

Changes in Weather and Climate Extremes: A Series of Workshops from the Climate Science Working Group



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Overview

- Climate Science Working Group
- Motivation for Initial Focus on Extremes
- Series of Five Extremes Workshops
- Update from First Workshop on Storms



National Climate Assessment Climate Science Working Group

- Tom Karl (NOAA) ---- Co-Chair
- Don Wuebbles (Univ of Illinois) ---- Co-Chair
- Tom Peterson (NOAA) ---- Observed Changes in Extremes
- Harold Brooks (NOAA) ---- Severe Storm
- Russ Vose (NOAA) ---- Observed Changes in Extremes
- Ken Kunkel (NC State) ---- Leading NCA Climate Outlooks; Observed Changes in Extremes
- Susan Cutter (U of SC) ---- Climate Extremes Impacts Date and Trends
- Ben Santer (LLNL) ---- Climate Change Detection and Attribution
- Rick Katz (NCAR) ---- Statistical analysis of extremes
- Jerry Meehl (NCAR) ---- Modeling
- Michael Wehner (LBNL) ---- Model Diagnostics
- Jim Kossin (NOAA) ---- Hurricanes
- Isaac Held (NOAA) ---- Modeling
- Katharine Hayhoe (Texas Tech University) ---- Climate Model Downscaling
- Randy Dole (NOAA) ---- Climate Diagnostics
- Jeff Trapp (Purdue University) ---- Severe local storms
- Phil Mote (Washington State University) ---- Regional Climate
- Peter Thorne (NC State University) ---- Attribution of Climate Change

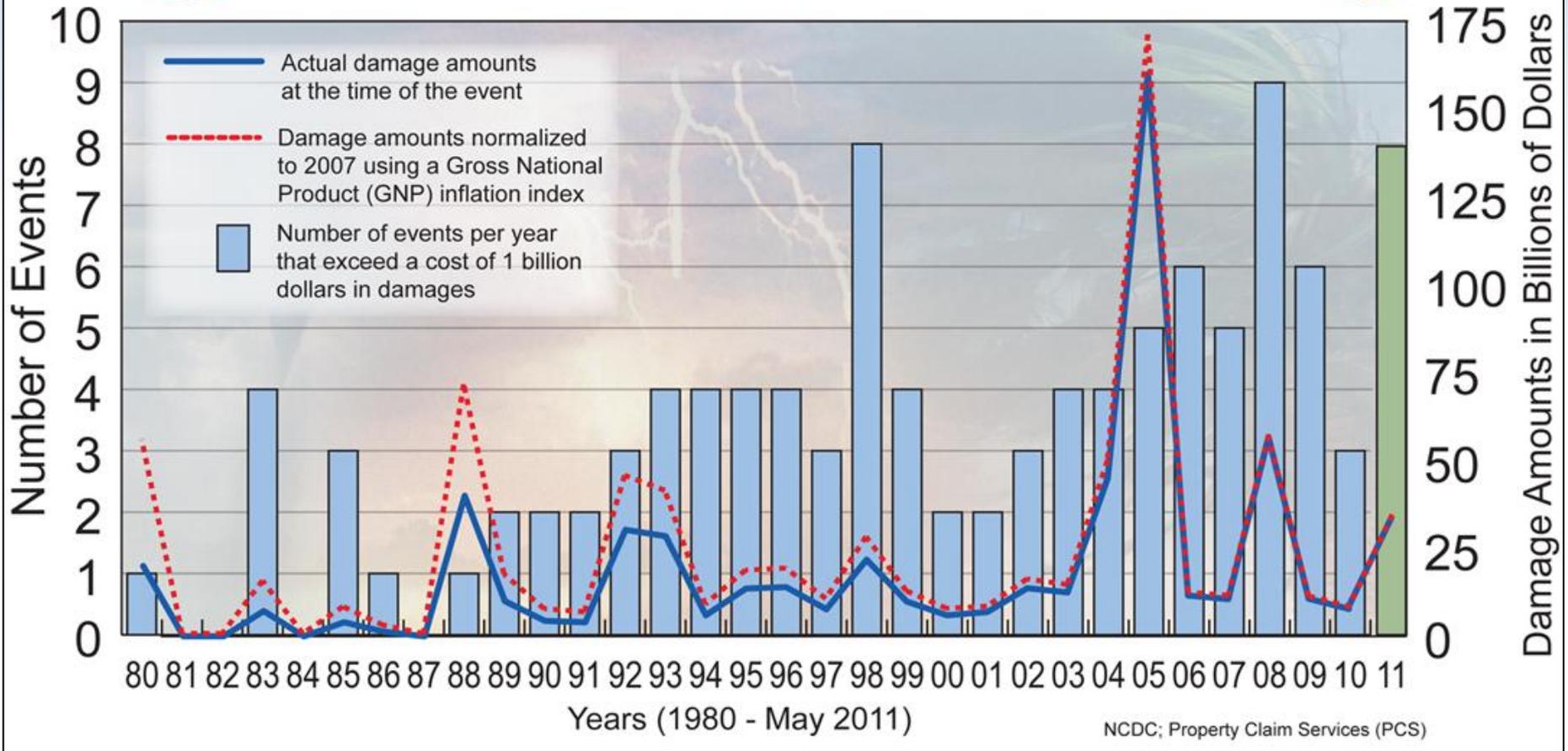


Billion Dollar Weather Disasters

11 disasters already in 2011



Billion Dollar U.S. Weather Disasters 1980 - May 2011
NOAA/NESDIS/NCDC

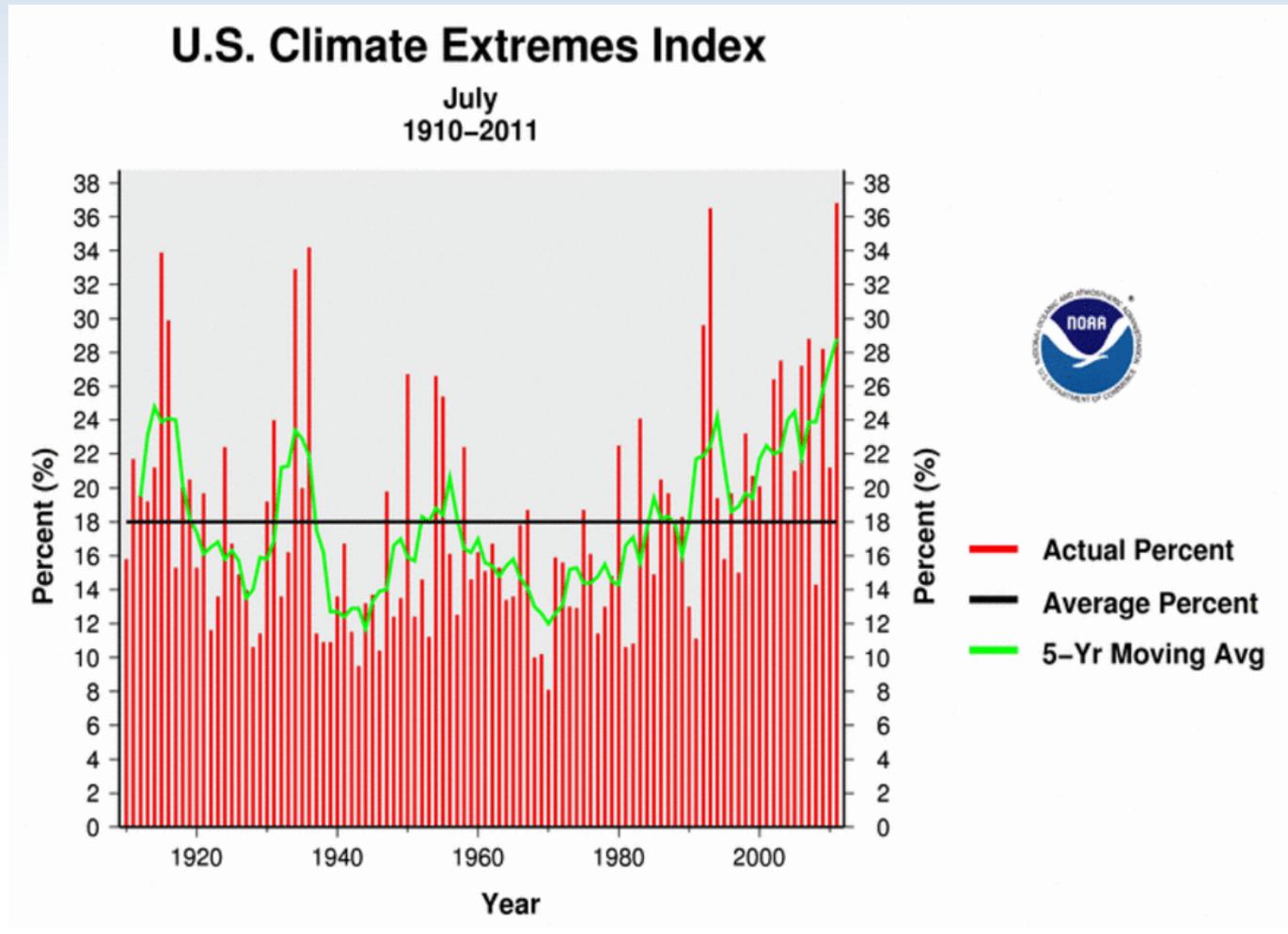


Note: 2011 figures based on preliminary information



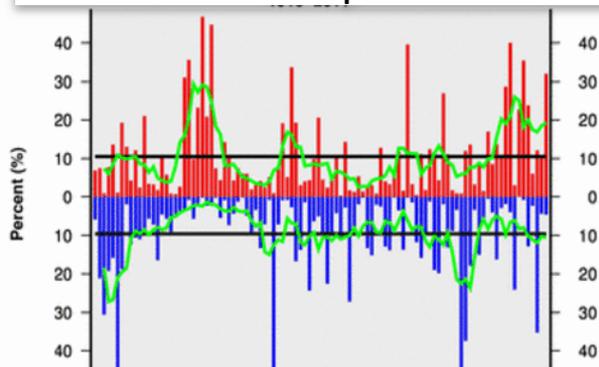
Climate Extremes Index

- Highest July value in CEI record

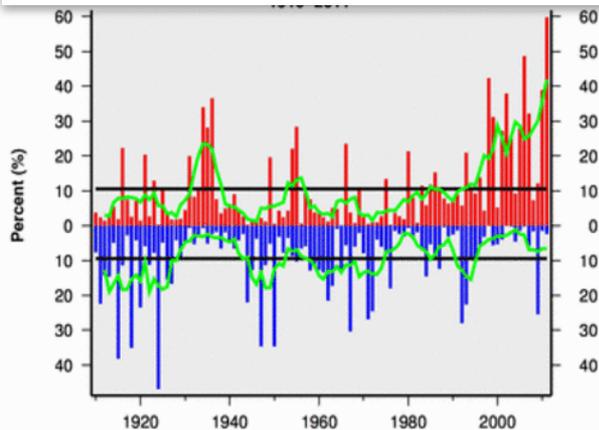


What can we say about detection and attribution of extremes?

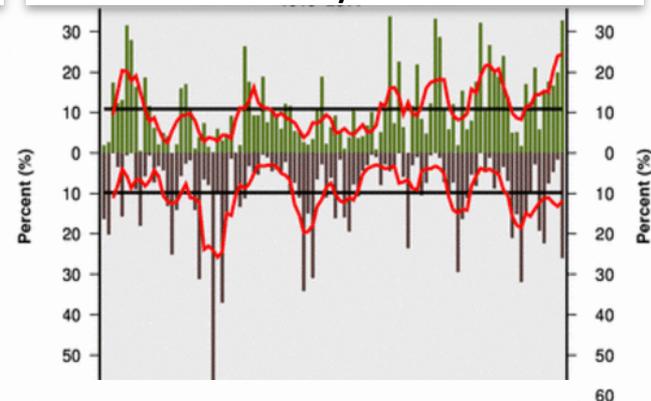
Extremes in Maximum Temp



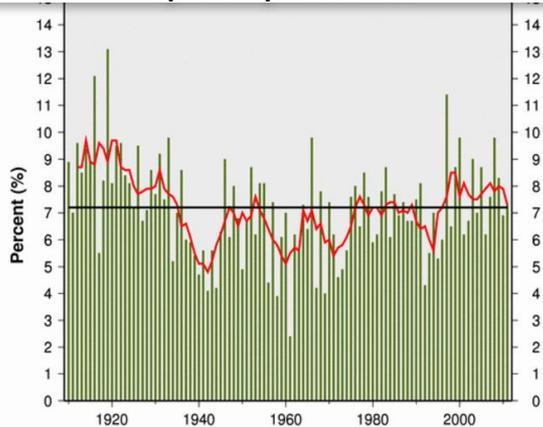
Extremes in Minimum Temp



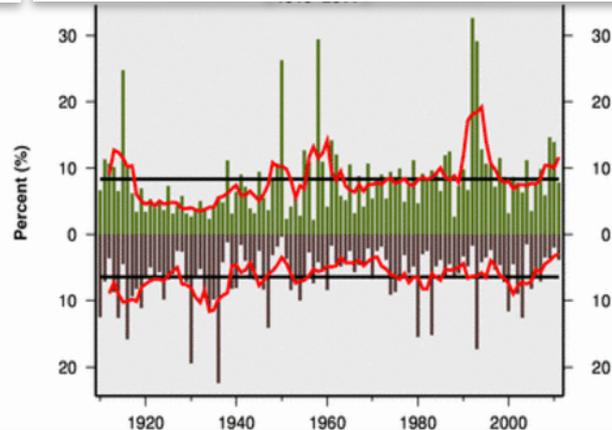
Extremes in Palmer Drought Severity Index



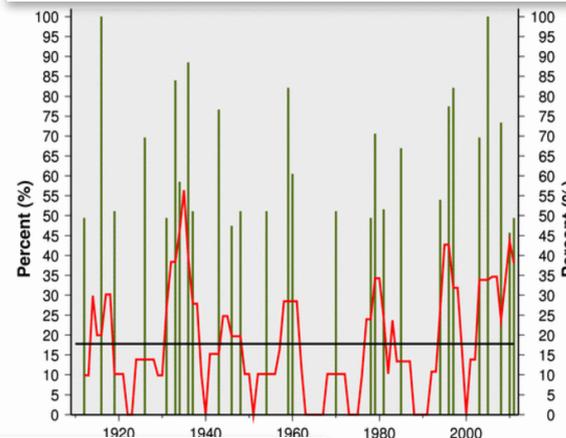
Extremes in 1-day precipitation



Extremes in number of days with precipitation



Landfalling Tropical Systems



* All graphs show July 1910 – 2011 *

Series of Five Extremes Workshops

- Climate Science Working Group agreed to convene a series of five workshops on extremes
 - Each workshop produces a peer-reviewed article for the Bulletin of the American Meteorological (BAMS). Target 3000 words and 6-7 figures. Quick review cycle.
- 1. Trends of Severe local storms including tornadoes and extreme precipitation**
July 26-28 2011, Asheville. Lead: Ken Kunkel
 - 2. Trends and causes of observed changes in heat and cold waves, drought and floods**
November 8-10 2011, Asheville. Lead: Tom Peterson
 - 3. The attribution of changes in climate extremes**
December 13-15 2011, Asheville. Leads: Peter Thorne & Randy Dole
 - 4. Trends of extreme waves, winds and extra-tropical storms along the coasts**
January 2012, Charleston. Lead: Russ Vose
 - 5. Climate Model Inter-comparison (CMIP) Results for IPCC 5**
Mid-March 2012, Honolulu. Leads: Jerry Meehl, Don Wuebbles

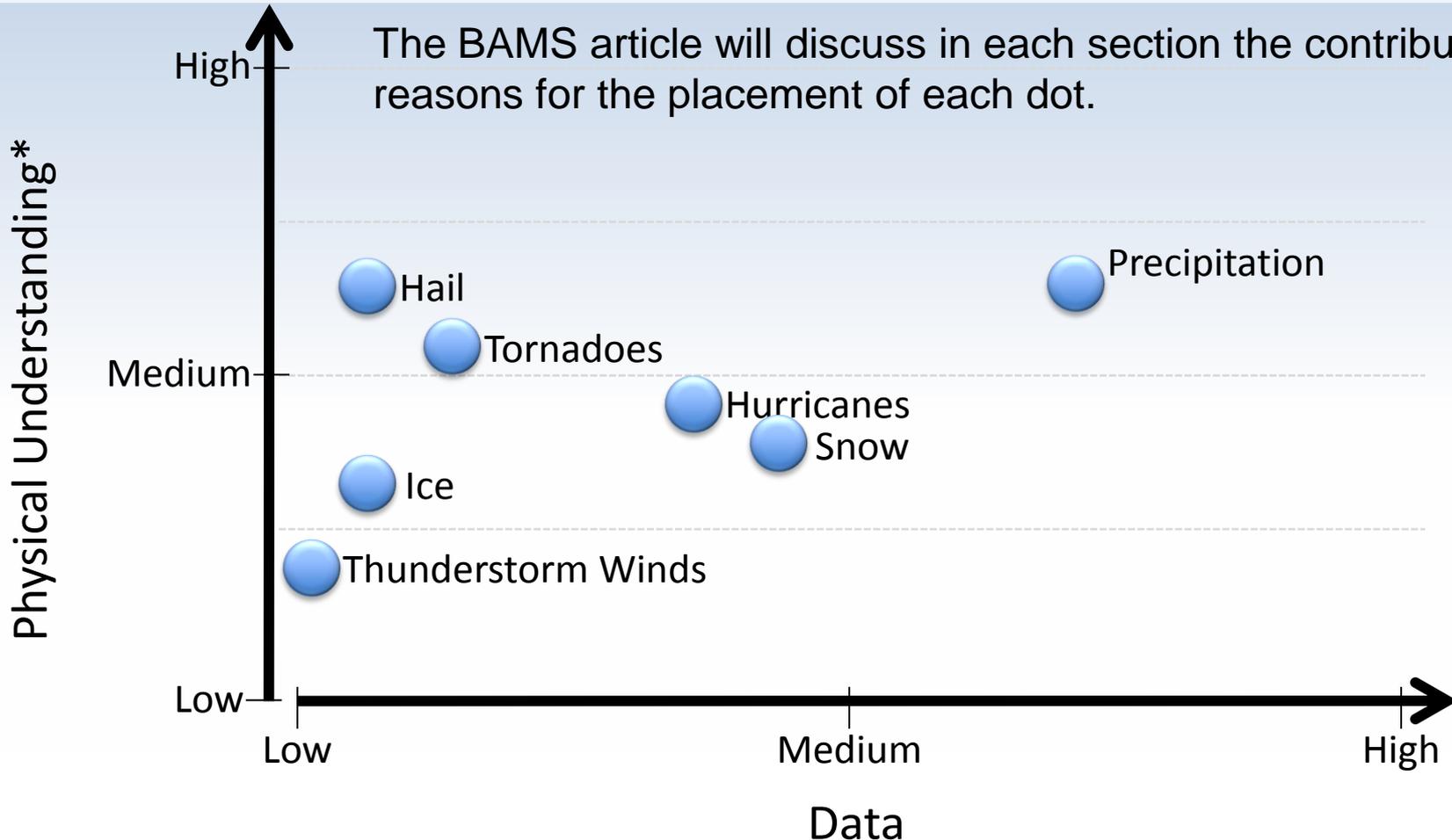
Update on Storms Workshop

- The group considered
 - Severe thunderstorms & tornadoes
 - Extreme precipitation
 - Hurricanes
 - Snowstorms and ice storms
 - Impacts of these kinds of storms
- Target date for first draft of the paper is September 2
- Target date to submit to BAMS is October 3



Adequacy for Detection and Attribution of Changes for Classes of Extreme Storms

The BAMS article will discuss in each section the contributing reasons for the placement of each dot.



* Draws upon theory, process research, empirical analysis & modeling to explain frequency, intensity, and physical location (will be explained in BAMS article).

Summary

- Papers written from Workshops will be great input to the Climate Assessment in important topical areas
- Working group members are committed to writing papers from each Workshop
- Would be useful if NCA author teams were identified
 - Could help frame the content of Workshop papers
 - Could be a part of the Workshop process
 - Would benefit by being engaged during the process

Regional Climatologies and Outlooks



Ken Kunkel

Lead Scientist for Assessments

Cooperative Institute for Climate and Satellites - NC

Regional Climatology Content

- General Description
 - Maps of spatial patterns of mean annual temperature and precipitation
- Major Climate Factors
 - e.g. drought, heat waves, winter storms, flash floods
- Trends (examples)



Regional Climatology Purpose

- These should represent a coherent picture of what has been happening in each region from a physical climatology perspective. They should provide a context for regional physical climate outlooks by drawing attention to those climate aspects closely linked to societal vulnerabilities and to those aspects where trends have been occurring



Status

- Mature draft for southwest region was finished and distributed to participants at southwest region workshop (Aug. 1-4). Contributions to the draft included experts in the region coordinated by the Western Regional Climate Center
- Drafts for southeast and northeast regions were distributed to the Regional Climate Centers covering those regions for coordination of additional input
- Other climatologies are in preparation

Regional Outlook Status

- First draft finished for southwest region and distributed to participants in southwest region assessment workshop
- Data analysis underway for other regions



Regional Outlook Data Sets

- Direct GCM output from CMIP3 archive
- Statistically downscaled data (1/8 degree resolution)
 - Bias-Corrected Spatially Disaggregated (BCSD) monthly data
 - Daily version of BCSD data
- NARCCAP
 - 50 km resolution
 - 1971-2000 and 2041-2070
 - 8 simulations included in draft outlook
- Frich extreme indices
 - 8 GCMs



Time Periods

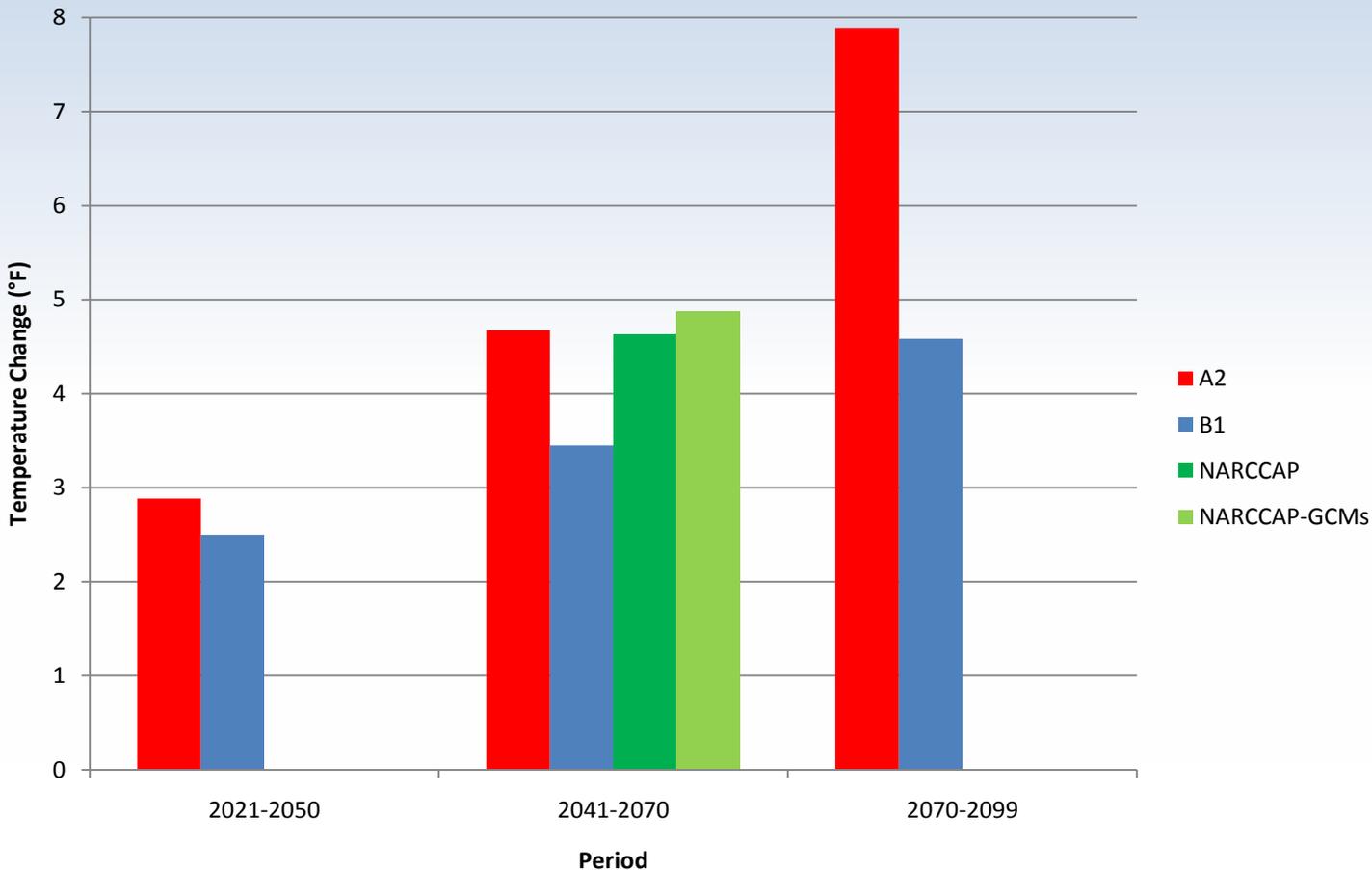
- 2021-2050: represents 25-yr outlook
- 2041-2070: matches NARCCAP period
- 2070-2099: represents 100-yr outlook



Products

- Multi-model mean maps
 - May be most robust estimate of future changes
- Spatially-averaged products
 - general comparisons of different models, periods, and data sources
- PDFs
 - estimate of the uncertainty of future changes

Southwest region temperature changes (multi-model mean values)



Distribution of southwest region temperature changes showing model-to-model variations

Period	Low	25%ile	Median	75%ile	High
A2 Scenario					
2021-2050	1.7	2.1	3.1	3.7	3.8
2041-2070	2.8	3.9	5.0	5.4	6.0
2070-2099	4.7	7.3	8.3	8.9	10.1
B1 Scenario					
2021-2050	1.3	2.1	2.7	3.0	3.5
2041-2070	1.8	2.8	3.6	4.0	4.8
2070-2099	2.7	3.8	4.8	5.7	6.3

Multi-model mean of 16 CMIP3 models, Precipitation difference (%) from 1971-2000

