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NWS Guam Assessment on Typhoon Mawar: Timing, Characteristics & Impacts to Guam, 24-25 May 2023

- **Mawar clips northern Guam as a Cat-4 Typhoon with maximum sustained winds of 130-140 mph**
- **The southern periphery of Mawar's eye did make passage over northernmost AAFB and Ritidian Wildlife Refuge**
- **Damage and Impacts ranged from high-end Cat-4 (super typhoon-equivalent) in northern Guam; to Cat-2 to Cat-3 in central Guam; to tropical storm to Cat-1 in southern Guam**
- **Mawar's slow passage allowed 1.5-2 feet of rain to fall over much of Guam**

The center of Typhoon (TY) Mawar passed through the Rota Channel, with the southern portion of the calm eye briefly passing over the northern tip of Guam (AAFB-Ritidian) Wednesday, 24 May evening/late night through early Thursday morning, 25 May. **Closest Point of Approach (CPA) to Guam was roughly 5-8 PM Wednesday, 24 May.**

During Mawar's slow approach to Guam, Mawar weakened from a strong Cat-4 'super typhoon' (155 mph) Tuesday evening and early Wednesday morning, to a 140 mph Cat-4 'typhoon' by mid-Wednesday morning, 24 May. A Joint Typhoon Warning Center (JTWC) post-storm reassessment lowered the overall intensity, slightly, to a 130 mph Cat-4 typhoon around the time of CPA. As Mawar pulled away from Guam early Thursday, 25 May, Mawar began rapidly intensifying. Within 24 hours after its Guam passage, Mawar was a Cat-5 super typhoon with maximum sustained winds of 185 mph. Based on debris patterns (especially tree falls); a significant amount of damage was caused by west to southwest winds as an intensifying Mawar slowly departed the area.

Impacts: Damage and impacts from TY Mawar varied significantly from northern Guam to southern Guam. Villages in the north, closest to the center of Mawar, and thus its most intense winds, saw the most widespread and significant damage. Maximum sustained winds decreased farther to the south, thus villages of central and southern Guam experienced lesser conditions–still typhoon-force–but less damage overall.

Northwestern areas of Guam–portions of Dededo and Yigo–exhibited extensive damage with many wood and tin buildings and dwellings (those without reinforced concrete) showing

devastating levels of damage. Overall damage across northern Guam is consistent with Cat-4 winds. Damage in the far northwest suggests the presence of winds in the high Cat-4 (super typhoon-equivalent) range. By comparison, the eye of Mawar in northern Guam lasted around 20 minutes at AAFB, while the eye of Pongsona (2002) lasted 2 hours 30 minutes at AAFB. This assessment had to consider maximum sustained winds at the ocean surface, as forecast and reanalyzed by the JTWC, but also the representative over-land winds (ROL), which were experienced across the higher elevations of NW Guam.

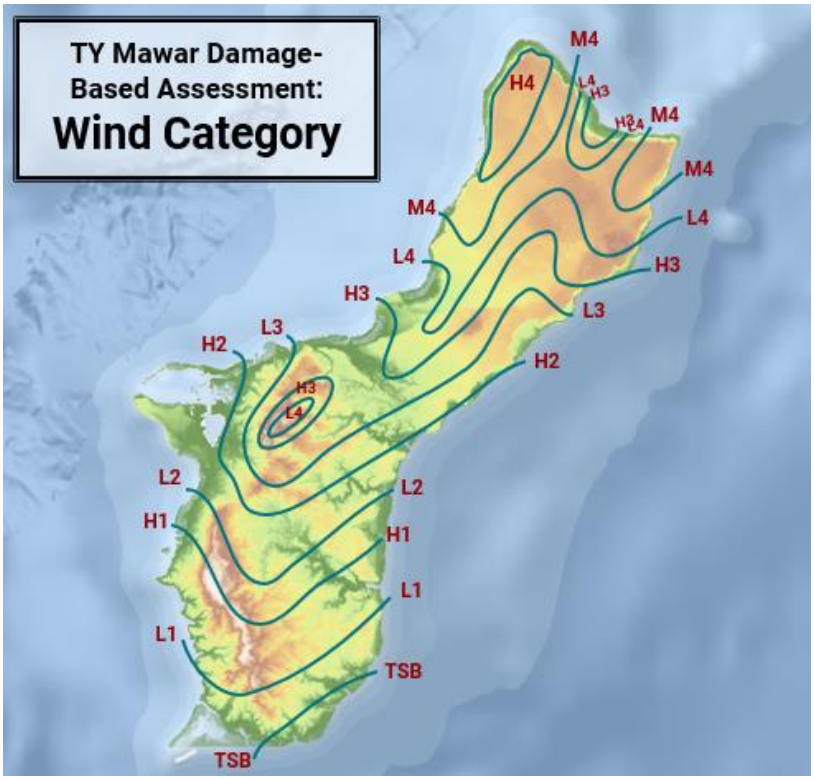
Background Info on Ground-Based Assessments:

A NWS Guam survey team traversed the island in the 2 weeks following Mawar to observe and categorize the general characteristics of Mawar's impacts on Guam based on the damage and impacts to vegetation, structures and infrastructure. This assessment sought to identify the first (approaching) and second (during/departing) wind, storm surge and significant rainfall. The determination of the wind over Guam was a challenge, since most wind sensors failed, and because Guam has a complex terrain that modifies the actual flow, as it would be, were the island's geography somewhat smoother. Additionally, wind sensor data may appear not to be physically sound and may ultimately be found to be erroneous. Thus, the damage characteristics to vegetation, structures and infrastructure are important inputs in determining the overall wind distribution across Guam. The direction of movement toward the island, which is oriented northeast—southwest, also played an important role in the overall wind damage distribution.

We are able to categorize storm damage as Typhoon (TY) Cat-1, the lowest category, up through TY Cat-5, the strongest. Historically, we have calculated typhoon sustained winds and gusts as Over Water Equivalent (OWE) wind, largely ignoring the effects of the island on the wind speed. The OWE wind more closely matches the JTWC intensity as it adjusts island winds to sea level. For Mawar, we were able to make another calculation called the Representative Over Land (ROL) wind, which is larger than the OWE. The ROL considers the island elevation, island terrain, and the level of damage to vegetation, structures and infrastructure. This assessment suggests that the extreme northwest part of Guam experienced some super typhoon-force sustained winds of 150 miles per hour as Mawar was intensifying and moving away from Guam.

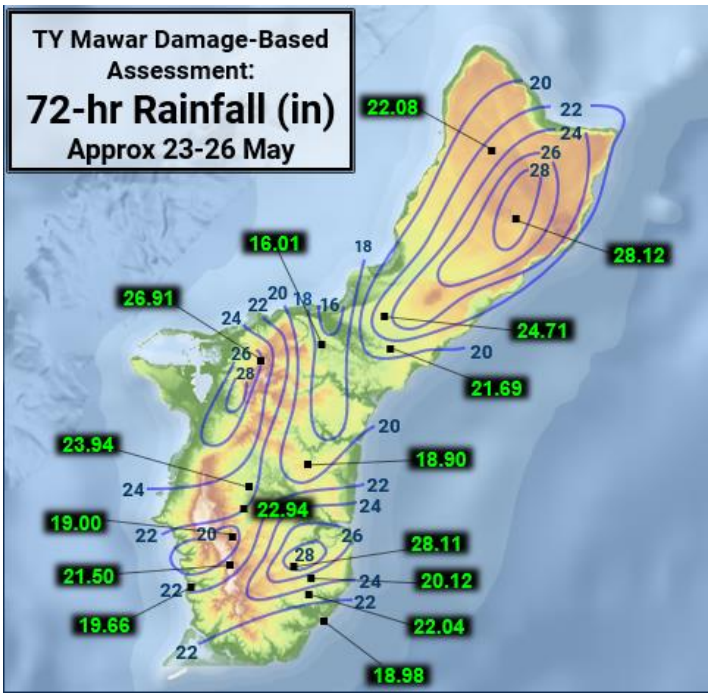
The Post Storm Report for Mawar can be found on the NWS Guam web page at https://www.weather.gov/gum/TropicalEventSummary. This report includes additional observational data (max winds and gusts, rainfall, and lowest pressures) across Guam and the CNMI, including island-specific impact narratives for all islands that were under a tropical cyclone watch or warning.

Tropical Cyclone Categories *Based on 1-minute average ***over open waters*** Maximum Sustained Winds (MSW) and 1-3 second Peak Gusts			
Tropical Storm Categories			
Tropical Storm "A"	**Weak Tropical Storm**	**MSW: 30-49 mph**	**Gusts: 40-64 mph**
Tropical Storm "B"	**Severe Tropical Storm**	**MSW: 50-73 mph**	**Gusts: 65-94 mph**
Typhoon Categories			
Typhoon Category 1	**Minimal Typhoon**	**MSW: 74-95 mph**	**Gusts: 95-120 mph**
Typhoon Category 2	**Moderate Typhoon**	**MSW: 96-110 mph**	**Gusts: 121-139 mph**
Typhoon Category 3	**Strong Typhoon**	**MSW: 111-129 mph**	**Gusts: 140-164 mph**
Typhoon Category 4	**Very Strong Typhoon**	**MSW: 130-156 mph**	**Gusts: 165-198 mph**
Typhoon Category 5	**Devastating Typhoon**	**MSW: 157+ mph**	**Gusts: 199-246 mph**
Super Typhoon: MSW: 150+ mph; Includes high-end Cat-4 and all Cat-5 typhoons **Damaging Winds:** MSW: 39 mph; Used for Tropical Storm/Typhoon Watch/Warning Issuance			

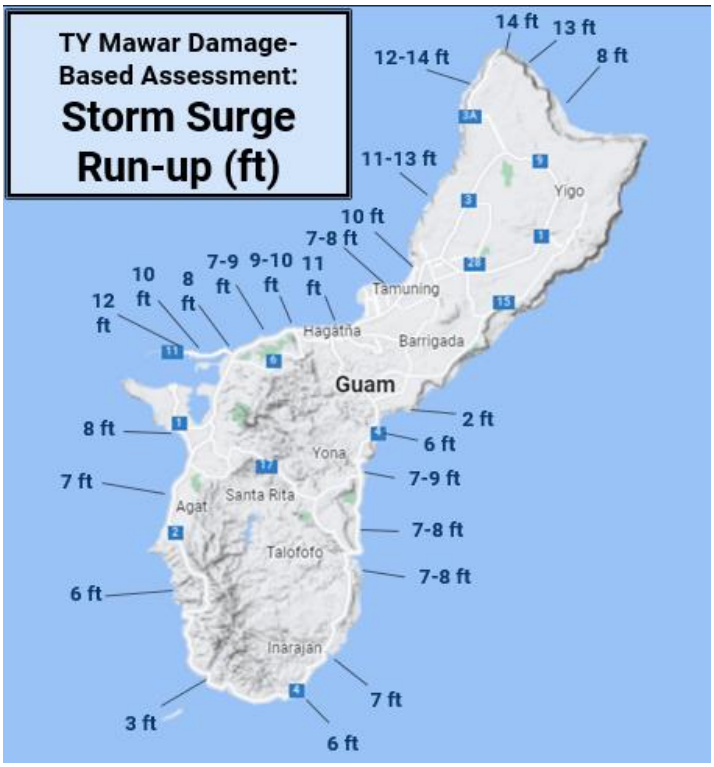


Wind Impacts: Typhoon intensities are based on 1-minute average winds over open waters. Land surfaces and topography greatly affect wind speeds and directions, resulting in frictional reduction of winds, but also localized increases in wind as winds funnel between and over topographical features. The wind categorization on this map seeks to represent the over land winds and gusts, as evidenced by the observed damage, and may not necessarily reflect the indicated 1-min average, open waters, intensity of TY Mawar. Additionally, smaller-scale features within tropical cyclone eyewalls can often lead to very localized areas of stronger winds, as may have been the case for NW Guam as Mawar began intensifying while moving away.

Rainfall: TY Mawar's slow passage around the north tip of Guam kept the torrential rains of the southern eyewall over much of Guam for a prolonged amount of time, resulting in much of the island receiving 1.5 to 2 feet of rain within a 72 hr (3-day) period. The bulk of rain fell within a 24 hr period from Wednesday morning, 24 May, through Thursday morning, 25 May. Rain observations are collected from various observational programs, including NWS, United States Geological Survey (USGS) and private collection sites.



Storm Surge, Wave Run-Up, and Coastal Inundation: A number of coastal areas were assessed to identify the vertical extent of salt-water run-up. These high water marks (HWMs) were the result of storm surge (rise in sea levels) and wind/wave stress as water pushed onto the coastal reefs and inundated low-lying coastal areas. The highest HWMs were found along the NW Guam coastline where HWMs reached as high as 12-14 feet. As noted earlier, a key contributor to these HWMs was the piling up of water on the reefs due to large ocean waves and winds forcing the water onto shore. The National Park Service also collected measurements and is post-processing their data before releasing it.



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