



# Russian State Hydrometeorological University

## PROJECT "BIOMET\_FORECAST": HUMAN'S ADAPTATION TO WEATHER CHANGES

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# Introduction

1. Modern problems **climate changes** require of innovation assessment of the impact of weather on humans.
2. Processes of **adaptation of the person** to various climatic conditions depend both on a condition of its health, and from climatic features of regions of residing.
3. The **analysis of known methods** of an estimation of comfort of the climate, which are applied in complex climatology and balneology, allows to select such optimum parameters and indicators which characterize degree meteopathy of the person, and to use them for a bioclimatic estimation of a climate.

# Actuality

- Weather and climate have a **complicated impact** on human health, and the processes of human's adaptation to different climatic conditions depend of the medical - geographical characteristics of the regions of human habitation, the state of his health and genetic factors.
- The universality action heliogeophysical, climatic and weather factors on biological objects, and above all a man requires a **modernization of special methods** for assessing and predicting environmental comfort and health of the population, given the current criteria and age groups, which is especially important in terms of global climate change.

# Global challenges of the XXI century

- Climate change.
- Environmental problems.
- The growth of world population.
- Adaptation of living things (humans, animals, plants and other).



# The conception of project “Biomet\_Forecast”



**The purpose** - to explore complex environmental situation and especially weather in St. Petersburg and its impact on human health.

**The main task** - scientific research and dissemination of the results obtained in the form of scientific articles and reports, as well as providing accurate information on these issues to a wider audience at conferences and in the mass media and social media.

# The target audience of project “Biomet\_Forecast”



1. Residents and guest of **St. Petersburg**
2. Organization are responsible for:
  - **public health;**
  - **school and university;**
  - **balneology &recreation;**
  - **sports and tourism.**

# Innovative project “Biomet\_Forecast”

The project is originative and includes three modules, each is aimed at the study of certain problem:

**Module 1.** Estimate bioclimate of the region;

**Module 2.** Effects to space weather and meteorological factors on human health (assessment at the population and individual degree of meteopathics);

**Module 3.** Estimate of environmental and social issues risk to human health and informing the public about the possible adverse weather and environmental situations (explanation and a warning for massmedia).

These problems can be taking into account available **development a choice of the famous criterions**, allowing to estimate and count various degrees of comfort/discomfort for health care of a recreation, tourism, sports, etc.

# Module 1.

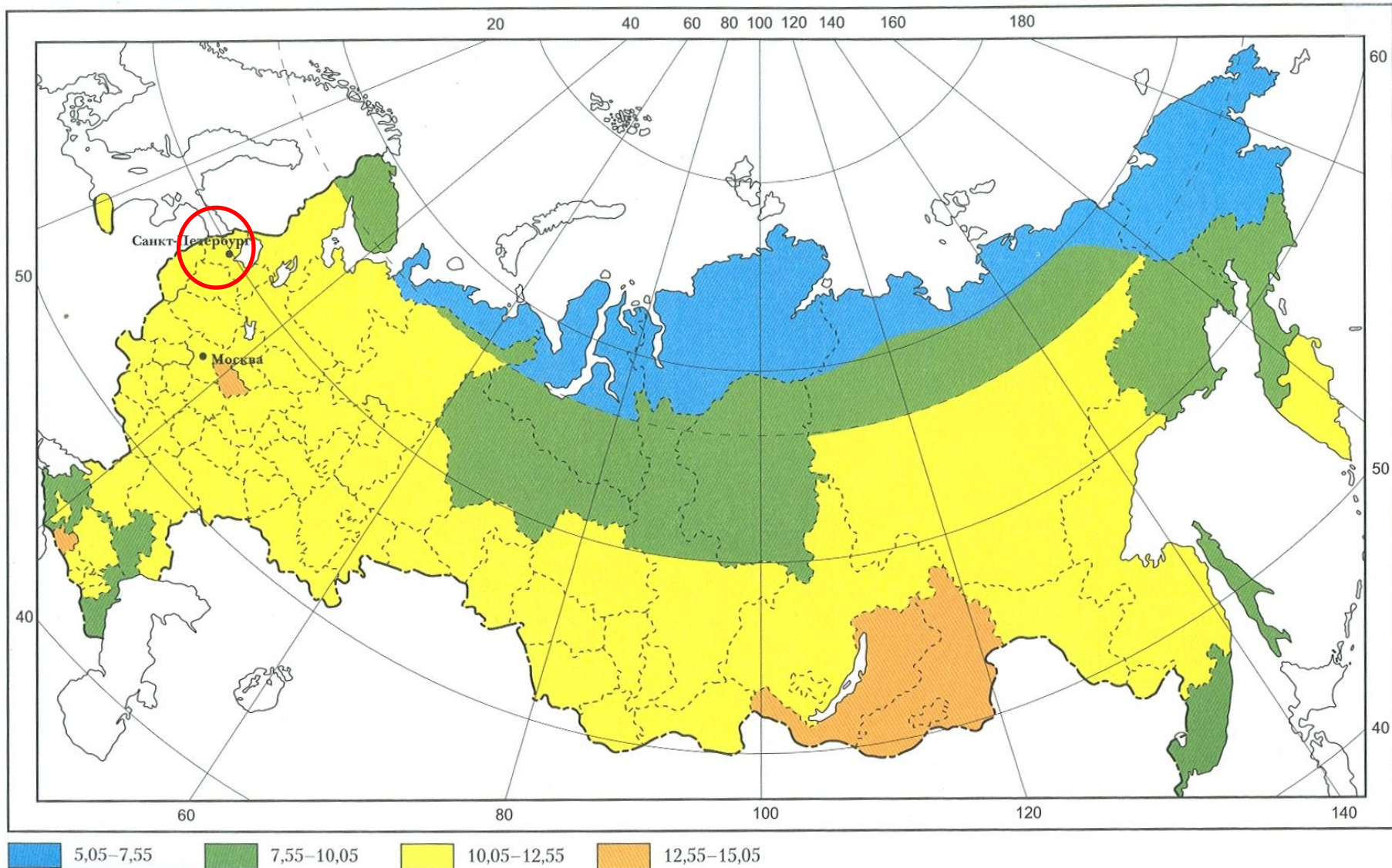
## Climatic resources are classified:

- of meteorological values;
- by area or scale climatic processes (macro-, meso-and microclimatic);
- the direction of the use of (agroclimatic, bioclimatic, etc.).

## Bioclimatic resources include the following elements:

1. recreational resources of climate;
2. hygienic/climatic resources;
3. physiological and climatic resources of the thermal state of a person;
4. curative and preventive climatic resources for the main types of diseases: cardiovascular diseases, chronic nonspecific respiratory diseases, asthma, rheumatism and colds, eyes, tuberculosis and ect.

# Bioclimatic resources

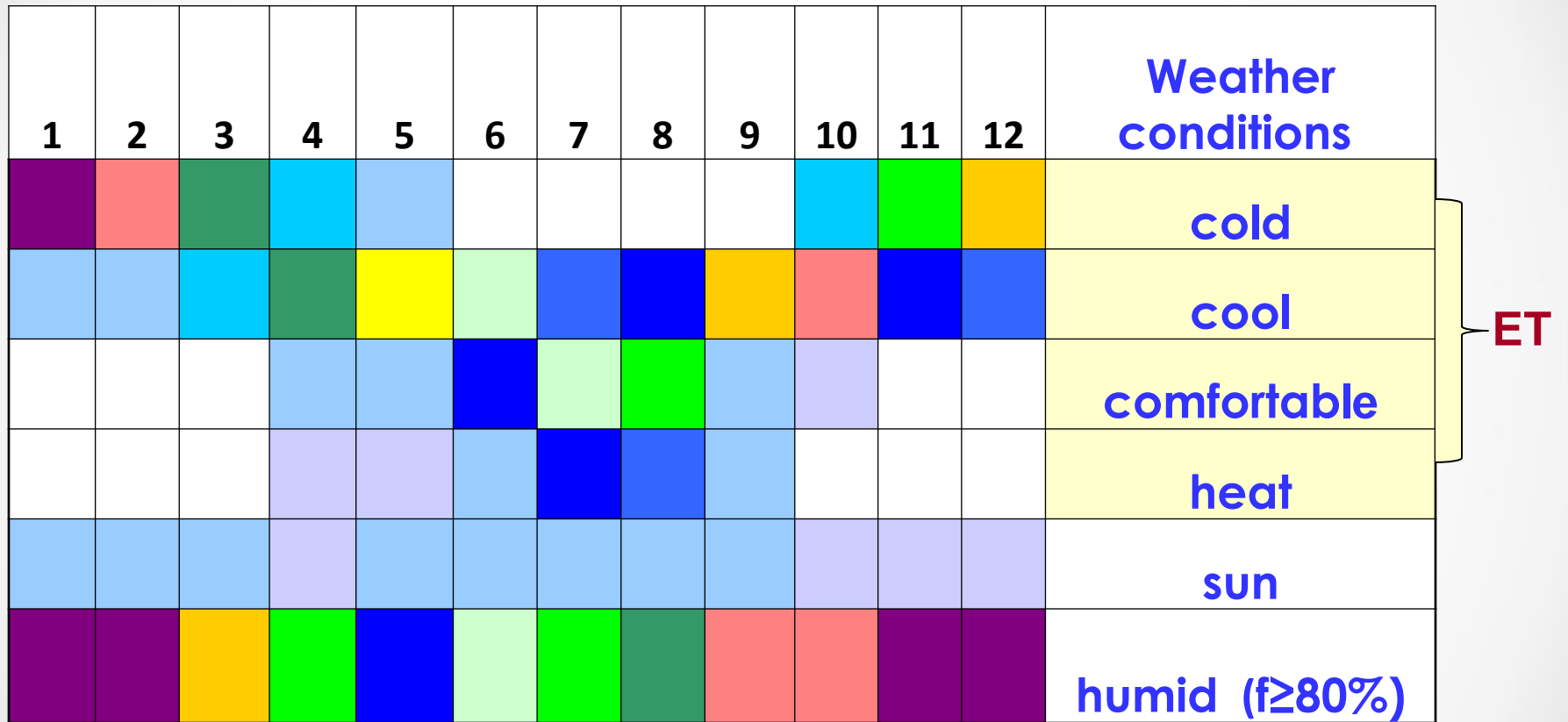


most adverse    adverse    average    favorable

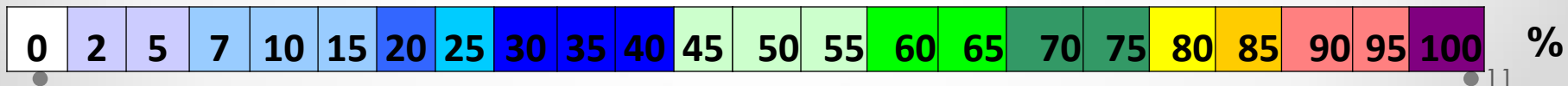
# Bioclimatic classification of global index ET (heat sensitivity and level of discomfort)

<b>ET (grad.)</b>	<b>ID</b>	<b>The level of comfort</b>
<b>&gt;30.1</b>	<b>3</b>	<b>Strong thermal load</b>
<b>24.1....30.0</b>	<b>2</b>	<b>Heat load is moderate</b>
<b>18.1....24.0</b>	<b>1</b>	<b>Comfortable - warm</b>
<b>12.1....18.0</b>	<b>0</b>	<b>Comfort (moderate heat)</b>
<b>6.1....12.0</b>	<b>-1</b>	<b>Cool</b>
<b>0.1.... 6.0</b>	<b>-2</b>	<b>Moderately cool</b>
<b>0.1.... -6.0</b>	<b>-3</b>	<b>Very cool</b>
<b>-6.1....-12.0</b>	<b>-4</b>	<b>Moderately cold</b>
<b>-12.1...-18.0</b>	<b>-5</b>	<b>Cold</b>
<b>-18.1...-24.0</b>	<b>-6</b>	<b>Very cold</b>
<b>&lt;-24.1</b>	<b>-7</b>	<b>It starts with the threat of frostbite</b>

# Bioclimate of St. Petersburg



Frequency of weather conditions



## Module 2. Adaptation

**Adaptation** - the process of effective **interaction** with the environment. Adaptation mechanisms developed in the course of evolution, allow the existence of the organism in a constantly changing environment, through optimum operation of all systems of the body and balance in the system "environment- human".

However, the adaptive capacity of the **individual** for each organism and depends on many factors.



## St.Petersburg: metropolis, world center of scientific and cultural life



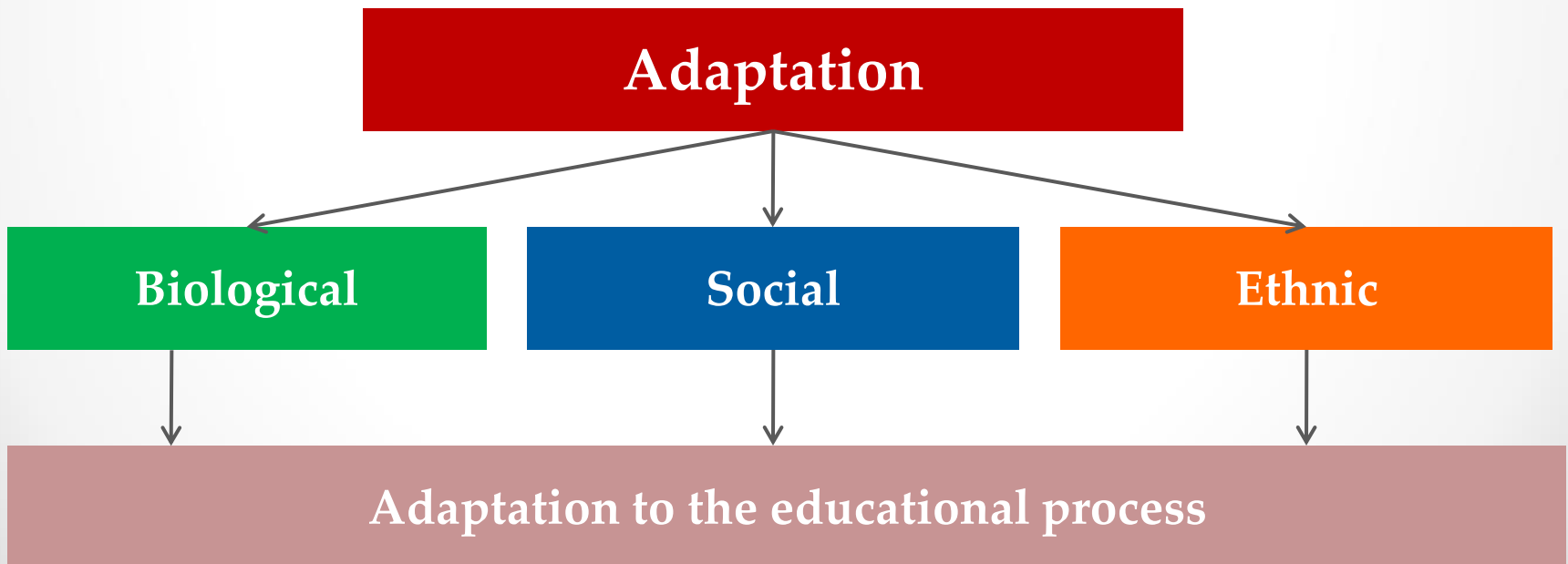
Population of Saint Petersburg:

Residents - **over five million**, migrant workers - **about one million**, students from other cities Russia and World – **more than one million**, tourists - **about one million**.

## The content of the study

**The purpose of the research** - the study and development of integrated assessment methodology for environmental and social factors which impact on the adaptation process of nonresident and foreign students to the metropolis conditions (St. Petersburg case of study).

### The basic kinds of adaptation



# Adaptation of students from other cities

**The purpose of the study** - a comprehensive assessment of the impact factors of the natural and social environment on the processes of adaptation of nonresident students in a metropolis (for example, St. Petersburg).

## Main tasks:

1

**Explore** the physiological and social - psychological aspects of adaptation of students from other cities in a metropolis.

2

**To conduct** an empirical study of the level of adaptation of students from other cities of different nationalities.

3

**Develop** recommendations to mitigate the level of adaptation of foreign students in a metropolis.



# Metods

# Heliometeosensitivity of human body (HMS)

**HMS is particularly individual characteristics and depends on a variety of factors:**

- **Body type**
- **Physiology**
- **Psychotype of individual**
- **Heredity**
- **Biological rhythms**
- **Working conditions**
- **Living conditions**
- **Lifestyle and bad habits**





# Software medical complex «Omega-M»

Organism's functioning assessment by software medical complex «Omega-Medicine». The method is based information analysis technology biorhythmological processes – "Fractal Neurodynamics." Web site: <http://dyn.ru>

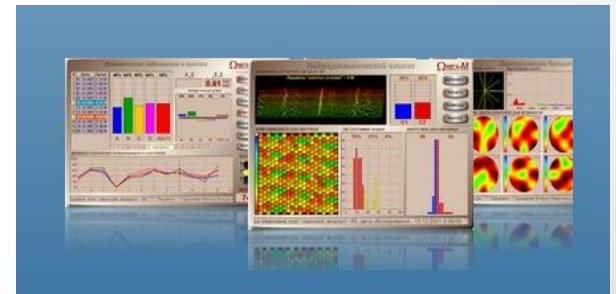


## Assessment of person health's parameters:

- Adaptation of cardiovascular system
- Assessment of vegetative system
- Neurohumoral regulation of body state
- Psychoemotional state



**Integrated indicator of organism's functioning (H,%)**



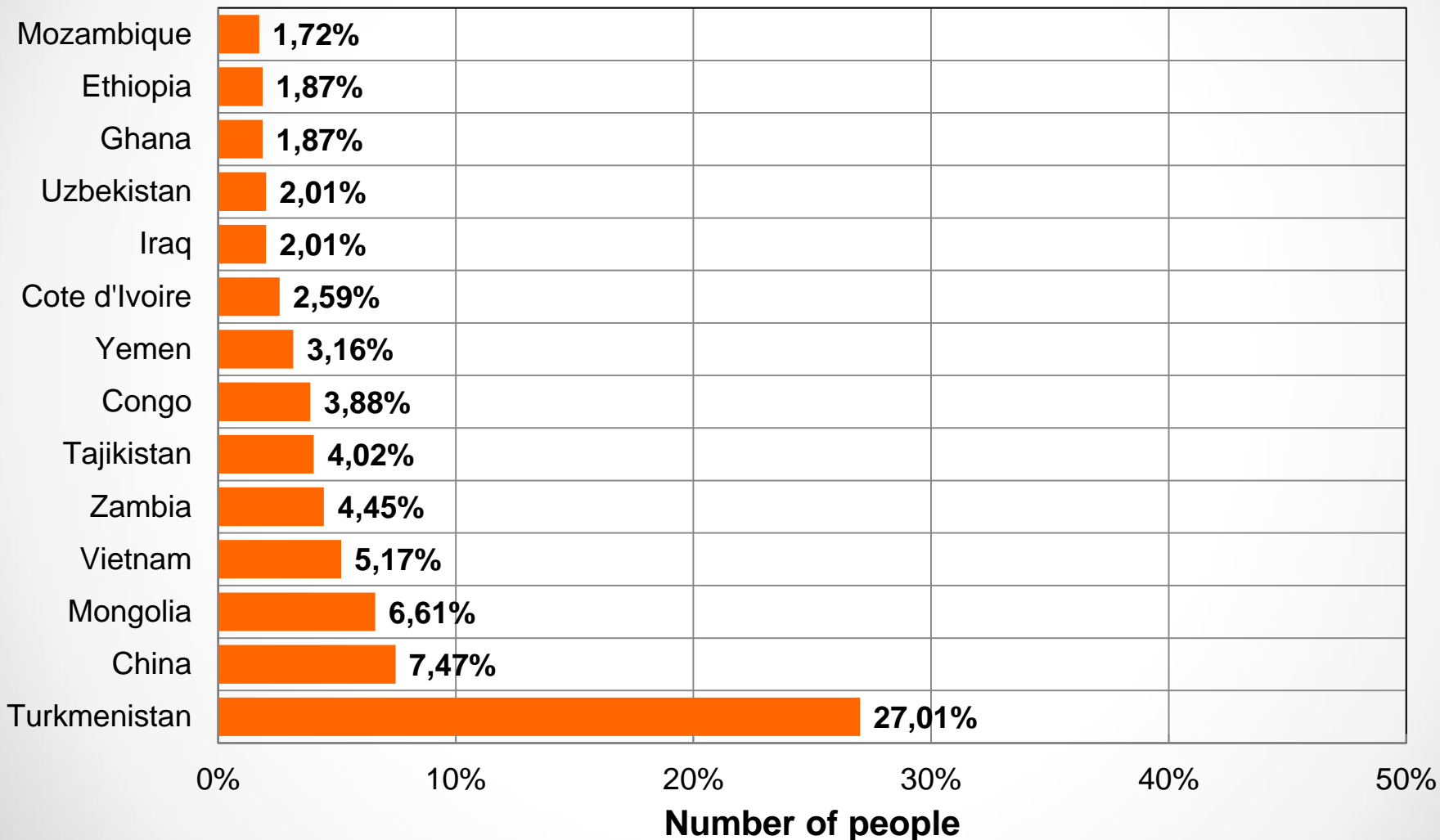


# Results



# Geographical distribution of RSHU students

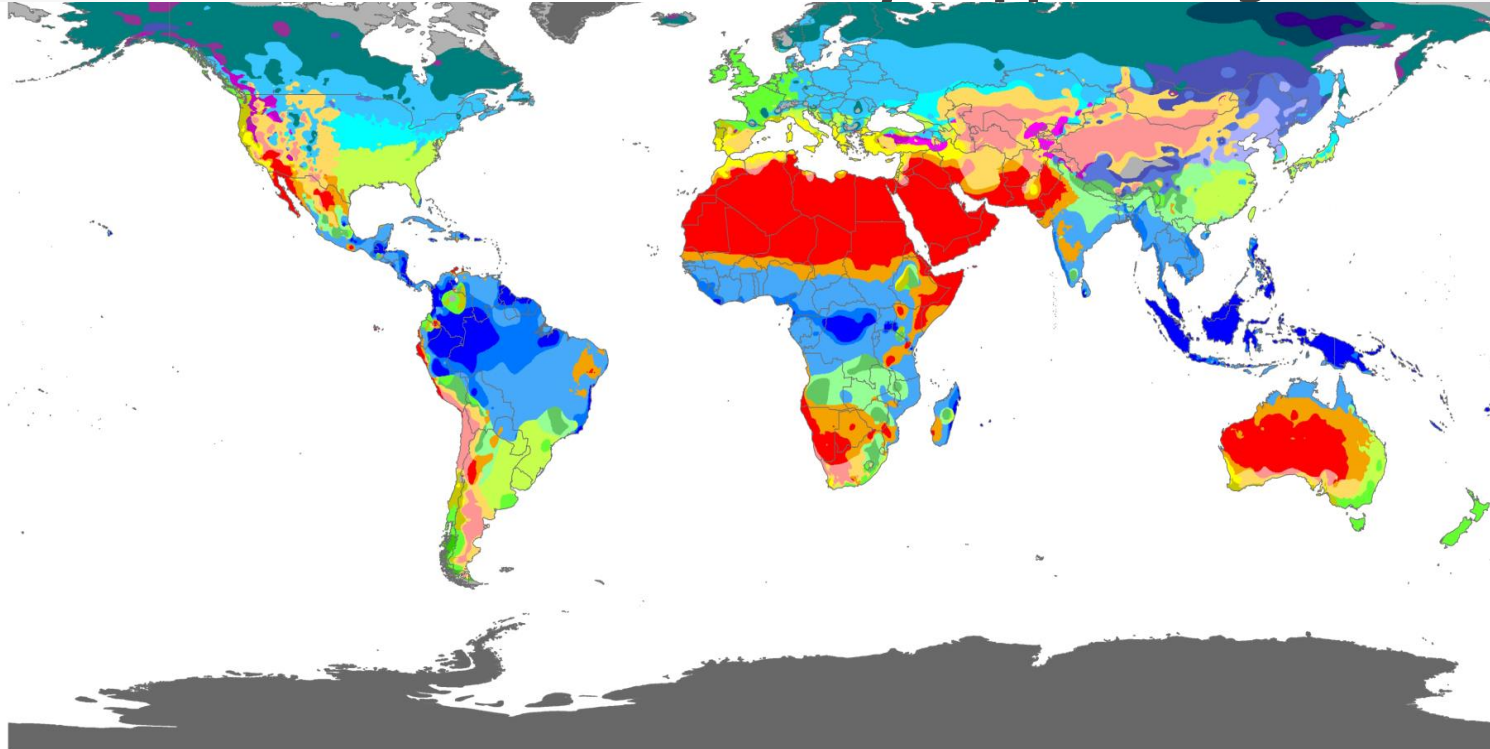
Distribution the inhabitation countries of resident students



# Habitual Climatic conditions of RSHU students

(before their arrival in St. Petersburg)

Classifications of climates by Köppen-Geiger



Af	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSh	Cwc	Cfc	Dsc	Dwc	Dfc		
	BSk			Dsd	Dwd	Dfd		

**DATA SOURCE :** GHCN v2.0 station data  
Temperature (N = 4,844) and  
Precipitation (N = 12,396)

**PERIOD OF RECORD :** All available

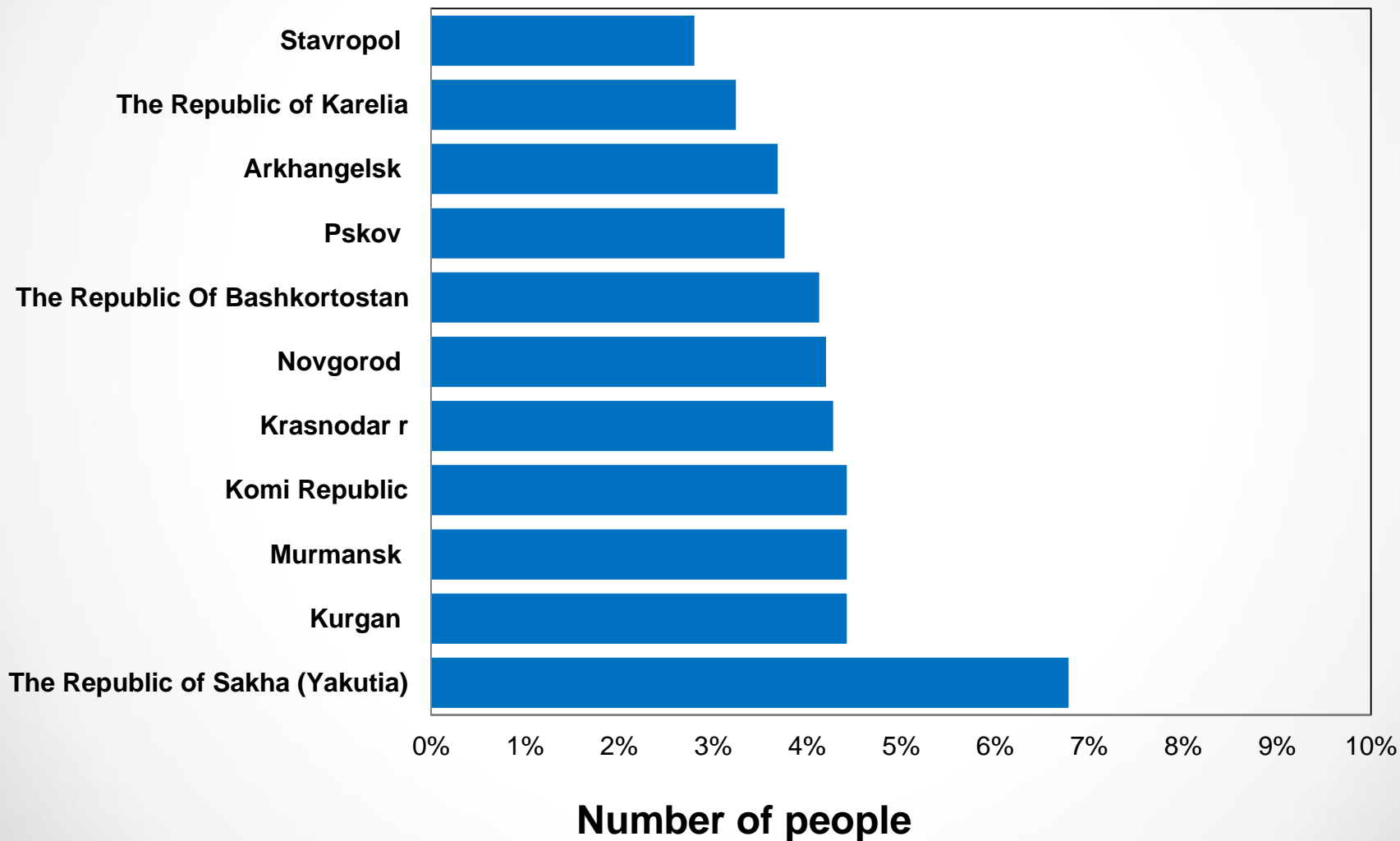
**MIN LENGTH :** ≥30 for each month.

**RESOLUTION :** 0.1 degree lat/long

**Contact :** Murray C. Peel (mpeel@unimelb.edu.au) for further information

# Geographical distribution of RSHU students

## Distribution the inhabitation regions of nonresident students



# Some results of the experiment

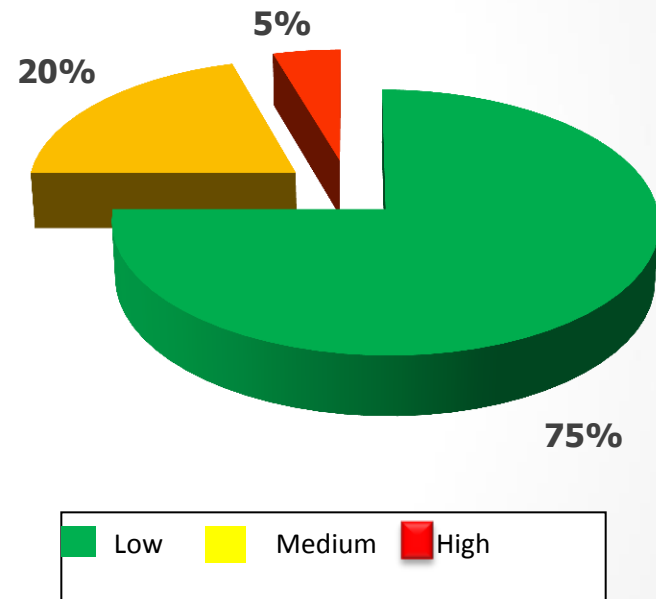
60%

students feel deteriorating state of health due with the change of weather

## Weather phenomena that affect the state of health of students

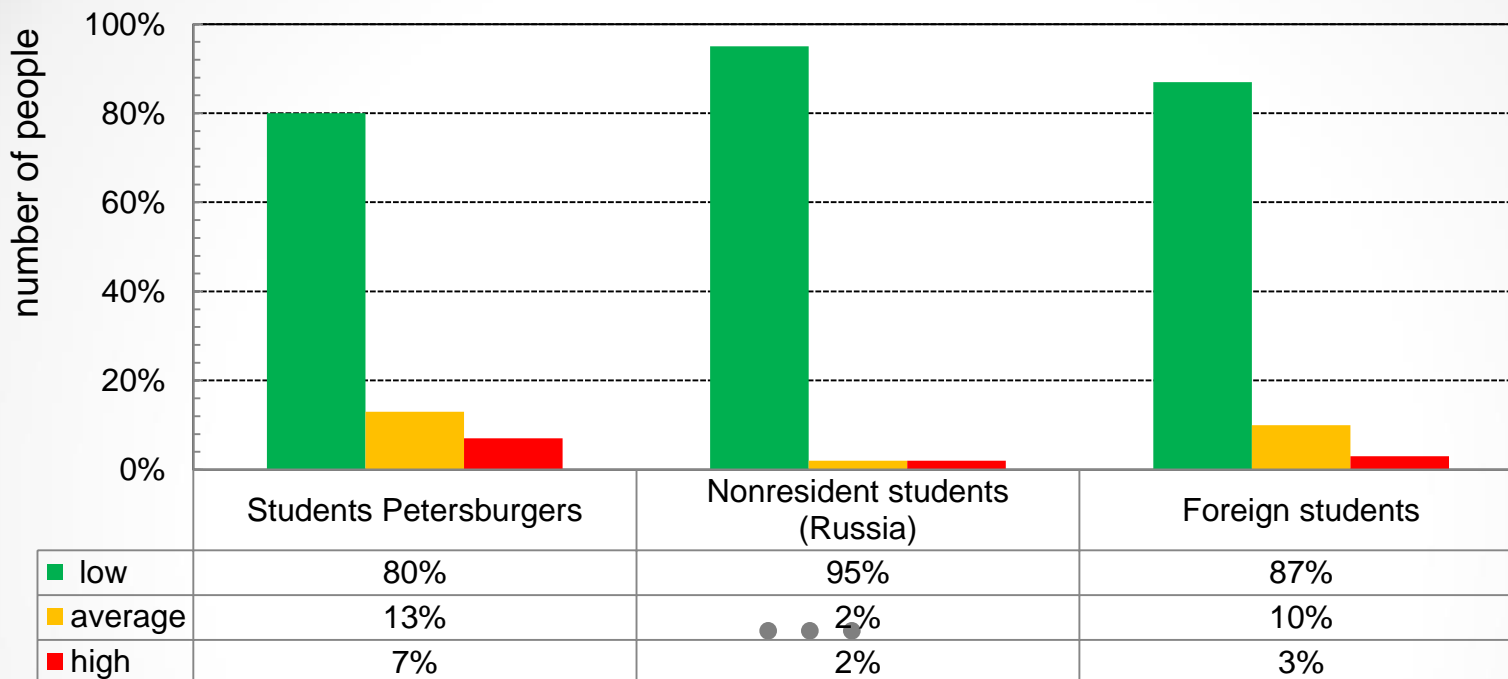
- 1 Rain
- 2 Drizzle
- 3 The blinding sun
- 4 Fair weather
- 5 Rain showers
- 6 Heat
- 7 Suffiness
- 8 Hunderstorm
- 9 Hurricane winds
- 10 Changes in temperature

## Level of weather-sensitive students



The questionnaire was  
100 foreign students

# Level of student's meteosensitivity



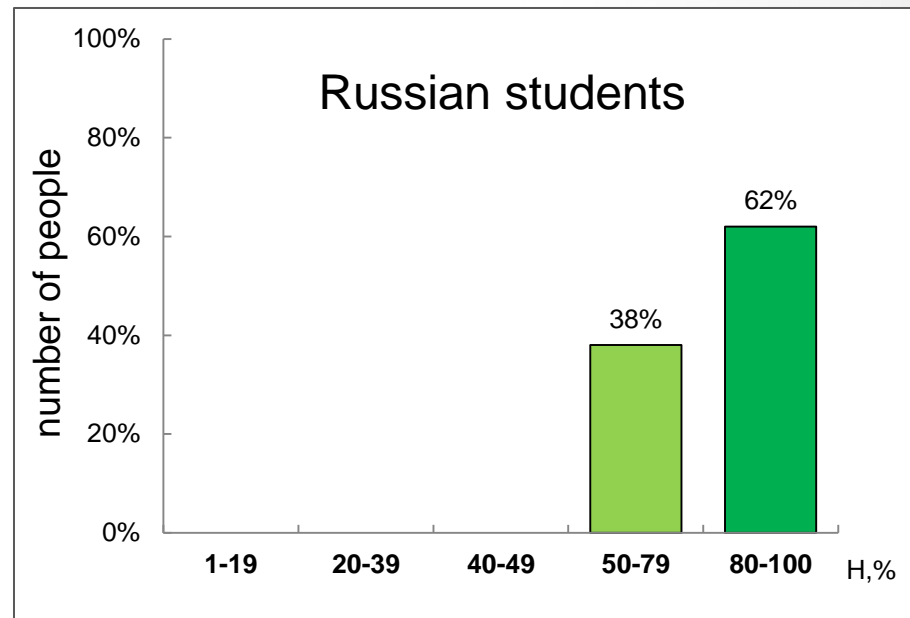
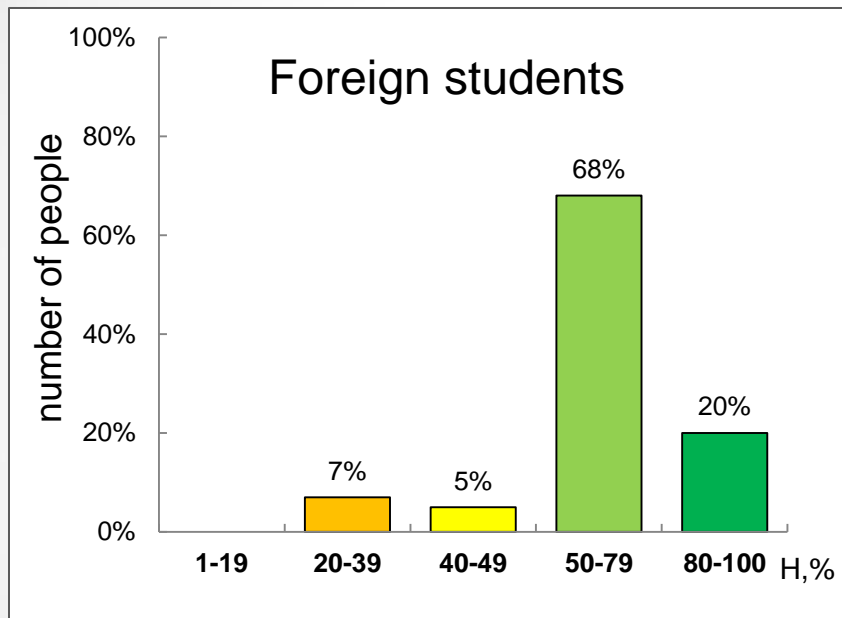
## Factors of relevance which affect students health

	Students Petersburgers	Nonresident students (Russia)	Foreign students
1	Change of atm. pressure	Change of atm. pressure	Change of atm. pressure
2	Rain	Cloudy weather	Sudden cold snap
3	Sudden cold snap	Sudden cold snap	Staying in the subway
4	Cloudy weather	Sudden warming	Plane Flight
5	Sudden warming	Stay in the subway	Rain

# Health assessment of students

(by software medical complex «Omega-M»)

Integrated indicator of organism's functioning (H,%)



Gradation H,%

H,%	1-19	20-39	40-49	50-79	80-100
Health	pathology	normal	good	very good	excellent

# Conclusions

**Most of students** come to RSHU from the countries with hot and sharp continental climate.

**Foreign students' adaptation** is much more expressive than the one of nonresident students, from other regions of Russia.

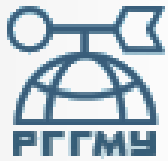
**Adaptation to new climatic and ecological conditions** causes high level of stress for students' adaptive mechanisms which is expressed in health deterioration, increasing of meteosensitivity levels and decreasing of adaptation potential of students' organisms.

**The main difficulties** experienced by foreign students are mostly related with adjustment to new sociocultural and living conditions, food change.

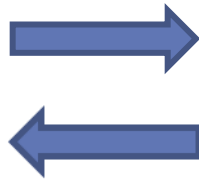


# Module 3.

- ✓ Developed the technology training of regular specialized weather forecasts for medical purposes in **collaboration** with Hydrometeorological Service.
- ✓ Regular informing residents about the possible adverse weather (TV, radio, mass media, web) in St. Petersburg.



*Russian State  
Hydrometeorological  
University*



*St. Petersburg Weather Central  
Hydrometeorological Service*



**Popular TV-programmes at St. Petersburg**

# Findings of the project

The results obtained in the performance of the project can be employed for several practical problems:

1. Assessment of climatic and therapeutic resources in order to solve the problems of tourism and sanatorium treatment.
2. Determination of the specific adaptation of nonresident students.
3. Assessment of the impact of weather on public health in different climatic zones.
4. Providing reliable information on the impact of space and terrestrial weather on human health and preparation of weather forecasts for medical purposes.
5. Special programs for mass media to explain the mechanisms of influence of the effects of weather on human health to inform and help weather-sensitive people.

# Development of the project “ Biomet\_Forecast”

- ❑ Formation **mechanisms adaptation** support in terms of adverse health effects of medico-geographical, weather and environmental factors. Establishment system of early warning of adverse weather or environmental conditions in the megalopolises.
- ❑ **Biometeorological assessment** of weather and climate of especially extreme characteristics which influence health and main types of a disease. Polluting role of megalopolises and their influence on health.

**Formula for own success:  
knowledge + collaboration = result!**



**THANK FOR YOUR ATTENTIONS 😊!**



# Contacts

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