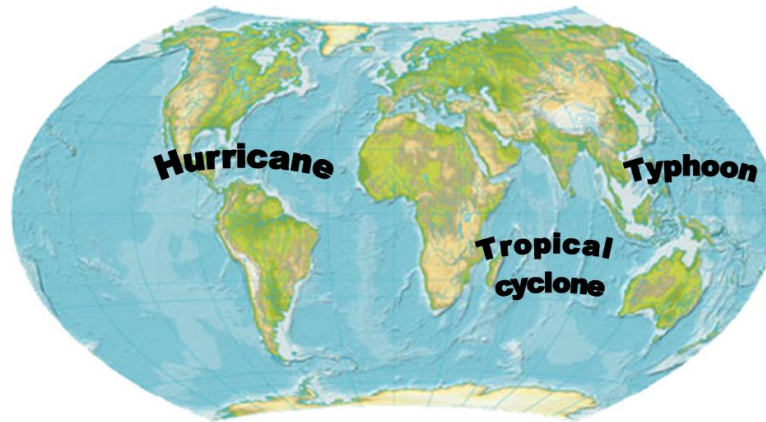


Typhoons, Hurricanes, and Cyclones



Hurricane Fiona (September 14 and still going) has recently passed through Puerto Rico and has become this year's first major cyclonic event in this year's Atlantic **hurricane** season. **Typhoon** Nanmadol (September 9 – September 19), Japan, was the largest cyclonic event in the Pacific region. There are **cyclones** as well.

1. Do some research to find the differences between typhoons, hurricanes, and cyclones?

All of these storms are measured and compared with their ACE score (Accumulated Cyclone Energy). The ACE score measures the storm's intensity and duration.

ACE uses an approximation of the wind energy used by tropical systems over each of their lifetimes. A wind velocity measurement is taken every 6 hours. The data of velocities that are greater than or equal to 35 knots are then squared, summed, and divided by 10,000 to reach a measure of the storm's intensity and duration.

This is the formula for finding the ACE score of each storm: $ACE = 10^{-4} \sum (v_{\max})^2$

Below are the every 6-hour measurements from Hurricane Fiona. We've left the first 6 calculations blank so that you can do a little math to get the feel of how the formula is used.

Date of Activity	Time of reading	Storm intensity in knots	Velocity squared	Velocity squared and divided by 10,000
9/21/22	6:00	115		
9/21/22	0:00	110		
9/20/22	18:00	100		
9/20/22	12:00	100		
9/20/22	6:00	100		
9/20/22	0:00	95		
9/19/22	18:00	85	7,225	0.7225
9/19/22	12:00	75	5,625	0.5625
9/19/22	6:00	80	6,400	0.64
9/19/22	0:00	75	5,625	0.5625
9/18/22	18:00	75	5,625	0.5625
9/18/22	12:00	60	3,600	0.36
9/18/22	6:00	55	3,025	0.3025
9/18/22	0:00	50	2,500	0.25
9/17/22	18:00	50	2,500	0.25
9/17/22	12:00	50	2,500	0.25
9/17/22	6:00	50	2,500	0.25
9/17/22	0:00	50	2,500	0.25
9/16/22	18:00	45	2,025	0.2025
9/16/22	12:00	45	2,025	0.2025
9/16/22	6:00	50	2,500	0.25
9/16/22	0:00	50	2,500	0.25

9/15/22	18:00	50	2,500	0.25
9/15/22	12:00	45	2,025	0.2025
9/15/22	6:00	45	2,025	0.2025
9/15/22	0:00	45	2,025	0.2025
9/14/22	18:00	30	900	0.09
9/14/22	12:00	30	900	0.09
		Sum of $V^2 =$	131,600	13.16

2. In the table above, fill in the calculations for velocity² and Velocity squared divided by 10,000 only for wind speeds **greater than or equal to 35 knots (40mph)**.

The sum of that last column = Fiona's ACE measurements so far = 13.16

- How many days of the storm's appearance were measured?
- How many of those days will be counted in the calculation of its ACE measurement?
- How many times per day was the data collected?
- How do you suppose this ACE calculation takes into account the duration of a storm?
- Why do you believe that the velocities are squared before being added together to reach an ACE measurement? What was accomplished by squaring these velocities?
- Why do you suppose the sum of the squared velocities was divided by 10,000?

Super Typhoon Nanmadol (Josie) battered western Japan between September 11th and September 20th this year.

Nanmadol (Josie)'s ACE score was 19.27

- According to their ACE scores, which was the more intense storm Fiona or Nanmadol (Josie)?
- From what you've calculated and observed about these two storms does the ACE measurement seem correctly identify which was a more severe storm? Please explain.

	Fiona	Nanmadol
Duration		6 days
Max velocity		130 knots
Number of days > 82 knots		4 days
Number of days > 95 knots		2.5 days
Number of days > 112 knots		1 3/4 day days

- What storm ramifications does the ACE measurement not account for?

Sources: <http://beachchairscientist.com/2017/06/01/hurricane-vs-cyclone-vs-typhoon/>
https://en.wikipedia.org/wiki/Accumulated_cyclone_energy
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