Is there a Rational Basis to the Alarmist/Extremist View of Climate Change?

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Main drivers of the climate debate

- Published opinion and the public's perception of climate change appears to be largely influenced by alarmist statements and reports in the mass media
- Prominent examples are Al Gore's movie "An Inconvenient Truth" (AIT) and the "Stern Review on the economics of climate change" and the "tipping point" debate
- In a democratic society published opinion and public perception are the main drivers for political action – not indisputable scientific facts
- Cases in point are the European Union's "Climate Change Strategy" of 10 January 2007 and the "Green package" of 23 January 2008", Waxman-Markey Cap and Trade, G20 proposal to limit global temperature rise to 2°C
- Those policy decisions and proposals are driven by the extremist view on climate change
- Both "AIT" and "Stern" have been thoroughly analyzed and discredited as a one-sided, extremist view of the world unsuited for policy decisions

Some key elements of the extremist view

- There is a significant chance of a temperature increase greater than 3℃ by 2100 if ghg emissions continue along BaU scenarios
- Observed global warming in the last few decades is almost entirely due to ghg emissions
- Warming has accelerated lately
- Significant increase of extreme weather and climate events with future warming (as eg hurricanes, tornados, wind-storms, extreme precipitation events, droughts)
- Extreme events have already increased as a result of man-made global warming
- There is a significant chance of a large sea-level rise of several meters (caused by partial melting of Greenland and/or Antarctica) if temperatures rise more than 2℃ (“tipping points”)
- Limiting global temperature rise to 2℃ requires an 80 % reduction of ghg emissions in the industrialized countries compared to 1990 by 2050 (50 % world-wide)

Does the alarmist view differentiate between facts, observations, theories, hypothesies, computer modeling, scenarios, speculation, personal opinions etc?

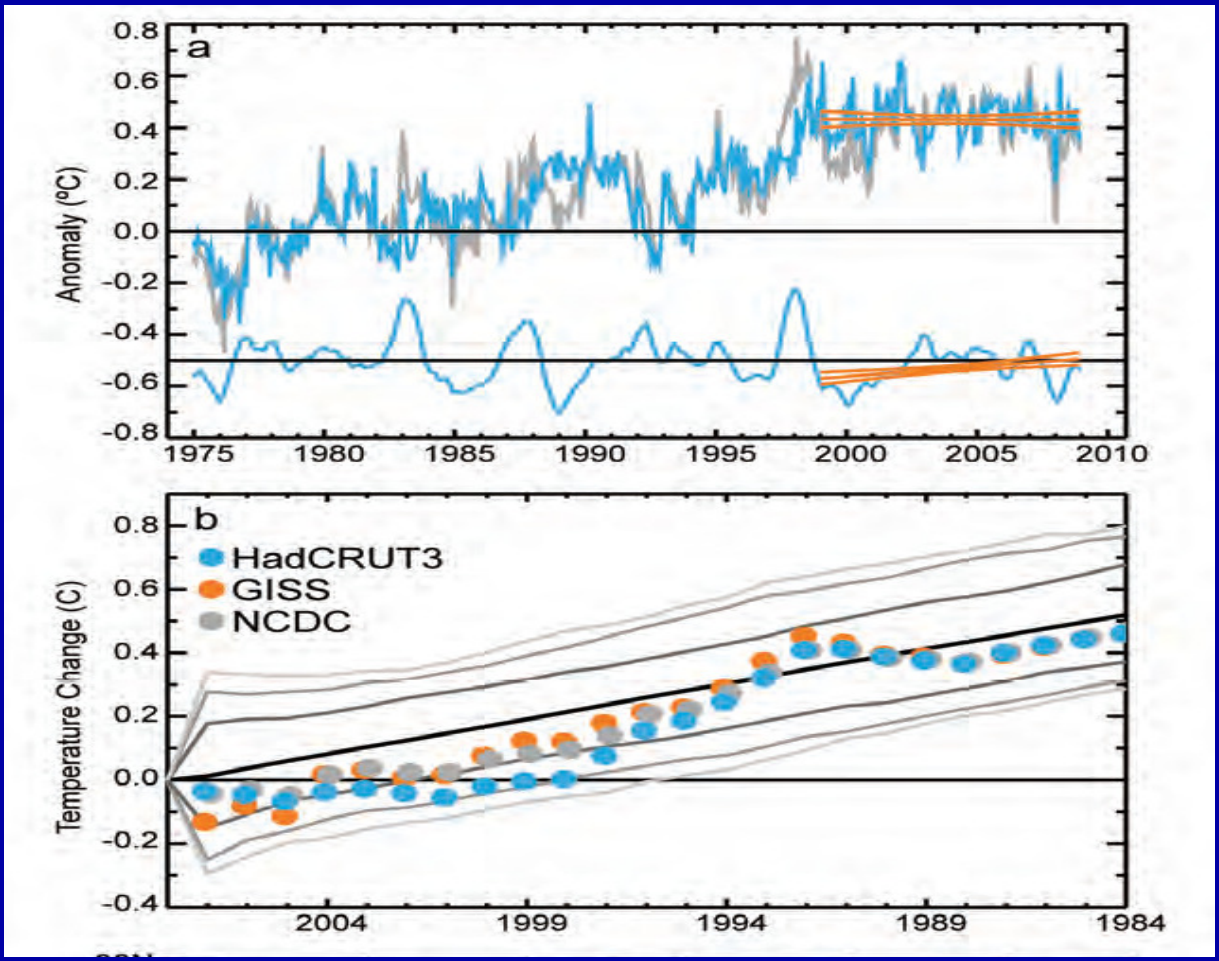
- Most of the key elements of the alarmist view on future climate change are presented as facts in the public debate
- A mere possibility becomes a fact, however improbable
- Any statement about future climate change can never be a fact, but at best a theory, hypothesis, scenario etc based on any number of assumptions, which may or may not be correct
- On observed climate change, there is frequently „cherry picking“: Observations that fit a perceived scenario are highlighted, contradictory evidence is suppressed or played down

„Projected average global surface warming at the end of the 21st century is 1.1 – 6.4 °C “

	IPCC 1990 SA90	IPCC 2001 SRES	IPCC 2007 SRES	Observed 1987 - 2006
CO_2 Concentration (increase in % pa)	.80	.36 -.96	.36 - .96	.45)1
CH_4 Concentration (increase in % pa)	.87	- .12 - .78	-.12 - .78	.30)2
Greenhouse Forcing (in W m^{-2} dec^{-1})	.75	.41 - .91	.41 - .91	.37)3
Projected Temperature Increase (°C per dec)	.30	.14 - .58	.11 - .64	.15 +/- .05)4

)1 From Mauna Loa data
)2 Higher in the 1980s, lower since 1990, no increase since 1999 following IPCC, 2007
)3 Higher in the 1980s, lower in the 1990s and 2000s, following Hansen and Sato, 2004;
)4 Lower value is radiosonde and satellite data of troposphere 0 - 8 km, higher value surface data

Recent global temperature trends: No indication of an accelerated warming

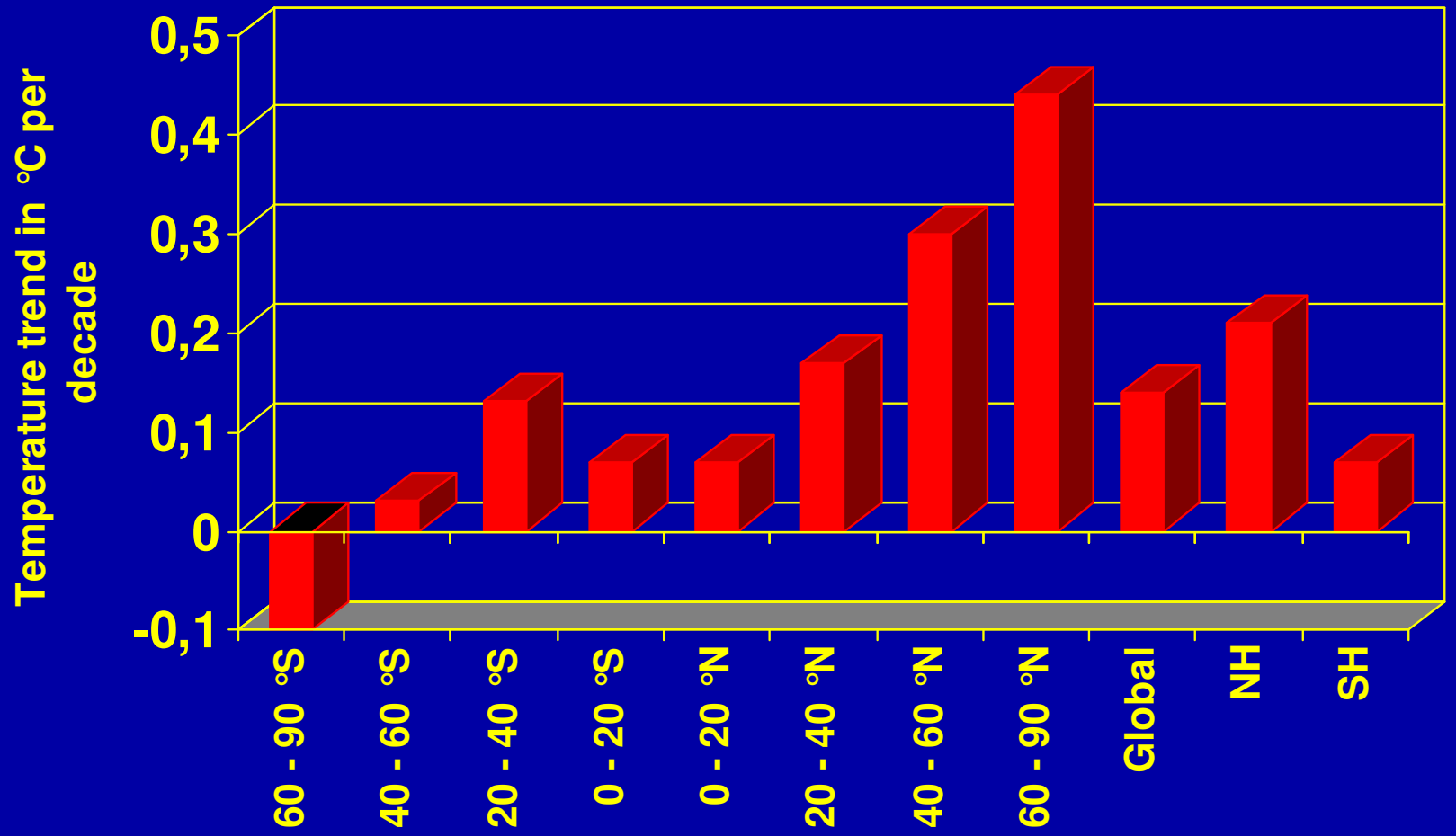


Decadal global temperature changes 1970 -1979 – 2000 – 2008:
70s to 80s: +.187
80s to 90s: +.132
90s to 00s: +.148
Average change: +.156

Source: State of the Climate 2008, BAMS, August 2009; Jones et al global surface data

MSU 2LT Satellite Temperature Trends 1979 - 2006;

Latitudinal Averages



Why is the global warming proceeding much slower than expected?

- Large disparity between modeled and observed warming has been noted since the 1990s (eg IPCC, 1996; MPI Report 256, 1998)
- Alarmists: Sulfate cooling responsible for disparity; high climate sensitivity to ghg (eg Ramanathan and Feng, 2008)
- But: This should have resulted in a strong relative cooling of the NH vs the SH (eg IPCC, 1996)
- However, the opposite has been observed in recent decades
- Other explanation are being ignored by alarmists (as eg lower climate sensitivity, Lindzen and Choi, 2009; Spencer, 2008)

Is sulphate cooling a realistic explanation of the difference between observed/modelled temperature trends?

- About 90 per cent of sulphur emissions/sulphate load occur in the NH, predominantly the ML's (US, Europe, South and East Asia)
- According to mainstream modelling, cooling effect strongest there
- Should result in larger warming trends SH than NH, particularly over land
- Not observed: Largest warming in recent decades ML's and HL's of NH, small/insignificant warming SH
- Sulfate cooling heuristic assumption: Cancellation of two unknowns with opposite signs; hypothetical and speculative; no firm scientific basis. Not entirely impossible but not very plausible
- Follows general trend in climate debate: Hypotheses that support models are stressed, countervailing evidence is played down by scientists and the media

Other explanations for differences observed/modelled

- Water vapour feedback may not be as large as modelled, especially in the tropics
- Cloud feedback effects may not be as large as modelled

Regional sulfur emissions in recent decades: high emissions in the NH, low emissions in the SH

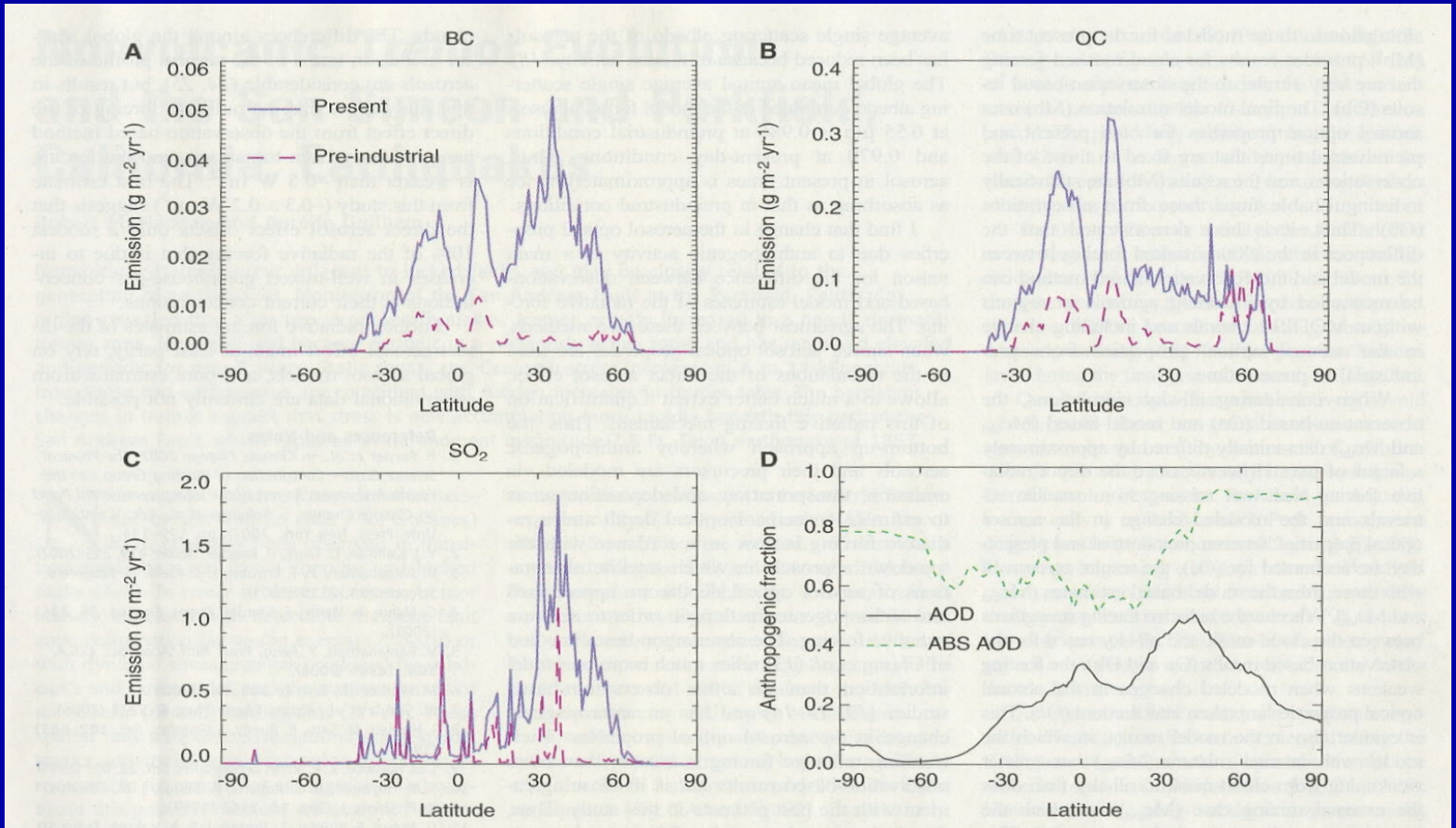


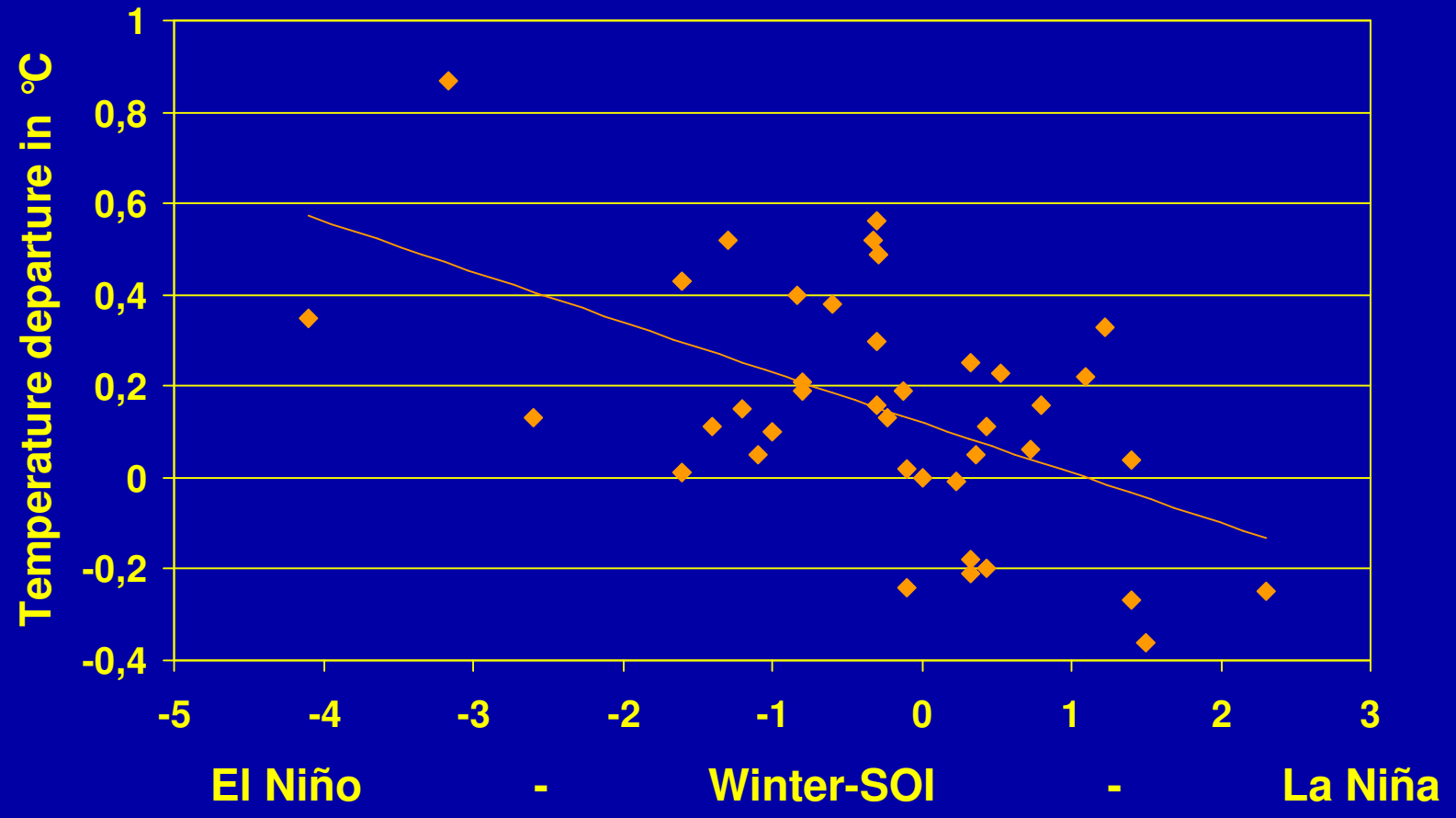
Fig. 3. Present time and preindustrial emissions of **(A)** BC, **(B)** primary OC, **(C)** SO_2, and **(D)** anthropogenic fraction of AOD (550 nm) and absorption AOD (ABS AOD) (550 nm). The anthropogenic fraction is shown as the ratio of the difference in AOD between 1750 and 2004 due to anthropogenic activity, to the total AOD (anthropogenic and natural).

Source: Myhre, Science, 10 July 2009

Is the observed warming in recent decades entirely due to greenhouse gases?

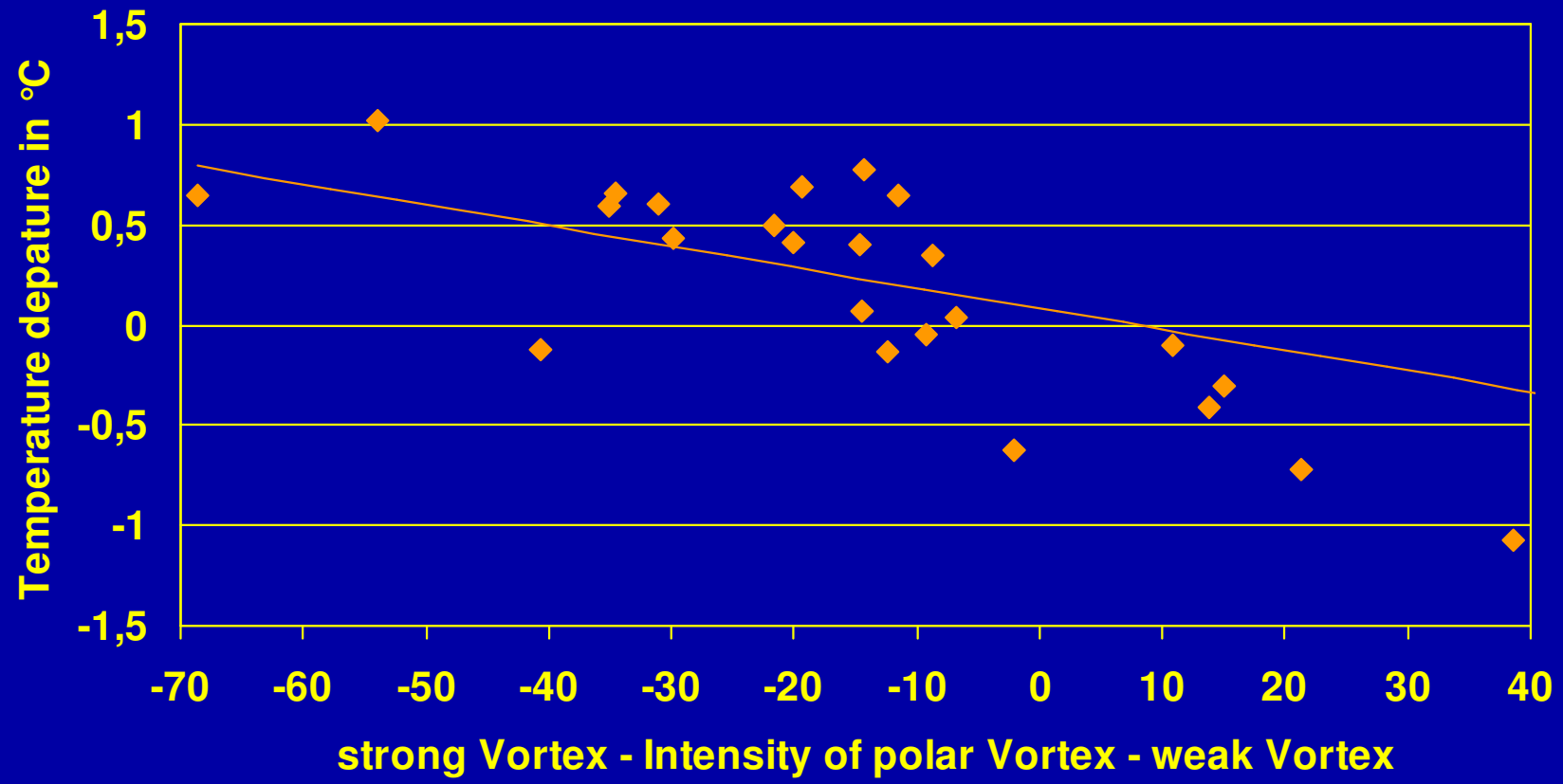
- Warming during the first half of the 20th century natural causes, possibly solar
- Cooling 1950-1975 unrelated to ghg increase, possibly solar
- Warming over the last three decades was concentrated in the mid and higher latitudes of the NH, small to insignificant in the Tropics and SH since about 1980
- Appears to be influenced by ENSO variations (more frequent El Nino events 1977 – 2007 compared to the 1950s – 1970s)
- Appears to be influenced by the NAO/AO/NAM, more zonal flow in recent decades, wintertime warming interior continents (large surface, smaller free troposphere)
- Probably explains significant part of the NH temperature rise

Tropospheric Temperatures 300/1000 mb in the Northern Hemisphere and SOI variations 1961 - 2000: Warm El Niños and cool La Niñas



Data Source: Met. Inst. Free University of Berlin

Intensity of the Polar Vortex and Tropospheric Temperatures 300/1000 mb in the Mid-Latitudes 40 - 60 °N in Winter (1976 - 2000)



Data Source: Met. Inst. Free University of Berlin

Significant increase of extreme weather events (model projections)

- Model projections of frequency and severity of tropical storms highly uncertain, does not entertain the view of definite frequency and intensity increases in a warmer world (eg Gualdi et al, 2008; Bengtsson et al, 2007)

- Countervailing effects of increasing static stability and vertical wind-shear to higher SST's in tropics and Hurricane regions

- Mid-latitude storm intensity and frequency in a warmer world highly uncertain, modelling errors larger than climate change signal; uncertain impact on phase and amplitude of stationary waves (eg Bengtsson et al, 2009; Brandefelt and Koernich, 2008)

- Equator to pole temperature gradient main driver of mid-latitude storm intensity, projected to decrease, larger warming in higher latitudes than in mid and lower latitudes

Impacts of global warming on storms

- It is often assumed that global warming will cause an increase in the frequency and intensity of extra-tropical and tropical cyclones
- Not necessarily the case
- Mid-latitude storms
  - Changes occur as a result of competing effects due to changes in atmospheric temperature and moisture
  - Decrease in low level temperature contrast between pole and equator
    - Less energy for storms
  - Increases in upper level temperature gradient
    - More energy for storms
  - Local temperature contrasts are also important
  - More moisture
    - More latent heating. More intense storms
    - Fewer storms are required to give the same energy flux between equator and poles
- Tropical storms
  - Linked to enhanced sea surface temperatures and increased moisture
  - Changes to large-scale circulation, wind shear
- Changes to modes of variability like NAO and ENSO also important

Source: RuthMcDonald, 2006

Future changes in the frequency of tropical storms

Ratio (%) of number of storms in global warming experiment to number in control experiment

			Ocean basin					
model	reference	Global	NA	WNP	ENP	NI	SI	SWP
T106 JMA 10y	Sugi et al. 2002	**66**	**161**	**34**	33	109	**43**	**69**
T42 NCAR CCM2 10y	Tsutsui 2002	102	86	111	91	116	124	99
N144 HadAM3 15y	McDonald et al. 2005	**94**	**75**	**70**	**180**	**142**	110	**82**
T106 CCSR/NIES/FRCGC	Hasegawa and Emori 2005			96				
T106 JMA 10y	Yoshimura & Sugi 05	fewer						
T63 ECHAM5-OM	Bengtsson et al. 2006	94						
20km MRI/JMA	Oouchi et al. 2006	**70**	**134**	**62**	**66**	**48**	**72**	**57**

Red = significantly **more** tropical storms in the future simulation

Blue = significantly **fewer** tropical storms in the future simulation

Summary: fewer tropical cyclones globally in the future simulations, sign of regional changes varies between model and basin

Source: Ruth McDonald, 2006

Tropical Storms and Climate Change

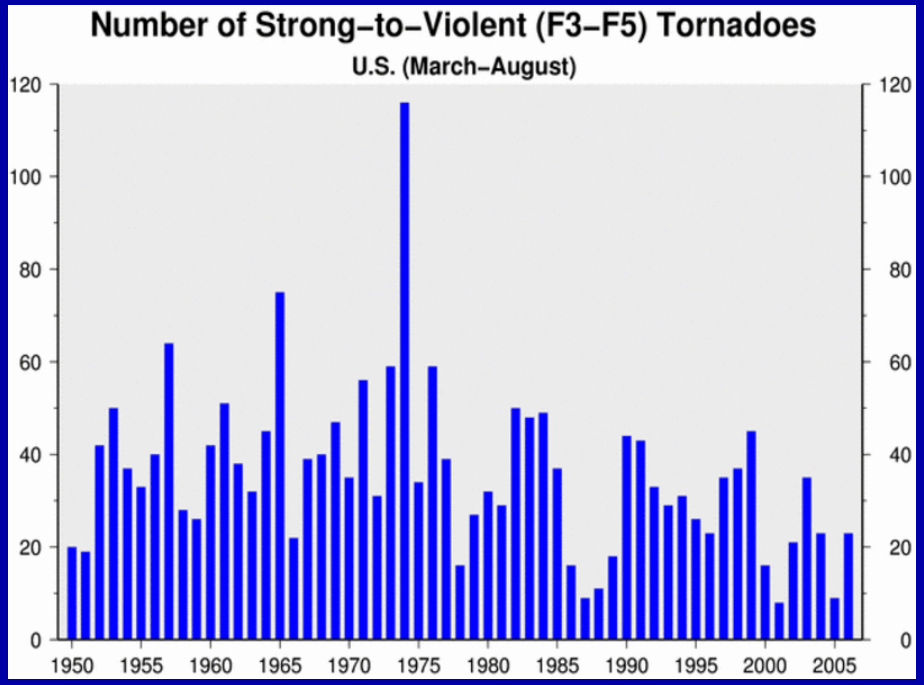
- There is a minor reduction in the number of tropical storms by some 6%
- There are no changes in the extremes of tropical storms in spite of increased tropical SST by 2-3°C
- There are marked changes in the regional tropical storm tracks which we suggest, analogues to ENSO, are driven by regional tropical SST anomalies

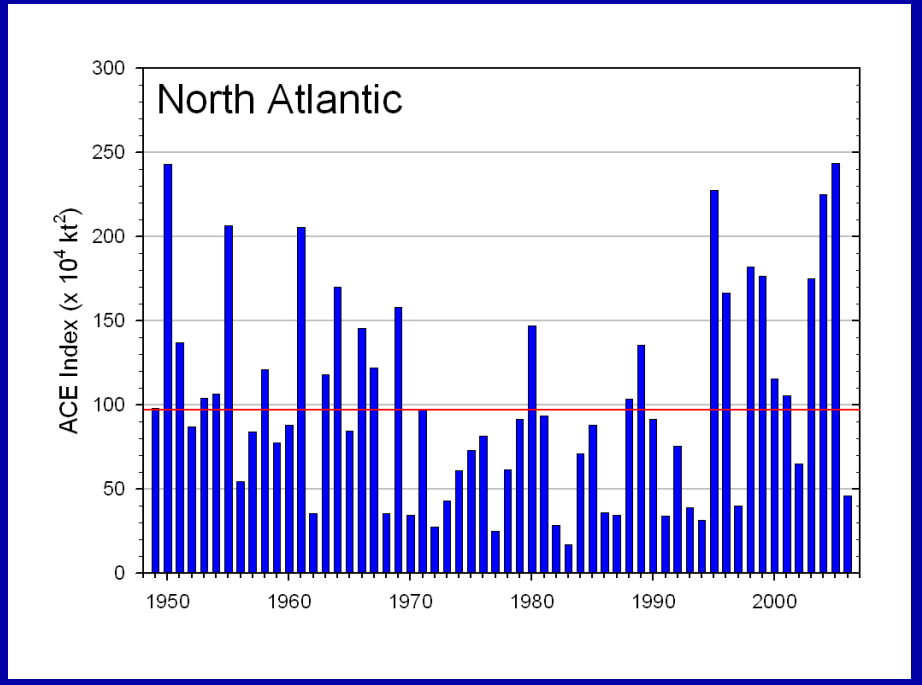
Have extreme events already increased as a result of global warming?

- The media and some scientific studies seek to support the view some extreme events have already increased as a result of man-made global warming
- Definition and detection of extreme events difficult in time series of limited length, parameter dependent
- Incidence of strong Hurricanes (Cat. 3 – 5) in the Atlantic basin has increased since the mid 1970s, but decreased between the 1940s and the 1970s, no long-term increase
- No global increase since the 1980s
- No increase in severe Tornados in the US since the 1950s
- Slight increase in severe precipitation events in US, but unrelated to temperature increase
- No increase in extreme precipitation events in Germany (despite warming there)
- No increase in severe wind-storms in Germany (despite warming there)
- No general increase of summer droughts in Germany and the US

(eg Seager et al, 2009)

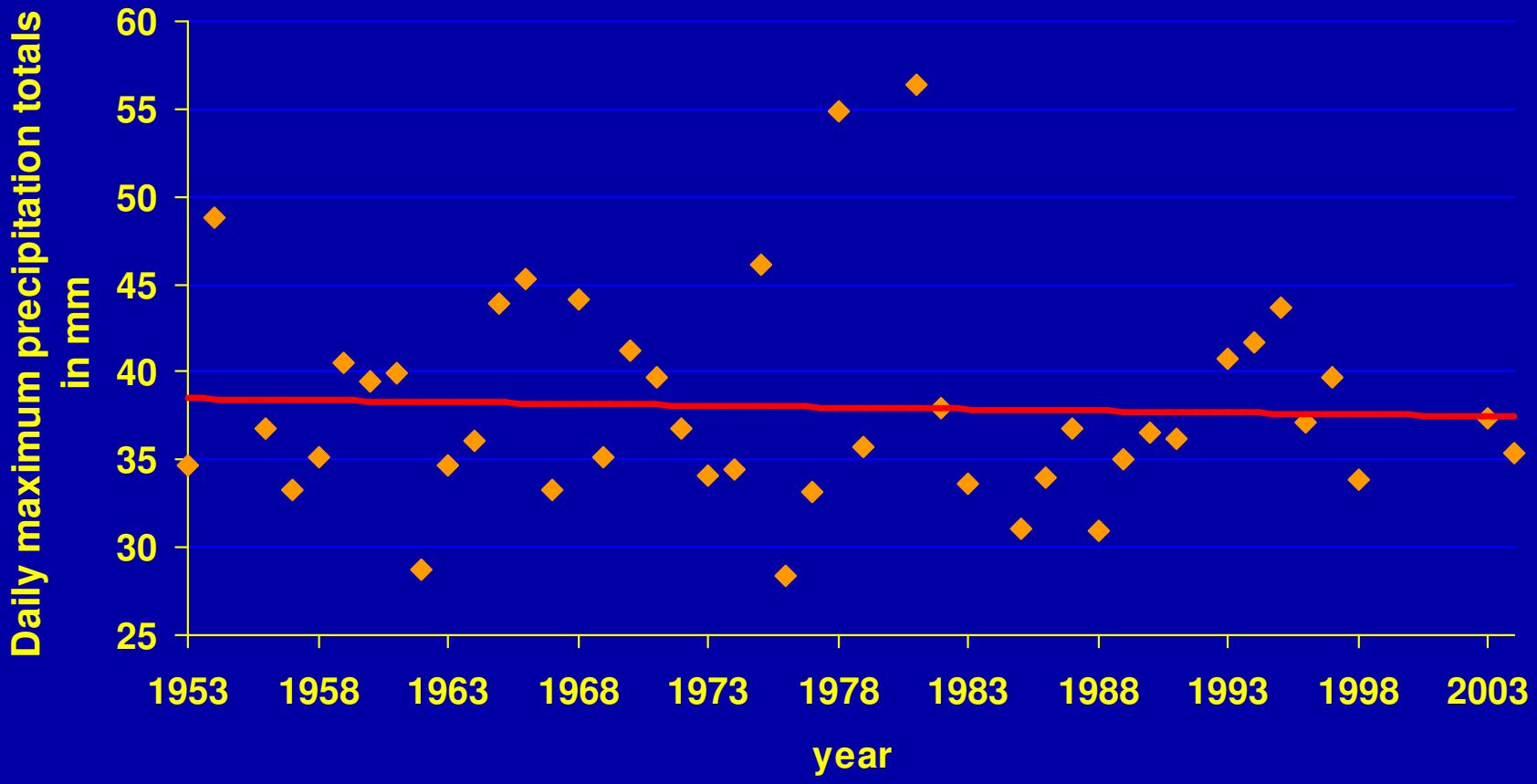
Extreme events (observations): Tornadoes and Hurricanes





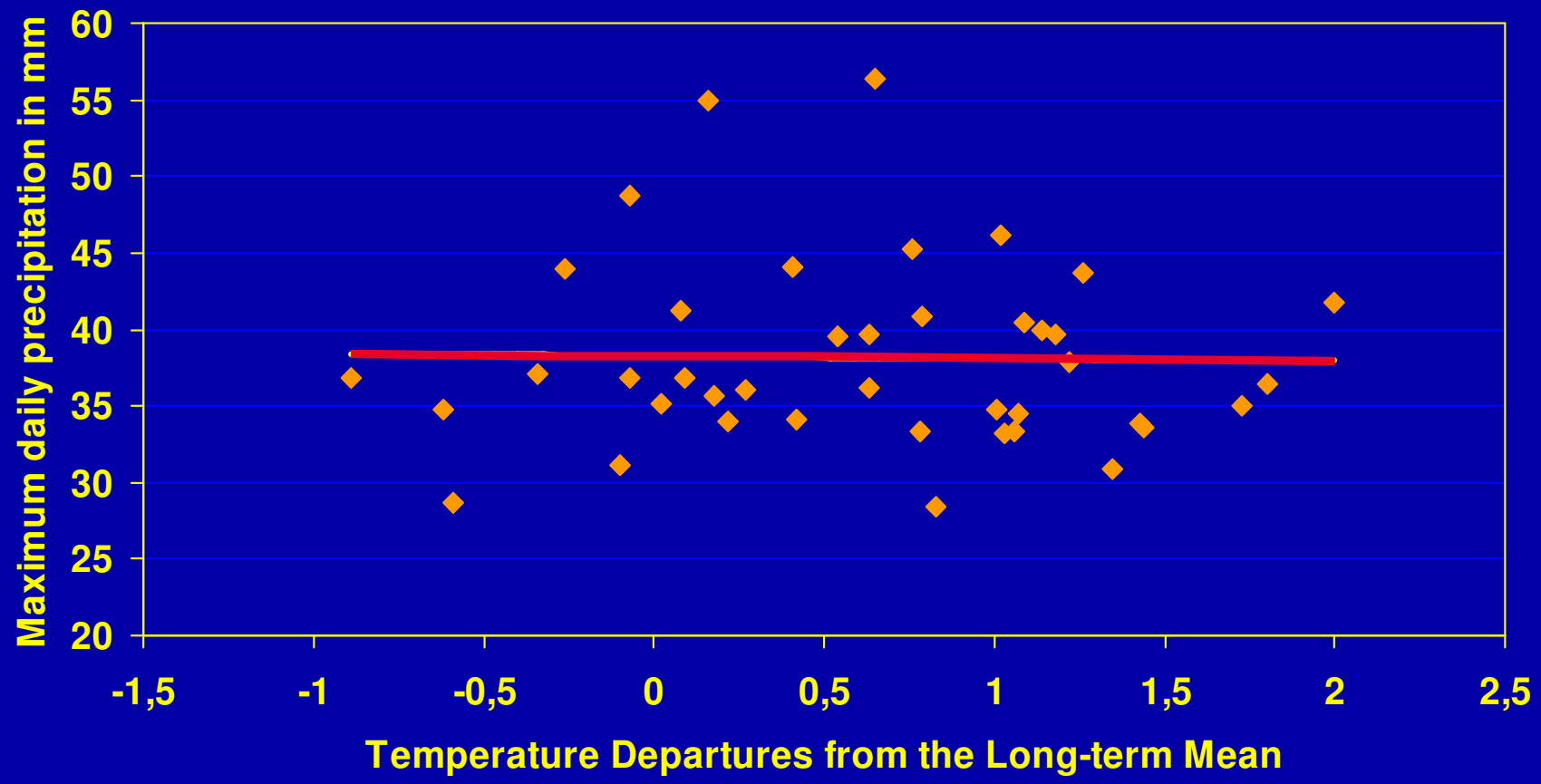
Source: US NOAA

Trends of extreme precipitation in Germany since 1953



Source: German Weather Service, Annual Climatological Data

Annual Average Temperatures vs. Extreme Precipitation in Germany since 1953

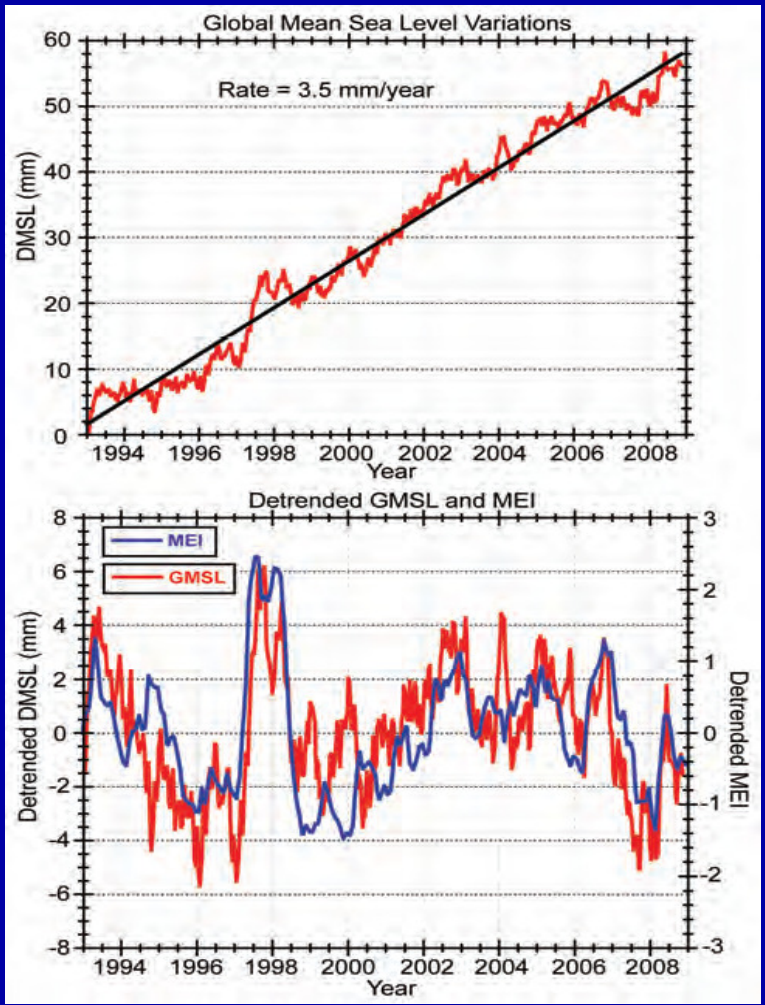


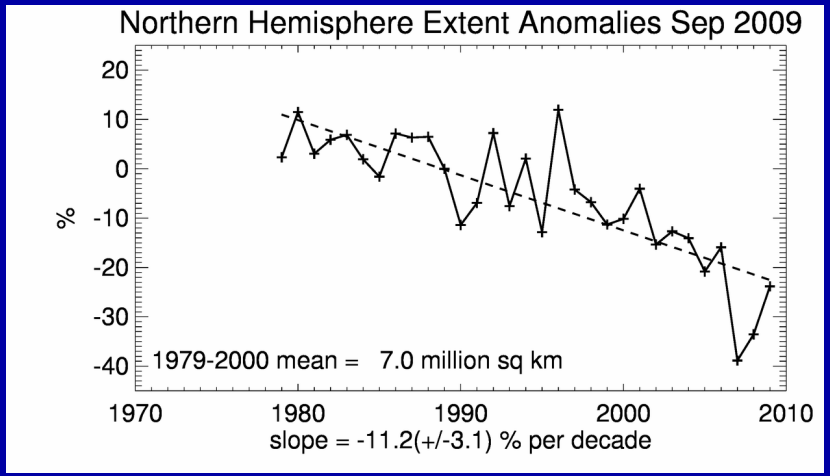
Source: German Weather Service, Annual climatological data

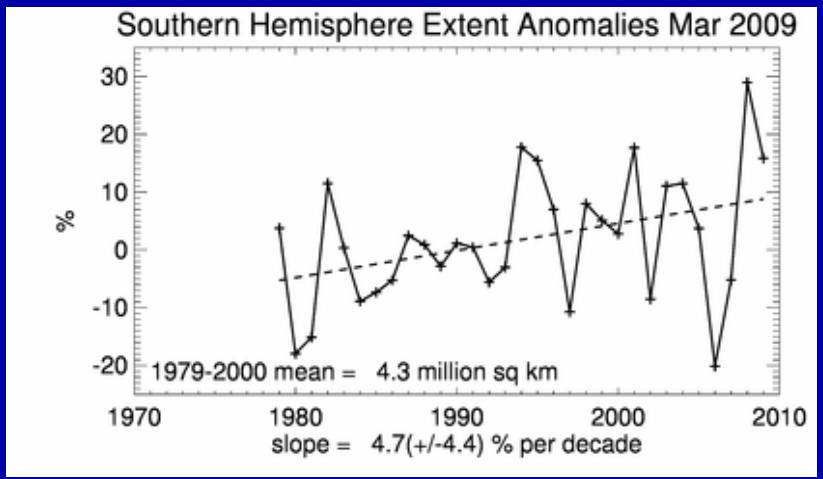
Is there a significant chance of a large sea-level rise due to melting of Greenland and/or Antarctic ice?

- Projections of sea-level rise have continuously been scaled down since IPCC 1990
- Models generally project an increase in Antarctic ice mass, no melting
- Antarctic ice mass has probably increased in recent decades, sea ice extent as well
- Models project some melting of Greenland ice at the edges, but increase in Greenland's interior (altitude between 7,000 and 10,000ft), little net effect on sea-level rise, recent observed temperature rise over Greenland about the same magnitude as rise 1920 – 1930, should not be extrapolated into the future (eg Kerr, 2009; Nick et al, 2009)

Observed sea-level rise and Arctic/Antarctic sea-ice extent





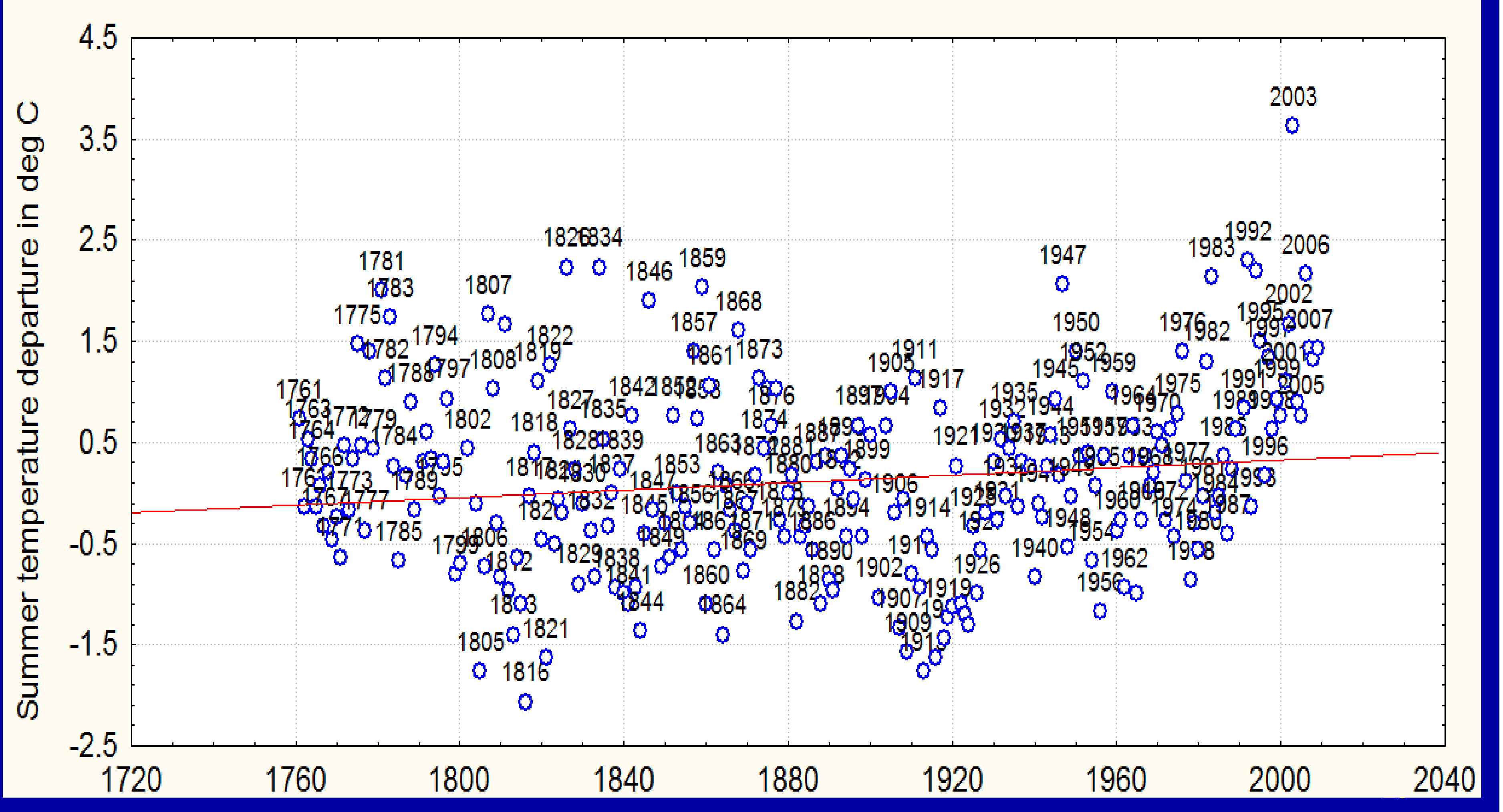


Source: State of the Climate 2008, BAMS, August 2009; National Snow and Ice Data Center, 2009

Climate change in Central Europe in the last decades

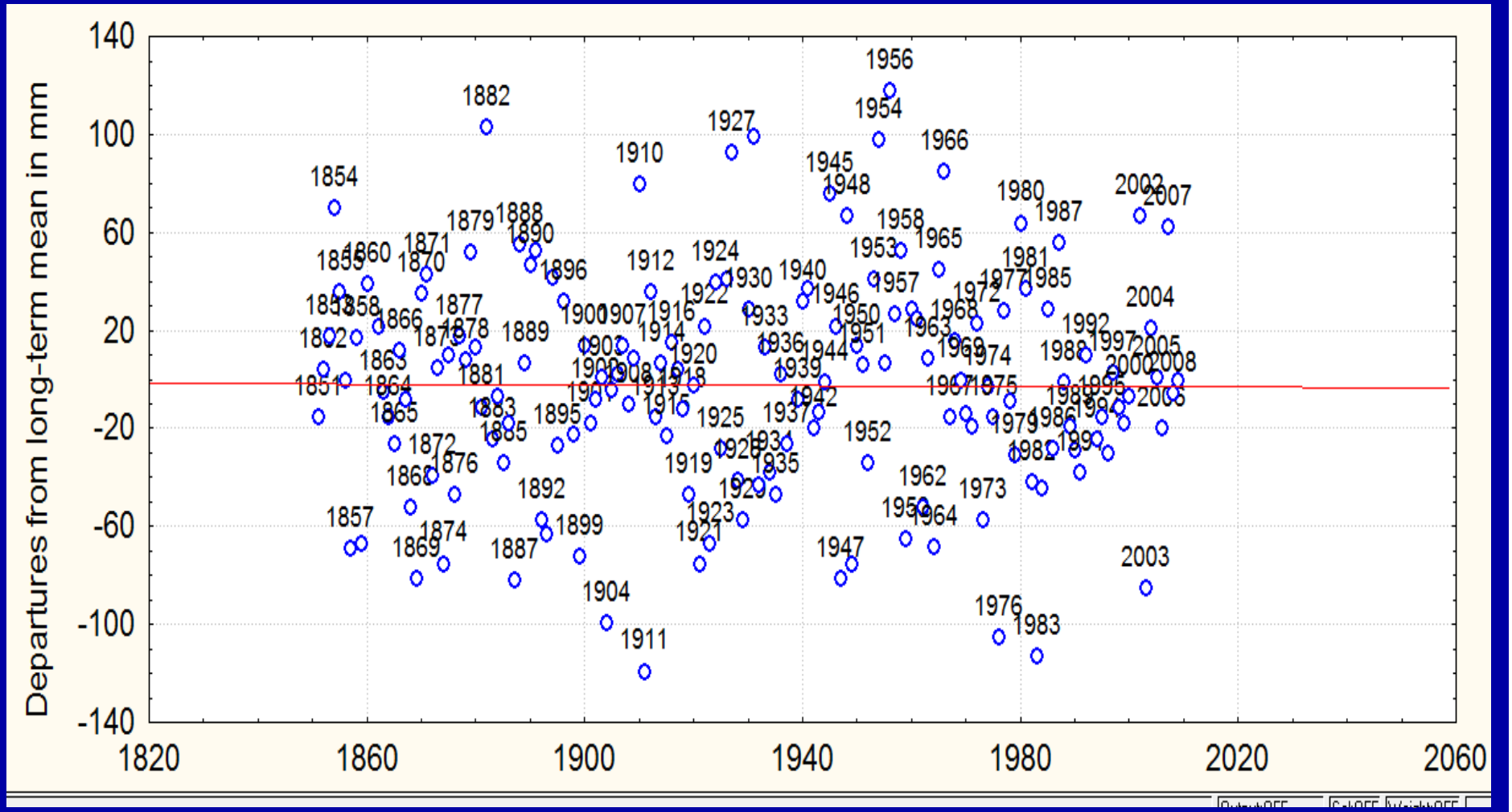
- Temperatures in central Europe have risen substantially in recent decades
- Decline of monthly and seasonal precipitation variability
- GHG increase only minor factor (1 - 2 W m-2) since 1980
- Large decrease of sulfate cooling (10 – 15 W m-2) since 1980
- Increase of southerly to southwesterly airflow over western and central Europe
- Substantial increase of sunshine duration since the 1980s, 10 – 15%
- The last three factors are an order of magnitude larger than ghg forcing increase in the last decades

Central European summer temperatures 1761 – 2009 (Baur record Vienna, Basel, De Bilt, Potsdam)



Source: Linke and Baur central European temperature record, Met. Inst. Free University of Berlin

Central European summer precipitation 1851 – 2009 (Baur record, Germany west of the Oder river)



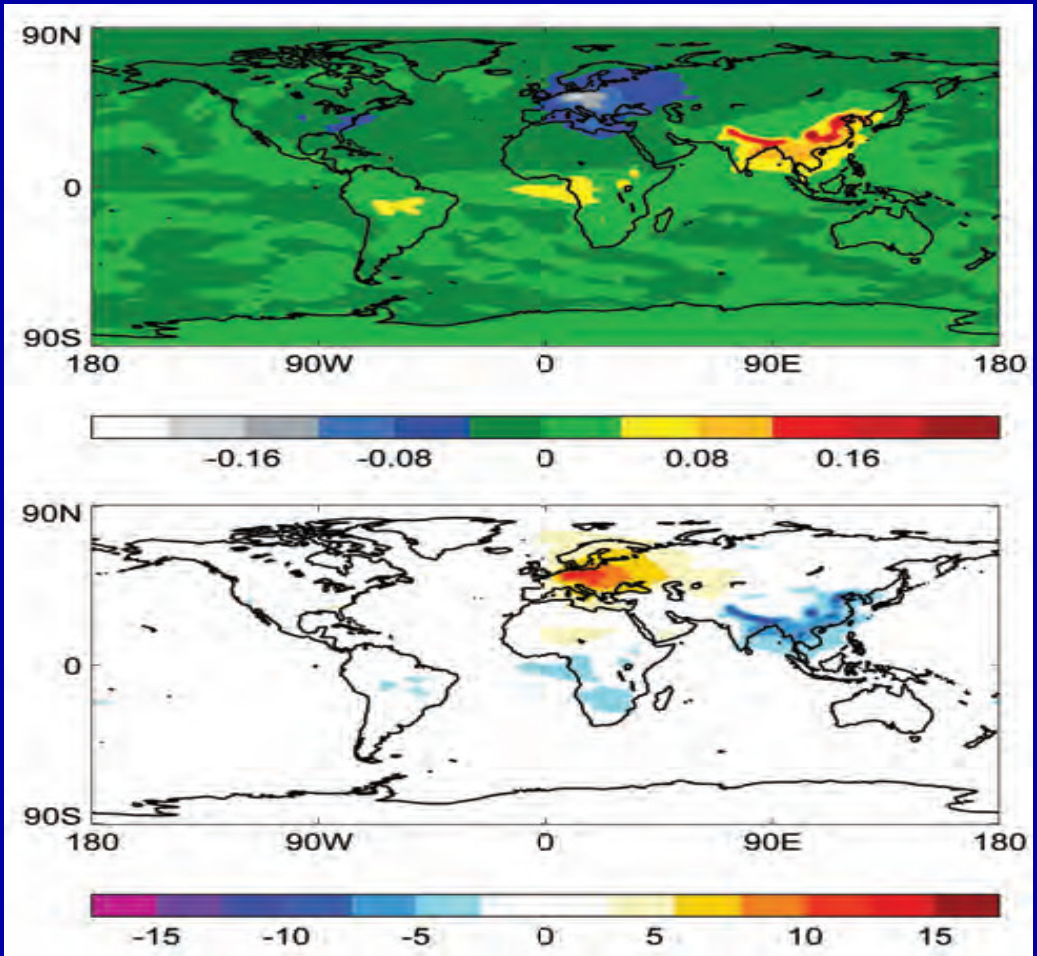
Source: Linke and Baur central European precipitation record, Met. Inst. Free University of Berlin

Changes of large-scale 500 mb flow patterns over western Europe/east Atlantic in recent decades: Enhanced southerly flow in most months; stronger westerly flow mostly in the winter half year

	Southerly Departure		Westerly Departure	
	Observation 2000-2009	Correlation with Central European Temperature	Observation 2000-2009	Correlation with Central European Temperature
	in gpdm		in gpdm	
Jan	10,3	0,32	3	0,79
Feb	4,5	0,51	3,6	0,86
Mrz	-4,2	0,47	6,9	0,4
Apr	4,3	0,69	0,19	-0,21
Mai	5,2	0,79	4,3	0,18
Jun	6	0,71	4,5	-0,06
Jul	4,7	0,78	-0,5	-0,27
Aug	2,4	0,71	0,9	0,01
Sep	0,6	0,74	-1	0,29
Okt	5,6	0,81	4,9	0,51
Nov	-2,9	0,22	5,2	0,54
Dez	3,9	0,31	-7,2	0,71

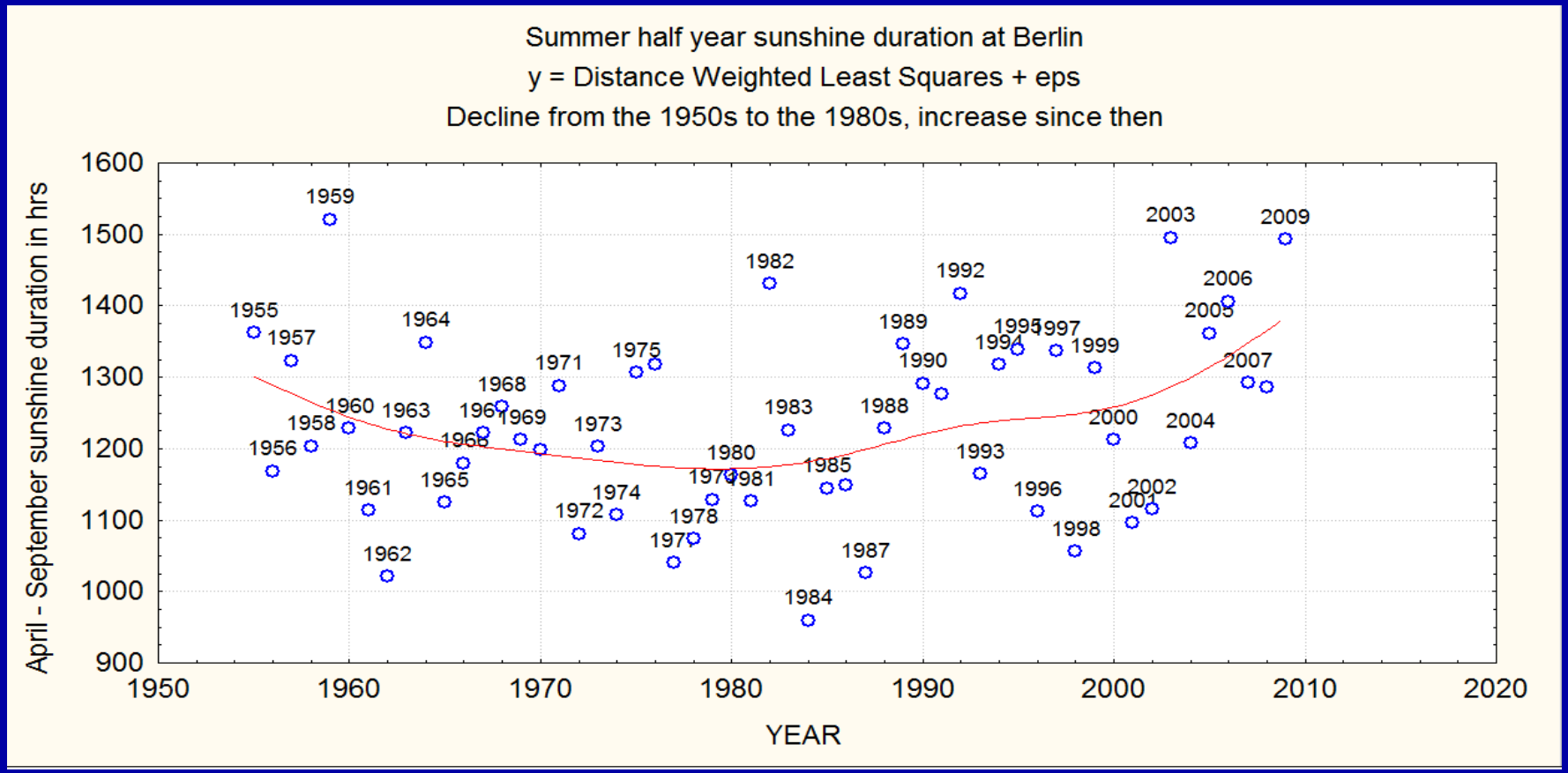
Source: Met. Inst. Free University of Berlin: KEU monthly climate reports

Changes in radiative forcing due to sulfates 1980 – present: Large decline of sulfate cooling over Europe



Source: State of the Climate 2008, BAMS August 2009

Trends of sunshine duration in Northern Germany
April – September: Significant increase since the 1980s



Source: Met. Inst. Free University of Berlin, monthly climate data Berlin-Dahlem

Is there a significant chance of a temperature increase greater than 3℃ by 2100?

- Projected warming by 2100 depends to a large extent on assumed socio-economic factors as eg population growth, economic growth, energy use
- Key element in mainstream climate model projections is a large positive feedback between CO_2/water vapour/clouds, leading to 2 X CO_2 projections of about 3 ℃, about triple basic 2X CO_2 radiative forcing
- For the presently observed equivalent CO_2 concentration (CO_2 plus other ghg) the forcing is about 75 per cent of a CO_2 doubling
- Should have resulted in a warming of close to 1.5℃ (or more for climate sensitivities above 3℃); adjusted for oceanic slowing
- Observed past 100 years .8, last 30/50 years .5 ℃, only last 30/50 years are being ascribed to ghg
- Even if all of that warming was due to ghg, only about 1/3 of modelled
- Even if present trends of ghg concentrations, ghg forcing and global temperature increase continued to 2100, temperatures would only increase by 1.5+/-.5℃; due to the logarithmic dependence temperatures would only go up linearly even if CO_2 concentrations continue to increase exponentially

Do ghg emissions have to be cut by 50 (80) % or more world-wide (indust. countries) by 2050 to limit warming to less than 2℃?

- The 50 (80) % reduction figure was derived from carbon cycle and climate modeling – not from hard and proven facts
- Assumes a long atmospheric residence time of CO2 and a complete understanding of the global carbon cycle – highly uncertain, ignores countervailing studies (see eg DOE/ER-0239, p. 247 – 287, 1985; Segelsatad, 1998)
- Assumes a high climate sensitivity to CO2 – highly uncertain, ignores countervailing studies, evidence (eg Lindzen and Choi, 2009; Spencer, 2008, Paltridge et al, 2009)
- Observed trends of ghg emissions, atmospheric concentrations, forcing and temperature change in recent decades do not support the claim global temperatures will rise by more than 2℃ even if emissions continue at the same rate of increase as during the last few decades
- Therefore, the 50 (80) per cent reduction demand lacks a sound scientific basis

Summary

- Most of the extremist claims about climate change have little or no sound scientific basis – mostly conjecture, claims, speculation
- Observed climate change supports the view of a modest or even benign ghg related warming, at the very lower end of climate model projections, effects might well be positive, as eg on agriculture (CO_2 fertilization!)
- The rational basis for extremist claims about global warming may be a desire to generate scare scenarios to push for political action on global warming