

Extreme atmospheric events on Earth



At Earth surface, the largest horizontal pressure difference is about 10% (324 km/h **typhoon** wind).

The average sea-level air pressure reading is 1013.25 mb.
The usual worldwide range in sea level air pressure is about 970 to 1040 mb.

The lowest sea level air pressure ever recorded was **870 mb** in the eye of a **typhoon** over the Pacific Ocean, whereas the highest sea level air pressure ever recorded was **1084 mb** in Siberia associated with an extremely cold air mass.

$$1 \text{ bar} = 100 \text{ kPa} = 100 \text{ kN/m}^2 = 0.99 \text{ atm} = 14.5 \text{ psi}$$

Hurricanes, cyclones, and typhoons

Hurricanes, cyclones, and typhoons are all the same weather phenomenon; we just use different names for these storms in different places:

Atlantic and Northeast Pacific = hurricanes

Northwest Pacific is called = typhoons

South Pacific and Indian Ocean = cyclones.

The ingredients for these storms include:

- a pre-existing weather disturbance,
- warm tropical oceans (at least 26.5°C over a depth of 50 m),
- moisture, and relatively light winds.

If the right conditions persist long enough, they can combine to produce the violent winds, incredible waves, torrential rains, and floods we associate with this phenomenon.

Hurricane Ian (Sep. 2022)

Category: 5

Peak winds: 267 km/h (gusts 348 km/h)

Lowest atmospheric pressure: 937 mb

Greatest diameter: 800 km

North Atlantic's Biggest Beasts

Peak winds (sustained for one minute)

Allen (1980): 306 km/h

Irma (2017): 298

Wilma (2005): 298

Gilbert (1988): 298

Katrina (2005): 282

Lowest atmospheric pressure

Wilma: 882 millibars

Gilbert: 888

Katrina: 902

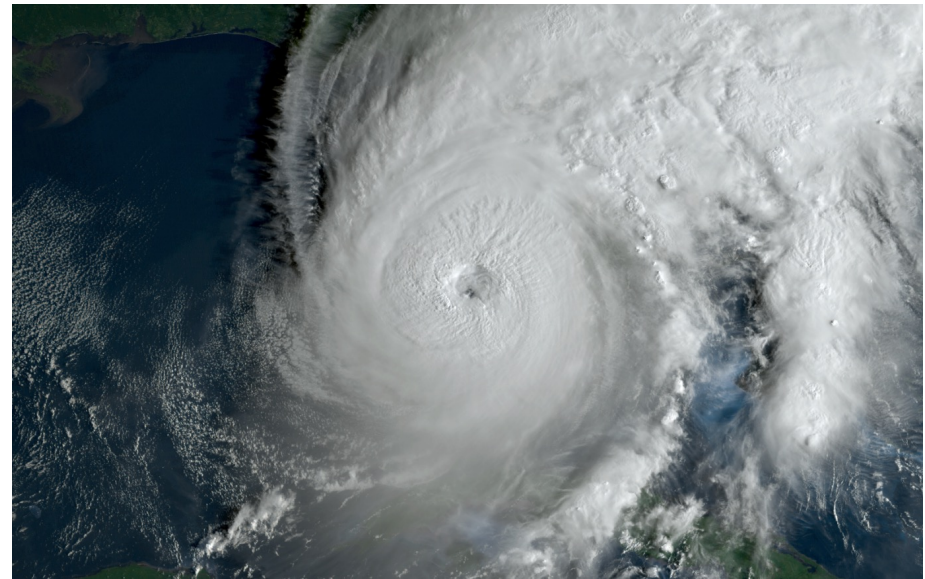
Typical pressure at sea level: 1013

Most rainfall in U.S. (Atlantic and Pacific)

Hiki (1950, Hawaii): 1.32 m

Harvey (2017, Texas): 1.30

Amelia (1978, Texas): 1.22



World Record Holders

*Peak winds **at sea***

Patricia (2015, South Pacific): 346 km/h

Nancy (1961, North Pacific) 346

*Peak winds **upon landfall***

Haiyan (2013, Philippines) 306 km/h

Meranti (2016, Philippines) 306

Lowest pressure

Tip (1979, South Pacific): 870 millibars

Greatest diameter (of circulation)

Tip: 2220 km (distance from New York City to Dallas)

Ellabell EF-3 tornado
Georgia, USA
April 5, 2022

Wind speeds between
218 and 267 km/h



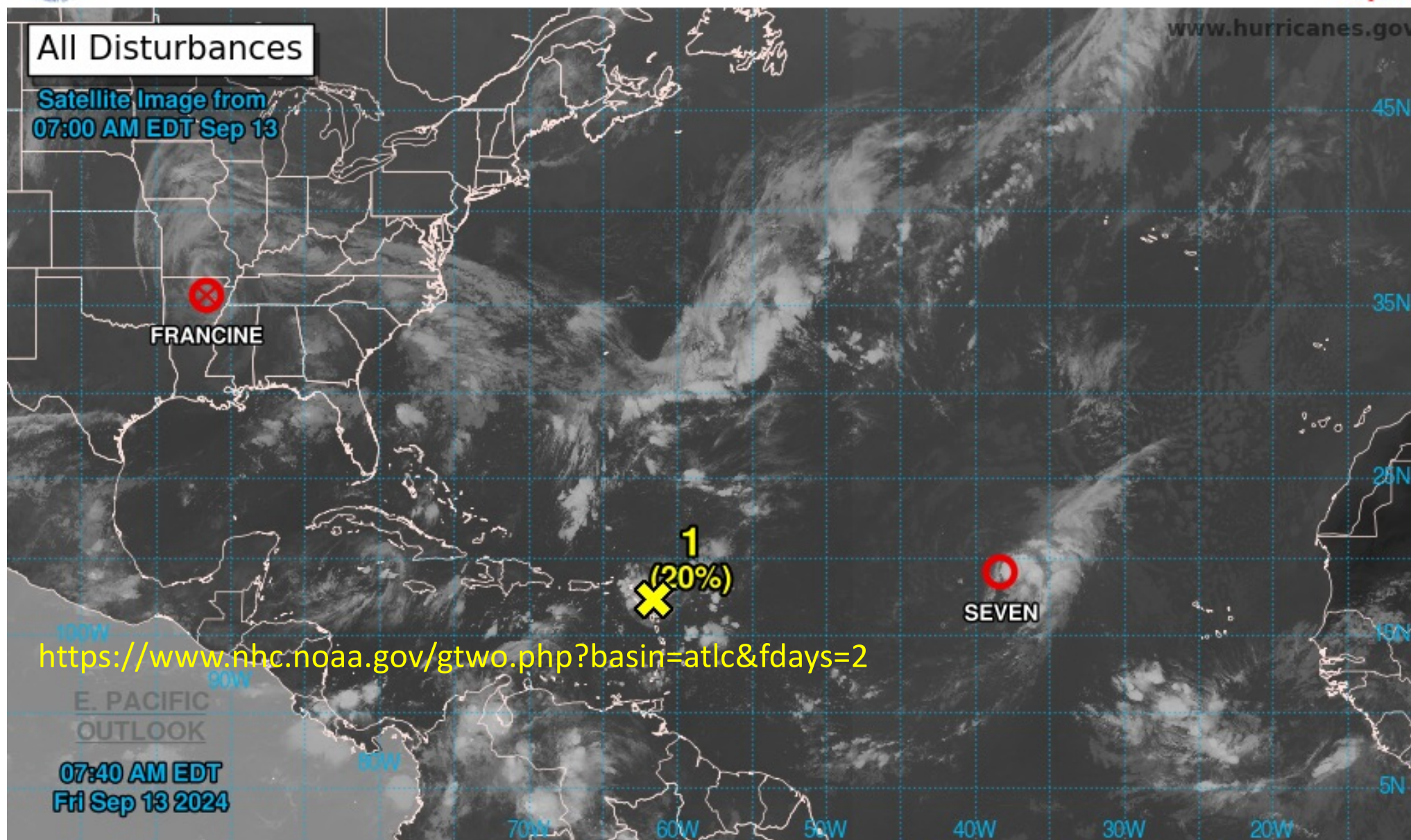
Hurricane Beryl, the first hurricane of the 2024 Atlantic hurricane season, rapidly strengthened to a Category 5 storm unusually early in the year. This explosive strengthening was fueled in part by **exceptionally warm** ocean temperatures. That heat was **one of the factors** behind **NOAA's prediction** in May of an 85% chance that the 2024 Atlantic hurricane season would be above normal.

[https://www.climate.gov/news-features/event-tracker/
category-5-hurricane-beryl-makes-explosive-start-2024-atlantic-season](https://www.climate.gov/news-features/event-tracker/category-5-hurricane-beryl-makes-explosive-start-2024-atlantic-season)



Two-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



Current Disturbances and Two-Day Cyclone Formation Chance: < 40% 40-60% > 60%

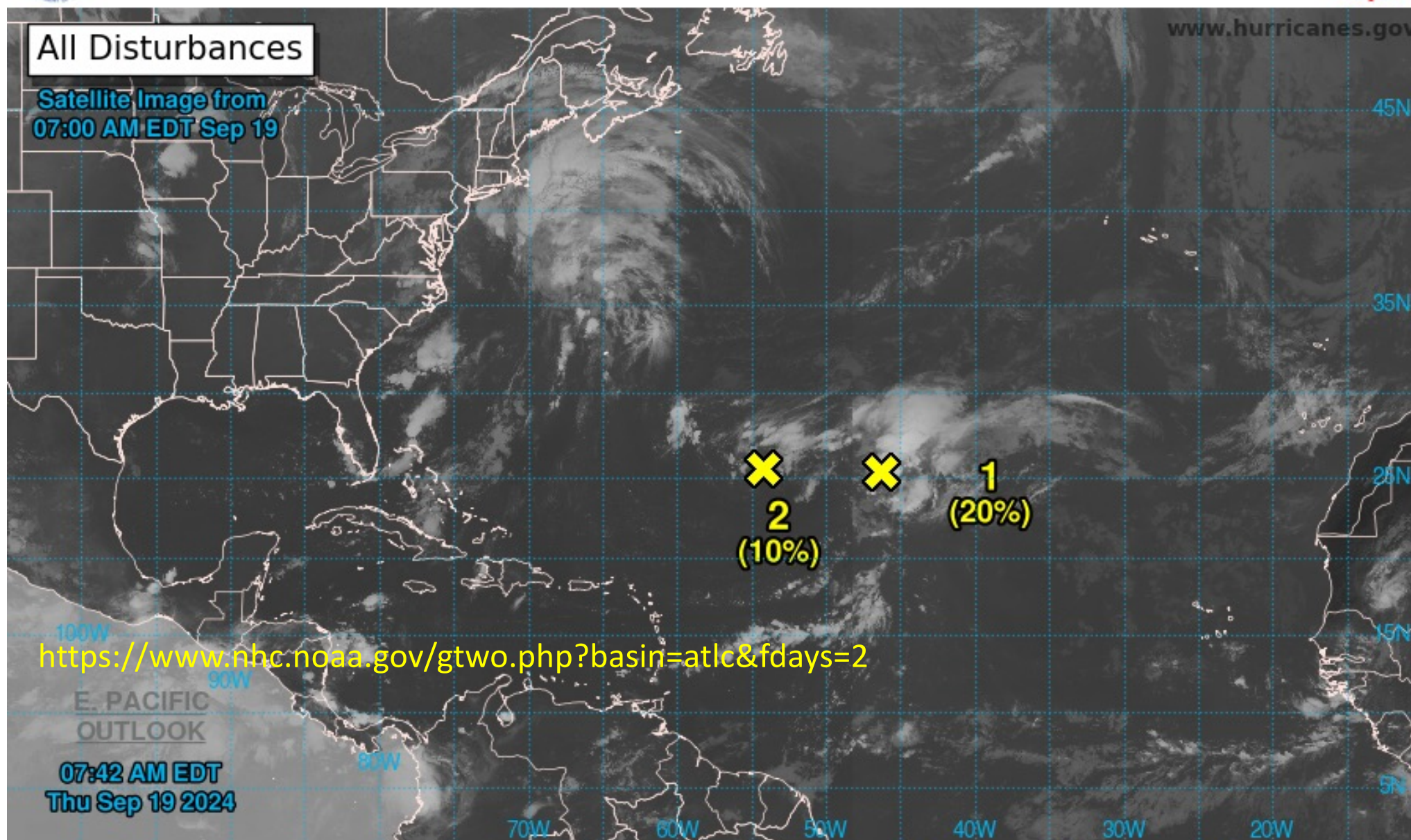
Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane

Post-Tropical Cyclone or Remnants



Two-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida

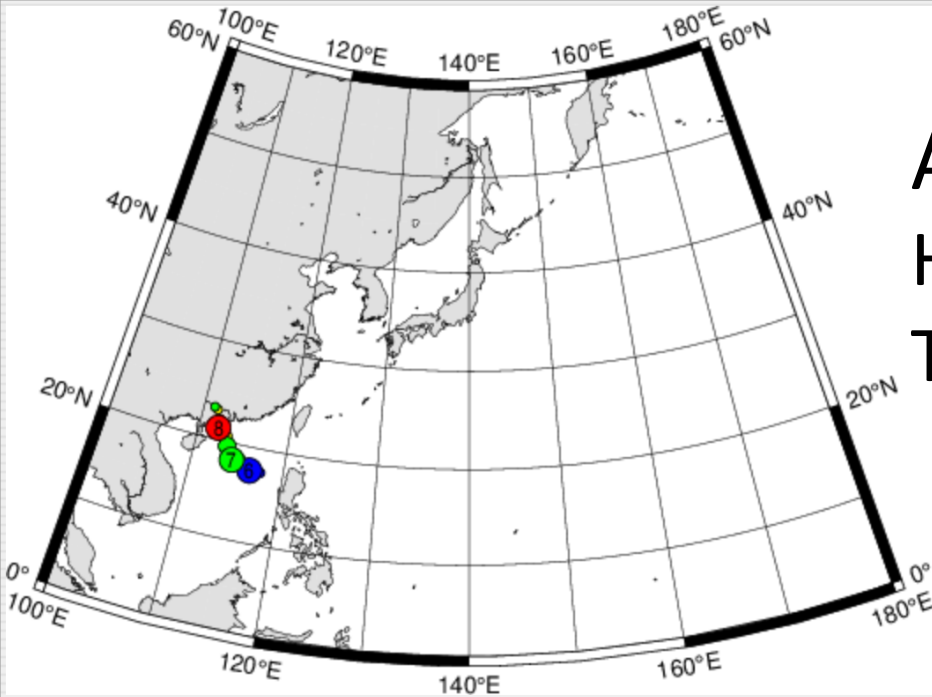


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Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane

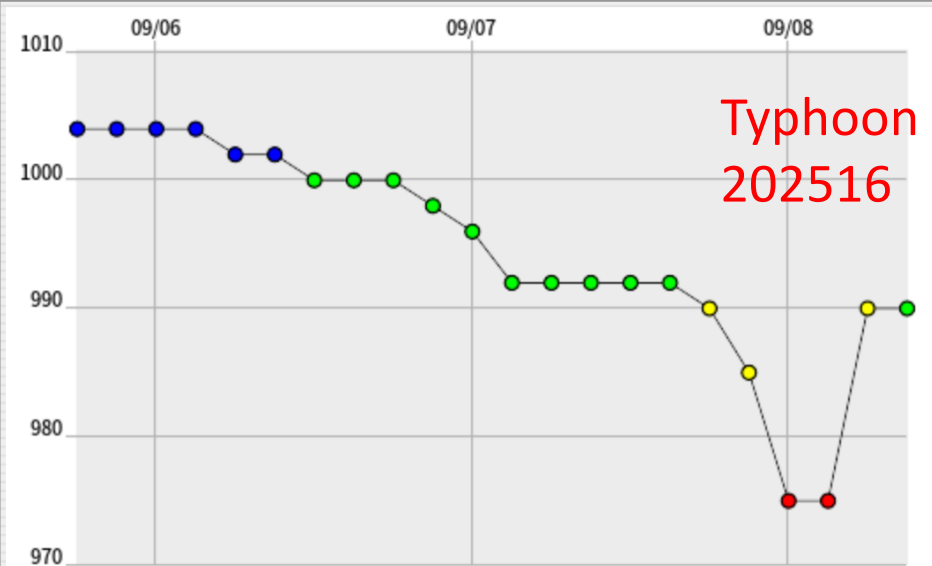
Post-Tropical Cyclone or Remnants

Best Track Map



Asia:
Hurricane =
Typhoon

Central Pressure Chart (Time Zone = UTC)



Typhoon TAPAH
202516

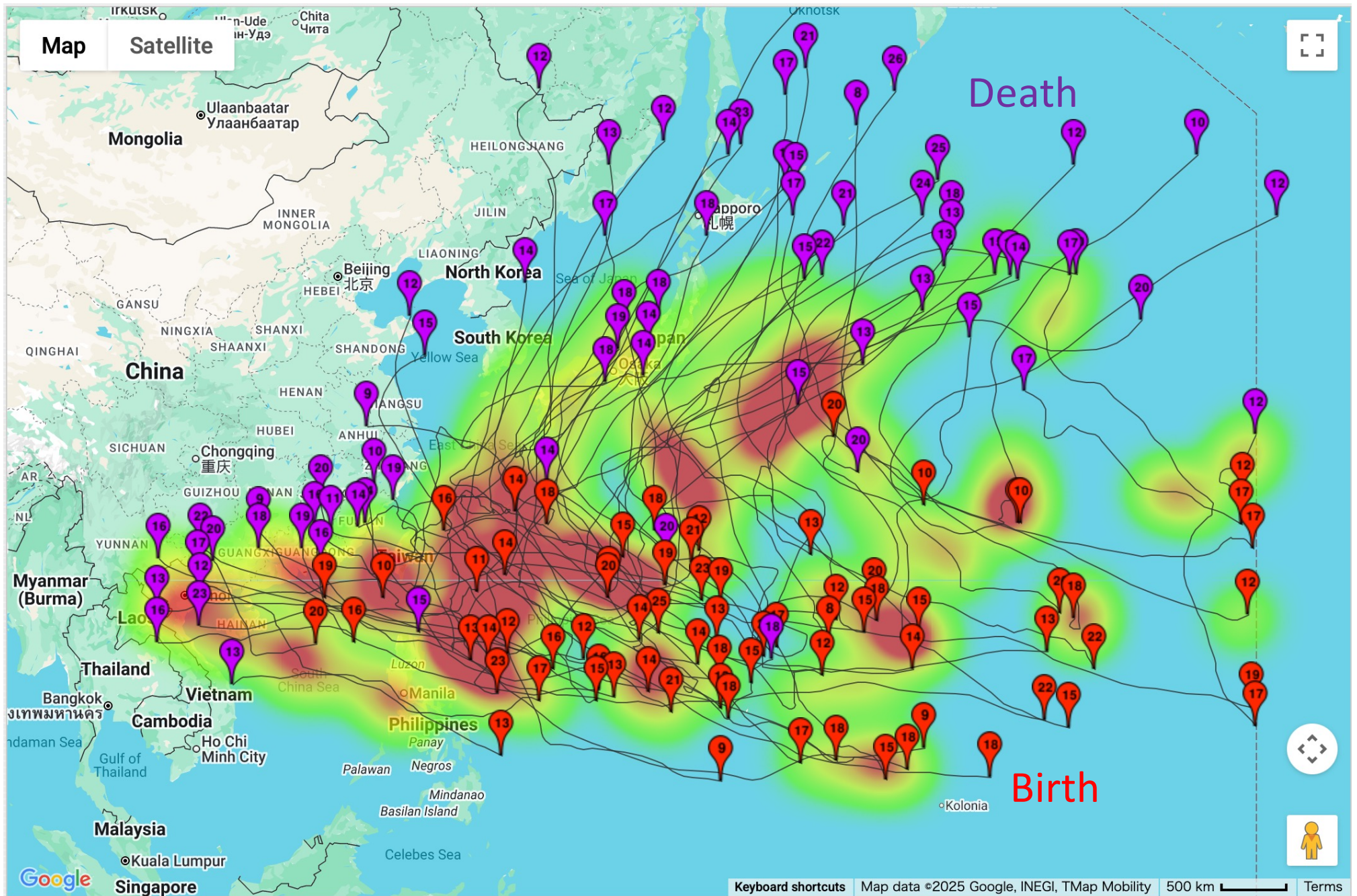
Daily Satellite Images

Basic Information

Birth	2025-09-06 12:00:00 UTC
Death (Latest)	2025-09-08 09:00:00 UTC
Lifetime	45 (hours) / 1.875 (days)
Lifetime [JMA]	45 (hours) / 1.875 (days)
Minimum Pressure	975 (hPa)
Maximum Wind	65 (knots)
Largest Radius of Storm Wind	60 (nm) / 110 (km)
Largest Diameter of Storm Wind	120 (nm) / 220 (km)
Largest Radius of Gale Wind	240 (nm) / 440 (km)
Largest Diameter of Gale Wind	360 (nm) / 670 (km)
Length of Movement	768 (km)
Average Speed	17.1 (km/h) 409 (km/d)
Range of Movement	Latitude 4.9 : Longitude 3.7

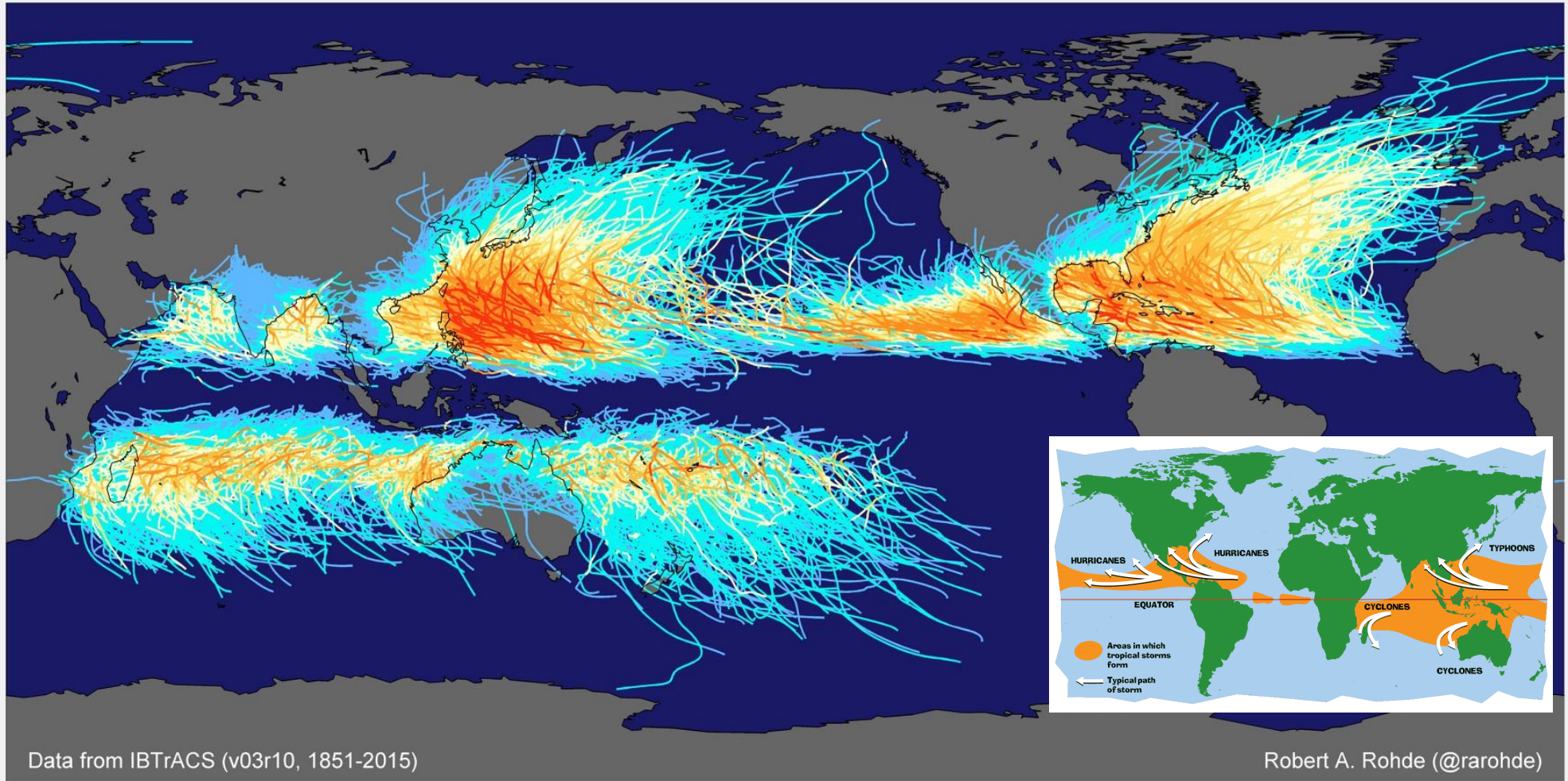
	Number	Name	Basin	Birth (UTC)	Death (UTC)	Duration	Min. Pres.
1	202501	WUTIP	W. N. Pacific	2025-06-11 00:00	2025-06-14 18:00	3 Days 18 Hours	980
2	202502	SEPAT	W. N. Pacific	2025-06-23 00:00	2025-06-24 18:00	1 Days 18 Hours	1004
3	202503	MUN	W. N. Pacific	2025-07-02 18:00	2025-07-08 00:00	5 Days 6 Hours	990
4	202504	DANAS	W. N. Pacific	2025-07-04 18:00	2025-07-09 00:00	4 Days 6 Hours	970
5	202505	NARI	W. N. Pacific	2025-07-12 18:00	2025-07-15 00:00	2 Days 6 Hours	985
6	202506	WIPHA	W. N. Pacific	2025-07-17 18:00	2025-07-22 18:00	5 Days 0 Hours	970
7	202507	FRANCISCO	W. N. Pacific	2025-07-23 00:00	2025-07-25 06:00	2 Days 6 Hours	990
8	202508	CO-MAY	W. N. Pacific	2025-07-23 12:00	2025-07-31 00:00	6 Days 0 Hours	975
9	202509	KROSA	W. N. Pacific	2025-07-24 03:00	2025-08-04 06:00	11 Days 3 Hours	965
10	202510	BAILU	W. N. Pacific	2025-08-03 00:00	2025-08-06 00:00	3 Days 0 Hours	994
11	202511	PODUL	W. N. Pacific	2025-08-07 18:00	2025-08-14 06:00	6 Days 12 Hours	960
12	202512	LINGLING	W. N. Pacific	2025-08-21 00:00	2025-08-22 00:00	1 Days 0 Hours	1000
13	202513	KAJIKI	W. N. Pacific	2025-08-23 00:00	2025-08-26 06:00	3 Days 6 Hours	950
14	202514	NONGFA	W. N. Pacific	2025-08-30 00:00	2025-08-30 18:00	0 Days 18 Hours	996
15	202515	PEIPAH	W. N. Pacific	2025-09-03 18:00	2025-09-05 12:00	1 Days 18 Hours	992
16	202516	TAPAH	W. N. Pacific	2025-09-06 12:00	2025-09-08 09:00	1 Days 21 Hours	975

Daily Tracking Charts for September 9 1954-2022



<https://agora.ex.nii.ac.jp/digital-typhoon/reference/daily/0909.html.en>

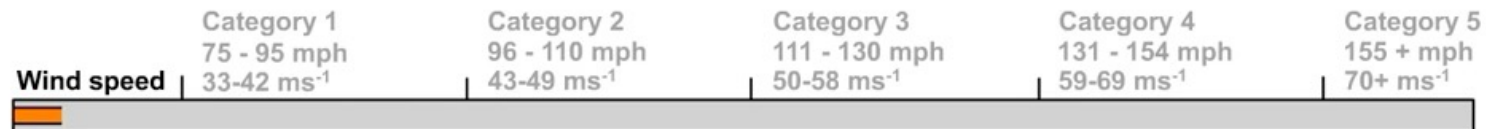
Tracks and Intensity of All Tropical Cyclones



Saffir-Simpson Storm Category

Storm Categories from 1 to 5

Hurricane Intensity Scale (Wind Damage)



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https://www.nhc.noaa.gov/video/SSHWS_animaton.mp4

International Category	Category (Saffir-Simpson Scale)	Maximum Sustained Wind (1-min Mean)		
		knots (kt)	meters per second (m/s)	kilometers per hour (km/h)
Typhoon / Hurricane	1	64 - 82	33 - 42	119 - 153
Typhoon / Hurricane	2	83 - 95	43 - 48	154 - 177
Typhoon / Hurricane	3	96 - 113	49 - 58	178 - 209
Typhoon / Hurricane	4	114 - 135	59 - 69	210 - 249
Typhoon / Hurricane	5	135-	70-	249-

<http://agora.ex.nii.ac.jp/digital-typhoon/help/unit.html.en#intensity>

Intensity Class	Maximum Sustained Wind (10-min Mean)			International Category	Class
	knots (kt)	meters per second (m/s)	kilometers per hour (km/h)		
Low Pressure Area	central position cannot be accurately identified			Low Pressure Area	-
Tropical Depression	- 33	- 17	- 62	Tropical Depression (TD)	2
Typhoon	34 - 47	18 - 24	63 - 88	Tropical Storm (TS)	3
	48 - 63	25 - 32	89 - 118	Severe Tropical Storm (STS)	4
Strong Typhoon	64 - 84	33 - 43	119 - 156	Typhoon (TY) or Hurricane	5
Very Strong Typhoon	85 - 104	44 - 53	157 - 192		
Violent Typhoon	105 -	54 -	193 -		

<http://agora.ex.nii.ac.jp/digital-typhoon/help/unit.html.en#intensity>