



**Ministry of the Public Health of Ukraine
Zaporozhe State Medical University
Chair of General Hygiene and Ecology**

HEALTH AND WEATHER

Zaporozhye 2014

Lecture plan

1. Concept of weather and climate
2. Weather and climate forming and characterizing factors
3. Parameters of solar activity
4. Definition degree variability of weather
5. Medical classification of weather
6. Weather features in different geographical regions
7. Concept of microclimate
8. Factors characterizing microclimate

Concept about weather and climate

Weather - dynamic set of physical properties of ground layer of air (troposphere) for a short time interval (hours, day, weeks).

Climate - the long-term mode of weather naturally repeating in the given district, its parameters - monthly average temperature of air, average amount of days with deposits.

Thus, weather - the changeable phenomenon, climate - statistically constant concept

- 1) Concept “weather” - very complex thing, it has very many forming factors, which is not good investigated in meteorology
- 2) Till now the mechanisms of the development of metheotropic reactions in the organism are not well investigated.

The basic weather forming factors:

- 1) **Geliophysical** - intensity of a sunlight and solar activity
- 2) **Geophysical** - intensity of a geomagnetic field of the Earth, geomagnetic storms
- 3) **Electric condition of atmosphere** - intensity and gradient of electric field, air ionization

4) Meteorological -
temperature, humidity,
speed and direction of
movement of air,
atmospheric pressure

5) Synoptic - overcast,
deposits

6) **Chemical compound** of atmosphere - the content of oxygen, CO₂, pollutants in atmospheric air.

All these factors are interconnected and operate on the person in a complex - difficulty

Meteorological factors –
sharp fluctuations of
temperature and
atmospheric pressure –
than more it is differences
– than more biotrophic
weather.

Electric condition of atmosphere:

- a) The contents + aeroions in air
- b) The gradient of electric field of the Earth

Synoptic factors

Are caused by atmospheric circulation of warm and cold air weights. There are 3 types of air masses - warm, cold, neutral (local). At it movement are formed atmospheric fronts - warm, cold, occlusion (mix of warm and cold masses).

Frequency of change of
air masses on the
average is 1 time in 5-6
days, but happens more
or less often - is
connected to type of
atmospheric circulation:

1) **Cyclone** - atmospheric whirlwind with low pressure in the center and movement of air masses counter-clockwise. It is more often in the winter, on the average above Europe for one year - 40 cyclones.

It is characterized by
unstable weather - it is
cloudy, deposits,
hurricanes, typhoons.
The big differences of
pressure, temperatures,
content O₂.

2) **Anticyclone** - the atmospheric phenomenon with a high pressure in the center and movement of air clockwise. Clear weather - strong heat in the summer or frost in the winter. Sharp differences of weather factors are not present - more favorable weather.

Geliophysical factors

Till now at estimation of weather are little taken into account, though the ingenious founder heliobiology A.L.Chizhevsky in 1920th years has established influence of solar activity on alive organisms, including people.

There are data on concurrence the periods of increase of solar activity with revolutions, wars, epidemics, even frequency of automobile failures.

Complexity studying this question - cyclic changes of solar activity has different periodicity - 11-years, 22-years, 60-years and more, which can be imposed against each other and poorly studied.

There are most investigated
11-12-years a cycles, the
beginning of last 24-th cycle,
known to mankind -1997
year, thus the maximal
activity - in middle of cycle
(2001-2002 years).

Parameters of solar activity:

Index Wolf (W) - amount of spots on the Sun,

Index S - the total area of spots,

Intensity of radio emission of the Sun on a wave 10,7 sm,

Solar wind - corpuscular streams (protons, electrons.)

from the Sun - carry away with themselves magnetic fields and form spiral - sector structure of interplanetary magnetic field (IMF) + and - marks. Each 6-7 days the Earth at movement on orbit gets in IMF other mark that results in changes of.

Geophysical parameters -
electromagnetic field of Earth
(EMF), its deviation from a usual
level named "magnetic storms" -
planetary, local, on intensity -
weak, moderate and big.

**Definition degree variability of
weather.**

Will be carried out under the formula:

$$K = \frac{N}{n} \times 100 \%,$$

Where:

K - coefficient variability of weather, %

N - number days with contrast change of weather

n - total number days in the apparent season

Degree variability of weather

V.Rusanova

<u>Weather</u>	<u>Coefficient variability, %</u>
Very stable	25
Stable	25 – 30
Changeable	30 – 50
Very changeable	more than 50

The reasons, mechanisms and displays MR

People as a whole adapted to
rhythmical changes of
climate and the weather,
connected with changes of
day and night, season of
year.

At aperiodic sharp
changes of weather
factors at people arise
MR, expressed the more
abruptly, than sharper
changes of weather are
observed.

MR is not illness and the diagnosis, but the original pathological condition having various displays on expressiveness at different people.

All people on metheosensibility share on 2 categories:

- a) **meteostable** - tolerant - young healthy people
- b) **meteosensitive** - on the different data it is 30-70 % of the population, in old age, among patients with bronchial asthma, hypertension - up to 90 %.

V.F.Ovcharova (1986)

allocates the following
biological effects of
influence of weather:

Tonic, Spastic, Hypoxic,
Hypotensive.

Displays MR

1) An easy degree -
asteno-vegetative syndrome
- mass character and
synchronism with changes
of weather allow us to think
about presence MR.

2) An average degree - the head and intimate pains, the expressed changes of pulse, blood pressure.

3) A heavy degree - aggravation and weighting chronic diseases - insults, heart attacks, aggravation bronchial asthma - growth mortality patients.

Diseases during which are marked MR

It is revealed 2 groups diseases

1. Diseases for which there are some data on presence MR:

Diseases gastroenterities way (stomach ulcer, gastritis, colites, etc.) - 40-60 % of patients,

Illnesses of kidneys and urine
ways - 40-50 %, diabetes -
weighting of current - 20 %,
Psychiatric frustration - 50 % of
patients, Ophthalmologic,
surgical pathology etc.
Among ill children 25-45 % -
meteosensitive

2. Diseases for which presence MR is authentically proved:

- **Cardiovascular diseases** - statistically authentic growth number of insults, hypertonic crisis's, heart attacks and mortality at biotropic weather
- including according to first aid,

- **A bronchial asthma** - increase and weighting attacks of asthma, mortality,
- Rheumatism - activation process, strengthening polyarthrititis, artralgya - in 90 % of patients,

- **CNPD** (chronic nonspecific pulmonary diseases) - in **60-72 %** of patients (according to the Yalta scientific research institute).

Medical estimation of weather

In a basis of all medical classifications - the concept offered N.E.Vvedenski about force of external irritation:
low, average and high.

This on G.P.Fedorov's
classification - 3 types of
weather: optimum,
irritating and sharp, on
other classifications from
4 up to 7 types.

The main thing in medical
estimation weather - the
account sharpness
fluctuations weathers
factors - it intraday
differences.

Scientists of the Yalta scientific climatic research institute named by Sechenov have offered the common clinical index **pathogenicity weather** - the sum of individual indexes changes for day on the most important weather factors.

If index

0-19 - optimum weather,

20-49 - irritating (demands

strengthened medical

control), more than 50 -

sharp (demands strict

medical control).

There is also indexes
variability of weather (for
estimation of a climate). The
chair of hygiene Kiev
medical university offers the
scheme medical estimation
weather on 15 parameters.

System prevention MR - 3 basic directions

- 1) Common hygienic methods – rational nutrition, rational mode of day
- 2) Organizational measures - medical weather forecasts, medical estimation of weather.

3) **Treatment**-and-prophylactic measures:

a) Increase nonspecific resistancy.

b) Sparing mode.

c) Medicaments prevention.

Thus allocate seasonal
prevention - regular
reception small doses of
preparations in adverse
months in the given area

Urgent prevention will be carried out **for metheosensitive cardiological** and other patients in hospital in the periods and days biotropic weathers on the basis of urgent medical weather forecasts.

**Seasons for seasonal prophylaxis
cardiovascular diseases in
Crimea(V.Bardov, 1985).**

**Most unfavorable months on
reliable rising frequency of
exacerbations:**

**hypertonic crises - 2,3,4,5 and 12
month**

**attacks of stenocardia -1,2,3,4,5
and 11 month**

myocardial infarction

-1,2,3,4,5,7,8

Month violation of
cerebral circulation
(insults etc.)-

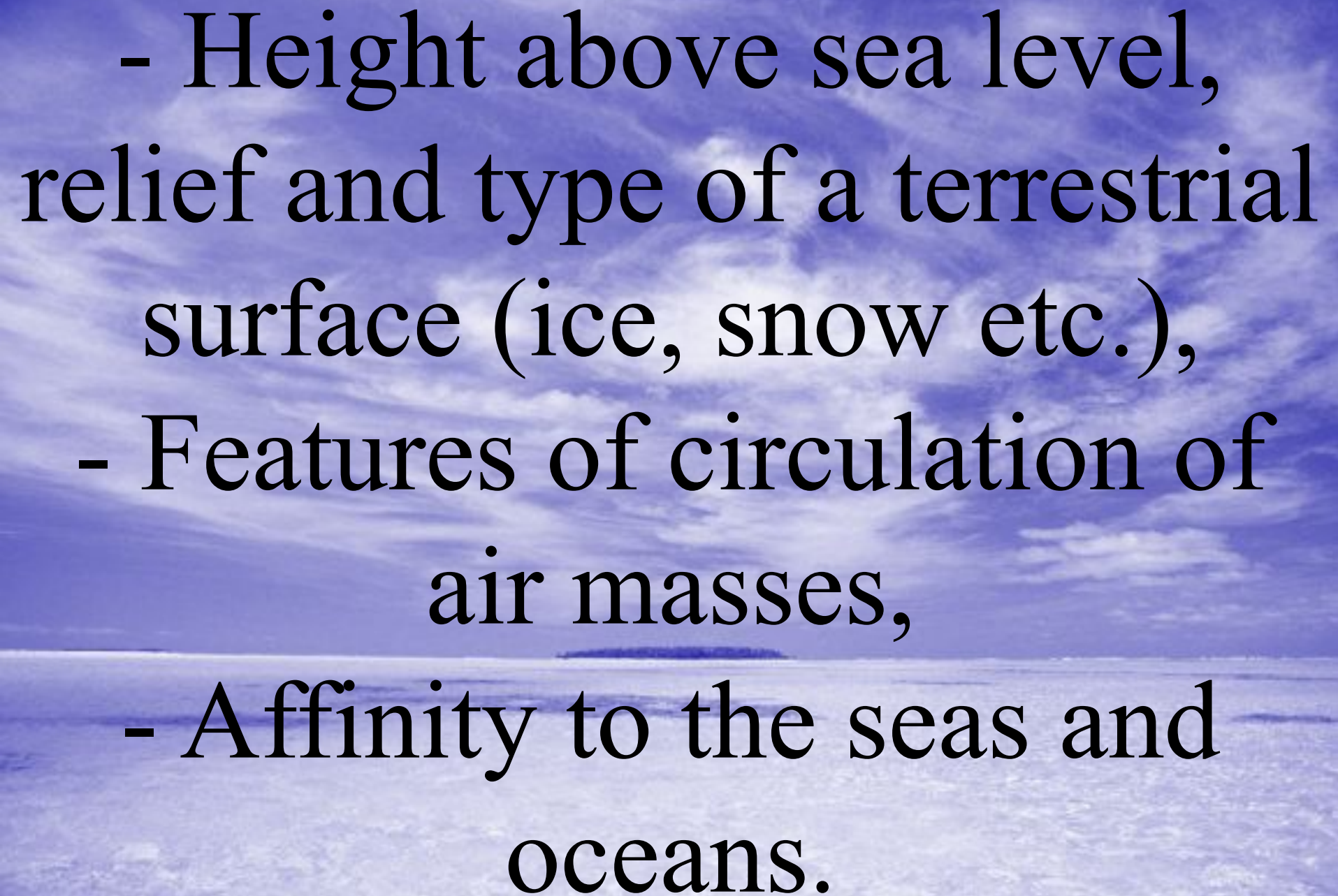
1,3,4,5,6,12 month

Hygienic value climate

Climate it is a long-term mode of weather in the given district.

The basic climate-formed factors:

- The geographical breadth, influencing size of a sunlight,

- 
- Height above sea level, relief and type of a terrestrial surface (ice, snow etc.),
 - Features of circulation of air masses,
 - Affinity to the seas and oceans.

Parameters of climate -

average (monthly
average, mid-annual)
parameters of
meteorological factors,
wind rose, number of
clear days etc.

The important parameter - index
of instability weather:

$$T = a / b,$$

where a - number of days with
changes weather, b - number of
days of the period of
supervision

(season, year). If index T more 0,5 – it is adverse climate (not good for ill person). At long residing at the certain climate the person has the certain dynamic stereotype providing normal ability to live.

At sharp change of climate
(moving to the different
climate) is observed
acclimatization - complex
functional - morphological
changes in organism, directed
on the adaptation to new
climatic conditions.

Conditionally in this process allocate 2 stages:

- a) **Partial acclimatization or adaptation** - from the first hours - to 14 days (at ill people - about 30 and more days).
- b) **Full acclimatization** - after 14 day - some months, to conditions of Far North - up to 1,5 years.

During acclimatization it is reduced resistancy of organism to adverse factors of environment - growth diseases, asteno-vegetative syndrome etc.

Acclimatization should be taken into account in resort treatment - to not direct patients on resorts with sharply distinguished climate (24 days - the basic period of acclimatization). The big problem for army, the Navy, workers on Far North.

The Earth climate classification

<u>Name of the climate zone</u>	<u>Geographical latitude</u>	<u>Average annual temperature</u>	<u>Surface type*</u>
1. Tropical	$\pm 13^\circ$ latitude	$+20-24^\circ\text{C}$	Evergreen, forests, jungle
2. Hot	$13-26^\circ$ "-	$+16-20^\circ\text{C}$	Forests, steppe, desert
3. Warm	$26-39^\circ$ "-	$+12-16^\circ\text{C}$	Forests, steppe, desert

4. Moderate	39-52° -"-	+8-12°C	Forest-steppe
5. Cold	52-65° -"-	+4-18°C	Forests
6. Inclement	65-78° -"-	0-4°C	Forests, tundra
7. Arctic (polar)	69-90° -"-	-4° and below	Tundra

*** The relief (flat and undulating grounds, highlands) and height above the sea level are of great importance.**

Medical weather classification by I.I. Grigor'ev

<u><i>The weather types</i></u>	<u><i>The weather characteristics</i></u>
The most comfortable	<p>The stable weather is determined by anticyclone without considerable cloudiness and precipitations. The atmospheric pressure is higher than 760 , an atmospheric difference is near 5, an air movement speed is to 3.0 m/sec</p>

Comfortable

Insignificant regional changes of the weather due to short-term precipitations and the variable cloudiness. An atmospheric pressure is 760-755, an atmospheric difference - 6-8 , an air movement speed 4.0-7.0 m/sec, a temperature difference to - 5, oxygen concentration - below 315.

The weather requires intensified medical control (supervision)

A cloudy unstable weather with precipitations, frequently caused by moderate cyclones and local thunderstorms. An atmospheric pressure is 754-745, an atmospheric difference is 9.0 – 14.0, air movement speed is 8.0 – 10.0 m/sec, a temperature difference is 6 - 9⁰C, oxygen concentration is 260 - 289 mg/l.

The weather requires severe medical control (supervision)

The weather is with storms and intensive precipitations, caused by deep cyclone. An atmospheric pressure is to 745, a pressure difference is above 14, a temperature difference above 10°C , oxygen concentration - below 260 mg/l.

Medical weather classification by G.P. Fedorov

<u>The weather type</u>	<u>Meteorological characteristics</u>			
	Air temperat ure difference , °C	Relative air humidity, %	Air moveme nt speed, m/sec	Air pressure difference, gPa
Optimal	2	40 - 70	3	3
Irritant	2 - 4	70 - 90	3 - 9	4 - 8
Acute	above 4	above 90	above 9	above 8

Medical weather classification by V.F. Ovcharova and others

The weather characteristics from the medical view

The weather pattern characteristics

Stable indifferent

The slow-moving anticyclone without atmospheric fronts

Unstable, passing from indifferent to "spastic" type

Destruction of the anticyclone. An approach of an inclination, a crest, a non-gradient region with increased pressure.

	An approach of a cold front or an occlusion front as a cold type.
"Spastic" type	An establishment of an inclination (ridge), a crest, a non-gradient region with increased pressure.
	A cold frontal passage or an occlusion frontal passage as a cold type.

**Unstable
„spastic“ type
with elements
of „hypoxic“
type**

The retreat of a cold front or an occlusion front as a cold type

An approach of a cyclone, a saddle, a dish, a non-gradient region with low pressure

An approach of a warm front or an occlusion front as a warm type

“Hypoxic” type

The retreat of a cyclone, a saddle, a dish, a non-gradient region with decreased (reduced) pressure

A warm front passage of an occlusion frontal passage as a warm type

*The weather
characteristics
from the medical
view*

The weather pattern characteristics

**Unstable
„hypoxic“
type with
elements of
„spastic“
type of
weather**

An establishment of a cyclone, a saddle, a dish, a non-gradient region with decreased pressure

The retreat of a warm front or an occlusion front as a warm type

	An approach of a inclination (ridge), a crest, a non-gradient region with increased pressure
"Spastic" type weather passing to stable indifferent	An establishment of an anticyclone after a cold front
	A formation of a local anticyclone

Microclimat - the climate of a small area, as of confined spaces such as caves or houses (cryptoclimate), of plant communities, wooded areas, etc. (phytoclimate), or of urban communities, which may be different from that in the general region.

Microclimate depends on humidity
and speed of movement of air,
temperature of protecting surfaces

$$Q_{total} = Q_r + Q_c + Q_t$$

Q_{total} - total loss of heat

Q_r - radiation

Q_c - convection

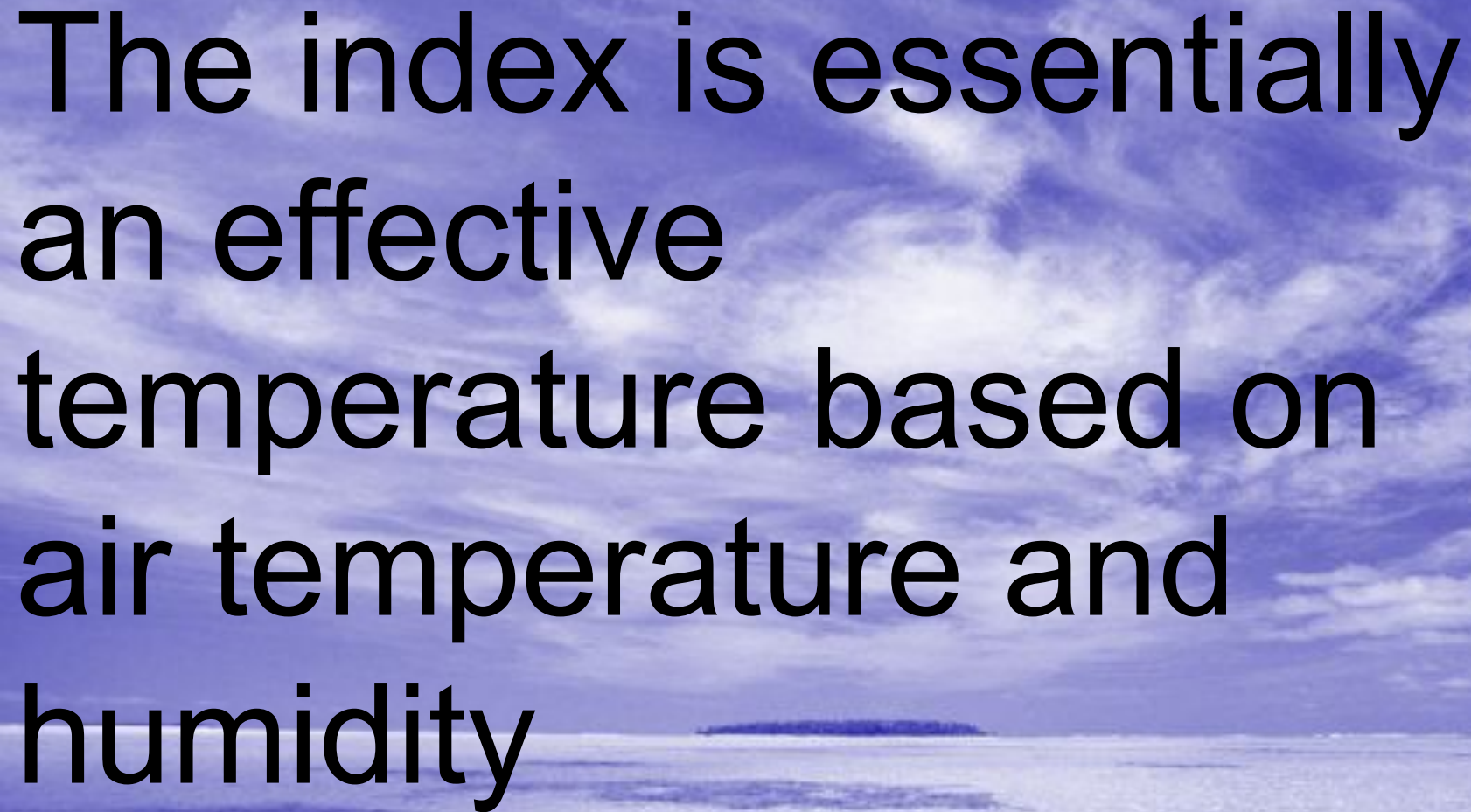
Q_t - transpiration

Hygienic estimation of a microclimate:

- Value estimation
- Objective estimation:

Comfort zone (comfort of 50% of people) – 17,2 -21,7 °C

Temperature-humidity index
combination of temperature
and humidity that is a
measure of the degree of
discomfort experienced by
an individual in warm
weather; it was originally
called the discomfort index.;



The index is essentially
an effective
temperature based on
air temperature and
humidity

Most people are quite comfortable when the index is below 70 and very uncomfortable when the index is above 80 to 85.

Pathological reactions to temperature discomfort

Sharp hyperthermia - rise in temperature of a body to 38,5-40 °C, sweat branch, pulse increase, breath increase, dizziness

Heatstroke - slackness, a headache, a damp skin, a nausea, vomiting, a tachycardia, temperature 39-40 °C

The conception of "climate" includes not only the temperature, humidity, the mobility of air masses and atmospheric pressure, but also electromagnetic characterization of factors - intensity of the magnetic field,

electrical conductivity
of air,
the activity of the
atmospherics, the
intensity of solar
radiation.

At the day time increases the motor activity of human, increases also metabolism, stronger secretes bile. This has important meaning for treatment of diabetes mellitus and diseases of the gastrointestinal tract, the building of therapeutic diets.

We also know that most people are born and die in the dark of night. Clinically are confirmed changes of physiological functions dependent of the seasons of the year.

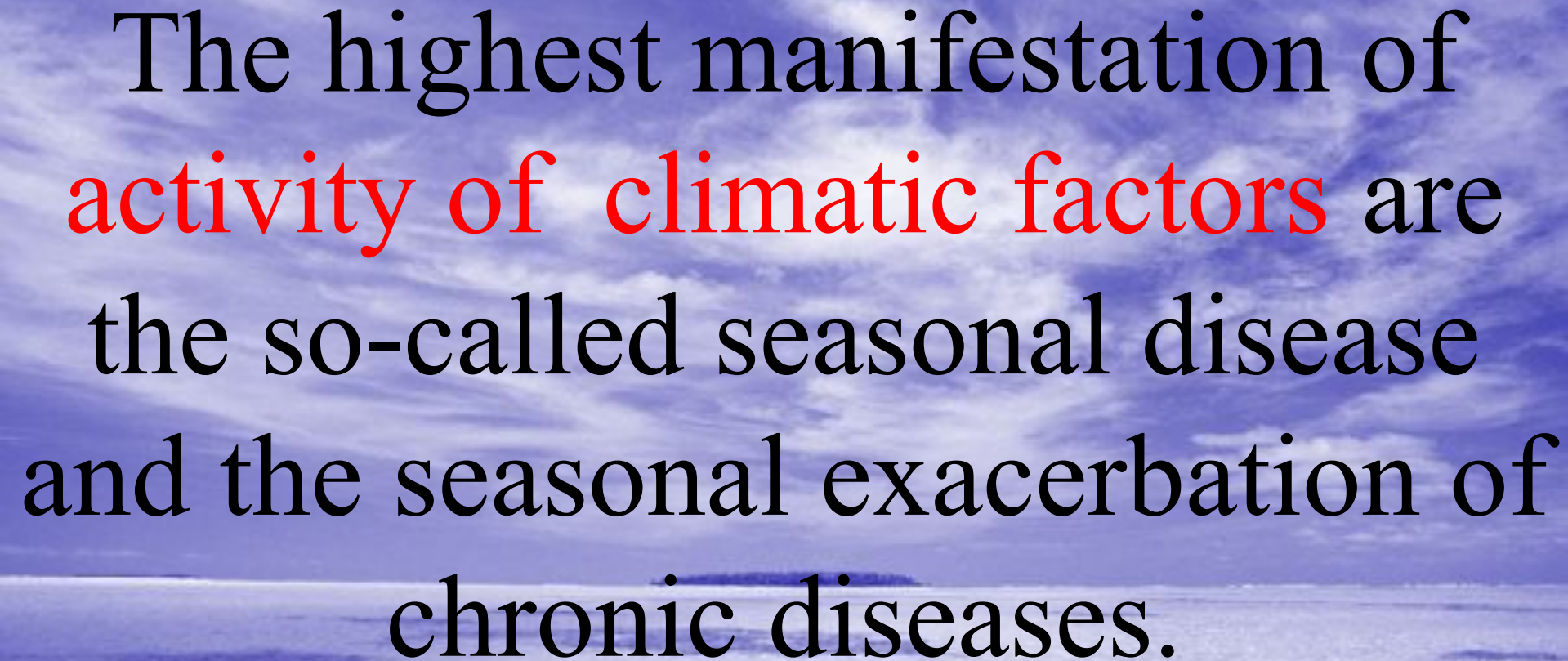
So, register cyclical changes
of skin sensitivity to
ultraviolet rays during the
year: in winter it is higher
than in summer

In the summer register redistribution of blood from internal organs to the skin, in connection with this fact blood pressure is lower in summer than in winter.

In the summer there is an increased cardiac output, less manifested vascular reaction and a large consumption of oxygen tissues than in winter. Ability of blood to bind carbon dioxide greatest **in the winter.**

Dry and hot strong wind,
brings a lot of sand. The dust
gets into the house, penetrates
clothes, hair, gets in eyes,
nasopharynx, generates the
feeling of bothersome
sultriness.

By humans develops low mood, special oft appear backsetsof chronic diseases of the nervous and cardiovascular system.



The highest manifestation of
activity of climatic factors are
the so-called seasonal disease
and the seasonal exacerbation of
chronic diseases.

Most remarkable are associated with the seasons catarrhal diseases (influenza, acute respiratory diseases, inflammatory diseases, respiratory diseases, etc.) The maximum number of these diseases happen in the autumn, winter and early spring.

The greatest number of cases of pneumonia by children under 1 year was registered in January and April, which coincides with the most drastic weather changes. Cooling, the violation of trophic of pharyngonasal cavity promote the development of the **infectious process.**

In cold weather increases mortality. Highest death-rate from pulmonary tuberculosis accounts for the winter and early spring, from cardiovascular disease - in November, December.

In the spring atmospheric pressure may have significant daily variation, it generally tends to decrease, decreases the absolute quantity of oxygen in the air.

Due to frequent changes of air masses in spring increases the number of days with so-called **meteorotropic effects** of the atmosphere, tonic and spastic during the passage of cold atmospheric fronts at increased atmospheric pressure and hypotensive-hypoxicin areas of the low atmospheric pressure and a warm front.

The process of **acclimatization** is a longtime adaptation to new climatic conditions associated with the formation of a new dynamic stereotype, which occurs through the establishment of temporary and permanent reflex connections with the environment through the central nervous system.

Adaptation is the process of supporting of the functional condition of homeostatic systems of the body, that provides its preservation, promotion, performance, maximum life duration in the inadequate conditions of natural environment.

Vital activity of organism in the
inadequate conditions of natural
environment by preservation of
optimal characteristics of vital
functions requires additional
inclusion of adaptive
mechanisms of physiological
reactions.

For the **successful
acclimatization** of man has so
much value does not effect the
harsh climatic conditions, as a
rational and purposeful
organization of dwelling,
clothes, working conditions and
nutrition.

By **successful resolution** of this question the human acclimatization in the inadequate climatological conditions is successful, without prejudice to his health and performance.



Thank you for attention