Stronger Atlantic hurricanes: Validating Elsner et al. (2008)

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Abstract

Using satellite derived wind speed estimates from tropical cyclones over the 25-year period between 1981 and 2006 our earlier research showed the strongest hurricanes getting stronger. They found 15% of all named storms across the North Atlantic had lifetime maximum wind speeds exceeding 48.9 m/s with an upward trend of .63 m/s/yr in this quantile wind speed. They related the increase in hurricane intensity to a rise in ocean temperatures consistent with theory. The oceans have continued to warm since that paper was published so we predict that the upward trend in the intensity of the strongest hurricanes has continued. Here we show that the 85th quantile lifetime maximum wind speed has increased by 5 m/s, which matches precisely an extrapolation of the trend from the earlier period. The analysis raises the question of why the earlier work was largely ignored (and discounted) when writing "state-of-the-knowledge" reports on hurricanes and climate change since its publication.

Forum

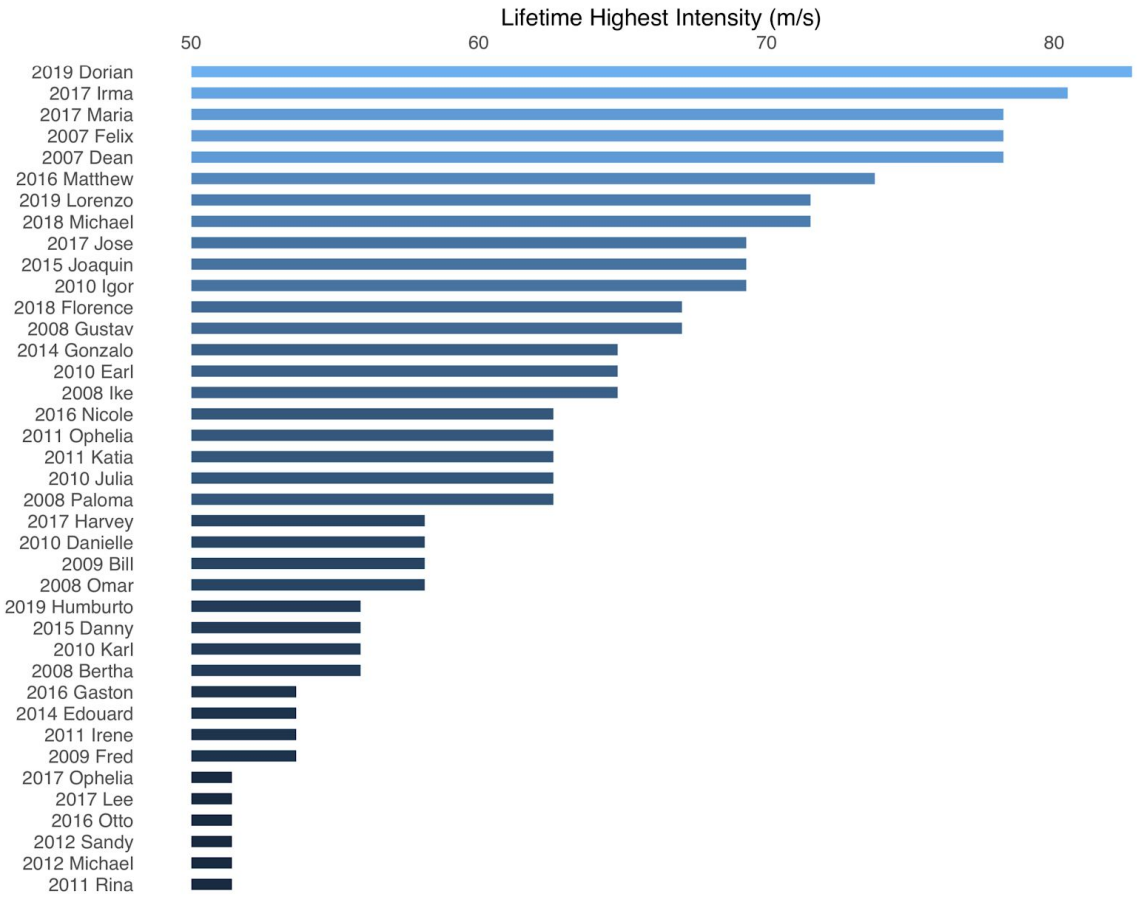
Science gets validated through predictions. Using satellite derived wind speed estimates from tropical cyclones over the 26-year period between 1981 and 2006, Elsner et al. (2008) showed that the strongest hurricanes were getting stronger. In particular, they found that 15% (85th quantile) of all named storms across the Atlantic had lifetime maximum wind speeds exceeding 48.9 m/s (Table 1 in Elsner et al. 2008) with an upward trend of .63 m/s/yr in this quantile wind speed.

They related this increase in hurricane intensity to a corresponding rise in ocean temperatures consistent with theory (Emanuel 1988). The oceans have continued to warm since that paper was published so we would predict that the upward trend in the intensity of the strongest hurricanes has continued.

To check this, consider all North Atlantic named storms (tropical storms and hurricanes) over the 13-year period 2007--2019 (Table below). We note that 20% of them had wind speeds exceeding 48.9 m/s. An increase of 5 percentage points over the earlier period examined in Elsner et al. (2008).

North Atlantic tropical cyclone and major hurricane counts over the period 2007--2019.

Year	Number of Tropical Cyclones	Number of Major Hurricanes	Major Hurricane Names
2007	15	2	Dean, Felix
2008	16	5	Bertha, Gustav, Ike, Omar, Paloma
2009	9	2	Bill, Fred
2010	19	5	Danielle, Earl, Igor, Julia, Karl
2011	19	4	Irene, Katia, Ophelia, Rina
2012	19	2	Michael, Sandy
2013	14	0	
2014	8	2	Edouard, Gonzalo
2015	11	2	Danny, Joaquin
2016	15	4	Gaston, Matthew, Nicole, Otto
2017	17	6	Harvey, Irma, Jose, Lee, Maria, Ophelia
2018	15	2	Florence, Michael
2019	18	3	Dorian, Humburto, Lorenzo



Lifetime highest intensity (m/s) for all major Atlantic hurricanes over the period 2007--2019.

During this 13-year period two of the hurricanes had lifetime maximum wind speeds of at least 80 m/s and eight of them had LMI of at least 70 m/s (Figure above).

We note that the 85th quantile wind speed has increased from 48.9 m/s during the earlier period to 53.5 m/s which is an increase of 5 m/s and which matches an extrapolation by taking the trend of .63 m/s/yr from Table 1 in Elsner et al. (2008) and multiplying it by seven (mid point number of years in a 13-year period) [48.9 + .63 x 7 = 53.3 m/s].

Further we note that 5% of the storms exceeded 60.3 m/s over the earlier period (Table 1, 95th quantile) but has increased to 10% over the later period. The 95th quantile wind speed has increased from 60.3 m/s to 68 m/s, which is somewhat stronger than the extrapolated trend [60.3 + .81 x 7 = 66 m/s].

It is hard to argue with this simple post publication analysis in light of the most recent hurricane seasons and the results raise the question of why Elsner et al. (2008) has been ignored or discounted

when writing "state-of-the-knowledge" reports on hurricanes and climate change (e.g., Knutson et al. 2019).

References

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