Climate Change
impacts, risks and some economic consequences

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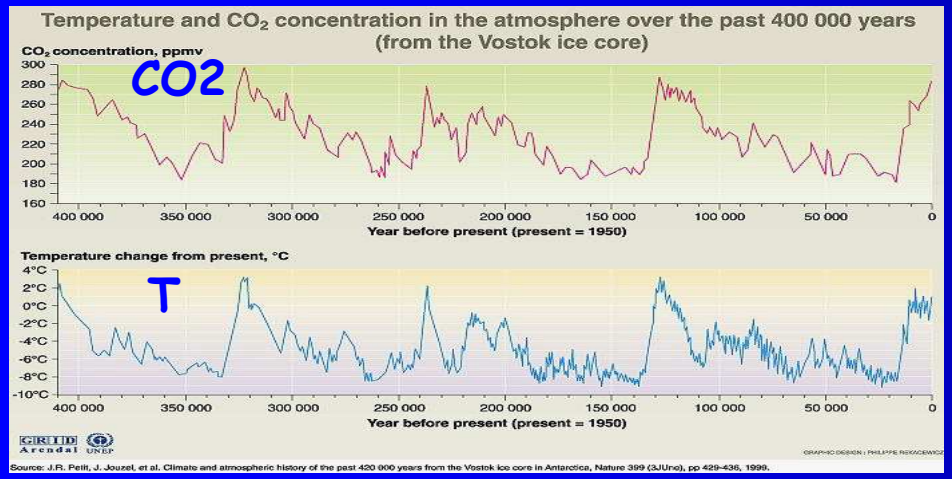
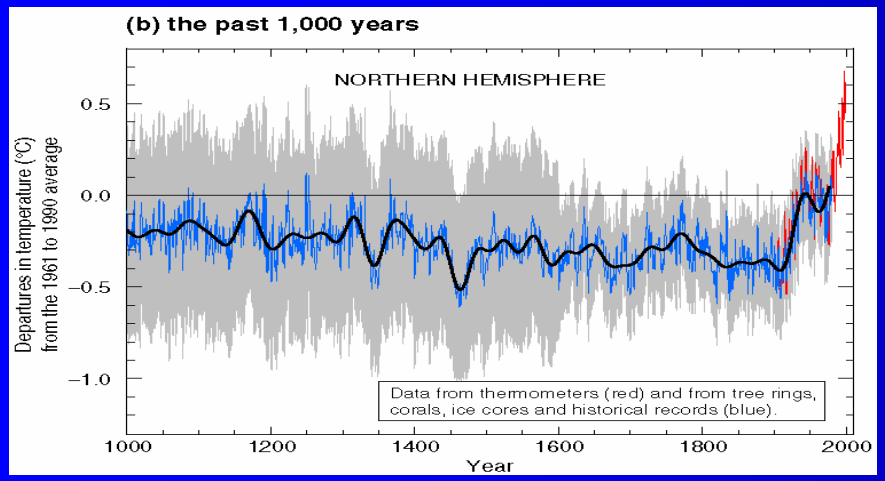
Workshop „*Climate Change and Industry*"
Prague, 23.4.2007

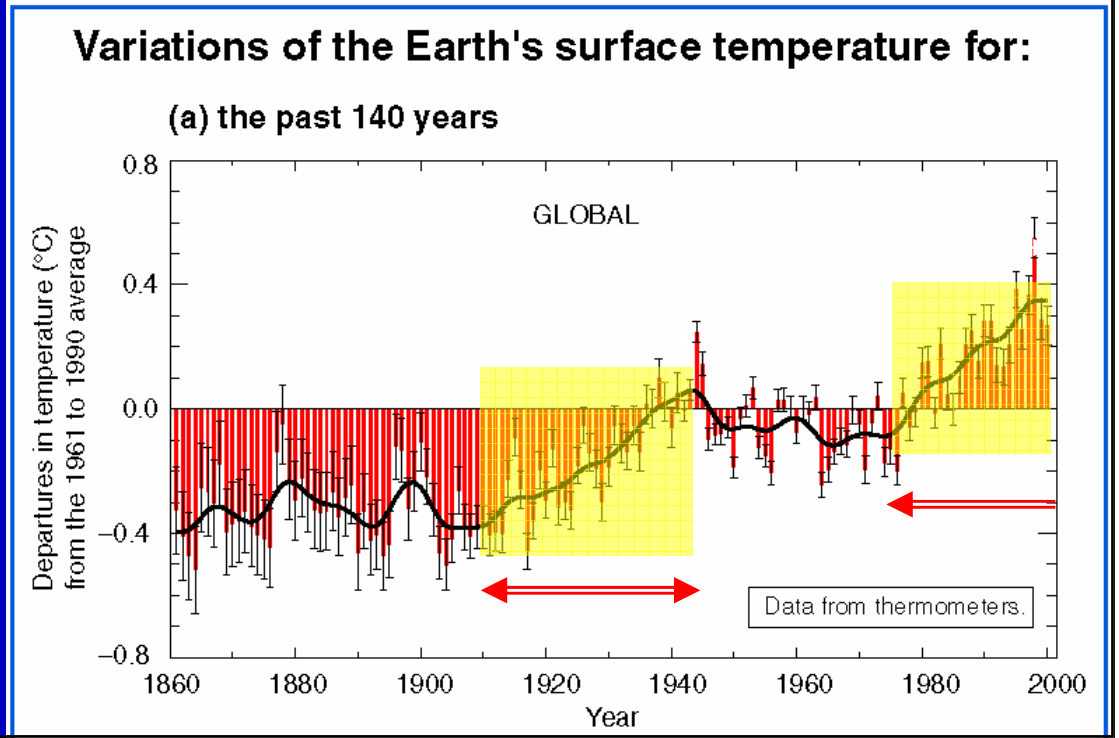
Global temperature increase



- temperature increase in 20th century largest in past 1000 years
- warming acceleration in last 2-3 decades
- last decade the warmest



11 of last 12 years = <u>the warmest</u>
(1998, 2005, 2003, 2002, 2004, 2006, 2001, etc.)



Climate change indicators (1)

(20th century)

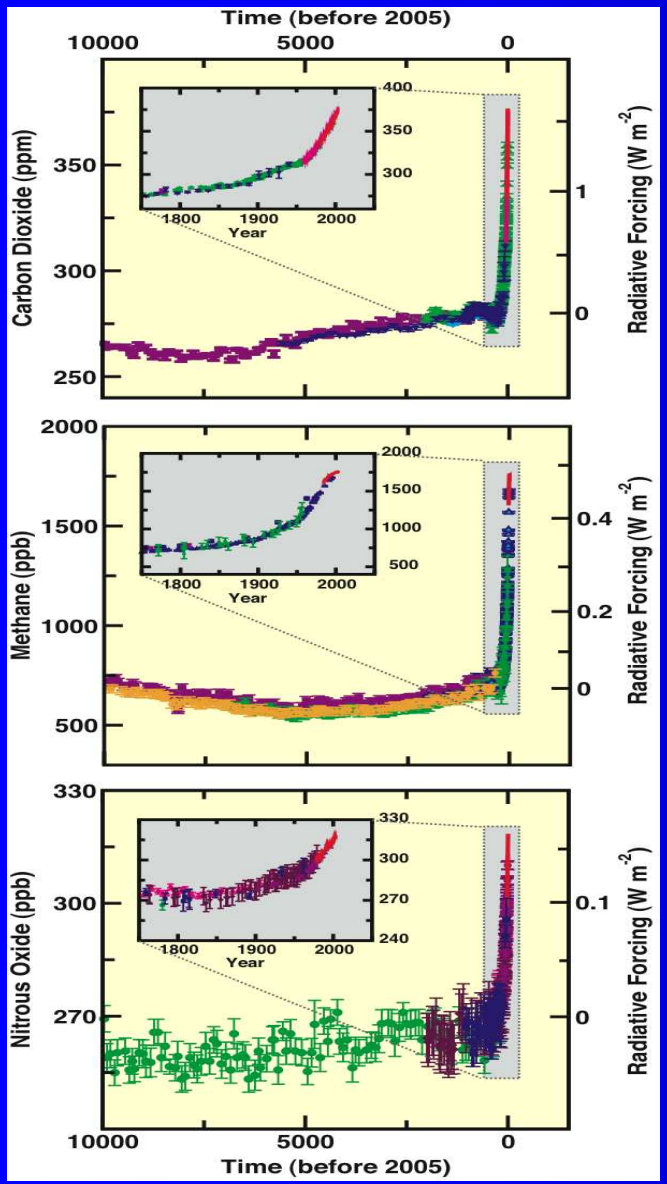
- snow cover – reduction by 10 % *(since 60th)*
- mountain glaciers - reduction on both hemispheres by 20-30% *(since 80th)*
- Arctic glaciers - reduction by 40 %
- Arctic see - reduction by 2,7 % /10 yrs, in summer - 7,4% *(since 80th)*
- Arctic permafrost
  - temperature increase by 3 °C *(since 80th)*
  - reduction of area by 7 %, spring by 15 % *(20th century)*

Climate change indicators (2)

(20th century)

- see level rise – increase by 17 cm *(1,8 mm/yr since 60th)*
- precipitation & evaporation = changes over oceans *(salinity reduction in middle and high latitudes, salinity increase in lower latitudes)*
- „extreme weather events"
  - increase of westerly winds in middle latitudes
  - increase of frequency of heavy precipitations
  - extreme temperature changes *(less cold days, cold nights, more hot days, nights and heat waves)*

Emissions & concentration



emissions - *(from 1990)* ↑ 13%

- accumulation in atmosphere
- long life (10^0 - 10^2 years)
- well mixed

⇒ global aspects

concentration *(from ca 1750)*

CO_2	↑ 35%
CH_4	↑ 140%
N_2O	↑ 18%
F-gases	↑ new!

Future projections (1)

- emission scenario SRES
  - almost independent on scenario by 2030
  - next 2 decades $\Rightarrow \Delta T \approx 0{,}2$ °C / 10 yrs
  - stabilization on level 2000 $\Delta T \approx 0{,}1$ °C / 10 yrs
- temperature increase
  - higher & regional differences
  - higher warming over continents and in higher latitudes N-hemisphere
  - lower warming over south oceans and N-Atlantic
- see level rise

end of 21st century

scenario	temperature increase (°C)		see level rise (m)
	best estimate	*interval*	*interval*
stabilization (2000)	0,6	0,3 – 0,9	n/a
B1	1,8	1,1 – 2,9	0,18 – 0,38
A1T	2,4	1,4 – 3,8	0,20 – 0,45
B2	2,4	1,4 – 3,8	0,20 – 0,43
A1B	2,8	1,7 – 4,4	0,21 – 0,48
A2	3,4	2,0 – 5,4	0,23 – 0,51
A1FI	4,0	2,4 – 6,4	0,26 – 0,59

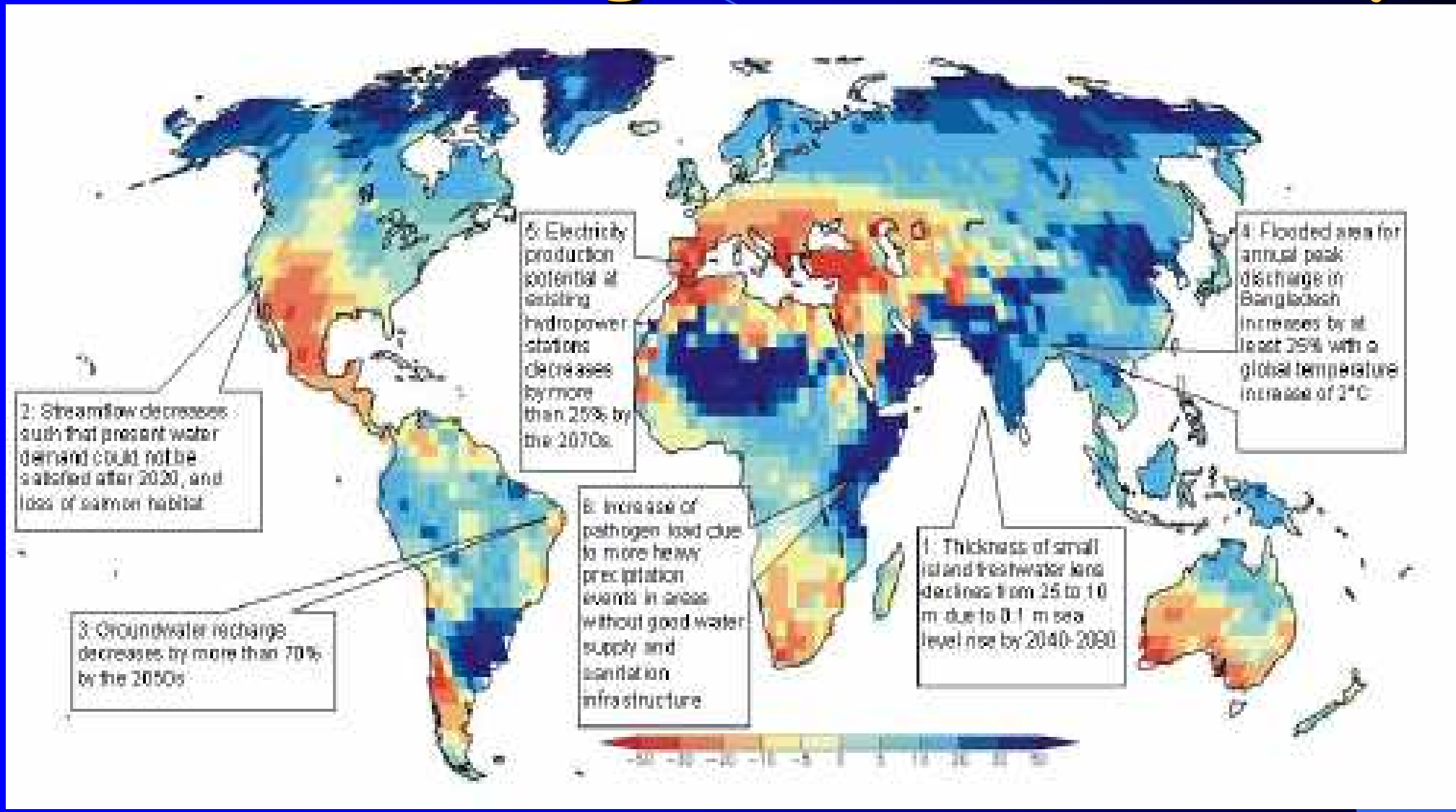
Future projections (2)

- snow cover reduction
- permafrost melting
- glaciers melting (continental, Arctic, mountain, partially also Antarctic)
- extreme temperatures
- heavy & intensive precipitation
- tropical cyclones reduction - more intensive
- changes in precipitation regime (increase in higher latitudes, decrease in subtropics over continents)

Impacts and risks

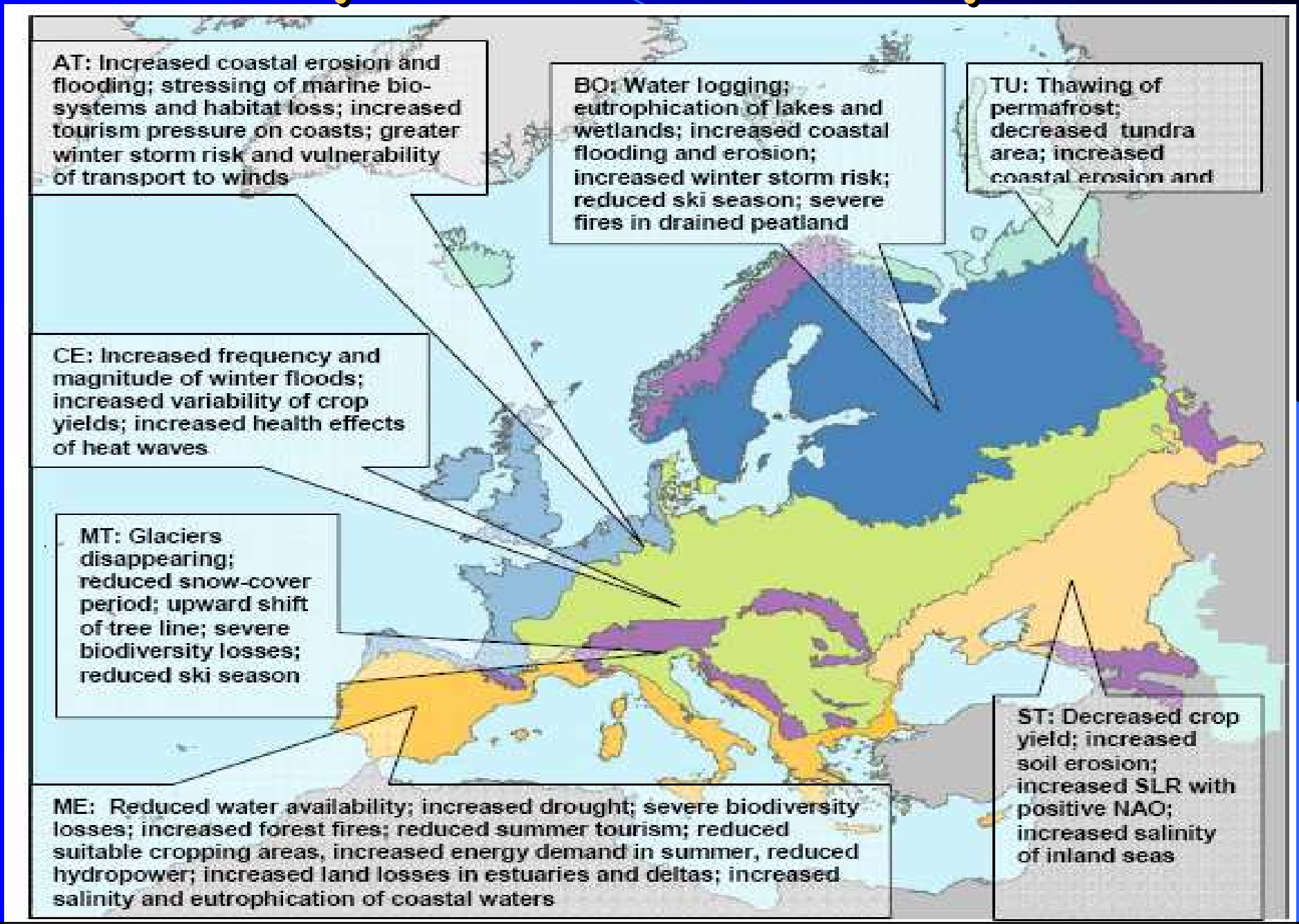
- all continents and most oceans
- sectors = water, artificial and natural ecosystems (incl. agriculture, forestry), food, costal areas, industry (energy), turismus, urban areas, health, human well-being
- non-homogenous distribution
  - climate change = global problem
  - impacts, vulnerabilities = regional/local problem
- social and economic dependence

Water change in 21st century

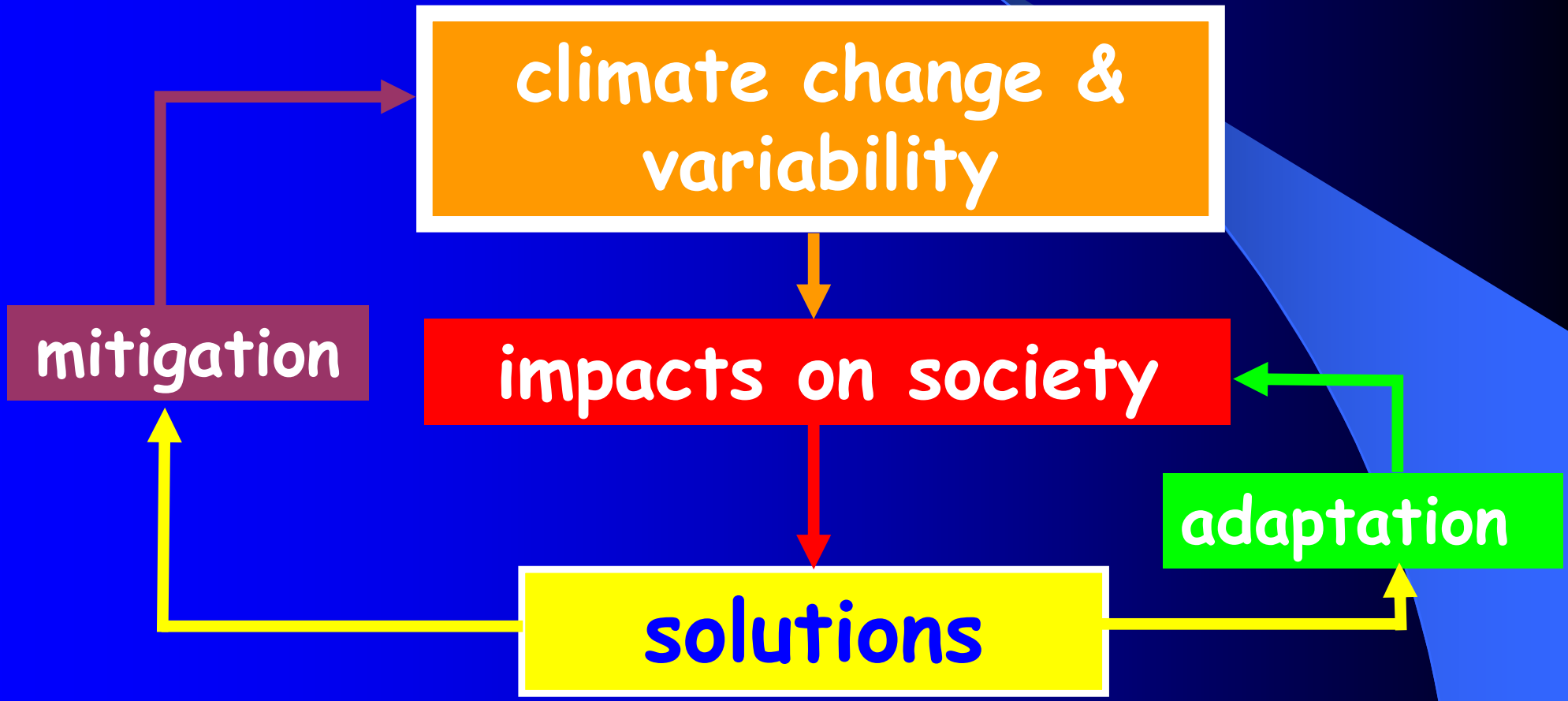


Scenario A1 = very rapid economic grow, population peaks in mid-century and declines thereafter, uniform energy mix

Key risks in Europe



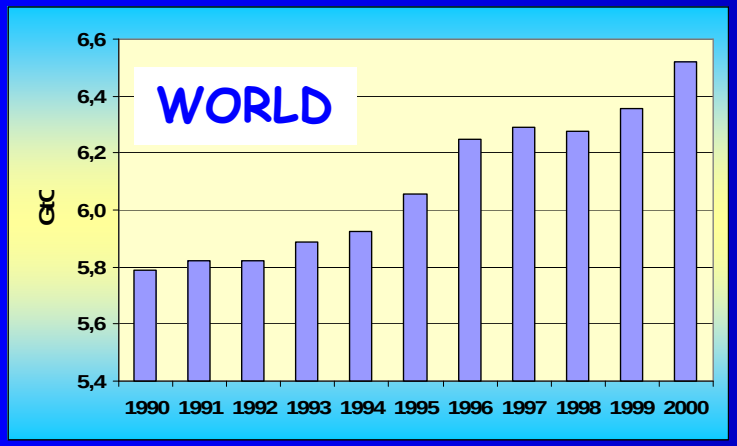
Ways to solve the problem

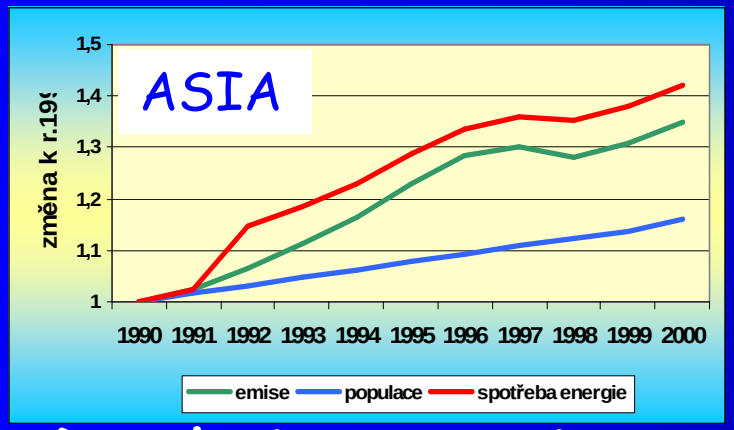


Vulnerability & Mitigation ↔ Adaptation

- **Vulnerability** of systems
  - degree to which a system is susceptible to (or unable to cope with) adverse effects of climate change, incl. climate variability and extremes
  - function of character, magnitude, and rate of climate variation, sensitivity and adaptive capacity
- **Mitigation**
  - anthropogenic intervention to reduce GHG emissions or enhance sinks
- **Adaptation**
  - adjustment in natural and human system in response to actual or expected climatic *stimuli* or their effects

Overview of emission balance





Developing countries
1990 – 30 %
2000 – 40 %
2010 – 50 %
2025 – 75 %

2004 vs. 1990

CZE	- 25 %
EU-8	- 28 %
EU-15	- 1 %
Russia	- 32 %
Ukraine	-55 %
Australia	+ 25 %
USA	+ 16 %
Japan	+ 7 %
Canada	+ 27 %

World emission trend
increase by 1,3 % / yr

Adaptation options (1)

- **autonomous**
  (no conscious response to climate *stimuli*, ecological changes in natural systems)
- **planned**
  (result of deliberate policy decisions)

- **anticipatory**
  (before impacts are observed)
- **reactive**
  (after impacts have been observed)

- ✓ **private** (by individuals as rational self-interest
- ✓ **public** (by governments at all levels)

Adaptation options (2)

adaptive capacity =

potential or ability of a system, region, or community to adapt to the effects or impacts of climate change (varies among countries, socioeconomic group, time)

Reasons to start adaptations now

- climate change is reality
- climate change may be more rapid and more pronounced than current estimates suggest
- anticipatory adaptation more effective then reactive („last-minute")
- almost immediate benefits

Conclusions

- Climate change is reality for the 21st century
- Human activities cannot be underestimated, but also not overestimated
- Anthropogenic interference with climate system is regionally non-homogenous
- Integrated climate change policy shall be consistent with economic aspects
- Mitigation and adaptation options shall be well balanced