PREDICTION OF HURRICANE WIND SPEEDS IN THE UNITED STATES[a]

*** POOR QUALITY ***

Discussion by Emil Simiu[3]

The comparisons presented by the authors in Fig. 5 between the hurricane fastest-mile wind speeds near the coastline estimated in their paper and those estimated in Batts et al. (1980) contain a basic inconsistency. The inconsistency stems from the fact that fastest-mile speeds are estimated by multiplying hourly mean speeds by a factor that accounts for the wind gustiness, and that different types of factors were used to obtain the authors' estimates and those of Batts et al. (1980).

To compare their estimates of fastest-mile wind speeds with estimates based on the work of Georgiou (1985), the authors correctly adjusted Georgiou's estimates by multiplying his hourly mean estimates by the same factor accounting for wind gustiness that was used for their own estimates, that is, a factor based on the Krayer and Marshall (1992) gust factor curve. The comparison between the author's estimates and those based on Georgiou's results is therefore a valid one. On the other hand, instead of making sure—as they did for the Georgiou results—that the adjustment factors for the two sets of estimates being compared are based consistently on the same gust factor curve, the authors compared their estimates, based as they are on the Krayer-Marshall curve, with Batts et al. fastest-mile estimates based on the Durst gust factor curve.

The claim by the authors that the differences shown in Fig. 5 are due to their use of a newly developed wind-field model is therefore incorrect. The influence of the wind-field model would be reflected in the hourly mean speeds, or in fastest-mile wind speeds based on the same gust factor curve. The differences of Fig. 5 are largely explainable by the authors' failure to adjust the Batts et al. results in the same consistent manner that they used for their comparisons with the Georgiou results.

For example, according to Fig. 5(b) for milepost 1500 the 100-yr fastest-mile wind speed based on Batts et al. (1980) is about 51 m/s. Fig. 10, taken from Batts et al. (1980), and reproduced in Fig. 5 after changing the units from mph to m/s, shows a fastest-mile speed of about 112 mph = 50.1 m/s (the difference between the values 51 m/s and 50.1 m/s is attributed to a small transcription error by the authors). For a 112 mph fastest-mile wind speed, the relevant averaging time is 3,600/112 = 32.1 s, and the corresponding value of the Durst conversion factor is about 1.315 (see commentary to the ASCE Standard 7-95, p. 155). The hourly mean speed is therefore 112/1.315 = 85.2 mph. To obtain the fastest-mile speed based on the Krayer-Marshall gust factor curve, this hourly mean speed must be multiplied by the appropriate value of the Krayer-Marshall conversion factor. This value is about 1.42, yielding 85.2 × 1.42 = 121 mph = 54.1 m/s, instead of 51 m/s, as indicated in Fig. 5(b). (To verify that 1.42 is the appropriate value of the Krayer-Marshall conversion factor, note that the relevant averaging time is 3,600/121.0 = 29.8 s, to which there corresponds indeed a conversion factor of about 1.42—see commentary to ASCE Standard 7-95, p. 155.) The difference between the fastest-mile speed estimates by Vickery and Twisdale (1995) and by Batts et al. (1980) is then 57 − 54 = 3 m/s. This difference accounts consistently for the conversion factor, which is based on the Krayer-Marshall curve in both cases. It is considerably smaller than the difference 57 − 51 = 6 m/s obtained from Fig. 5(b) in which one set of values is affected by one gust response curve, and the other set of values is affected by a different gust response curve.

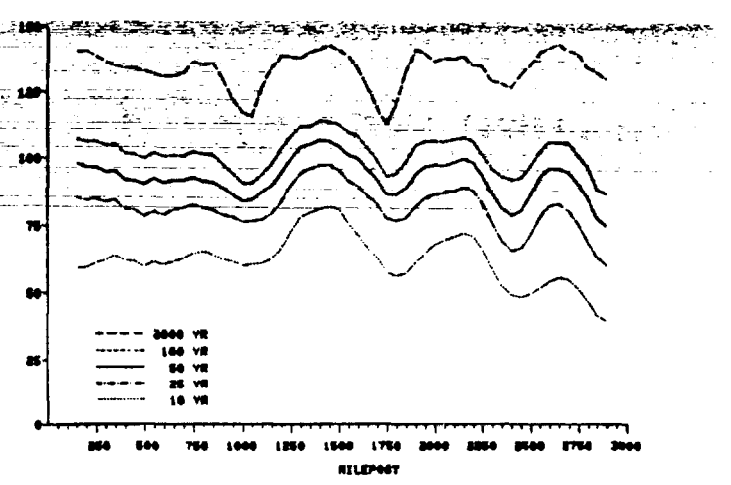

FIG. 10. Estimated Fastest-Mile Hurricane Wind Speeds Blowing from Any Directions at 10 m above Ground in Open Terrain near Coastline, for Various Mean Recurrence Intervals (Batts et al. 1980)

The need for the corrections just noted emerged from conversations between the authors and the discusser. In the belief that the values of Fig. 5 were mutually consistent, the discusser applied the same conversion factors to the Vickery and Twisdale (1995) and the Simiu and Batts (1980) values to obtain the corresponding hourly mean speeds listed in Table 1 of the report by Simiu and his colleagues (Simiu et al. 1996). Corrected mean hourly speeds based on Vickery and Twisdale's estimates that should replace those listed in that table are given in Table 6. (All other values listed in Table 1 of the report need no modification.)

Once the inconsistency of Fig. 5 is removed, the 50-yr estimates of Vickery and Twisdale and those of Batts et al. (1980) are in most cases reasonably close to each other (Simiu and Scanlan 1996). This is quite remarkable, given that: (1) the results were obtained by using entirely different models of the hurricane boundary layer; and (2) the various assumptions that govern the estimates by Twisdale and Vickery (1995) and by Batts et al. (1980) are subject to significant uncertainties. It is the discusser's opinion that claims of superiority of one set of estimates over the other are therefore unwarranted. This opinion is reinforced by the fact that, according to Shapiro (1983, pp. 1995–1996), whose boundary layer model and analytic formulation are used by Vickery and Twisdale (1995), "the simple slab model with constant depth used in the present analysis cannot describe the detailed structure of the boundary layer, especially near the convective eye wall," and "the truncated spectral formulation used in this paper includes only modes through wavenumber 2," and "it approximates the fully nonlinear solution to within approximately 25%."

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[a]November 1995, Vol. 121, No. 11, by Peter J. Vickery and Lawrence A. Twisdale (Paper 7006).

[3]NIST Fellow, Build. and Fire Res. Lab., Nat. Inst. of Standards and Technol., Gaithersburg, MD 20899.

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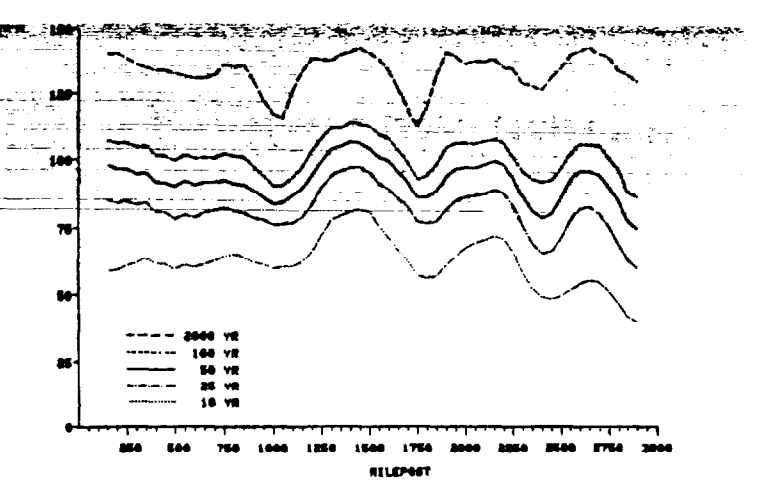

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[a]November 1995, Vol. 121, No. 11, by Peter J. Vickery and Lawrence A. Twisdale (Paper 7006).

[3]NIST Fellow, Build. and Fire Res. Lab., Nat. Inst. of Standards and Technol., Gaithersburg, MD 20899.

Table 2. Estimated Hourly Mean Hurricane Wind Speeds with 50-yr, 100-yr, and 2,000-yr Mean Recurrence Intervals (MRI) at 10 m above Ground over Open Terrain near Coastline

	Coastal Distance[a]																											
Time (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	9 (9)	10 (10)	11 (11)	12 (12)	13 (13)	14 (14)	15 (15)	16 (16)	17 (17)	18 (18)	19 (19)	20 (20)	21 (21)	22 (22)	23 (23)	24 (24)	25 (25)	26 (26)	27 (27)	28 (28)
50-yr	30	29	31	31	34	34	34	33	32	31	31	32	35	36	31	30	32	34	34	34	32	29	30	29	30	32	29
100-yr	34	32	34	33	36	38	38	36	35	34	34	35	39	39	34	32	37	37	37	37	35	32	33	32	33	34	33
2,000-yr	45	43	43	43	48	50	46	45	44	42	44	47	51	49	44	45	44	48	49	48	47	45	46	45	45	46	45

Note: Measurements are in m/s and are based on Vickery and Twisdale (1995).
[a]In hundreds of nautical miles.

APPENDIX. REFERENCES

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