The Ph.D. thesis deals with extreme wind gust analysis over the area of the Czech Republic. The first part of the thesis deals with processing of wind measurements, in particular maximum wind gusts measurements. Analysis of high-frequency wind measurement using 3-D sonic anemometer on the Kopisty station is included. Homogenization of the highest daily wind gusts was performed. Descriptive statistical analysis of measured wind gust values was performed. The following part of the thesis describes statistical theory of extreme values and discusses its applicability to wind gust data. Some theoretical findings were obtained. Numerous numerical experiments were performed focused on evaluation of proposed method. In the last part of the thesis station measurements were processed using the proposed methods and a model of dependence between extreme and mean wind climate was derived. The model was applied to the map of mean wind climate calculated earlier on the Institute of Atmospheric Physics and thus a map of extreme wind climate was obtained. The accuracy of this map was estimated. The map was compared with other maps of extreme wind calculated by other authors earlier.