

A Comparison of Hurricane Dorian (2019) and Hurricane Michael (2018)

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Introduction

Hurricane Michael was an intense hurricane that caused billions of dollars in damage to northwest Florida in October of 2018. Hurricane Dorian was an intense hurricane that caused billions of dollars in damage and an unknown number of deaths in the northwestern Bahamas in September of 2019. Both of the hurricanes underwent a period of rapid intensification and both of them strengthened to Category 5 on the Saffir-Simpson Scale. At certain points in their existence both Hurricanes Michael and Dorian were quite similar in intensity and size. Hurricane Dorian ultimately intensified into one of the strongest Atlantic hurricanes on record. This work used the components of an experimental Hurricane Wind Intensity Size Index (HWISI) to compare the two hurricanes.

Hurricane Michael (2018)

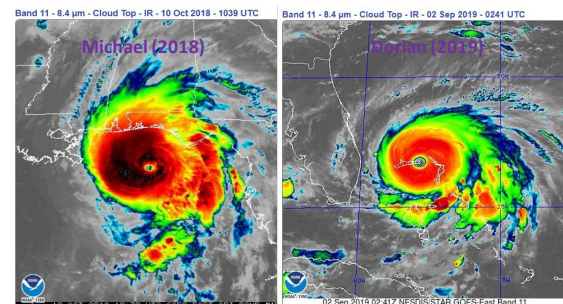
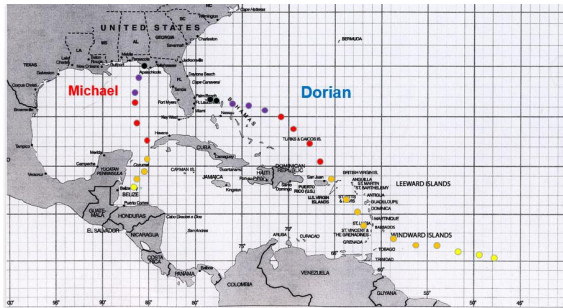
- October 6-10, 2018
- Landfall . Mexico Beach, Florida
- Maximum sustained wind speed . 160 m.p.h. (260 km/h)
- 16 deaths
- 25 billion dollars damage in U.S.
- Fourth Category 5 hurricane to hit U.S.

Source: John L. Beven II, Robbie Berg and Andrew Hagen; NHC Tropical Cyclone Report on Hurricane Michael (2018)

Hurricane Dorian (2019)

- August 28 . September 2, 2019
- Landfall . the Abacos, Grand Bahama Island
- Maximum sustained wind speed . 185 m.p.h. (300 km/h)
- Uncertain number of deaths . estimates 74-200+, 245 missing
- Catastrophic damage . 3.4 billion dollars
- One of most powerful Atlantic Hurricanes on Record

Source: Lixion A. Avila, Stacy R. Stewart, Robbie Berg, and Andrew B. Hagen; NHC Tropical Cyclone Report on Hurricane Dorian (2019)



HWISI

Designed to be a 100 point index

Two components

Hurricane Intensity Index (HII)

Hurricane Size Index (HSI)

Hurricane Intensity Index

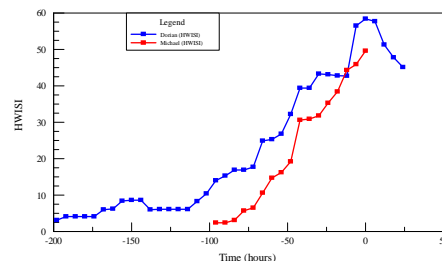
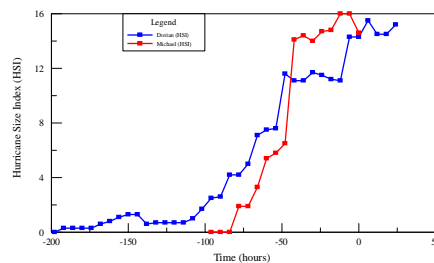
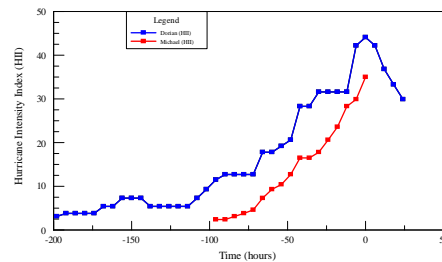
$$HII = 50 \cdot X \left(V_{\max} / 200 \text{ m.p.h.} \right)^{1.6}$$

Hurricane Size Index

Designed to equal 50 points when a hurricane is the size of Hurricane Sandy

Based on radii of 64 kt, 50 kt and 34 kt winds

$$HWISI = HII + HSI$$



Discussion

Hurricanes Michael (2018) and Dorian (2019) were very similar in strength and size while they intensified rapidly to Category 5 on the Saffir-Simpson Scale. The top graph shows the Hurricane Intensity Index for both hurricanes. Negative times are before landfall. The portion of the graph where plots for the two hurricanes are parallel indicates similar rates of rapid intensification. Hurricane Michael's rapid intensification ended at landfall on the coast of northwest Florida, while Hurricane Dorian intensified into one of the strongest Atlantic hurricanes on record.

The Hurricane Size Index for Michael and Dorian is shown in the middle graph. Once again, the portion of the plots where the curves are parallel indicated the period when the sizes of the two hurricanes increased at a similar rate. Hurricane Dorian ultimately grew to be larger than Michael. The increase in the size of Dorian was likely related to the development of concentric eyewalls. There were some indications that Hurricane Michael might have been about to develop concentric eyewalls near the time of landfall.

The bottom graph shows the Hurricane Wind Intensity Size Index for the two hurricanes. This index represents the sum of the two other indices and it provides a measure of the overall size and strengthen of a hurricane. The part of the graph where the two curves are parallel shows the period when the combined intensity and size of Hurricanes Michael and Dorian increased at a very similar rate. The two hurricanes were remarkably similar during much of their rapid intensification. Hurricane Dorian eventually grew to be bigger and stronger than Hurricane Michael.

Even though they occurred in different locations, months and years, both Hurricanes Michael and Dorian moved through similar environments. Both hurricanes moved over water where the Sea Surface Temperatures (SSTs) were warmer than normal. Michael and Dorian were in an environment where there was little vertical wind shear over the core of the hurricanes during the period of rapid intensification. Although Hurricane Michael rapidly intensified over the northern Gulf of Mexico in October, drier air did not penetrate to the core of its circulation prior to landfall. Hurricane Dorian was in a nearly perfect environment for rapid intensification, which allowed it to strengthen to one of the strongest hurricanes on record.

Summary

- " Hurricanes Michael (2018) and Dorian (2019) had very similar rates of rapid intensification.
- " Rapid intensification occurred in environments of warm SSTs, little vertical wind shear, and no dry air penetration of the core.
- " Both hurricanes exhibited similar intensity and size 12 hours prior to landfall.

Sources

John L. Beven II, Robbie Berg and Andrew Hagen; NHC Tropical Cyclone Report on Hurricane Michael 2018.

Lixion A. Avila, Stacy R. Stewart, Robbie Berg and Andrew B. Hagen; NHC Tropical Cyclone Report on Hurricane Dorian (2019).