MULTI-YEAR DYNAMICS OF AVERAGE MONTHLY WIND SPEED AT THE ODESA-OBSERVATORY STATION IN DIFFERENT PERIODS OF OBSERVATIONS

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The Earth's modern climate system is undergoing significant changes associated with climate change processes. An increase in average annual temperatures, an increase in the frequency of extreme weather events, a change in the precipitation regime and circulation processes in the atmosphere - all this indicates a climate transformation that has both a global and regional dimension. One of the key parameters of the regional climate is wind. It plays an important role in the redistribution of heat and moisture in the atmosphere, the formation of weather conditions and is a significant factor for maritime and aviation transport, energy and agriculture. In the context of climate change, the wind regime may undergo fluctuations, which are reflected both in the average monthly speed values and in extreme manifestations [1].

The study of wind speed dynamics is especially relevant for coastal regions, where the interaction of the sea and land creates specific climatic conditions. The Odesa Observatory station, which has a long history of meteorological observations, is an important source of data for analyzing changes in the wind regime in the Northern Black Sea Region. The study of the long-term dynamics of the average monthly wind speed allows us to trace trends associated with climate change and assess their significance for the region.

The data of the Climatic Cadaster's of Ukraine [2, 3] were used as the source material in the work. The average monthly wind speed for different hours of the day (0,3,6,9,12,15,18,21) was calculated by averaging the time-series wind speeds for each month for the period of the first (1961-1990) and second (1991-2020) climate norms. The observation periods are indicated in Greenwich Mean Time.

Table presents the average monthly wind speeds during the main observation periods at the Odesa Observatory station in different climatic periods. Let us analyze the long-term dynamics of the surface wind speed of the studied region for the central months of the seasons. In January, at the Odesa Observatory station, insignificant wind speeds are observed during the day from 4.4 to 4.6 m/s during the period of the first climatic norm (1961-1990) to 3.2-3.3 m/s during the period of the second (1991-2020). Which is directly related to the nature of atmospheric circulation and a small amount of solar radiation. For both periods, the maximum average monthly wind speeds are recorded at 12 SST, which in winter corresponds to 14 hours local time.

Table.

Average monthly wind speed during the observation periods at the Odesa Observatory station in different climatic periods, m/s [2, 3]

time	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1961-1990												
0	4,4	4,5	4,1	3,4	3,1	2,9	2,9	3,2	3,5	3,7	4,1	4,0
3	4,4	4,4	4,1	3,4	3,1	2,9	3,0	3,2	3,3	3,6	4,1	4,1
6	4,4	4,5	4,1	3,4	3,2	2,9	2,9	3,2	3,4	3,7	4,1	4,1
9	4,5	4,6	4,3	3,7	3,4	3,0	3,0	3,1	3,4	3,7	4,1	4,1
12	4,6	4,7	4,5	4,0	3,6	3,5	3,3	3,4	3,7	3,9	4,2	4,2
15	4,5	4,6	4,4	4,0	3,8	3,8	3,7	3,5	3,7	3,8	4,2	4,1
18	4,3	4,5	4,1	3,6	3,5	3,3	3,2	3,0	3,1	3,3	4,0	4,1
21	4,4	4,4	3,9	3,3	3,0	2,7	2,7	2,9	3,2	3,5	4,2	4,1
1991-2020												
0	3,2	3,3	3,0	2,6	2,2	2,0	2,0	2,2	2,5	3,0	3,5	3,3
3	3,2	3,3	3,1	2,6	2,2	2,0	2,0	2,1	2,5	3,0	3,5	3,4
6	3,3	3,2	3,1	2,8	2,5	2,3	2,2	2,2	2,7	3,1	3,5	3,4
9	3,3	3,5	3,5	3,2	2,9	2,7	2,6	2,6	3,0	3,4	3,6	3,4
12	3,3	3,6	3,6	3,4	3,1	3,0	2,9	2,7	3,0	3,2	3,5	3,4
15	3,2	3,3	3,3	2,9	2,7	2,6	2,5	2,2	2,5	2,8	3,5	3,3
18	3,3	3,3	3,1	2,6	2,3	2,0	1,9	2,0	2,5	3,0	3,7	3,4
21	3,3	3,3	3,1	2,7	2,2	2,1	2,0	2,2	2,6	3,1	3,6	3,4

As for the dynamics of wind speed at different times over the 60-year period (1961-2020), there is a clear trend towards a decrease in wind speed in January at the Odesa-Observatory station during all periods by an amount from 1.0 to 1.3 m/s.

In the month of April, the amount of solar energy that reaches the subsoil surface increases, which affects the surface wind speed at the studied station. The April average monthly wind speed values are lower than those in January. The daily amplitude of the wind speed decreases. The daily course remains unchanged, and for the first and second climatic periods, the maximum wind speed values fall on 12 hours of the UTC. Their values reach 4.0 m/s in the first and 3.4 m/s in the second climatic period.

In April, the trend of wind speed over time at the Odesa observatory station remains the same as in January: wind speeds in the second climate norm are significantly lower than in the previous one. The magnitude of the decrease, taking into account the thermal factor, in April fluctuates within wider limits, from 0.5 to 1.1 m/s.

In July, the nature of the circulation is determined by the amount of radiation reaching the underlying surface, and therefore the thermal factor increases. The wind speed at the Odesa Observatory station in July varies from 2.7 to 3.7 m/s during the first and from 1.9 to 2.9 m/s during the second climatic norm. The highest speeds, which is understandable, occur in the afternoon: 15 UTC (1961-1990) and 12 UTC (1991-2020).

The general trend towards a decrease in wind speed from the first to the second climatic period at the station in July persists, the magnitude of the decrease is from 0.4 (9-12 hours) to 1.3 (18 hours) m/s.

In October, the daily amplitude of wind speed increases slightly. The wind speed varies from 3.3 to 3.9 m/s (first period) and from 2.8 to 3.4 m/s (second) period. Taking into account the nature of the circulation, the intraday distribution undergoes changes: maximum speeds are recorded at 12 o'clock (1961-1990) and at 9.00 (1991-2020). The general trend towards a decrease in wind speed from the first to the second climatic period in October at the Odesa-Observatory station is maintained. The magnitude of the decrease is from 0.3 m/s (9 a.m.) to 1.0 m/s (3 p.m.).

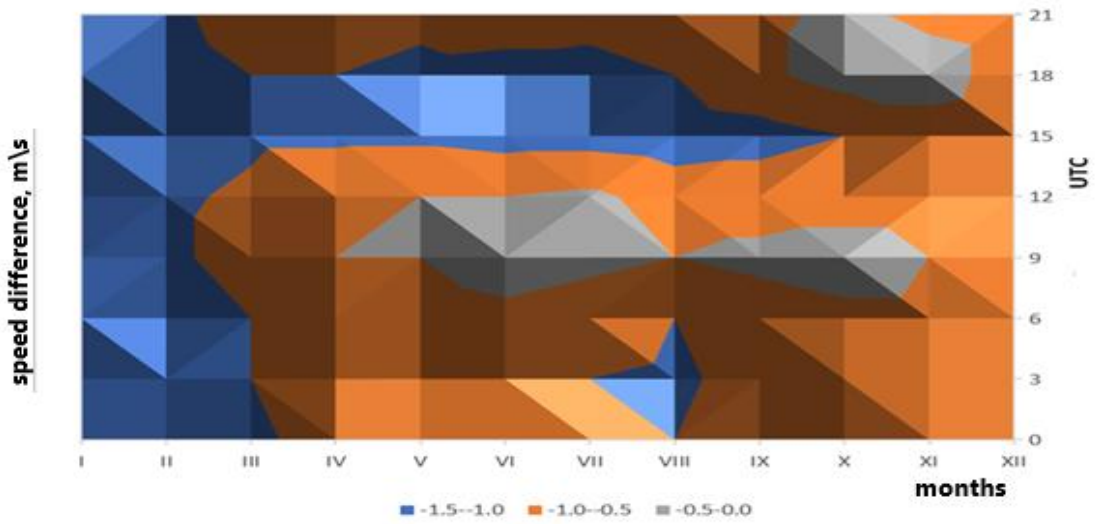

Fig. Surface diagram of the difference in wind speed at the Odesa-Observatory station between the second and first climatic periods for all observation periods and all months of the year (m/s)

Figure shows a surface diagram of the difference in wind speed at the Odesa-Observatory station between the second and first climatic periods for all periods and all months of the year. Analysis of the diagram allows us to confirm the fact of a decrease in wind speed in all months of the year. The largest decrease (1.0-1.5 m/s) occurs in January-February (all periods), and in the period 15.00 (from January to September). The period 9.00 from May to October is characterized by the smallest decrease in speed (0.0-0.5 m/s). The remaining months-periods show a decrease in speed in the range 0.5-1.0 m/s.

References:

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