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Assessing extreme wind speeds at return intervals of 20 years and 50 years from the USAF data set

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Maximum wind speeds are an important consideration in some regions for the placement of wind turbines for electricity production. The current IEC61400 (International Electrotechnical Commission) wind turbine classification scheme uses three standardized categories (Classes I, II, and III) that are based on different wind strengths, including average wind speed for normal operating conditions and the 50-year extreme gust over 3 seconds to define turbine survival thresholds. For Class I turbines (the most robust category) the 50-year extreme gust threshold is 70 m/s, and this represents the maximum wind speed survival threshold. A recent study based on a numerical model has indicated that wind conditions during the most severe hurricanes exceed wind turbine survivability limits. This supports other published case studies that document wind turbine damage during severe cyclones and typhoons in south and east Asia. For economic viability, wind farms must be placed in areas where hurricanes are not too frequent in order to minimize the risk of damage during an operational lifetime that spans about 20 years. The present contribution uses the USAF meteorological data set to derive statistics of maximum wind speeds that can be expected with return intervals of 20 and 50 years. The contribution shows distribution maps of the wind speed at different return intervals, highlighting areas where damaging winds may be expected during the operational lifetime of a wind turbine. This work is a potential application of data being made available through the Copernicus Climate Change Service (C3S) global marine and marine database.