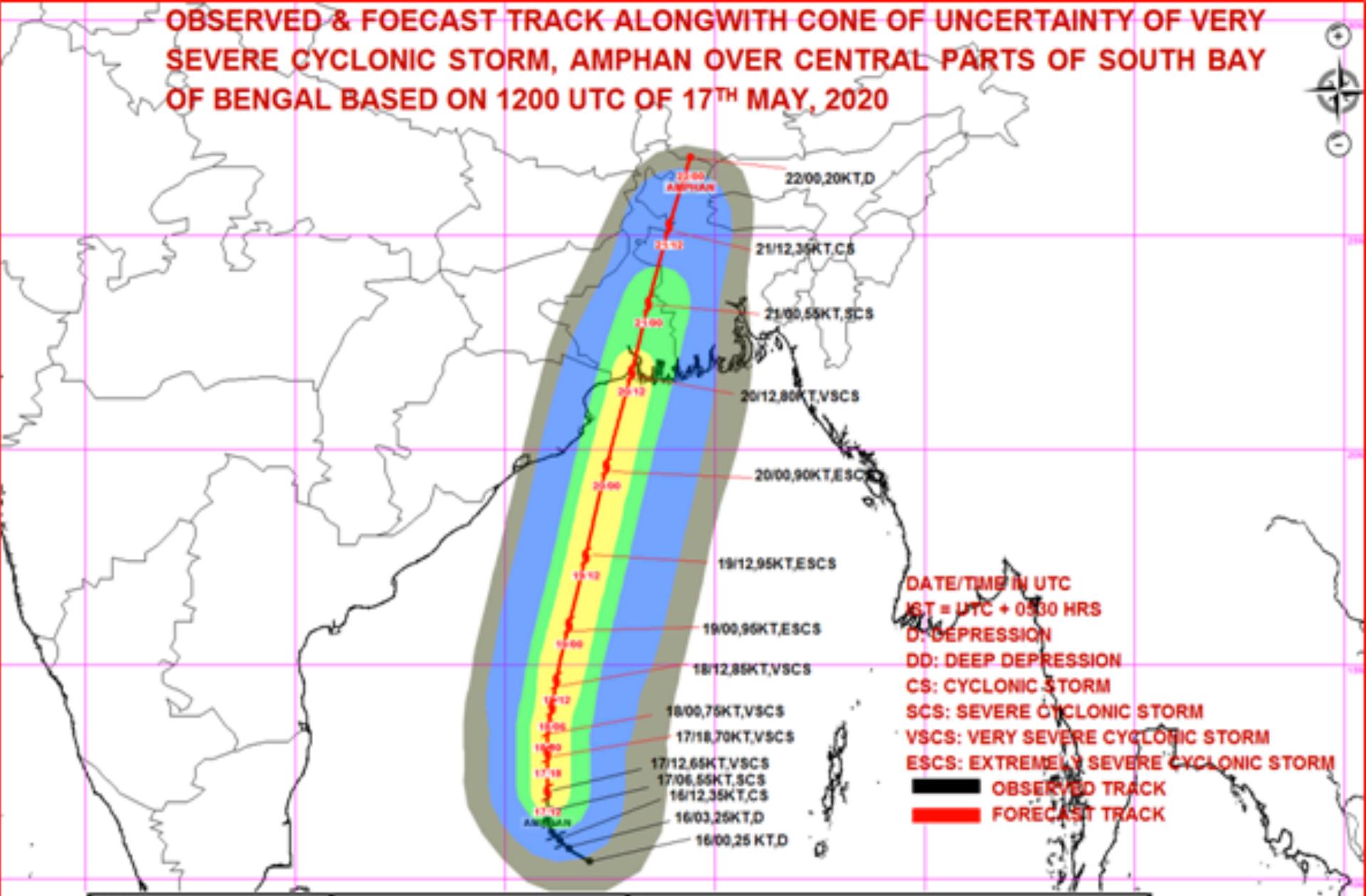
The Saffir-Simpson Hurricane Scale



**OBSERVED & FORECAST TRACK ALONGWITH CONE OF UNCERTAINTY IN ASSOCIATION
WITH VERY SEVERE CYCLONIC STORM "BULBUL" OVER NORTHWEST BAY OF BENGAL
BASED ON 0300 UTC OF 09th NOVEMBER 2019**

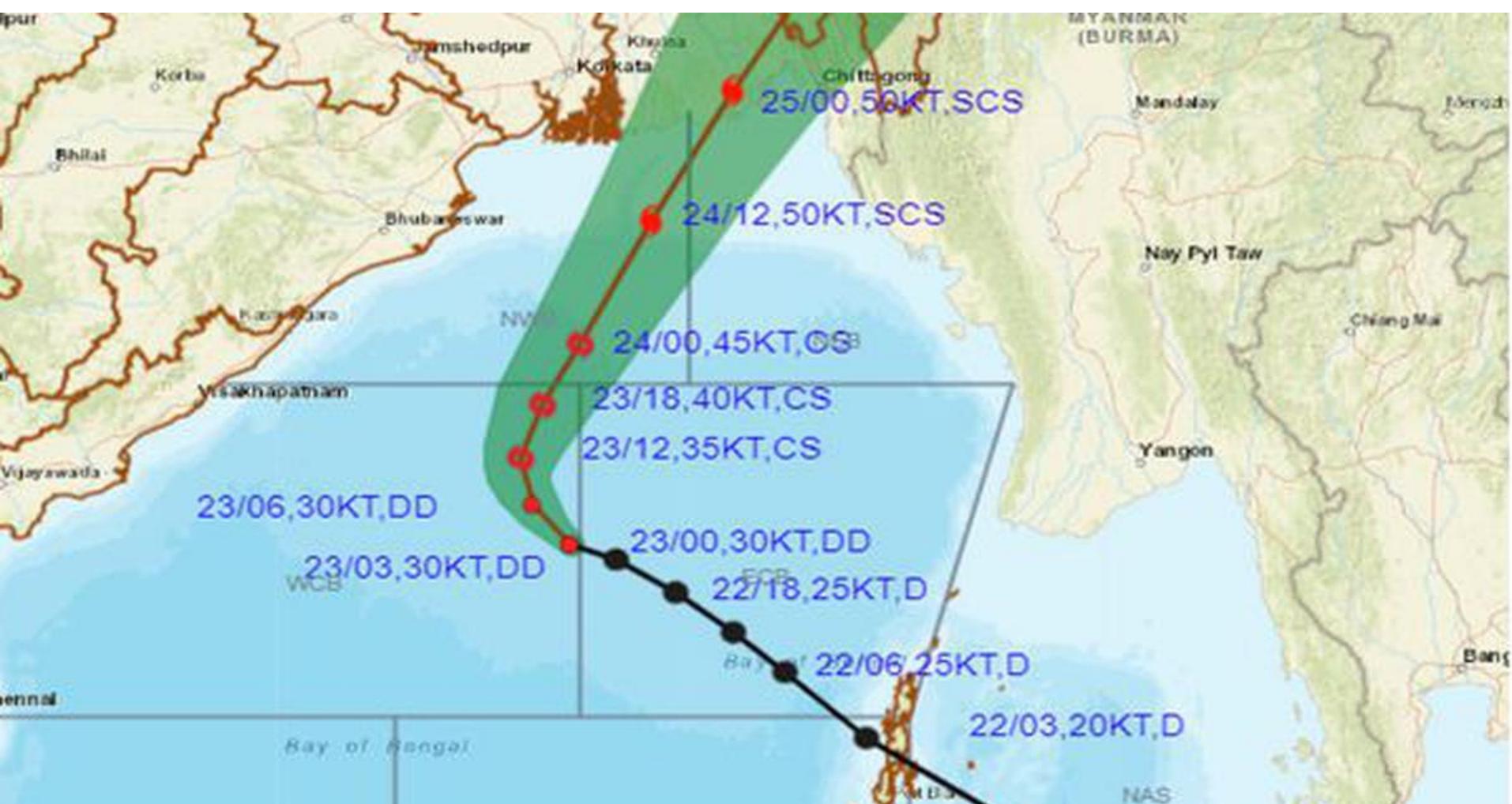


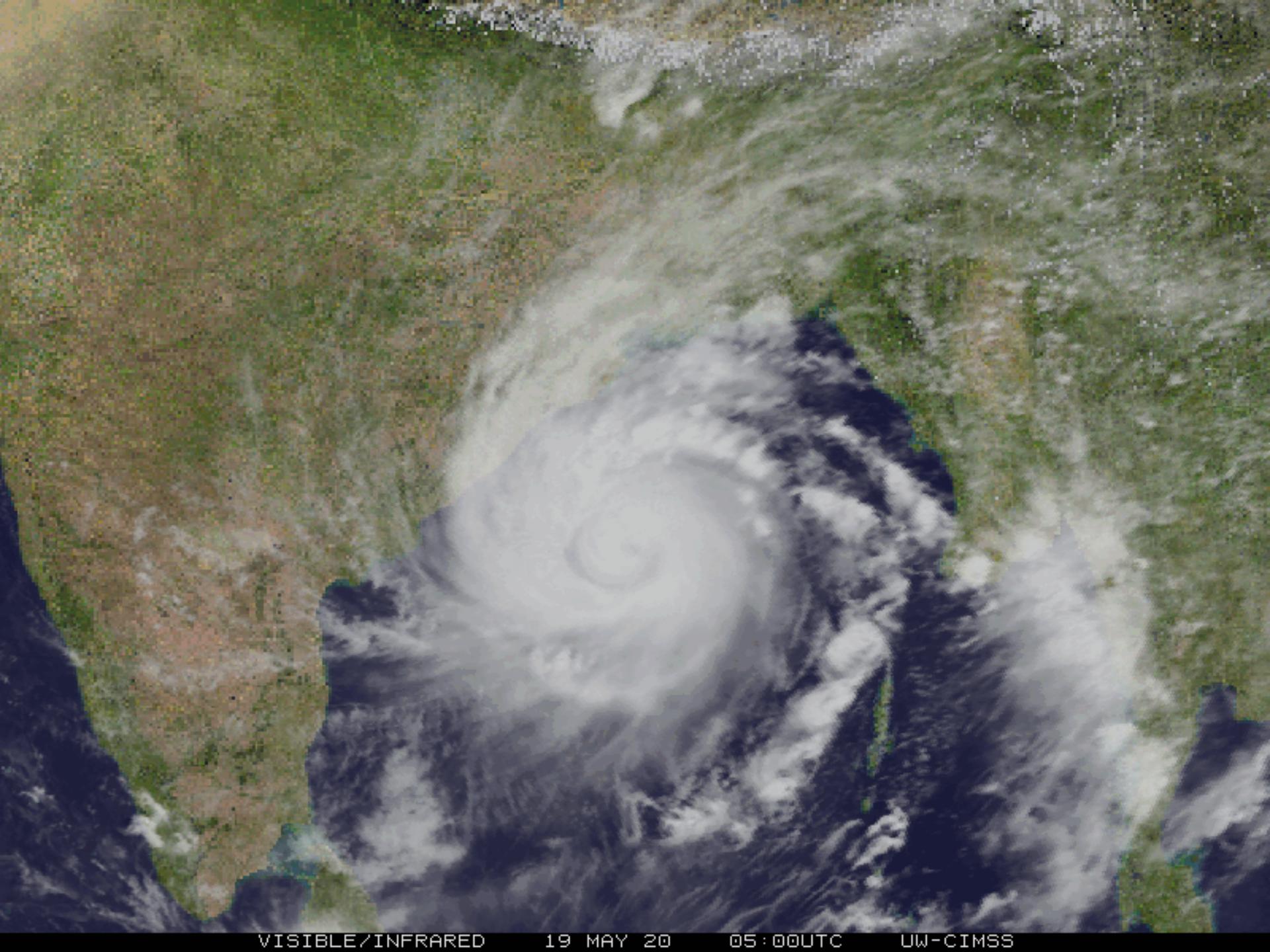
OBSERVED & FORECAST TRACK ALONGWITH CONE OF UNCERTAINTY OF VERY SEVERE CYCLONIC STORM, AMPHAN OVER CENTRAL PARTS OF SOUTH BAY OF BENGAL BASED ON 1200 UTC OF 17TH MAY, 2020



MSW(kn/kt)/kmp/h	Impact	Action
28-33 (52-61)	Very rough seas.	Total suspension of fishing operations
34-40(62-74)	High to very high seas	Total suspension of fishing operations
41-63(75-117)	Very High seas	Total suspension of fishing operations
≥ 64 (≥ 118)	Phenomenal	Total suspension of fishing operations

Cyclone Sitrang





VISIBLE/INFRARED

19 MAY 20

05:00UTC

UW-CIMSS



ঘূর্ণিঝড় প্রস্তুতি কর্মসূচি (সিপিপি)

CYCLONE PREPAREDNESS PROGRAMME (CPP)

A Joint Programme of Government of Bangladesh and Bangladesh Red Crescent Society



Signals 1-3

No flag hoisted.
Verbal
discussion on
possibility of
depression/
cyclone
formation.



Signals 4

One flag hoisted.
Raise awareness
on formation of
cyclone and
possibility of
impact. Public
address through
megaphones and
loudspeakers.



Signals 5-7

Two flags
hoisted. Public
address through
megaphones and
loudspeakers.



Signals 8-10

Three flags
hoisted. Public
address through
megaphones
and loudspe-
akers and use of
static and hand
sirens.

* adjusted specifically for camp settlements

Signal	Wind Speed (km/hr)	
Cautionary Signal No.	2	20 - 40
Warning Signal No.	4	41 - 61
Damage Signal No.	6	62 - 87
Great Signal No.	8	88 - 117
Great Signal No.	9	118 - 170
Great Danger Signal No.	10	More than 171

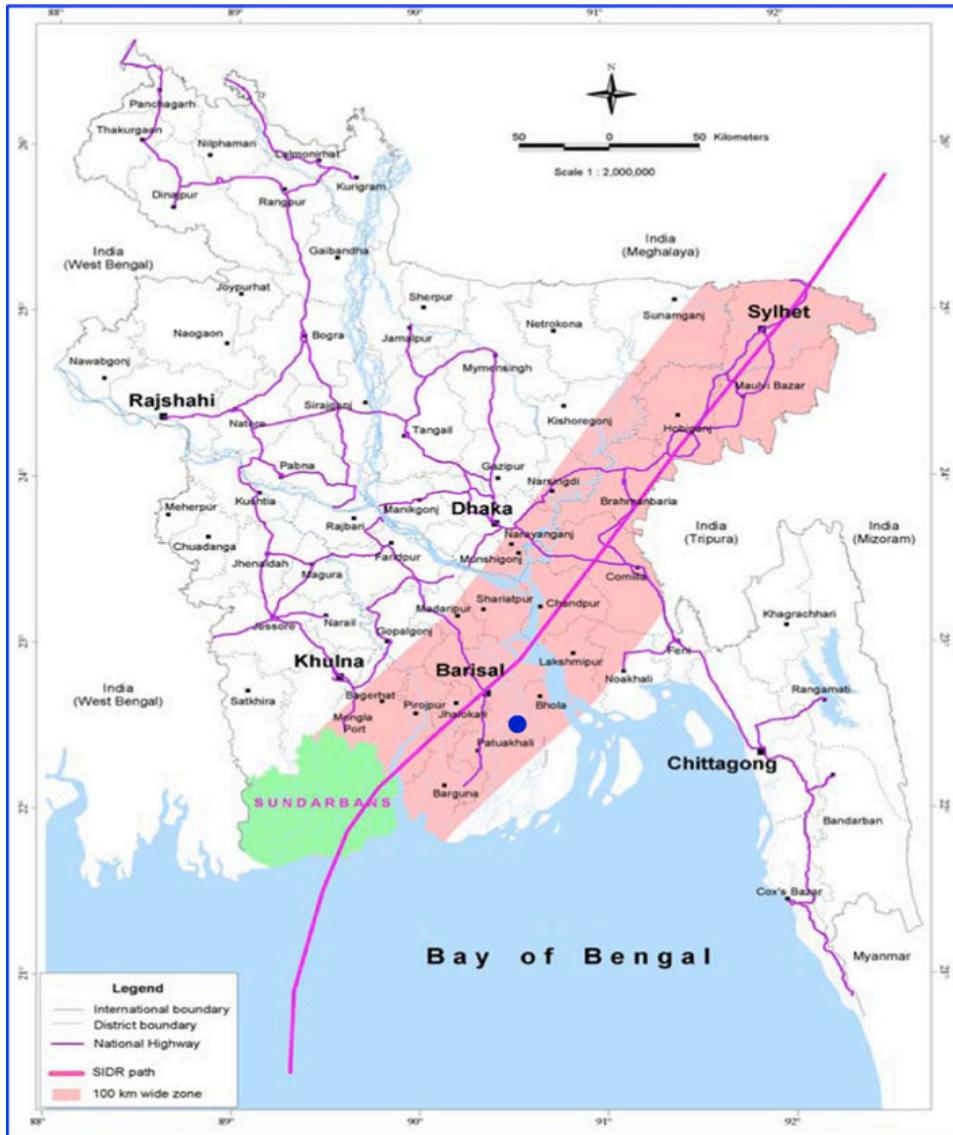
Meaning of existing warning

Stage of Action	Signal No.	Meaning
Alert Stage	Distant Cautionary SN-1	There is a region of squally weather (strong & sudden wind)
"	Distant Warning SN-2	A storm has formed in the distant area.
"	Local cautionary SN-3	The port is threatened by squally weather.
Warning Stage	Local Warning SN-4	The port is threatened by a storm but it does not appear that the danger is yet sufficiently great to justify extreme precautionary measures.
Disastrous Stage	Danger Sn-5	The port will experience severe weather from a storm of great intensity that is expected to cross the coast to South of the port of Chittagong or Cox's Bazar & the coast of the MagierPWH
"	Danger SN-6	The port will experience severe weather from a storm of great intensity that is expected to cross the coast to North of the port of Chittagong or Cox's Bazar & the West of the MagierPWH
"	Danger SN-7	The port will experience severe weather from a storm from light to moderate intensity that is expected to cross over or near the port.
"	Great Danger SN-8	The port will experience severe weather from a storm of great intensity that is expected to cross the coast to South of the port of Chittagong or Cox's Bazar & to the East of the MagierPWH
"	Great Danger SN-9	The port will experience severe weather from a storm of great intensity that is expected to cross the coast to North of the port of Chittagong or Cox's Bazar & to the West of the MagierPWH
"	Great Danger SN-10	The port will experience severe weather from a storm of great intensity that is expected to cross over or near the port.
"	Great Danger SN-11	Communicating with the meteorological warning center has broken down.

Impact of cyclone

- Loss of life (social losses)
- Economic losses
 - Damage of homes
 - Damage of business (loss of crops and animals of firms)
 - Public utility are badly disrupted
 - Disruption of fresh water supply, sewerage treatment, waste disposal
 - Increase of disease and epidemics

SIDR's route



Cyclone Sidr was the strongest named cyclone in the Bay of Bengal that resulted into one of the worst natural disasters in Bangladesh

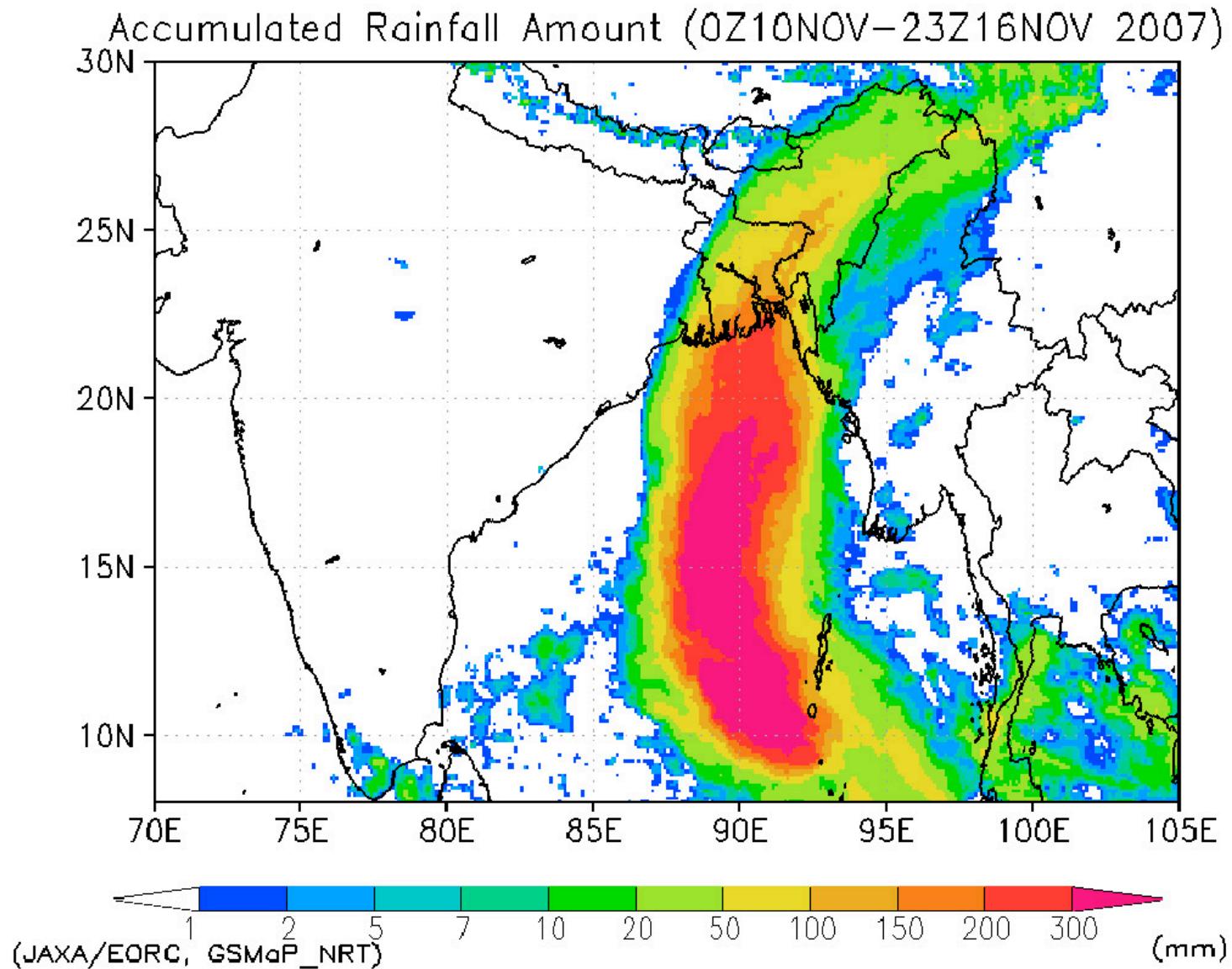
Total fatalities: 10,000

Date: November 2007

Affected areas: [Bangladesh](#), [India](#)

Entire coastal belt is vulnerable to Storm Surges and Cyclones.

SIDR



- In 1970 about 300,000 people died in a cyclone
- 1988 cyclone Death toll over 2,000
- cyclone 1991 an estimated **140,000 deaths.**



Coastal Flooding

Coastal flooding is a sudden and abrupt inundation of a coastal environment caused by a short-term increase in water level due to a storm surge and extreme tides.

The **magnitude and extension** depend on the **coastal topography**, **storm surge conditions** and **broader bathymetry** of the coastal area.

Coastal flooding is generally a natural process and constitutes an important part of the natural coastal dynamics, especially for **salt marshes and mangrove forests**. In areas with human activities, however, it can constitutes a major challenge and leads to loss of property and lives.

Over the last 200 years, it is estimated that about two million people have been died in flood events mainly in South Asia, and with growing coastal populations and sea level rise, the world faces increasing potential for coastal flood disasters.



Coastal Flooding paths-

The seawater can flood the land via from several different paths:

- 1. Direct flooding**
- 2. Overtopping of a barrier**
- 3. Breaching of a barrier**

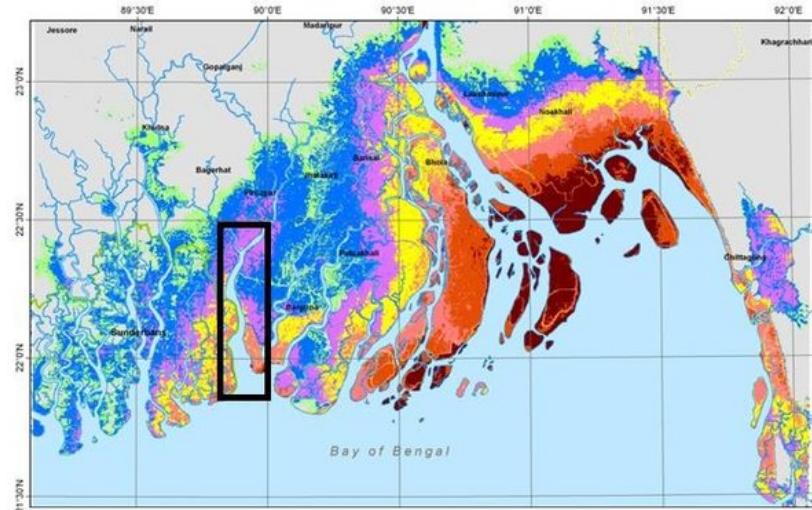


Coastal Flooding: causes-

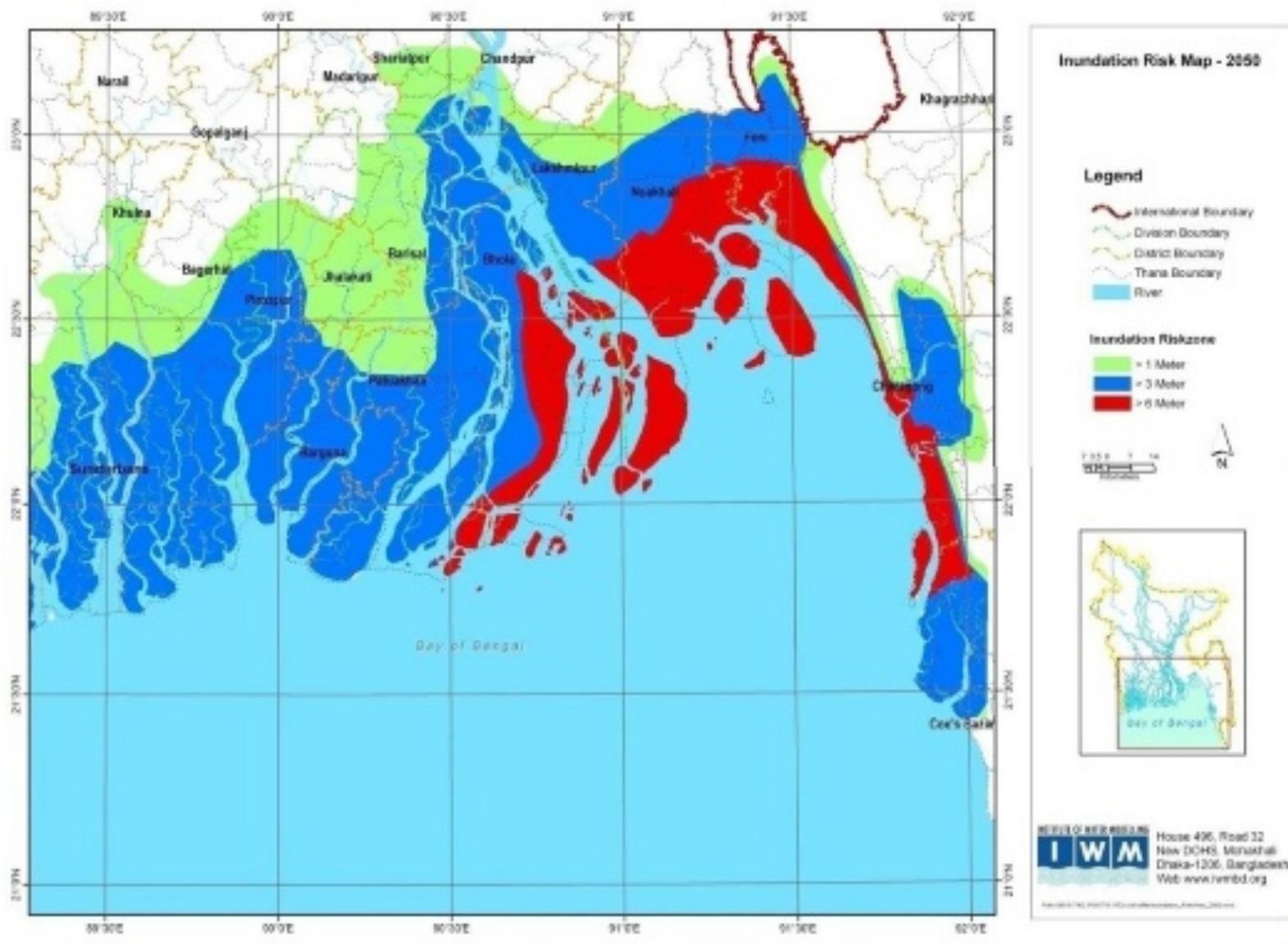
1. Storm and storm surges

Storms, including hurricanes and tropical cyclones, can cause flooding through storm surges which are waves significantly larger than normal. If a storm event coincides with the high astronomical tide, extensive flooding can occur.

During the years from 1797 to 1991, Bangladesh has been hit by 60 severe cyclones (mostly accompanied by storm surges).



Storm surge inundation risk for predicated climate change context by the year 2050

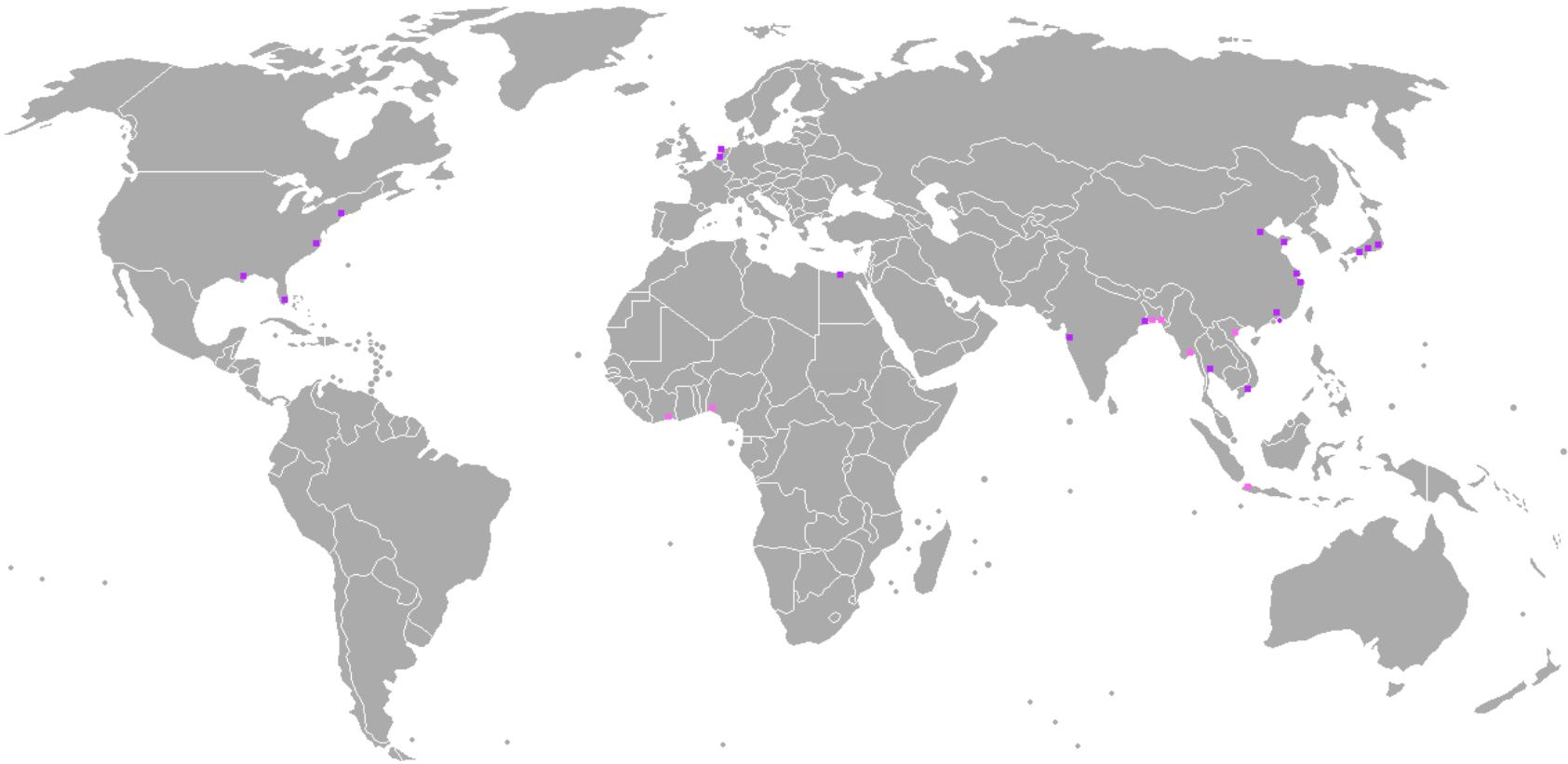


Sea level change

The Intergovernmental Panel on Climate Change (IPCC) estimates global mean sea-level rise from 1990 to 2100 to be between nine and eighty eight centimetres (9-88cm).

It is also predicted that with climate change there will be an increase in the intensity and frequency of storm events such as hurricanes. This suggests that coastal flooding from storm surges will become more frequent with sea level rise.

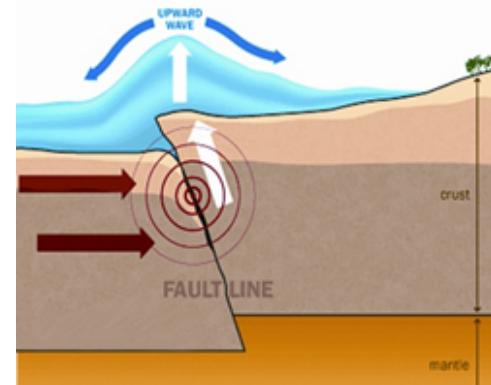
A rise in sea level alone threatens increased levels of flooding and permanent inundation of low-lying land as sea level simply may exceed the land elevation. This therefore indicates that coastal flooding associated with sea level rise will become a significant issue into the next 100 years especially as human populations continue to grow and occupy the coastal zone.



Major cities threatened by sea level rise. The cities indicated are under threat of even a small sea level rise (of 1.6 foot/49 cm) compared to the level in 2010.

Tsunami

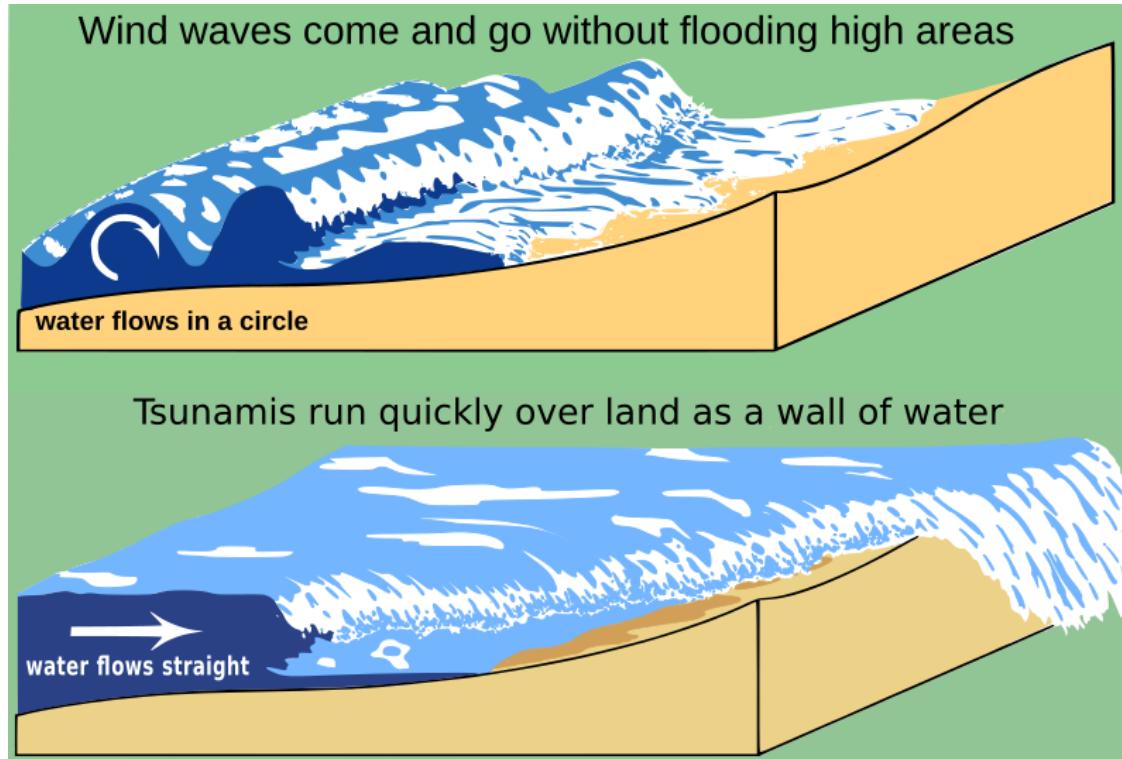
Coastal areas can be significantly flooded as the result of tsunami waves which propagate through the ocean as a result of the displacement of a significant body of water through earthquakes, landslides, volcanic eruptions and glacier calving.



Tsunamis in the BoB

In a total of 2 tidal waves classified as a tsunami since 1762 a total of 2 people died in Bangladesh. Tsunamis therefore occur only rarely here.

The strongest tidal wave registered in Bangladesh so far reached a height of 2.4 meters. At this Tsunami on 12/26/2004 a total of 2 people have been died.



Factors of coastal flooding

Physical

1. Coastal bathymetry
2. Physiography
3. Tidal channels
4. Amount of rainfall
5. Storm surges
6. Changes in sea level



Human-induced

1. Presence of protection measures
2. Development activities
3. Unplanned urbanization



Management of coastal flooding

1. Engineering approach
2. Natural defences (vegetation cover/ mangroves)

Coastal erosion

Coastal erosion is the loss or displacement of land, or the long-term removal of sediment and rocks along the coastline due to the action of waves, currents, tides, wind-driven water, waterborne ice, or other impacts of storms.

Factors that influence the rate of erosion

Primary

1. Waves
2. Land susceptibility
3. Bathymetry
4. Distance from the coast

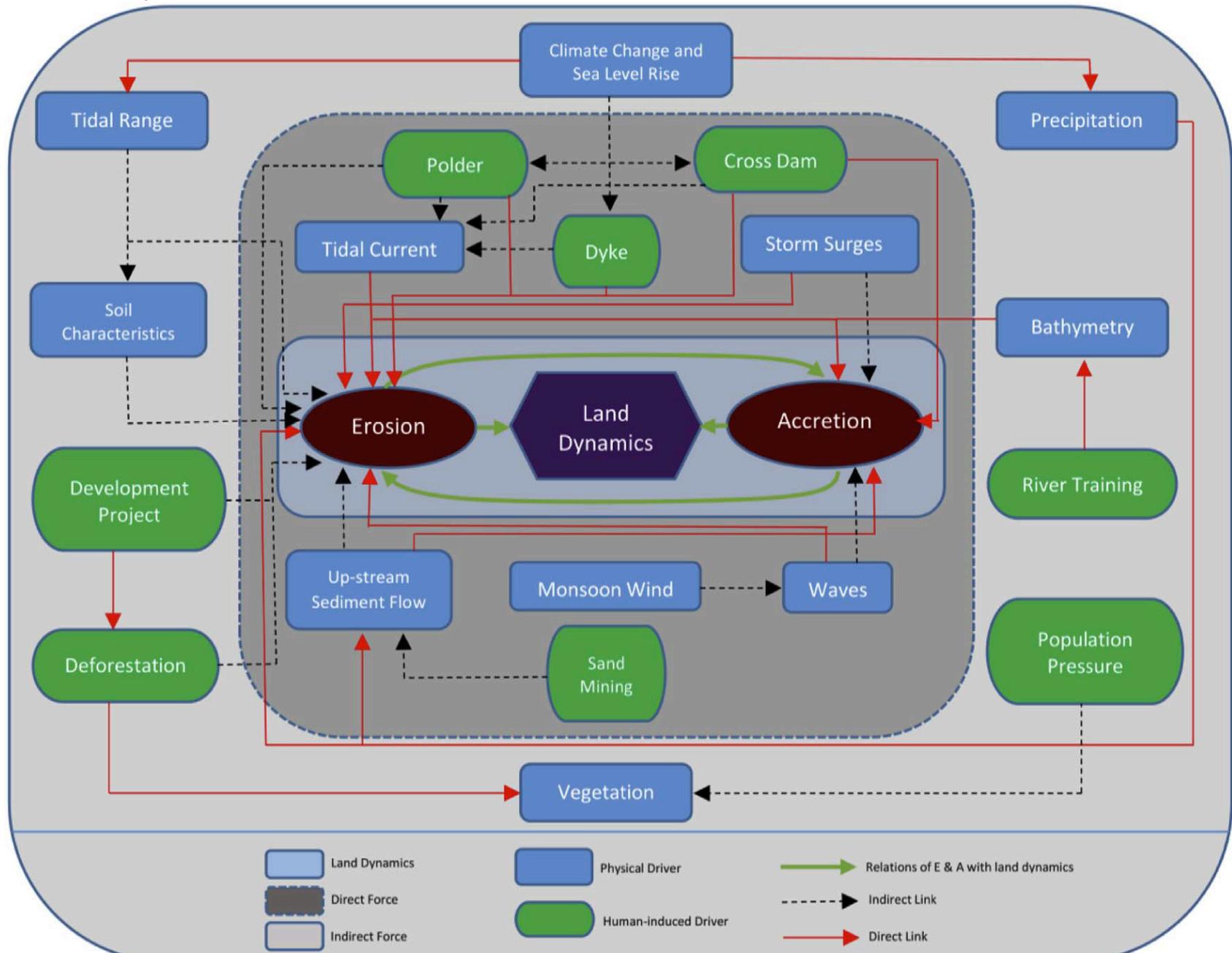
Secondary

1. Weathering and transport slope processes
2. Slope hydrology
3. Vegetation
4. Cliff foot erosion
5. Cliff foot sediment accumulation
6. Resistance of cliff foot sediment to attrition and transport
7. Human Activity

Tertiary

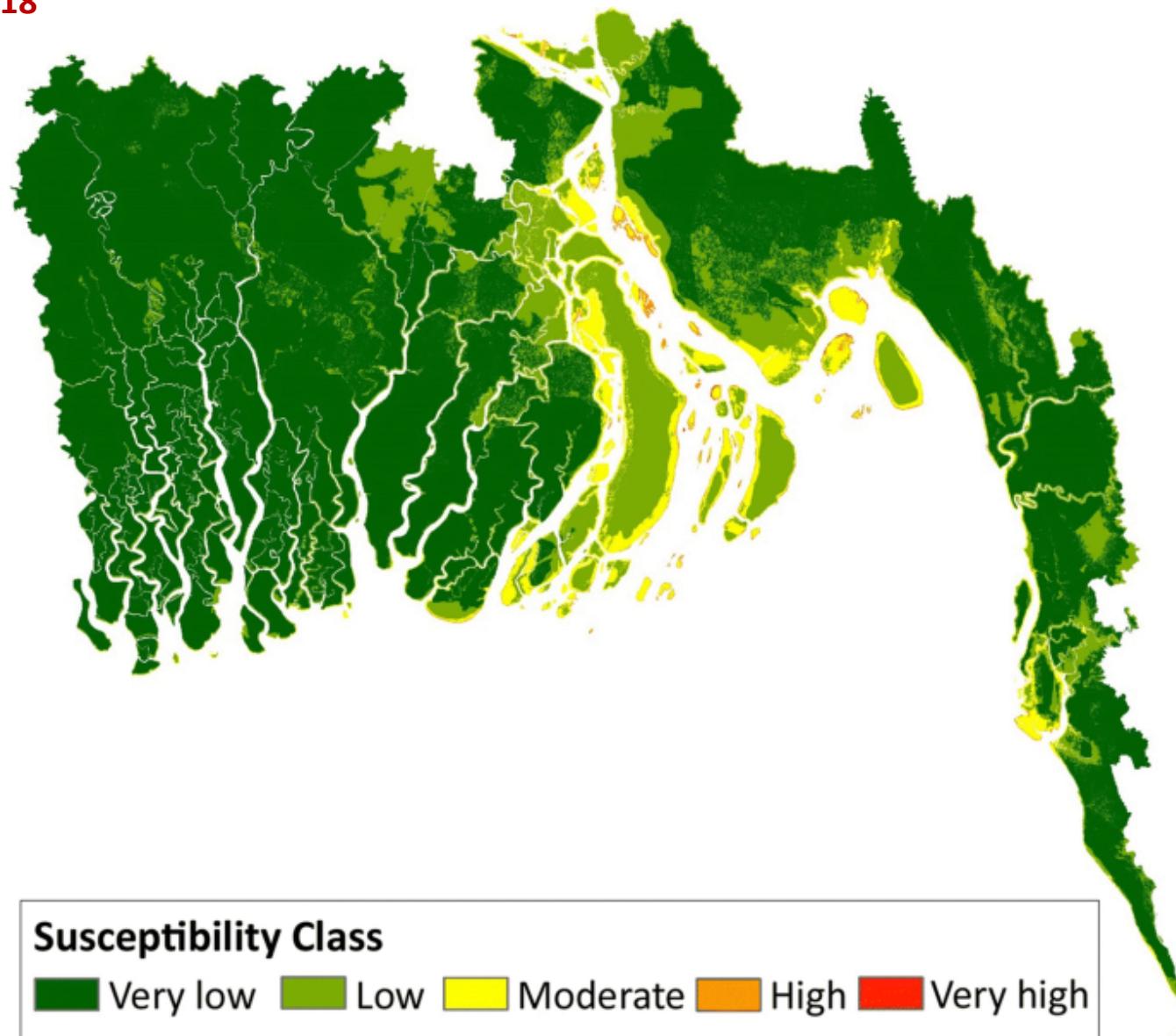
1. Resource extraction
2. Coastal management

Factors of land dynamics in BD (Ahmed et al., 2018)



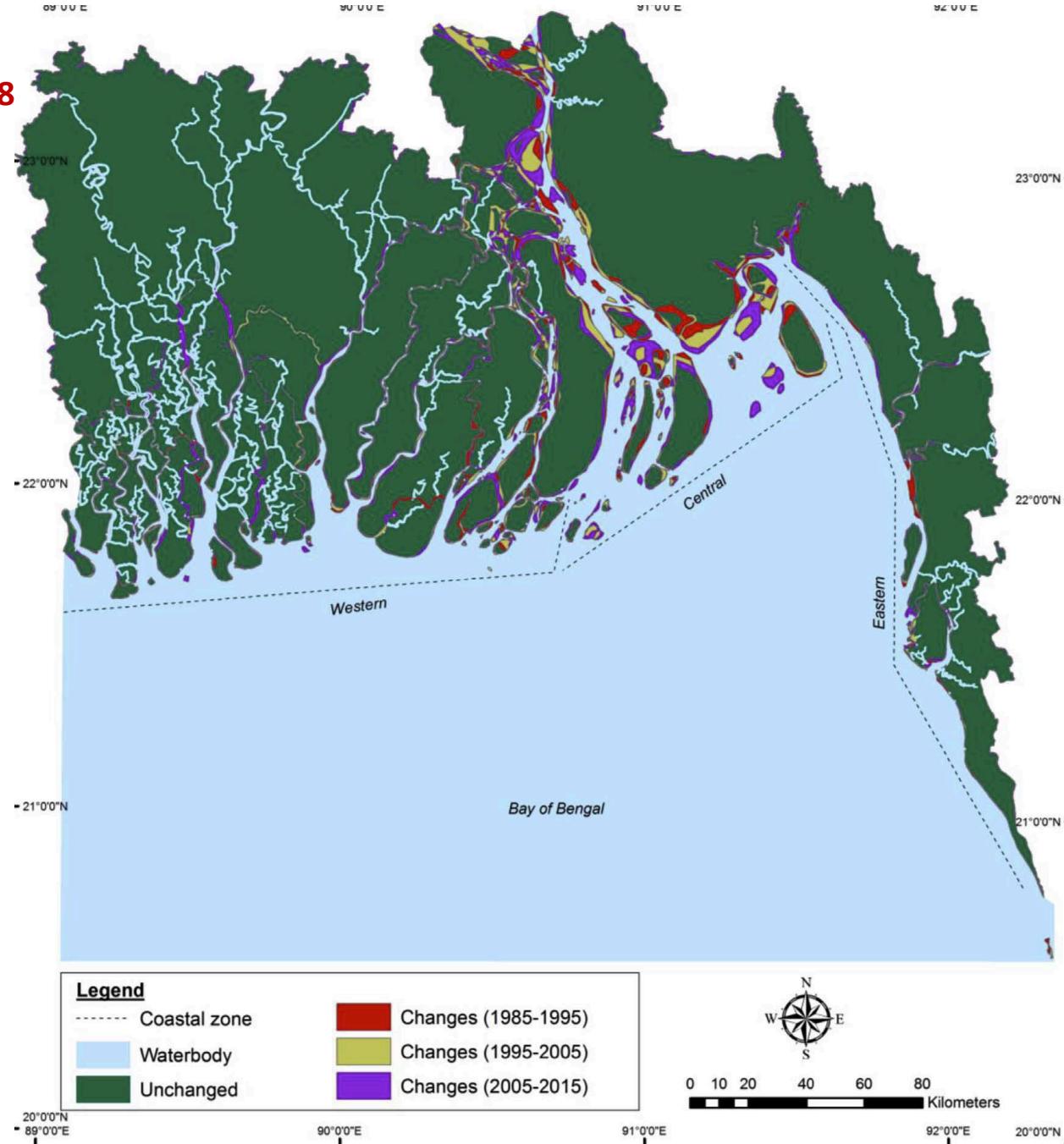
Land susceptibility to erosion (1985-2015)

Ahmed et al., 2018



Land dynamics (1985-2015)

Ahmed et al., 2018



Land dynamics (1985-2015)

Ahmed et al., 2018

