



ASPEN GLOBAL CHANGE INSTITUTE

Weather and Climate Extremes in a Changing Climate

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Session Description

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This AGCI session will develop and summarize the scientific understanding of weather and climate extremes for the CCSP SAP 3.3. The workshop will review material developed for each of the topical areas and serve as a synthesis process for developing a draft executive summary.

The following session description is excerpted from the CCSP “Weather and Climate Extremes in a Changing Climate” synthesis and assessment product prospectus.

Description

The impact of climate extremes can be severe and wide-ranging. Extremes affect all sectors of the economy, including agriculture, utilities, transportation, water resources and the insurance industry. The costs of weather-related disasters can be considerable. The U.S. National Climatic Data Center maintains a Web page (<http://www.ncdc.noaa.gov/oa/reports/billionz.html>) that describes those events that have had the greatest economic impact in the United States since 1980. During the period 1980-2005, the United States experienced 67 weather-related disasters in which overall damages exceeded \$1 billion at the time of the event (and subsequently adjusted in terms of constant dollars).

Clearly, the direct impact of extreme weather and climate events on the U.S. economy is substantial. However, the evidence for increases in extreme weather and climate events varies, depending on the event of interest (e.g., changes in heavy and extreme precipitation, frost days, heavy snow events, etc.).

A workshop convened in Bermuda in October 2005 assembled climate scientists and insurers/reinsurers to assess the current state of knowledge of climate extremes. A

summary of the meeting is available in EOS (Vol. 87, No. 3, Jan. 17, 2006). The meeting addressed anticipated changes in the frequency of extreme events in response to global warming; whether these changes could be bounded; and the observations needed to improve knowledge (i.e. improve models and the statistics of extremes). Hurricanes were of particular interest because of recent, very active seasons and the large impact on the insurance industry. The workshop recognized the importance of both observations and models to accurately quantify risk. The need to better understand the natural and anthropogenic drivers of changes in climate extremes was underscored.

Recent and ongoing Intergovernmental Panel on Climate Change (IPCC) assessments have evaluated extreme weather and climate events in the context of climate change on a global basis. However, there has not yet been a specific focus on those events in North America, where observing systems are among the best in the world.

There is also environmental evidence that changes in weather and climate extremes have important biological impacts for both natural and managed ecosystems. In addition, there are prospects from climate model simulations that a gradually warming world will be accompanied by changes in the variability and frequency of weather and climate extremes. For all these reasons, monitoring changes and variations in weather and climate extremes, and assessing what we know and do not know regarding future changes is important for both socio-economic and environmental interests. Therefore, it is timely to undertake an in-depth assessment of the state of knowledge for North America, where we live, work, grow much of our food, etc.

Extreme weather and climate events span many weather and climate variables, and an important aspect of this synthesis and assessment report will be to identify those key variables or indices that may provide important information related to socio-economic or environmental impacts. Identifying recent changes and trends in these parameters will be a focus of the report, as well as identifying what can be said about future changes. Examples of some of the key variables include temperature related parameters (severe freezes, heat waves), precipitation related parameters (wet spells, heavy precipitation events, droughts), tropical and extra-tropical storm frequency and intensity, ice and hail, snow cover and depth, etc. Since extreme weather and climate events on a global scale are regularly addressed in international assessments, this CCSP synthesis and assessment product will focus on weather and climate extremes primarily across Canada, Mexico and the United States, including its territories. In accordance with CCSP guidelines, the synthesis and assessment products are intended to support informed discussion and decision-making regarding climate variability and change by policymakers, resource managers, stakeholders, the media and the general public. This report also should have particular value to ongoing free-trade agreements (Canada, United States and Mexico) and bi-lateral and multi-lateral agreements related to the management of natural resources in North America.

Report

The main body of the report will be presented in four chapters, the contents of which will be summarized in an Executive Summary:

- **Chapter 1. Why Weather and Climate Extremes Matter – Why are extremes important?**
 - Defining extremes in relation to social, economic and environmental impacts
 - Measures of weather and climate extremes and their data limitations
- **Chapter 2. Observed Changes of Weather and Climate Extremes**
 - Observed changes and variations in weather and climate extremes
 - Key uncertainties related to measuring specific variations and changes
- **Chapter 3. Do We Understand the Causes of Observed Changes in Extremes and What are the Projected Future Changes?**
 - What are the physical mechanisms of observed changes in extremes?
 - Attributing observed changes to external forcing
 - Projected future changes in extremes, their causes, mechanisms and uncertainties
- **Chapter 4. Recommendations for Improving Our Understanding**
- **Executive Summary**