

Extreme wind speeds in France

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The industrial security sector and the wind power industry require knowledge of maximum expected gust speeds. Wind extreme values for most users (building security for example) are often stated in terms of 50-year quantiles. The aim of a study of Météo-France in 2006 was to calculate 10 meter wind speed quantiles for the largest possible number of stations and then to update the values in the French climatological database (BDCLIM) yearly.

Météo-France developed a Peak Over Threshold (POT) method to predict extreme wind speeds : threshold exceedances are fitted to an exponential distribution (Generalized Pareto Distribution with a shape parameter of zero) and the occurrence of exceedances over a high threshold is modelled as a Poisson process. Daily gust speed data from 623 wind measurement stations in France have been selected on the 1993-2005 period. The autocorrelation of several daily gust speed time series was carried out before proceeding with the GPD-Poisson analysis, and confirmed that the daily gust speeds are not independent. A minimum time separation of one day between the selected events has been chosen. The threshold value has been determined according to sample size constraints and the chi-square good fit test statistic. The threshold values have been objectively and independently chosen for each station.

The statistical validation of the analysis has been done in four steps. In the first step, stations with missing data at strong storms (December 1999 for example) were rejected. In the second step the threshold values have been checked. On the one hand they must be high enough to obtain exceedances over the threshold that succeed in converging to GPD asymptote. On the other hand they must not be too high to get suitable sample size. The thresholds vary from 16 ms^{-1} to 39 ms^{-1} for the stations below an elevation of 500m. The third step consists in assessing the model fit looking closely at the return level plots including 70% confidence intervals and the chi-square test statistic. The last way to validate the stations is to use the maps of the 10-year and 50-year quantiles for spatial control. The maps examination allows atypical wind stations to be detected. Analysis of the maps reveals a very good spatial consistency in extreme wind speeds and a distinction between the coastal regions with 50-year quantiles higher than 40 ms^{-1} and the inland regions with quantiles lower than 35 ms^{-1} . This spatial coherency is noteworthy considering the fact that no correction was made on raw data (roughness correction for example). 485 French wind stations have been finally kept. For next end-user demands, the regional climatological expert of Météo-France will choose the most appropriate station within this list depending on his local

knowledge of the site.