

Myanmar Flood Report <2024 No.01>

Cyclone and flood risks in Myanmar and prospects for the 2024 rainy season

[Summary]

- In Myanmar, flood risk is highest from July to September as main rainy season.
- The frequency of cyclones in the Bay of Bengal increases from June to October, with a peak in July to September. Historically, most cyclones in Myanmar landfall before/after rainy season, therefore it is necessary to monitor and prepare for strong wind and storm surge disasters during April-May and October-December.
- Cyclone Nargis in May 2008 was the most severe cyclone in Myanmar’s history. The storm surge, with a maximum tide level of 7m caused severe damage and resulted in the tragic loss of over 80,000 lives.
- Many meteorological departments in global have predicted the occurrence of La Nina event later 2024. La Nina often brings heavy rainfall situation to Southeast Asia including Myanmar. It is necessary to prepare for flood risk possibility from more heavy rain disasters during 2024 rainy season.

Characteristics of annual climate and natural disaster seasonally in Myanmar

Seasons in Myanmar are roughly divided into 3 seasons: the dry season from late October to March, the extremely hot season in April and May, and the rainy season from mid-June to mid-October. From June to September, the southwest monsoon, which blows in humid and warm winds, causes high temperatures and humidity, and heavy rain and thunderstorm are likely to occur. From December to April, the northeast monsoon causes relatively cool weather.

The figure below shows the annual calendar of natural disaster hazards provided by the Department of Meteorology and Hydrology in Myanmar (DMH). Special warning periods include the Thunderstorm from March to October, the Heavy rain from May to September, the Flood from June to October, the Cyclones from April to May and October to November, and the Strong winds and Heavy rain from Monsoon depression from May to September.

Hazards Calendar in Myanmar												
Hazards	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cyclone												
High Temperature												
Low Temperature												
Drought												
Squalls & Thunderstorm												
Flood												
Heavy Rain												
Monsoon Depression					6	6	6	6	6			
Hail												

Hazard Calendar of Natural Disasters in Myanmar
(Source : Department of Meteorology and Hydrology (Myanmar))

Classification of cyclones and characteristics of cyclone occurrence in Myanmar

The cyclone is a tropical cyclone that occurs in the northern Indian Ocean, southern Indian Ocean and southern Pacific Ocean. In the North Indian Ocean region including Myanmar, cyclones are classified according to the maximum wind speed as table below. The following terms are used in the announcement document of India Meteorological Department and DMH. In the Bay of Bengal part of North Indian Ocean facing Myanmar, when the maximum wind speed is less than 34 kt (knots, 1 knot is about 0.5144 m/s), it is classified as the Depression [D] or the Deep Depression [DD], and when it is 34 kt or more, it is classified as the Cyclonic Storm [CS]. Normally, when a cyclone reaches CS level or above, caution is required against violent winds and storm surges.

Maximum sustained winds speed	North-Indian Ocean	North Atlantic Ocean & Northeast Pacific Ocean	Northwest Pacific Ocean	Japan Meteorological Agency
17-28kt (9-14m/s)	Depression [D]	Tropical Depression	Tropical Depression [TD]	Tropical Depression
28-34kt (14-17m/s)	Deep Depression [DD]			
34-48kt (17-25m/s)	Cyclonic Storm [CS]	Tropical Storm	Tropical Storm [TS]	Tropical Storm
48-64kt (25-33m/s)	Severe Cyclonic Storm [SCS]		Severe Tropical Storm [STS]	Severe Tropical Storm
64-90kt (33-46m/s)	Very Severe Cyclonic Storm [VSCS]	Hurricane Category1(64-83kt) Category2(83-95kt) Category3(95-113kt) Category4(114-135kt) Category5(135kt-)	Typhoon [TY]	Typhoon (64-85Kt)
90-114kt (46-62m/s)	Extremely Severe Cyclonic Storm [ESCS]			Very Strong Typhoon (85-105Kt)
120kt- (62m/s-)	Super Cyclonic Storm		Super Typhoon [STY](100kt-)	Violent Typhoon (105Kt-)

Classification criteria for tropical cyclones in the Northern Hemisphere based on wind speed
(Compiled by Interrisk from meteorological department in India, Myanmar, Japan, Philippines, United States, etc. *)

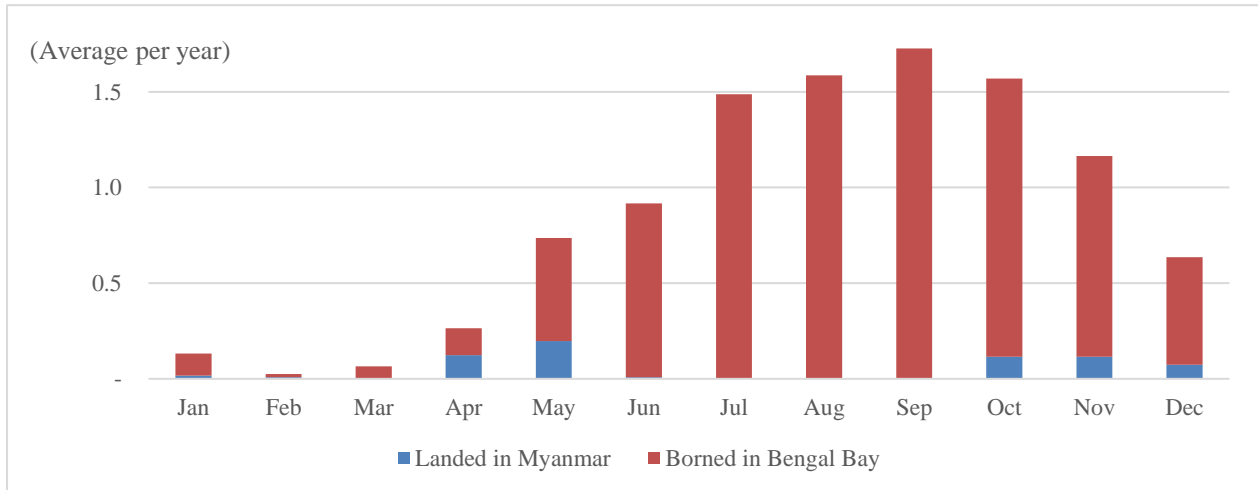
*Note that some countries use different definitions of the above table

The table below shows the number of landfalls of cyclones in the Bay of Bengal with a strength of CS or above by country from 2014 to 2023. On average, near 3 cyclones occur in the Bay of Bengal per year. Cyclones tend to move from east to west or from south to north, and they frequently land or approach India, Sri Lanka, and Bangladesh. In the past 10 years, there have been 2 landfalls along the coast of Myanmar, in 2017, 2023.

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average per year
India	1	-	2	-	4	1	2	3	2	1	1.6
Sri Lanka	-	-	-	1	-	-	1	-	-	-	0.2
Bangladesh	-	1	1	1	-	-	-	-	1	2	0.6
Myanmar	-	-	-	1	-	-	-	-	-	1	0.2
No landfall	-	-	1	-	-	-	-	-	-	-	0.1
Total	1	1	4	3	4	1	3	3	3	4	2.7

Number of cyclone landfalls by country, developed to a cyclonic storm or greater in the Bay of Bengal in 2014–2023
(Compiled by InterRisk based on information published by India Meteorological Department, Bureau of Meteorology)

According to the long-term statistical data (119 years up to 2005) of DMH, cyclones in Myanmar mainly make landfall in April-May and October-December, which are before/after the rainy season. In the Bay of Bengal, about 10 cyclones including depression-level tropical cyclones occur annually, and the frequency of cyclone occurrence increases mainly from May to December. However, cyclones with strong intensity never made landfall in the Bay of Bengal from June to September after the start of the rainy season.



Annual average number by month of cyclones borned in the Bay of Bengal from 1887 to 2005, and landed in Myanmar (Compiled by InterRisk based on "Hazard Profile of Myanmar" from Department of Meteorology and Hydrology (Myanmar))

Cyclone damage in Myanmar is characterized by storm and heavy rain, as well as frequent storm surge damage. The most severe cyclone in the past was Cyclone Nargis in May 2008, which caused severe storm surge damage. Cyclone Nargis occurred in the central part of the Bay of Bengal on April 27, 2008. It initially headed toward India, but then suddenly changed its course to the east. Cyclone Nargis made landfall in the Ayeyarwaddy River Delta in Myanmar on May 2, and disappeared near the border between Myanmar and Thailand the next day. The coastal area where Nargis made landfall and the Ayeyarwaddy River Delta are topographic conditions that cover a wide area of low-lying land with a small difference in elevation from sea level. Conditions such as the cyclone's wind direction, air pressure, and path influenced the occurrence of storm surge damage. This resulted in serious storm surge damage, the worst ever recorded from a cyclone in Myanmar. There are records that the storm surge water level is 3-4 m in the main basin of the Yangon River, and the maximum is over 7 m. In recent years, major cyclones that caused severe damage in Myanmar occurred in 1968 (over 1,000 deaths) and 1975 (over 300 deaths). However, the number of deaths caused by Nargis is an unprecedented over 80,000.



Path of Cyclone Nargis 2008 (Source : UNOSAT hazard map)

Characteristics of Flood Occurrence in Myanmar

Myanmar area has a high rainfall due to its monsoon climate, and floods occur almost every year during the rainy season. The table below shows the monthly numbers and proportion of major flood events that occurred between 1997 and 2007, according to DMH the table below shows that floods were concentrated from June to October, especially from July to August.

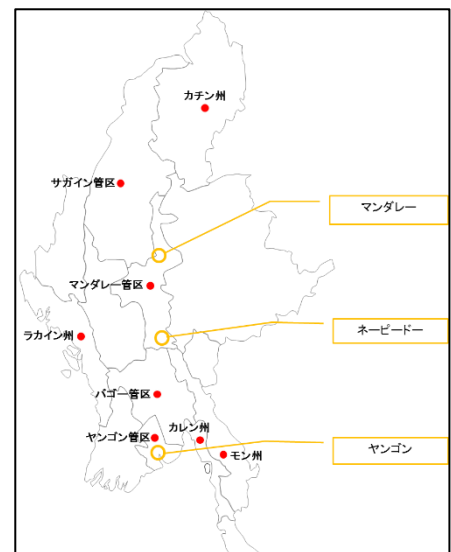
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year Total
Number of flood events	-	-	-	-	-	2	8	6	3	2	-	-	21
Percentage	-	-	-	-	-	9.5%	38.1%	28.6%	14.3%	9.5%	-	-	100%

Number of major flood events by monthly and rate in 1997–2007

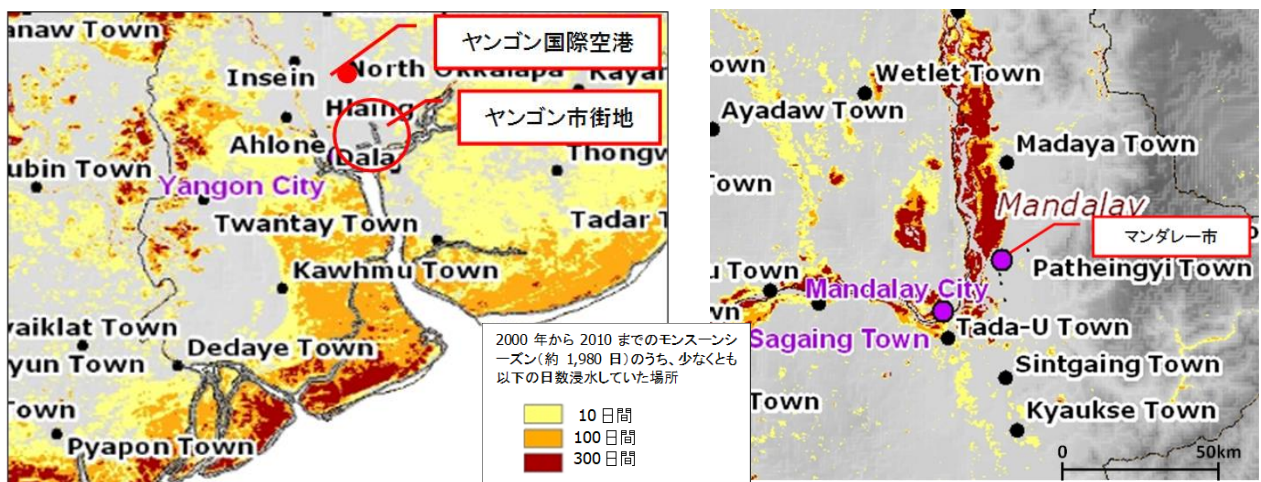
(Compiled by InterRisk based on "Hazard Profile of Myanmar" from Department of Meteorology and Hydrology (Myanmar))

According to statistics from DMH, the Sagaing Region in northern Myanmar has experienced about half of all floods in the past in Myanmar. The Yangon and Mandalay Regions have also had a relatively high number of flood events. Additionally, flood has been reported in Kachin, Bago, Mon, Kayin, and Rakhine States.

The figure below is a hazard map created through a joint project by UN agencies. In the vicinity of Yangon, the low-lying delta area along the lower stream of Ayeyarwaddy River is particularly vulnerable to flood and storm surge. While most flooding in the area is caused by river overflow, severe damage was inflicted by storm surge during Cyclone Nargis in 2008. In the Yangon Region, almost all areas except for inside of Yangon city and northern parts of Yangon are exposed to flood hazards. Specifically, many areas along the Yangon River and near its mouth of the river have experienced frequent flood events in the past.



Districts and states affected by flooding (red circles)
(Compiled from Hazard Profile of Myanmar)



Historical flooded locations and cumulative inundation duration in Yangon, Mandalay in 2000–2010

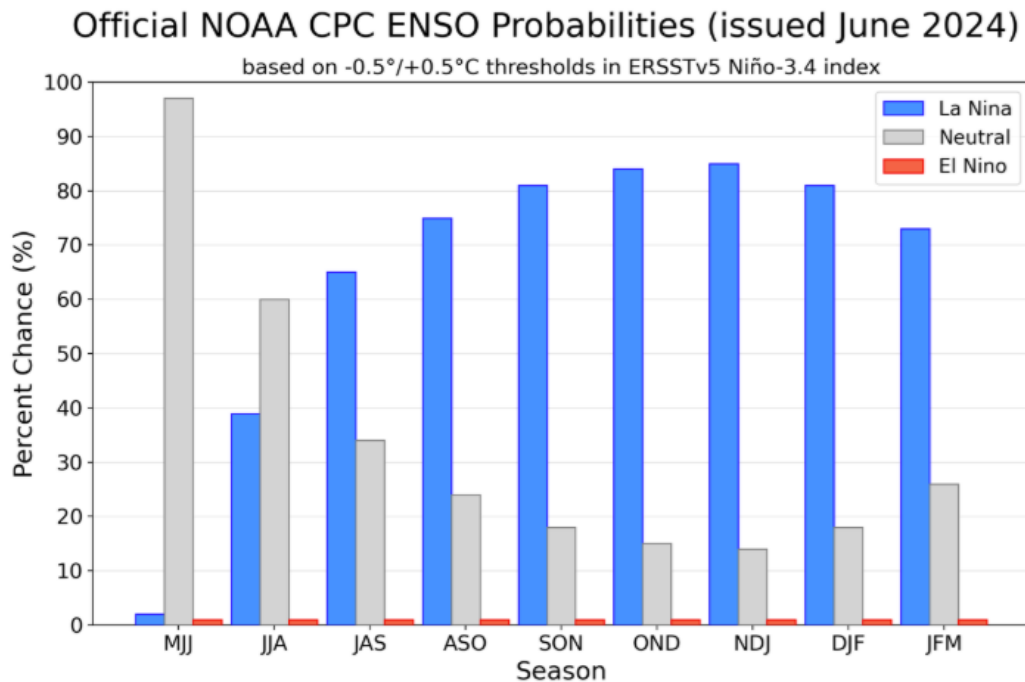
Source : Information Technology for Humanitarian Assistance, Cooperation and Action)

Prediction of the La Nina occurrence in 2024 and its impact for Myanmar

Many meteorological departments in global have predicted the La Nina event later 2024. The El Nino/La Nina are phenomena in which sea surface temperatures in the central and eastern equatorial Pacific Ocean area continue to be higher or lower than normal for several months to a year. Some meteorological departments in global monitor the sea surface temperatures in the region, and the National Oceanic and Atmospheric Administration (NOAA) in US calls the El Nino when the three-month average sea surface temperature is 0.5°C above normal, and the La Nina when it is 0.5°C below normal. The case where neither is the case is called the Neutral state.

The El Nino and La Nina are thought to be one of the causes of extreme weather in global. In Southeast Asia, such as Myanmar, the El Nino period tends to be dryer with higher temperatures and less rainfall than usual, while the La Nina period tends to have lower temperatures and more rainfall than usual.

NOAA predicts that the current El Niño is weakening and moving toward neutral, and that a La Niña is likely to develop later this year. Meteorological departments in Thailand, Japan, Australia, and other countries have also announced similar forecasts. According to NOAA's latest forecast in June, the average sea surface temperature from June to August is most likely to be neutral, but there is a 65% chance that La Nina will occur from July to September, additionally at least will continue until the beginning of next year.



El Nino/La Nina probability by monthly from May 2-24 to January 2025 (last updated on 13 June, 2024)

(Source : Climate Prediction Center, NOAA)

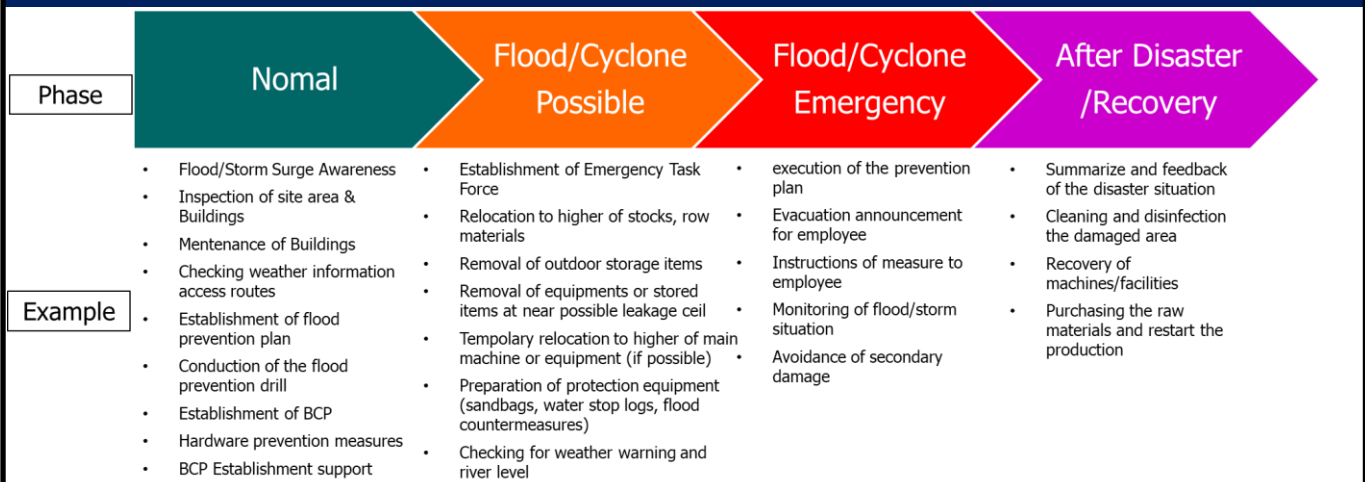
*The horizontal axis shows the probability of occurrence calculated from the predicted 3 month mean sea surface temperature for May-July, June-August... and next January-March.

The above situation suggests that the La Nina may develop during 2024 rainy season, resulting in a heavier rainfall than usual. And, according to DMH's latest forecast in 28 June for the mid monsoon period (July-August), rain or thundershower will be expected above normal in Lower Sagaing, Mandalay, Magway Regions and (Southern and Eastern) Shan State and about normal in others region including Yangon.

It is important for companies to aware the latest status of flood risks and countermeasures in normal phase, and to confirm and strengthen responses before/after floods by reviewing plans and conducting drills.

Please refer to the following page for examples of responses by phase normal and before/after flood and cyclone, and examples of risk checklist.

Response Phases & Examples of Measures Before/After Flood and Cyclone



Normal phase

Examples of checklist for preparation of Flood and Cyclone

Check box	Checkpoints (Examples)	Common Improper Cases
<input type="checkbox"/>	Drainage system (inside/outside)	Accumulated sediment or plants in drainage system, lack of regular inspections of drainage pumps
<input type="checkbox"/>	Outdoor storage status	Items vulnerable to strong winds are usually stored outdoors
<input type="checkbox"/>	Deterioration and damage status of roofs/walls	Cracks, lifting, rusting, and seal deterioration of exterior materials
<input type="checkbox"/>	Status of building drainage system	Clogged, damaged, or deformed rain gutters
<input type="checkbox"/>	Height of building entrances and exits	The entrance floor level is the same or close to the ground level
<input type="checkbox"/>	Location of machinery and electrical equipment	Machinery and equipment are installed close to the building entrance
<input type="checkbox"/>	Storage status of raw materials and products	Products are stored directly on the floor
<input type="checkbox"/>	Location of utility equipment	Installed in a low area of the premises
<input type="checkbox"/>	Storage status of hazardous materials	Hazardous liquids are stored in an unlocked area, high risk of leakage
<input type="checkbox"/>	Location of network equipment and servers	Server or network room are located underground or ground floor
<input type="checkbox"/>	Storage status of flood prevention equipment	Sandbags are stored at the edge of the site and take time to transport
<input type="checkbox"/>	Establishment status of emergency manual and flood timeline	Only a response manual for fires has been shared, and a flood timeline has not been established
<input type="checkbox"/>	Emergency assembly point for flood event	Emergency assembly points are only considered for fires, and inappropriate for floods due to low elevation area

Possible phase

Examples of checklist for measures before Flood and Cyclone

Check box	Checkpoints (Examples)	Specific examples
<input type="checkbox"/>	Monitoring of real-time information	Confirm collection routes for weather, river water levels, and traffic information
<input type="checkbox"/>	Reconfirm flood/cyclone response timeline	Reconfirm who will respond, by when, and what measures
<input type="checkbox"/>	Instruct employees	Come to work/go home considering, secure personnel for emergency response
<input type="checkbox"/>	Outdoors	Relocation of items stored outdoors to inside, no stacking high pallets, fix tents
<input type="checkbox"/>	Reconfirm drainage operation	Reconfirm the operating conditions of drainage pumps and water gates
<input type="checkbox"/>	Flood protection for buildings	Set sandbags, water stop logs, close doors and windows, smoke vents
<input type="checkbox"/>	Protection of equipment and products	Waterproof products and equipment near doors or windows, remove to higher
<input type="checkbox"/>	Protection of important documents	Remove of contracts, drawings, other important documents to upper floors
<input type="checkbox"/>	Prevention of electrical leakage	Shut off breakers and unplug equipment to prevent leakage
<input type="checkbox"/>	Protection of harmful/water reactive chemicals	Seal and move hazardous materials to prevent leakage or contact with water
<input type="checkbox"/>	Preparing of emergency equipment/supplies	Prepare generators, portable pumps, food, sanitary and move them to higher
<input type="checkbox"/>	Confirmation of emergency contacts	Confirm contact list of machinery/utility equipment vendor, business partners

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