Climate Change and Water Resource Adaptation

USGS Circular 1347

Interagency activities under the Adaptation Task Force

Science and data to support water-adaptation to climate change

- Some lead-in thoughts from John Holdren's April 21 speech

Climate change is not just "global warming"

That term implies something…

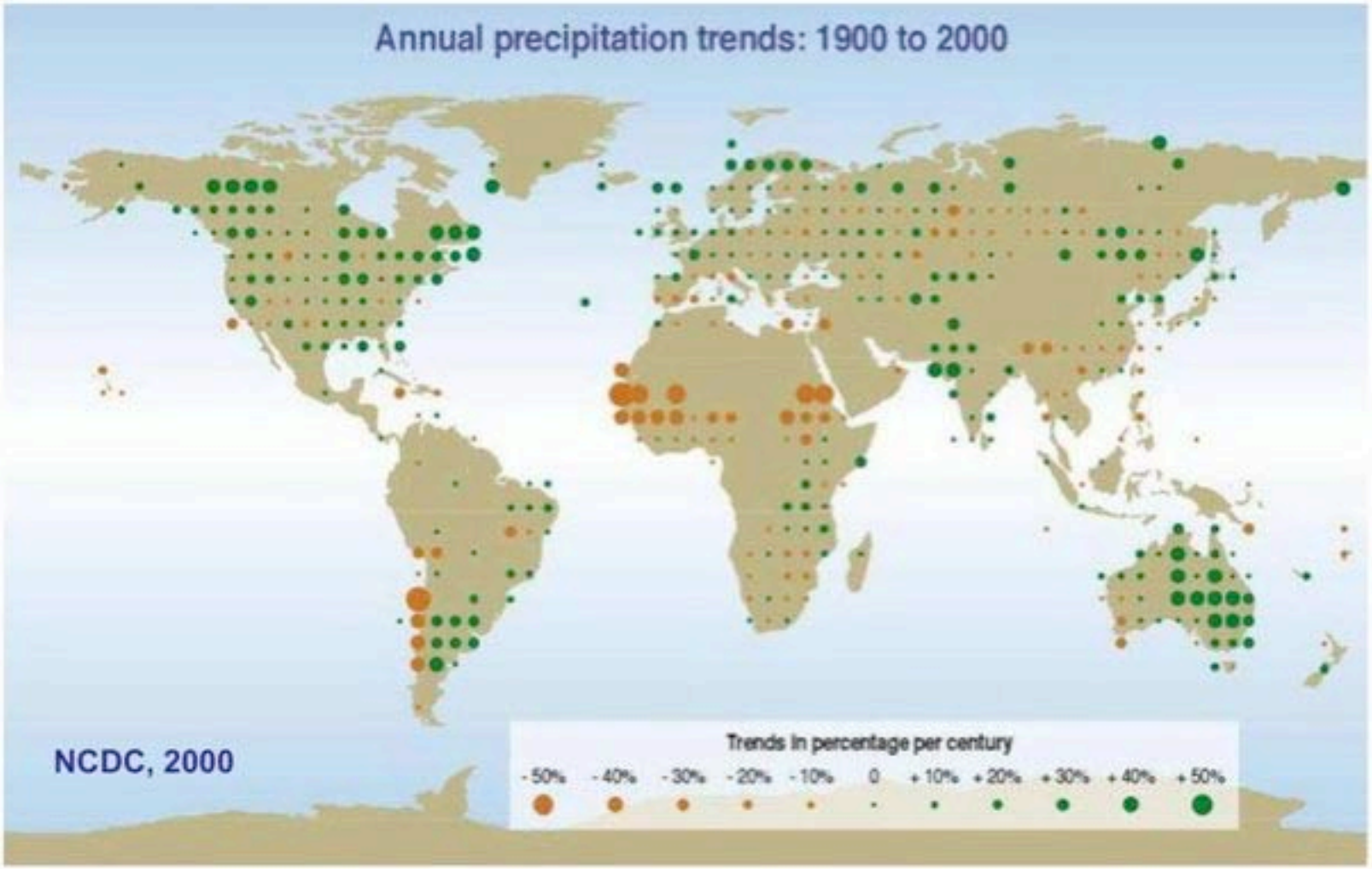
- uniform across the planet,
- mainly about temperature,
- gradual,
- quite possibly benign.

What's actually happening is…

- highly nonuniform,
- not just about temperature,
- rapid compared to capacities for adjustment
- harmful for most places and times

We should call it "global climate disruption".

…and precipitation patterns



Global average is an increase, but some places are getting drier.

What's at risk?

Climate governs (so climate disruption affects)

- availability of water
- productivity of farms, forests, & fisheries
- prevalence of oppressive heat & humidity
- formation & dispersion of air pollutants
- geography of disease
- damages from storms, floods, droughts, wildfires
- property losses from sea-level rise
- expenditures on engineered environments
- distribution & abundance of species

Water is a huge part of the story

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Adaptation possibilities include…

- Changing cropping patterns
- Developing heat-, drought-, and salt-resistant crop varieties
- Strengthening public-health & environmental-engineering defenses against tropical diseases
- Building new water projects for flood control & drought management
- Building dikes and storm-surge barriers against sea-level rise
- Avoiding further development on flood plains & near sea level

Some are “win-win”: They’d make sense in any case.

4 of the 6 are heavily related to water and all 6 involve water

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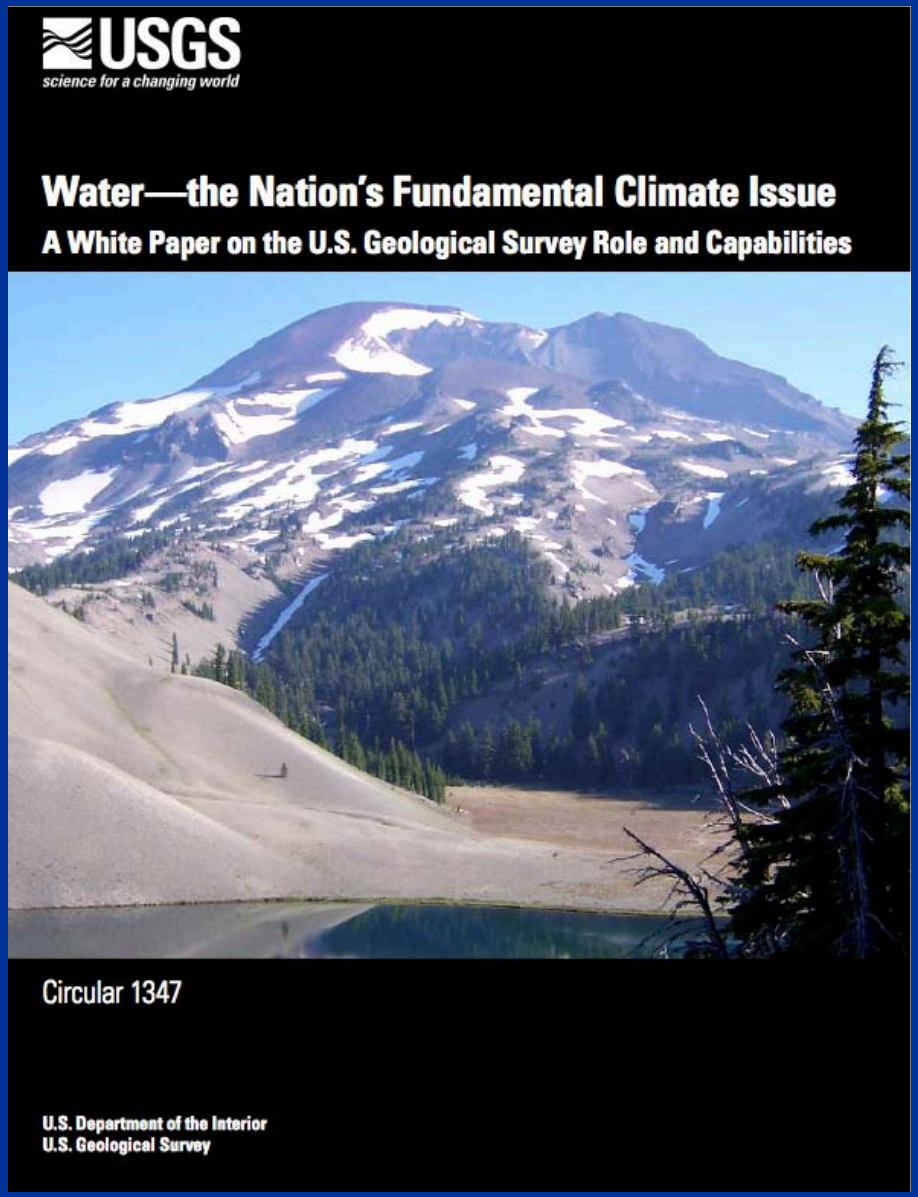
USGS Role

- Preserve the continuity of long-term data collection

- Analyze and interpret water data to determine how the Nation's water resources are changing



From Ralph Keeling

The only way to figure out what is happening to our planet is to measure it,

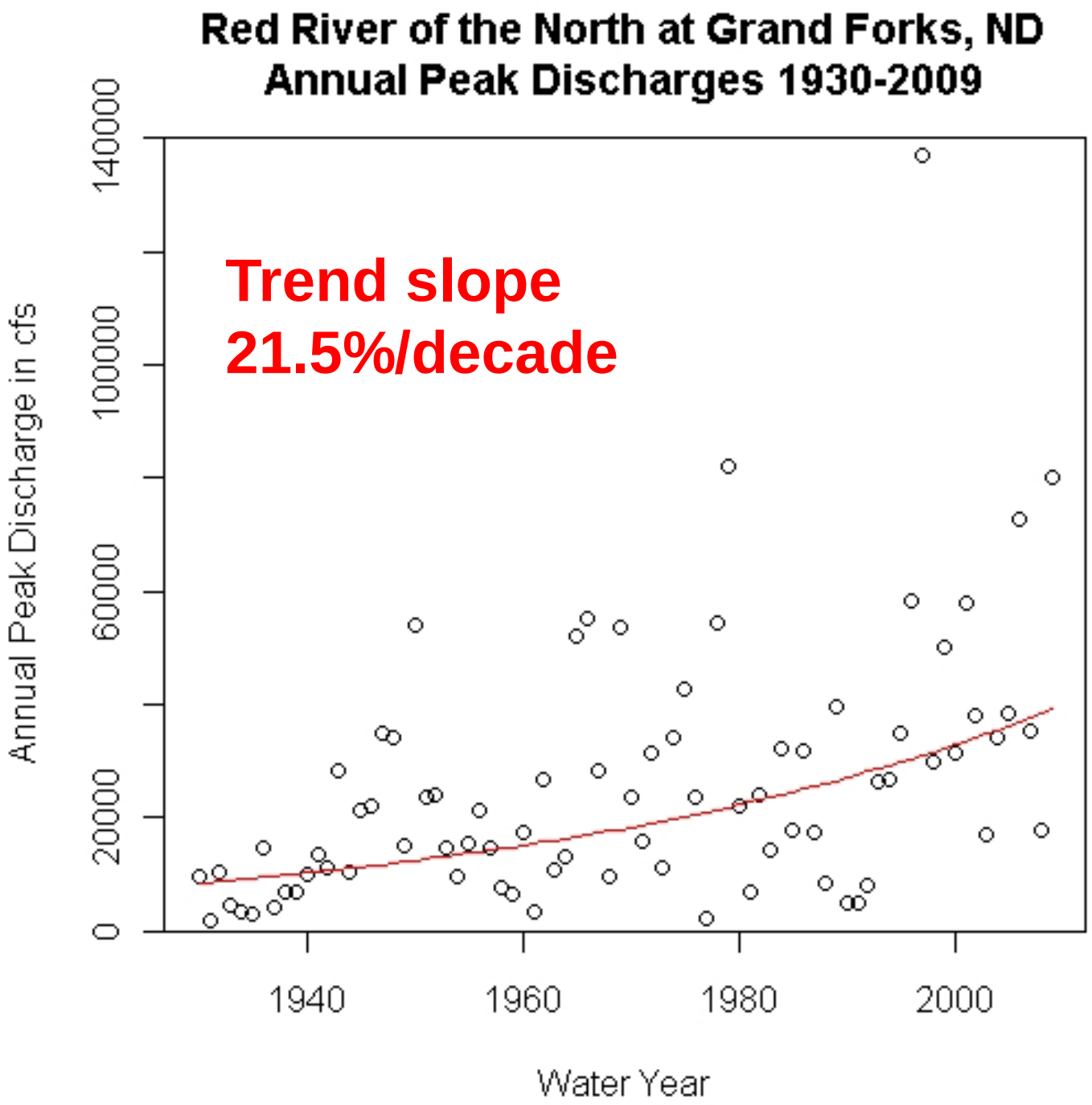
and this means tracking changes decade after decade

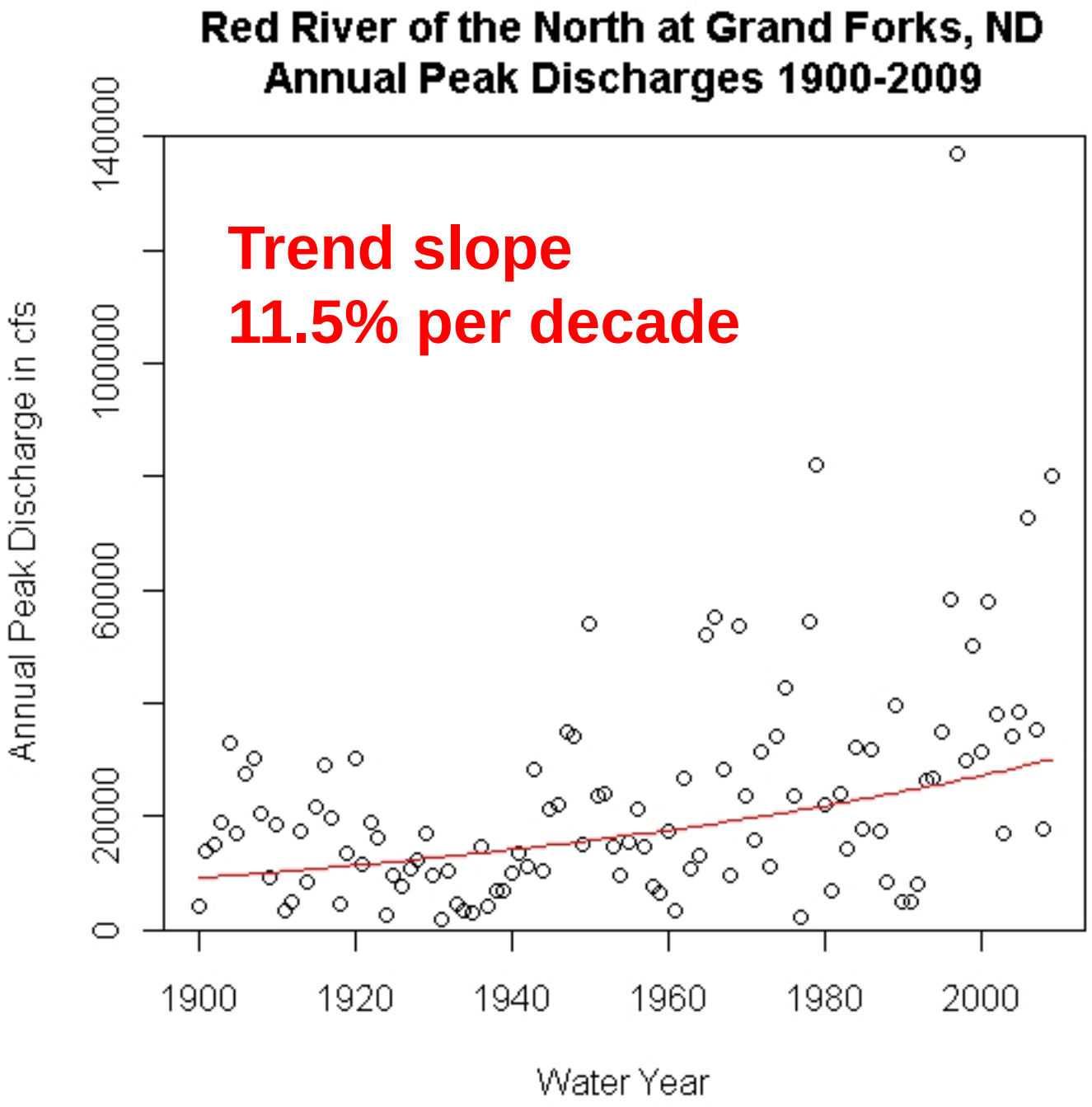
and poring over the records.

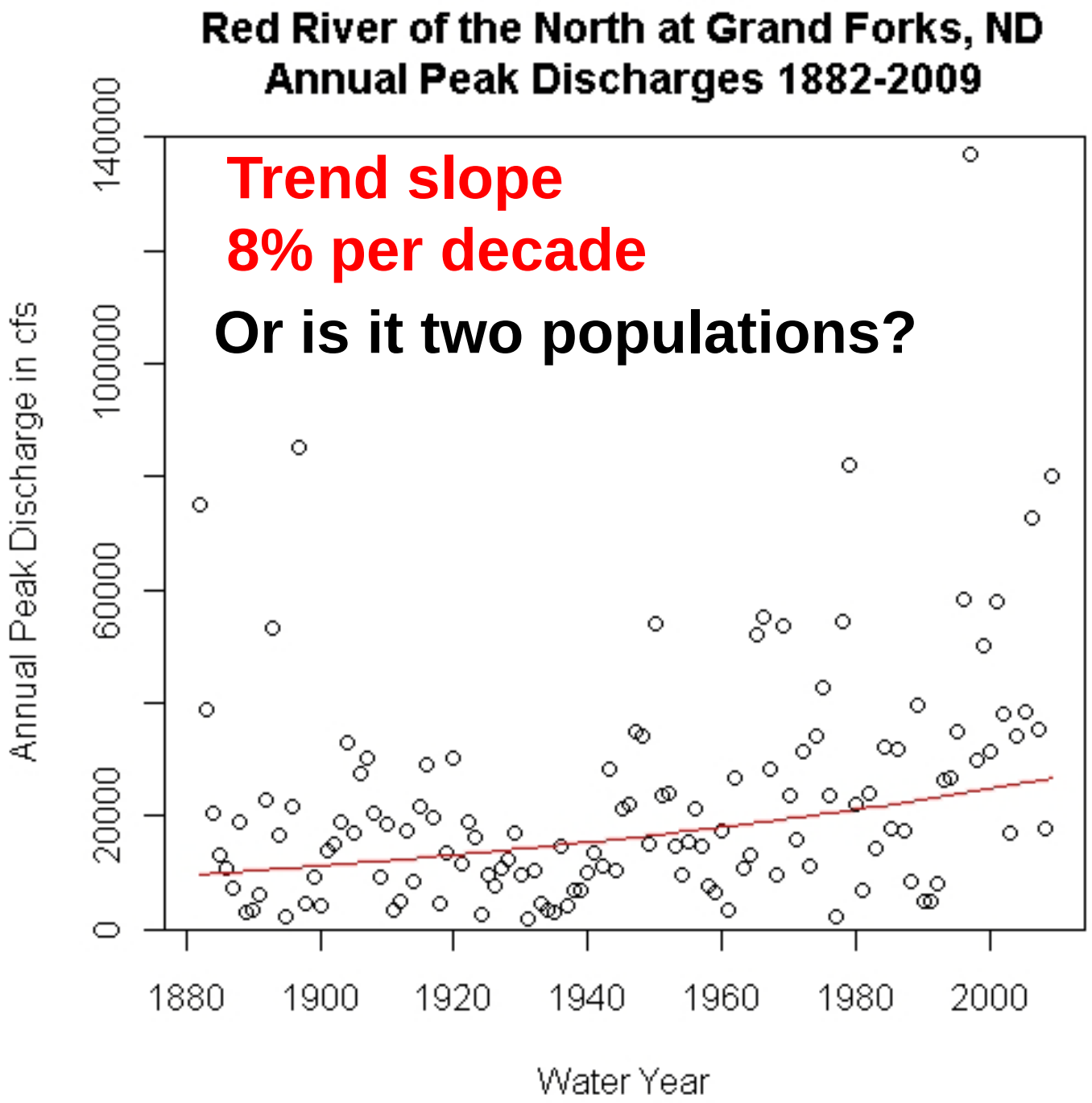
Science, 2008, p. 1771-1772

What Kinds of Changes Should We Explore?

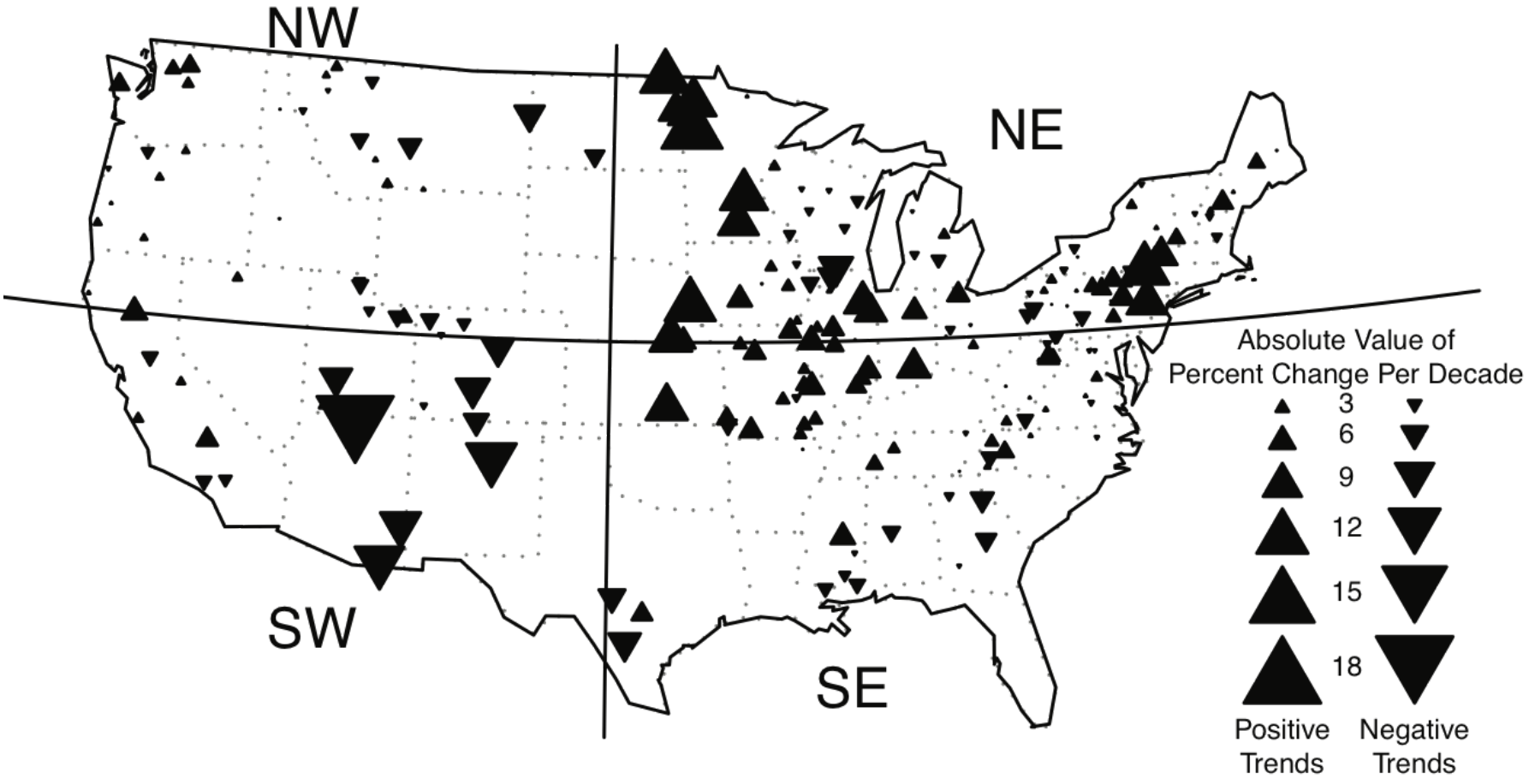
- Average flows
- Seasonal flows
- Low flows
- Flood volumes
- Flood peaks
- Groundwater levels


Red River of the North at Grand Forks, ND
Annual Peak Discharges 1930-2009
Trend slope
21.5%/decade
Annual Peak Discharge in cfs
0
20000
60000
100000
140000
1940
1960
1980
2000
Water Year

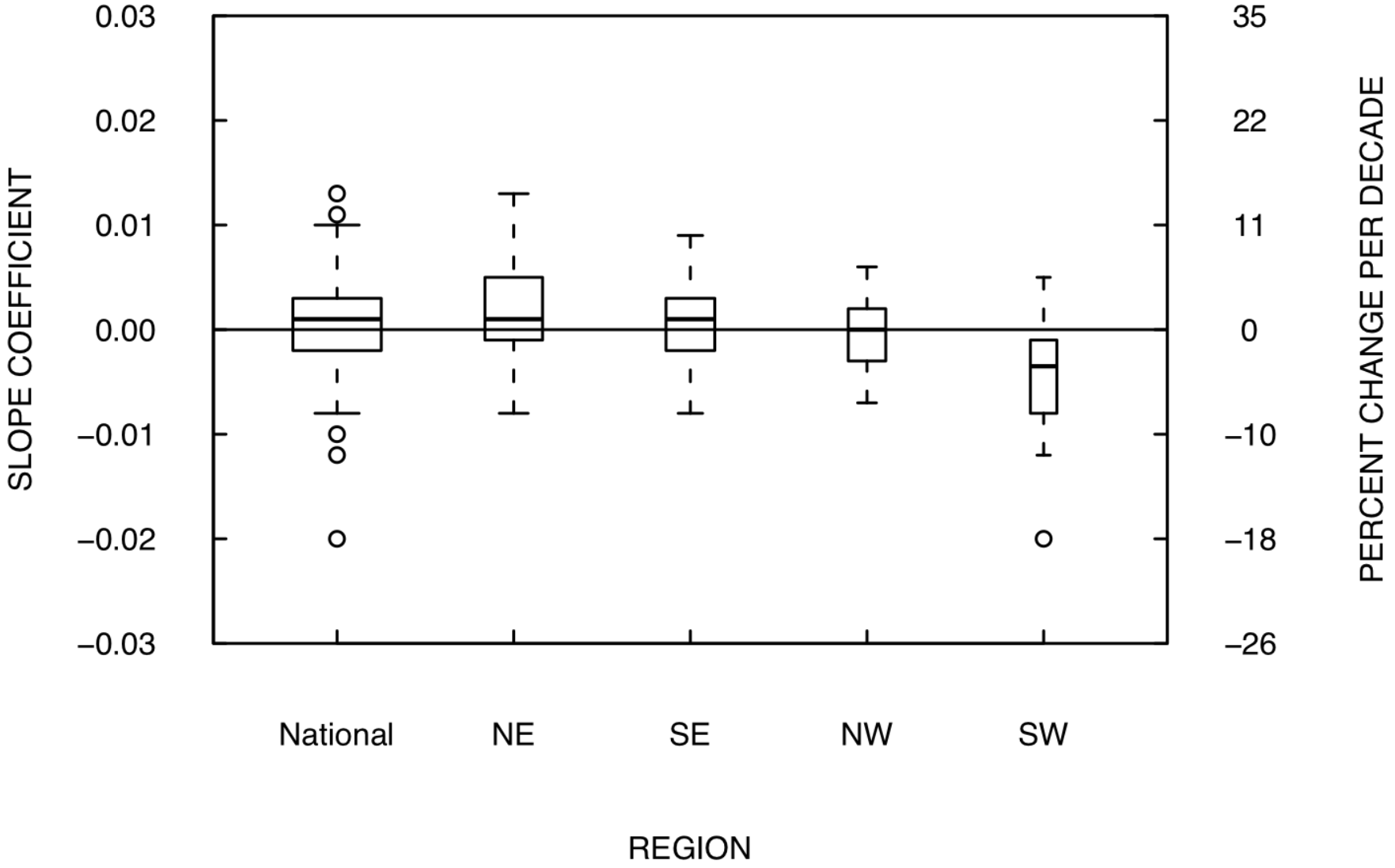

Red River of the North at Grand Forks, ND
Annual Peak Discharges 1900-2009
Trend slope
11.5% per decade
Annual Peak Discharge in cfs
0
20000
60000
100000
140000
1900
1920
1940
1960
1980
2000
Water Year


Red River of the North at Grand Forks, ND
Annual Peak Discharges 1882-2009
Trend slope
8% per decade
Or is it two populations?
Annual Peak Discharge in cfs
0
20000
60000
100000
140000
1880
1900
1920
1940
1960
1980
2000
Water Year

Trends in Annual Flood Peaks
Records of 85-127 year length
% Change per Decade



Annual Flood Peak Trends



Science challenge: sort out the drivers of change

- Reservoirs
- Consumptive Use
- Groundwater depletion
- Land use (tile drains, urban,…)
- Natural variation (ENSO, PDO, AMO)
- Greenhouse gas induced climate change

National efforts should follow two paths:

- Climate models with downscaling
- Empirical approach (the past century is a global experiment…every watershed is an experimental subject)

Both paths have serious flaws.
They need to cross check each other.
we need to be prepared for surprise.

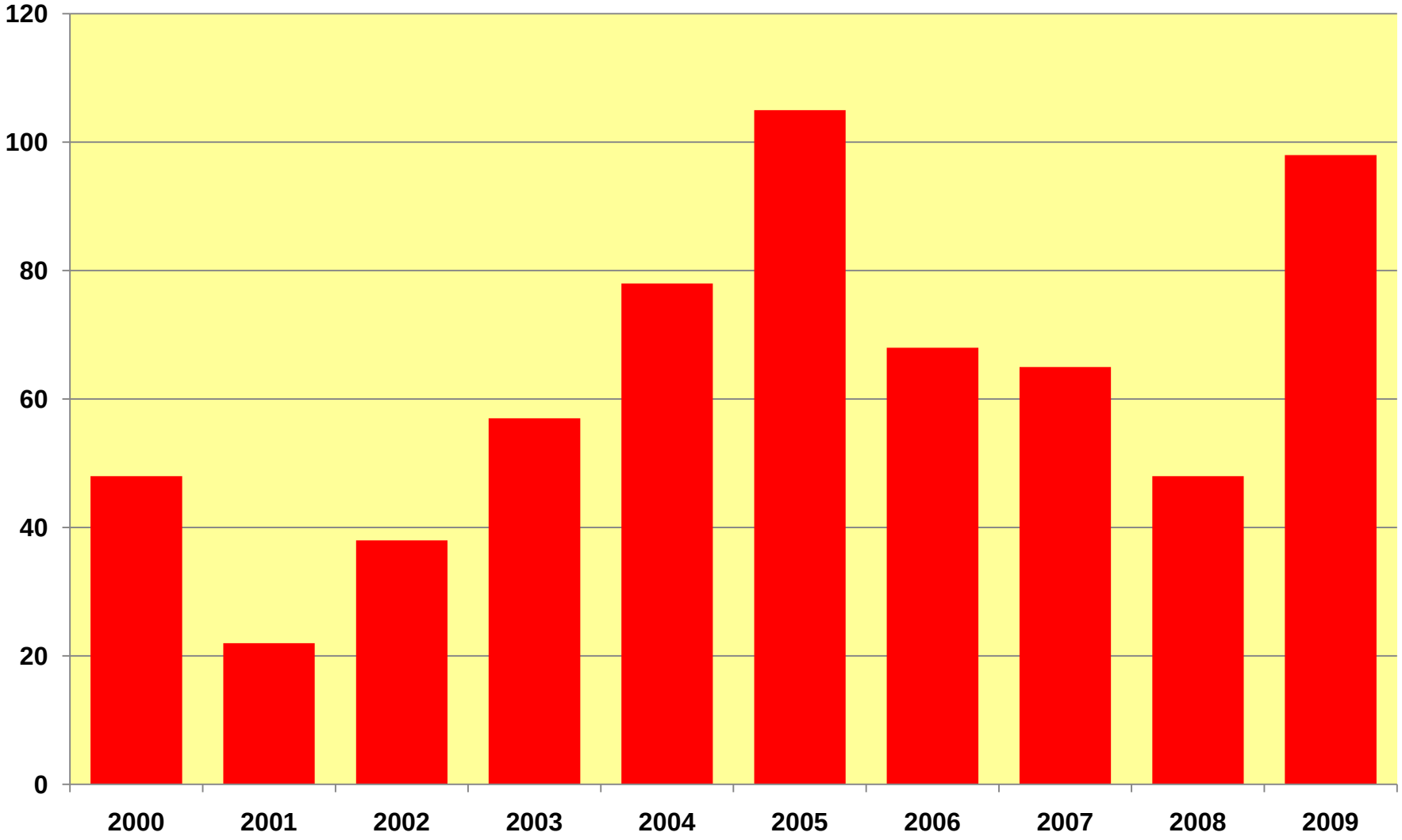
From Milly et.al. 2008

"Modeling should be used to synthesize observations; it can never replace them."

"In a nonstationary world, continuity of observations is crucial."

Stationarity is Dead: Whither Water Management, *Science*, p. 573-574, 2008

30+ year Record Streamgages Discontinued



Interagency activities

Water Resources Adaptation to Climate Change: A Workgroup of the Interagency Climate Change Adaptation Task Force

Subcommittee on Water Availability and Quality (SWAQ) has been providing input on science needs

Task Force recommendations are in preparation

Interagency activities

Workgroup is serving as “Climate Change and Water Intergovernmental Panel” called for in Section 9506 of the Secure Water Act

SWAQ is preparing draft materials for the report called for in Section 9506

External input is being sought – We want your input!!

How did we approach the task?
We started with a focus on decisions

- Today's decisions have long-term implications
- Water related changes may be large and have multiple causes
- The specifics of climate-change induced water-resources change are very uncertain and will remain so for a long time to come

Who makes the decisions?

- Water users (farmers, energy companies, municipalities, individuals)
- Agencies responsible for investing in water infrastructure (municipal, State, and Federal)
- Agencies responsible for protecting and enhancing ecosystems, human health, and safety

Types of decisions:

- Investments in water infrastructure
- Regulating pollution (NPDES, TMDL)
- Design of water facilities near sea-level
- Inland flood hazard mitigation (zoning, insurance, and structures)
- Design and rehab of drainage systems (including new “green” systems)
- Operations of water infrastructure (at time frames from hours to years)
- Protecting public health from waterborne disease
- Protecting or restoring aquatic habitat

Questions related to these decisions

A. Do the analyses reflect recent and current conditions?

B. Are the methods appropriate to the kinds of changes we might expect?

C. Are programs in place to assure that critical sources of data will continue to be available to support these analyses?

D. Are programs in place to assure that the analyses will reflect the latest data and latest scientific insights?

Issues we will certainly address:

- Adequacy and stability of water data collection
- Water census (availability, use, quality)
- Up-to-date hydroclimatic statistics
- Waterborne disease surveillance
- Science base for sea-level rise impact on water infrastructure

Your questions & input

- Questions now?
- Please help us identify position papers or statements of your organizations
- Comments and suggestions over the next two months can go to me: rhirsch@usgs.gov