

Water Vapour Amount Trends in Troposphere over North-West of Siberia Detected by the Method Based on the Using of Hourly Observations

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Estimations of climatic changes for water vapour amount (VA) for standard isobaric levels in troposphere over North-West of Siberia are presented for stations Ostrov Dixon and Salehard on base dataset CARDS [Estridge et al, 1995] over period 1964-10.2007 years.

Number of humidity observations used for researches have shown in Table 1 for different months for standard levels: 850 hPa, 700 hPa, 500 hPa and 400 hPa. Table 1 demonstrates that number of humidity observations is decreasing with height, especially in cold months.

TABLE 1. Number of humidity observations used for researches for different levels for different month.

Level (hPa)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	Ostrov Dixon											
400	654	675	816	747	1013	1275	1420	1193	1028	684	655	644
500	952	981	1203	1238	1486	1377	1451	1253	1256	1158	1079	1023
700	1399	1341	1523	1445	1504	1392	1464	1267	1274	1274	1357	1380
850	1406	1343	1528	1447	1506	1394	1468	1267	1277	1283	1361	1388
	Salehard											
400	1547	1391	1657	1716	1758	1801	1711	1731	1789	1639	1429	1489
500	1813	1658	1985	1970	1885	1843	1733	1762	1864	1639	1670	1755
700	1926	1748	2041	2022	1913	1845	1742	1795	1894	1881	1756	1870
850	1902	1729	1995	1987	1877	1803	1693	1762	1872	1854	1736	1842

The multiannual monthly mean values for VA for isobaric levels and linear trends in correspondent time series for VA anomalies, calculated on the base of hourly observations with taking into account the time correlations of observations [Alduchov et al, 2006, Alduchov and Chernykh, 2008] are presented at Figure 1. The trends are presented for different months, seasons and for year without estimation of significance, with significance not less than 50% and 95%.

Figure 1a demonstrates that biggest mean values of VA in troposphere over both stations take place in summer. For 500 hPa it equal to 13.7 kg/m² for Ostrov Dikson and 18.1 kg/m² - for Salehard. But tendencies of climatic changes of VA for summer are opposite direction for the stations. VA is decreasing over Ostrov Dikson and is increasing over Salehard (fig. 1b, 1c). For example, trends of VA for 500 hPa, detected with significance 82% and 92%, equal to -0.2 kg/m²/dec. and 0.3 kg/m²/dec. correspondently.

Figure 1d shows that trends with significance not less than 95% are detected only in high troposphere over Ostrov Dikson for October (for 400 hPa trend equal to 1.2 kg/m²/dec.) and in low troposphere over Salehard for June, summer and year (for 700 hPa decadal changes equal to 0.5 kg/m²/dec., 0.3 kg/m²/dec. and 0.1 kg/m²/dec. correspondently).

It was shown in [1] that warming with significance not less than 95% was detected only for January, May and June, spring, summer and autumn and year for both stations. In Table 2 linear trends values for VA anomalies and its significance are presented for these months and year. According [1] and Table 2 the warming and increasing VA for these months and year are detected at most levels of troposphere over Salehard and only in low troposphere over Ostrov Dikson.

TABLE 2. Linear trends for vapour amount VA anomalies (kg/m²/dec) for standard isobaric levels 850 hPa, 700 hPa, 500 hPa calculated on the base of hourly observations with taking into account the time correlations of observations, for January, May, June and year and its significance (%).

Station		January			May			June			Year		
		Standard isobaric levels, hPa											
		500	700	850	500	700	850	500	700	850	500	700	850
Ostrov Dikson	Trend	.37	.09	.08	-	-	.05	.13	.13	-	-	.05	
	Significance	99	67	85	-	-	56	54	79	-	-	88	
Salehard	Trend	.18	.14	.08	.16	.16	.12	.61	.53	.35	.13	.12	.10
	Significance	84	80	77	59	69	77	94	96	97	92	96	99

The results can be used for analysis of climate change of humidity in Arctic atmosphere.

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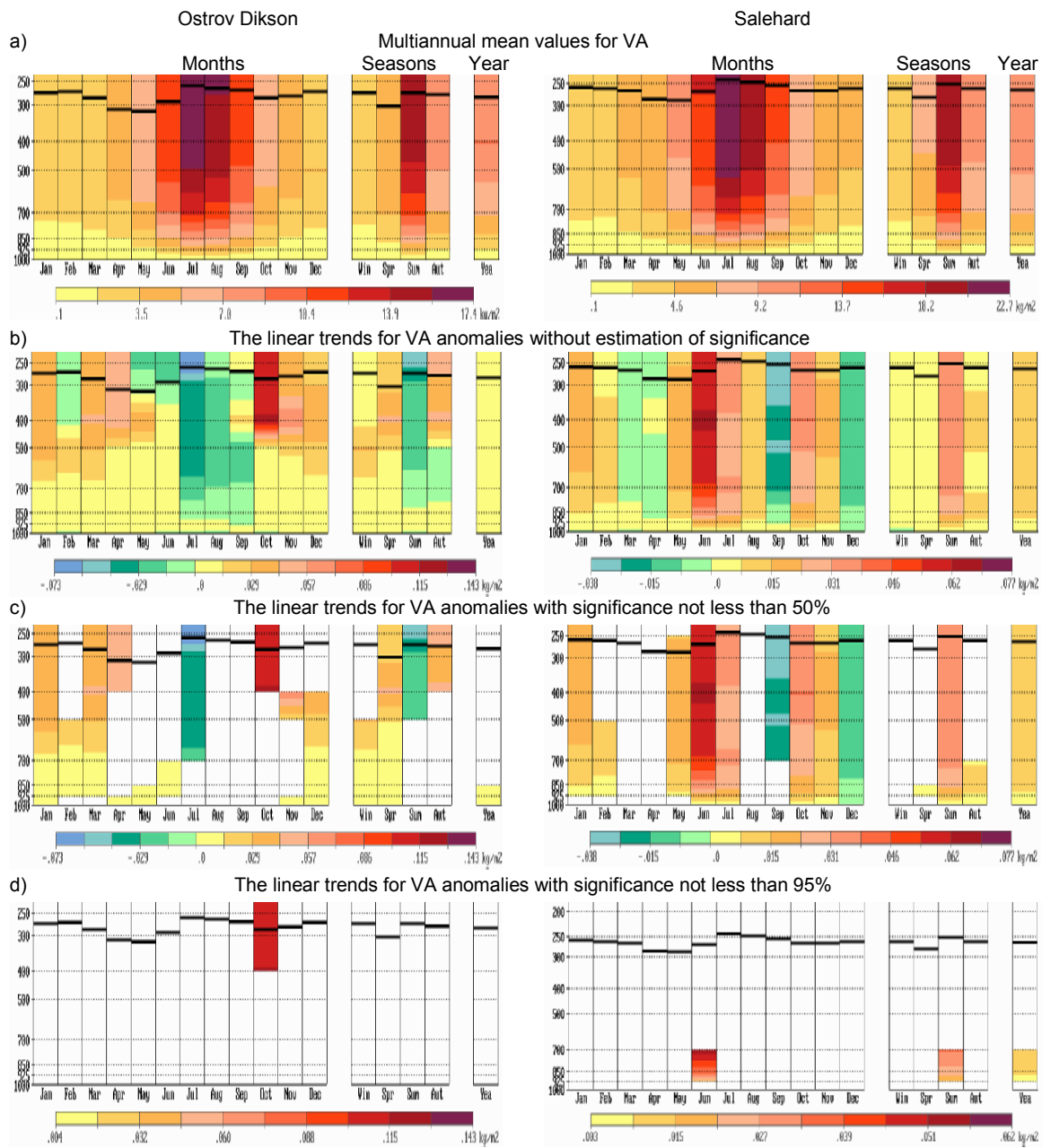


Fig. 1. Multiannual mean values (kg/m^2) for vapour amount VA and linear trends in time series of vapour amount anomalies ($\text{kg/m}^2/\text{year}$) for the isobaric levels calculated on the base of hourly observations with taking into account the time correlations of observations for different months (in the left), seasons (in the center) and for year (in the right) without estimation of significance, with significance not less than 50% and 95%. The first tropopause is marked by black line. Stations Ostrov Dikson (left column) and Salehard (right column). CARDS. 01.1964 – 10.2007.

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