STATISTICAL STRUCTURE OF WINDY DAYS IN HUNGARY WITH RESPECT TO CLIMATE CHANGE

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I. INTRODUCTION

An important structural element of the wind field is energy content in which respect quantity is a fundamental question. Overwhelming proportion of wind energy in Hungary consists of rarely occurring higher wind speeds. That is why we included in our discussion the monthly number of windy days, when the maximum wind speed exceeds 10 m/s, a characteristic of wind field what is not studied extensively yet. This article analyzes the basic statistics, temporal changes and distribution of such windy days. We think that our results contribute to the deeper understanding of the wind climate and its changes in Hungary.

II. TEMPORAL CHANGES OF WIND CLIMATE

There had been investigations for the temporal changes of speed, direction and energy of the wind, and attempts to forecast them in Europe and the United States. An interpretation of relationship between atmospheric circulation patterns and anomalies in the wind climatology and cyclone activity was also given (Kaas and Schmith, 1996). It was found that within the present century both the monthly mean windiness and cyclonic activity show variations on the decadal time scale but no significant overall trends in winter over the northern North Atlantic region. Using reanalyzed data for the 40 years period (1958-1997), a wind statistic for the North See was derived also on decadal scale (Siegismund and Schrum, 2001). Changes in the introduced wind density function for three regions were analyzed for two seasons. All of the three sectors resemble each other in the last decade. In the first three decades an enhancement of southerly wind direction was found in the northern part of North Sea. The annual mean wind speed for the North Sea shows a rising trend of about 10 % during the 40 years. There are trends in mean monthly maximum and minimum surface wind speeds in the United States, too (Klink, 1999). Regression lines fit to the 30 years (1961-1990) time series show that, on, balance, mean monthly maximum winds are increasing and mean monthly minima are decreasing. Possible causes of these trends include hemispheric temperature trends, changes in cyclone and anticyclone frequency, urbanization effect, and instrumentation and observation biases. By a climatic scenarios in northern Europe the mean wind speeds, 90^{th} percentile wind speeds and energy density are slightly lower in the 2081-2100 climate protection period then during 1961-1990 at the majority of the 46 stations studied. The winter time of 2046-2065 is largely indistinguishable from 1961-1990 for the majority of stations, while the winters of 2081-2100 appear to be associated with lower mean and 90^{th} percentile wind speed and energy density (Pryor et al., 2005).

III. METHODS AND RESULTS

The sample taken from the ϑ probability distribution which describes the number of windy days in a month in Hungary wiil be called D10. The source of its elements is the National Meteorological Service's periodical called Monthly Reports in the period from January, 1971 to December, 2005. We processed the data originating from weather stations where the conditions of wind measurement remained unchanged. The following stations feature monthly data series of windy days that can be considered homogeneous in the period: Debrecen, Szeged, Budapest-Pestszentlőrinc, Pécs, Keszthely, Szombathely and Kékestető. Their locations and their accurate geographical coordinates are shown in a figure, as well as the altitude of the anemometer aboveground level. We define basic statistics then we analyze the time sequences with the help of autocorrelation. It was demonstrated with a statistical test that our time series cannot be considered white noise and select the significant autocorrelation coefficients. The significance of the linear trends also was investigated in the case of yearly sums. The gamma distribution was found as the theoretical distribution which best approximates the empirical distribution of the anomalies of untransformed elements in the time series.

IV. REFERENCES

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