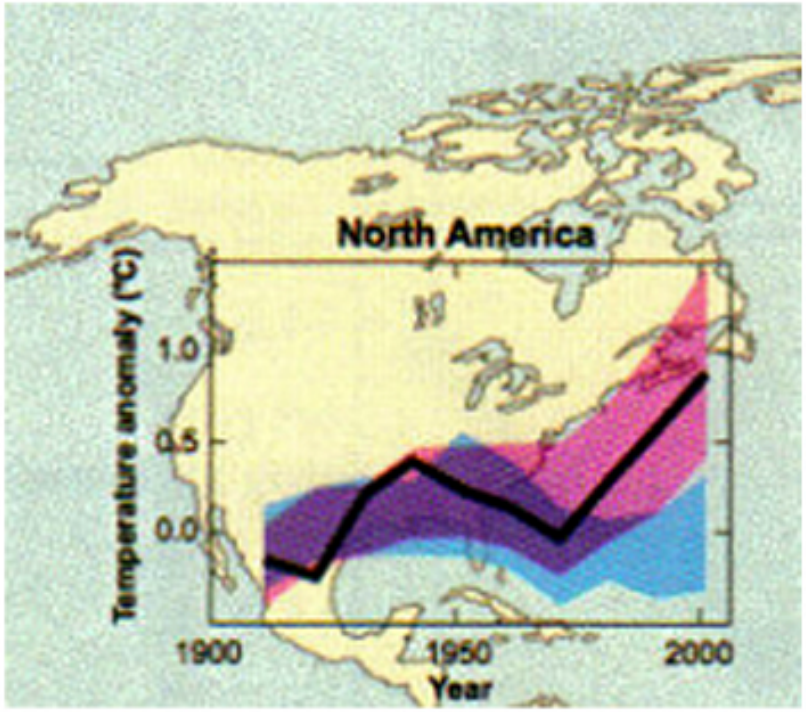
4th INTERNATIONAL SYMPOSIUM ON FLOOD DEFENCE

Toronto 6-8 May, 2008

TRENDS IN EXTREME RAIN EVENTS and FLOOD IMPLICATIONS

J.P. BRUCE
Soil and Water Conservation Society

Global and Contintental Temperature Changes

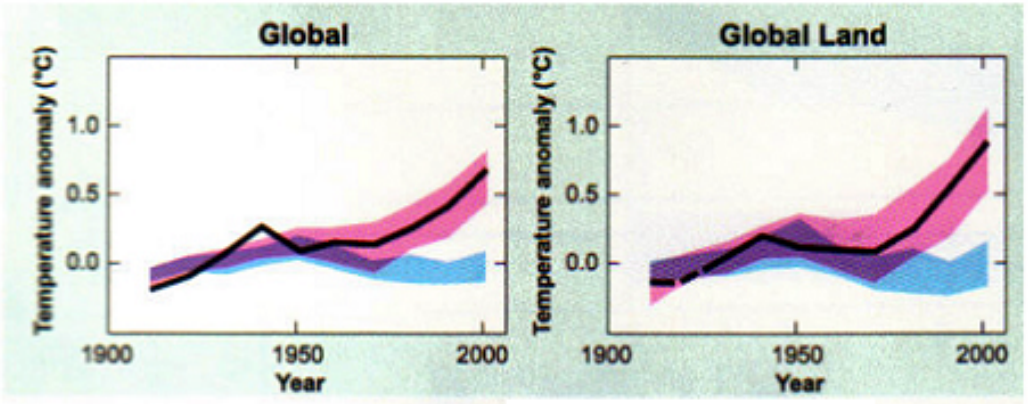


Observed mean temperature

Temperatures expected from natural external forcing

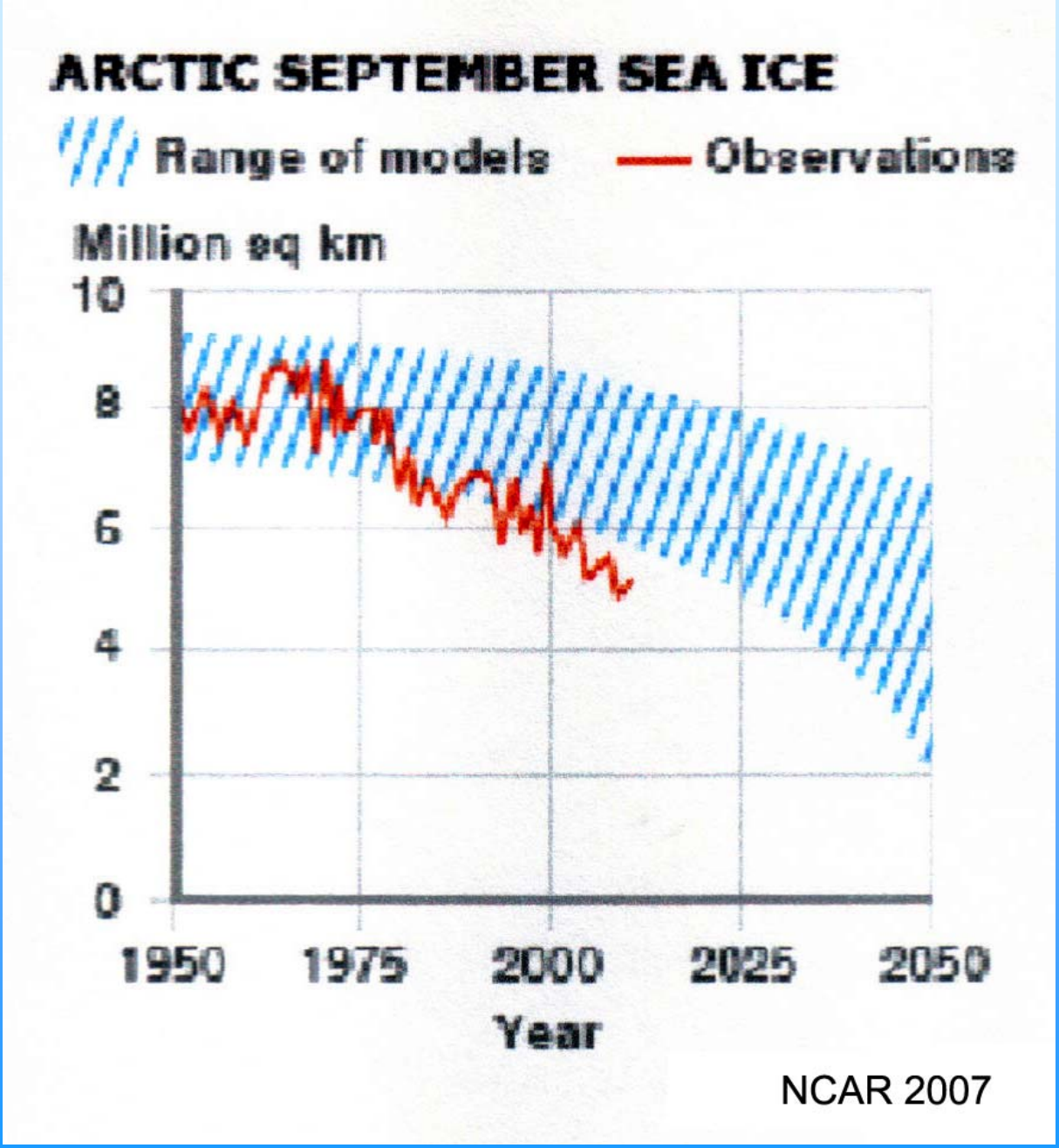
Temperatures expected from greenhouse gas forcing

(IPCC - WG1, 2007)



INTERNATIONAL ENERGY AGENCY 2007

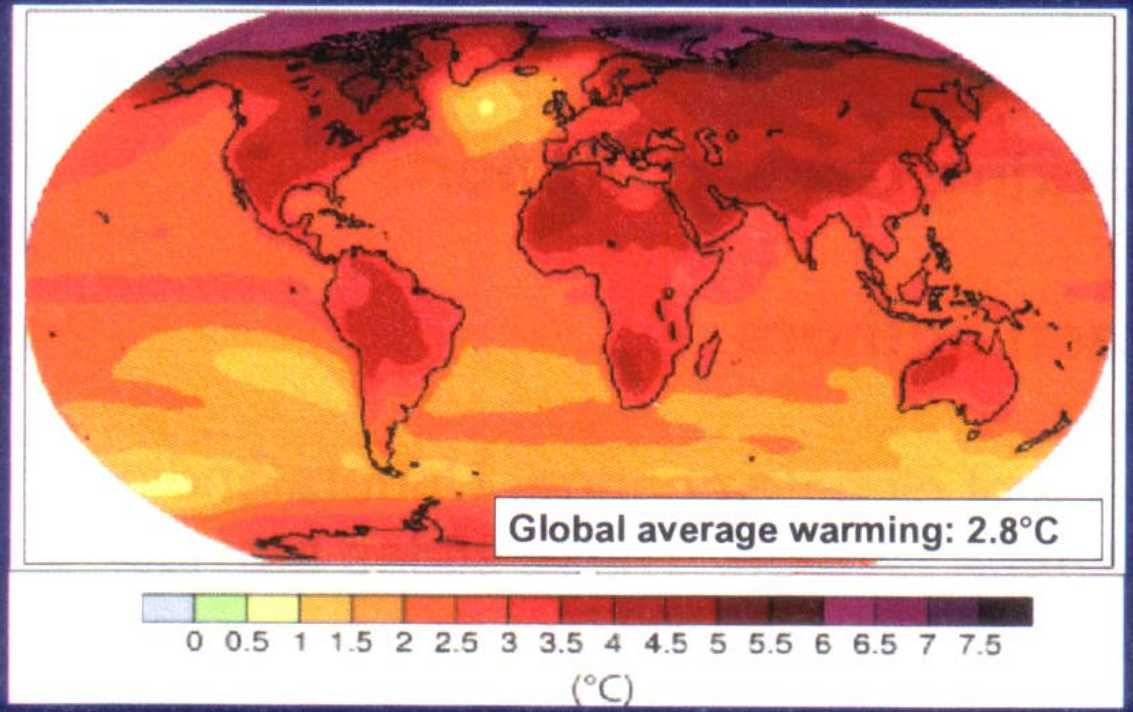
INCREASES: 2005 – 2030	
WORLD'S ENERGY NEEDS	+55%
WORLD'S GHG EMISSIONS	+57%
WORLD'S GHG EMISSIONS With strong and urgent global actions on reductions	+27%


ARCTIC SEPTEMBER SEA ICE
Range of models
Observations
Million sq km
10
8
6
4
2
0
1950
1975
2000
2025
2050
Year

NCAR 2007

How Much More Warming Can We Expect?

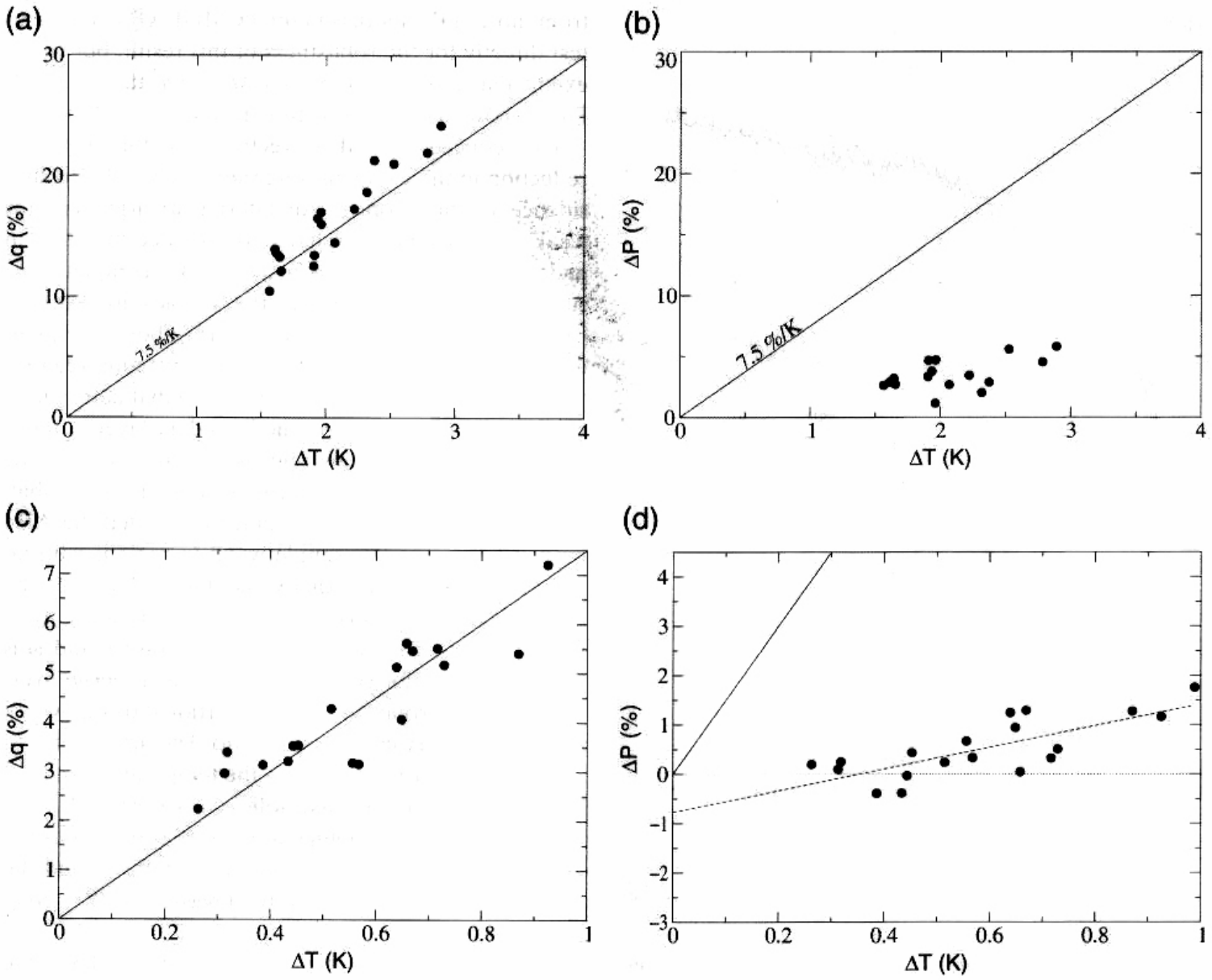
(2090s: medium emissions scenario)



•Increases in hot extremes and heat waves *(very likely)*

IPCC - WGI

Expected pattern of temperature rise shows more warming over land than over ocean.


(a)
Δq (%)
ΔT (K)
7.5 %/K
(b)
ΔP (%)
ΔT (K)
7.5 %/K
(c)
Δq (%)
ΔT (K)
(d)
ΔP (%)
ΔT (K)

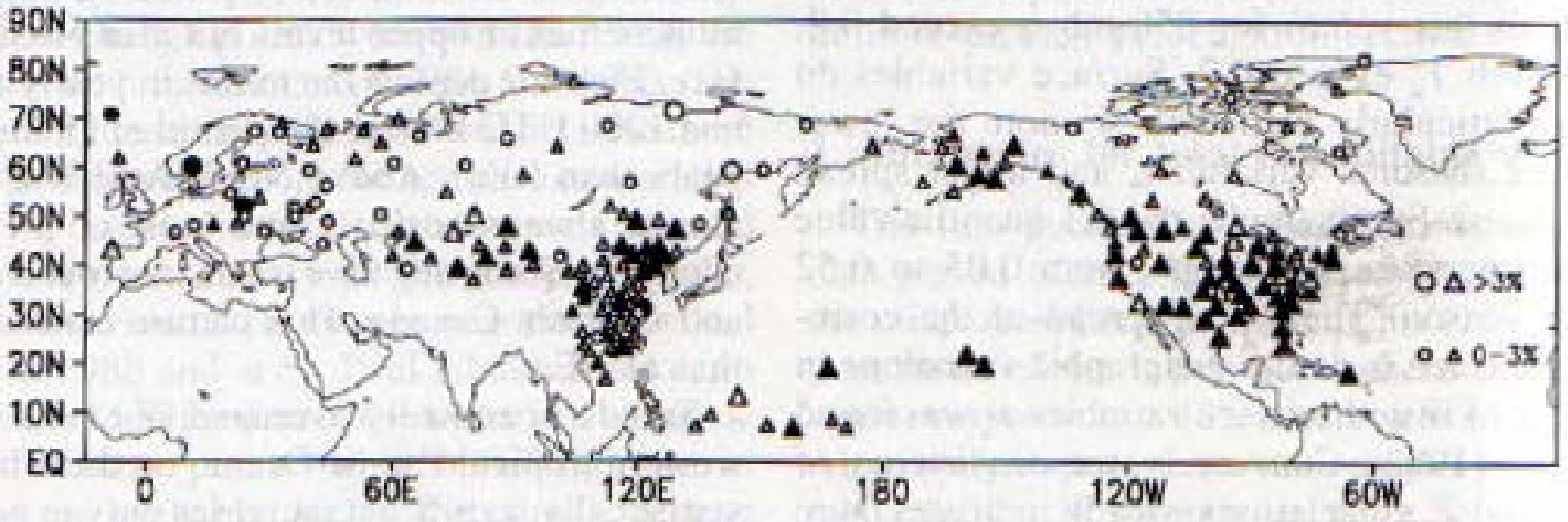


FIG. 3. Same as Fig. 2 but for annually averaged trends in 0000 UTC 850-mb q (% decade^{-1}).

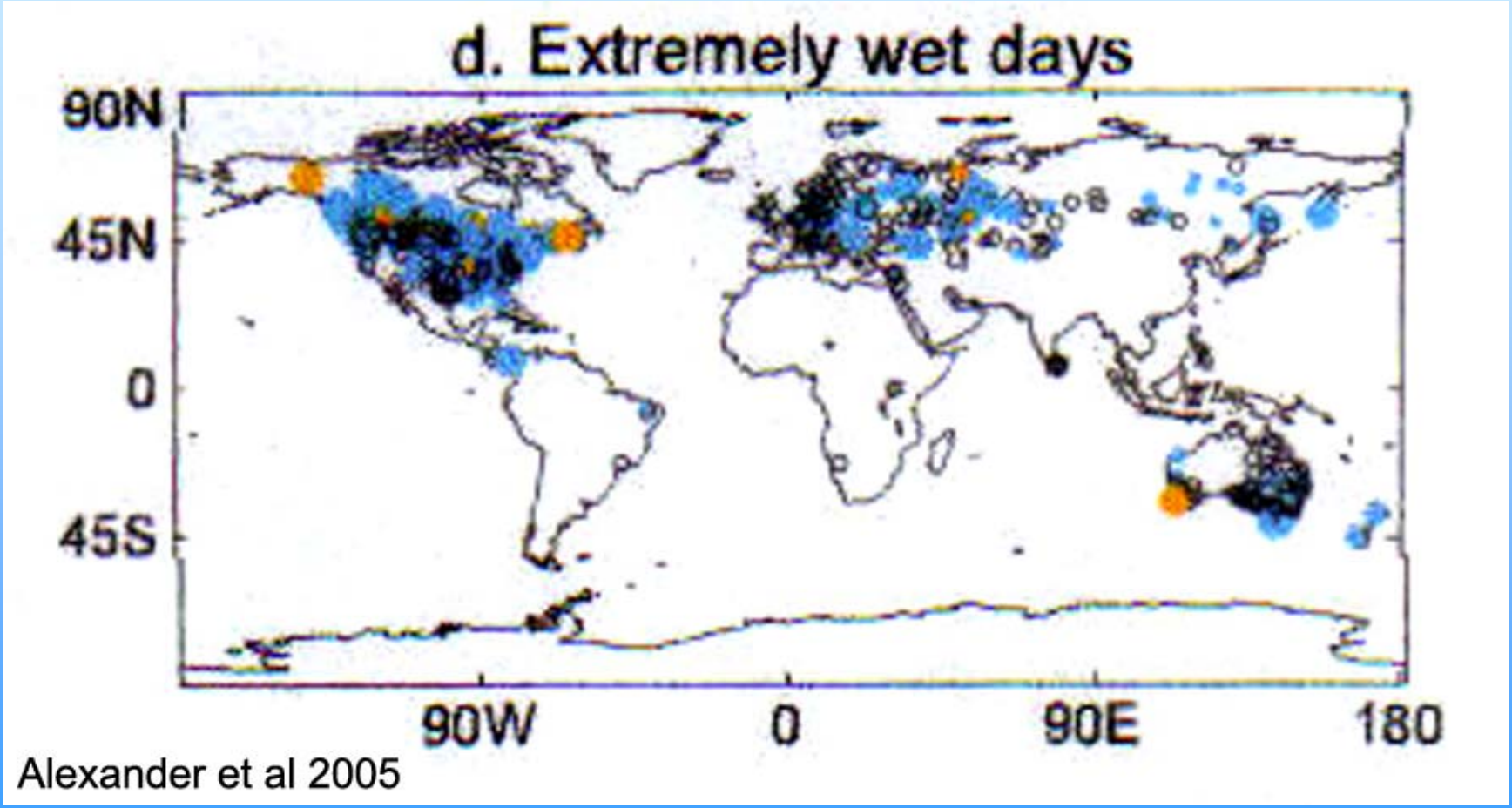
Ross & Elliott 2001

PROBABLE MAXIMUM STORMS AND FLOODS

Rainfall maximization sometimes used for estimating "physically maximum" design flood.

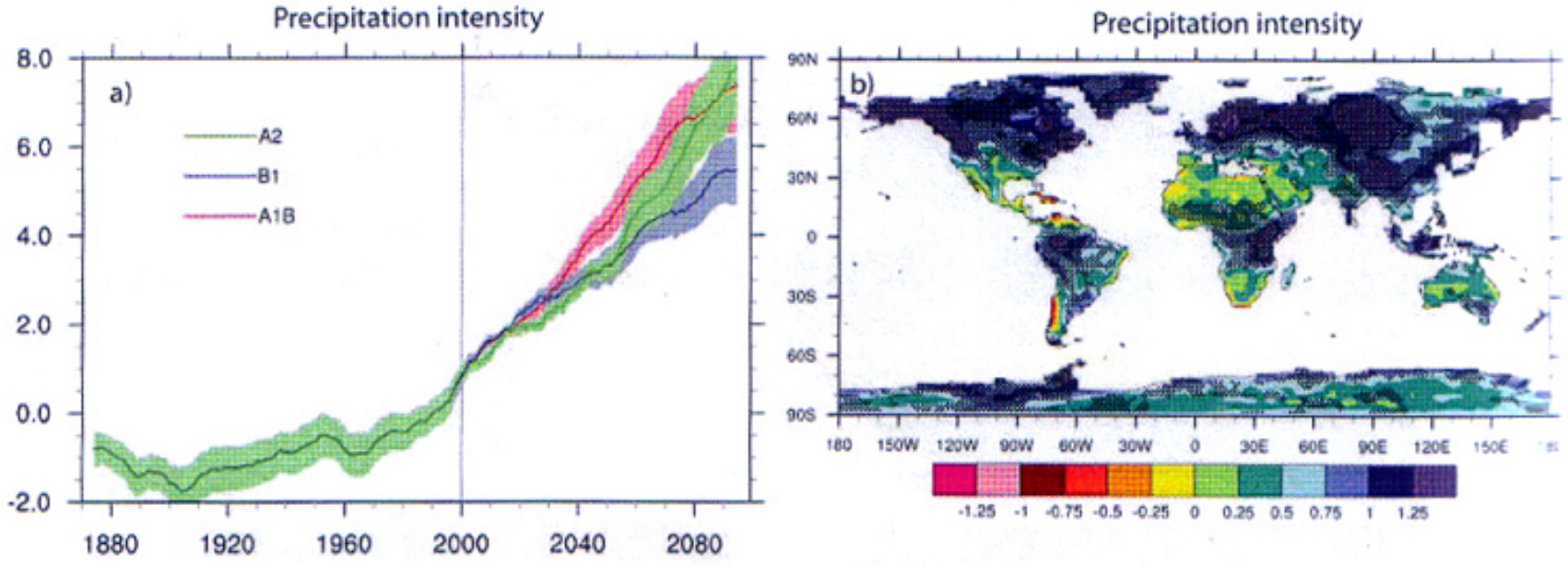
1	**Select past storms in region with greatest rain producing dynamics.**
2	**Increase rain amounts in such storms by maximum observed precipitable water in the region.**
3	**BUT $\underline{P_{w\,max}}$ RISING**

$$R_{max} = \frac{P_{w\,max}}{P_{w\ storm\ obs.}} \times R_{storm\ obs.}$$

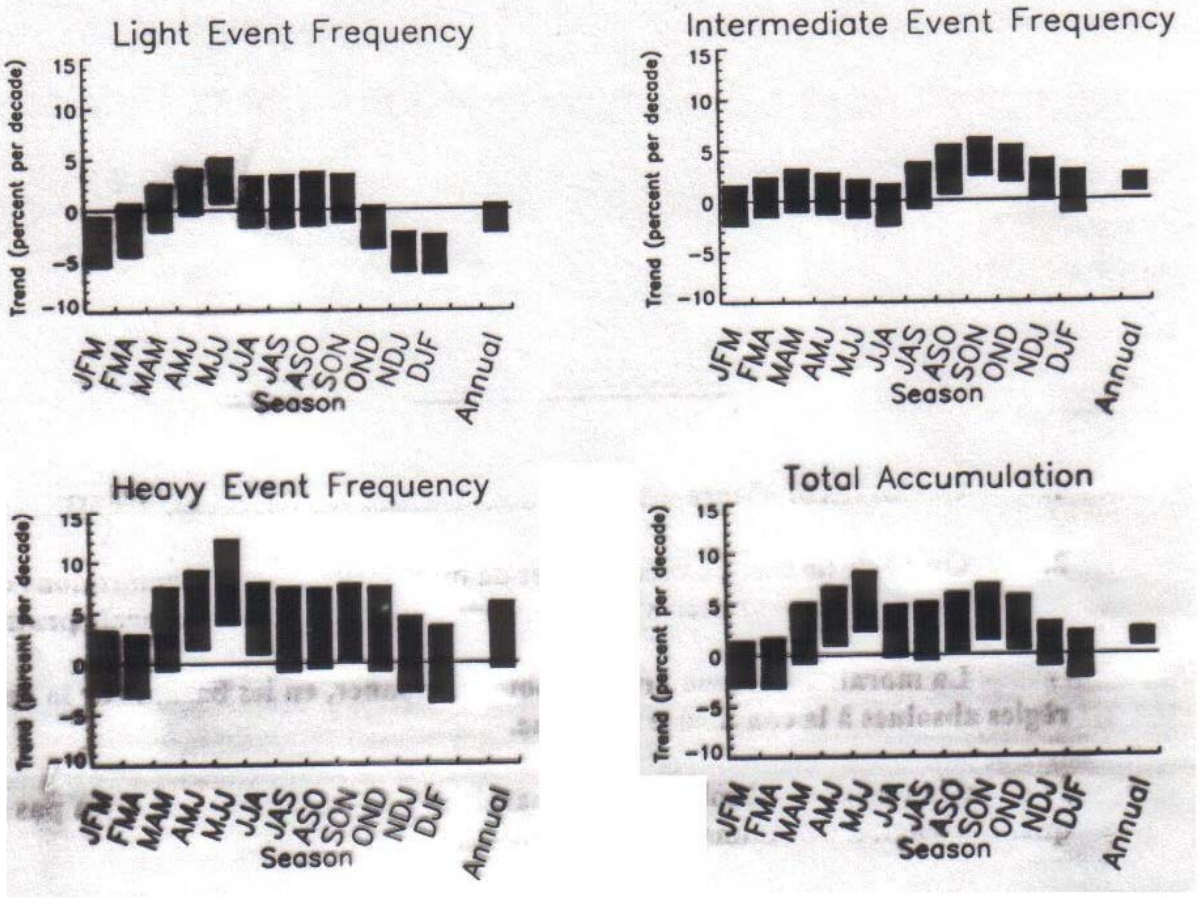


Alexander et al 2005

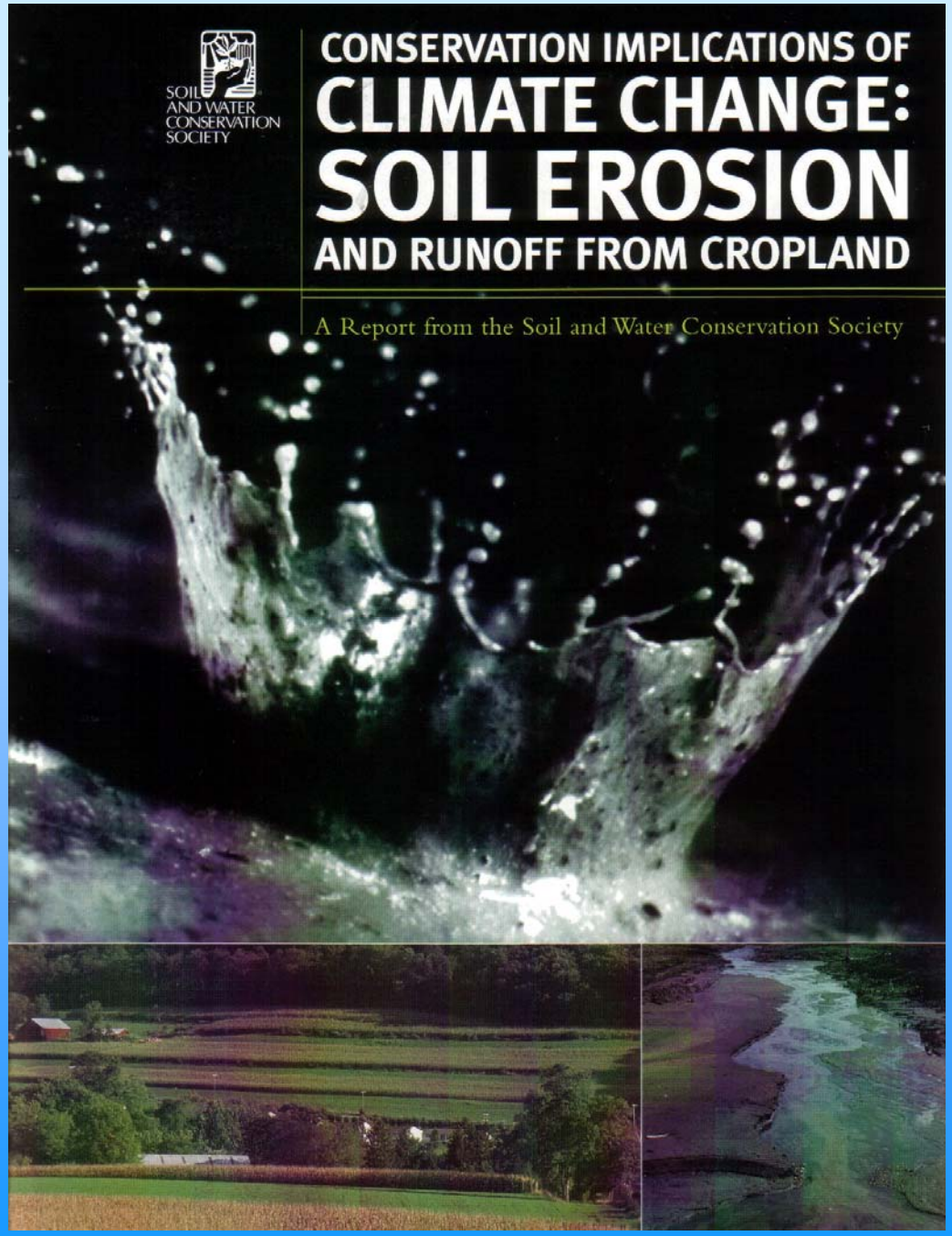
Changes in extremes (a) Precipitation intensity and dry days for 2080-99



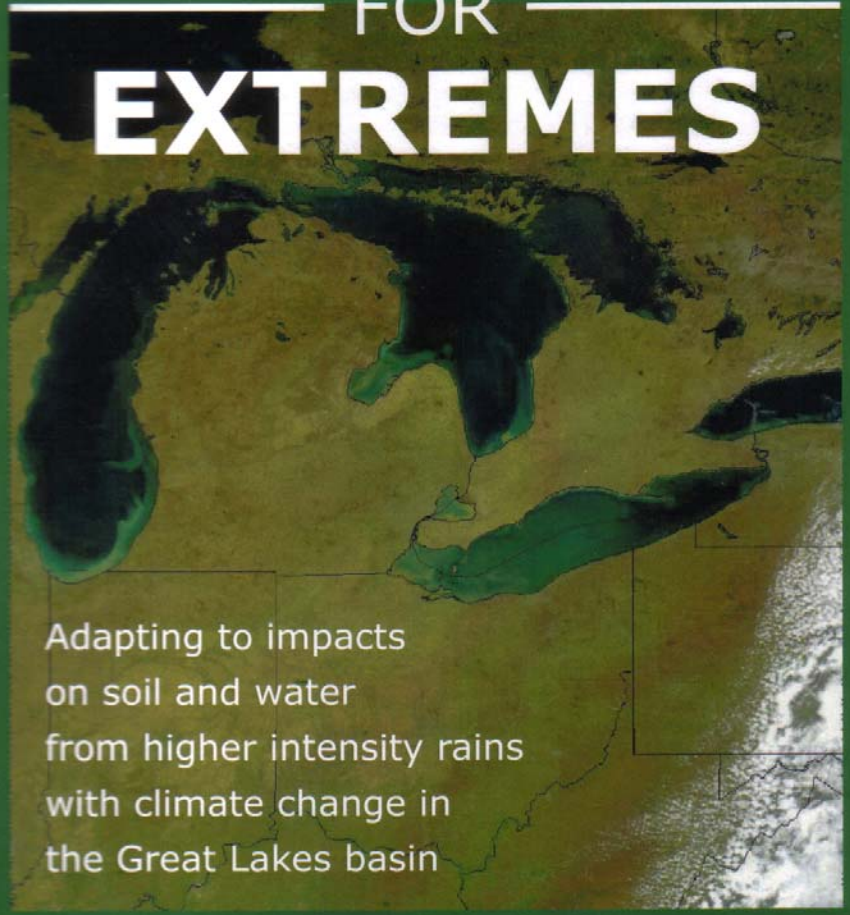
(SouthEastern Canada)



D. A. Stone et al., Atmosphere Oceans, 2000


SOIL AND WATER CONSERVATION SOCIETY
CONSERVATION IMPLICATIONS OF
CLIMATE CHANGE:
SOIL EROSION
AND RUNOFF FROM CROPLAND
A Report from the Soil and Water Conservation Society

PLANNING FOR EXTREMES



Adapting to impacts
on soil and water
from higher intensity rains
with climate change in
the Great Lakes basin

Final Report: March 2007

Ontario Chapter of the Soil and Water Conservation Society

Cover Photo from Great Lakes Information Network www.great-lakes.net/infocenter/images/photogallery.html

POTENTIAL EFFECTS ON SOIL EROSION AND RUNOFF FROM CROPLAND OF OBSERVED CHANGES IN PRECIPITATION (SWCS)

	Increase in Mean Annual Precipitation			
	5%	**10%**	**20%**	**40%**
Change in Erosion				
Increase only frequency of precipitation	4%	9%	17%	34%
Increase only intensity of precipitation.	**12%**	**24%**	**48%**	**95%**
Increase frequency and intensity equally	8%	17%	33%	66%
Change in Runoff				
Increase only frequency of precipitation	6%	13%	26%	51%
Increase only intensity of precipitation	**13%**	**25%**	**50%**	**100%**
Increase frequency and intensity equally	10%	20%	39%	79%

Source: Derived from Pruski and Nearing 2002.

Main Recommendations from the Workshop

1. Climatic data, trend and frequency analyses used for planning and design, especially for heavy rainfall events, must be up-dated at frequent intervals in the changing climate.

2. Analytical tools used to design erosion prevention measures should more explicitly provide risk assessment information, but presently available tools should be much more widely applied, and best combinations of these used.

3. Smart monitoring must provide for assessment of sediment and pollutant transport immediately following extreme rain and intense snowmelt events, as well as including long term systematic measurements.

4. Watershed changes, other than climatic, also need to be up-dated regularly including changes in vegetation and cropping practices with climate change.

5. Erosion prevention programs should preferentially target the limited areas in a watershed that are most vulnerable.

6. More field technical advisors in both Canada and U.S.A. are essential to cope with problems of erosion and transport of sediments and pollutants into the Great Lakes.

7. Financing mechanisms must be strengthened so that downstream beneficiaries contribute to solutions in upper parts of a watershed.

8. Innovative strategies to increase adoption of farm conservation measures are required, building upon successes to date.