The Gust Factor During Hurricanes as Measured by NDBC Buoys

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The gust factor is defined as the ratio of the maximum (or peak) gust speed to the sustained wind speed. This factor is important for mariners to know, particularly during storms. The purpose of this brief note is to synthesize the gust factor recorded by NDBC buoys during hurricanes.

In order to obtain a large sample from as much spatial variability as possible, a ten-year data set has been compiled in Table 1. The period from 1991 through 2000 was used. The area of coverage included the Gulf of Mexico and the U.S. Eastern Seaboard from Florida northward to the Gulf of Maine. Buoy measurements included both deep and shallow water locations. The data sets are based on the "Annual Summaries" for Atlantic hurricane seasons as published in the Monthly Weather Review.

In Table 1, the gust factor is obtained from the ratio of peak gust to the sustained wind. The grand mean from all 67 measurements is 1.29, with a standard deviation of 0.077. The coefficient of variation (or dispersion), defined as the ratio of the standard deviation to the mean, is approximately 6%. Since these deviations are small, the gust factor of 1.3 based on the 3 tropical storms and 16 hurricanes listed in Table 1 should be useful operationally. For example, if only the wind speed is available, the peak gust can be estimated simply by multiplying the speed by 1.3 during storm conditions.

Characteristics of the Gust Factor Measured by Coastal-Marine Automated Network (C-MAN) Stations During Hurricane Georges in 1998

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The gust factor is the ratio of peak gust to sustained wind speed. Two questions often asked are: "Does the gust factor increase with wind speed?" and "Does it increase with height?" In order to respond, simultaneous measurements from a large number of stations are needed. Such an opportunity arose during Hurricane Georges in September 1998. The measurements are listed in Table 1, along with the anemometer height for each station. It is evident from this table that the gust factor does not increase with either height or sustained speed within approximately 20 to 160 ft and 24 to 81 kts.

Between 1400 and 1500 UTC on 25 September 1998, four C-MAN stations along the Florida Keys provided an interesting sub-data set. These four stations were: Molasses Reef (C-MAN MLRF1), Long Key (LONF1), Sombrero Key (SMKF1), and Sand Key (SANF1). When the wind speed increased from 46 kts at MLRF1 to 81 kts at SMKF1, the gust factor remained virtually the same at both locations, even though the anemometer height at MLRF1 was 52 ft versus 159 ft at SMKF1.

We therefore conclude from the data provided in Table 1 that the gust factor does not increase with either height or speed. Certainly, more data are needed to substantiate this conclusion.