Regional climate clusters on the territory of Eurasia against the background of global climate change

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GOAL

Возможности моделирования гидрометеорологических процессов ограничены недостатком знаний о системе, отсутствием «убедительной теории и полхолящего ей математического аппарата»

ПОДХОДЯЩЕГО ЕЙ МАТЕМАТИЧЕСКОГО АППАРАТА» (Дымников В.П. Устойчивость и предсказуемость крупномасштабных атмосферных процессов.2007)

✓ DETECTION OF PATTERNS OF TRANSFORMATION OF CLIMATE SYSTEM STRUCTURE

- Patterns of spatial-temporal changes in the components of the climate system is the basis of warning systems and adaptation to changing environmental conditions
- **!!** The topicality is stipulated by the growing importance of climate forecast quality improving.







Alisov's Genetic classifications of earth's climate is based on the factors that determine the climate in a given place - on the spatial distribution and movement of the prevailing air masses. The most common in use, mainly in the post-Soviet states

The Koppen climate classification is the most widely used system to catalog climate types in the world. Distribution of five base zones made by isotherms of the coldest and warmest months of the year

!! Classical climatic classifications are an indicator of climate differences, not climate change

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Il As climate change becomes a reality, it's becoming more necessary in different intervals of years to document and catalog climate types around the world

✓ The patterns of restructuring the fields of climate parameters can be detected by objectively solving the problem of climate classification in different periods of years taking into account the influence of external factors on the formation of regional climate clusters

 «... целью анализа многомерных временных рядов систем мониторинга предлагается считать поиск сигналов синхронизации, согласованности вариаций наблюдаемых параметров, измеряемых в пространственно разнесенных пунктах системы

МОНИ ТОРИНГА ИЛИ ИЗМЕРЯЕМЫХ В ОДНОМ (Любушин А.А. Анализ данных систем геофизического и экологического Мониторинга 2007) ЫХ ВЕЛИЧИН»

Climate Change Indicators: Global Temperature



The trend in global average temperature compared to a reference period of 1961–1990, as determined using three separate and independently analyzed sets of data. The grey shading indicates the uncertainty in the dataset from the Hadley Centre [UK Met Office Hadley Centre via WMO]

CLIMATE CLUSTERS ARE FORMED ON THE BASIS OF SYNCHRONIZED TEMPERATURE FLUCTUATIONS

CLIMATIC CLUSTERS FORMATION ALGORITHM

- **#1 AVERAGE MONTHLY MATRIX FORMATION**
- **#2 CALCULATION OF INITIAL PHASES**
- **#3 CALCULATION OF CORRELATION MATRIX OF PHASES**
- **#4 FORMATION OF CURRENT CLUSTERS**
- **#5 CALCULATION OF CURRENT PHASES**
- #6 VERIFICATION OF CONVERGENCE : $Y \Rightarrow #7, N \Rightarrow #3$
- **#7 CALCULATION OF TYPE PHASES**
- **#8 CLUSTERS SEPARABILITY VERIFICATION**
- **#9 CLUSTERS CARD-SCHEME FORMATION**

NAO - main mode of variability at a seasonal time scale over the North Atlantic mid-latitudes





CLIMATE CLUSTERS ARE FORMED ON THE BASIS OF SYNCHRONIZED TEMPERATURE FLUCTUATIONS AT 485 METEOROLOGICAL STATIONS IN EURASIA

RESULTS and CONCLUSION

EURASIA TEMPERATURE FIELD CLASSIFICATION

The value of the threshold correlation coefficient 0,8 Stations that are not included in any of the classes are marked with "+"

Different station classes are indicated by different icons Areas where there have been changes in the structure fields are marked by ovals





12,2%

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RESULTS and CONCLUSION

ALPINE STATIONS ARE MOST SENSITIVE TO GLOBAL TEMPERATURE FLUCTUATIONS

/+++ Se >++γ >	+ + + + + + + + + + + + + +				S
1961-1990	X	+++	• • • • • • • • • • • • • • • • • • •	+ + + ++ + ++ + +	+ + + +
1955-1975	N.	+	M H H H H H H H H H H	+ + + + + + + + +	
				+++++++++++++++++++++++++++++++++++++++	+
1976-2011	Z	+	M +	+ + + + + ++ + +	+ + +

station	country	altitude	P _N	P ₅₅	GW
Villacheralpe	Austria	2140	+	С	С
Mukteswar	India	2311	+	+	С
Saentis	Switzerland	2494	+	С	С
Sonnblick	Austria	3111	+	С	С



alpine weather station Sonnblick (3111 m) [https://www.sonnblick.net/de/das-observatorium/]

The index of phase modulation for the normal period



class	error, %
\bigcirc	40,77
	39,46
	57,28
0	<mark>20,72</mark>
	32,72
•	45,21
	33,94
V	55,12
\diamond	<mark>9,45</mark>
۲	55,49
\diamond	<mark>15,40</mark>

- Significant changes in the structure of the consistency of temperature fluctuations in most parts of Eurasia are revealed.
- ✓ The use of only the surface temperature for the classification makes it possible to significantly simplify the dynamic analysis of the climate system structure transformation.

Thank you for your attention!

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