North American Weather & Climate Extremes
Key Priorities for Assessing Uncertainties

What types of climate "extremes" have the greatest impacts on human society & the environment?

***Different types of extremes*:**

• Short time scale event type of phenomena (e.g., hurricanes, 100-yr flood, "exceptional heat wave", coral bleaching event.

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What types of climate "extremes" have the greatest impacts on human society & the environment?

Intermediate time scales:

- *severe/extreme "extraordinary" drought*
- *"El Niño* of the century"
- Mother of all PDO's
- A climate feature that recurs or extends for a period longer than 2 years (but arbitrarily less than about 10yrs)

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What types of climate "extremes" have the greatest impacts on human society & the environment?

Long time scales (> ~ 10 yrs):

- *Culture ending droughts -- e.g., Maya civilization, Anasazi cultures of the US Southwest*
- *Little Ice Age (demise of Greenland settlements)*
- Dust Bowl of the 1930s

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Workshop on

Assessing, Modeling, and Monitoring the Impacts of Extreme Climate Events

Hamilton, Bermuda

October 13–14, 2005

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Topics

Do we have the right tools?

- Assessing robust statistics for extreme event return periods.
- What can we say about extreme event frequency under global warming?

Are we measuring the right things?

- What, if any, improvements in the climate monitoring system are needed to develop more accurate models and estimates of extreme event statistics?

Connecting extremes to societal impacts

- What are the critical systems that will be most impacted by climate-driven extreme events?

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- *Assessing robust statistics for extreme event return periods.*

- *What can we say about extreme event frequency under global warming?*

Excerpted from David Stephenson

- (short time scales) Extreme events arise by several different dynamical processes such as:

- Fast growth caused by unstable positive feedback (e.g. baroclinic storms, tropical cyclones, convective precipitation, etc.)

- Survival of an event into a new spatial region or time period (e.g. transition of a tropical cyclone into mid-latitudes)

- Conjunction of several non-rare events (e.g., freak waves)

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Intermediate Time Scales

• Persistence of weather conditions leading to a climate extreme (e.g., drought).

• Clustering/recurrence of weather events (e.g. unusually stormy wet season).

Long Time Scales -- Multi-year to Multi-decadal

• Most likely slow changes in the background state are involved. Recurrence statistics rely on stationary processes ==➡ Violation of stationarity assumption.

- *Paleoclimate records useful and provide the longer records with which to evaluate decadal extremes*
(e.g., N=30 ensemble of 30-yr averages)

Connecting climatic extremes to societal impacts

- *What are the critical systems that will be most impacted by climate-driven extreme events?*

✓ Heat waves and morbidity. Large forest fires.
✓ Tropical cyclones: loss of life versus loss of property. River and coastal flooding. Wind storms at sea and extreme wave heights
✓ Severe convective storms (tornadoes, hail storms)

Temperature and Precipitation Extremes

Observed changes in the distribution of daily maximum and minimum temperatures *David Easterling*

Extensive summer hot and cold spells under current and possible future climatic conditions: North America and Europe *Sasha Gershunov*

Climatic extremes and their impacts: Examples from the European Alps *Martin Beniston*

Beyond mean climate change: What climate models tell us about future climate extremes *Claudia Tebaldi*

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Extreme Events--Weather Systems

Simulations of tropical cyclone activity using global and regional models at GFDL *Tom Knutson*

Statistical model of extreme U.S. hurricane winds *Jim Elsner*

Hurricane risk: Present and future *Kerry Emanuel*

A 21st Century extreme wave climate scenario for the North Pacific: Calibration and projection *Nick Graham*

Using environmental observations to estimate the distribution of severe thunderstorms *Harold Brooks*

Towards a European database on severe convective storm events: Results and implications for climatic trends in their occurrence, size or intensity *Nikolai Dotzek*

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Measuring extremes by its effects

The impact of weather and climate extremes on coral growth *James Crabbe*

Application of climate model simulations to estimating insurance loss costs *Chuck Watson*

Quantifying drought impacts and economic losses *Michael Hayes*

Climate, fire, and human extremes: The merging of shaping factors for 21st century land management *Tim Brown*

Disaster risk management in Caribbean small-island economies *Roger Pulwarty*

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What can we say about climatic extremes under increasing greenhouse warming?

- *European summer 2003 heat wave*
- *More intense synoptic events?*
- *More intense multi-year droughts/flooding?*
- *Decadal variability or climate change?*
  (hockey sticks and other games…)

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