TRENDS OF WIND SPEED IN LOW TROPOSPHERE FROM RADIOSONDE DATA OF RUSSIAN ARCTIC STATIONS

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The knowledge about distribution of main meteorological parameters in low troposphere is necessary for many science and practical needs. The paper presents the trends in time series of wind speed (S) in the low troposphere layer from the surface to the 2-km height.

The computations are based on the radiosonde data from eleven Russian Arctic aerological stations located in the North-European, West-Siberian and East-Siberian climatic areas of the Arctic region of Russia. Data from aerological dataset CARDS [1] supplemented by current data from datasets AROCTAB [2] and AROCTAC [3] for the observation period of 1964-2016 were used for this research. The data were subject to a complex quality control procedure. Another quality control procedure was developed especially for the low troposphere layer.

The Akima cubic spline interpolation method was used for calculating S in the atmospheric layer 0–2 km. The trends were estimated using the least squares method.

Table, Figs. 1 and 2 show that the spatiotemporal distribution of the trends is not uniform. The wind speed and standard deviations in the low troposphere layer over the Arctic region of Russia mainly increase at the heights of 400–600 and 400–800 m above the surface, respectively. We can see negative trends near the surface.

The obtained knowledge about long-time changes of wind speed in the low troposphere may be useful for geo-economic justification of nuclear power stations construction, for needs of aviation, shipping, for studying climate change in the Arctic region.

Table. **The ranges of inter-annual changes for the linear trends of anomalies of long-time monthly means and square deviations for wind speed, m/s *decade^{-1}, in the low troposphere layer 0-2-km for 00 and 12 UTC for different climatic areas of the Arctic region of Russia. 1964–2016.**

The ranges of inter-annual changes of the linear trends of anomalies of long-time monthly means S, m/s *decade-1		The ranges of inter-annual changes of the linear trends of anomalies of square deviations for wind speed, m/s *decade-1		Number of observations	
00 UTC	12 UTC	00 UTC	12 UTC	00 UTC	12 UTC
North-European area					
-0,2—**0,7**	-0,4—**0,7**	-0,4—**0,4**	-0,4—**0,4**	58083	56647
West-Siberian area					
-0,6—**0,6**	-0,6—**0,5**	-0,4—**0,3**	**-0,5—0,4**	37657	37510
East-Siberian area					
-0,7—0,8	-0,5—**0,9**	**-0,5—*0,4***	**-0,4—0,5**	52247	52855

Note. Trends with significance not less than 95% are marked by bold. Trends detected at heights of 400–600 m are underlined and those detected at heights of 700–800 m are shown in italic

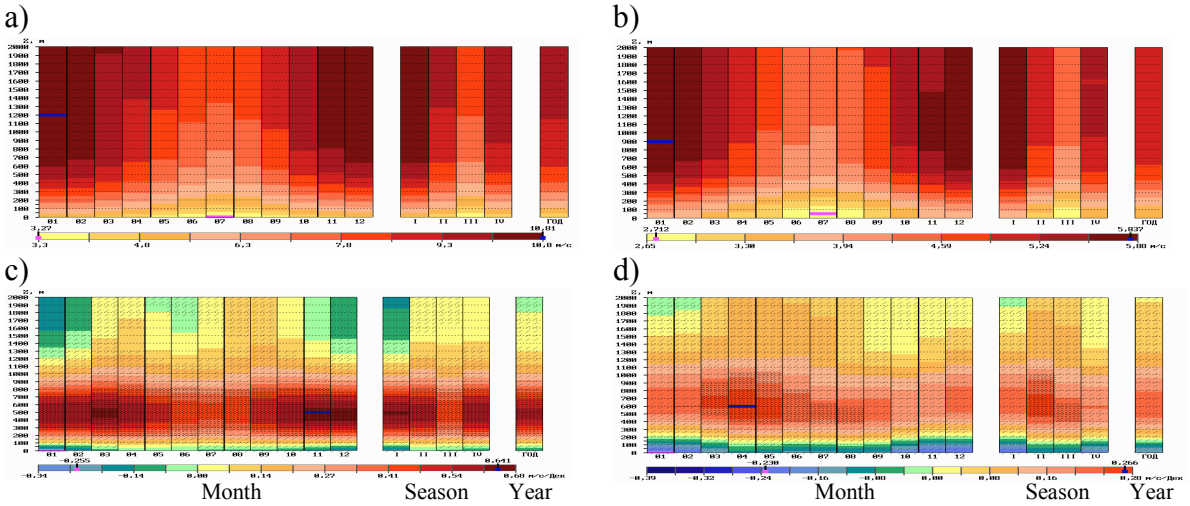

Fig. 1. Long-time mean values (a) and square deviations (b) for wind speed, m/s, the linear trends of anomalies of long-time means (c) and square deviations (d) for wind speed, m/s *decade-1, in the low troposphere layer 0-2-km for 00 UTC for every month, season (I, II, III, IV for DJF, MAM, JJA, SON correspondingly), year. Statistics calculated for station Murmansk for 1964–2016 were smoothed by the twofold smoothing of time series. The three-point smoothing was used. Trends with significance not less than 50% are marked by sloping line segments and trends with significance not less than 95%, by lattice. Blue and pink segments correspond to maximum and minimum values.

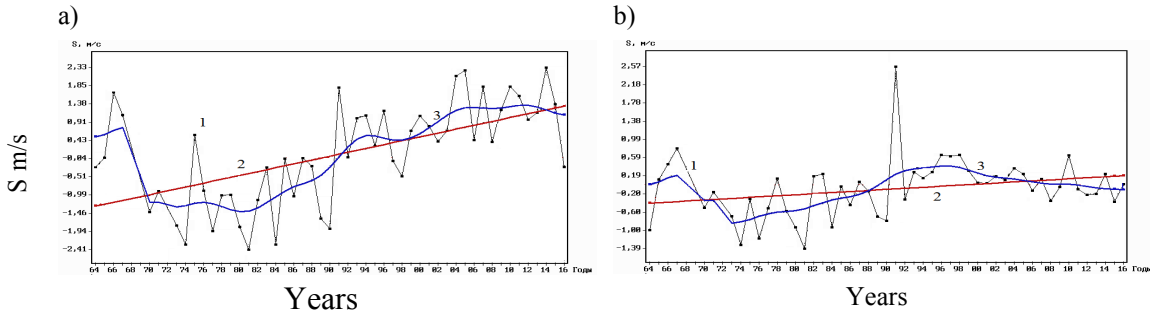

Fig. 2. Black lines (1) – time series for anomalies of means (a) and square deviations (b) for wind speed S, m/s, at height of 500 m for autumn, calculated on the base of upper-air data for station Murmansk for 1964–2016. Red lines (2) show linear trends, blue lines (3) show smoothed trends. The smoothed trends were obtained after the tenfold smoothing of the time series by using the three-point smoothing.

References

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