intended for use with the 3-s gust speed at 33 ft (10 m) above ground in open country. It is necessary, therefore, that regional climatic data based on a different averaging time, for example, hourly mean or fastest mile, be adjusted to reflect peak gust speeds at 33 ft (10 m) above ground in open country. The results of statistical studies of wind-speed records, reported by Durst (1960) for extratropical winds and for hurricanes (Vickery et al. 2000b), are given in Fig. C26.5-1, which defines the relation between wind speed averaged over t s, V_t, and over 1 h, V_{3600}. The gust factor adjustment to reflect peak gust speeds is not always straightforward, and advice from a wind engineer or meteorologist may be needed.

In using local data, it should be emphasized that sampling errors can lead to large uncertainties in specification of the wind speed. Sampling errors are the errors associated with the limited size of the climatological data samples (years of record of annual extremes). It is possible to have a 20 mi/h (8.9 m/s) error in wind speed at an individual station with a record length of 30 years. While local records of limited extent often must be used to define wind speeds in special wind areas, care and conservatism should be exercised in their use.

If meteorological data are used to justify a wind speed lower than 110-mi/h 700-yr peak gust at 10 m, an analysis of sampling error is required to demonstrate that the wind record could not occur by chance. This can be accomplished by showing that the difference between predicted speed and 110 mi/h contains two to three standard deviations of sampling error (Simiu and Scanlan 1996). Other equivalent methods may be used.

C26.5.4 Limitation

In recent years, advances have been made in understanding the effects of tornadoes on buildings. This understanding has been gained through extensive documentation of building damage caused by tornadic storms and through analysis of collected data. It is recognized that tornadic wind speeds have a significantly lower probability of occurrence at a point than the probability for basic wind speeds. In addition, it is found that in approximately one-half of the recorded tornadoes, gust speeds are less than the gust speeds associated with basic wind speeds. In intense tornadoes, gust speeds near the ground are in the range of 150–200 mi/h (67–89 m/s). Sufficient information is available to implement tornado-resistant design for above-ground shelters and for buildings that house essential facilities for postdisaster recovery. This information is in the form of tornado risk probabilities, tornadic wind speeds, and associated forces. Several references provide guidance in developing wind load criteria for tornado-resistant design (Wen and Chu 1973, Akins and Cermak 1975, Abbey 1976, Mehta et al. 1976, Minor et al. 1977, Minor 1982, McDonald 1983, and Minor and Behr 1993).

FIGURE C26.5-2 Tornadic Gust Wind Speed Corresponding to Annual Probability of 10–5 (Mean Recurrence Interval of 100,000 Years) (From ANSI/ANS 1983).

Tornadic wind speeds, which are gust speeds, associated with an annual probability of occurrence of 1×10^{-5} (100,000-yr Mean Recurrence Interval [MRI]) are shown in Fig. C26.5-2. This map was developed by the American Nuclear Society committee (ANS) 2.3 in the early 1980s. Tornado occurrence data including all historical data can provide a more accurate tornado hazard wind speed for a specific site.

C26.6 WIND DIRECTIONALITY

The wind load factor 1.3 in ASCE 7-95 included a “wind directionality factor” of 0.85 (Ellingwood 1981 and Ellingwood et al. 1982). This factor accounts for two effects: (1) The reduced probability of maximum winds coming from any given direction and (2) the reduced probability of the maximum pressure coefficient occurring for any given wind direction. The wind directionality factor (identified as K_d in the standard) is tabulated in Table 26.6-1 for different structure types. As new research becomes available, this factor can be directly modified. Values for the factor were established from references in the literature and collective committee judgment. The K_d value for round chimneys, tanks, and similar structures is given as 0.95 in recognition of the fact that