

Climate Change and Europe: a few messages inspired by IPCC



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What is the IPCC?

- ⌘ **IPCC : Intergovernmental Panel on Climate Change (GIEC in French)**
- ⌘ **Created by World Meteorological Organisation (WMO) & United Nations Environment Programme (UNEP) in 1988**
- ⌘ **Mandate : assess the science of climate change, impacts and adaptation, mitigation options**
- ⌘ **Publishes consensus reports (1990, 1996, 2001, 2007) (Cambridge University Press) Advises
Climate Change Convention**
- ⌘ **Nobel Peace Prize 2007**
- ⌘ **Web : <http://www.ipcc.ch>**

What does IPCC tell us about climate science?



⌘ WG1: climatology

Key points from the WG1 IPCC AR4 Report



- ⌘ **Warming of the climate system is unequivocal**
- ⌘ **Very high confidence that net effect of human activities since 1750 = warming**
- ⌘ **Last 50 years likely to be highest temperature in at least last 1300 yrs**
- ⌘ **Most of this warming is very likely due to increase in human greenhouse gases**
- ⌘ **Without emission reduction policies, global temperature could increase by 1.1 to 6.4°C, or even higher in 2100 compared to 1990**
- ⌘ **Sea level could increase by 18 to 59 cm, or more**
- ⌘ **Frequency/intensity of several extreme phenomena due to increase (ex: heat waves, droughts, floods, ...)**

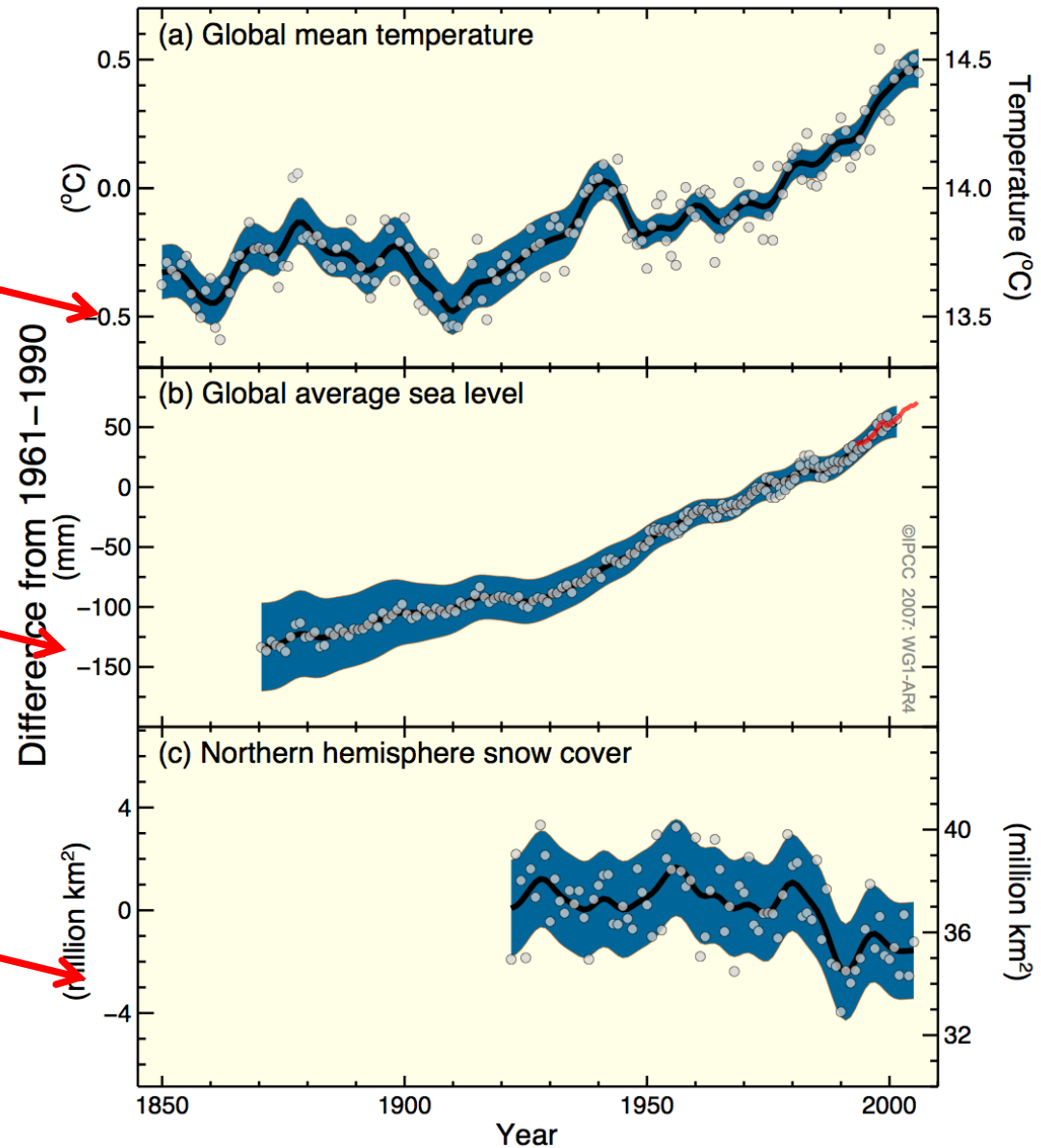
Warming is Unequivocal

Rising atmospheric temperature

Rising sea level

Reductions in NH snow cover

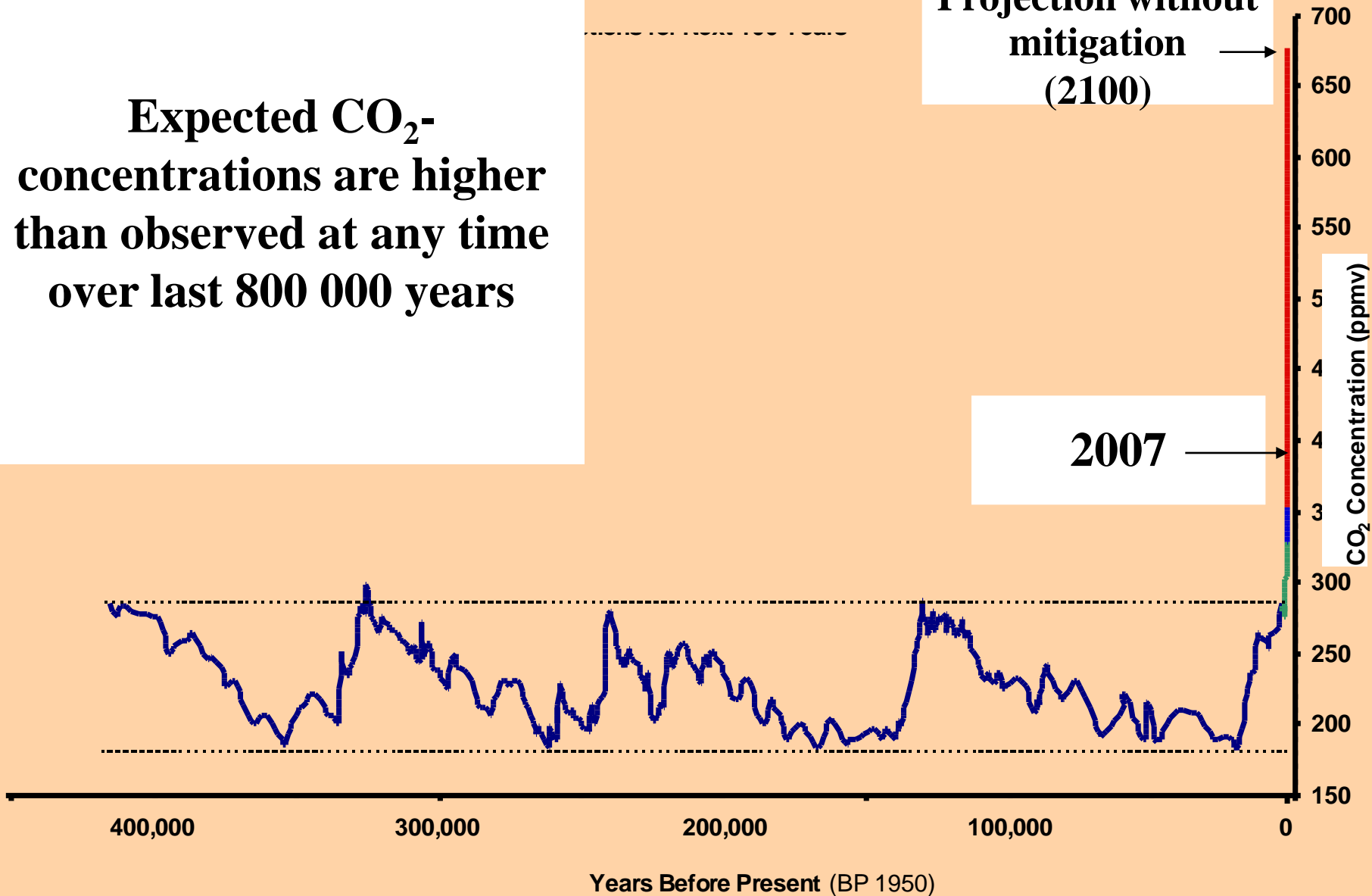
Changes in Temperature, Sea Level and Northern Hemisphere Snow Cover



**Expected CO₂-
concentrations are higher
than observed at any time
over last 800 000 years**

**Projection without
mitigation
(2100)**

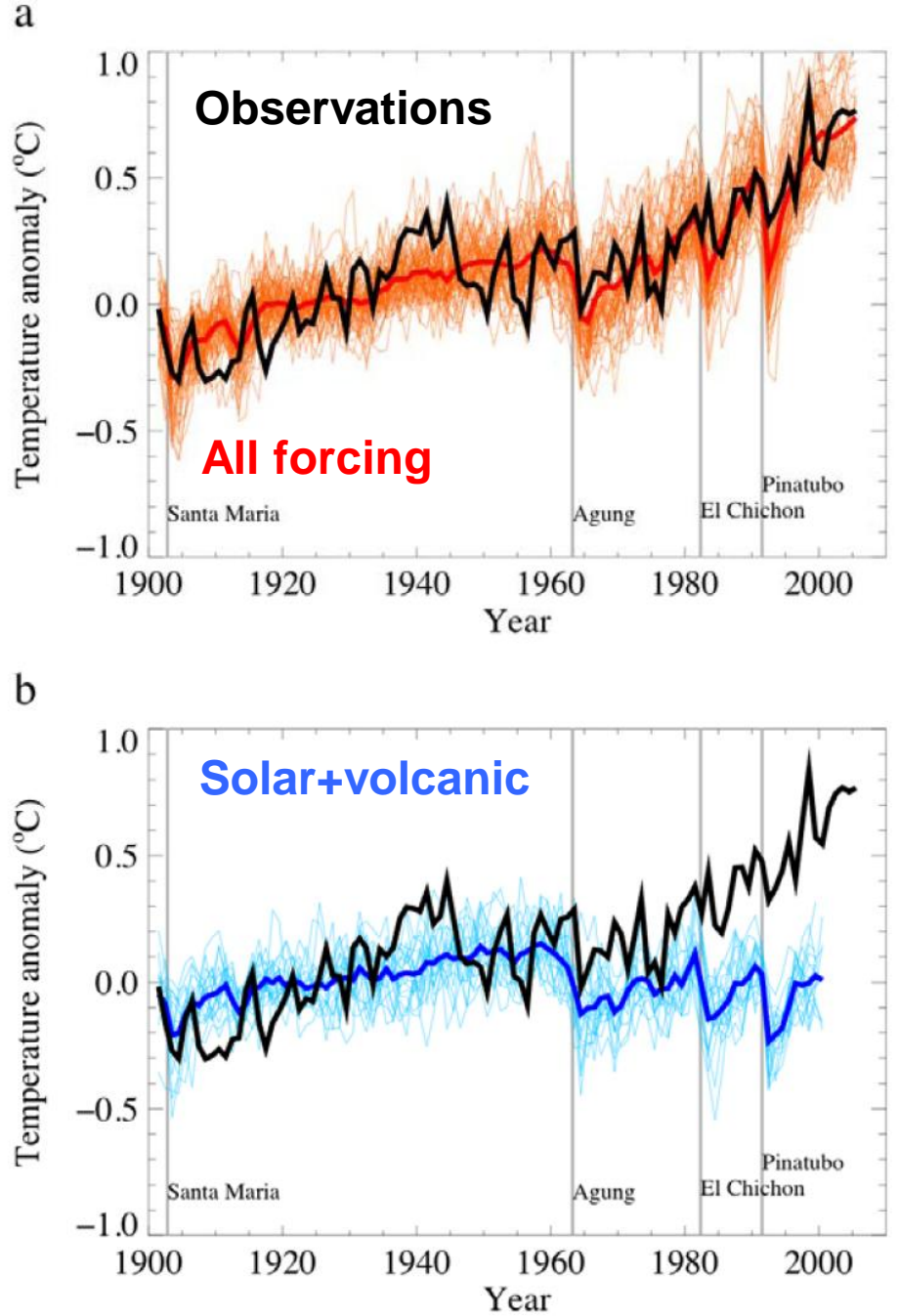
2007



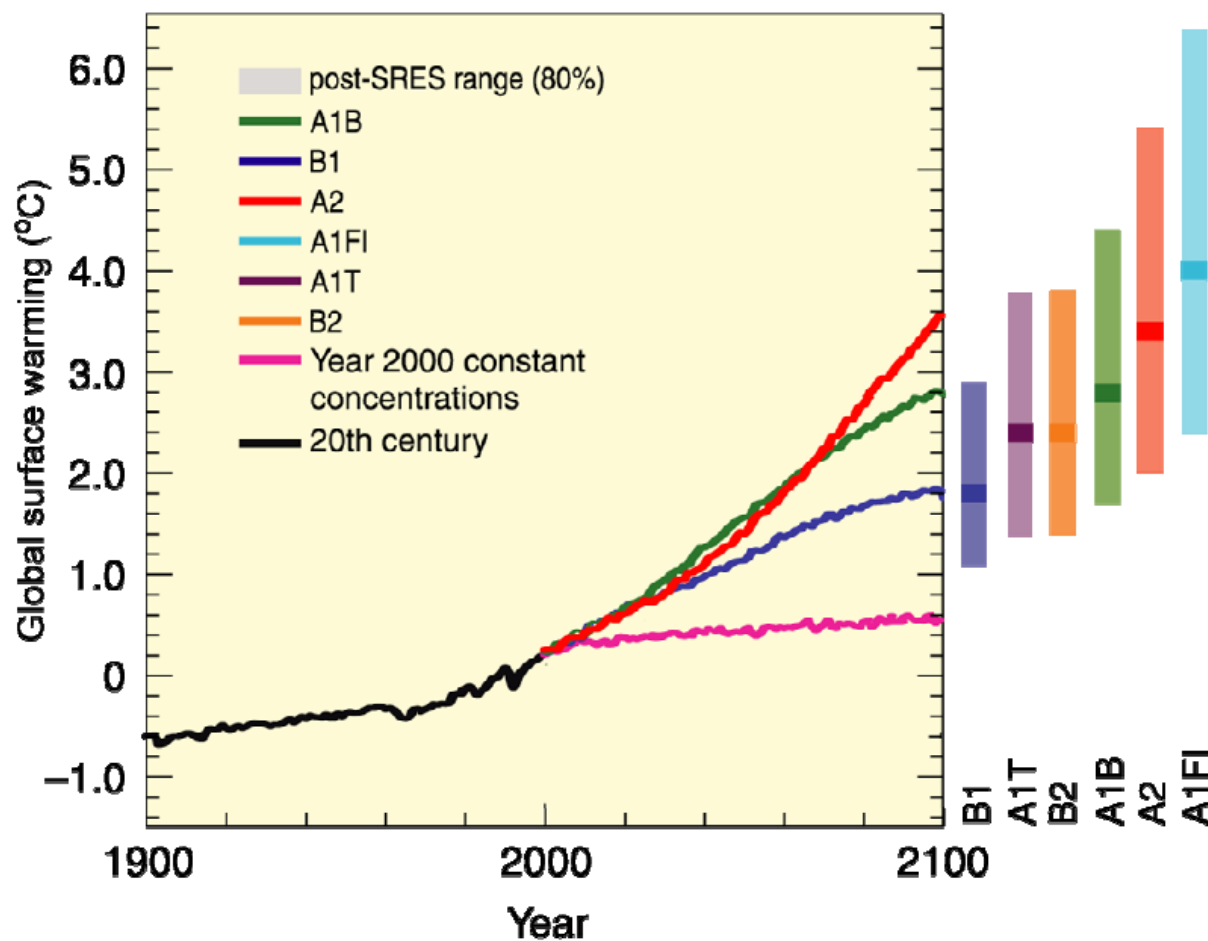
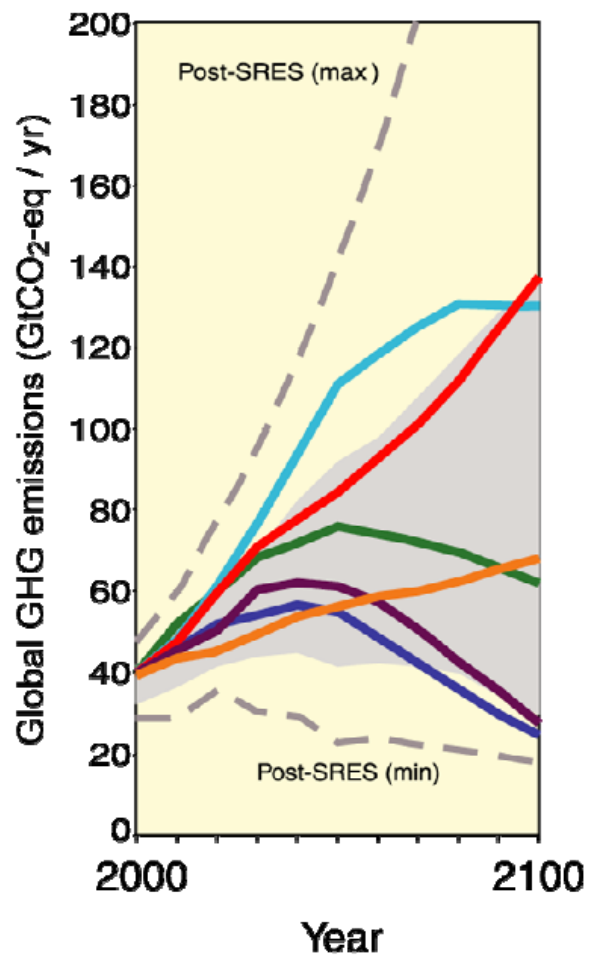
Attribution

Are observed changes consistent with expected responses to natural forcings?

IPCC (2007):
“Warming is unequivocal, and most of the warming of the past 50 years is very likely (90%) due to increases in greenhouse gases.”



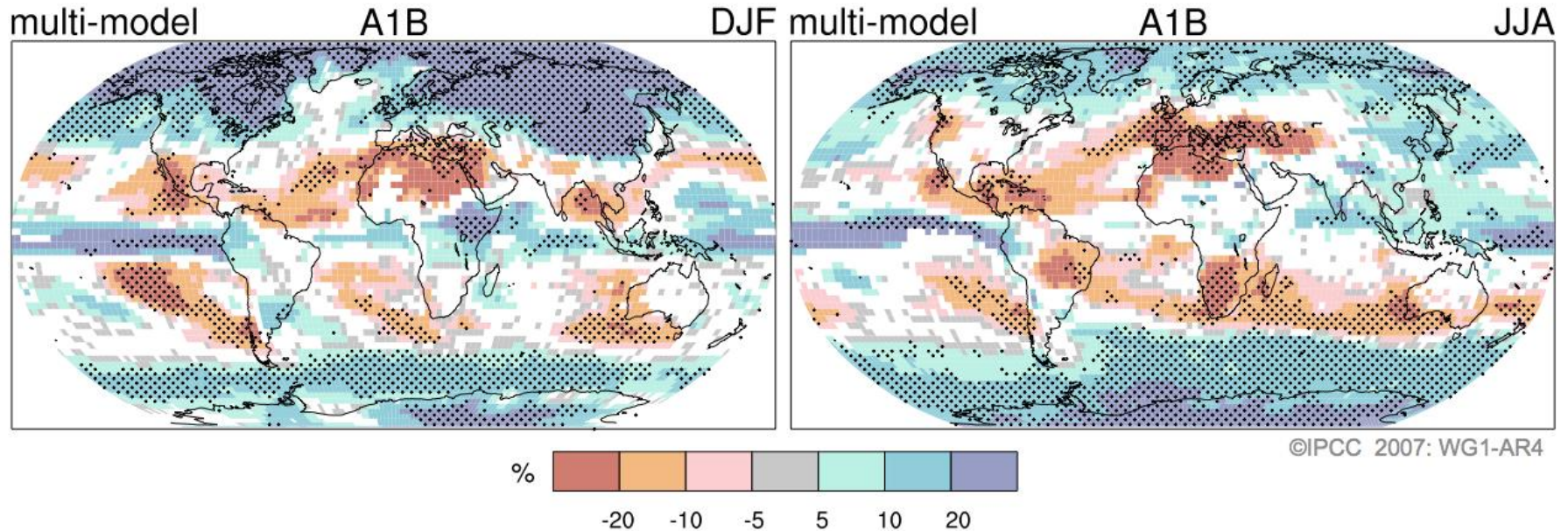
Climate projections without mitigation



NB: écart par rapport à la moyenne 1980-1999

Projections of Future (2100) Changes in Climate

Projected Patterns of Precipitation Changes



Changes are plotted only where more than 66% of the models agree on the sign of the change. The stippling indicates areas where more than 90% of the models agree on the sign of the change.

Brand new in AR4: Drying in much of the subtropics, more rain in higher latitudes, continuing the broad pattern of rainfall changes already observed.

Climate change and extremes

(IPCC AR4 WG1)

Post 1960

21th century

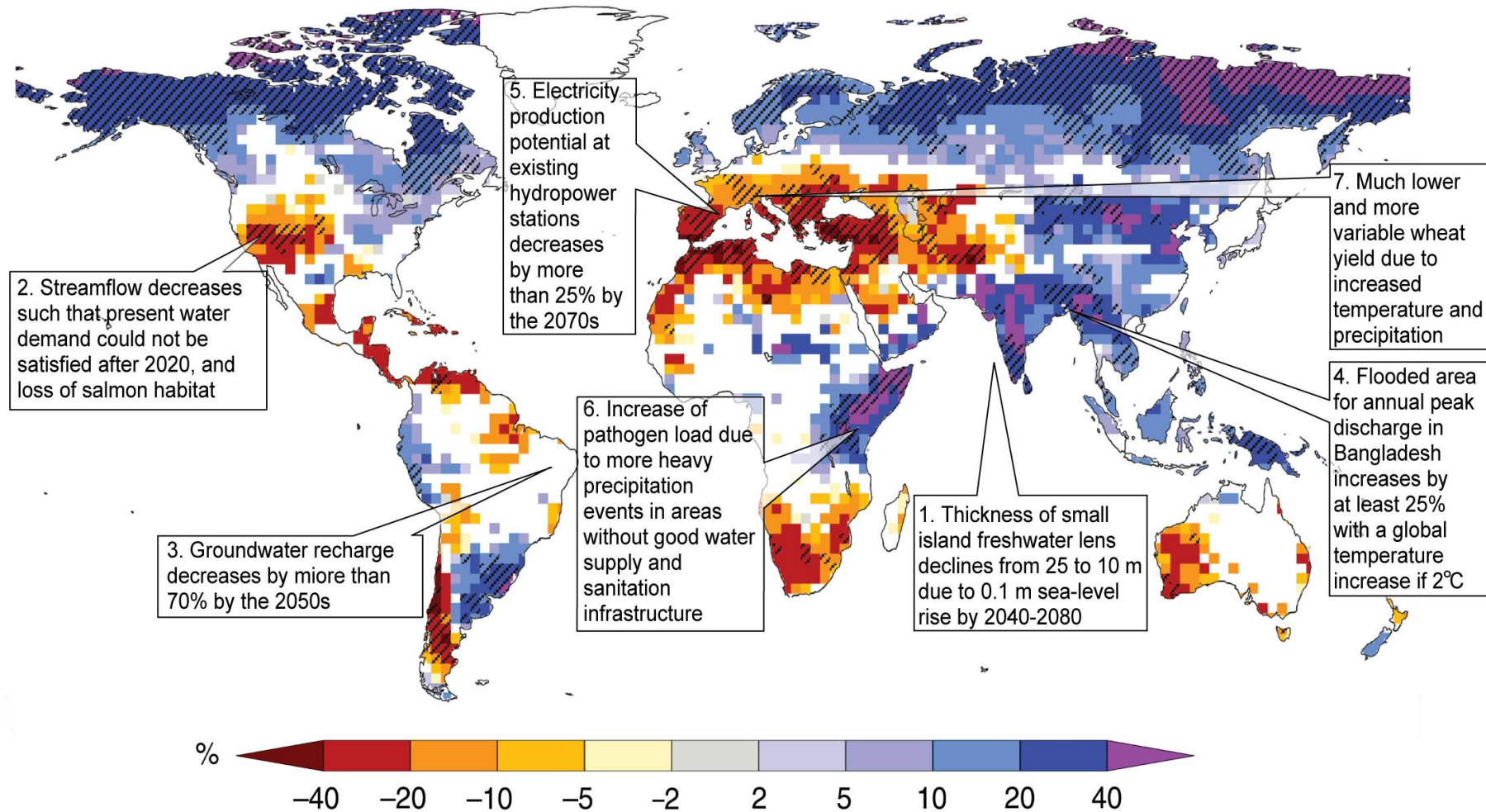
Phenomenon ^a and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend ^b	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	<i>Very likely^c</i>	<i>Likely^d</i>	<i>Virtually certain^d</i>
Warmer and more frequent hot days and nights over most land areas	<i>Very likely^e</i>	<i>Likely (nights)^d</i>	<i>Virtually certain^d</i>
Warm spells / heat waves. Frequency increases over most land areas	<i>Likely</i>	<i>More likely than not^f</i>	<i>Very likely</i>
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	<i>Likely</i>	<i>More likely than not^f</i>	<i>Very likely</i>
Area affected by droughts increases	<i>Likely in many regions since 1970s</i>	<i>More likely than not</i>	<i>Likely</i>
Intense tropical cyclone activity increases	<i>Likely in some regions since 1970</i>	<i>More likely than not^f</i>	<i>Likely</i>
Increased incidence of extreme high sea level (excludes tsunamis) ^g	<i>Likely</i>	<i>More likely than not^{f, h}</i>	<i>Likelyⁱ</i>

Virtually certain > 99%, very likely > 90%, likely > 66%, more likely than not > 50%

What does IPCC tell us about impacts and adaptation?

⌘ WG2: Impacts, Vulnerability, and adaptation

Water at the end of the 21st century for SRES A1B



TP Figure 3.4: Ensemble mean change of annual runoff, in percent, between present (1980-1999) and 2090-2099 for the SRES A1B emissions scenario (based on Milly et al., 2005).

**20% - 30% of plants
and animals species
at increased risk of
extinction**

**if ΔT 1.5°C - 2.5°C
(above 1990 temperature)**

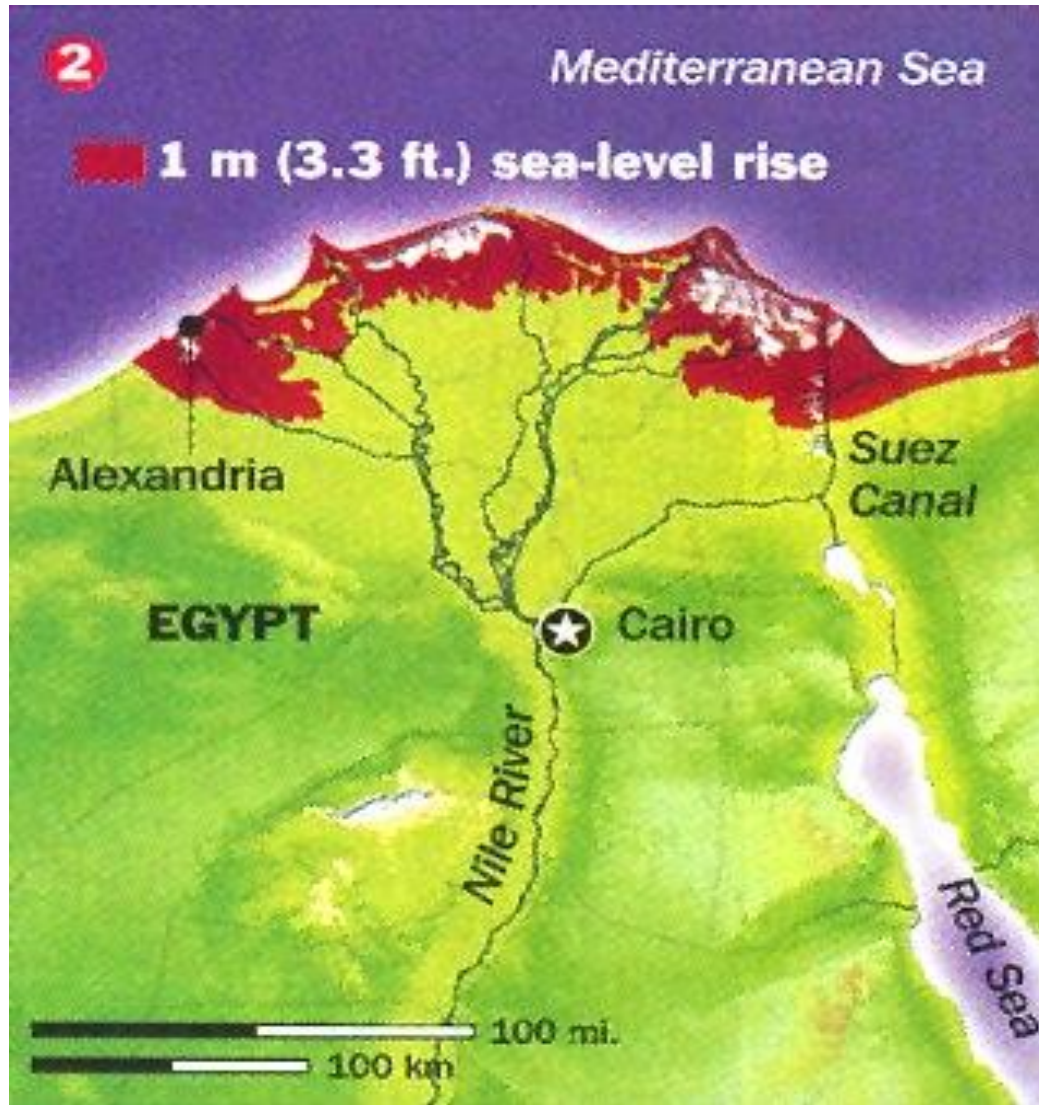


WMO



UNEP

Effects on Nile delta: 10 M people above 1m



(Time 2001)

Ice sheet melting

- Melting of the Greenland ice sheet
 - Total melting would cause 7 m SLR contribution
- Melting of the West Antarctic Ice Sheet
 - Total melting would cause 5 m SLR contribution
- Warming of 1 – 4°C over present-day temperatures would lead to partial melting over centuries to millennia

With 8 metre sea-level rise: 3700 km² below sea-level in Belgium
(very possible in year 3000)
(NB: flooded area depends on protection)



Source: N. Dendoncker (Dépt de Géographie, UCL), J.P. van Ypersele et P. Marbaix (Dépt de Physique, UCL) (www.climate.be/impact)

Excerpts from IPCC AR4 WG2 (Chapter Europe)

- **For the first time, wide ranging impacts of changes in current climate have been documented in Europe**
 - retreat of glaciers, lengthening of growing season, shift of species, heat wave in 2003, ...
- **Climate-related hazards will mostly increase, although changes will vary geographically**
 - More winter floods in maritime regions, snowmelt-related floods in Central and E. Europe, flash floods throughout Europe.
 - Coastal flooding related to increasing storminess and sea level rise is likely to threaten up to 2.5 million additional people annually.
 - Some impacts may be positive, as in reduced risk of extreme cold events. However, on balance, health risks are very likely to increase.



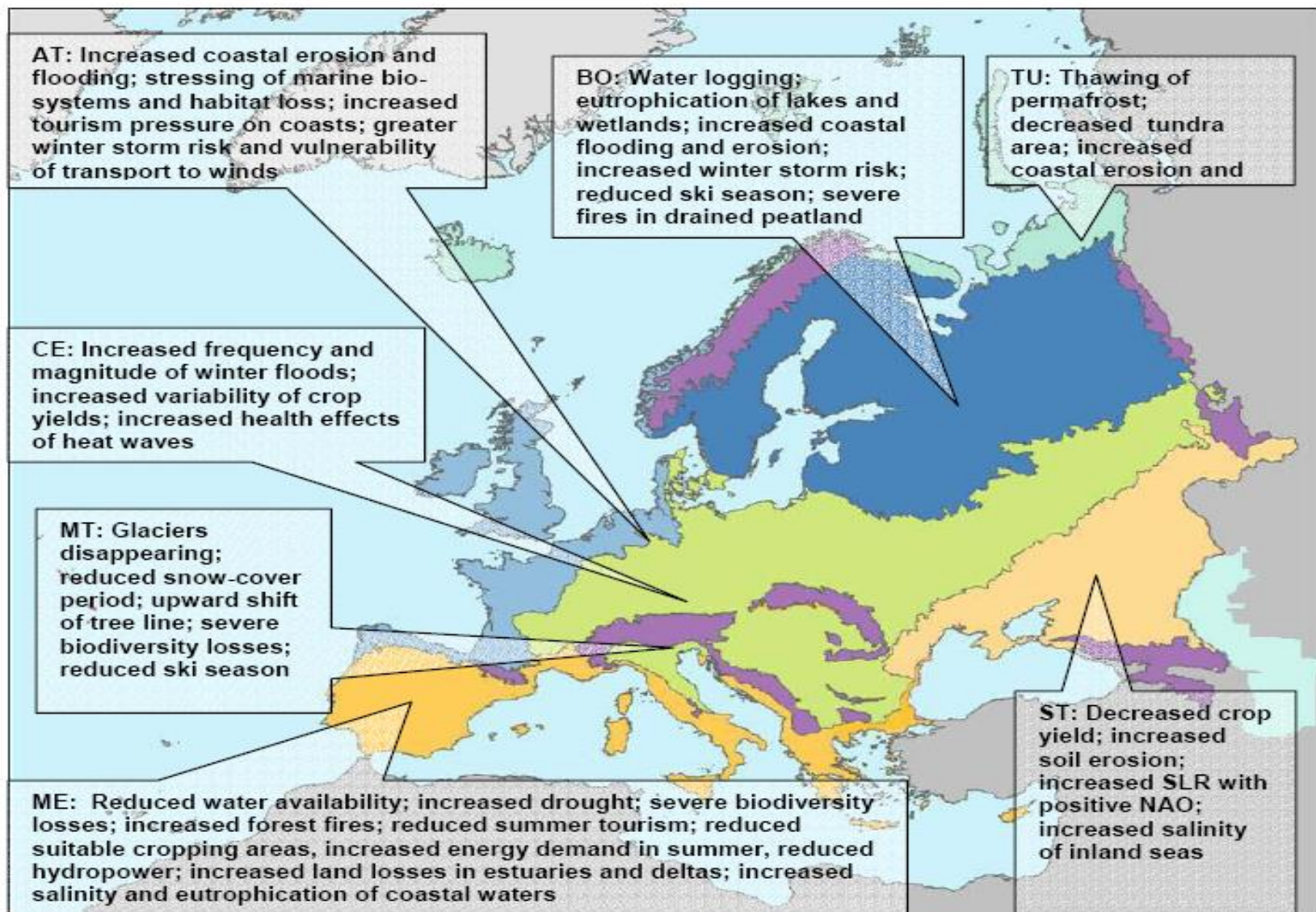
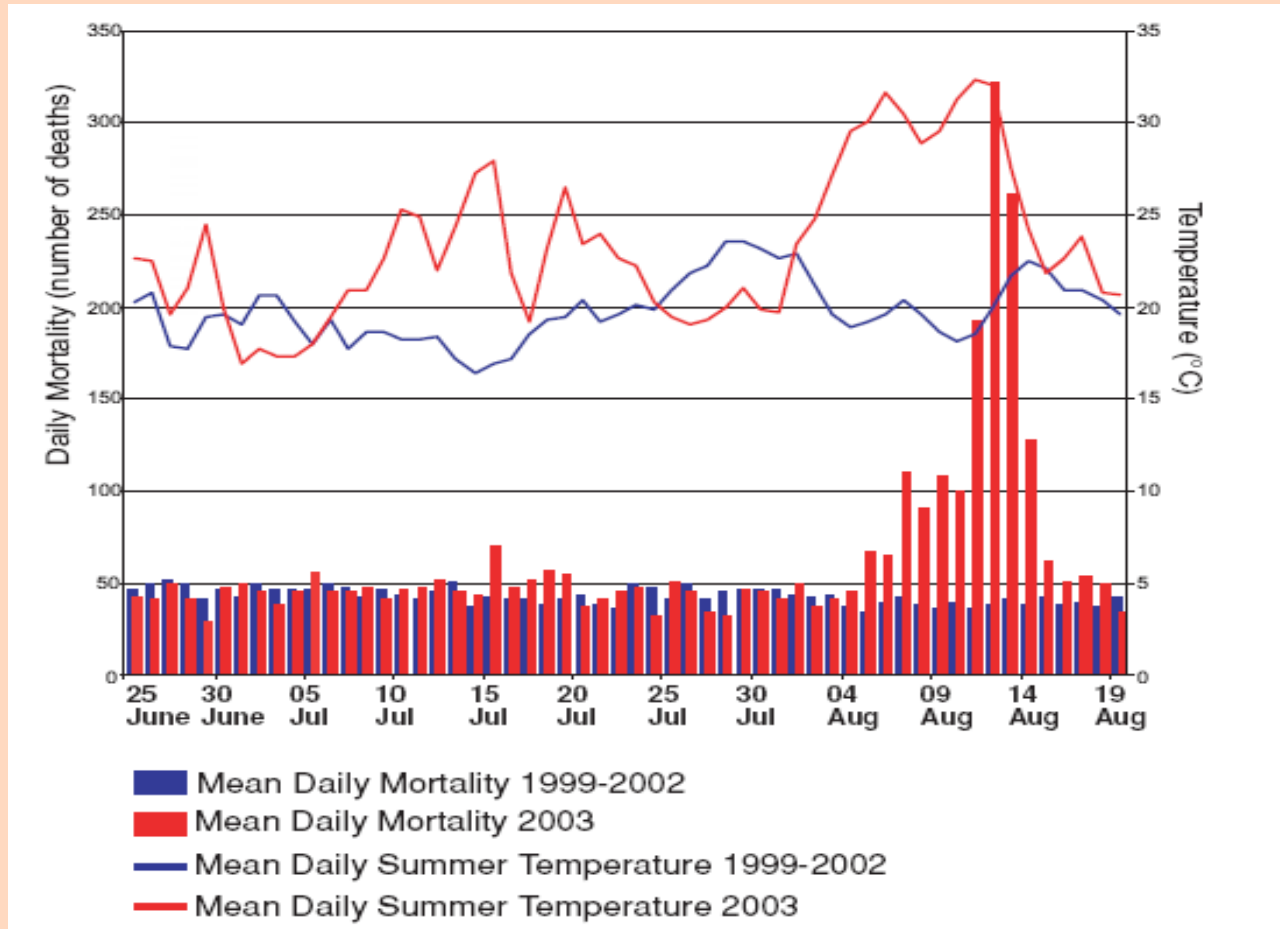


Figure 12.3: Key vulnerabilities of European systems and sectors to climate change during the 21st century for the main biogeographic regions of Europe (EEA 2004a): TU (Tundra, pale turquoise); BO (Boreal, dark blue); AT (Atlantic, light blue); CE (Central, green [includes the Pannonian Region]); MT (Mountains, purple); ME (Mediterranean, orange [includes the Black Sea region]); ST (Steppe, cream); SLR (sea-level raise); NAO (North Atlantic Oscillation).

Daily mortality in Paris (summer 2003) (IPCC AR4 Ch 8)



Excerpts from IPCC AR4 WG2 (Chapter Europe)

- **Climate change is likely to magnify regional differences of Europe's natural resources and assets.**
- **Water stress will increase over Central and S. Europe, as well as the number of people living in river basins under high water stress.**

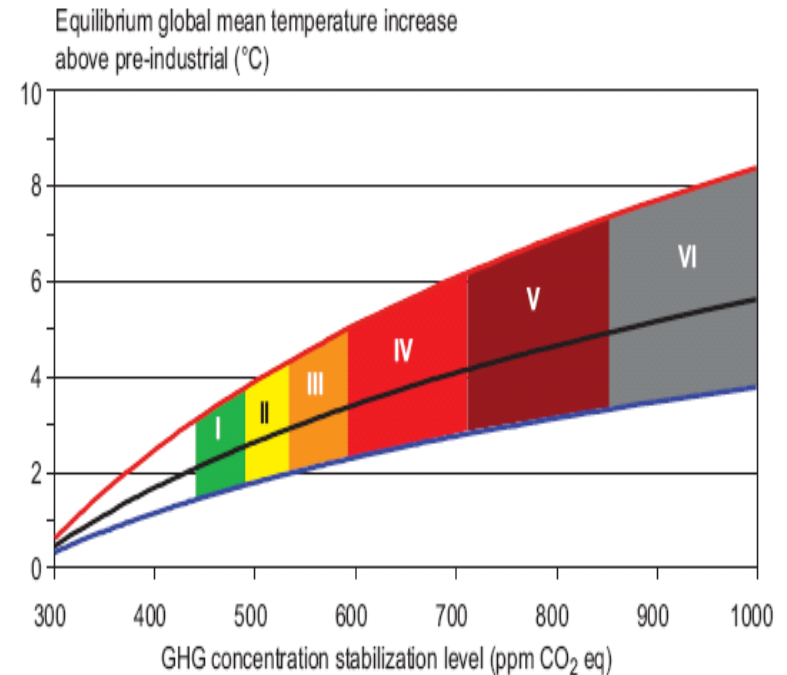
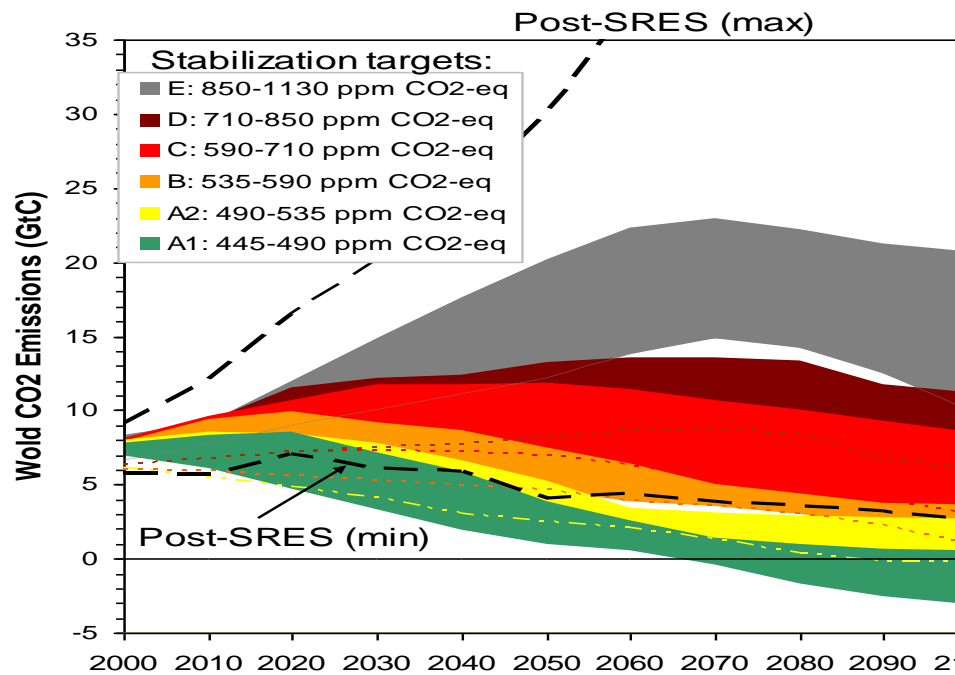
Excerpts from IPCC AR4 WG2 (Chapter Europe)

- **Climate change is estimated to pose challenges to many European economic sectors and alter the distribution of economic activity.**
 - **Agriculture will have to cope with increasing water demand for irrigation in S. Europe.**
 - **Peak electricity demand is likely to shift in some locations from winter to summer.**
 - **Winter tourism in mountain regions is anticipated to face reduced snow cover.**

What does IPCC tell us on mitigation?

⌘ WG3: Mitigation

The lower the stabilisation level the earlier global emissions have to go down



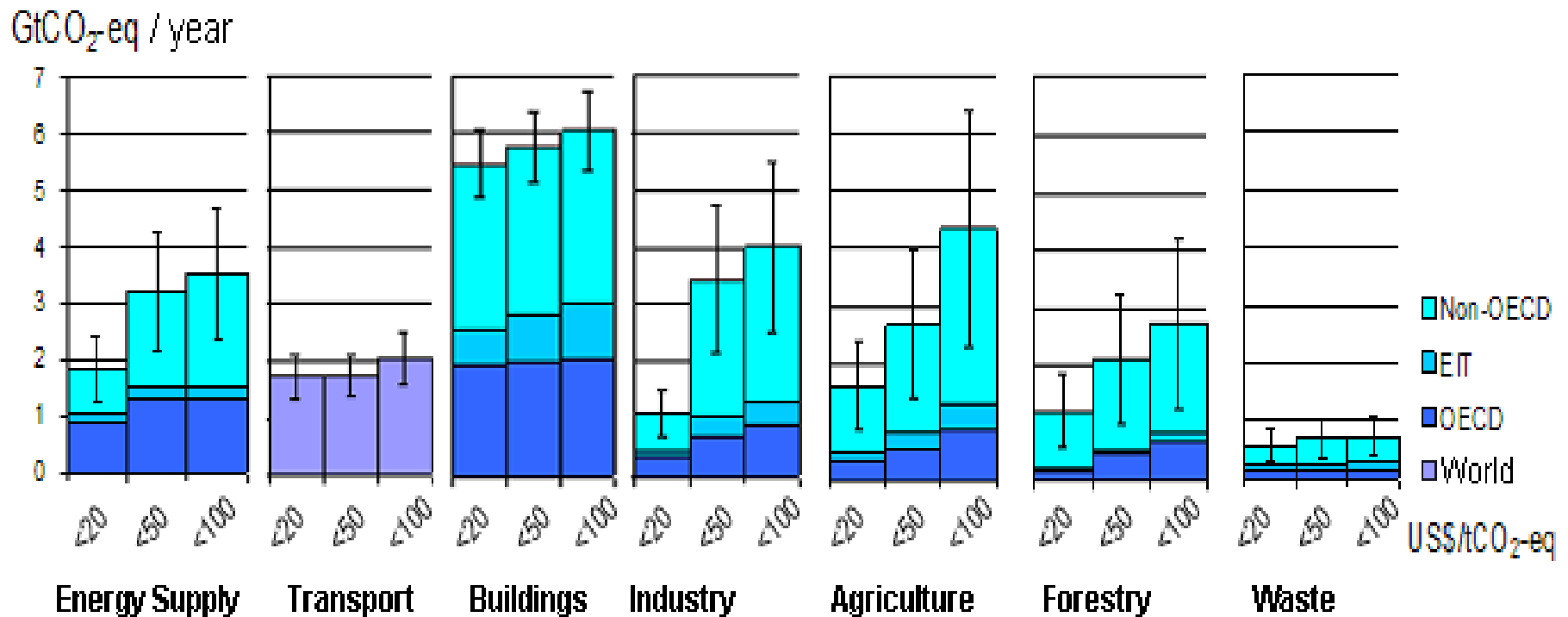
Multigas and CO₂ only studies combined

Long term mitigation (after 2030)

- The lower the stabilization level, the more quickly emissions would need to peak and to decline thereafter
- Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

Stab level (ppm CO ₂ -eq)	Global Mean temp. increase at equilibrium (°C)	Year CO ₂ needs to peak	Reduction in 2050 compared to 2000
445 – 490	2.0 – 2.4	2000 - 2015	-85 to -50
490 – 535	2.4 – 2.8	2000 - 2020	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080	+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090	+90 to +140

All sectors and regions have the potential to contribute by 2030



Note: estimates do not include non-technical options, such as lifestyle changes.

John Holdren, Past-President of the American Association for the Advancement of Science, now President Obama's science adviser

- ⌘ ***'We basically have three choices – mitigation, adaptation, and suffering.'***
- ⌘ ***We're going to do some of each. The question is what the mix is going to be.***
- ⌘ ***The more mitigation we do, the less adaptation will be required, and the less suffering there will be.'***

Useful links:



⌘ www.ipcc.ch : IPCC

⌘ www.climate.be/JCM: interactive climate model

⌘ www.climate.be/vanyp : many of my slides