DATA PROCESSING AND MATRIX DESCRIPTION OF MONITORING RESULTS FOR ASSESSMENT OF NATURAL AND CLIMATIC CHANGES

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The spatial organization of the climate system

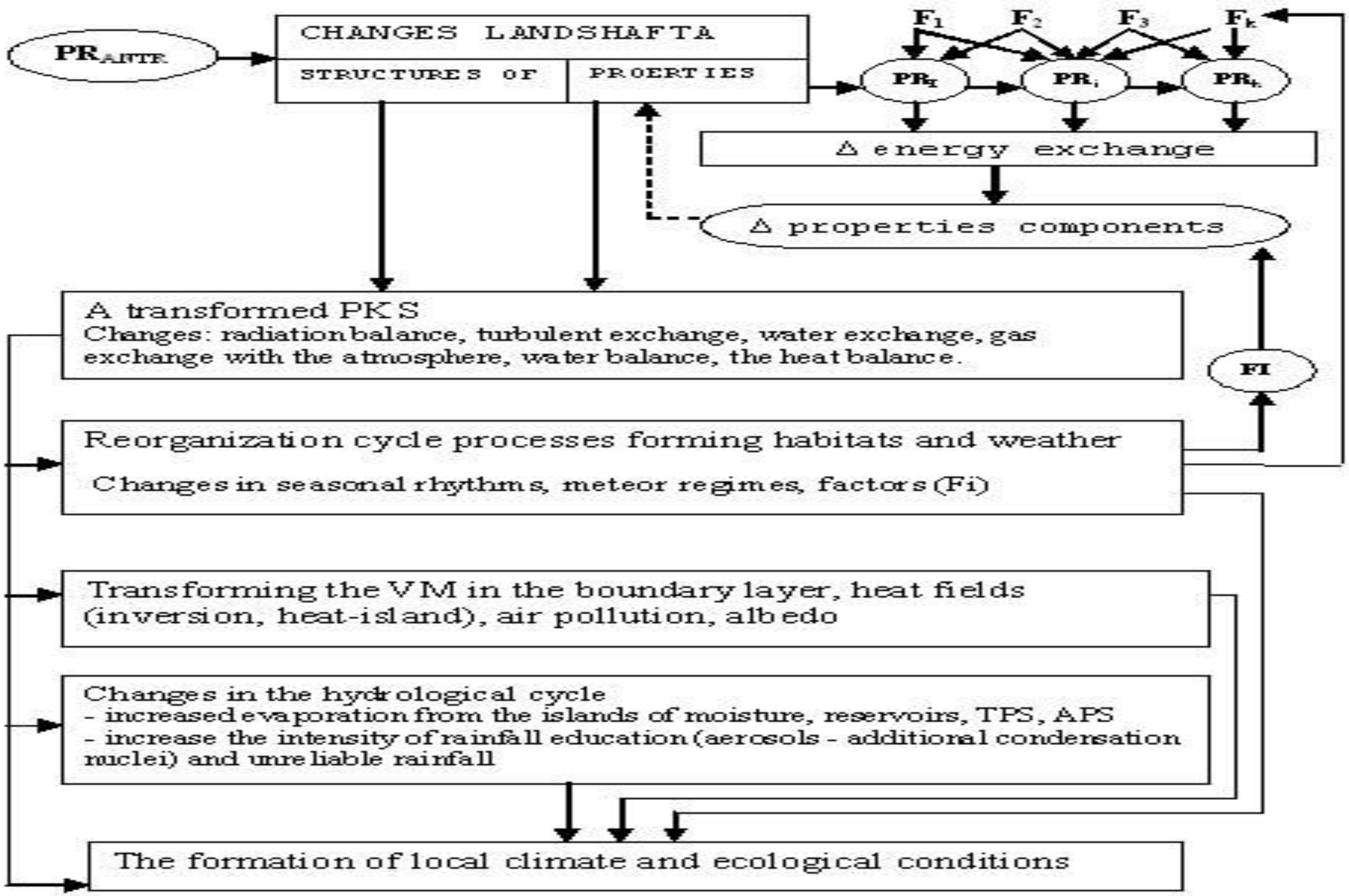
Global factors and mechanisms of climatic changes

- The planetary mechanism of redistribution of energy and direction of movement of air weights at interactions AAC and the connected transformations thermal and baric fields.
- A mechanism of change of energy conversion and energy-mass transfer cycles at transformations of relations in the ocean-cryosphere-atmosphere-land system.
- An increase atmospheric humidity under influence of tidal forces.
- The expansion of a zone of a high pressure, aggravation of high-altitude zone circulation and cyclogenesis.
- A mechanism of oceanic mass circulation in the Arctic Basin and restructuring baric systems
- A mechanism of dynamic changes of a multiregime process of the weather formation based on the reorganization of energy conversion processes in the surface ECS at change of a media properties and conditionally reversible transformation of relations between elements.
- Relations between Atmospheric Action Centers (AAC) have significant influence on energy-mass transfer through the circulation mechanism.

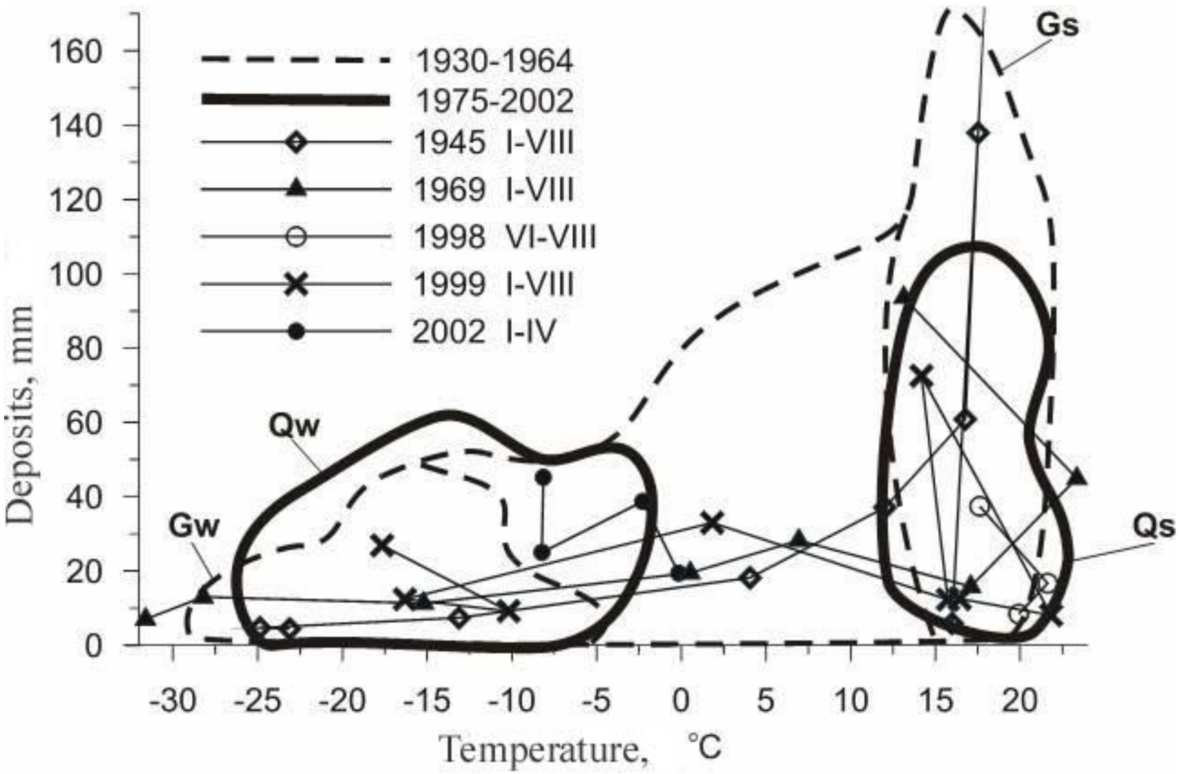
Estimation of variability limits of average annual temperature for regions

Stages	1881 -1913	1914-1950	1951-1968	1968-1977	1978-1994	1995-2001	2002-2010
Tr.-Scatto		1.7÷4.2	1.4÷3.9	1.4÷4.0	1.8÷3.9	2.7÷3.7	**2.3**÷**4.4**
Haparanda	-2.3÷2.4	-0.6÷3.7	-1.8÷3.2	-1.5÷3.0	-0.4÷2.9	1.4÷3.1	2.1÷3.6
Vardo	-1.3÷1.8	-0.7÷2.4	-0.2÷2.4	-0.1÷2.3	0.3÷2.9	0.6÷2.7	2.1÷3.1
Wroclaw	7.5÷9.8	6.7÷9.6	6.6÷9.4	6.8÷9.2	7.1÷10.0	7.2÷9.8	8.6÷10.5
Murmansk		-1.5÷**2.3**	-2.5÷1.8	-2.1÷1.4	-1.3÷2.1	0.1÷1.8	0.4÷2.2
Arkhangelsk		-1.3÷3.7	-1.2÷2.8	-1.6÷2.8	-1.0÷3.2	-1.3÷3.0	0.5÷**2.9**
Salekhard	-10.8÷-4.2	-8.3÷**-2.9**	-8.7÷-3.6	-9.0÷-5.3	-8.5÷-3.7	-8.3÷**-2.9**	-7.6÷**-4.1**
Tobolsk	-1.6÷2.4	-1.7÷1.7	-1.8÷2.1	-3.5÷0.9	-0.7÷2.2	-0.9÷2.6	-0.1÷2.6
Kh.-Mansiysk	-3.8÷-0.2	-2.8÷0.3	-3.9÷1.0	-7.9÷0.7	-3.3÷0.6	-2.9÷1.5	-1.9÷**0.8**
Omsk	-1.5÷2.4	-1.5÷2.3	-1.0÷3.1	-2.0÷2.0	0÷3.6	0.3÷3.1	1.1÷3.8
Barnaul	-1.6÷2.8	-0.6÷2.1	-0.1÷3.5	-1.0÷3.0	0.3÷4.3	1.1÷4.3	0.4÷4.9
Turukhansk	-9.9÷-5.2	-8.2÷-5.1	-9.7÷-5.2	-10.0÷-5.2	-8.5÷-3.9	-8.2÷**-3.4**	-8.0÷**-4.1**
Kolpashevo		-3.3÷0.6	-3.5÷0.2	-4.2÷-0.4	-2.3÷1.0	-2.3÷1.1	-2.2÷1.6
Eniseisk	-4.1÷0.5	-3.8÷-0.3	-2.8÷-0.7	-4.4÷-0.6	-3.0÷0.6	**-2.0**÷0.5	**-2.8**÷0.6
Irkutsk	-2.5÷-0.3	-2.7÷0.3	-1.8÷0.6	-1.6÷0.4	-0.5÷1.9	0÷2.3	-0.4÷2.9
Bratsk	-4.1÷-2.1	-3.8÷-0.9	-3.7÷0.1	-3.8÷-0.6	-2.6÷0.7	-1.2÷0.8	**-2.0**÷1.7

The organization of education habitat and climate cycles

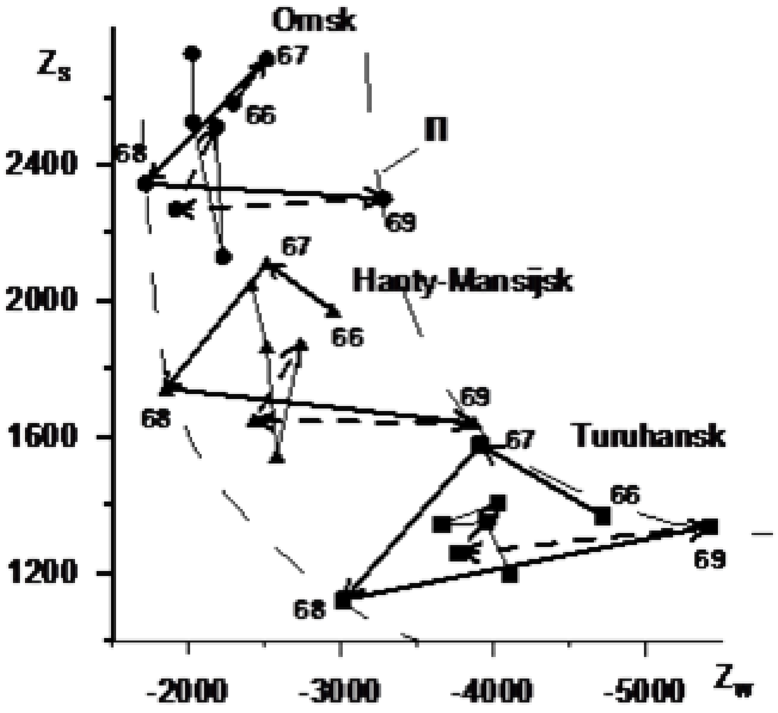


Analysis of changes in regional climate



Changes of the states of taiga climate areas and track of monthly CS state

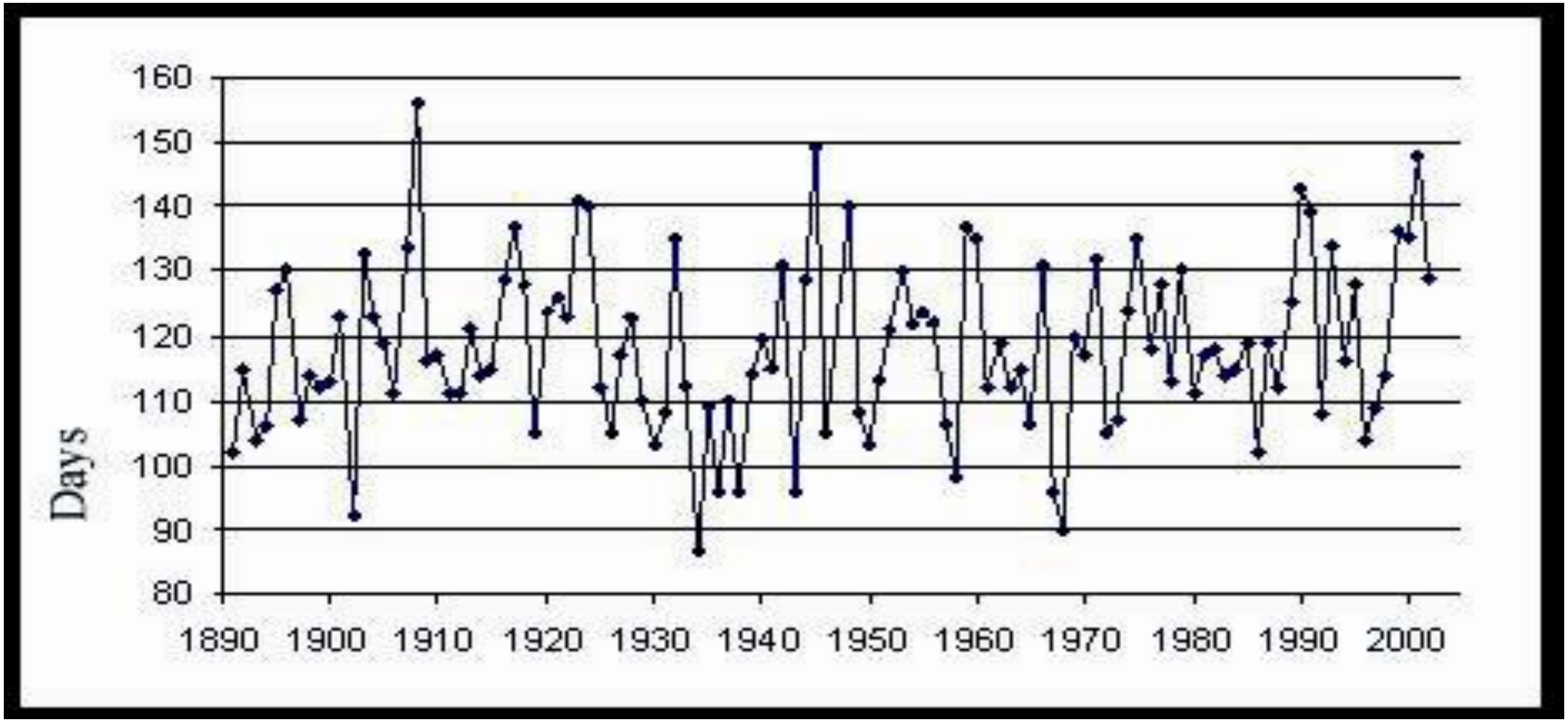
Oscillation of regional climates of Siberia



Mapping of an ensemble of CS states

Single directed changes were in all regions. Arrows show directed changes. CS of all regions made a cycle of transition and return to the initial state (1963-1966 yrs). The profile (Π) of space distribution of estimation functions was conserved during all transitions. Rate of estimation characteristic change was 56 % per year in Tomsk, 68% in Khanty-Mansiysk. Amplitude of oscillation was 154%. A single cycle of climatic mesoscale processes in the single CS of West Siberia.

Change of duration the without frosty period



- Reduction of warm deficit is due to decreased duration of the cold period in the forest-steppe zone (Omsk) in 15-22 days, in the southern taiga subzone (Tomsk) in 13-17 days and in subzone of northern taiga (Khanty-Mansiysk) in 8-12 days due to increase the duration of frost-free period

Empirical informational models

- matrix series of meteorological data and measured parameters
- matrix series of assessment characteristics of climatic and natural conditions;
- matrixes (spatial models with the positional geographical reference) of the state characteristics of climatic systems;
- spatial and temporal geographic models represented by the matrix series of annual (seasonal) sequence states of the geographical area;
- matrixes of the aggregated description of the natural and climatic conditions of the region.

Matrices of seasonal characteristics of climate condition for Tromo-Scatto and Arkhangelsk

YEAR	Tromo-Scatto					Arkhangelsk				
	D-J-F	M-A-M	J-J-A	S-O-N	ANN	D-J-F	M-A-M	J-J-A	S-O-N	ANN
2002	-2,6	3,4	12,2	1,7	3,67	-11,3	0,9	13,4	-1,1	0,46
2003	-3,3	2,9	11,9	3,9	3,86	-13,7	1,9	14,5	3,5	1,55
2004	-3,6	3,4	11,8	3,6	3,79	-9,3	0,7	14,8	2,3	2,13
2005	-0,7	2	11,6	4,7	4,38	-8,7	-0,8	15,4	5,9	2,93
2006	-1,5	1,9	10,4	3,5	3,57	-13,3	0,4	14,3	1,9	0,83
2007	-2,9	2,7	11,6	4,5	3,94	-9,1	3,1	14,7	3.0	2,93
2008	-0,5	0,4	9,8	3,6	3,31	-5,5	-0,5	13,1	3,8	2,73
2009	-2,2	2,1	11,1	3,8	3,68	-8,3	0,2	13,8	3,4	2,28
2010	-4,9	1,5	9,5	3,1	2,3	-14,6	2,3	15,4	1,8	1,23

Aggregation description of regional climate

<table>
<tr><td rowspan="2">Performance characteristics of long-term changes :
• The limits of variability of states
• The mean annual
• Rhythm perennial changes</td><td rowspan="2">Characteristics of annual state:
• Mean annual meteorological values
• Norms matrices
• The amplitudes of the annual cycle
• Extremes</td><td rowspan="2">Estimates of seasonal cold and warm periods:
• The duration
• Integral characteristics (temperature sum, precipitation)</td><td rowspan="2">Estimates of monthly meteorological variables:
•Monthly averages
•Extremes
• Range</td><td colspan="2">Characteristics of</td></tr>
<tr><td>Agroclimate:
• moisture reserves in soil
• temperature regime
• FAR
• characteristics of the growing season
• rhythm hydrothermal conditions</td><td>Biocimate:
• classes weather
• Index volatility
• Lack of heat
• Period of UFD</td></tr>
</table>

Typification of the annual state of the climate on the temperature regime

type A – duration of the warm period T_{WP} =9 months, type B – T_{WP} = 8 months, type C – T_{WP}=7 months,
type D – T_{WP} = 6, type E – T_{WP} = 5 months, type F – T_{WP} = 4 months,

Description of the multi-year rate changes in temperature – sequence of operators **C, C, C, E, D, C…**

Matrix element of the annual state of the climate **Mij** is given

Year	T_Y	P	Z_{WP}	Z_{VP}	T_{VII}	D_W	τ_{CP}	T_W	T_I	C

where rhythm P ={C at T_{WP}=7; D at T = 6};

Z_{WP} – sum of the temperatures of the warm period Z; D_W – deficit temperatures ;

Z_{VP} - sum of the temperatures of the growing season

Empirical date sourse: http://data.giss.nasa.gov/gistemp/station_data/

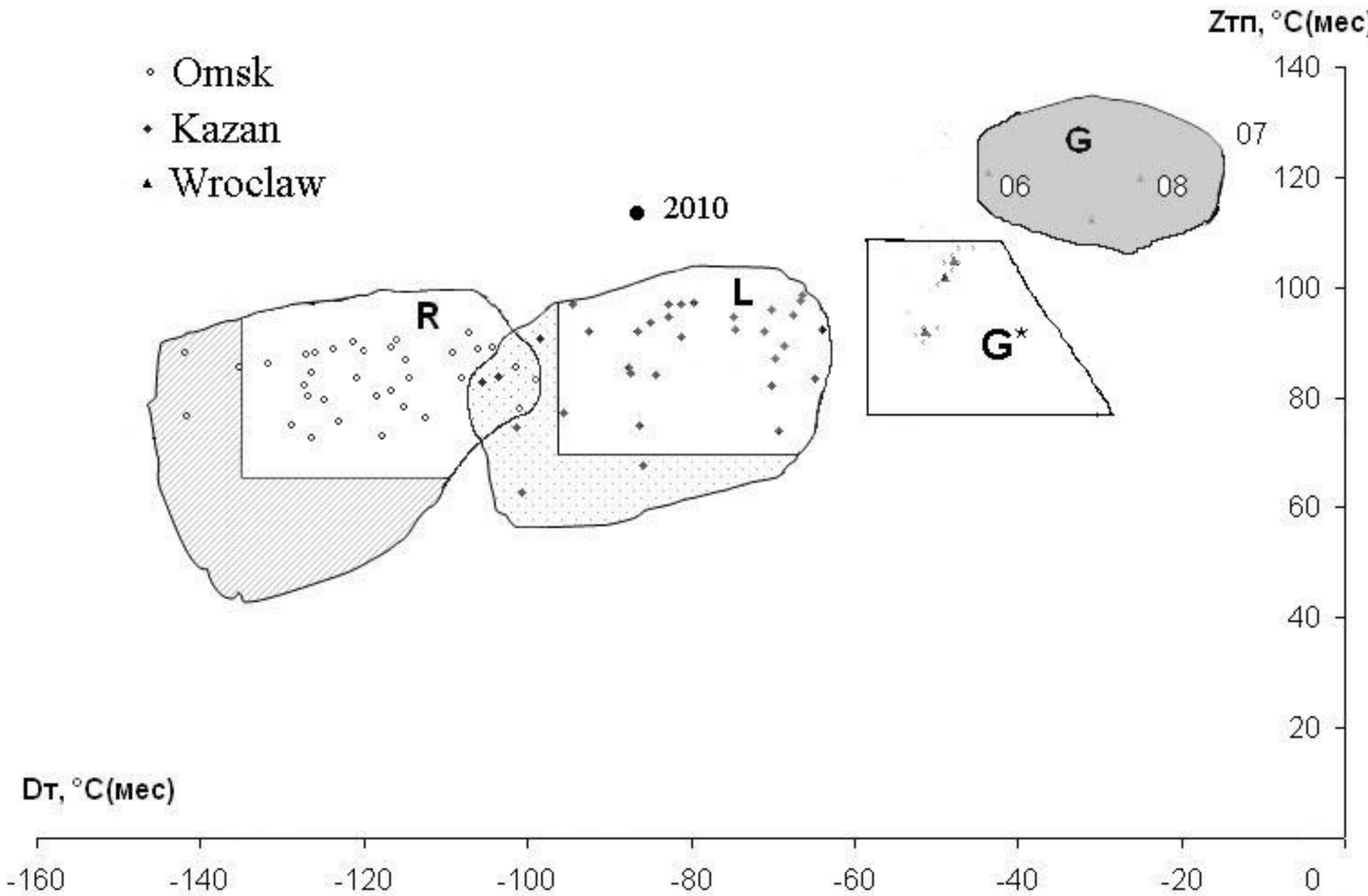
Assessment of multi-stage changes of the regional climates of Eurasia

Year	Wroclaw	Arkhangelsk	Kazan
1838	**6,3** A 94 (91) **-54** (6) **-6,0 (-11)**	**-1,1 D 54 (52) -121 (9) -18 (-21)**	**1,8** C 85 (77) **-112** (7) **-17 (-19)**
1839	8,3 B 103 (93) -47 (7) -1,0 (-2)	1,2 D 66 (62) -105 (7) -10 (-13)	4,0 C 92 (86) -96 (7) -10 (-12)
1843	8,5 A" 95 (84) **-35** (6) 1,7 (-1)	0,7 D **53** (**49**) -110 (9) -7,0 (-10)	4,3 C **86** (77) -84 (7) -8,0 (-11)
1850	**7,5** A 105 (97) -48 (6) **-4,0 (-9)**	0,0 C 61 (54) **-113 (8) -14 (-19)**	**1,8 D 79** (78) **-109** (7) **-16 (-22)**
1851	8,4 A 101 (96) -33 (6) -0,1 (-1)	2,0 C 69 (66) -91 (8) -11 (-15)	4,0 B 96 (88) -103 (7) -12 (-15)
1855	**7,4** A 100 (91) -52 (6) -4,0 (**-9**)	0,4 C 58 (55) -97 (8) -12 **(-17)**	4,7 C 92 (80) -64 (7) -9,0 (-12)
1859	9,3 A" 112 (99) -28 (6) 0,7 (-1)	2,3 D 60 (59) -92 (8) -8,0 (-9)	4,2 C 88 (77) -104 (7) -10 (-12)
1863	9,5 A* 118 (94) -31 (6) 1,0 (-2)	2,3 C 65 (59) -91 (9) -9,0 (-9)	4,0 C 83 (79) -92 (7) -10 (-15)
1869	9,0 A" 108 (92) -31 (5) 2,0 (-3)	2,5 C 69 (66) -99 (8) -12 (-13)	4,8 B 101 (92) -85 (7) -12 **(-18)**
1871	**6,2 A 92 (80) -51 (7) -6,0 (-7)**	**-1,6 D 51 (49) - 139 (9) -20 (-25)**	**1,3 C 80 (73) -103 (7) -19 (-21)**
1872	9,2 A' **118** (93) -42 (6) -2,0 (-5)	0,0 D 55 **(52)** -112 (9) -12 (-12)	4,0 C 90 (78) -89 (7) -12 (-16)
1882	9,1 A" 100 (87) -28 (6) 1,0 (1)	0,9 D 57 (56) -99 (9) -8,8 (10)	3,8 D 84 (84) -92 (7) -11 (-13)
1887	7,9 A 99 (93) -38 (5) -1,5 (-3)	-1,7 E **51 (51)** -110 (8) -17 **(-19)**	4,4 C 92 (85) -90 (7) -9 (-14)
1890	8,7 A 108 (99) -34 (5) -1,0 (-3)	0,9 D 56 (53) -98 (8) -97 (-15)	4,2 C 95 (86) -84 (7) -11 (-12)
1893	8,1 A' 109 (101) -44 (5) -3,3 **(-9)**	**-2,2** D **51 (45) -138** (9) –**18** (-12)	2,6 C 86 (78) **-109 (7) -17 (-20)**
1899	9,5 A 110 (96) -23 (5) 2,5 (2)	**-1,3 D 46 (43) -125 (8) -14 (-16)**	4,4 C 88 (77) -90 (7) -9 (-13)
1909	7,9 A' 104(98) -45 (6) -2,4 (-4)		

1911	9,8 A' 117 (105) -30 (5) 0,9 (6)	0,4 D 52 (47) **-109** (8) -12 (-17)	3,3 B 86 (79) -101 (7) -13 (-16)
1921	9,3 B 111 (100) -30 (6) 1,4 (6)	2,5 D 68 (62) -94 (7) –89 (-11)	**4,8 C 99 (96)** -91 (6) –11 (-12)
1922	**7,2 A** 97 (84) -41 (7) **-3,0 (-5)**	1,9 C (67) **-107** (8) -12 (-14)	4,1 C 91 (83) -95 (7) -13 (-14)
1925	8,8 A" 96 (86) -28 (5) 2,1(0)	**1,7 C** 59 (58) -87 (8) **-7,1** (-10)	5,5 B 94 (86) -72 (7) -7,6 (-9)
1929	**6,7 A" 101** (92) **-57 (6) -7,1 (-13)**	**0,2 D** 60 (56) (7) **-13 (-18)**	**2,5 D** 84 (79) **-109** (7) **-15 (-20)**
1930	9,4 A 109 (99) -29 (5) 1,0 (0)	1,9 D 58 (53) -7,5 (-12)	3,4 C 86 (80) -88 (7) -13 (-15)
1940	**6,7 A 88 (81) -56 (7) -7,1 (-11)**	**0,0 D 64 (63) 0 (-22)**	3,0 C 89 (84) **-103 (8) -15 (-21)**
1941	**6,7 A** 92 (80) -43 (7) **-3,8 (7)**	**-1,2 D 49 (47) -105 (8)** 13 **(-18)**	**1,2 D 72 (70) -105 (8)** -14 (-16)
1942	7,6 A 104 (101) **-56** (6) **–4,6 (9)**	**-0,9 D** 57 (56) **-106 (7) -16 (-19)**	**1,2 C** 81 (75) **-124 (7) -17 (-21)**
1956	**6,6 A'** 96 (94) **-52** (6) **–5,2 (-13)**	**-1,2 D** 55 (55) **-120 (8) -17 (-21)**	**1,0 C** 82 (74) **-110** (7) **-18 (-20)**
1963	**6,9 B** 109 (102) –46 (6) **-8,4 (-11)**	0,3 C 56 **(49)** -14 (-17)	3,1 C 91 (82) -102 (7) -13 (-18)
1970	**6,8 A 99 (93) -53 (6) -5,6 (-8)**	**-1,6 D 47 (43) -105 -16 (-20)**	**1,0 C 77 (70) -115 (7) -18 (-22)**
1972	7,8 A' 101 (90) -42 (7) -2 (-6)	**1,1 D** 54 **(46)** -13 (-16)	3,3 C 96 (85) -94 (7) **-13 (-21)**
1976	8,1 A 99 (93) -40 (6) -0,5 (-1)	**0,1 D 51** (50) -12 (-18)	**1,8 D** 77 (72) –101 (7) **-13 (-17)**
1978	8,2 A 100 (89) -38 (6) -0,1 (-1)	**-0,3 D** 49 (47) -101 (7) **-13 (-18)**	3,3 C 75 (69) 86 (7) -10 (-12)
1979	7,6 A' 89 (81) **-45** (6) **-4 (-7)**	**1,5 D** -10,7 (-13)	2,6 D 83 (81) **-106** (7) **-15 (-18)**
1985	**7,1 A'** 104 (97) **-49 (5) -5 (-9)**	**-1,0 D** 59 **(52) -133 (9) -19,5 (-25)**	2,7 C 84 (77) **-107** (7) -13 (-15)
1987	**7,2 A** 101 (95) **-48 (5) -4 (-10)**	**-1,0 D** 62 **-16,4 (21)**	2,3 C 84 (80) 21 -104 (7) **-13 (-20)**
1988	9,0 A' 107 (100) -32 (5) 2,1 (1)	**3,2 C 72 (68)** -88 (7) -9,3 (-12)	**4,4 C 97** (88) -95 -11 (-13)

1991	8,9 A” 106 (93) -25 (5) 1,6 (0)	1,8 C 63 (57) –97 (9) -11 **(-15**)	5,3 C 97 (82) -80 (7) -9 (-11)
1994	9,8 A' 112 (92) -30 (5) 1,7 (-1)	0,7 C -12 (**-15**)	**3,5** C 84 (**75**) **-100** (8) -11 **(-17**)
1996	**7,2 B** 99 (93) **-51** (5) **-4,1 (-5)**	1,2 C 56 (**51**) -12 (-13)	4,1 B -93 (7) -11 (-14)
1997	8,2 A 108 (96) – **45** (5) –1,8 (4)	0,5 E 56 (56) -98 (9) -12 **(-15**)	
1998	9,5 A" 112 (101) -26 (6) 2,8 (2)	**-0,3 D** 61 (58) **-121** (8) **–15 (-22)**	3,8 C 87 (82)
1999	9,6 A' 115 (105) –33 (5) 0,4 (0)	**0,3** C 62 (54) **-116** (9) **-15 (-18)**	4,6 C 92 (85) -80 (7) -8,0 **(-9)**
2001	9,5 A" 113 (102) –28 (5) 1,3 (0)	1,2 D 65 (61) -97 (8) -11 (-16)	**6,0** C 95 **(91)** -68 (6) **–6,4 (-9)**
2002	10,1 A' 119 (110) -25 (5) 1,4 (-2)	**0,5** D **55 (53)** **-103** (8) -11 (-13)	5,3 C **87** (**81**) -70 (7) **-7,0** (-12)
2003	8,7 A' 113 (103) -40 (5) **–2,7 (-3)**	2,1 D 66 (62) **-113** (8) **–14 (-18)**	3,9 C 92 (**80**) –93 (7) **–13 (-18**)
2005	9,1 A' 108 (103) -32 (5) 0,5 (-2)	**2,9 C 72 (65)** -88 (7) -8,7 (-11)	5,2 **B 97** (85) -81 (7) -8,9 (-12)
2006	9,1 A' 117 (110) **-44** (5) **–2,4 (-6)**	0,8 C 64 (61) -96 (7) -13 (-16)	4,4 C 95 (84) -83 (7) -12 (**-16**)
2007	10,5 A* 125 (118) -16 (5) 3,8 (2,7)	**2,9 C** 67 (61) -82 (8) **-9 (-18)**	**6,0 C 99** (86) **-66** (7) **-6,6** (**-14**)
2008	10,2 A 121 (104) -25 (5) 2,6(1)	2,7 C 66 (61) -79 (8) **-6 (-7)**	5,6 A 95 (**77**) -75 (6) -9,8(-12)
2009	9,4 A' 116 (104) -31 (5) -1 (-3)	2,3 D 61 (60) **-75** (9) -8 (-12)	5,7 C 96 **75** -70 (7) -8,4 (**-11**)
2010	8,6 A' 112 (101) **-40** (6) **-2,4 (-6)**	1,4 C 71 (67) **-106** (7) **-15 (-17)**	5,5 B 114 (106) **-89** (8) **-13,7 (-17**)

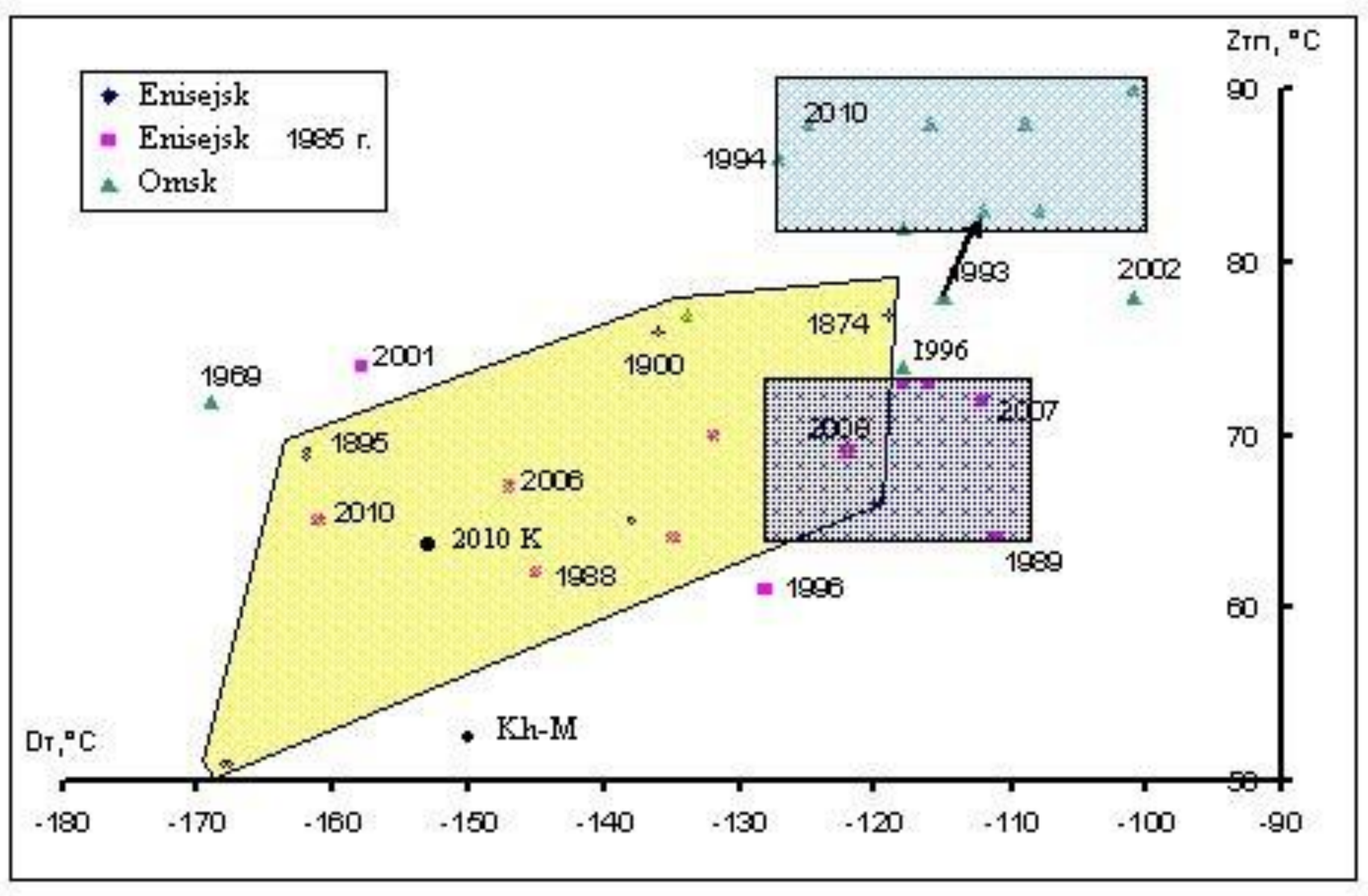
Assessment of changes of states of the regional climates of Eurasia



Aggregation description of Siberia climate

	Omsk	Barnaul
1969	**-2,0 D 72 70 22 -169 -26 -30 РК**	**-1,0** С 80 **69** 24 **-153 -25 -29** РК
1985	**-0,1** С 77 **71** 18 **-134** -19 **-24** К	**0,3** С **79** 72 19 -128 **-20 -26** РК
1987	**0,7** С 82 81 21 -118 -16 -19 К	1,4 С 80 79 20 -108 -13 -14 УК
1988	2,4 С **88** 80 22 **-116** -16 **-19** К(З)	2,5 С **85** 77 20 **-117** -15 -19 К
1991	**3,0** С **97** 84 22 **-109 -14 -15** К	**3,0** С **90 83** 22 **-103 -13 -15** УК
1994	1,3 С 86 75 18 -127 -17 -22 К	2,6 С 89 81 19 -118 -16 -18 К
1996	**0,3** С **74 73** 20 -118 -17 -21 К	1,2 С 80 77 22 -112 -16 -22 К
1998	**0,7** D 86 82 23 -123 -19 -23 К(З)	1,8 С 89 81 22 -115 -17 -23 К(З)
2002	**4,0** С 78 75 18 **-101 -11 -17** УК	**4,9** С **91** 82 20 **-88 -10 -16** УК
2003	1,8 С 88 82 19 -117 -17 -21 К	2,1 С 88 **83** 20 -104 -15 -19 К
2006	1,3 С 83 78 21 -112 -19 **-27** РК	2,0 С 84 80 21 -105 -19 -22 К
2007	**3,8** С **90** 78 20 **-101 -10 -15** УК	3,6 С **93 80** 21 **-83** -8,5 -10 УК
2008	3,4 С 88 78 22 -109 -15 -20 К	3,5 С 89 79 21 **-99** -15 -21 К
2009	2,0 С 84 75 18 -108 -16 -20 УК	2,9 С 84 75 19 **-101** -17 -19 К
2010	**1,1** С 88 84 19 **-125 -21 -25** РК	**0,4** С **83** 74 18 **-132 -22 -26** РК

Changing the state of Siberia climate



Matrix description of geographic objects and parametric fields

When using matrix description of geographical objects and distribution of parametric fields, we use geographic reference for information on spatially distributed objects. In this position of each element of the matrix is uniquely associated with geographic coordinates (rows correspond to the latitudinal bands, and the columns-meridians).

The distribution of annual (seasonal) weather variables on the territory of Siberia in the designated area with E60°-110° and N52°-67° described by the following matrix.

60°		**80°**	**100°**	**ВД**		
M_{11}	M_{12}		M_{14}		**67°С Ш**	**M_{11}-Salekhard; M_{12}-Tarko-Sale; M_{14}-Turukhansk; M_{21}-Khanty-Mansijsk; M_{22}-Surgut; M_{24}-Bor ; M_{31}-Tobolsk; M_{32}-Tara; M_{33}-Kolpashevo; M_{34}-Enisejsk; M_{42}-Omsk; M_{43}-Tomsk; M_{44}-Krasnoyarsk; M_{45}-Bratsk; M_{53}-Barnaul; M_{54}-Minusinsk; M_{55}-Irkutsk**
M_{21}	M_{22}		M_{24}		**63 °**	
M_{31}	M_{32}	M_{33}	M_{34}		**60 °**	
	M_{42}	M_{43}	M_{44}	M_{45}	**57 °**	
		M_{53}	M_{54}	M_{55}	**52 °**	

Spatial and temporal model of climate

-7.7F 37-29			-9.9F 36-32	1890
-2.5E 66-23	-5.5E 51-24			
-1.2D* 63-18	-1.5D* 63-19		-3.7D* 57-24	
	-0.7C 76-20	-2.9D* 59-21	-0.4D* 72-21	
		-0.5D* 71-15	-0.1D* 73-19	-1.8D* 59-21

-9.0F 33-30	-9.6F 40-36	M	-9.7F 42-38	1969
-4.9E 52-30	-5.8E 51-32	M	-7.1E 54-36	
-3.5E 59-30	-3.4E 64-31	-4.2E 62-31	-4.4E 65-33	
	-2.0D 72-30	-2.7E 68-30	-1.5E 69-26	-3.8E 60-29
		-1.0C 80-29	-0.7C 82-29	-1.6D 69-28

-2.9D 46-13	-2.7E 49-16		-3.4E 44-20	1995
1.5D 73-13			-2,2D 55-18	
2.6C 82-15		1.1C 74-16	0.5D 66-16	
	3.1C 89-17	4.8C 90-15		0.8C 66-15
		3D* 81-15	2.5C 83-17	1.9C 74-14

-7.6F 42-30	-6.8F 40-37		-7.5E 51-38	2006
-1.9E 64-30	-3.1E 64-35		-4.9E 64-38	-9.8E 56 -43
-0.1D* 71-28	-0.3D* 73-30	-2.2E 69-34	-2.8E 67-31	
	1.3C 83-27	0.8D E75-29	-0.3D* 71-25	-2E 66-22
		2.0C 84-24	0.2D* 76-21	0.3C 72-19

-4.1E 47-29	-3.2E 51-31	M13	-4.1F 48-33	2007
0.8C 71-24	0.7C 62-24	M23	-1.1D 62-26	-7.0D 51 -35
2.6C 80-19	2.8C 81-18	1.6C 73-20	1.4D 72-18	
	3.8C 90-15	3.1C 84-14	3.7C 82-11	1.4C 74-14.2
		3.6C 93-10	4.1C 90-12	2.9C 82-13

-4.4E 41-29	-3.7E 49-20	M13	-4.7E 51-27	2008
0.4C 63-16		M32	-2.5E 59-29	-7.0E 53 -33
1.9C 71-18		1.0D* 69-22	0.4D 69-27	
	3.4C 88-20	2.7C 80-20	2.6C 76-21	1.1D* 65-14
			3.3C 87-21	2.1C 76-14

-7.34E 38-33	-7.3E 38-30	M13	-8.0E 38-33	2010
-2.7C 53-27	-3.3D 60 -28	M32	-5.1D 53-32	-9.8E 48-41
-0.5C 78 -28	-0.6C 77 -27	-2.6C 63 -27	-2.6D 65 -28	
	1.1C 88 -25	-0.8C 76 -27	-0.4C 75 -25	-2.5D 65 -26
		0.4C 83 -26	0.8C 81 -26	-0.4 D 72 -22

Aggregated description of the region's climatic conditions

Climatic conditions			Landscapes	Cryogenic conditions	Hydrological conditions
Limits long-term changes	Rhythm of long-term changes	Matrix estimation characteristics	Type Composition Features	Type Features	Type Features

Aggregate matrix describing the climatic conditions of the region is as follows:

Rhythm Limits T_Y (°C) Limits A (°C) Limits P_Y (mm)	**Limits Z_{WP} (°C)** Limits Z_{VP} (°C) Limits T_I (°C) Limits P_{VP} (mm)	**Landscape type** Forest type (part) Meadow (part) Arable (part)	**Type of CrCond** Depth (m) Repeatability (f)	**Type of HydrCond** Drouhgt (Dr) Repeatability (f)

Matrix of natural and climatic characteristics of conditions in Omsk region

CCDCCCDC 0 ÷ 3,8 33 ÷ 44 340 ÷ 480	**75 ÷ 90** 63 ÷ 70 -8 ÷ -27 110 ÷ 230	**Forest-steppe** Mixed forest 0,42 Meadow 0,28 Arable 0,3	**Soil freezing** 0,9 ÷ 1,8 0,8	**Moderate hydromorphic** Drouhgt 0,4

Typification of the natural-climatic conditions on Siberia

1 – arid steppe foci, climate: Z_{WP}=(90÷100) °C, rhythm C C C, Z_{VP}=(75÷90) °C, T_S=(18÷23) °C, T_J =(-8÷-24) °C;

2 – steppe with droughts and pockets of soil freezing, climate: Z_{WP}=(85÷95)°C, rhythm C C D, Z_{VP}=(75÷83)°C, Tл=(17÷21) °C, TI =(-7÷-24) °C;

3 – forest-steppe soils with the freezing, climate: Z_{WP}=(75÷90)°C, rhythm C D C D, Z_{VP}=(68÷78) °C, T_S=(16÷21) °C, T_J =(-8÷-27) °C;

4 – forest land, soil freezing, climate: Z_{WP}=(68÷85) °C, rhythm C C D E, Z_{VP}=(65÷75) °C, T_S=(15÷19) °C, T_J=(-8÷-29) °C;

5 – Taiga hydromorphic area (swamp), soil freezing, climate: Z_{WP}=(60÷75) °C, rhythm D C D E, Z_{VP}=(57÷70) °C, T_S=(14÷18) °C, T_J=(-10÷-34) °C;

6 – northern taiga hydromorphic, Rare island permafrost, climate: Z_{WP}=(55÷65) °C, rhythm D E E, Z_{VP}=(53÷60), T_S= (13÷17) °C, T_J =(-12÷-38) °C;

7 – forest-tundra, island permafrost, climate: Z_{WP}=(40÷50) °C, rhythm E D F D, Z_{VP}<50 °C, T_S=(11÷15) °C, T_J=(-15÷-37) °C;

8 – tundra, island permafrost, climate: Z_{WP} =(35÷56) °C, rhythm E F E F , Z_{VP}<48 °C, T_S=(10÷16) °C, T_J=(-14÷-38) °C;

9 – mountainous area, perennially frozen, climate: Z_{WP}=(30÷45) °C, T_S=(10÷15) °C, T_J=(-20÷-40) °C.

Natural-climatic zoning

Cold state

● Sal	8		● Tur	
	● T-Sale	8		9
▲ Kh-M	Δ Sur Al Δ	7	Bor Δ	
Tob ○	▲ 6	▲ Kol	En ▲	9
○ Tum	○ Tara 5	○ Tomsk		Br ▲
● Kurg	♦ Omsk 4	Kem ♦	Kr ○	
2	Irt ●	● Barn 3	♦ Min	Irk ○

Current warm state

● Sal	8		● Tur	
	● T-Sale	7		9
▲ Kh-M	Δ Sur Al Δ	6	Bor Δ	
Tob ○		▲ Kol	En ▲	9
○ Tum	○ Tara 4	○ Tomsk	5	Br ▲
● Kurg	♦ Omsk 3	Kem ♦	Kr ○	
1	Irt ● 2	● Bar 2	♦ Min	Irk ○

Summary

As a result, multi-criteria assessment of climate change are set:

- Variability of conditions has increased
- In the regions of Western Europe, new centennial maxima assessment characteristics T_Y, Z_{WP}, Z_{VP} и T_W appeared
- Revealed the special status of the regional climate of Eastern Europe with a few extremes of valuation characteristics
- Value of autumn temperatures are critical for the cryosphere (indicators of accelerated melting)
- Lowering the climatic resources of the forest-steppe and taiga zones under the influence of the cooling rains and cloud cover
- Increased annual temperature in due to winter warming under the influence cyclogenesis at low climatic resources

For evidentiary basis of conclusions (warnings about the consequences) need to develop engineering knowledge about climate change and its consequences (based on semi-empirical models of the formation of development impact, methodologies for assessing critical characteristics, technology assessment of expected losses

Thank you for your attention