

## = Meteorological history of Hurricane Dennis =

The meteorological history of Hurricane Dennis spanned twenty @-@ two days , beginning with its inception as a tropical wave over Africa on June 26 , 2005 , and terminating with its dissipation on July 18 over the Great Lakes of North America . The incipient wave that became Dennis emerged over the Atlantic Ocean on June 29 and moved briskly to the west . Dry air initially inhibited development , though once this abated the wave was able to consolidate into a tropical depression on July 4 . The depression soon crossed Grenada before entering the Caribbean Sea whereupon increasingly favorable environmental factors , such as low wind shear and high sea surface temperatures , fueled intensification . Turning west @-@ northwest , the system achieved tropical storm status on July 5 and hurricane status the following day .

Formation of a well @-@ defined eye and central dense overcast signaled Dennis 's intensification into a major hurricane . The powerful storm soon struck Granma Province , Cuba , as a Category 4 early on July 8 ; violent winds battered the province and caused extensive damage . Paralleling the western coast of Cuba , Dennis attained its peak winds of 150 mph ( 240 km / h ) later that day before making a second landfall in the country , this time in Matanzas Province . Interaction with the mountains of Cuba caused significant weakening ; however , once Dennis emerged over the Gulf of Mexico on July 9 , it was able to quickly reorganize . The hurricane reached Category 4 strength for a third time on July 10 as it approached Florida , weakening somewhat before striking the state . Dramatic weakening ensued once the cyclone moved ashore . Dennis lingered as a tropical depression and remnant low for roughly a week , traversing the Mississippi River Valley and Ohio River Valley before finally dissipating over Ontario on July 18 .

## = = Origins = =

On June 26 , 2005 , the National Hurricane Center ( NHC ) began monitoring a tropical wave well @-@ inland over Africa . The feature was tracked via radiosonde observations from various nations for two days before being analyzed as a surface feature on June 28 over western Senegal . Accompanied by scattered convection ? shower and thunderstorm activity ? the westward moving system featured some cyclonic flow ; it emerged over the Atlantic Ocean early on June 29 . Conflicting observations from Dakar , Senegal , made tracking the wave difficult , with surface observations revealing a clear shift in wind direction and upper @-@ level soundings showing no change . Regardless of the exact position of the system , accompanying convection soon diminished and the system became ill @-@ defined . By June 30 , the system grew significantly and multiple low @-@ level circulations developed within the broader cyclonic envelope . Weather models at the time depicted a low probability of tropical cyclogenesis in the subsequent days . Gradual development ensued over the following days , though the broad circulation initially remained largely devoid of convection due to dry air associated with the Saharan Air Layer .

Two distinct low @-@ level centers became apparent on July 2 as the overall system progressed west . Surface observations from the Windward Islands and Guyana depicted a broad circulation ; however , satellite animations failed to show a defined center , inhibiting its classification as a tropical cyclone . The westernmost of the two centers moved across the Windward Islands early on July 4 and lost organization soon thereafter . Banding features developed with the eastern circulation throughout the day , consolidating around a 1012 mbar ( hPa ; 29 @.@ 89 inHg ) low . Later on July 4 , upper @-@ level outflow ? an anticyclonic feature that provides thermal ventilation for tropical cyclones and allows for further development ? became increasingly prominent . With continued organization , the NHC classified the system as Tropical Depression Four at 18 : 00 UTC at which time it was situated 65 mi ( 105 km ) east of St. George 's , Grenada .

## = = Intensification and Cuban landfalls = =

Embedded within deep east @-@ southeasterly flow and along the periphery of a subtropical ridge , the depression moved rapidly along a west @-@ northwest course ; it soon made landfall over

Grenada at 21 : 00 UTC on July 4 with maximum sustained winds of 35 mph ( 55 km / h ) . Upon entering the Caribbean Sea , deep convection flared over the system . Environmental conditions ahead of the depression favored intensification into a hurricane , with little to no wind shear ? analyzed to be roughly 25 mph ( 35 km / h ) below average ? and high sea surface temperatures around 84 ° F ( 29 ° C ) present along its path . Based on satellite intensity estimates obtained through the Dvorak technique , the depression is assessed to have become a tropical storm by 12 : 00 UTC on July 5 . Accordingly , the NHC assigned it the name Dennis at this time . This marked the earliest formation of a season 's fourth named storm on record ; however , this was later surpassed by Tropical Storm Debby of 2012 which was named on June 23 .

Throughout July 6 , convection steadily consolidated as the system acquired a more northerly component to its track . Hurricane Hunters investigating Dennis found steadily falling barometric pressures , indicative of intensification . Around 22 : 00 UTC , observation from the aircraft indicated that Dennis achieved hurricane @-@ strength ; a central pressure of 985 mbar ( hPa ; 29 @.@ 09 inHg ) and flight @-@ level winds of 91 mph ( 146 km / h ) were measured . A central dense overcast soon blossomed over the hurricane 's center while microwave satellite imagery depicted a closed , well @-@ defined mid @-@ level eye . At this point , the only factor inhibiting development was interaction with the mountains of Hispaniola and Jamaica . Dennis developed unusually prominent outflow , especially along its western side , for its location and time of year due in part to an unseasonably weak trough over the mid @-@ Atlantic .

Rapid intensification ensued throughout July 7 , as Dennis turned more northwest and tracked through the Jamaica Channel . A well @-@ defined , 10 mi ( 16 km ) eye formed within the hurricane 's central dense overcast that evening . Dennis achieved major hurricane status by 18 : 00 UTC and Category 4 status by 00 : 00 UTC on July 8 as it approached southern Cuba . An abbreviated eyewall replacement cycle likely took place during this period as the eye expanded to 18 to 23 mi ( 29 to 37 km ) in diameter . Reconnaissance flying in the storm reported flight @-@ level winds of 154 mph ( 248 km / h ) , and based on this Dennis is estimated to have reached its initial peak with surface winds of 140 mph ( 225 km / h ) . Around 02 : 45 UTC , Dennis briefly moved over Granma Province , Cuba , with its center crossing the coast near Punta del Inglés ( close to Cabo Cruz ) . Violent and destructive winds battered the province . A weather station in Cabo Cruz reported sustained winds of 133 mph ( 214 km / h ) and a gust to 148 mph ( 238 km / h ) before being destroyed .

Interaction with land caused slight weakening ; however , Dennis soon emerged over the Gulf of Guacanayabo and the region 's shallow , warm waters fueled an abrupt reorganization . The hurricane traveled along the western spine of the Jardines de la Reina archipelago , subjecting the islands to Category 3 and 4 strength winds . Paralleling the coast of Cuba , Dennis attained its peak winds of 150 mph ( 240 km / h ) around 12 : 00 UTC on July 8 . Hurricane Hunters observed flight @-@ level winds of 173 mph ( 278 km / h ) and a pressure of 938 mbar ( hPa ; 27 @.@ 70 inHg ) around this time . The former value indicated surface winds around Category 5 strength while the latter yielded slightly lower winds , via a pressure @-@ wind relationship method . The aforementioned peak strength was chosen accordingly as a compromise between the conflicting data . Another eyewall replacement cycle took place soon after this peak and slight weakening ensued . Around 18 : 45 UTC , Dennis made its second landfall in Cuba near Punta Mangles Altos in Matanzas Province with winds of 140 mph ( 225 km / h ) ; a gust of 149 mph ( 240 km / h ) was reported in Cienfuegos . Despite moving over land , weakening was initially slow due to the hurricane 's proximity to water . Nearly six hours after moving ashore , Unión de Reyes was subjected to sustained winds of 110 mph ( 180 km / h ) and gusts up to 123 mph ( 198 km / h ) .

= = Gulf of Mexico and dissipation = =

Maintaining its northwesterly course , Dennis emerged over the Gulf of Mexico just north of Havana around 05 : 00 UTC on July 9 . Prolonged interaction with the mountains of Cuba severely disrupted the hurricane 's core , though it managed to retain a ragged 14 mi ( 23 km ) wide eye . By the time Dennis emerged over water , its maximum winds fell to 85 mph ( 140 km / h ) and its pressure rose

to 973 mbar ( hPa ; 28 @. @ 74 inHg ) . Situated along the western periphery of a ridge , a gradual turn to the north @- @ northwest ensued . A cool eddy temporarily halted notable reorganization ; however , once Dennis cleared this eddy it was able to strengthen . Starting at 18 : 00 UTC , the hurricane underwent rapid intensification " at a rate that bordered on insane " , as described by forecaster Jack Beven . In the subsequent 18 hours , its central pressure fell by 32 mbar ( hPa ; 0 @. @ 95 inHg ) , including a drop of 11 mbar ( hPa ; 0 @. @ 32 inHg ) in 1 hour and 35 minutes . Hot towers extending to 10 mi ( 16 km ) were observed during the strengthening . The intensification culminated with Dennis attaining winds of 145 mph ( 230 km / h ) at 06 : 00 UTC on July 10 and reaching its lowest pressure of 930 mbar ( hPa ; 27 @. @ 47 inHg ) at 12 : 00 UTC . This ranked Dennis as the strongest pre @- @ August hurricane in the Atlantic basin ; however , this was eclipsed just six days later by Hurricane Emily which was the first July Category 5 on record . At this time , the hurricane was situated roughly 180 mi ( 290 km ) southwest of Tallahassee , Florida . Although Dennis featured a large circulation with tropical storm @- @ force winds extending up to 230 mi ( 370 km ) from its center , its core was compact and hurricane @- @ force winds only stretched 40 mi ( 65 km ) outward .

During the latter part of July 10 , Dennis traversed an area with lower ocean heat content . Coupled with entrainment of mid- to upper @- @ level dry air , notable weakening took place as the hurricane approached the Florida Panhandle . Around 19 : 30 UTC , Dennis made its third and last landfall as a major hurricane over Santa Rosa Island , between Navarre Beach and Gulf Breeze , with estimated winds of 120 mph ( 195 km / h ) and a pressure of 946 mbar ( hPa ; 27 @. @ 94 inHg ) . A Florida Coastal Management Program tower in Navarre observed sustained winds of 99 mph ( 159 km / h ) and a gust to 121 mph ( 195 km / h ) . Dramatic weakening ensued once the hurricane moved onshore , with winds falling below tropical storm @- @ force in just 12 hours . Upon weakening to a depression on July 11 , handling of operational advisories was transferred from the NHC to the Weather Prediction Center ( formerly the Hydrometeorological Prediction Center ) .

The lingering depression continued north @- @ northwest through the Mississippi River Valley and gradually slowed . Weakening steering currents caused Dennis to slow and turn northeast as it traversed the Ohio River Valley on July 12 ? 13 . Dennis 's circulation became elongated and the system degenerated into a non @- @ convective remnant low by 12 : 00 UTC on July 13 as it moved across Illinois . Thereafter , the cyclone executed a prolonged clockwise loop over the state before accelerating northeast on July 16 . During this period , a band of heavy precipitation set up over the southern Appalachian Mountains ; record rain fell across northern Georgia , with localized totals exceeding 10 in ( 250 mm ) . The remnants later crossed the Great Lakes before being absorbed into a larger extratropical cyclone over Ontario on July 18 .