

Education **of** and **by** climate change

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Teaching of CC is needed, media and re-posting does not help

Rázsi et al, 2015 (Hungary, 2014. January – June)

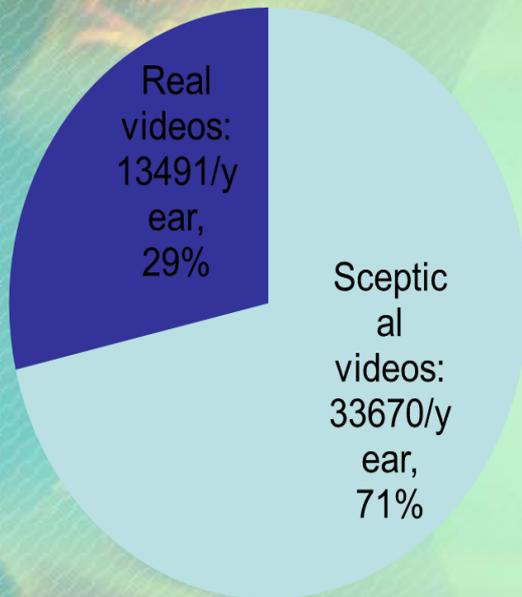


Figure 6: The viewership ratio of the sceptical and real videos

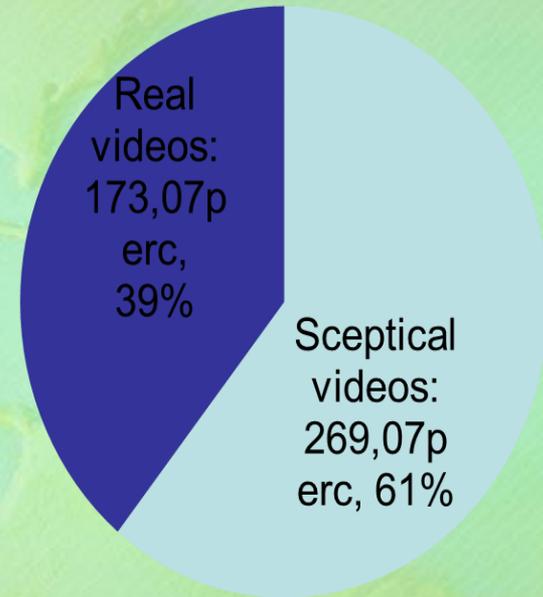


Figure 7: The time ratio of the sceptical and real videos

THE FIELDS OF TEACHING CC IN EGER

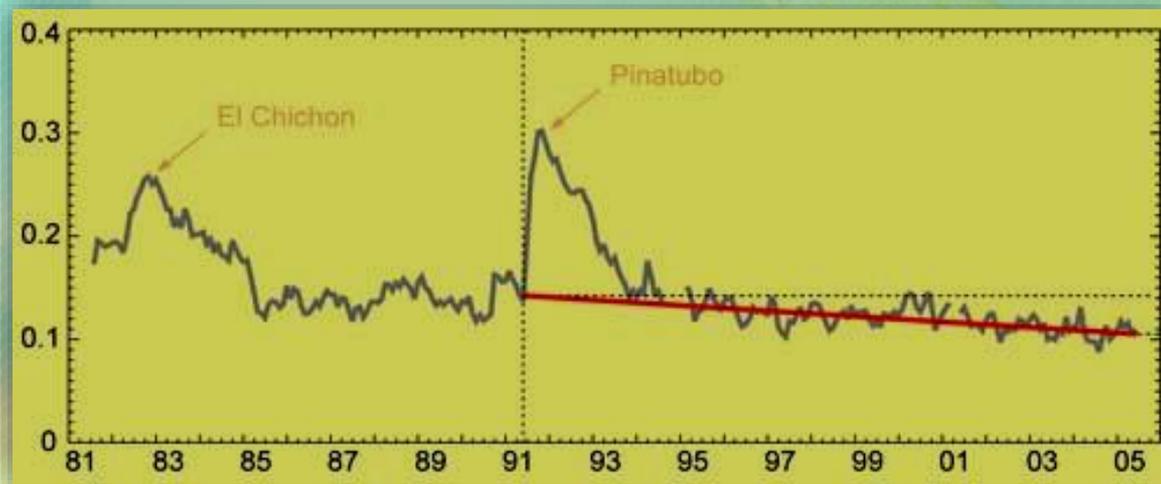
1. Higher education - EKV

Geography BSc. (2006-), teachers of geography (2013-)

Geographer MSc. (from September 2011)

Teachers of geography MA (since 2009)

PhD School for Education (since 2012)



Aerosol optical
thickness

Credit: Michael
Mishchenko, NASA

COURSES IN THE CURRICULA

Meteorology and climatology (BSc)

Renewable energy sources (BSc)

Topo- and microclimatology (BSc,)

Atmosphere as a risk and resource (MA, MSc)

Satellite remote sensing (MA, MSc)

Modeling and simulation (MSc)

Urban climate and pollution (MSc)



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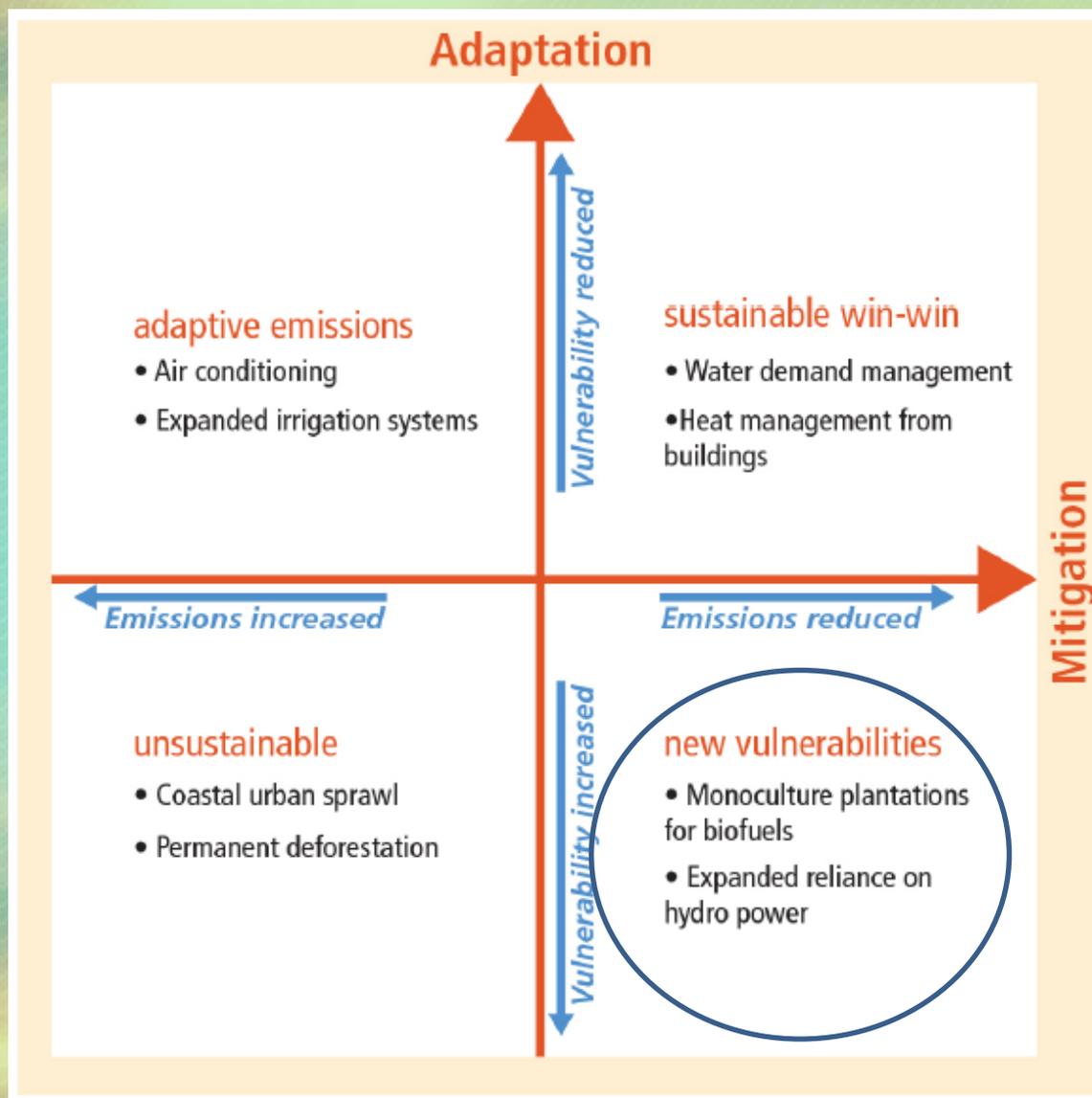
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Urban climate and pollution (MSc)

Teaching sustainability and risk management (PhD)

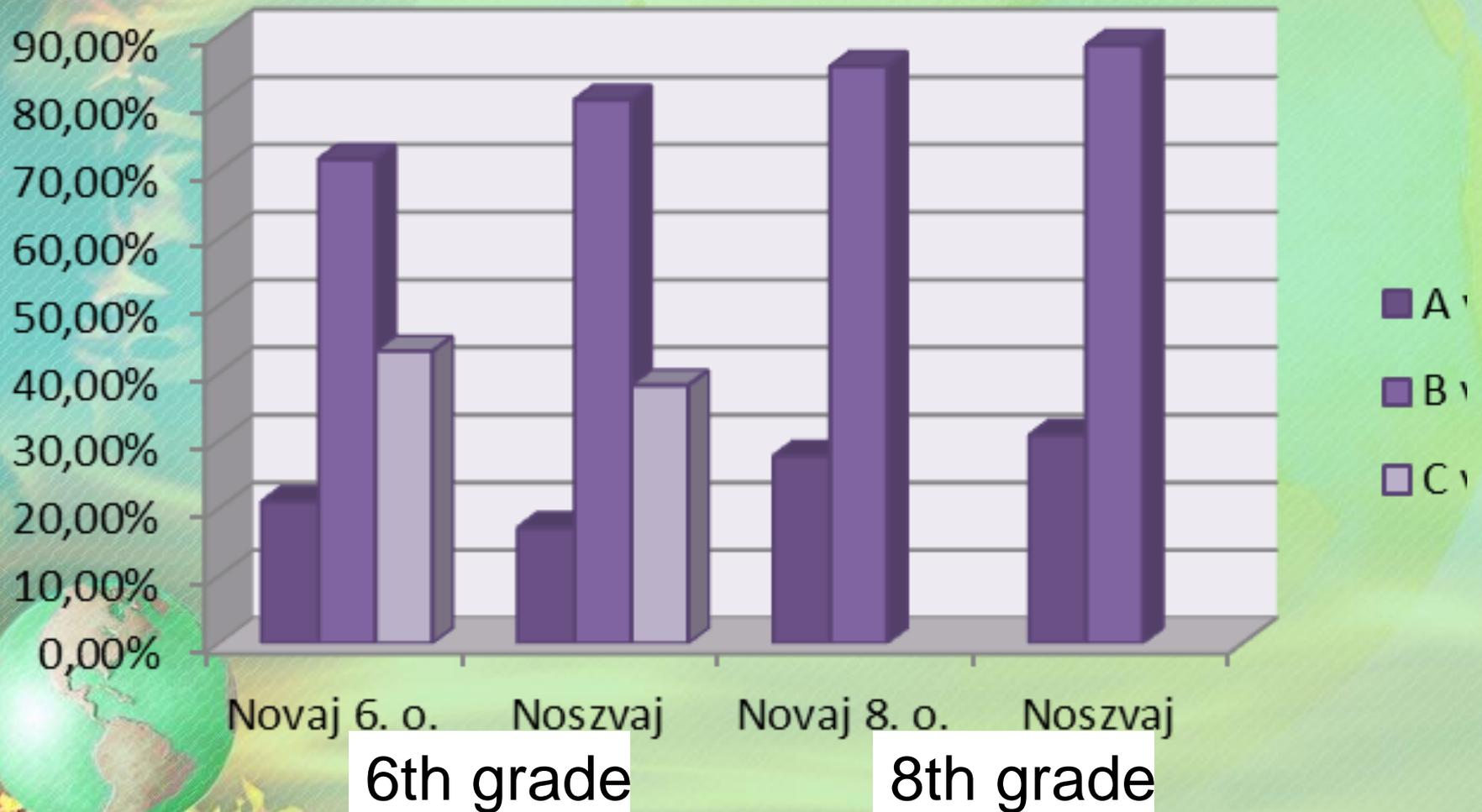
Pedagogical aspects of climate change (PhD)

BALANCED (WIN-WIN) RESPONSES ARE NEEDED



2. Education in elementary school (HU)

RESULTS IN PERCENT (A – before, B after, C 1.5 years later)



Teaching school subjects by CC

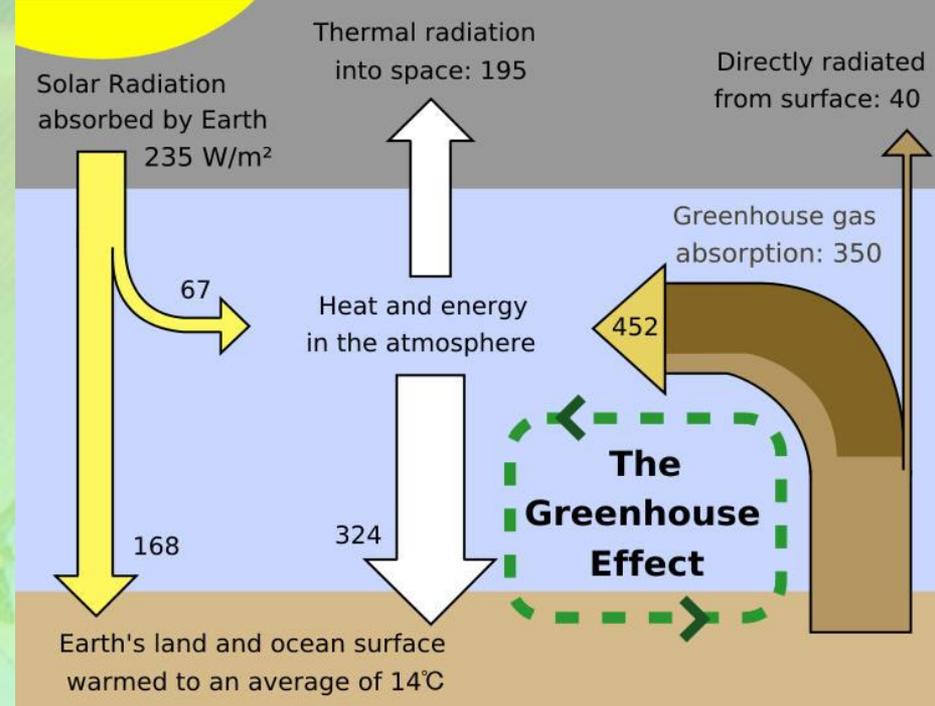
- INTEREST IN CLIMATE CHANGE AND WEATHER EXTREMES CAN BE USED FOR ILLUSTRATION OF SCHOOL TOPICS.
- EXAMPLES:



PHYSICS

The greenhouse effect

http://upload.wikimedia.org/wikipedia/commons/thumb/2/26/Greenhouse_Effect.png/300px-Greenhouse_Effect.png



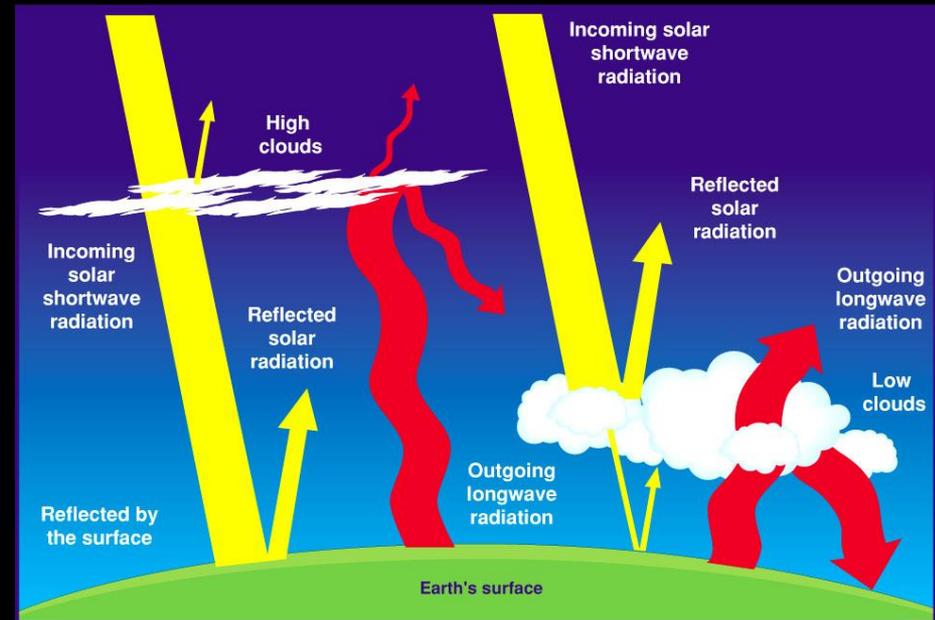
The aim of the school subject is to **make the pupils acquainted with the laws of physics and to learn the basic knowledge of physics.** *Source: National Core Curriculum, 2003*

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The greenhouse effect

http://upload.wikimedia.org/wikipedia/commons/thumb/2/26/Greenhouse_Effect.png/300px-Greenhouse_Effect.png

Cloud Effects On Earth's Radiation



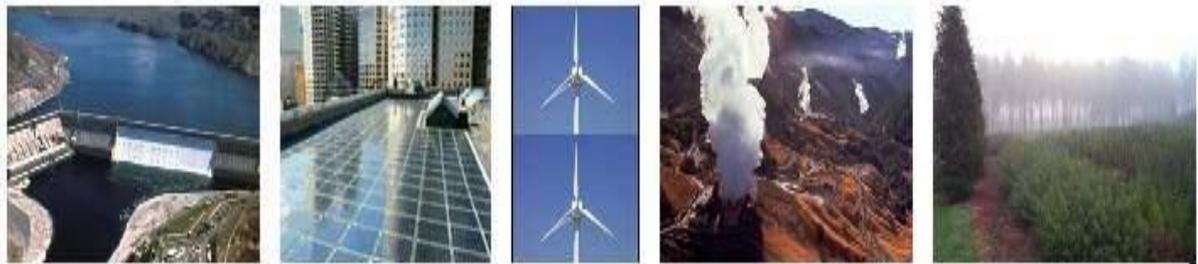
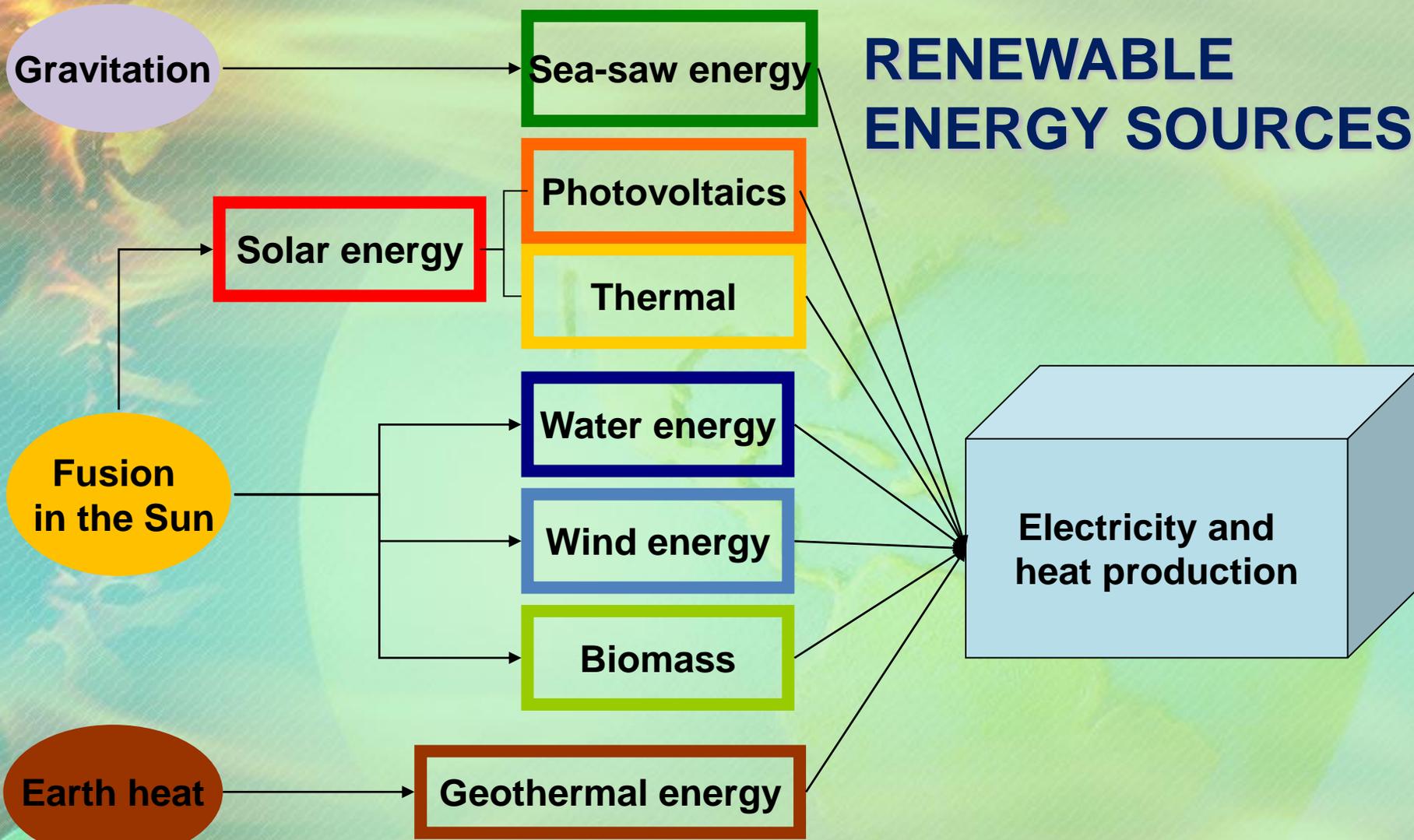
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SOME EXAMPLES FOR UTILIZING CC

<i>Phenomenon/ process</i>	<i>Broader topic</i>	<i>Reason for emphasis</i>	<i>Relation to climate</i>
Melting and freezing	Phase transitions	Melting of the ice caps, increase of the sea-level.	Global warming
Space-born images	Artificial planets, meteorological satellites	Monitoring of geophysical changes.	Changing climate zones.

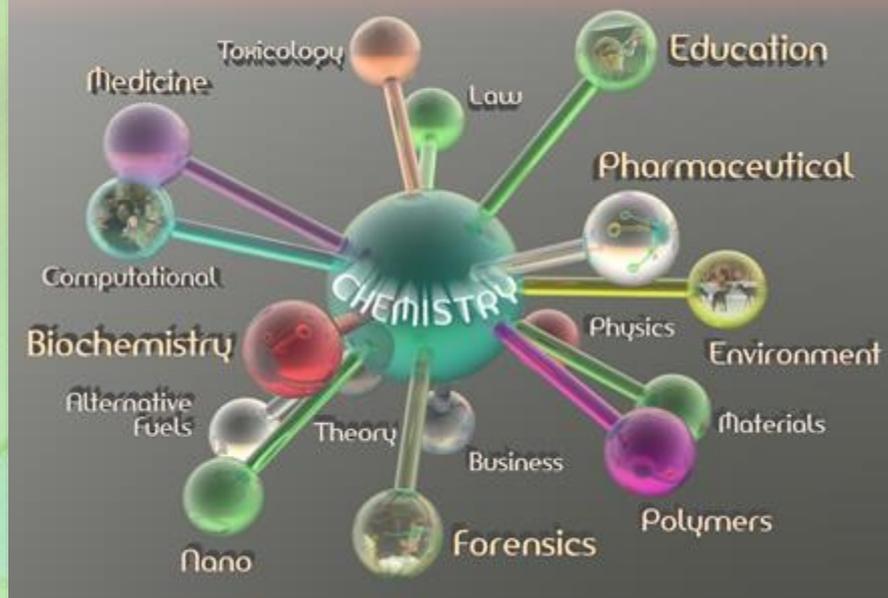


RENEWABLE ENERGY SOURCES



Károly TAR – Andrea BÍRÓ-KIRCSI, 2008

CHEMISTRY



<http://www.csc.edu/sci/chemistry/>

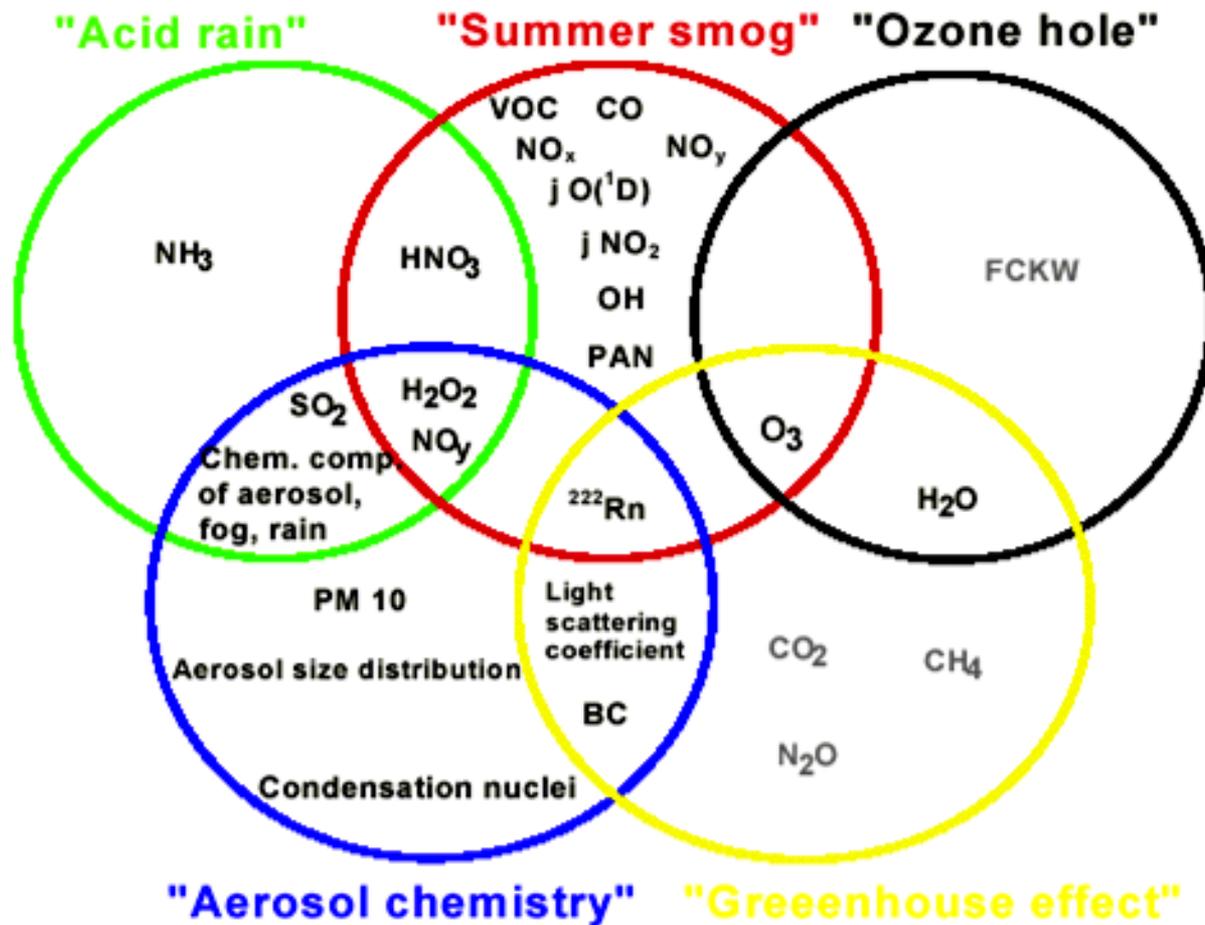
Aim and task of teaching chemistry is to make the pupils **understand the chemical features, effects, chemical phenomena relationships and interdependence of the materials, occurring in their environment, and to purposeful use of them in our everyday activities.** *Source: National Core Curriculum, 2003*

SOME EXAMPLES FOR UTILIZING CC

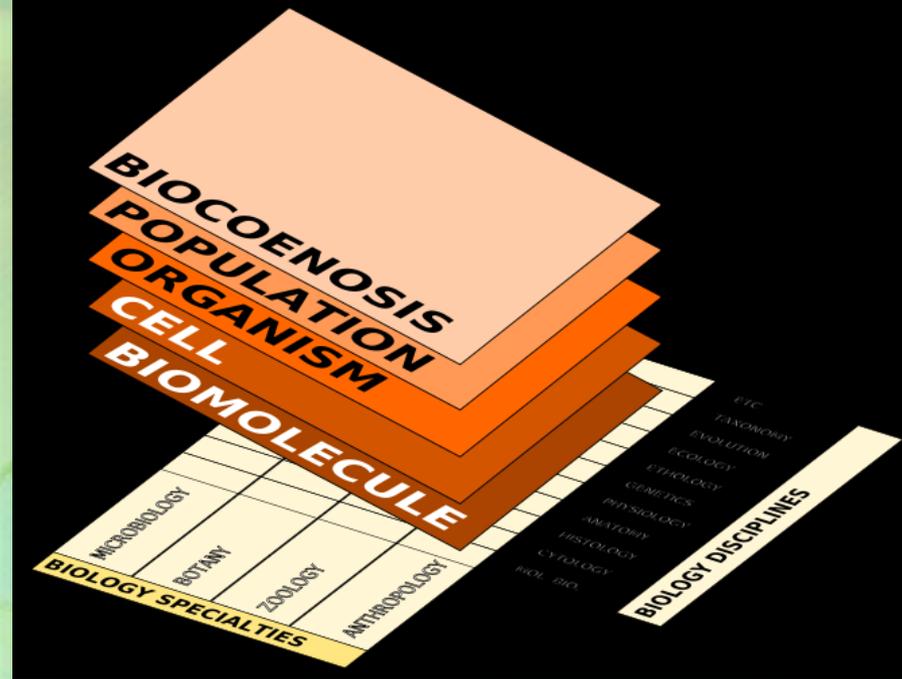
<i>Phenomenon/Process</i>	<i>Broader topic</i>	<i>Reason for emphasis</i>	<i>Relation to climate</i>
Atmospheric composition	Materials of the environment.	Knowing our territory of life	Greenhouse gases and their effects
Photochemical reactions	Inorganic chemistry (oxygen)	Atmospheric processes	Ozone formation and decomposition
Cycle of the elements	Environmental chemistry.	Ever renewing environment	Rain-water quality. Soil resources supply and mobilisation.



WIDE VARIETY OF POLLUTION, NO SINGLE RESPONSIBLE (NEITHER SIMPLE SOLUTION)



BIOLOGY



Hungarian National Core Curriculum, 2003: The main areas in teaching biology are **the ecological topics, physiological parts and the human biology themes**, including the of **adaptation and natural selection** during the fast changes in the environment.



SOME EXAMPLES FOR UTILIZING CC

<i>Phenomenon/process</i>	<i>Broader topic</i>	<i>Reason for emphasis</i>	<i>Relation to climate</i>
CO ₂ atmospheric level and CO ₂ absorbing capacity of plants	Plant physiology, assimilation	Showing the importance of assimilation processes in big cycles of Earth.	The effect of the increasing CO ₂ level
Changing temperature maximum-minimum, average and stress tolerance of some species	Ecological tolerance	Presenting growing danger for sensitive species	Temperature data, annual average values of temperature according certain regions

AMPHIBIANS AND OTHER ANIMALS: SENSITIVE REPRODUCTION STRATEGY



Fire salamander (*Salamandra salamandra*)



Great Crested Newt
(*Triturus cristatus*)

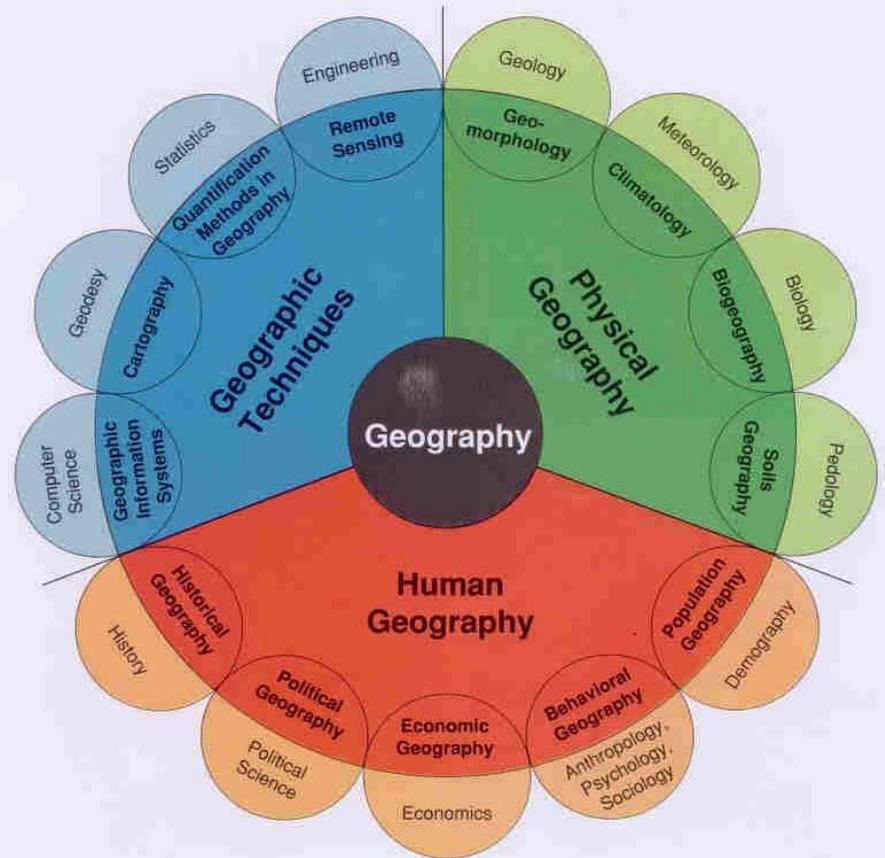


The larvae of stag beetle
(*Lucanus cervus*) develop for 3-5 years

Some animal species have special strategy for reproduction which can be reduced by climate change. Teachers must show the relationships between some changing factors and the species which need permanent habitats for some phases of their reproduction.

GEOGRAPHY

inc. physical
and
social
geography



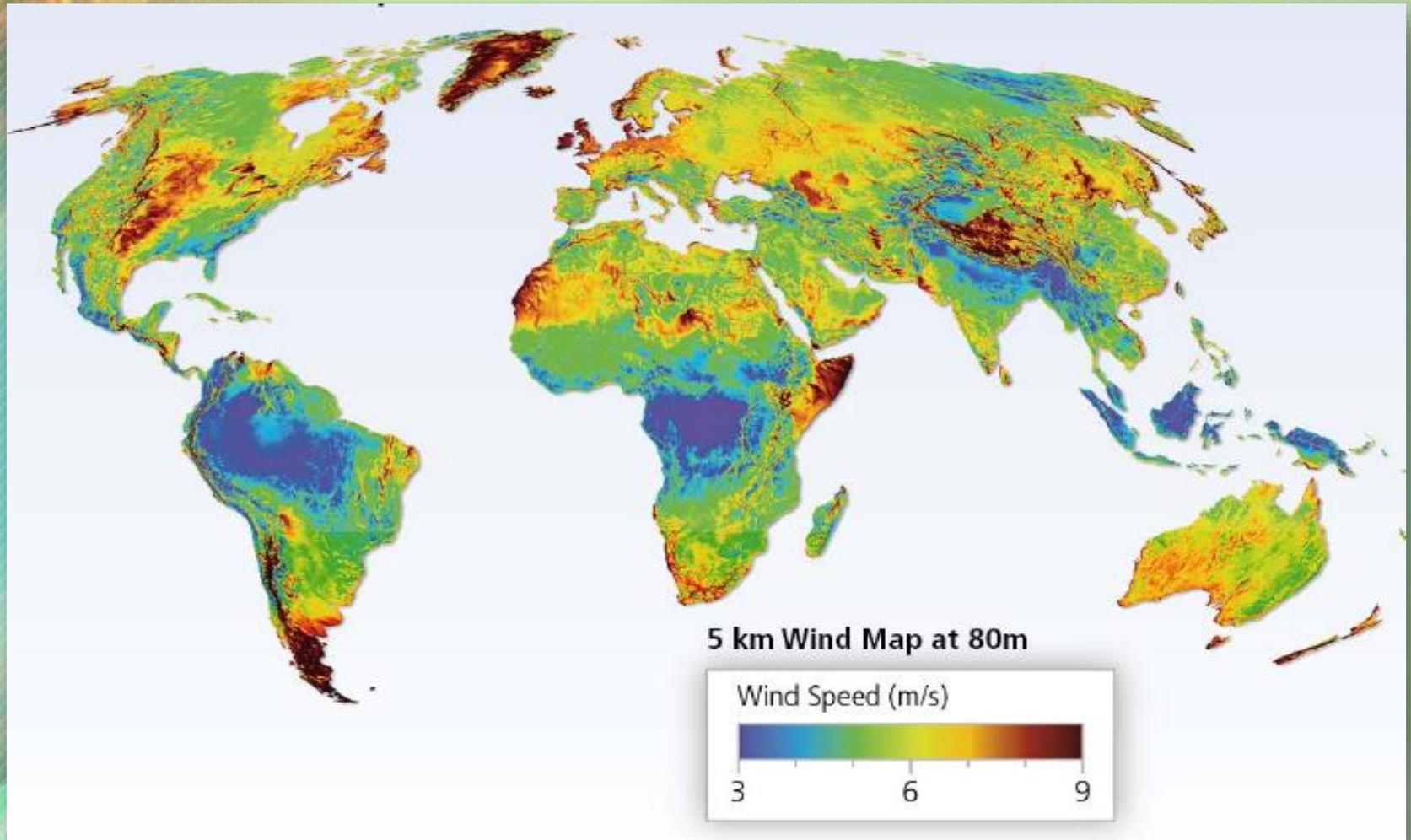
Geography is a so called chorological science (chorology: study on distribution, in anc. Greek), i.e. it investigates the geo-systems. **Geosystems are** systems of the common space of **natural and societal interactions** among the solid (lithosphere), fluid (hydrosphere), gaseous (atmosphere) and living (biosphere) sub-systems. This space of interaction is called *geosphere*, *geographical shell* or *geographical environment*.

SOME EXAMPLES FOR UTILIZING CC

<i>Phenomenon/process</i>	<i>Broader topic</i>	<i>Reason for emphasis</i>	<i>Relation to climate</i>
Shift of vegetation zones; extinction of species, expansion of other species. Expansion or reduction of the wet ecosystems.	Biogeography	Importance to retain the present biodiversity. Possibilities and limitations of the vegetation to adapt.	Regional climate changes, reminding to shift of climate zones.
Lack of food and water, poverty, epidemic	Social Geography	Existence and geographical distribution of poverty, famine, thirst and epidemic.	Slow changes, but especially the changes in extreme events.



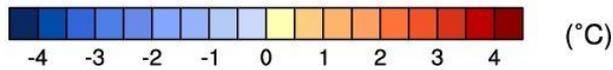
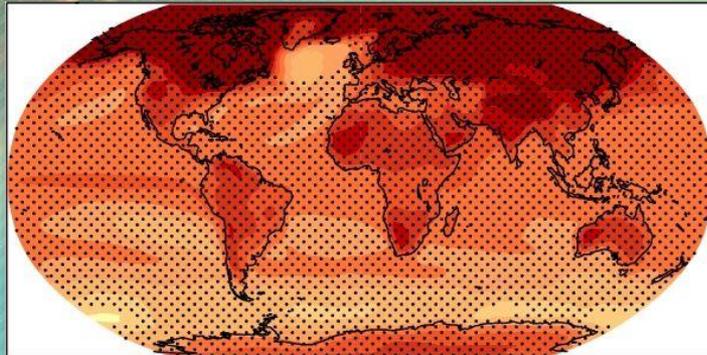
Role of relief in wind energy



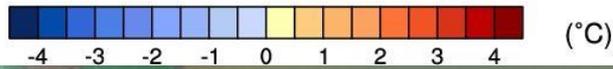
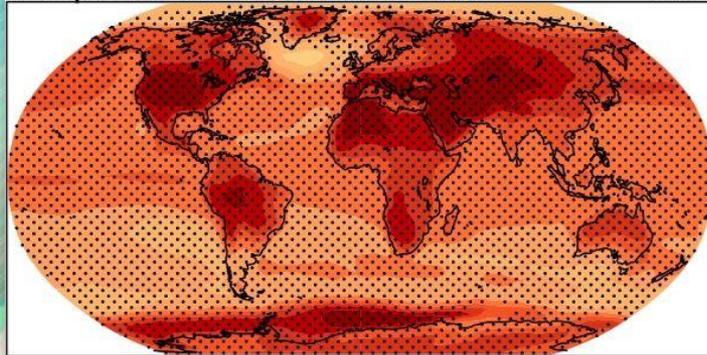
Mean simulated wind speed at 80 m, 5x5 km resolution.

(IPCC SRREN, 2011 Fig. 7.1)

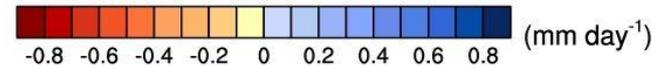
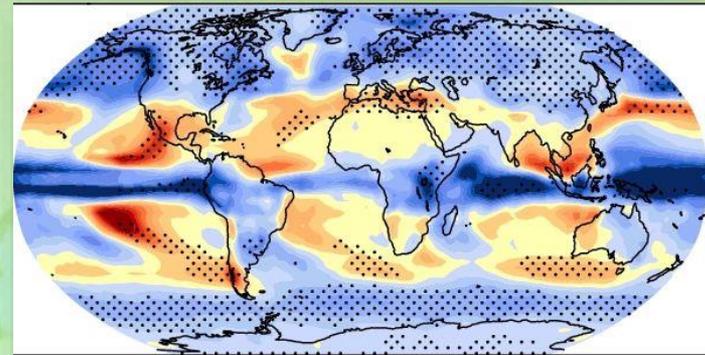
ZONALITY RE-INVENTED BY CLIMATE MODELS



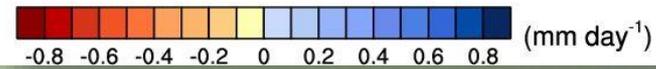
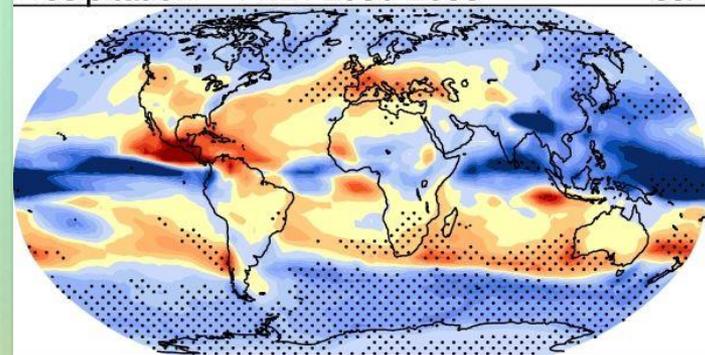
Temperature A1B: 2080-2099 JJA



Model-average changes of temperature



Precipitation A1B: 2080-2099 JJA



Model-average changes of precipitation

KEY COMPETENCES

- **Communication in the mother tongue**
e.g. learn new words of climate, effect and responses
- **Communication in second languages**
e.g. find extra motivation in understanding the CC disputes
- **Competences in natural science**
e.g. use CC to teach and integrate Natural Sciences
- **Digital competence**
e.g. besides the Internet, calculations in CC

KEY COMPETENCES

- **Learning to learn**

e.g. use CC as a fast developing topic to learn for learning

- **Social and Civic Competences**

e.g. weather extremes are good examples of cooperation

- **Sense of Initiative and Entrepreneurship**

e.g. renewable- and low-carbon industry as good examples

- **Aesthetic and Artistic Awareness and Expression**

e.g. storm nature itself provides picturesque examples

EVEN, HISTORY OF FINE ART!

Geothermal energy



Wind energy



Water energy

Bioenergy

CONCLUSIONS

- **Science subjects can be enriched by climate change information, even if the aim is just to make these subjects more attractive.**
- **Each subjects of natural sciences have possibilities for it. Some examples were resented.**
- **Probably, it is possible in several other school subjects, as well. E.g. history, literature, etc.**



THANK YOU FOR YOUR ATTENTION!



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