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QUANTUM METEOROLOGY: QUANTA BEHAVIOR OF METEOROLOGICAL PARAMETERS ON A THREE HOUR MEASUREMENTS BETWEEN THE DECEMBER SOLSTICES

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Abstract. Factor analysis of three-hour dynamics from the winter solstice 22.12.2013 to 21.12.2014 of four meteorological parameters: atmospheric pressure; air temperature; relative humidity; dew point temperature was carried out by the method of identification of stable regularities (weather station Yoshkar-Ola, Russia, 2917WMO_ID=27485). The sample capacity was 2917 rows. The correlation coefficient increased to 0.5065, which is more than 0.4583 for a seven-year data set. The ranking of the factors changed only for dependent parameters: the air pressure was the third. 14 members of the model were accepted for all meteorological parameters. The article analyzed the first four terms. For the dynamics of air pressure, the first term shows a decrease from the beginning of the year to its end, and the second term – an increase in air pressure. And two wavelets counteract the growth of air pressure. The period of oscillation of the third member at the beginning of the year is 21.2 days. Second wavelet on 22.12.2013 had a period 33.0 days. For the dynamics of relative humidity, the first term is the law of death, and the second term of the trend is the biotechnical law showing the limit of increase. The third term characterizes the daily fluctuation with a constant period of 0.5 days. The maximum oscillation period of 129.4 days is in the 11th member of the model. At air pressure and dew point temperature daily fluctuations are observed. For the dynamics of the dew point temperature, the first term, as well as for the air temperature, has a negative sign and therefore shows the effect of space (global cooling). And the second member of the biotechnical law gives the growth of the meteorological parameter due to sunlight to the summer equinox. The third term gives a jerk of the oscillatory perturbation of the dew point temperature in the first 100 days. The quantum certainty of binary relations is different.

Keywords: weather station, weather, factors, three-hour measurements, year, dynamics, wavelets, binaries, quanta of behavior, regularities.

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1 Introduction

The winter solstice is the shortest day (with the longest night) of the year in the Northern hemisphere.

The winter solstice is an astronomical phenomenon when the inclination of the earth's axis of rotation in the direction from the Sun takes the greatest value $23^0\ 26'$. In different cultures, the interpretation of this event was perceived differently, but in most people it was regarded as a revival.

Within a few days before and after the solstice, the Sun almost does not change the declination, its midday heights in the sky are almost unchanged (the height during the year changes according to the schedule close to the bell-shaped top of the sinusoid); hence the name of the solstice. The slope of the Ecliptic plane to the plane of the celestial equator can be determined from observations of the sun's heights during both solstices.

The main factors of meteorology are: P_0- atmospheric pressure at the level of weather station (mmHg); T- air temperature (degree Celsius) at a height of 2 meters above the earth's surface;

$U-$ relative humidity (%) at a height of 2 meters above the earth's surface at the weather station. For connection with the vegetation period near this meteorological station, we also take into account the fourth meteorological parameter T_d – the dew point temperature (degree Celsius) at an altitude of 2 meters above the earth's surface.

For each ground-based weather station it turns out that it is necessary to study ***the point distributions*** of meteorological measurements every three hours on the above four parameters for the year between the December solstices. Pair connections between these parameters allow us to study ***the quanta of weather behavior*** for the year.

A priori, it is clear that the weather affects the course of development and growth (ontogenesis), especially of annual plants. And perennials weather is affected through annual ontogenesis of leaves. Quanta of leaf behavior, for example, birch (Mazurkin & Kudryashova, 2018a; Mazurkin & Kudryashova, 2015a; Mazurkin & Kudryashova, 2015b), common in the Northern hemisphere, clearly depend on quanta (asymmetric wavelets (Mazurkin, 2014; Mazurkin, 2015) behavior of air temperature and relative humidity. The water regime of meadows (Mazurkin, 2018a) and carbon dynamics in Europe change according to wavelets of universal design (Mazurkin, 2018b).

The dynamics of ontogenesis of birch leaves during the growing season (Mazurkin & Kudryashova, 2018b; Mazurkin & Kudryashova, 2018c) in 2014 is characterized by biotechnical law (Mazurkin, 2014) and additionally asymmetric wavelets. Since the wavelets of the mathematical construction are the same (invariant) for any objects of research, the purpose of studying the quanta of behavior in binary relations between the taken into account meteorological parameters from 22.12.2013 to 21.12.2014 was revealed.

There are two types of quantum behavior:

first, in dynamics, each factor is divided into the sum of wavelets, that is, in time, the factor is represented as a bundle of solitary waves (solitons) and this process is characterized as ***quantum unraveling;***

secondly, the mutual influence of the four above factors with the frequency of measurements every three hours additionally obtains ***quantum entanglement*** in some boundaries.

Thus, any phenomenon or process can be estimated by the level of adequacy (correlation coefficient) of the decomposition of the functional connectivity of the system into quantum unraveling and quantum entanglement.

2 Source data

Weather Station Yoshkar-Ola, Russia, WMO_ID=27485, the sample was accepted from 22.12.2013 to 21.12.2014, all days. Then sharply deviating points from the data array were excluded (Table 1). The power of statistical sampling on four meteorological parameters was 2917 lines.

In factor analysis, time is excluded, and it acts only as a system-forming factor that ensures the relationship between the four weather parameters. Therefore, the adequacy of the dynamics models is taken into account in the diagonal cells of the correlation matrix.

3 Factor analysis identification of the trend

The wavelet signal, as a rule, of any nature (object of study) is mathematically recorded by the wave formula (Mazurkin, 2014) of the form

$$y_i = A_i \cos(\pi x/p_i - a_{8i}), A_i = a_{1i} x^{a_{2i}} \exp(-a_{3i} x^{a_{4i}}), p_i = a_{5i} + a_{6i} x^{a_{7i}}, \qquad (1)$$

where A_i is an amplitude (half) of wavelet (axis y), p_i is a half period of the wave (the axis x).

According to the formula (1) with two ***fundamental physical constants****e* (the Neper number or the number of time) and π (the Archimedes number or the number of space), ***a quantized wavelet signal*** is formed from within the phenomenon and/or process under study.

Table 1: Data for the meteorological station of Yoshkar-Ola http://rp5.ru
(Russia, WMO_ID=27485, sampling 22.12.2013 21.12.2014 on all days)

Number in order	Time t, day	Meteorological parameter			
		Air pressure	Temperature	Relative humidity	Temperature dewpoint
1	0.042	747.7	-2.5	91	-3.8
2	0.167	746.5	-2.7	91	-4.0
3	0.292	745.9	-2.9	95	-3.6
4	0. 417	746.2	-2.9	95	-3.6
5	0.542	746.5	-3.4	92	-4.5
...	...	...	...	...	...
2913	364.5	738.8	1.5	91	0.1
2914	364.625	739.9	1.4	85	-0.8
2915	364.75	740.6	0.9	85	-1.4
2916	364.875	736.8	0.4	96	-0.2
2917	365	741.1	0.6	86	-1.2

The concept of wavelet signal allows us to abstract from the physical meaning of many statistical series of measurements and consider their additive decomposition into components in the form of a sum of individual wavelets.

A signal is a material carrier of information. And we understand information as ***a measure of interaction***. A signal can be generated, but its reception is not required. A signal can be any physical process or part of it. It turns out that the change in the set of unknown signals has long been known, for example, through the series of three-hour meteorological measurements. However, there are still no statistical models of both dynamics and mutual connection between the four weather parameters at this weather station.

The trend is formed under the condition that the period of oscillation a_{5i} tends to infinity. Most often, the trend is formed from two members of the formula (1).

All models in this paper have been identified in the special case when $a_2 = 0$, by a two-term formula

$$y = aexp\left(-bx^c\right) + dx^e \exp(-fx^g), \tag{2}$$

where y – the dependent measure, x – influencing variable, a–g – model parameters (2) identified in the software environment CurveExpert-1.40.

Table 2 shows ***the correlation matrix*** of binary links and the rating of four factors obtained by the method of identification (Mazurkin, 2014) according to Table 1. In our example, in the diagonal cells we put the correlation coefficient of the trend on the dynamics models from 22.12.2013 to 21.12.2014.

Table 2: Correlation matrix of factor analysis and
rating of factors after identification by trend pattern (2)

Influencing factors (Characteristic x)	Dependent factors (indicators y)				Sum Σr	Place I_x
	T, ^0C	P_0, mm Hg	U, %	T_d, ^0C		
Air temperature T, ^0C	0.8633	0.3804	0.5576	0.9380	2.7393	1
Atmospheric pressure P_0, mm hg	0.3092	0.2872	0.0855	0.3627	1.0446	4
Relative humidity U, %	0.5033	0.1127	0.5614	0.2564	1.4338	3
Dewpoint temperature T_d, ^0C	0.9227	0.3882	0.0636	0.8220	2.1965	2
Sum Σr	2.5985	1.1685	1.2681	2.3791	7.4142	-
Place I_y	1	4	3	2	-	0.4634

The coefficient of correlation variation, that is a measure of the functional relationship between the parameters of the system (weather at the weather station), is equal to $7.4142/4^2 = 0.4634$ which is more than 0.3018 for a seven-year period. As an influencing variable and dependent indicator on the first place was the meteorological parameter "Air temperature", on the second – "Dew point temperature" and on the third place - "Relative humidity".

In total, two strong regularities were obtained according to the formula (2) with a mutual relationship between temperatures with a correlation coefficient of at least 0.7.

4 Factor analysis by wave equation identification

At the information technology level, the 23rd Hilbert problem (development of methods of variational calculus) was solved by us (Mazurkin, 2014).

At the same time, ***the variation of functions*** is reduced to the conscious selection of stable laws and the construction of adequate stable laws on their basis. We adhere to the concept of Descartes on the need to apply an algebraic equation of a General form directly as a finite mathematical solution of unknown differential or integral equations. For this purpose, a new class of wave functions (1) was proposed.

The concept of oscillatory adaptation in nature assumes that there are dependencies in the form of wave equations between the factors selected in Table 1. However, it turned out that there is no wave connection between these four factors, which indicates the presence of a sufficiently strong quantum entanglement of meteorological data.

If the residues after the wavelet analysis are not further modeled, then experts say about some noise. But we believe that noise can be called only such residues that are equal to or less than the measurement error. Therefore, part of the noise exceeding the measurement errors in binary relations should be attributed to quantum entanglement. And the share of parameter values determined by the revealed regularities should be attributed to quantum unraveling.

For the dynamics we managed in the software environment CurveExpert-1.40 (URL: http://www.curveexpert.net) identify the second wavelet (Table 3).

Table 3: Correlation matrix of factor analysis and factor rating after trend identification (2) for binary relations and two wavelets (1)

Influencing factors(characteristic x)	Dependent factors (indicators y)				Sum Σr	Place I_x
	T, ^0C	P_0, mm Hg	U, %	T_d, ^0C		
Air temperature T, ^0C	0.9162	0.3804	0.5576	0.9380	2.7922	1
Atmospheric pressure P_0, mm Hg	0.3092	0.6776	0.0855	0.3627	1.4350	4
Relative humidity U, %	0.5033	0.1127	0.7373	0.2564	1.6097	3
Dew point temperature T_d, ^0C	0.9227	0.3882	0.0636	0.8928	2.2673	2
Sum Σr	2.6514	1.5589	1.4440	2.4499	8.1042	-
Place I_y	1	3	4	2	-	0.5065

The coefficient of correlative variation increased to $8.1042/16 = 0.5065$, which is more than 0.4583 for a seven-year data set. At the same time, the rating of factors changed only for dependent indicators: air pressure became the third. The dynamics of the parameters is identified before the measurement error, and the number of members of the model can reach several tens. Therefore, in the diagonal cells of table 3, we can put the correlation coefficient 1. But the correlation coefficients of binary relations will not change. Then the coefficient of correlation variation will reach $8.8803/16 = 0.5550$. Quantum entanglement data array in able 1 is equal to $1 - 0.5550 = 0.4450$.

5 Regularities of the dynamics of air pressure

We take dynamic models containing four terms (two for trend and two asymmetric wavelets). As a rule, the models of any dynamics can be brought to a finite set of wavelet signals by the identification method. The criterion for stopping the identification process is only the measurement error. Each wavelet becomes a separate quantum of behavior (the structure of macro-objects in comparison with their behavior can be assumed constant). For example, the average air temperature in Central England for 1659-2017 years according to Hadley Centre

Central England Temperature (HadCET) to the measurement error $\mp 0.05^0 C$ is characterized by a set of 188 wavelets.

Table 4: The parameters of the models (1) the dynamics of air pressure on 22.12.2013 at 21.12.2014

Number i	Wavelet $y_i = a_{1i}x^{a_{2i}} \exp(-a_{3i}x^{a_{4i}}) \cos(\pi x/(a_{5i} + a_{6i}x^{a_{7i}}) - a_{8i})$								Coef. Cor. r
	The amplitude (half) the fluctuations				The half-period of oscillations			Shift	
	a_{1i}	a_{2i}	a_{3i}	a_{4i}	a_{5i}	a_{6i}	a_{7i}	a_{8i}	
1	738.14195	0	0.010570	0.70779	0	0	0	0	0.6776
2	15.44367	0.54610	0	0	0	0	0	0	
3	-1.40325	0.89918	0.028576	1	21.09724	-0.059204	1	-2.45480	
4	-0.37997	0.46945	0	0	16.48322	0.022579	1.00290	2.43588	
5	-2.49191	0	0	0	45.74785	0	0	0.21616	0.3062
6	-0.20929	1.32384	0.032236	1.03057	6.48371	-0.00019228	1.49276	-2.24131	0.3326
7	1.41824	0	-2.05606e-5	1.84981	10.74999	-6.03524e-5	1	3.20725	0.3241
8	0.14268	0.50149	0	0	7.68535	0.15373	0.19509	-0.69539	0.2807
9	1.88647	0	0.00088457	1	99.01833	-0.13617	0.94903	0.022215	0.2437
10	2.86962	0	0.0084019	1	4.01732	0	0	-0.16695	0.1798
11	-4.16447e-7	4.11079	0.013255	1.17996	7.75720	-0.0020526	1.01708	-1.89061	0.2707
12	-0.0012181	2.43264	0.033951	1.00857	29.36251	0.015225	1.07225	3.03426	0.2437
13	0.13183	0.49641	0	0	8.39726	0.0065835	1.12772	-0.55428	0.2987
14	-1.86467e-8	4.49292	0.019959	1.05206	9.90102	-0.0047687	0.86494	1.18621	0.2540

14 members of the model (1) were accepted for all meteorological parameters. As already mentioned, the wavelet analysis can be continued until the measurement error is reached. Therefore, the correlation coefficient of dynamic models can approach 1. But to package all wavelets, we need a new software environment for our scenarios of the method of identification of equation (1).

The adequacy of the model (1) according to table 5 by four terms is equal to the correlation coefficient 0.6776 (Fig. 1) what's more with 7-year data.

Further in the article we analyze only the first four terms of the model (1).

The first term according to the modified Laplace law (Mazurkin, 2014) shows a decrease in air pressure from the beginning of the year to its end. But the second term according to the law of exponential growth shows an increase in air pressure. As a result, two oppositely directed forces act on the change of pressure in the dynamics of three-hour changes during the year. And two wavelets counteract the growth of air pressure.

From the values of half-period oscillations is seen that the third member is the oscillation cycle 21.09724 × 2 ≈21.2 days, while the period of fluctuations during the year reduced. The second wavelet on 22.12.2013 had a period of oscillation of $16.48322 \times 2 \approx 33.0$ days and in the future it increases.The ninth member has a starting value on 22.12.2013 for almost 200 days, and then increases until the end of the year.

The graphs in Fig. 1 show that the first wavelet in amplitude is significant up to the summer equinox, and a strong pressure fluctuation can excite plants to ontogenesis, and the second wavelet increases the amplitude until the end of the year. When exceeding a certain amplitude plants shed their leaves.

6 Regularities of air temperature dynamics

Four members of the air temperature (Table 5) have the highest correlation coefficient 0.9162 (0.8924 was obtained for seven-year data). Thus, the reduction of the measurement time interval usually increases the adequacy of the model (1). The two forces on the two members of the trend is the opposite. The first term according to the law of exponential growth shows an increase in negative temperatures, that is, it shows an increased impact on the weather of space. And the second term of the trend according to the biotechnical law (Mazurkin, 2014) shows the influence of sunlight during the year. The maximum air temperature is observed near the summer equinox (Fig. 1).

Both wavelets on the sign are aimed at increasing the temperature of the air, which indicates global warming. There are four more such members with a positive sign in table 5. A negative sign in front of the component of the model shows global cooling.

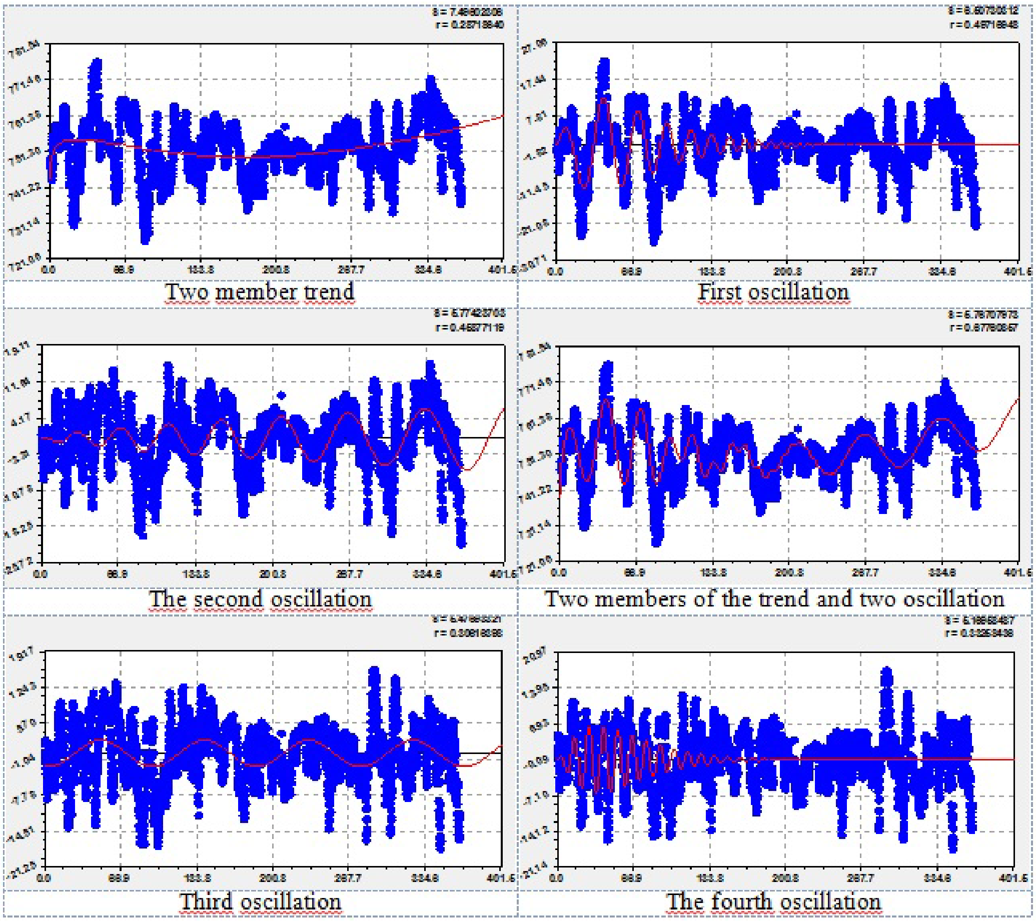

Figure 1: Graphs of six members of the general model (1) air pressure dynamics: S is the variance; r is the correlation coefficient

Table 5: The parameters of the models (1) dynamics of air temperature 22.12.2013-21.12.2014

Number i	Wavelet $y_i = a_{1i}x^{a_{2i}} \exp(-a_{3i}x^{a_{4i}}) \cos(\pi x/(a_{5i} + a_{6i}x^{a_{7i}}) - a_{8i})$								Coef. Cor. r
	The amplitude (half) the fluctuations				The half-period of oscillations			Shift	
	a_{1i}	a_{2i}	a_{3i}	a_{4i}	a_{5i}	a_{6i}	a_{7i}	a_{8i}	
1	-0.00024614	0	-9.96646	0.025224	0	0	0	0	0.9162
2	7.76716e-6	3.57165	0.013939	1.04016	0	0	0	0	
3	258581.26	0	9.07603	0.041716	25.75917	0.024118	1.12438	1.58470	
4	2.14985	0	-0.0011327	1	6.49912	2.59548	0.25744	5.78106	
5	-2.75824	0	-2.85338e-5	1	0.5	0	0	1.07972	0.4090
6	-0.49144	0	-0.0040715	1	7.89075	0.00022325	1.01921	-0.18770	0.1974
7	0.86031	0	-0.0010505	1.09488	13.92372	0.0029063	1.00758	-0.71044	0.2028
8	-0.55478	0.29594	0.0036615	0.99052	9.19755	-4.49232e-5	0.79126	-2.32079	0.2174
9	-0.096836	1.09313	0.087090	0.70019	23.77614	-0.0010413	1.45782	1.87651	0.1857
10	0.14676	1.73926	0.55716	0.47401	5.91474	0.00094407	1.04117	4.29127	0.3822
11	-3.85298e-6	4.02211	0.40883	0.57826	25.58752	0.30173	0.82130	4.02500	0.1691
12	-0.18928	0.63583	0.0073801	0.99346	3.40674	0.00046753	1.01608	-0.29967	0.2507
13	1.62851e-38	28.85755	0.43419	1.03042	2.73459	6.81008e-5	1.51149	1.00912	0.2401
14	1.47577e-8	4.66084	0.044525	0.92652	6.04894	-0.0032240	0.93995	-3.81366	0.2619

At the same time, with a maximum period of about 51.6 days at the beginning of the series in 22.12.2013, the first oscillation shows a sharp drop in air temperature. This decline is dangerous from extreme values of model parameters (1). The second wavelet shows a slow rise in temperature from the beginning to the end of the year. At the same time, the period of both oscillations increases by the end of the year. With a constant daily cycle changes the fifth component. Therefore, the air temperature at intervals of 0.5 days is very important for plant life.

7 Regularities in the dynamics of relative air humidity

Table 6 shows the parameters of 14 members of the model (1), the total correlation coefficient of the first four members is 0.7373, which is greater than the level of adequacy 0.7 for strong bonds. Four graphs are shown in Fig. 3.

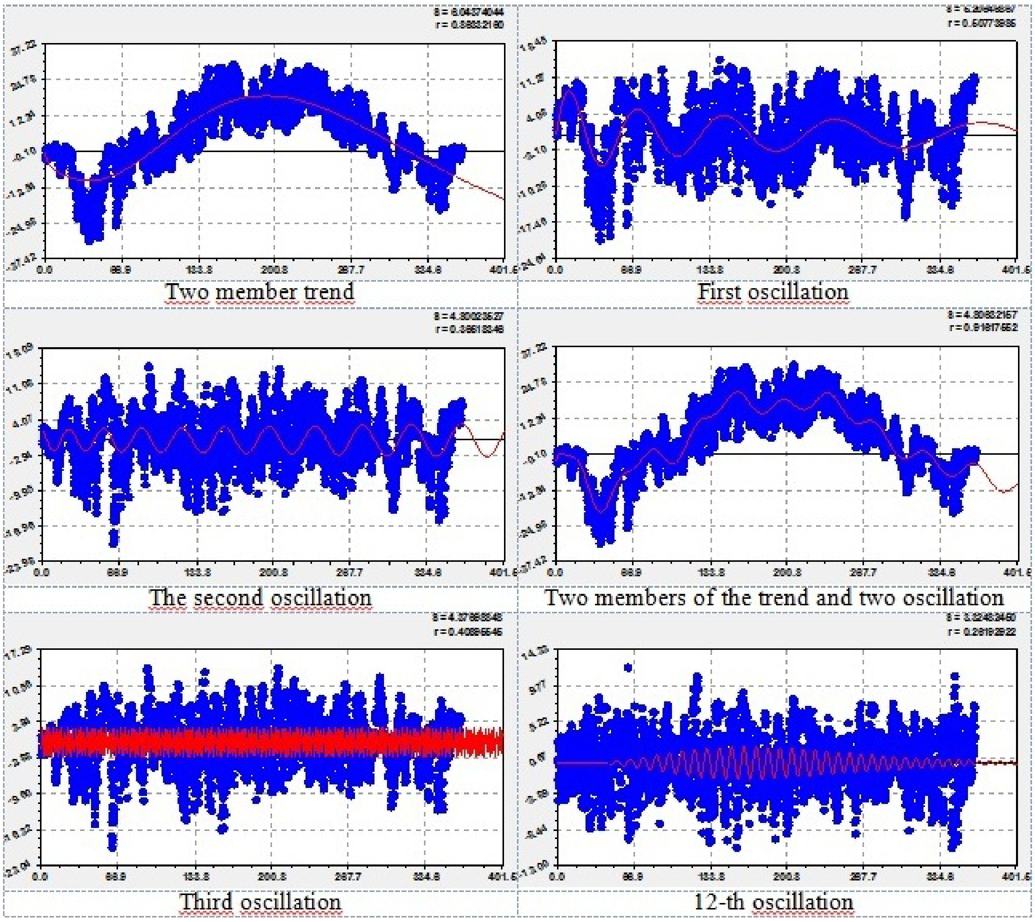

Figure 2: Graphs of the General model (1) air temperature dynamics

Table 6: The parameters of the models (1) the dynamics of relative air humidity

Number i	Wavelet $y_i = a_{1i}x^{a_{2i}} \exp(-a_{3i}x^{a_{4i}}) \cos(\pi x/(a_{5i} + a_{6i}x^{a_{7i}}) - a_{8i})$							Coef. Cor. r
	The amplitude (half) the fluctuations				The half-period of oscillations			Shift	
	a_{1i}	a_{2i}	a_{3i}	a_{4i}	a_{5i}	a_{6i}	a_{7i}	a_{8i}	
1	85.21996	0	8.51493e-5	2.04463	0	0	0	0	0.7373
2	0.066422	1.39731	0.00099654	1.18180	0	0	0	0	
3	5.91701e-6	3.35966	0.0014460	1.43131	0.49992	0	0	1.25151	
4	-3.12674	0	-0.00092870	1	22.24947	-0.0010088	1.34434	-1.25169	
5	-1.99472e-6	3.68488	0.017236	1.06949	10.96725	0.00022044	1.40532	1.29290	0.1780
6	-1.45946e-29	16.78391	0.077431	1.05791	7.36504	-0.00018774	1.32689	-3.21478	0.2113
7	4.20853	0	0.0042281	0.99736	15.01246	-0.00010318	1.35626	-1.31284	0.1513
8	-4.81330e-22	13.70302	0.11426	1.01113	4.80588	0.00022277	1.27581	1.26824	0.1815
9	0.015734	2.80693	0.44465	0.63097	7.18942	-0.10806	0.45460	-3.31478	0.1193
10	-1.31981e-27	16.29224	0.052082	1.16580	3.42391	0.0066358	0.80494	6.26292	0.2177
11	3.29109e-33	21.00719	1.09677	0.65039	64.67062	-0.096337	0.98929	-0.61129	0.2640
12	-0.0025929	2.25217	0.0013689	1.69127	44.00524	0	0	2.02577	0.1565
13	2.99505	0	-0.00064508	0.96716	8.89412	0.010571	0.80799	0.086625	0.2154
14	7.79217	6.96622	0.040106	1.00435	4.57343	0	0	-2.54491	0.0936

The first term is the law of death according to the modified Laplace law, and the second term of the trend is the biotechnical law showing the limit of relative humidity increase after 30.09.2014. The two term trend refers to classical forms according to equation (2).

The third term characterizes the daily fluctuation with a constant period of 0.5 days. And the fourth term inhibits the increase in relative humidity in increasing amplitude (only 6 members

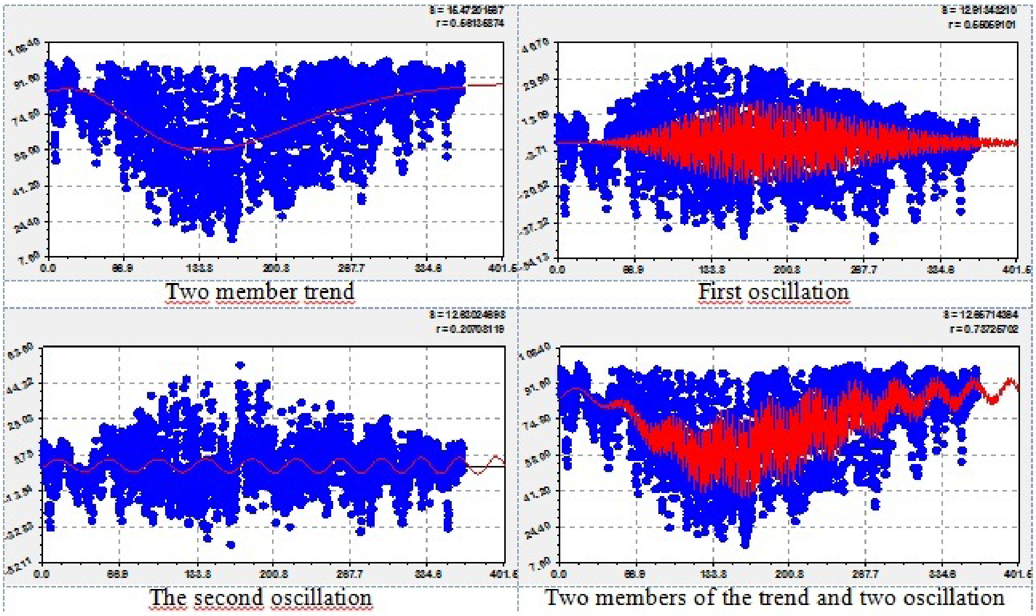

Figure 3: Graphs of the General model (1) relative humidity dynamics

out of 14, reducing the meteorological parameter). The maximum oscillation period of 129.4 days is in the 11th member of the model.

It can be seen from the graphs in figure 3 that in comparison with other factors, relative humidity has a more pronounced amplitude with a daily cycle of changes in the wave of oscillatory perturbation (correlation coefficient 0.5506). Already this fact indicates that the dynamics of relative humidity for plants is more important than the air temperature (in figure 2, the fifth member of the daily temperature fluctuation has a correlation coefficient 0.4090).

The other two meteorological parameters (air pressure and dew point temperature) do not have daily fluctuations. Therefore, plants adapted oscillatory adaptation of ontogenesis to the daily dynamics of relative humidity and air temperature.

As it turned out, humidity has a stronger influence in ontogenesis compared to air temperature (Mazurkin & Kudryashova, 2018a; Mazurkin & Kudryashova, 2015a).To explore their joint influence on the ontogeny of the leaves need not two, but three-factor modeling.

8 Regularities of the dynamics of the dew point temperature

With a correlation coefficient of 0.8928 (Table 7) for the first four members of the model (1), this meteorological parameter has a controversial effect throughout the year. The first term, as for air temperature, has a negative sign and therefore shows the effect of space.

Thus, the first term of the trend shows the influence of space (global cooling). A second member of the biotechnical law gives stress excitation of meteorological parameters due to the growth of sunlight to the summer equinox (Fig. 4).

The third term gives a jerk of the oscillatory perturbation of the dew point temperature in the first 100 days. It may turn out that this almost symmetrical wavelet gives plants a signal to prepare for the ontogenesis of leaves. this tremor occurs with a growing period of 41.4 days on 22.12.2013. moreover, the first wavelet has a positive effect on the growth of the dew point temperature. And the second wavelet is negative for growth. The period of fluctuation at the beginning of the year is almost 69 days.

The minimum at the beginning of the year half-period of oscillation of 14 members of the model (1) is 3.44 days for the 11th member. This is a weekly cycle of dew point temperature change.

Table 7: The parameters of the models (1) the dynamics of the dew point temperature

Number i	Wavelet $y_i = a_{1i}x^{a_{2i}} \exp(-a_{3i}x^{a_{4i}}) \cos(\pi x/(a_{5i} + a_{6i}x^{a_{7i}}) - a_{8i})$							Coef. Cor. r
	The amplitude (half) the fluctuations				The half-period of oscillations		Shift	
	a_{1i}	a_{2i}	a_{3i}	a_{4i}	a_{5i}	a_{6i}	a_{7i}	a_{8i}	
1	-0.18936	0	-2.81878	0.098966	0	0	0	0	0.8928
2	1.39050e-5	3.04791	0.00017347	1.70345	0	0	0	0	
3	0.00012540	4.87970	0.20548	0.92861	20.69567	0.0034076	1.81081	1.95676	
4	-0.0030764	0	-0.022258	1	34.47307	-0.025187	1.01282	-1.37549	
5	0.013693	1.66468	0.11350	0.68263	14.55722	0.041216	0.089847	-0.62478	0.2125
6	-1.44015	0	0.00014723	1.50466	20.71200	-0.073479	0.61114	-2.24882	0.1623
7	0.34100	0.82842	0.015307	0.99488	5.95628	0.0010119	1.00723	-2.03789	0.3647
8	-0.010127	1.30923	0.074108	0.56678	22.60526	0.040146	1.03313	0.22750	0.3570
9	1.58968e-5	2.52925	0.012189	0.99300	19.07206	0.013431	0.98197	2.31115	0.1383
10	-0.00045834	2.74629	0.21063	0.64949	3.52609	0.019512	0.74960	5.98173	0.2456
11	-0.10170	1.00390	0.018188	0.97790	3.43769	0.00026649	1.08059	-0.51632	0.2379
12	0.63980	0	-0.00016586	1.52777	11.65001	0.043959	0.35962	1.90599	0.2515
13	-2.66880e-20	9.59685	0.010742	1.18621	13.00789	-0.0062600	0.96185	-3.46955	0.1851
14	-20263.433	2.99396	12.48694	0.13348	9.96159	-0.00067640	1.22372	2.47789	0.3144

Compared with the air temperature, this meteorological indicator (Fig. 4) obtained a smaller correlation coefficient 0.8928 (for a seven – year array-0.8654 with a strong correlation coefficient of not less than 0.7).

We believed that the temperature of the dew point somehow, in a special way, affects the process of ontogenesis of leaves of woody plants. It may be that this factor strongly affects low-growing plants less than 2 m high, such as leaves of grass and herbaceous plants, as well as shrubs and agricultural plants. However, it turned out that this factor for the assessment of ontogenesis of birch leaves is significant.

9 Binary relations between meteorological parameters

Binary relations, and without any pre - conditions of selection, are necessary to assess the level of adequacy between the accepted factors. Due to the quantum entanglement of the relations between the factors, the wave equations by (1) are not obtained, so the trend model (2) was adopted for identification.

Effect of air pressure. The other three factors are air pressure affected by two members of the formula of the trend (Fig. 5):

- the influence of air pressure on the air temperature for the year 0.3092 is more than 0.2378 in comparison with the data set for seven years, but the design is preserved as an equation

$$T = 0.46454 \exp(0.31813 {P_0}^{0.45214}) - 1.20657e - 10 {P_0}^{4.28906}; \quad (3)$$

- the effect of air pressure on relative humidity has not changed, with a decrease in the correlation coefficient of 0.0855 instead of 0.1407, according to the formula

$$U = 706.36012 \exp(0.00039569 {P_0}^{1.02237}) - 0.62630 {P_0}^{1.20362} \exp(-0.00092486 {P_0}^{0.099548}); \quad (4)$$

- the effect of air pressure on the dew point temperature (0.3627 instead of 0.3081) with the same design of the two trend members

$$T_d = 335.13272 \exp(0.00099963 {P_0}^{0.77356}) - 0.40872 {P_0}^{1.03833}. \quad (5)$$

With increasing air pressure in the surface layer of the atmosphere by the modified Laplace law increases all three meteorological parameters. The second term of all three meteorological parameters is negative, which most indicates the anthropogenic impact of pressure. In this case, the second term for relative humidity receives instead of the indicative law a complete construction in the form of a biotechnical law (Mazurkin, 2014).

Effect of air temperature. Fig. 6 shows the effect graphs.

The graphs of the left column with quantum certainty (unraveling) are characterized by equations (with the invariance of the structure of the equations):

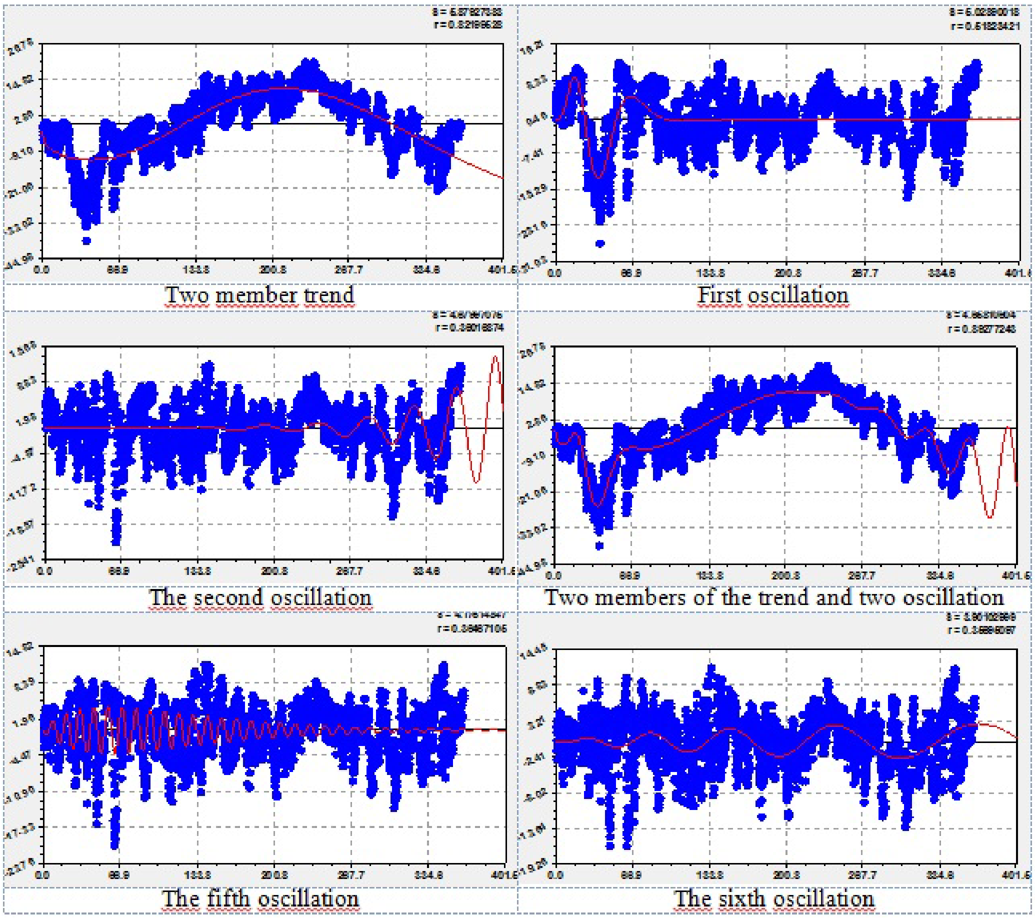

Figure 4: Graphs of the general model (1) dynamics of the temperature of the dew point of the air

- air temperature effect on air pressure (0.3804 instead of 0.3315)

$$P_0 = 756.10486\exp(0.0059889(T+50)^{0.49581}) - -0.017104(T+50)^{2.23702}\exp(-0.0080338(T+50)^{1.25520}); \quad (6)$$

- effect of air temperature on relative humidity (0.5576 instead of 0.5267 for seven years of data)

$$U = 72.13535\exp(9.55678e-5(T+50)^{1.99403}) - 4.46355e-8(T+50)^{4.92090}; \quad (7)$$

- the effect of air temperature on dew point temperature (0.9380 instead of 0.9485, that is, due to annual cycles of seven years, the data is better)

$$T_d = -37.10235\exp(0.015626(T+50)^{1.06994}) + 0.18545(T+50)^{1.60939}. \quad (8)$$

Because of the negative temperature values, the abscissa axis was shifted by 50 ^{0}. Or it was necessary to switch to the absolute scale in Kelvin.

Effect of relative humidity. This effect is shown by the graphs in Fig. 7, which were identified by equations of the form, and without changing the design of the two trend members:

- effect of relative humidity on air pressure (for one year of data 0.1127 instead of 0.1859 due to exclusion of one year of cycle)

$$P_0 = 751.18725\exp(6.28528e-6U^{1.92882}) - 0.00063005U^{2.37758}; \quad (9)$$

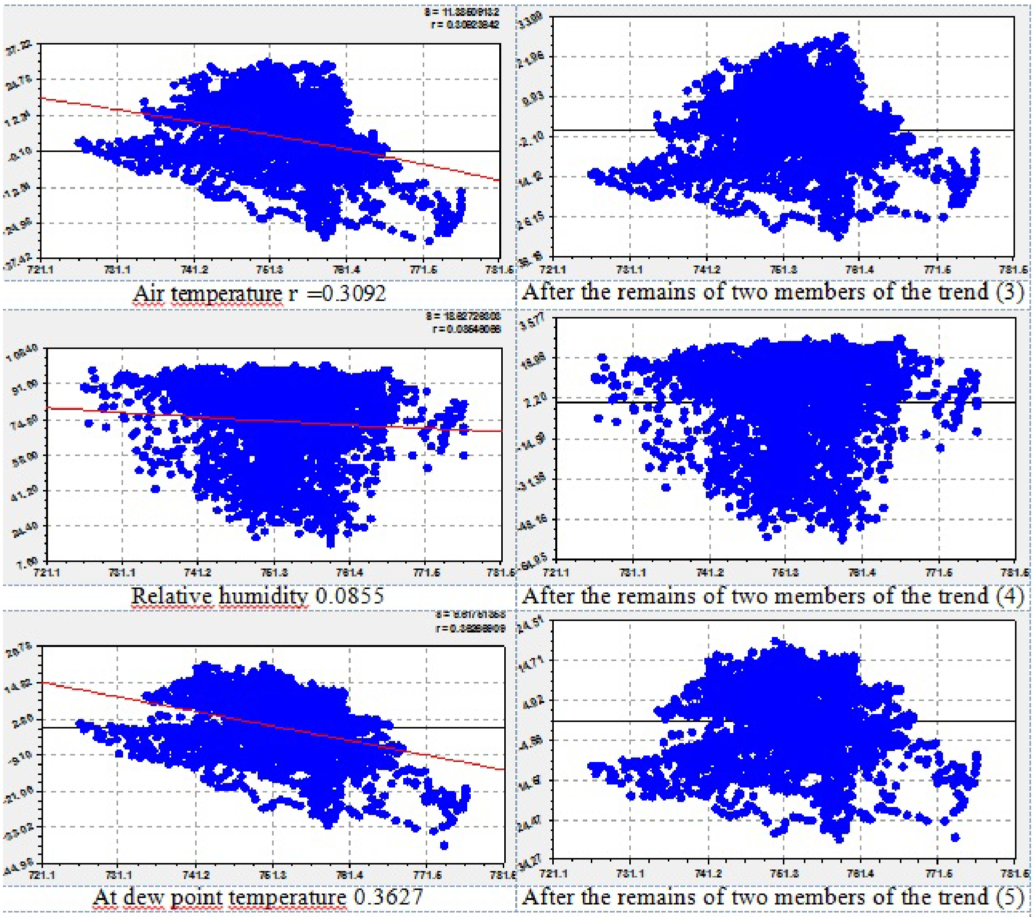

Figure 5: Effect of air pressure on other meteorological parameters: left column – trend charts; right column-trend balances

- effect of relative humidity on air temperature (0.5533 instead of 0.4490 due to reduction to a year instead of seven years)

$$T = 11.68930\exp(0.063240U^{0.85042}) - 0.0066400U^{2.30492}; \quad (10)$$

- the influence of relative humidity on the dew point temperature (0.2564 instead of 0.1853 due to increased certainty for a particular year)

$$T_d = 0.0057330\exp(2.28644U^{0.934241}) - 4.60364U^{3.44464}. \quad (11)$$

Table 8: Limit values of meteorological parameters at zero values of influencing variables by equations (3-14)

Influencing factors (characteristic x)	Dependent factors (indicators y)			
	P_0, mmHg	T, ^0C	U, %	T_d, ^0C
Pressure $P_0 = 0$ mmHg	-	0.46	706.36	335.13
Temperature $T = -50^0C$	756.10	-	72.14	-37.10
Relative humidity $U = 0\%$	751.19	11.69	-	0.01
Dew point temperature $T_d = -50^0C$	774.47	-34.56	70.15	-

The design of the models for all three meteorological parameters is the same: the first term of the trend is the law of exponential growth modified by us, and the crisis growth of the indicator the second term shows the growth according to the exponential law.

Influence of dew point temperature. Other meteorological parameters (Fig. 8) the dew point temperature is influenced by the formulas:

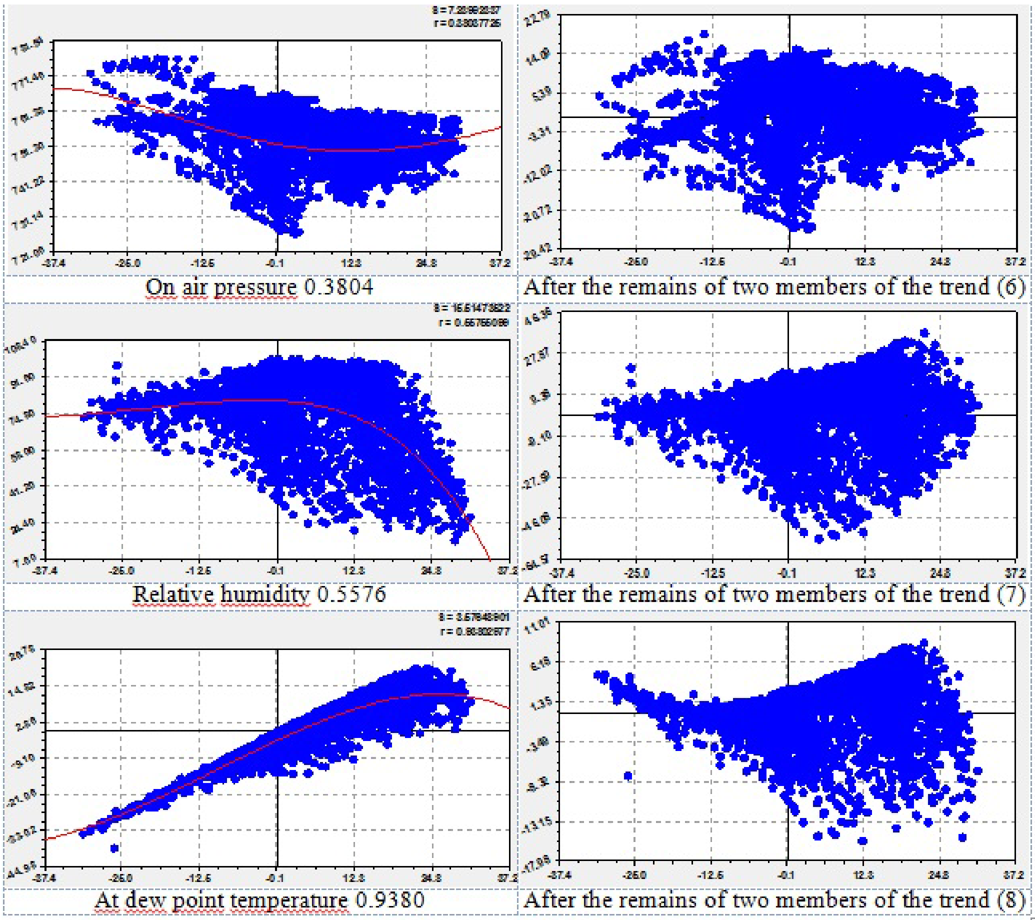

Figure 6: The influence of air temperature and other meteorological parameters: left column – trend charts; right column-trend balances

- dew point temperature effect on air pressure (0.3882 for year instead of 0.3520 for seven years)

$$P_0 = 774.47201 \exp(-2.7831‘6e - 5(T_d + 50)^{1.61439}) - \\ -0.0046218(T_d + 50)^{2.54416} \exp(-0.0048181(T_d + 50)^{1.56307}). \qquad (12)$$

- influence of dew point temperature on air temperature (0.9227 instead of 0.9373 due to exclusion of annual cycles)

$$T = -34.56289 \exp(0.0079639(T_d + 50)^{1.18655}) + 0.17307(T_d + 50)^{1.58142}; \qquad (13)$$

- influence of dew point temperature on relative humidity (0.0636 0.0735 also due to exclusion of annual cycles)

$$U = 70.14890 \exp(0.0079852(T_d + 50)^{0.84610}) - 0.017214(T_d + 50)^{1.69800}; \qquad (14)$$

Here, too, the design of the model has not changed, and the origin of the temperature is shifted to the left by 50^0C.

The dew point affects in a complex way. With its increase, the air pressure on both members decreases. And the air temperature increases significantly. In a certain range of dew point temperature relative humidity remains almost constant, but the certainty of such a conclusion is only 0.0636. Therefore, the maximum quantum entanglement is observed under the influence of the dew point temperature on the relative humidity.

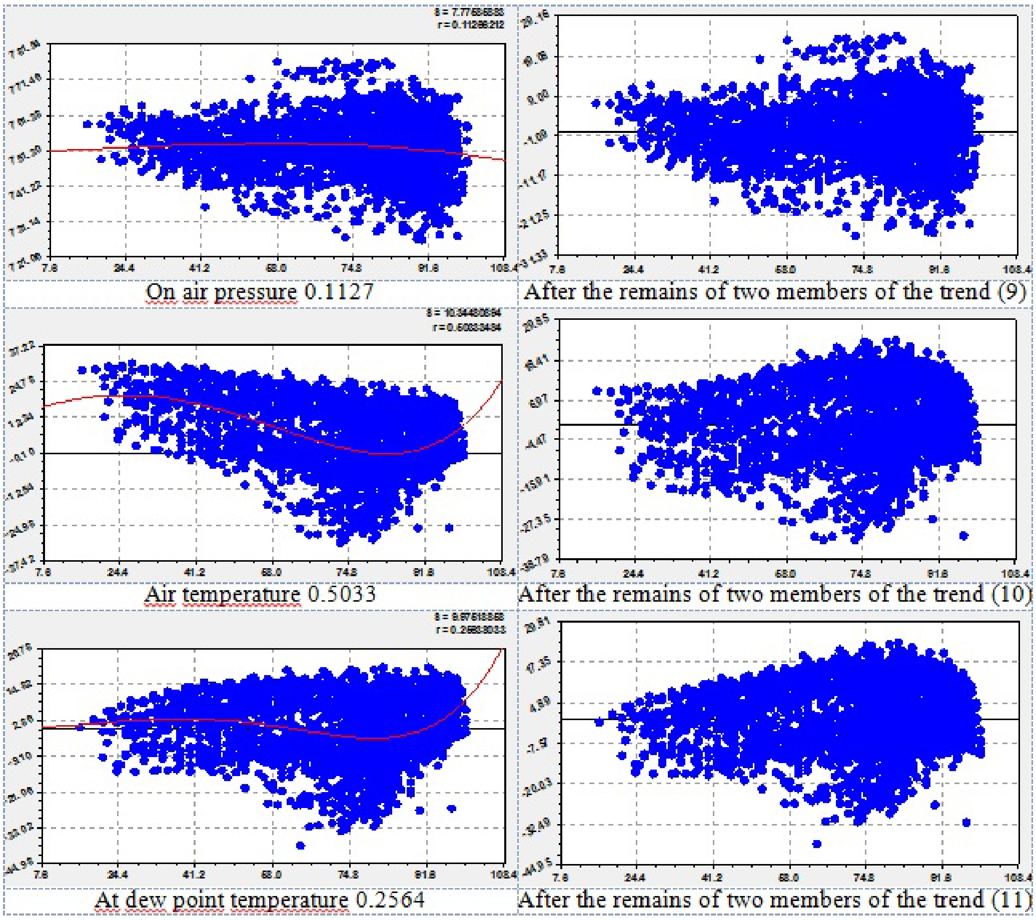

Figure 7: Influence of air humidity on other meteorological parameters: left column – trend charts; right column-trend balances

At zero values of the influencing variables according to the previous formulas, we obtain the limit theoretical values of the dependent indicators (Table 8).

From the data in Table 8 it can be seen that the most dangerous is the change in air pressure to zero. The atmosphere will be at an extremely high humidity of 706.36 %.In this case, there is a disproportion between the air temperature and the dew point temperature. Therefore, we believe that in every geographical point of the earth's land at weather stations it is necessary to pay close attention to the air pressure drops.

10 Quantum entanglement between meteorological parameters

In figures 5-8 quantum entanglement is characterized by residues in the second column of the graphs. The correlation coefficient of quantum entanglement is determined by the expression 1-r (Table 9).

We introduce a new concept – ***quantum unraveling***, which shows the adequacy of the detection of mathematical regularities in the form of wavelet signals. Therefore, the adequacy of quantum unraveling is characterized by the same value of the correlation coefficient, which was obtained during the application of the method of identification of asymmetric wavelets.

To characterize a part of the system of meteorological parameters on binary relations (interaction quantum), we introduce a new statistical indicator – ***the coefficient of correlative variation of quanta.*** For quantum unraveling in Table 9, it will be 0.4067. At the same time, for seven-year data, this figure is 0.3897. Then it turns out that for three-hour observations it is necessary to take one year between December solstices. And for long-term three-hour data it is necessary to come up with a method of data reduction.

Table 9: The values of correlation coefficients according to equations (3-14)

Influencing factors (characteristic x)	Dependent factors (indicators y)	Correlation coefficient quantum behavior	
		unraveling	entanglement
Pressure P_0, mmHg	Temperature T, ^0C	0.3092	0.6908
	Relative humidity U,%	0.0855	0.9145
	Dew point temperature T_d,^0C	0.3627	0.6373
Temperature T,^0C	Pressure P_0, mmHg	0.3804	0.6196
	Relative humidity U,%	0.5576	0.4424
	Dew point temperature T_d,^0C	0.9380	0.062
Relative humidity U,%	Pressure P_0, mmHg	0.1127	0.8873
	Temperature T,^0C	0.5033	0.4967
	Dew point temperature T_d,^0C	0.2564	0.7436
Dew point temperature T_d,^0C	Pressure P_0, mmHg	0.3882	0.6118
	Temperature T,^0C	0.9227	0.0773
	Relative humidity U,%	0.0636	0.9364
The sum of the correlation coefficients		4.8803	7.1197
The correlative coefficient of variation of quanta		0.4067	0.5933

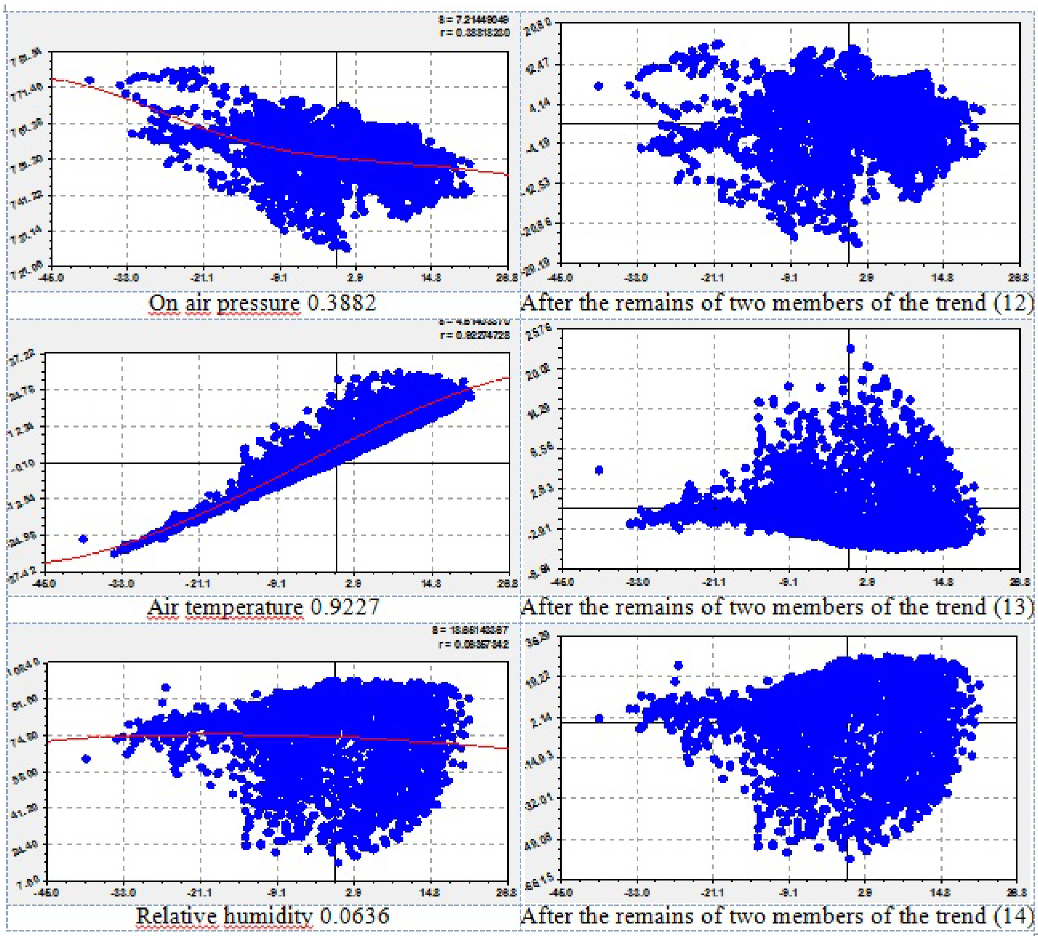

Figure 8: The influence of the dew point temperature meteorological parameters: left column – trend charts; right column-trend balances

In the simplest case, the sides along the abscissa and ordinate axes of a rectangle describing a swarm of points become the boundaries of the residuals on the graphs in figures 5-8. From figures 5-8 it can be seen that the swarms of points have a complex shape.

Coordinates of the centers of the remnants of the swarm can be adopted an arithmetic average of the values on the abscissa and the ordinate. There may be special centers for fashion and other statistical indicators of the sample.

11 Conclusions

Since the winter solstice is in the Northern hemisphere begins the annual revival of nature. Three-hour measurements of meteorological parameters on an array of 2917 lines from 22.12.2013 to 21.12.2014 allowed to identify models (1) and (2) in the software environment CurveExpert-1.40.Then there will be an opportunity of annual comparison of the revealed regularities.

The coefficient of correlation variation for 2,917 rows of four meteorological parameters increased to 0.5065, which is more than 0.4583 for a seven-year data array.The ranking of the factors changed only for dependent parameters: the air pressure was the third. The dynamics of the parameters is identified before the measurement error, and the number of members of the model can reach several tens. But the correlation coefficients of binary relations will not change.

14 members of the model (1) were accepted for all meteorological parameters. The article analyzed the first four terms.

For the dynamics of air pressure, the first term according to the modified Laplace law shows a decrease from the beginning of the year to its end. But the second term according to the law of exponential growth shows an increase in air pressure. As a result, two oppositely directed forces act on the change of pressure in the dynamics of three-hour changes during the year. And two wavelets counteract the growth of air pressure. The period of oscillations of the third member in the beginning of the year is equal to 21.2 days for the year is reduced. The second wavelet on 22.12.2013 had a period of 33.0 days and in the future it increases. The ninth member has a maximum of almost 200 days and then rises to the end of the year. The first wavelet in amplitude is significant up to the summer equinox.

For the dynamics of air temperature, the two forces are opposite. The first term according to the law of exponential growth shows an increase in negative temperatures, that is, an increased influence on the weather of space. And the second term of the trend according to the biotechnical law shows the influence of sunlight during the year. The maximum air temperature is observed near the summer equinox. In this case both the wavelet at a sign aimed at the growth temperature, indicating global warming. A negative sign in front of the component of the model shows global cooling.

For the dynamics of relative air humidity, the first term is the law of death according to the modified Laplace law, and the second term of the trend is the biotechnical law showing the limit of increase. The third term characterizes the daily fluctuation with a constant period of 0.5 days. The maximum oscillation period of 129.4 days is in the 11th member of the model.

In comparison with other factors, relative humidity has a more pronounced amplitude with a daily cycle of changes in the wave of oscillatory perturbation. The dynamics of relative humidity for plants is more important than air temperature. The other two meteorological parameters (air pressure and dew point temperature) do not have daily fluctuations. Therefore, plants adapted oscillatory adaptation of ontogenesis to the daily dynamics of relative humidity and air temperature.

For the dynamics of the dew point temperature, the first term, as well as for the air temperature, has a negative sign and therefore shows the effect of space (global cooling). And the second member of the biotechnical law gives the growth of the meteorological parameter due to sunlight to the summer equinox. The third term gives a jerk of the oscillatory perturbation of the dew point temperature in the first 100 days. Tremor occurs with a growing period of 41.4 days on 22.12.2013. moreover, the first wavelet has a positive effect on the growth of the dew point temperature. And the second wavelet is negative for growth. The period of fluctuation at the beginning of the year is almost 69 days. The minimum at the beginning of the year half-period of oscillation of 14 members of the model (1) is 3.44 days for the 11th member. This is a weekly cycle of dew point temperature change.

The quantum certainty of binary relations is different.

With increasing air pressure in the surface layer of the atmosphere by the modified Laplace law increases all three meteorological parameters. The second term for all three meteorological parameters is negative. Thus the second term for relative humidity receives instead of the indicative law a full design in the form of the biotechnical law. Because of the negative temperature values, the abscissa axis was shifted by 50 ^0C. Or it was necessary to switch to the absolute scale in Kelvin.

For the influence of relative humidity, the design of the models for all three meteorological parameters is the same: the first term of the trend is the law of exponential growth, and the crisis second term shows the growth according to the exponential law. The dew point affects in a complex way. With its increase, the air pressure on both members decreases. And the air temperature increases significantly. In a certain range of dew point temperature relative humidity remains almost constant.

A new concept is introduced – ***quantum unraveling***, which shows the adequacy of revealing mathematical regularities in the form of wavelet signals. To characterize a part of the system of meteorological parameters on binary relations (interaction quantum), a new statistical indicator is introduced – ***the coefficient of correlative variation of quanta***. For quantum unraveling it is equal 0.4067. For seven-year data, it is 0.3897. Then it turns out that for three-hour observations it is necessary to take one year between December solstices.

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