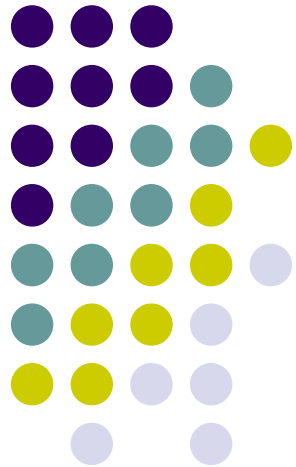
Climate change in the Asia-Pacific Region: What's the Evidence?

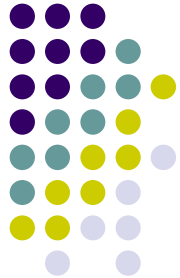
Ching-Cheng Chang
The Institute of Economics, Academia Sinica
Chinese Taipei



Presentation at The Pacific Food System Outlook
"WHERE CLIMATE CHANGE WILL TAKE THE REGION'S FOOD SYSTEM"
September 15-17, 2008
East-West Center, Honolulu, Hawaii

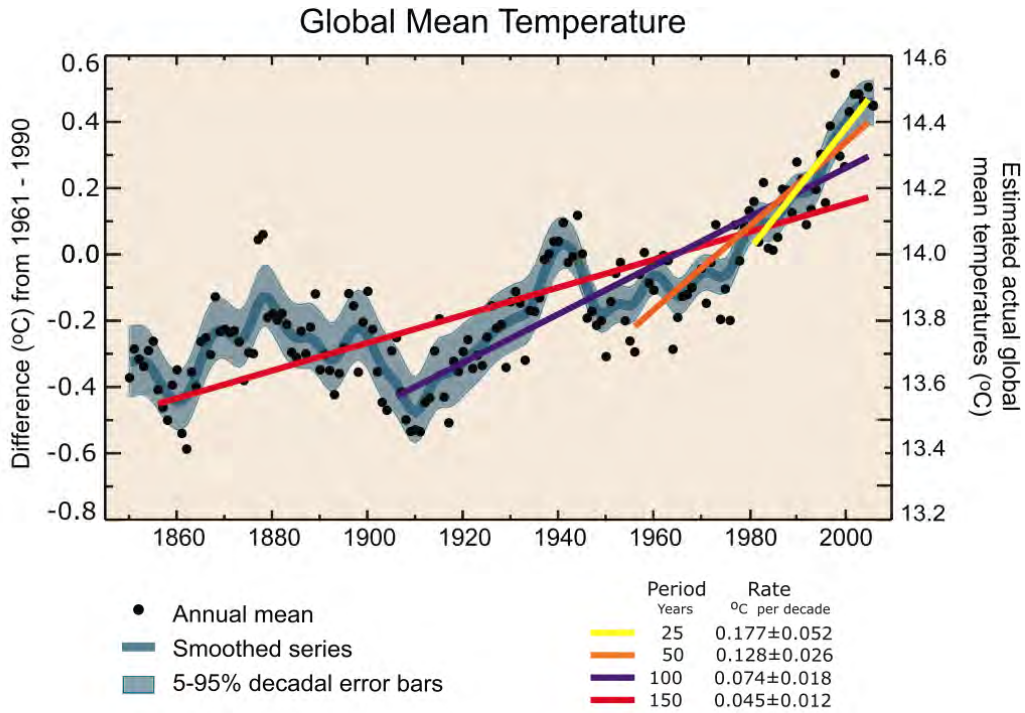
Outline

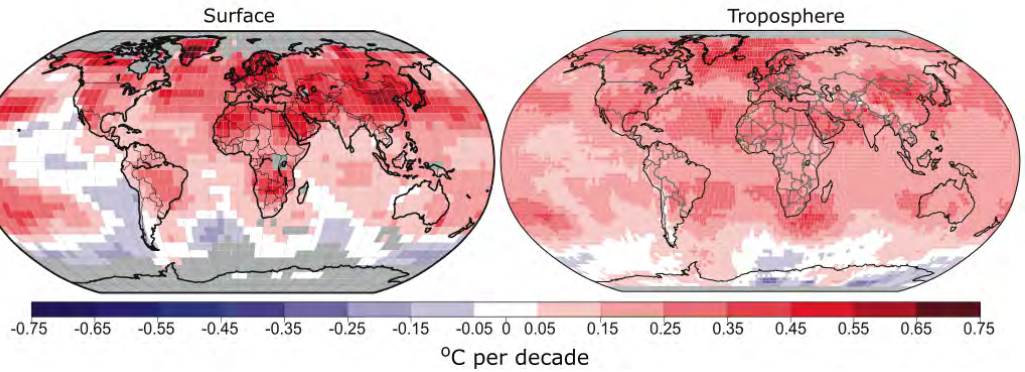
- What is happening?
- Why is this happening?
- What is projected to happen?
- What can be done?



What is happening?

What is happening?
1. Global Temperature-Time Trend





Rates of change accelerating as time progresses (colored lines)

http://ipcc-wg1.ucar.edu/wg1/Figures/AR4WG1_Ch03-Figs_2007-10-23.ppt#299,43,FAQ 3.1, Figure 1

What is happening?
1. Global Temperature- Regional

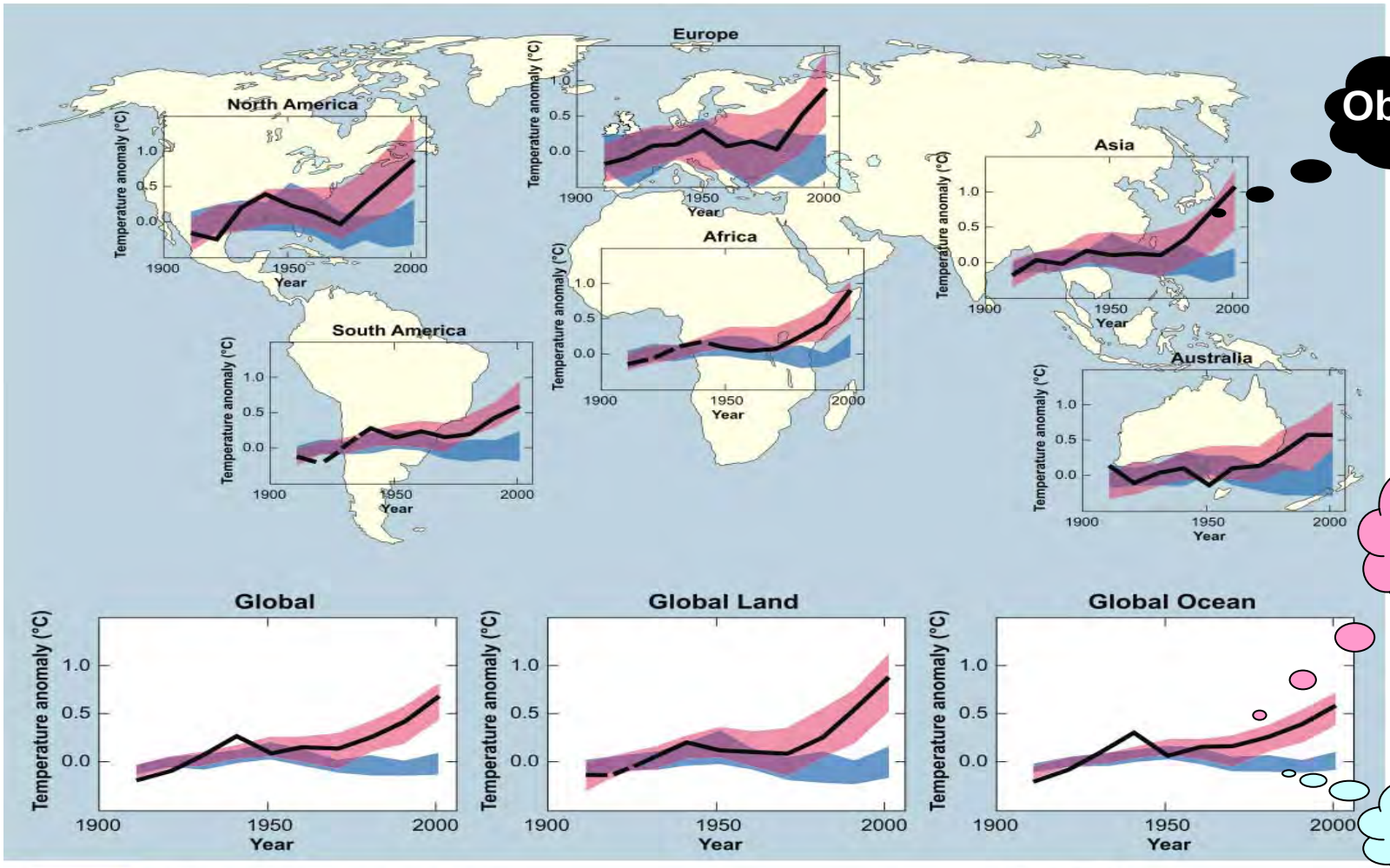


Figure SPM.4

What is happening ?
2. Ocean Heat Content

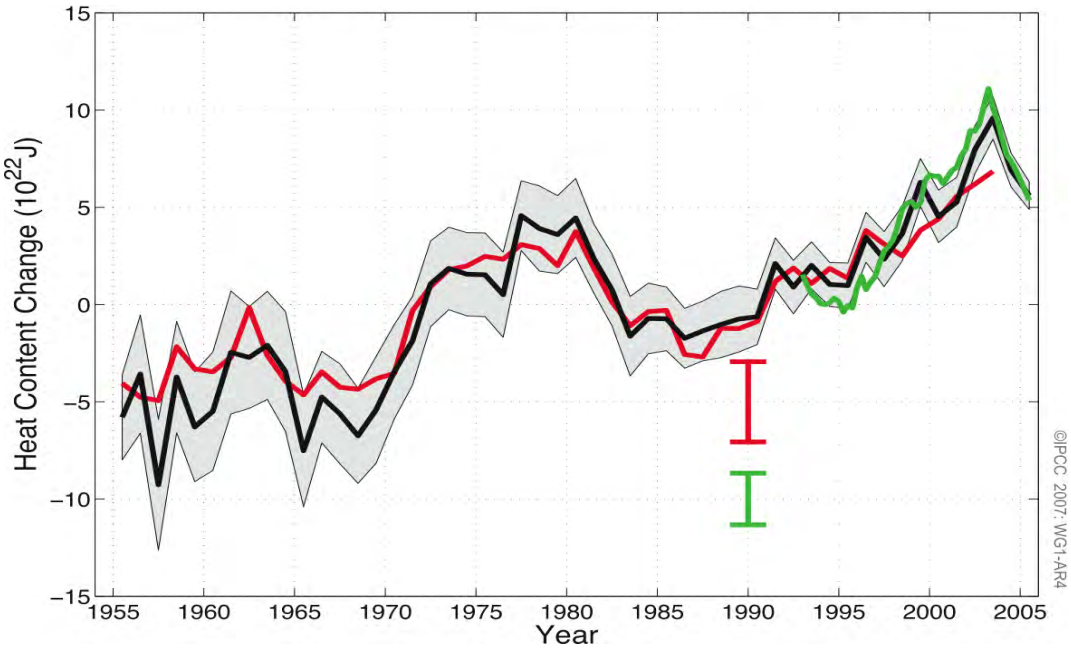


Figure TS.16

Ocean also shows temperature increase

--Based on 3 independent studies of oceanographic data

Source : Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report WGI
http://ipcc-wg1.ucar.edu/

What is happening?
3. Ocean Water Vapor

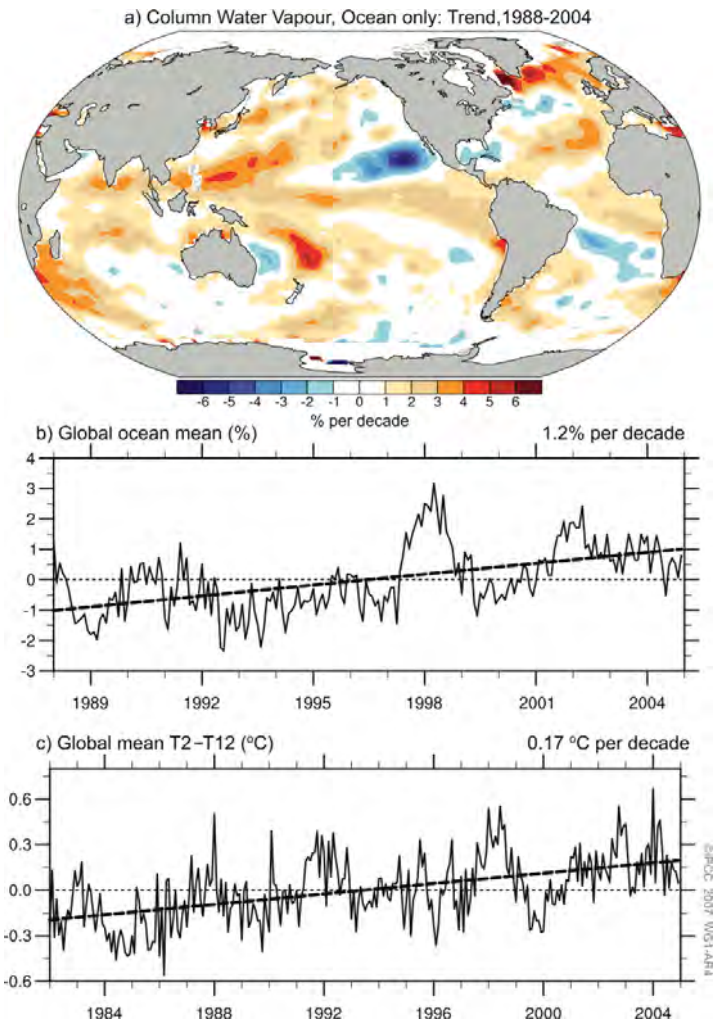


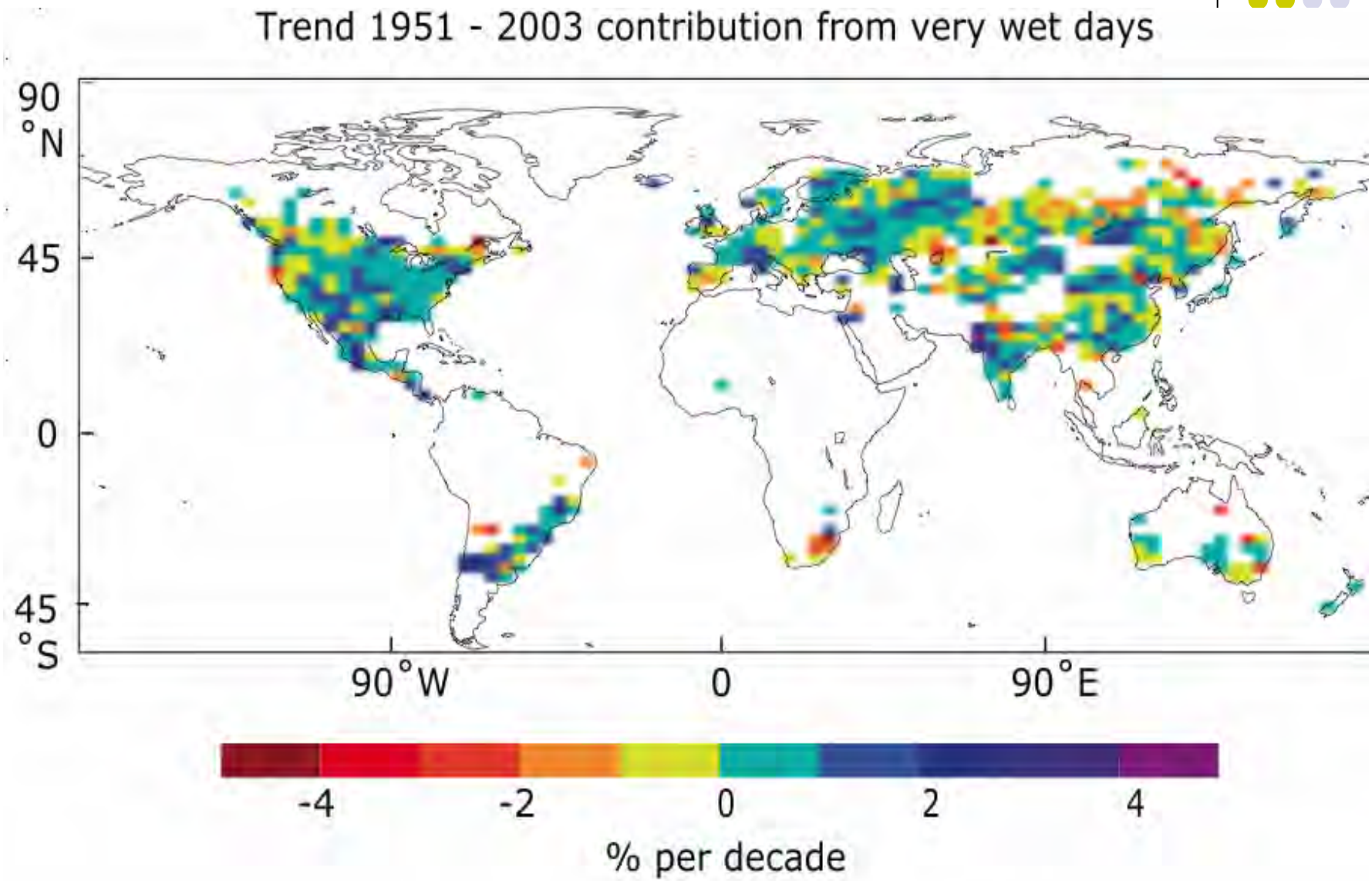
Figure TS.8

Rainfall is increasing

What is happening?

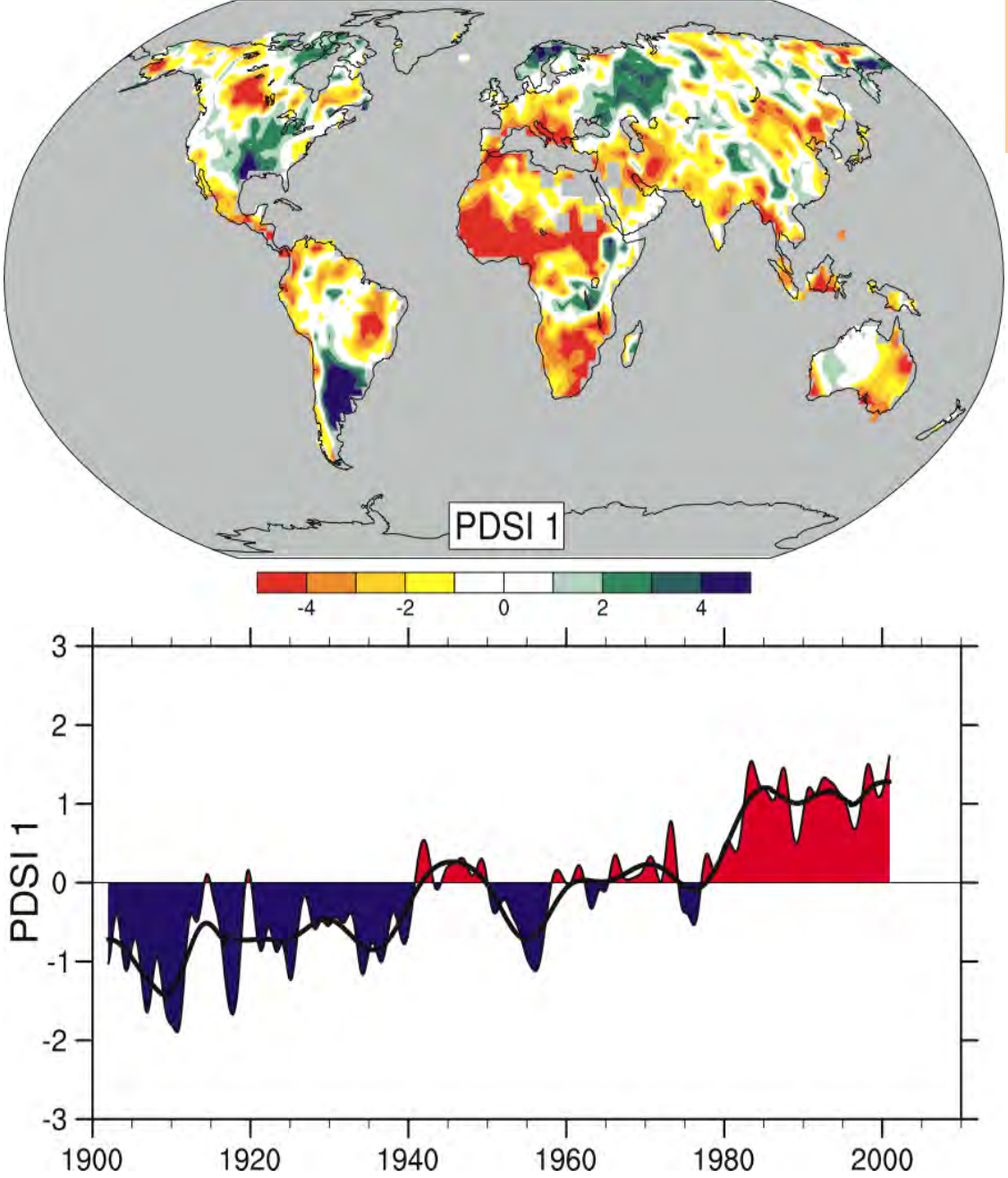
4. Precipitation –Rainfall became more concentrated.

Asia-Pacific has such areas



http://ipcc-wg1.ucar.edu/wg1/Figures/AR4WG1_Ch03-Figs_2007-10-23.ppt#296,40,Figure 3.39

What is happening?
5. Drought

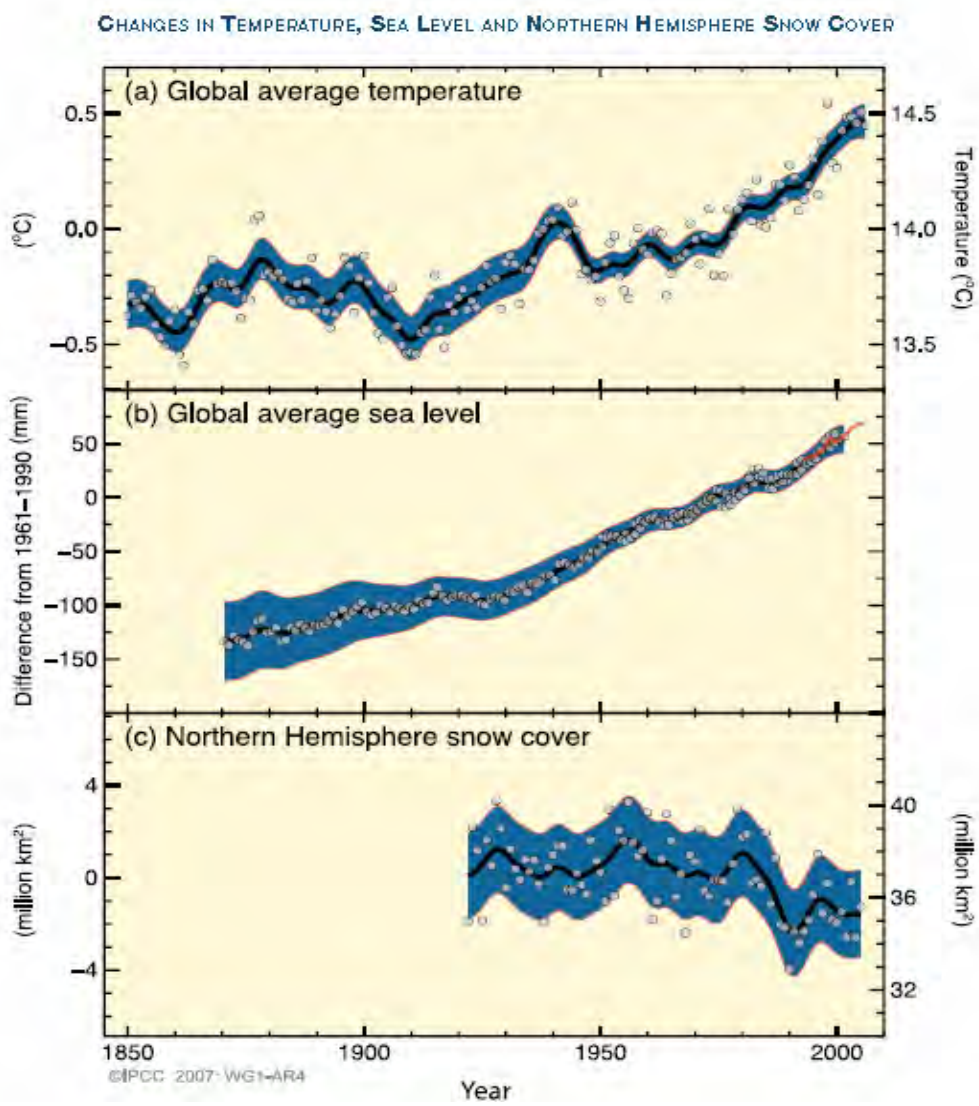


Regional map of global average

Palmer drought index
change 1900-2002

http://ipcc-wg1.ucar.edu/wg1/Figures/AR4WG1_Ch03-Figs_2007-10-23.ppt#300,44,FAQ 3.2, Figure 1

What is happening?
6. Sea level, snow cover



a) global average surface temperature

(b) global average sea level from tide gauge (blue) and satellite (red) data

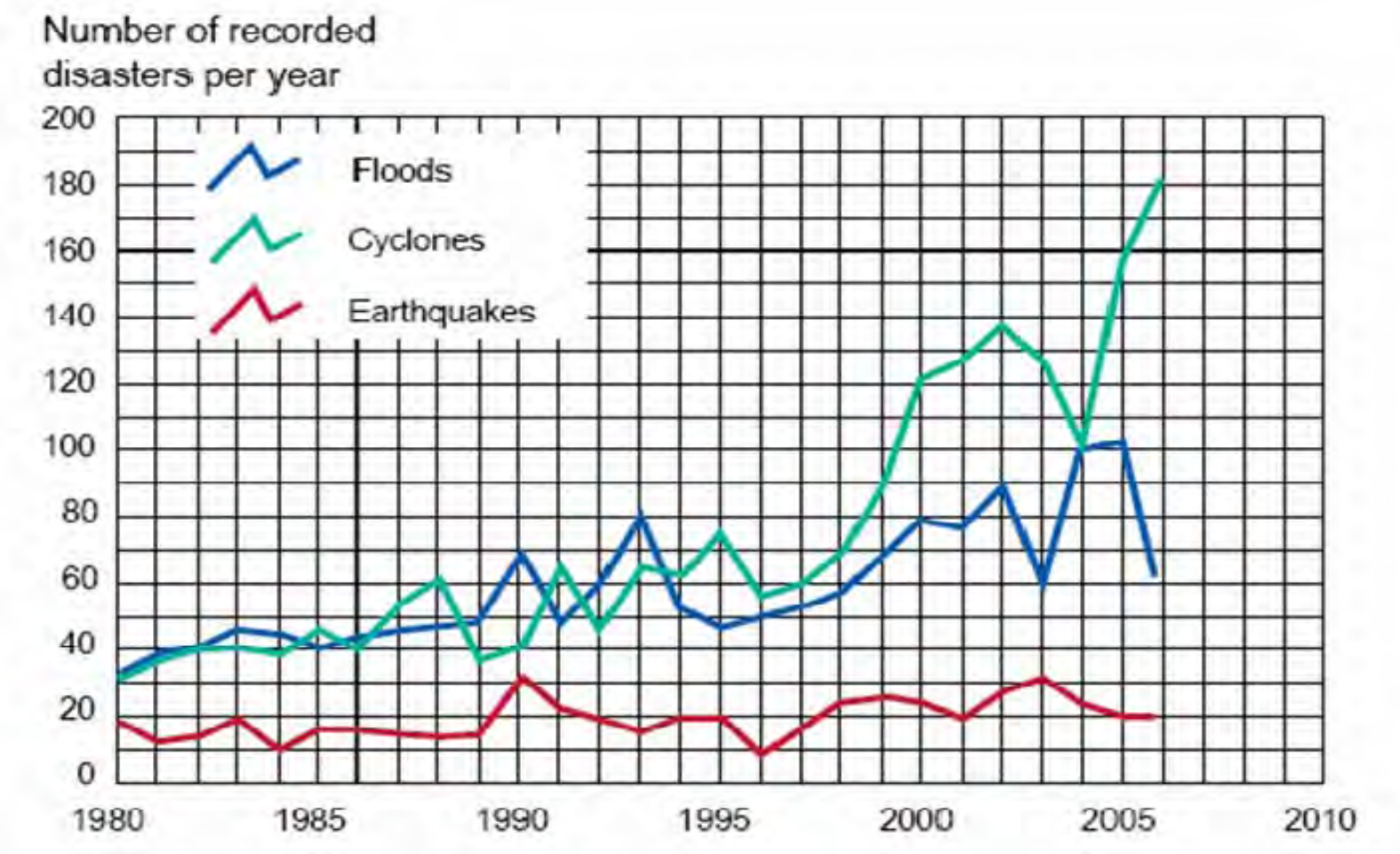
(c) Northern Hemisphere snow cover for March-April.

Source : Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report WGI http://ipcc-wg1.ucar.edu/

What is happening?

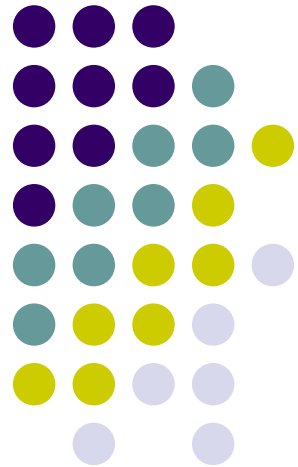
Source: Munich Re, Geo-Risk, World Map of Natural Hazards.
http://www.munichre.com/en/ts/geo_risks/natural_catastrophes_and_risks/world_map_of_natural_hazards/default.aspx

What is happening?
7. Time trend of recorded natural disasters

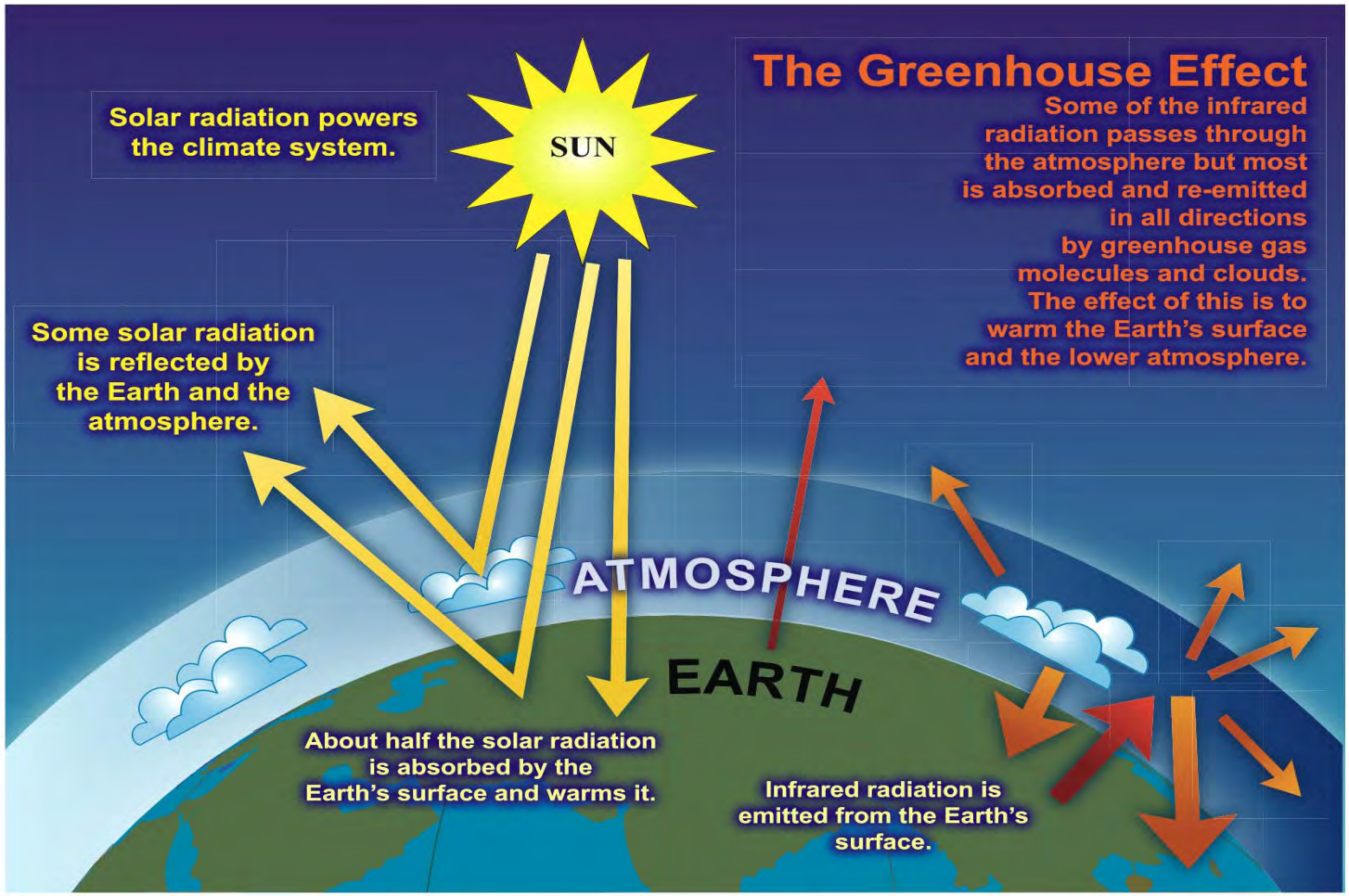


Data sources: EM-DAT: The OFDA/CRED International Disaster Database - www.em-dat.net

Why is this happening?



The Greenhouse Effect



FAQ 1.3, Figure 1

Source: IPCC AR4, FAQ 1.3, Figure 1.

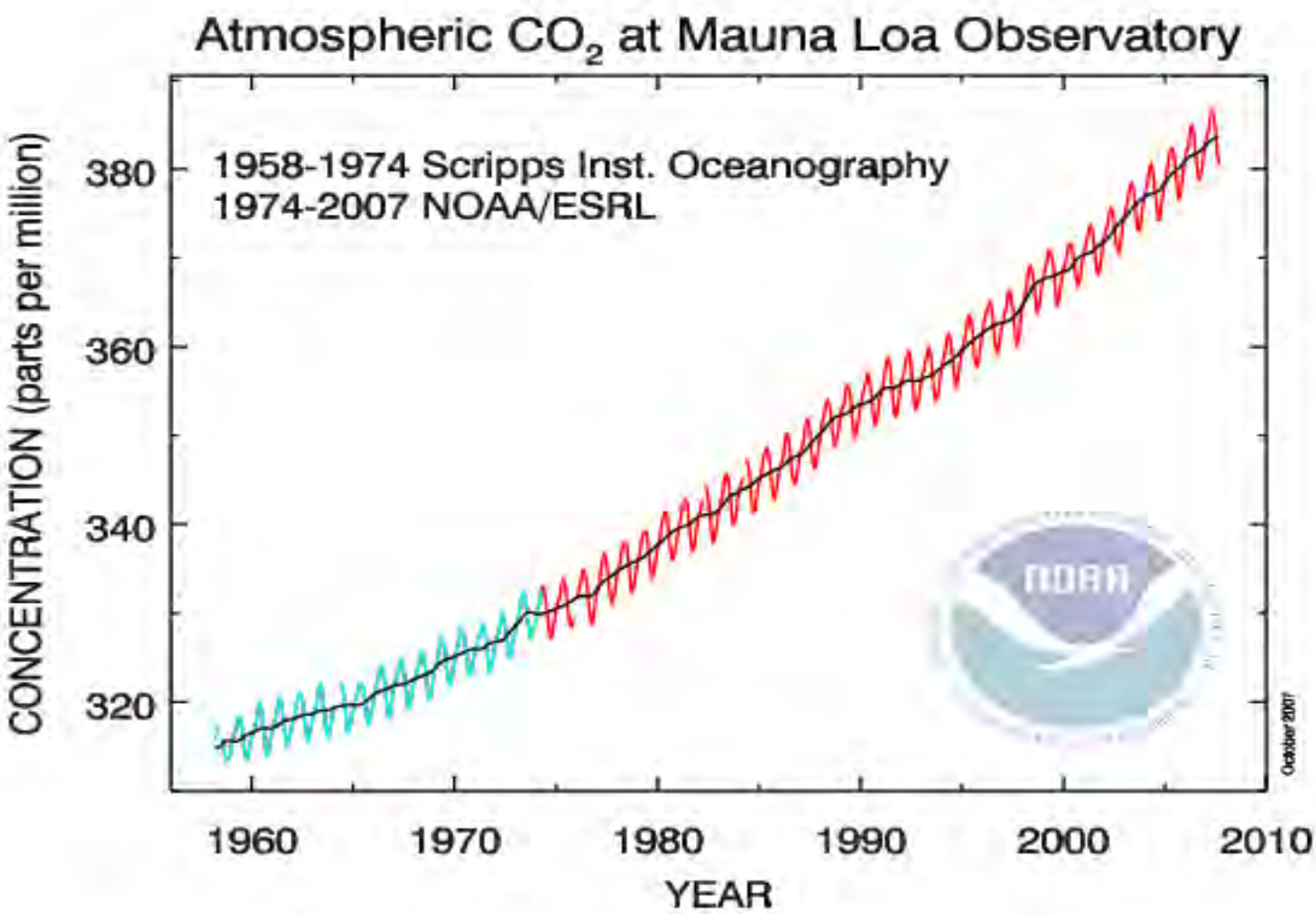
Natural or Man-made?

- IPCC (1995) “The balance of evidence suggests a discernible human influence on global climate.”

- IPCC (2001) “Most of the warming of the past 50 years is likely (>66%) to be attributable to human activities.”

- IPCC (2007) ”Most of the observed increase in global average temperatures since the mid-20th century is very likely (>90%) due to the observed increase in anthropogenic (human emission caused) greenhouse gas concentrations.”

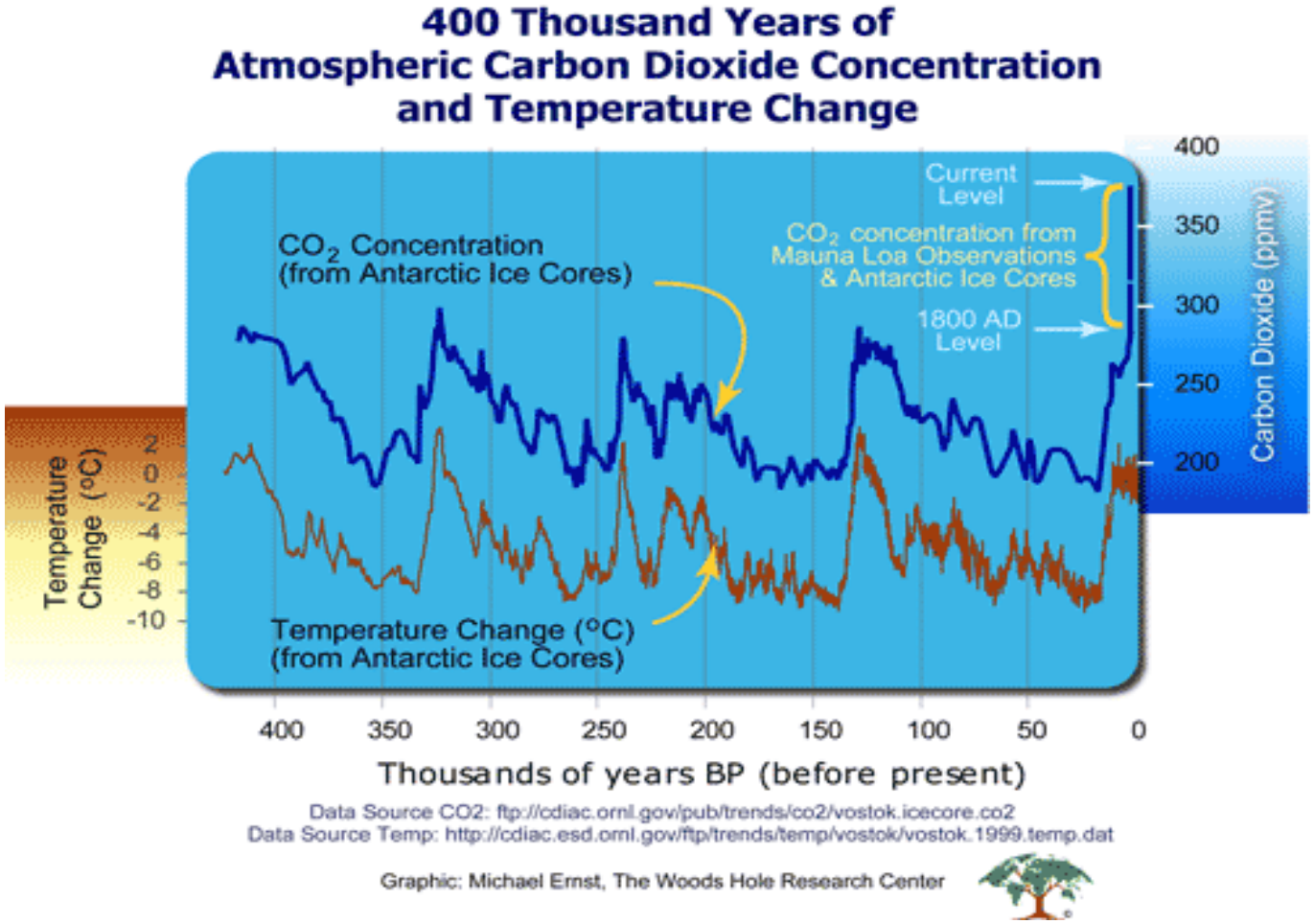
Why is this happening?



http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html

Why is this happening

- CO2 and temperature linked but does not lead
- Don't Waite until the cause is understood

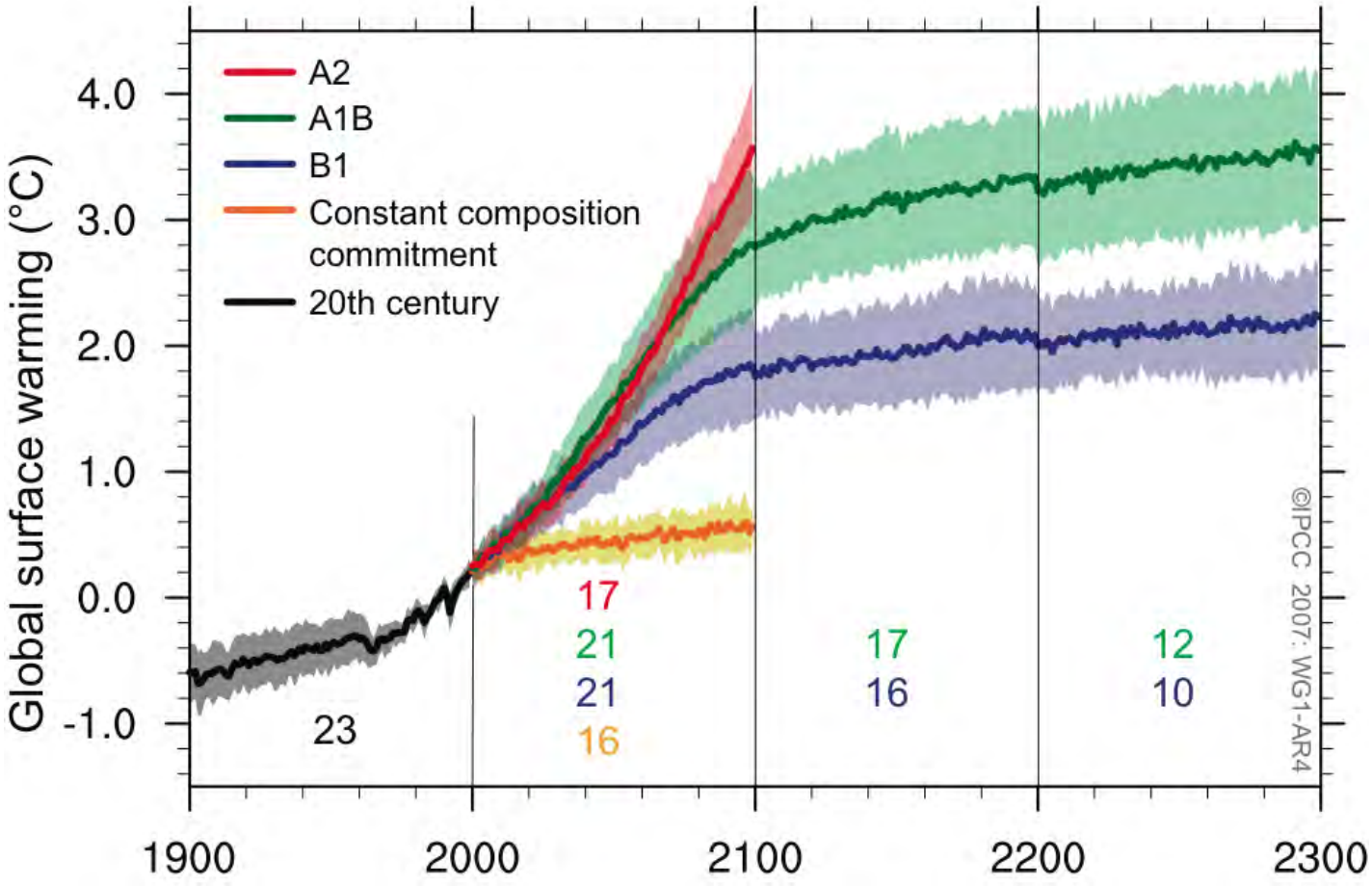


http://www.whrc.org/resources/online_publications/warming_earth/scientific_evidence.htm

What is projected?

What is projected?

- B1, A1B, B1 scenarios
- Increasing emissions will cause a temp increase



Source : IPCC AR4t

What is projected? Hotter

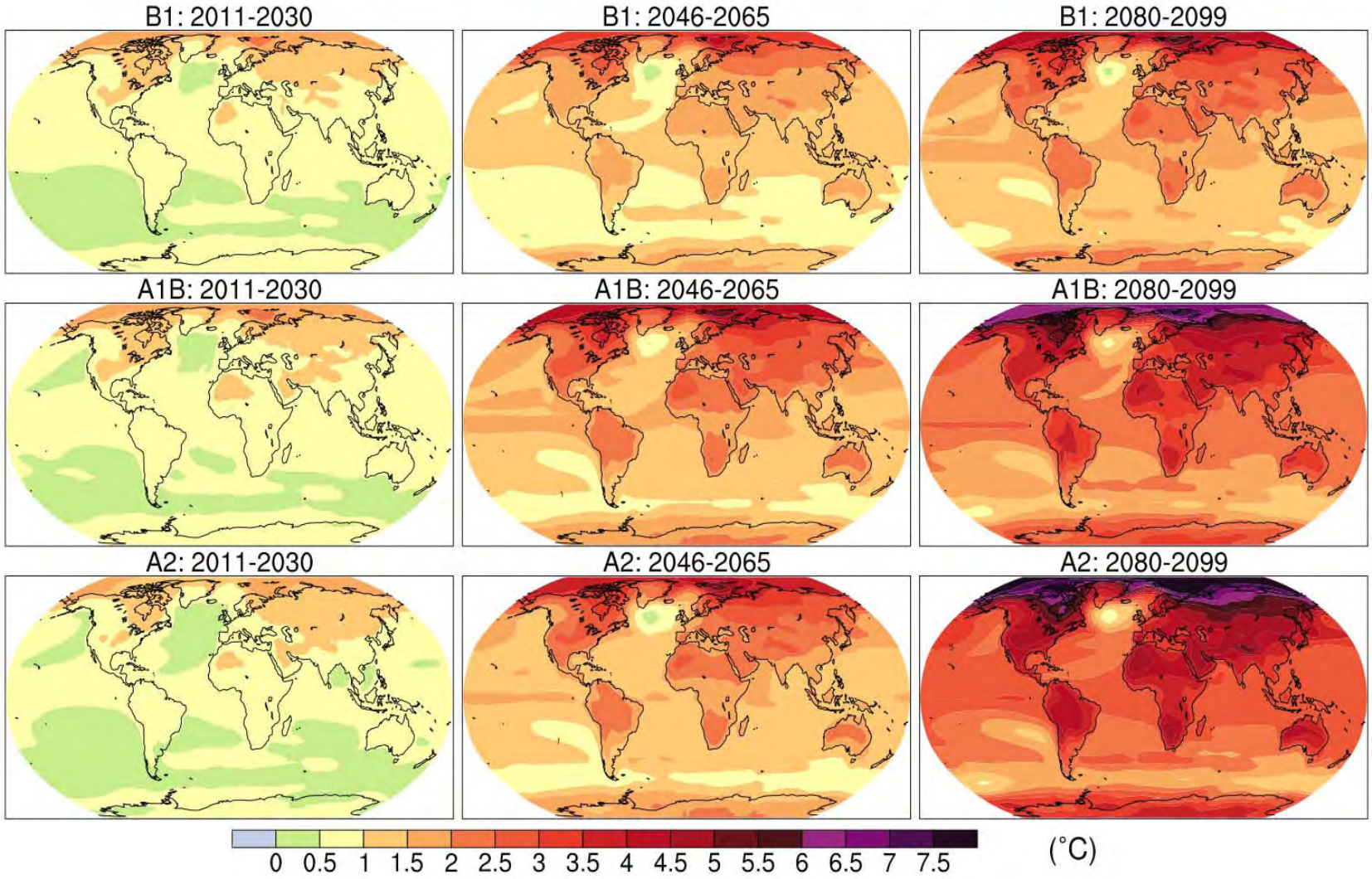
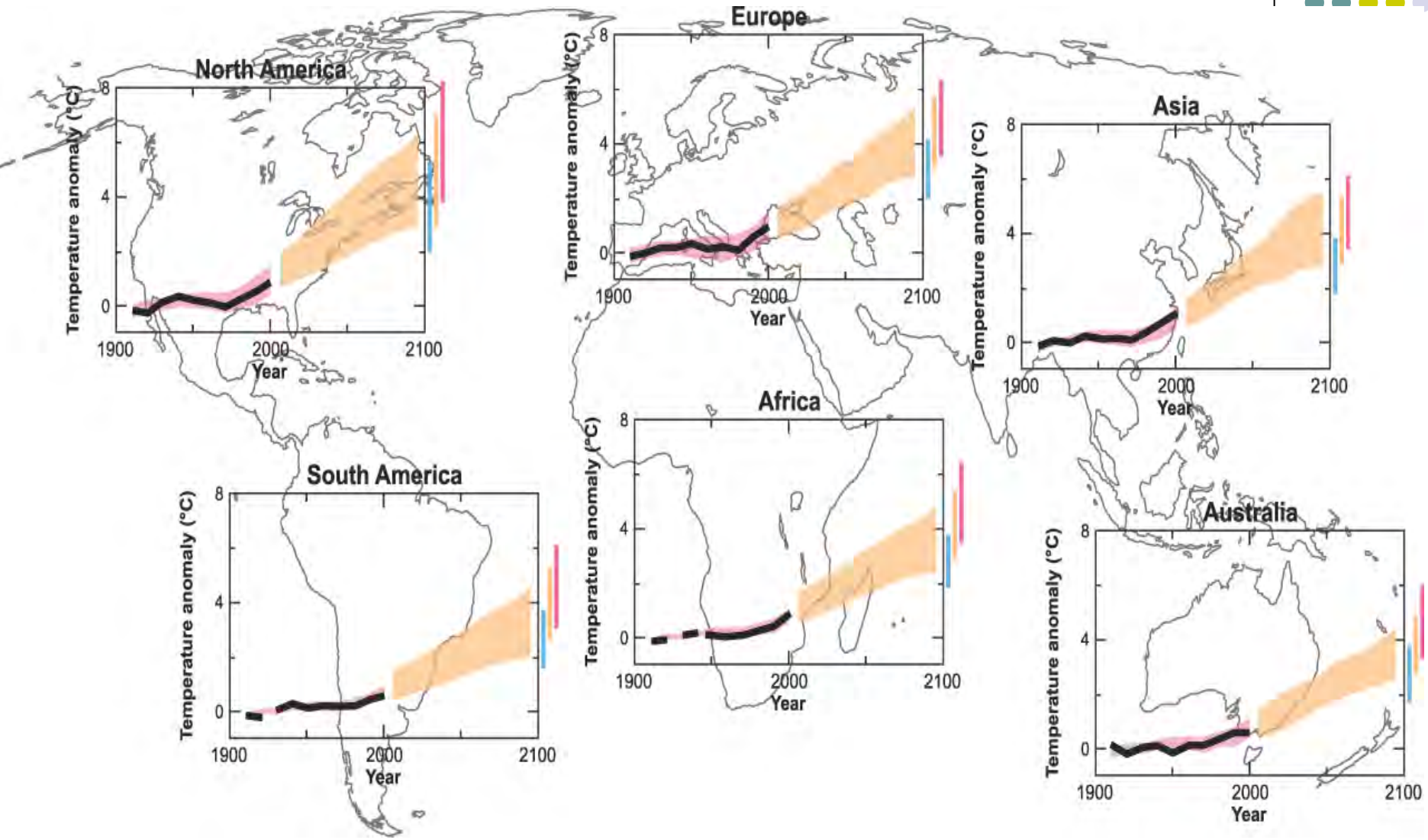


Figure 10.8

What is projected?

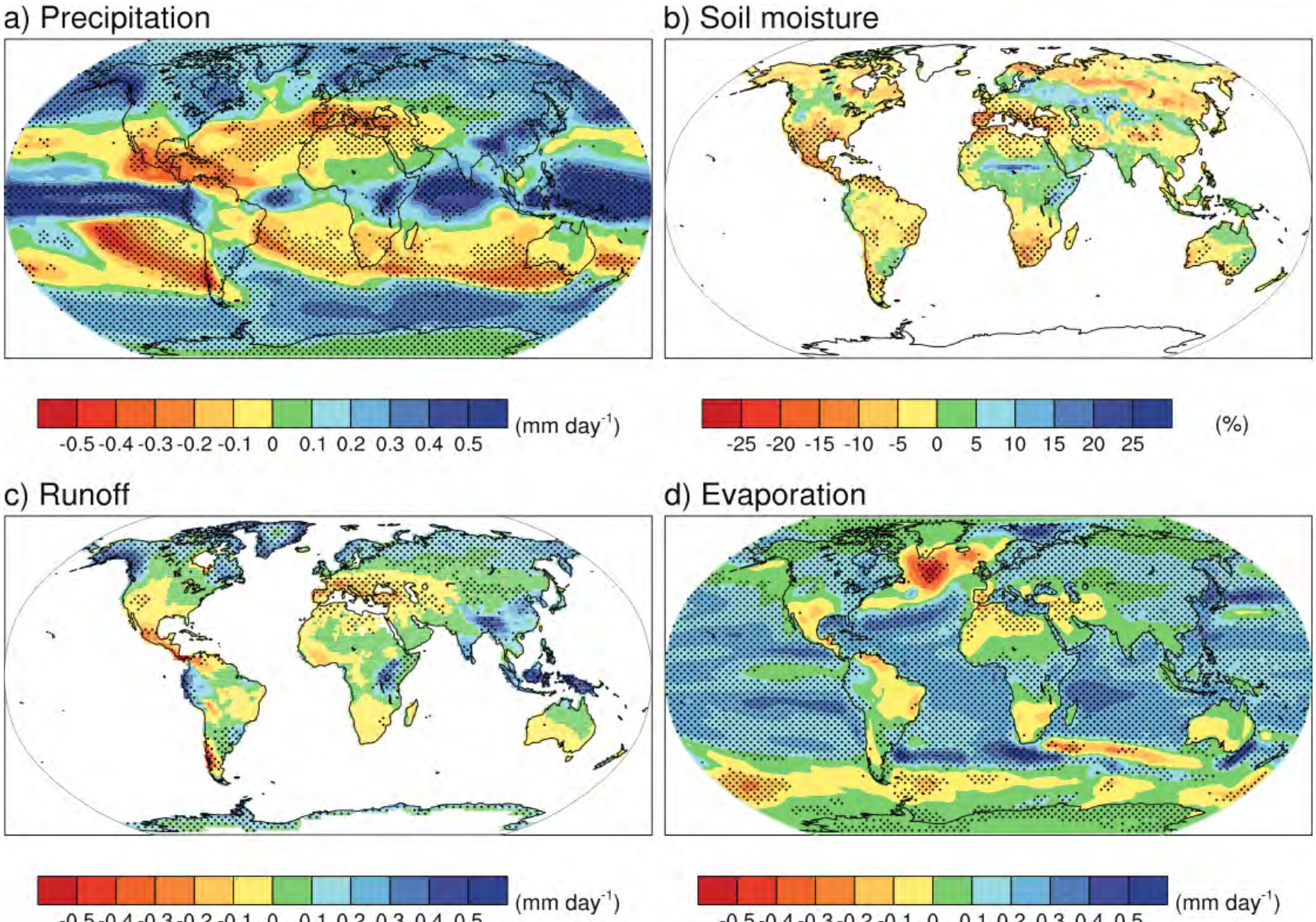
- Regional GCM projections
- 2001 to 2100 for A1B scenario



Source: IPCC AR4-WG1, Box 11.1 Figure 1.

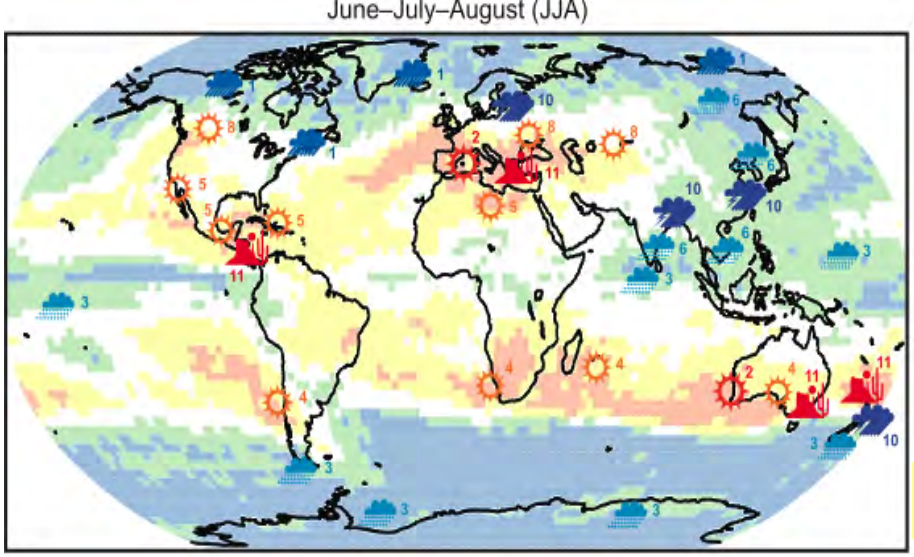
What is projected?

- Multi-model mean changes for the A1B scenario
- Period 2080 to 2099 relative to 1980 to 1999.

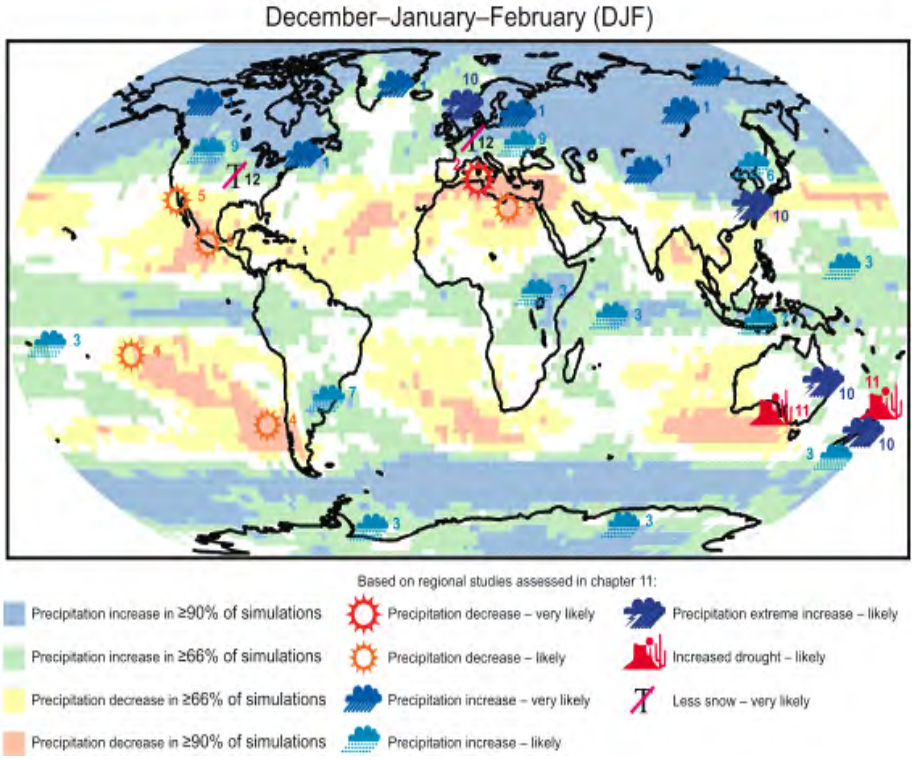


What is projeted?

-Regional GCM models
-A1B scenario
-Seasonal mean and extreme



Winter months



Summer months

Box 11.1, Figure 2

Source: IPCC AR4, Chapter 11, Box 11.1, Figure 2.

What is projected?

- A1B scenario
- Extreme conditions

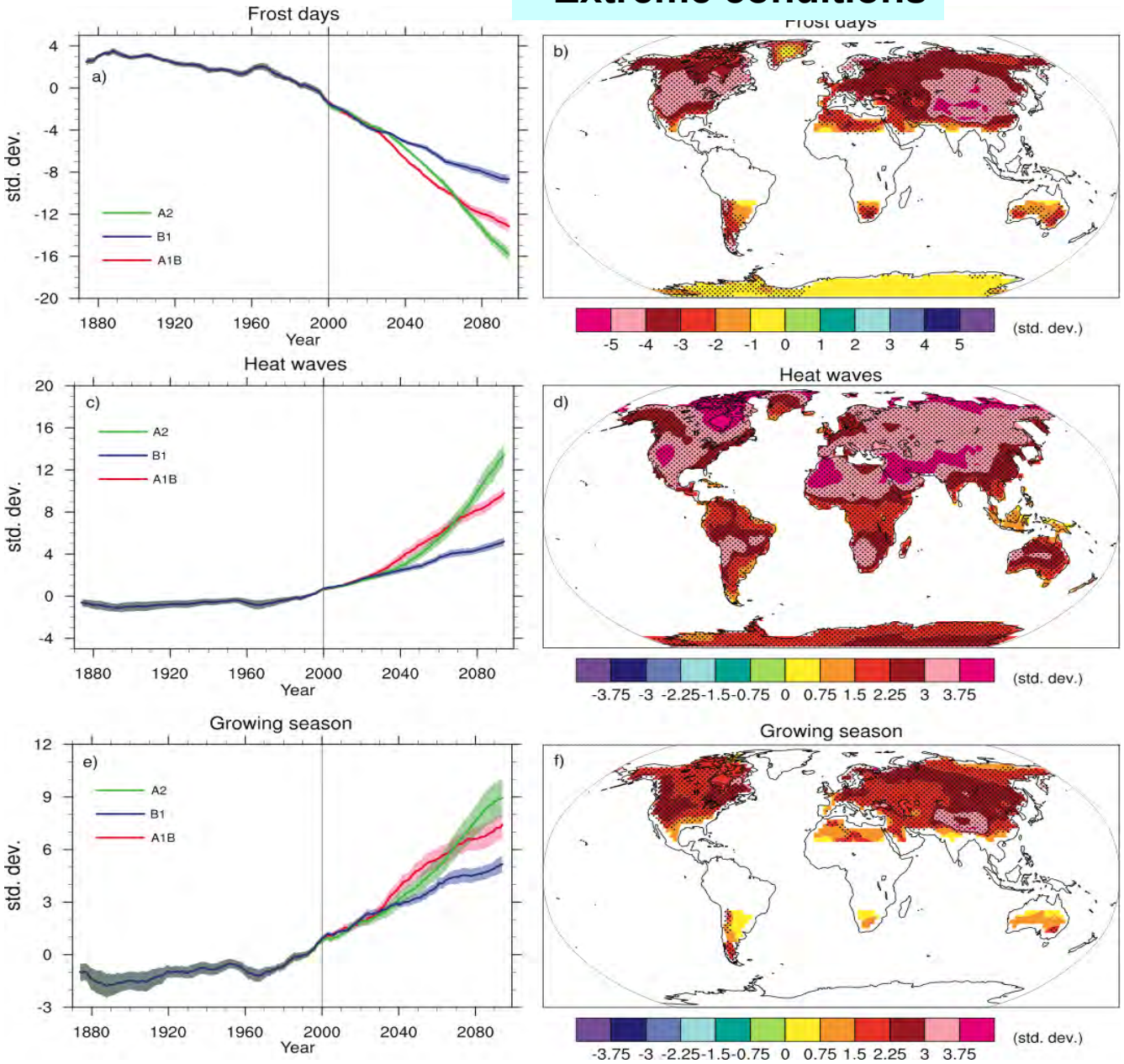
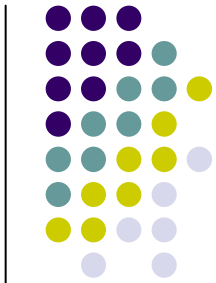


Figure 10.19

What is projected? – Global Scale

- Very likely that heat waves will be more intense, more frequent and longer lasting
- Precipitation generally increases but with general decreases in the subtropics
- Precipitation intensity is projected to increase but there would be longer periods between rainfall events.
- Tendency for drying of mid-continent during summer, indicating a greater risk of droughts in those regions.
- Sea level projected to rise 1999 and 2099 by 0.18 to 0.59 m.
- Likely increase in hurricane
  - peak wind intensities
  - numbers of the most intense.
- Fewer mid-latitude storms- poleward shift of storm tracks

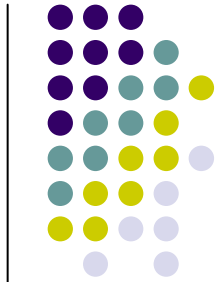
What is projected in Asia-Pacific?-1



- **Asia:**
  - Warmer in South and East,
  - Much warmer in Central, Tibet, Northern
  - Wetter in most area and more in North and East.
  - Dry summer but wet winter in Central Asia
- **North America:**
  - Warmer in most areas
  - Wetter in Canada and Northeast, drier in Southwest
  - Less snow in North
- **Central and South America:**
  - Warmer in continental areas (inner Amazon, Northern Mexico)
  - Drier in Central, large variation in Southern region.
  - El-Nino impact

What is projected in Asia-Pacific?-2

- **AU-NZ:**
  - Moderate warming, but more extreme temperature
  - Drier in South-western AU in winter., Wetter in south-west NZ
  - ENSO Impact
- **Decrease in light rainfall poses a serious threat to drought problem**
  - A crucial source of water in replenishment and retention of soil moisture
  - Maybe a serious contribution to desertification in Asia



What can be done?

What can be done?

- **Wait for more information –**
  - ➔ **Do Nothing and live with it**
- **Plan to adapt**
- **Try to reduce future change**
  - ➔ **Mitigate emissions**

Implications of living with changing climate

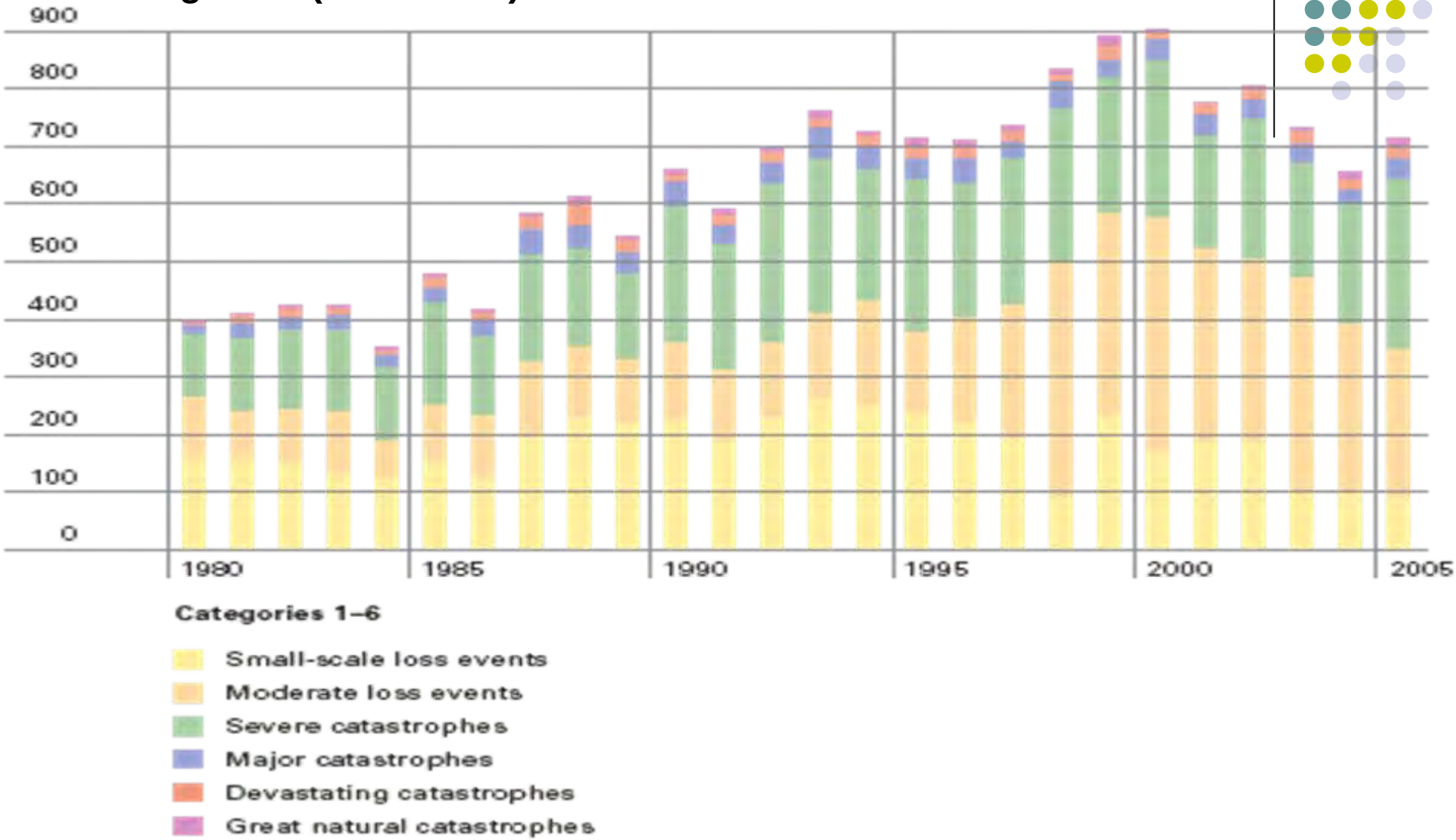
Losses caused by floods

Unit: US$ million, in 2007 values.

	2005	2006	2007	Average 1980–2004
Overall losses	5,400	6,200	750	1,150
Insured losses	850	410	n/a	5
Fatalities	1,650	1,100	2,000	1,100

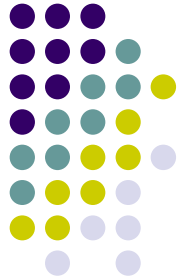
Source: Munich Re, Climate Change and Insurance,
http://www.munichre.com/en/ts/geo_risks/climate_change_and_insurance/monsoon/losses_caused_by_floods.aspx

Number of events per year broken down into catastrophe categories (1980-2005)



Source: Mniche Re, Geo-Risk, http://www.munichre.com/en/ts/geo_risks/natcatservice/increasing_intensity_and_costs_of_natural_catastrophes/increasing_intensity_and_costs_of_natural_catastrophes_02_fig2.aspx

Avoid it – GHG Emission Mitigation



What are the strategies

- **Reduce where the emissions are**
  - **Fuel standards**
  - **Fuel switching**
  - **Emissions capture and storage**
  - **Energy Conservation**
  - **Lifestyle change**

- **Offset from elsewhere**
  - **Agriculture**
  - **Forestry**
  - **Biofuels**

Plan to Adapt

Agricultural Adaptation

- Irrigation
- Drought resistant varieties
- Tolerant breeds and varieties
- Crop and livestock mix
- Abandonment

Pass a price signal

- GHG trading
- Carbon Tax

Reduce carbon footprint

Investment to Adaptation

Ref: McCarl, B.A., Adaptation Options for Agriculture, Forestry and Fisheries, A Report to the UNFCCC Secretariat Financial and Technical Support Division, 2007. http://unfccc.int/files/cooperation_and_support/financial_mechanism/application/pdf/mccarl.pdf

The onset and exact effects of climate change are still uncertain

Mitigation

Adaptation

Consequences

Asia-Pacific is vulnerable and very likely to be squeeeeezed!

References

1. Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report - Climate Change 2007: Impacts, Adaptation and Vulnerability, http://www.ipcc.ch/.

2. Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report - Climate Change 2007: Mitigation , http://www.ipcc.ch/.

3. Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report - The Scientific Basis, http://www.ipcc.ch/.

4. Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report – Synthesis Report, http://www.ipcc.ch/.

5. National Assessment Synthesis Team, US Global Change Research Program , Climate Change Impacts on the United States: *The Potential Consequences of Climate Variability and Change* Overview: 2000 http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm

6. National Assessment Synthesis Team, US Global Change Research Program , Climate Change Impacts on the United States: *The Potential Consequences of Climate Variability and Change* Foundation: 2000 http://www.usgcrp.gov/usgcrp/Library/nationalassessment/foundation.htm

7. McCarl B.A. Personal website, http://agecon.tamu.edu/faculty/mccarl/papers.htm

Comment Welcome