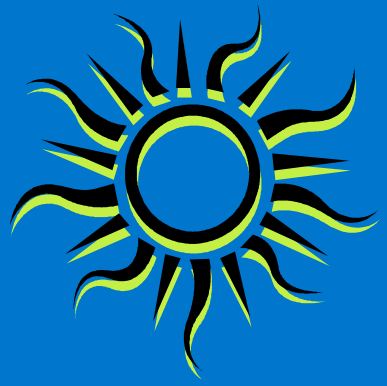
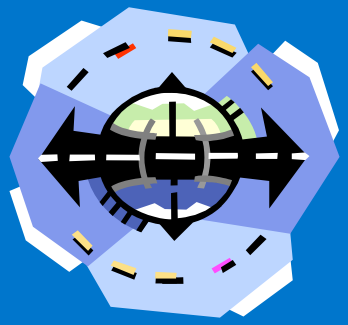


Climatic risks minimization: Problems of global climate change Carbon problem

What is the climate?



Climate is the item of international regulation

Under the conditions of anthropogenic climate changes the collision of the interests of different states is unavoidable.

The priorities of economic growth of one country can come into contradiction with the priority of safety of others.

Millenium Development Goals

For the purpose of solution to problems of humanity United Nations adopted "Millenium Development Goals" (MDG).
Millenium Development Goals of UN is a programme for poverty reduction and general rise in the standard of living.
The program was adopted by 147 heads of states and representatives of 189 countries in 2000, including the Russian Federation.

If the world obtains Millenium Development Goals, 500 million people will climb out of poverty. Others 250 million will not be pinched with hungry any more. 30 million children and 2 million mothers will manage to be save, which otherwise would likely die.

Millenium Development Goals must be obtained by 2015

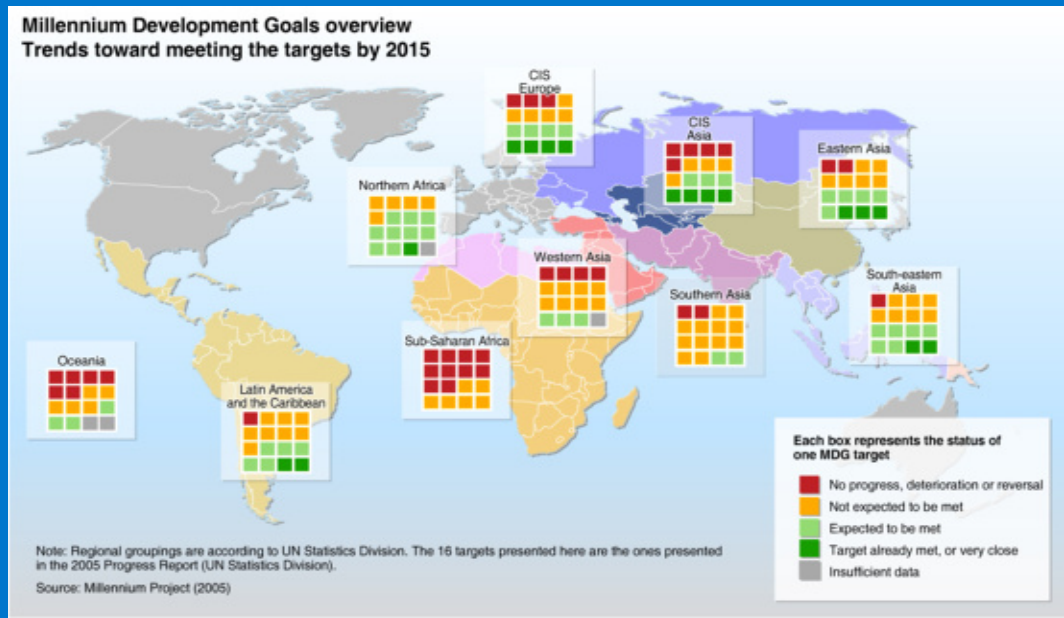
1. Eradication of poverty and hungry.
2. Provision of universal primary education.
3. Encouragement of equality between women and men and empowerment of women.
4. Infant mortality reduction.
5. Improvement of maternity protection.
6. Eradication of HIV/AIDS, Malaria and other diseases.
7. Providing of sustainable development of environment.
8. Organization of worldwide partnership for the purpose of development.

Goal 7. Providing of sustainable development of environment.

Aim 1:

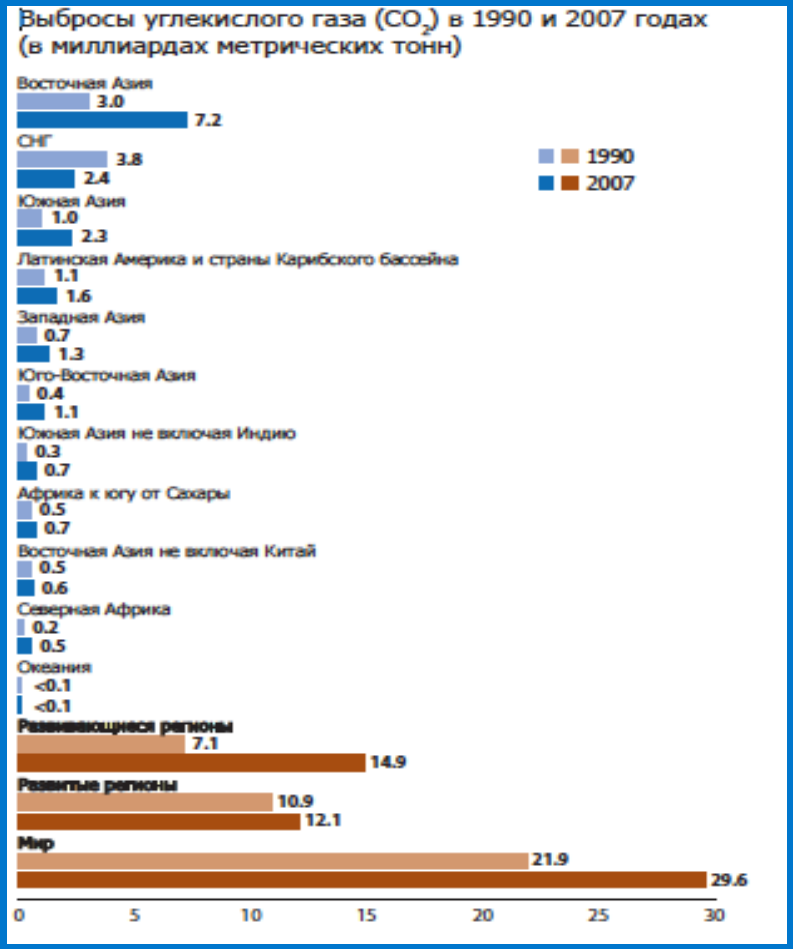
Include principles of sustainable development in the country strategies and programmes and reverse the process of natural resources loss.

- **Evidence of slowdown of woodland loss has already appeared but it is still dangerously high.**
- **The problem of climate change requires urgent and firm measures.**
- **Unparalleled results of Montreal protocol activities show that standing against climate change is in our hands.**



Realization of the goals in development sphere

- Increase of world emission of CO_2 by 35% in comparison with 1990
- Volume released per head in developed countries – 12 tons/person per year
- Volume released per head in developing countries – 3 tons/person per year

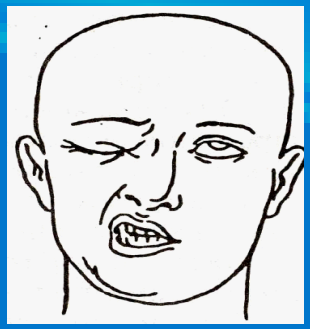


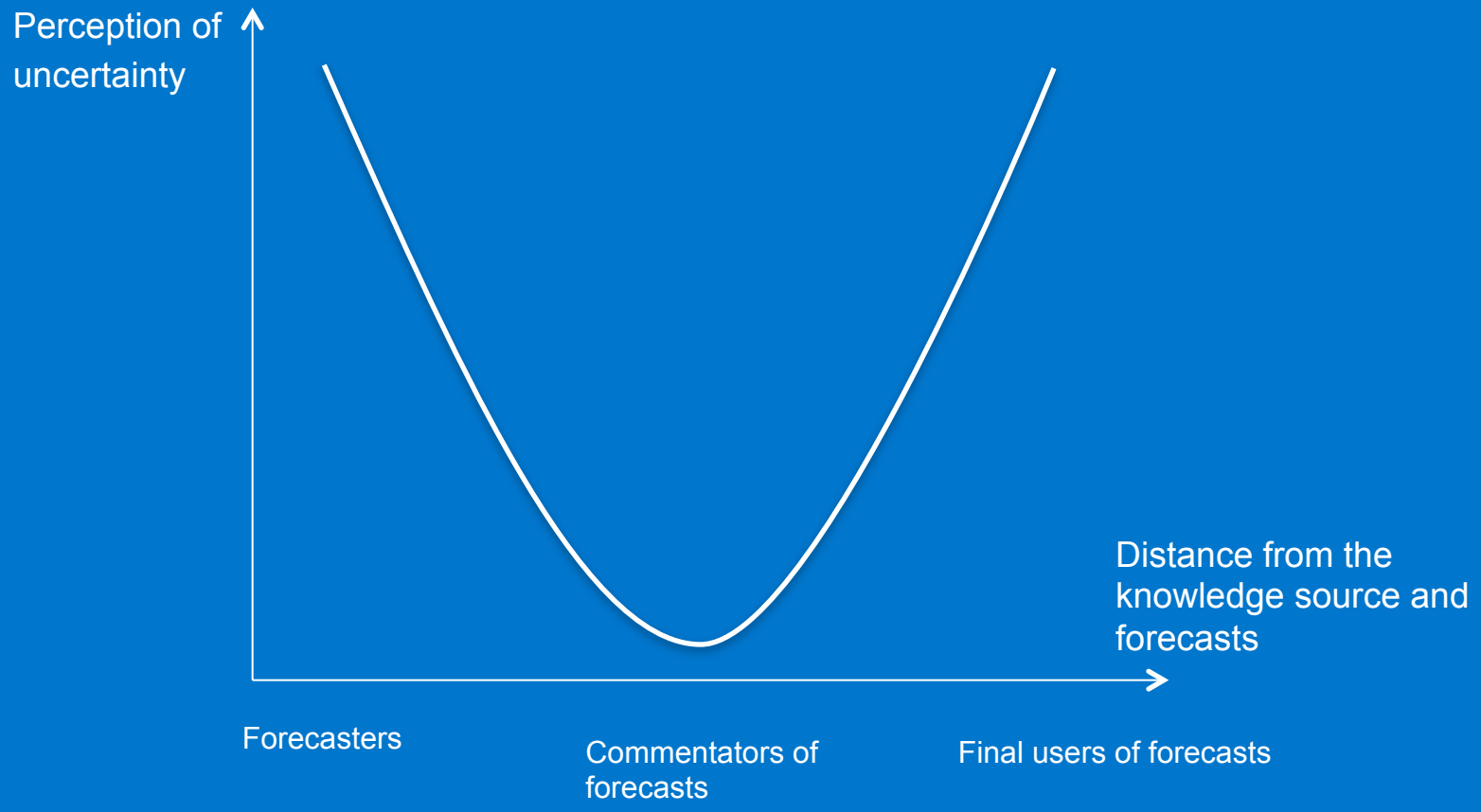
Source: Report on realization of the goals in sphere of development formulated in Millenium Declaration (2010)

Nature of climatic risks

- Climate change is a part of a wider range of critical situations
- The consequences of climate change are contradictory for different economies, types of activities and social groups
- Dynamics, extent and character of climate changes and their consequences differ substantial uncertainty
- Long-term character of climate changes and their consequences
- Difference in a availability and information perception

Asymmetry of information





Uncertainty of climatic forecasts

"The best way to formulate the problem of climate change is to analyze it as a problem of consistent decision making under conditions of uncertainty"

John P. Weyant

STANFORD UNIVERSITY (2000)

ACTIVITY of international agencies and intergovernmental organizations

- WMO – World Meteorological Organization plays a leading role in climate system monitoring and prediction of its future state **(www.wmo.ch)**
- IPCC – Intergovernmental Panel on Climate Change – official reports, climate change and its causes identification affairs, forecasts, environment impact assessment (**www.ipcc.ch**)
- IEA – International Energy Agency - efficient use of energy affairs, renewable power generation etc. (World Energy Outlook) **(www.iea.org)**

Implications of World Meteorological Organization

- **The phenomenon of climate change itself and its anthropogenic causes are admitted as an accepted fact;**
- **The danger of coming changes for humanity is pointed out definitely;**
- **Greenhouse gas emission stabilization or reduction all over the world will require efforts of planetary scale and will have an impact on all the fields of human activity.**

Delhi Declaration

- Eighth Conference of the Parties to the Framework Convention on Climate Change in Dehli in 2002
- Article 6 UN FCCC – educational affairs, access to information, public and international cooperation implication.

Global climate

- “Climate” (Greek κλίμα (klimatos) – “slope”)
- Global climate is a statistical ensemble of conditions, that the climatic system of the Earth passes over a period of several decades.

Climate and weather

Climatic factors

- temperature
- humidity
- air circulation
- pressure

Amounts in vivo (sea level)

from - 88 to +60 °C

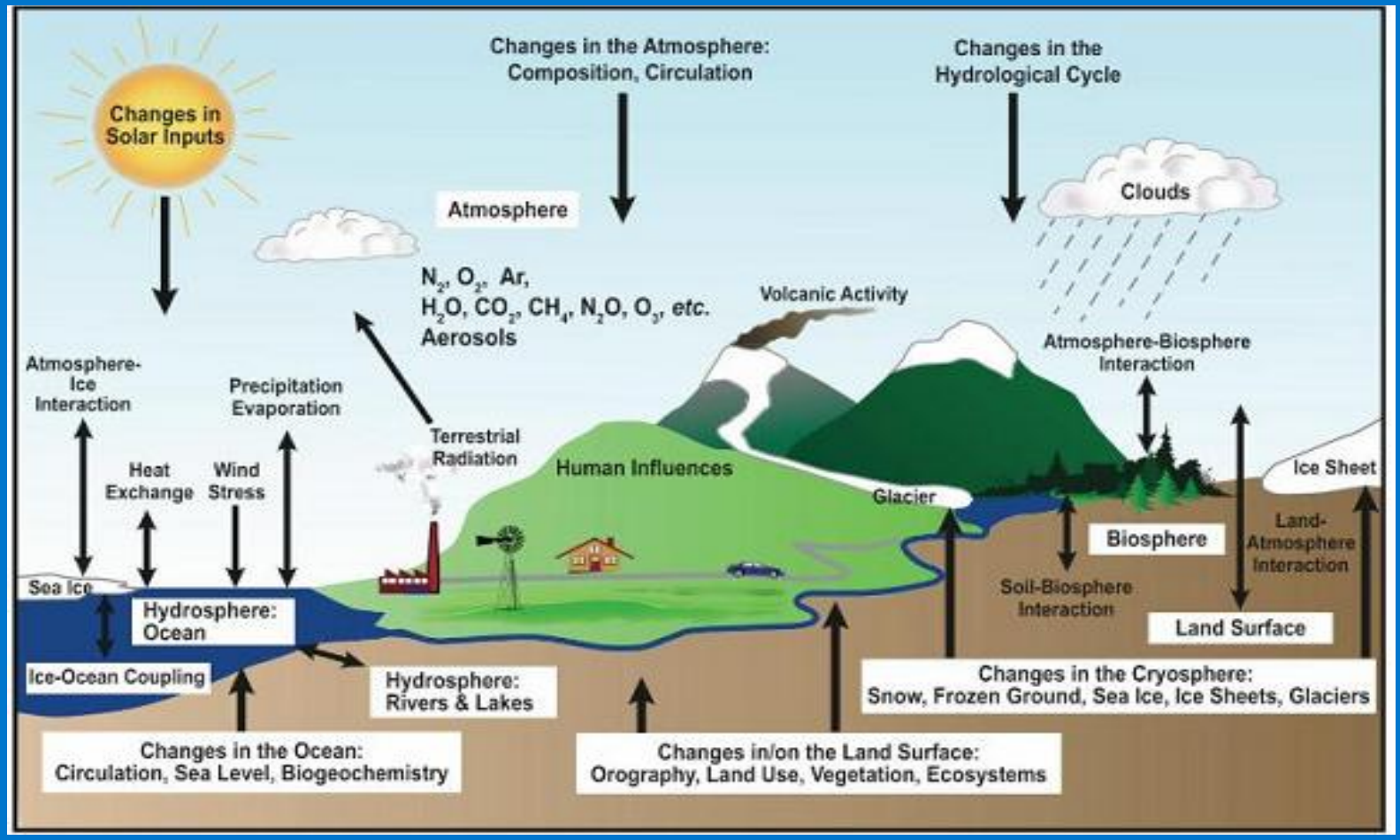
from 10 to 100 %

from 0 to 100 m/sec

from 680 to 810 Mmhg

What do amounts depend on?

Climatic system of the Earth and its parts interference



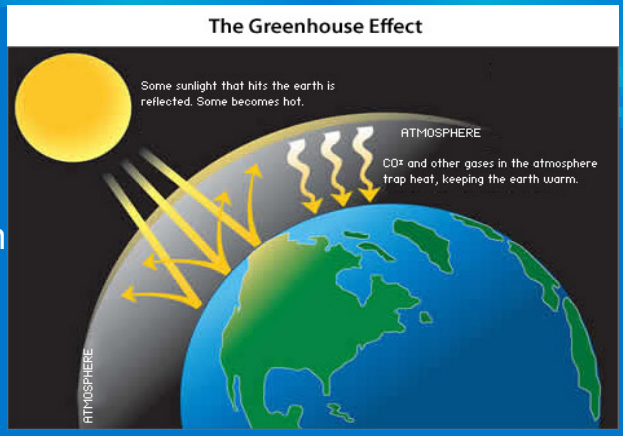
Источник: Наш будущий климат, Отчет ВМО, 2003 г.

Atmosphere

- weight 5,3x10^{18} kg (99,8% is concentrated in lower 55 km)

- covered with complex wind system – general **atmospheric circulation**

Greenhouse effect



- **Water vapour** is the main greenhouse gas, responsible for more than 60% of natural greenhouse effect.

Anthropogenic increase in its concentration in the atmosphere was not registered.

- **Carbon dioxide** is the best known of greenhouse gases. Its natural sources are volcanic outburst, organisms activities. Anthropogenic sources are fossil fuel burning (including включая forest fires), as well as a wide range of industrial processes (e.g. cement and glass production).
- **Methane** is the second in order of importance greenhouse gas. It is emitted because of fossil coal and natural gas spillage in the reserve development, out of the pipe line, as a result of biomass burning, in the waste deposits (as a component of biogas) and also in agriculture (cattle production and rice growing) etc.
- **Dinitrogen monoxide** is the third in order of importance greenhouse gas: its exposure is 310 times higher than CO_2 but it is contained in very small amounts in the atmosphere. It gets into the atmosphere as a result of plants and animals activities, as well as due to manufacture and use of mineral fertilizers, enterprises of chemical industry perfomance.
- **Halocarbons** (hydrofluorocarbons and perfluorocarbons) - gases created for ozone-depleting substances replacement. They are used mainly in cooling machinery.
- **Sulphur hexafluoride**. Its intake into the atmosphere is connected with electronics and isolating matters production.

Hydrosphere

- Active high layer of the ocean 100–300 m. thickness, in which **seasonal warm circulation** occurs.
- Its weight $7,9 \times 10^{19}$ kg, i.e. 15 times larger than the atmosphere weight .
- Area of the World ocean – 71% of the earth's surface.

Cryosphere

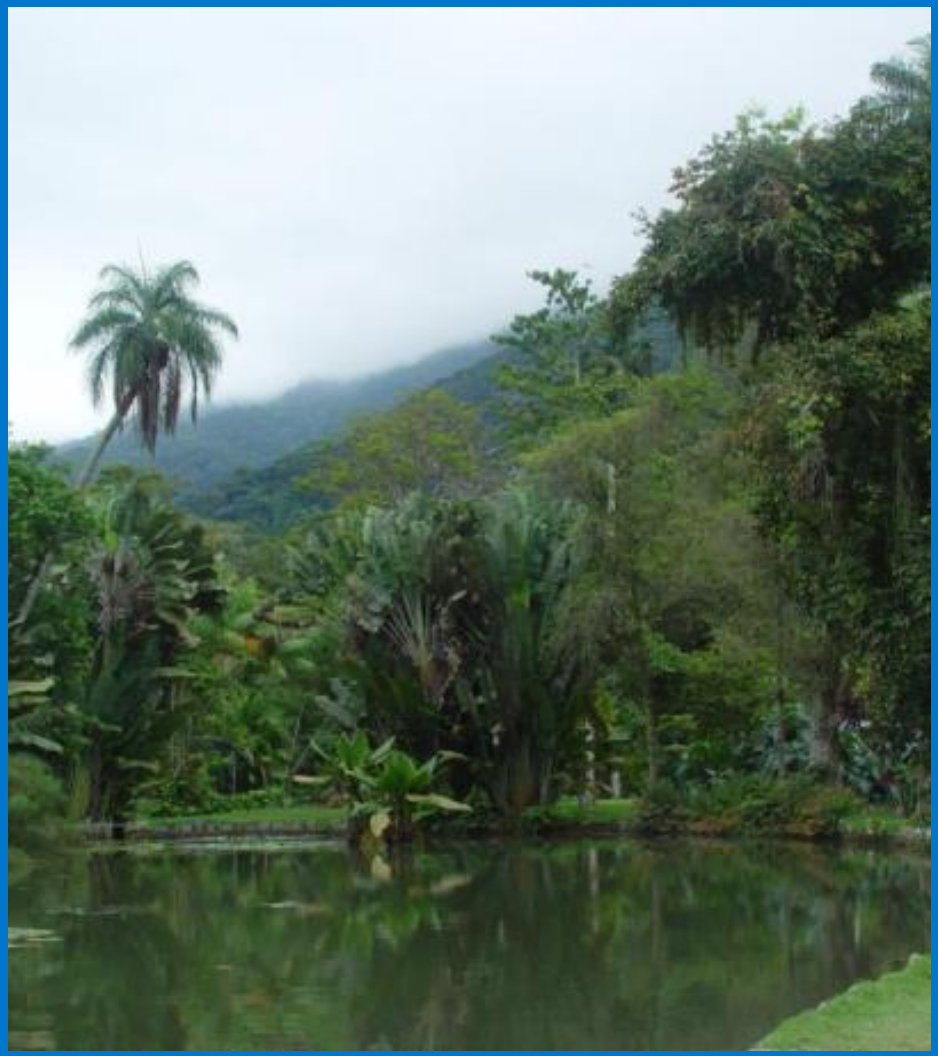
- includes ice-domes of Antarctica, Greenland, mountain glaciers, sea ice and surface covered by blanket of snow
- a great **reflective feature of** incident energy (albedo), reaching 70–80%, by average value 30% for the Earth
- area of the cryosphere is hardly larger than 10% of the Earth's surface

Land

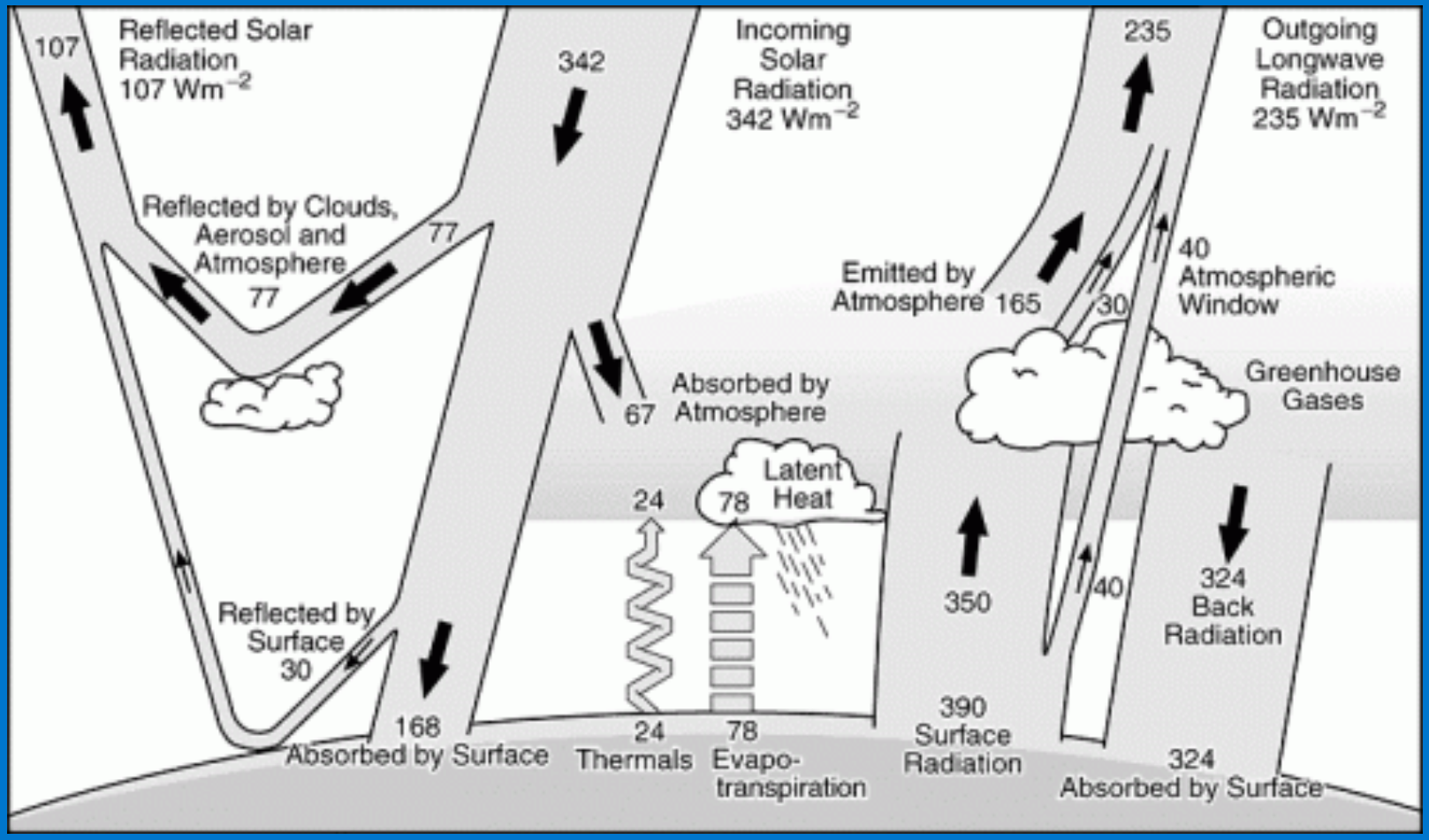
- Active high layer 5–30 m. thickness, in which **seasonal warm circulation** occurs.
- Its weight 3 x10^{18} kg, or 0,57 of atmosphere weight .
- Area of the land is 29% of the earth's surface.

Biosphere

Includes mainly vegetation playing an essential role in climatic system as a **deflecting surface** (area sizes, kinds of plants) and a **source of photosynthesis**



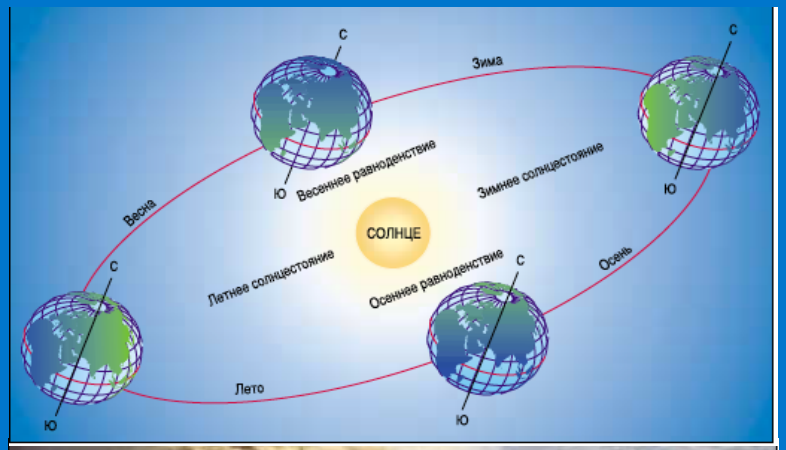
Radiation balance of the atmosphere



Источник: Наш будущий климат, Отчет ВМО, 2003 г.

Natural factors

- solar activity;
- orbital parameters of the Earth (eccentricity, precession, angle of slope of the axis of revolution of the Earth to ecliptic plane);
- greenhouse gases concentration in the atmosphere;
- tropospheric aerosols concentration (sulphuric acid or sulphate aerosols appearing as a result of sulphur dioxide and atmospheric water vapour exposure)
- volcanic activity determining the level of saturation of the stratosphere by sulphuric acid aerosols;
- aperiodic ascillations in the system “atmoshere – ocean” (El Nino phenomenon)



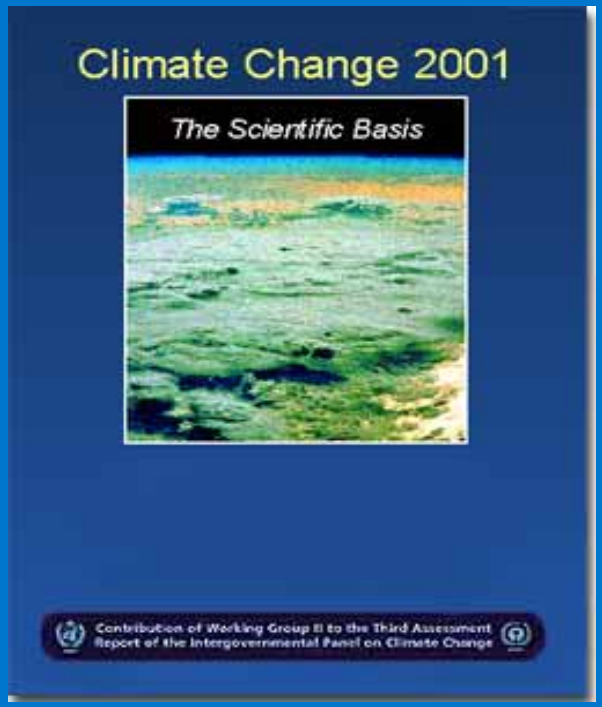
Anthropogenic activities

- Greenhouse gases emission due to fossil fuel burning and industrial processes implementation
- Land use and urbanization

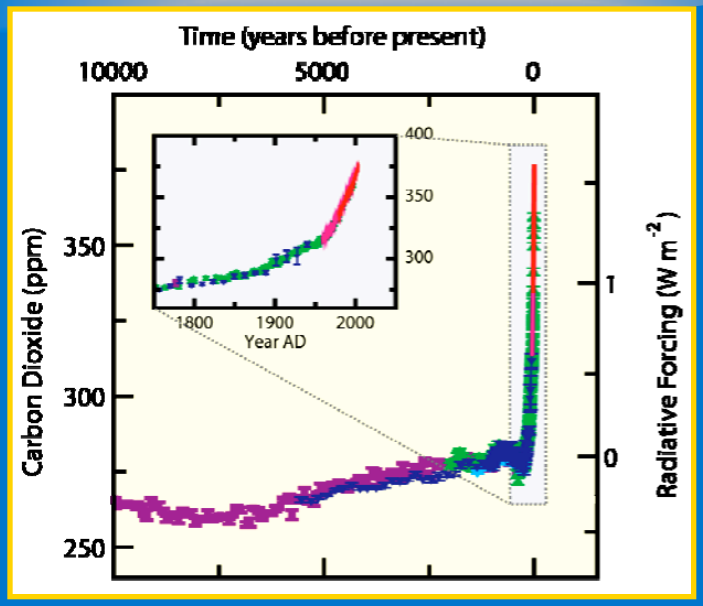
IPCC

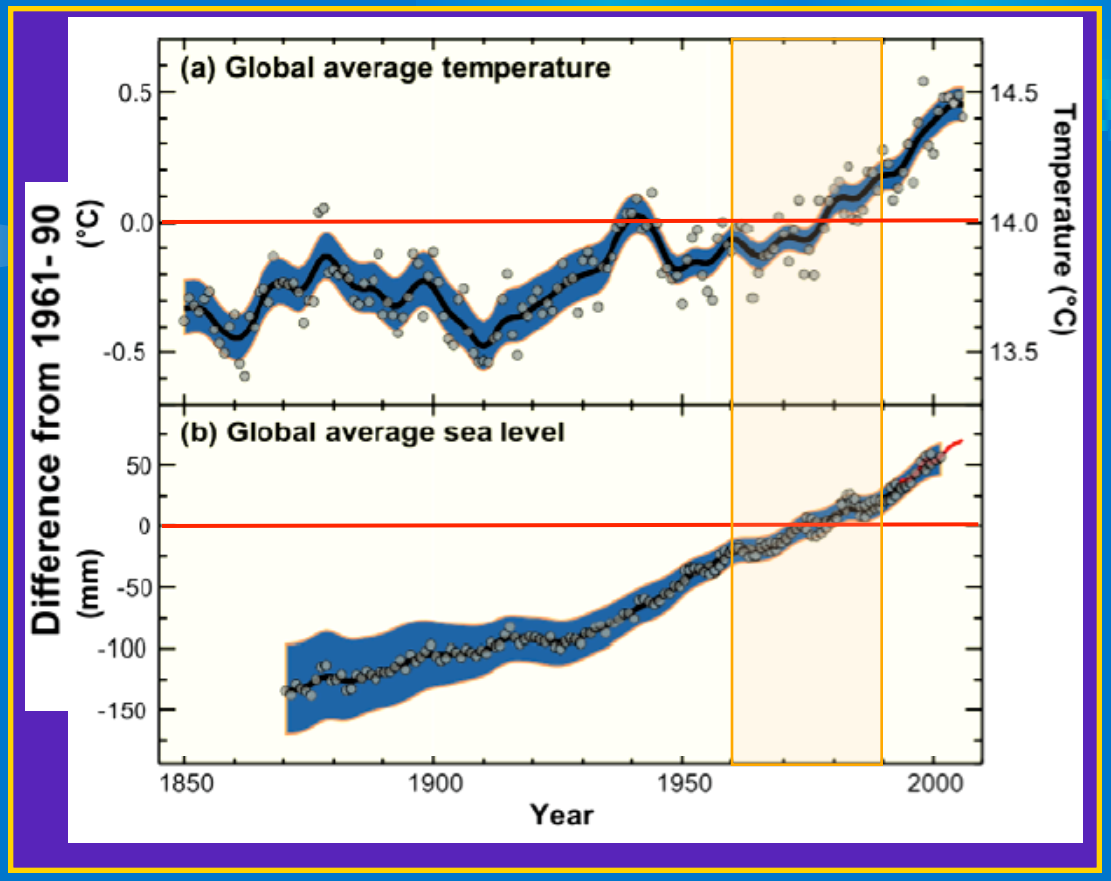
(Intergovernmental Panel on Climate Change)

- ✓ *"Generally observable warming during last 50 years is likely to be caused by increase in greenhouse gases concentration affected by anthropogenic activity"* [Climate change, 2001. Generalized report. 1, p.37]
- ✓ **There is a very high probability (>90%) that observable climate changes occur first of all because of anthropogenic increase in greenhouse gases concentration in the atmosphere.** [Climate Change, 2007: The Physical Science Basis Summary for Policymakers Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007, p5]
- ✓ **Further emission of greenhouse gases leads to warming intensification and climate changes, greater than in the 20s century. Even in case of concentrations stabilization warming and the Ocean level increase will continue during several decades.**



Observable climate changes



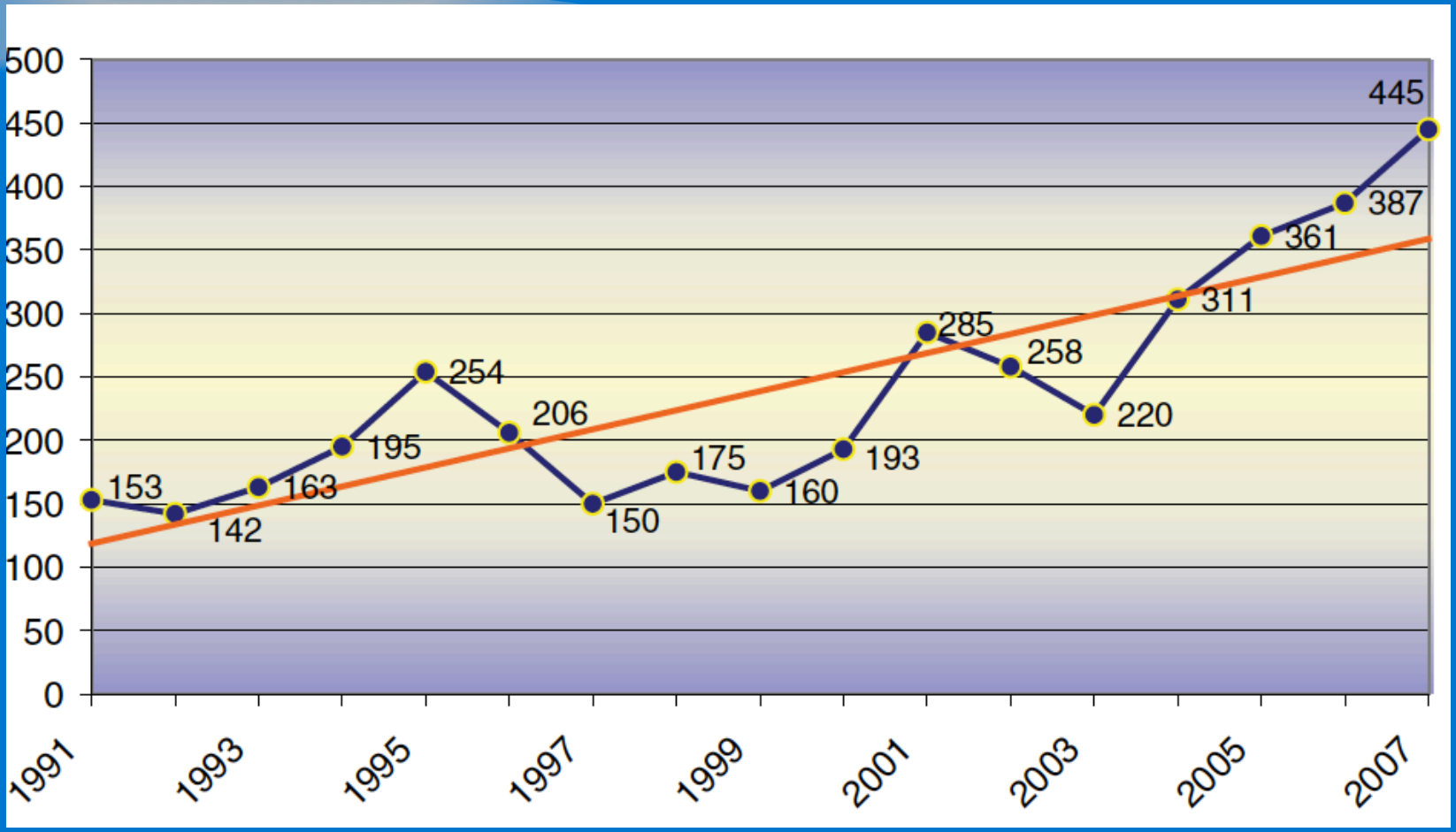


- Sharp increase in carbon dioxide content for the last 50 years
- Rise of average global temperature of air by 0.74° for the last 100 years
- The Ocean level increase on about 17 cm for the last 100 years and 3 mm per year during the last 10-15 years

Summary assessment of impact of climatic risks on the elements of the global system

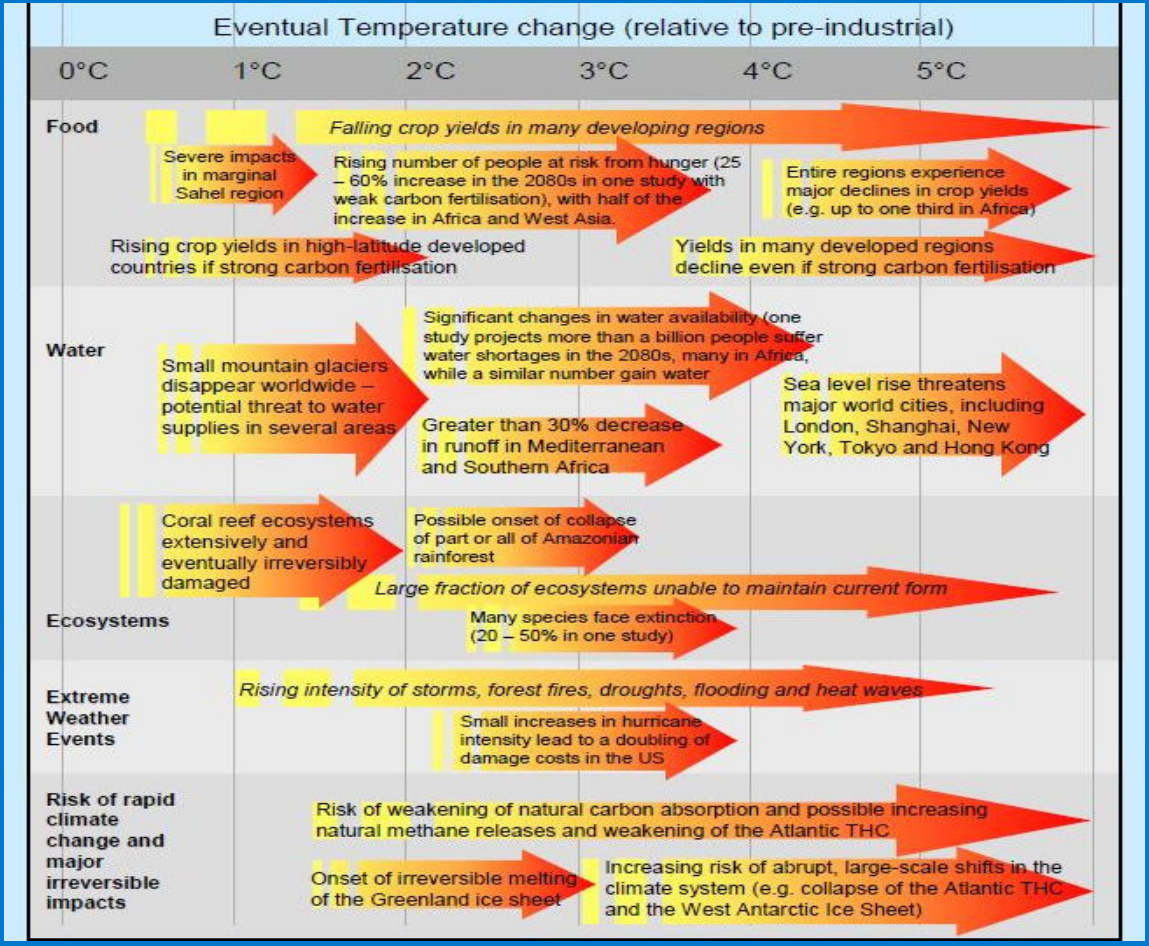
Consequences	Examples
Ecological consequences	•possible disruption of ecological balance in ecosystems; •permafrost degradation in northern regions; •fire hazard rise in the woodland; •increase in number of natural disasters; •the Ocean level increase.
Economic results	•industrial and agricultural efficiency fall; •possible infrastructure destruction; •increase in expenses on the climate changes adaptation and liquidation of damage by natural disasters.
Social impact	•abnormal deceases expansion; •reduction of fresh water availability; •flooding an area of human life and activities; •fall of social standards of living.

Increase in number of dangerous hydrometeorological phenomena in Russia, 1991-2007



Source: Report on the climate patterns in Russia in 2007. RosHydroMet, 2008

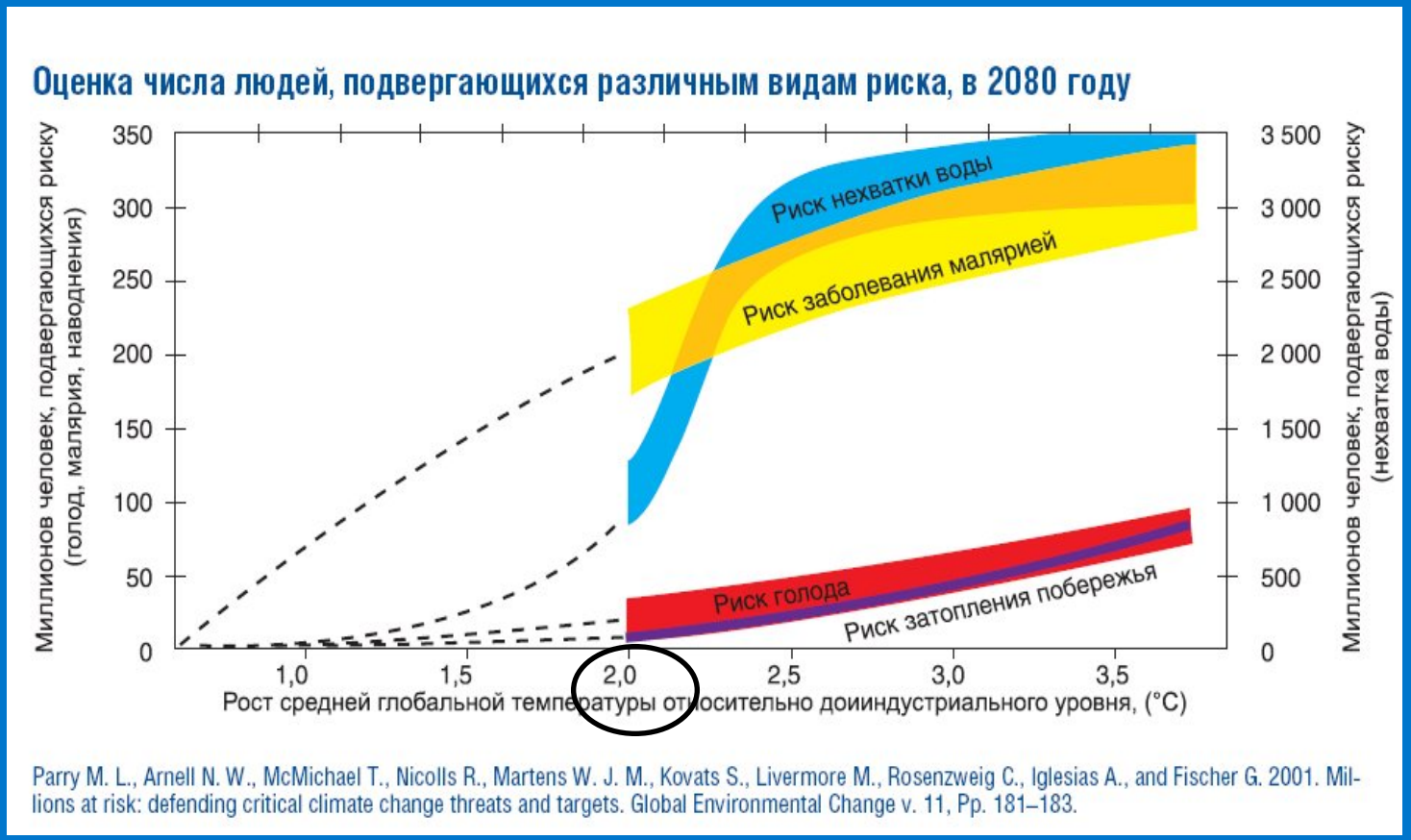
Climate changes risks



Source: Stern Review (2006)

Assessment of number of people exposed to climatic risks in 2080

Global goal – no more than +2° C



Parry M. L., Arnell N. W., McMichael T., Nicolls R., Martens W. J. M., Kovats S., Livermore M., Rosenzweig C., Iglesias A., and Fischer G. 2001. Millions at risk: defending critical climate change threats and targets. Global Environmental Change v. 11, Pp. 181–183.

Report on "Economy of climate change" by ***Nicolas Stern***

Formal economic models estimate expenses and climate change exposure risks amounting to 5% of global GDP annually but this number can rise to 20% allowing for a wider range of risks.

Source: Stern Review (2006)

Effective international measures for climatic risk minimization

- Long-term quantitative goals aimed at risk reduction;
- Short-term flexible mechanisms permitting price breakdown;
- Collaboration in high technology advancement;
- Equal distribution of forces;
- Transparency and general understanding of undertaken actions.

United Nations Framework Convention on Climate Change (UN FCCC)

FCCC (Rio-92) came into force in 1994 (190 countries worldwide).

Goal: stabilization of greenhouse gases concentrations in the atmosphere on the safe level

Principles:

- ► insufficient scientific certainty is not a reason for prolongation of taking preventive steps;
- ► common but differentiate responsibility, a leading role of developed countries in solution to problems of climate change.

Liabilities: The parties of FCCC represent “national communication” containing anthropogenic emission and absorption inventories; adopt national programmes, collaborate in scientific and technical and educational spheres etc.

Kyoto protocol: ideas and results

Restrictions on greenhouse gases emissions (at average, for 5 years, 2008-2012) are determined in percents of emission of the country in 1990:

EU - 92 % (with internal redistribution)
USA - 93%
Japan, Poland, Hungary, Canada - 94%,
Russia, Ukraine - 100%
Norway - 101%
Australia- 108%
Island - 110%

To bring in and debug mechanisms:

- Emission trading (article17)
- Joint implementation (article 6)
- Clean Development Mechanism (article 12)

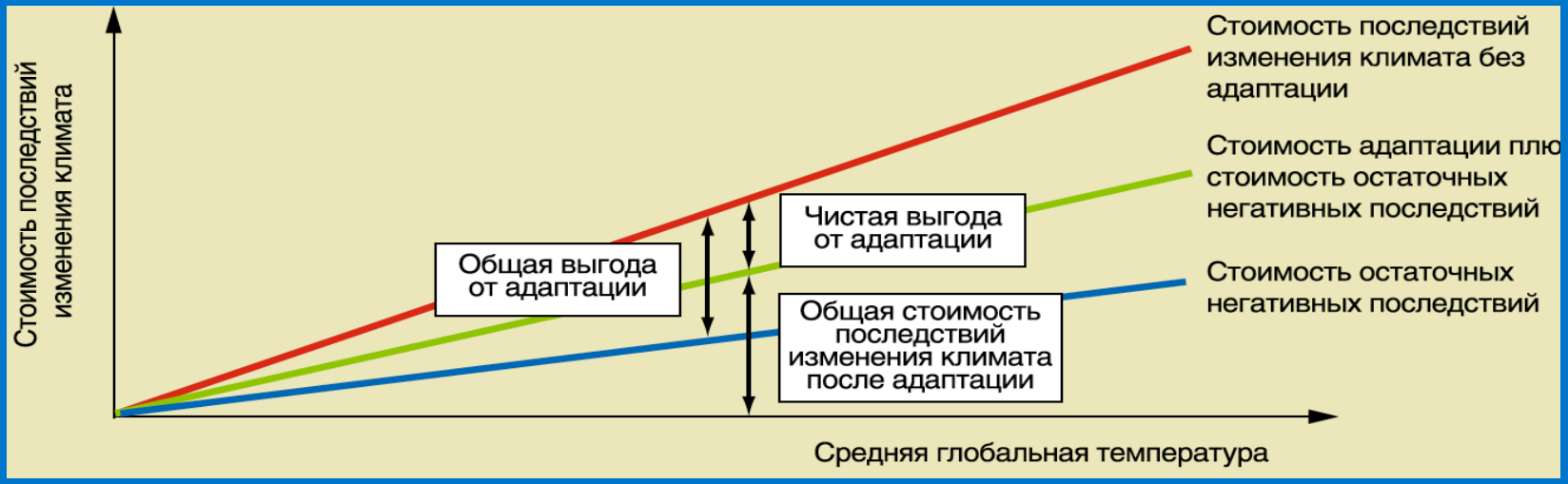
International actions for climatic risks minimization

- UN FCCC and Kyoto protocol along with a range of partnerships and initiatives represent a basis for international cooperation, however more ambitious steps must be taken.
- Key steps of the future international collaboration must contain following elements:

1) Emission trading;
2) Technologic collaboration;
3) Measures on deforestation reduction;
4) Measures on adaptation.

Adaptation

It is any kind of measure on reduction in the natural and anthropogenic systems sensitivity to factual or prospective climate change consequences.

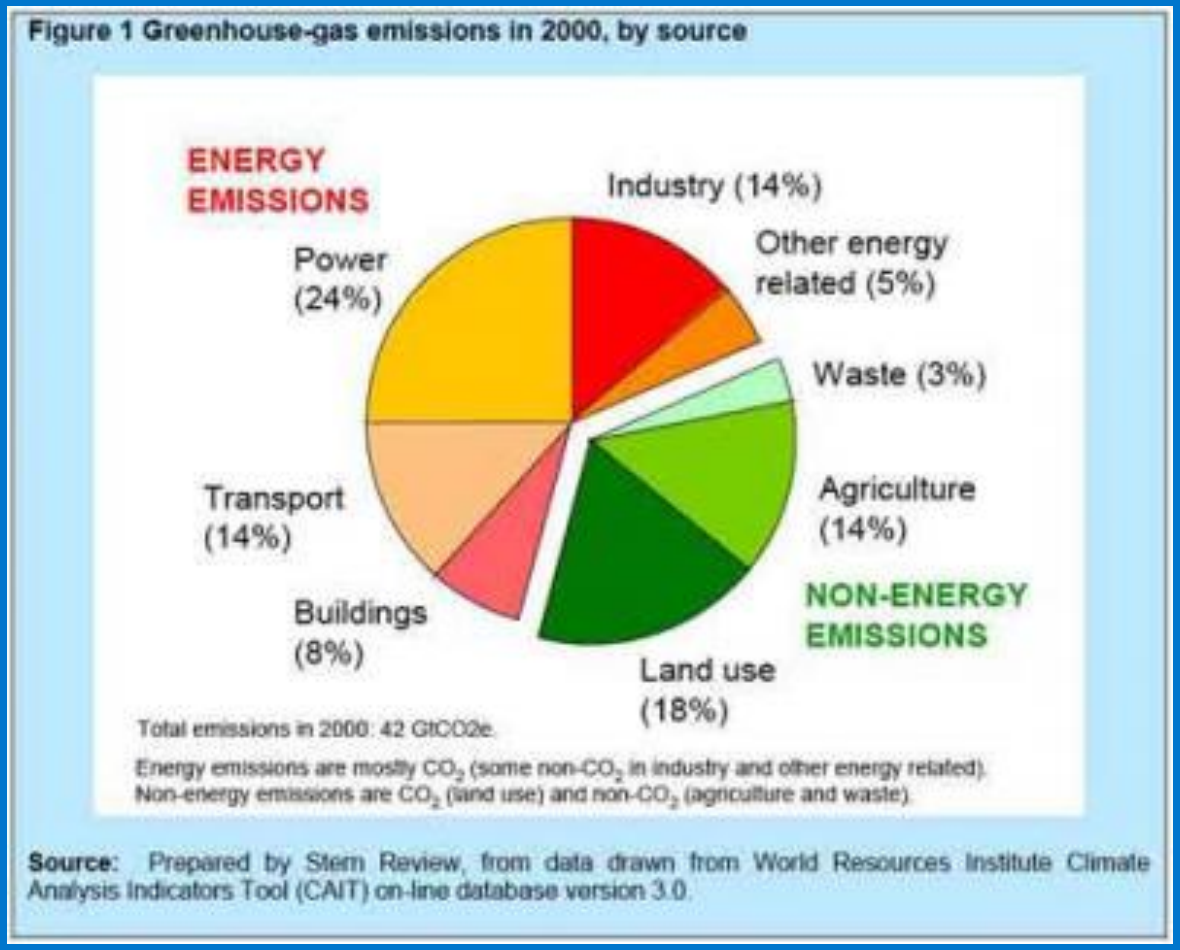


Source: Stern Review (2006)

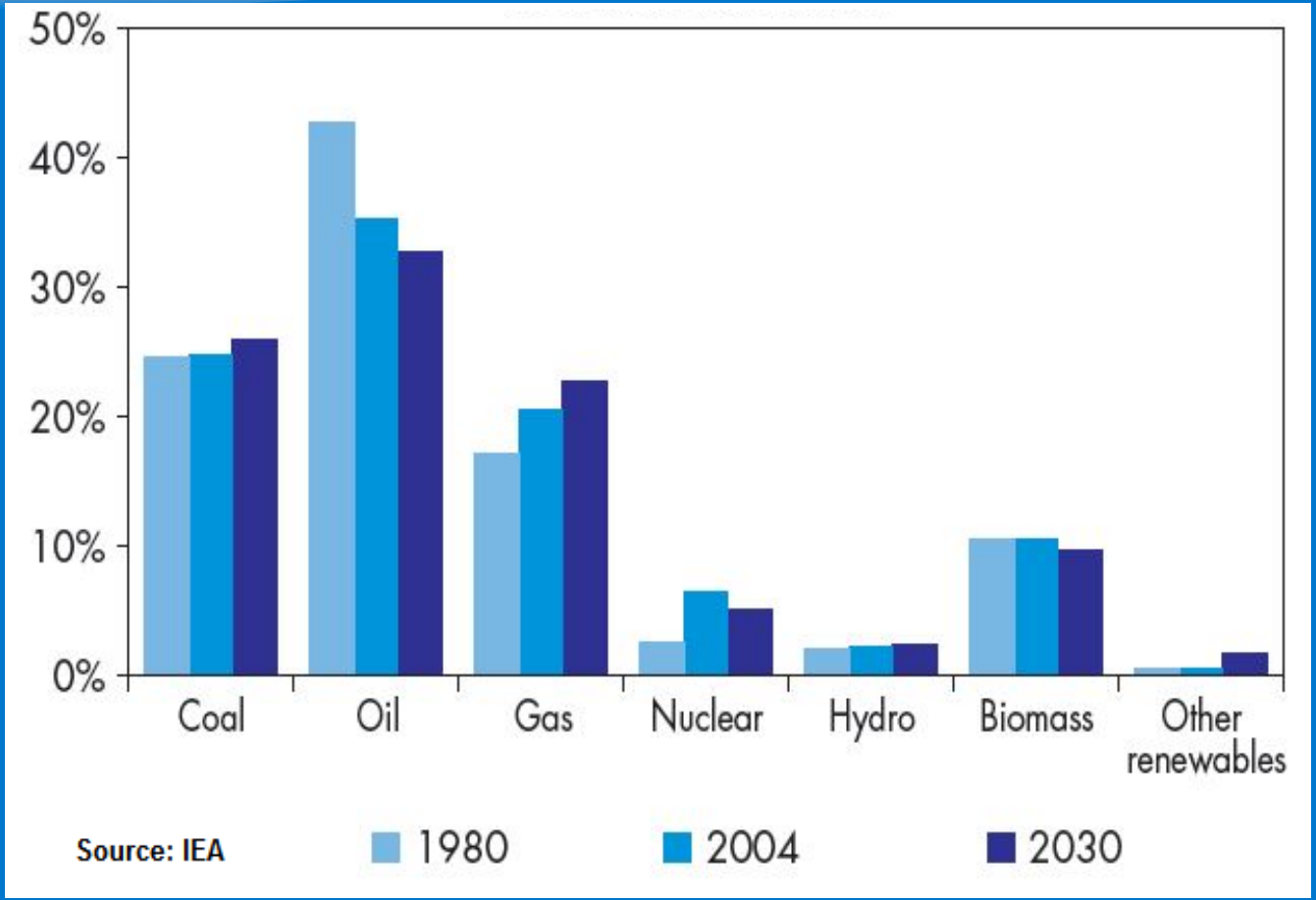
Reduction of consequences

- limitations and reductions of fossil fuel consumption (coal, oil, gas);
- rise in energy consumption efficiency;
- implementation of measures on energy conservation, more wide use of noncarbon and renewable sources of energy;
- prevention of forest fires and forests restoration;
- development of new ecologically friendly and low-carbon technologies.

Sources of greenhouse gases emissions

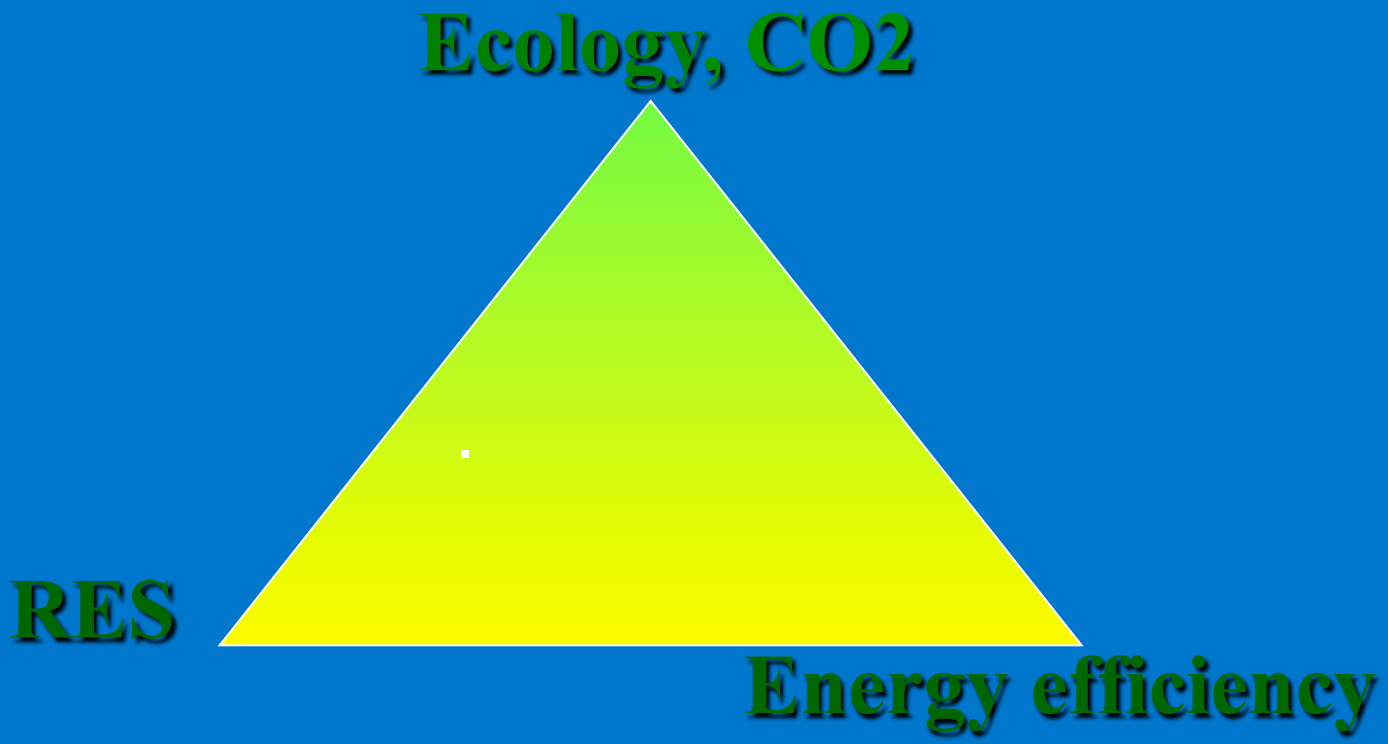


Energy strategy



World energy

Energy efficiency, renewable energy source, ecology, reduction in carbon dioxide emissions – priorities of worldwide policy



Ecology, energy efficiency, RES – interconnected components of global system of energy

(Example: energetic package of EU provides for three interconnected goals achievement: 20-20-20 by 2020)

Programme of EU on emissions reduction

Energy policy for Europe
(Strategic energy review)

Limitation of global climate change up to 2° C

Strategic goal

One-sidedly free obligation of EU on reduction in greenhouse gases emissions at least by 20% by 2020, in comparison to the level in 1990 and 30% of reduction in case of wider participation.

The Russian Federation's activity on climatic risks minimization

1. Importance of the problem of greenhouse gases emissions stabilization is realized both by world community and Russia for which the priority is rise in energy efficiency:

- ✓ Reduction in greenhouse gases emissions by 20-25% by 2020 in comparison with the level in 1990
- ✓ Reduction in power capacity of GDP by 2020 not less than 40% in comparison with 2007

2. Inadequate assessment of reducing power of environment is one of the primary causes of understatement of ecosystem services cost that affects natural environment

"Principles of national ecological policy of the Russian Federation till 2030" :

Principle – priority ranking for the society of life-supporting functions of the biosphere in relation to direct use its resources.

Significance for the Russian Federation

- Strategic goal – Reduction in greenhouse gases emissions by 20-25% by 2020 in comparison with the level in 1990

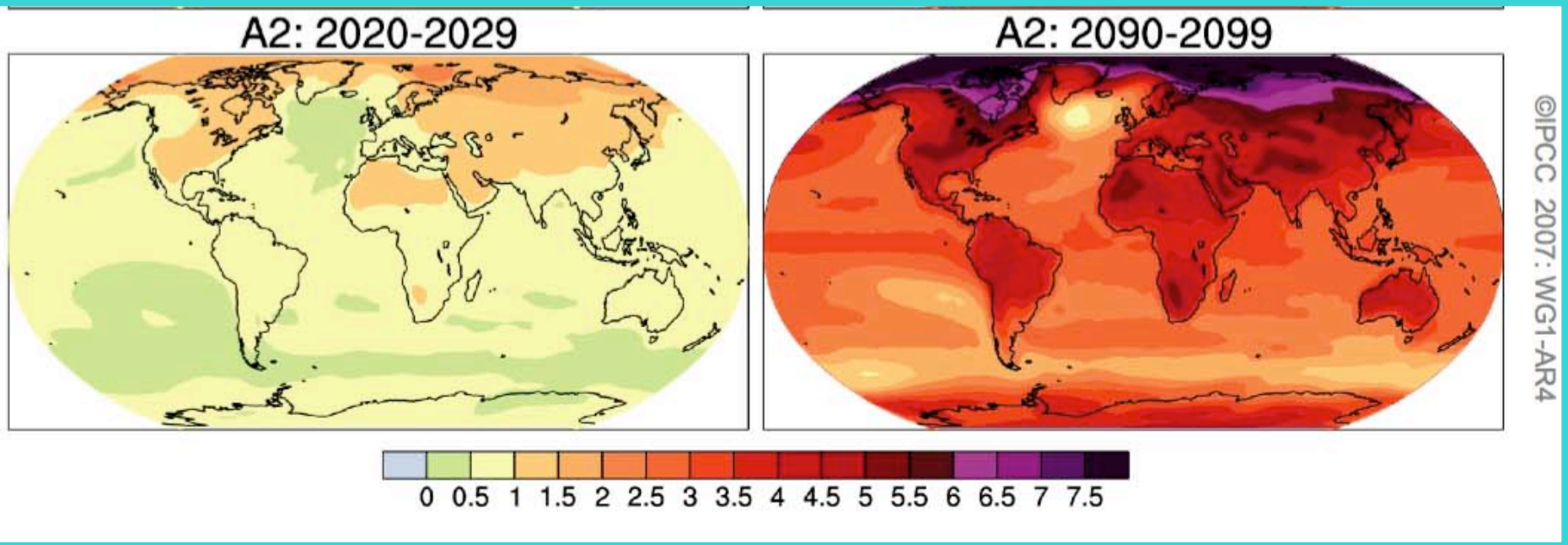
- ✓ Reduction in power capacity of GDP by 2020 not less than 40% in comparison with 2007

- ✓ Supplying sustainable and ecologically responsible energy use and energy resources.

Climate doctrine of Russia

Preamble: Climate change and sustainable development

I.Background
II. Goal and principles of Russia's policy in climate sphere
III. Contents of the policy
IV. Realization of the policy



Comprehensive implementation plan of "Climate doctrine of the Russian Federation till 2020"

Strategic goal of Russia' policy in climate sphere

sustainable development of Russia including institutional, economic and social (demographic) aspects of development under the conditions of changing climate and appearance of appropriate warning.

During the period 2011-2020 long-term macroeconomic forecasts will be corrected "with due regard to climatic risks, reduction in human impact on climate and adaptations to climatic changes":

- ✓measures as for transport (increase in production of hybrid cars and "package of measures" on the use of alternative gas and hydrogen kinds of fuel).
- ✓rise in energy efficiency;
- ✓development and implementation of economic tools of limitation greenhouse gases emissions in industry.

Sites of intergovernmental international organizations and official agencies

- www.unfccc.int – Secretariat of Framework Convention on Climate Change and Kyoto protocol. Архив документов и решений Конвенции, новости, данные о выбросах парниковых газов, официальные государственные доклады.
- www.wmo.ch – World Meteorological Organization. Широкий спектр материалов и данных об изменениях климата, новости, прогнозы, ссылки на последние публикации.
- www.ipcc.ch – IPCC – Intergovernmental Panel on Climate Change. Официальные доклады, вопросы идентификации изменений климата и их причин, прогнозы, оценка влияния на окружающую среду.
- www.unep.ch – United Nations Environmental Programme(UNEP). Образовательные материалы по изменению климата и влиянию на экосистемы. Библиотека публикаций.
- www.who.int – World Health Organisation (WHO). Образовательно-информационные материалы, включая и влияние изменений климата на здоровье человека.
- www.iea.org – International Energy Agency. Информация по вопросам эффективного использования энергии, возобновляемой энергетики и др.
- www.meteorf.ru - Federal service of Russia for Hydrometeorology and Monitoring of the Environmnet , прогноз погоды, информация о погодных явлениях, новости и пр.