

**Draft Prospectus for CCSP Synthesis and Assessment Product 3.3****“Climate Extremes: Analysis of the Observed Changes and Variations and Prospects for the Future”****Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific islands**

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**1. Overview: Description of Topic, Audience, Intended Use, and Questions to Be Addressed**

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 U.S. since 1980. During the period 1980-2005, the U.S. 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, January 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 our 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 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

1 reasons monitoring changes and variations in weather and climate extremes and assessing what  
2 we know and do not know regarding future changes is important for both socio-economic and  
3 environmental interests. Therefore, it is timely to undertake an in-depth assessment of the state of  
4 our knowledge for North America, where we live, work, grow much of our food, etc.

5  
6 Since extreme climate and weather events span many weather and climate variables, an  
7 important aspect of this synthesis and assessment report will be to identify those key variables or  
8 indices that may provide important information related to socio-economic or environmental  
9 impacts. Identifying recent changes and trends in these parameters will be a focus of the report,  
10 as well as identifying what can be said about future changes. Examples of some of the key  
11 variables might include temperature-related parameters (severe freezes, heat waves),  
12 precipitation-related parameters (wet spells, heavy precipitation events, droughts), tropical and  
13 extra-tropical storm frequency and intensity, ice and hail, snow cover and depth, etc. Since  
14 extreme weather and climate events on a global scale are regularly addressed in international  
15 assessments, this CCSP Synthesis and Assessment Report will focus on weather and climate  
16 extremes primarily across Canada, Mexico, and the United States, including its territories.

17  
18 In accordance with CCSP guidelines, the synthesis and assessment products are intended to  
19 support informed discussion and decision-making regarding climate variability and change by  
20 policy makers, resource managers, stakeholders, the media, and the general public. This report  
21 also should have particular value to ongoing free-trade agreements (Canada, U.S., and Mexico)  
22 and bi-lateral and multi-lateral agreements related to the management of natural resources in  
23 North America.

## 24 25 **2. Contact Information for Responsible Individuals at the Lead and Supporting** 26 **Agencies**

27  
28 The National Oceanic and Atmospheric Administration (NOAA) is the lead agency for this  
29 synthesis and assessment product. Relevant agency personnel are presented in the following table:

30 <u>CCSP Member Agency</u>	31 <u>Agency Leads</u>
32 Department of Commerce (NOAA)	Thomas Karl, Christopher Miller
33 Department of Energy	Anjuli Bamzai
34 National Aeronautics and Space Administration	Don Anderson, Tsengdar Lee
35 U.S. Geological Survey	Tom Armstrong

## 36 37 **3. Lead Authors: Required Expertise of Lead Authors and Biographical** 38 **Information for Proposed Lead Authors**

39  
40 The author team for this Product will be constituted as a Federal Advisory Committee in  
41 accordance with the Federal Advisory Committee Act (FACA) of 1972 as amended, 5 U.S.C.  
42 App.2. Each author team member shall be appointed for a term of two years, and will serve at  
43 the discretion of the Under Secretary of Commerce for Oceans and Atmosphere. Appointments  
44 are renewable for additional terms. Committee members will include non-Federal experts and  
45 Federal officials who are also experts and who may remain on the committee should they leave  
46 Federal service. Non-federal employee committee members will be subject to the ethical

1 standards applicable to Special Government Employees and to Departmental and FACA vetting  
2 procedures. The Committee Charter, a list of Committee members, and meeting announcement  
3 information will be made available to the public on a dedicated web page. Committee meetings  
4 will also be announced in the *Federal Register* at least 15 days in advance and these meetings  
5 will be open to the public. All materials made available to the Committee, as well as meeting  
6 reports, will be made available to the public unless subject to exemption under the Freedom of  
7 Information Act.

8  
9 The list of author team nominees presented in Appendix A is proposed based on past records of  
10 interest and accomplishment in framing the core issues related to changes, trends, and  
11 uncertainties in the occurrence of extreme climate events and their impacts, advancing relevant  
12 scientific arguments, and contributing to increased understanding of the behavior of respective  
13 components of the end-to-end system that provides the required data sets. Past contributions to  
14 relevant scientific assessments and publication records in refereed journals are among the  
15 measures to be used in the selection process. In addition to factors cited above, committee  
16 balance and diversity will be considered during the selection process. Dr. Thomas Karl, the  
17 Director of the National Climatic Data Center, and Dr. Gerald Meehl, of the National Center for  
18 Atmospheric Research, are nominated as co-Chairs of the FACA Committee. Once the  
19 nominations have been approved and vetting has been completed, the chapter assignments  
20 proposed in Appendix A will be confirmed.

#### 21 22 **4. Stakeholder Interactions**

23  
24 An initial workshop was held in July 2005 to bring together a number of leading scientists in the  
25 area of climate extremes and members of key segments of the stakeholder community. The  
26 primary objective of this workshop was to help frame the critical issues related to this synthesis  
27 and assessment. This framework included various aspects of the science, impacts, and  
28 stakeholders' concerns related to the changes and variations of weather and climate extremes. A  
29 specific outcome was an outline of an action plan to produce the required CCSP product, i.e., an  
30 assessment report on climate extremes. A second workshop, this one focusing more on the  
31 impacts of extreme weather and climate events for a specific stakeholder community occurred in  
32 October 2005. The output from the second workshop will be used to help refine critical issues  
33 the report will address.

34  
35 In summary, the general objectives of these workshops were to: (1) identify a framework to  
36 define climate extremes with particular ecological or economic impact; (2) assess the state of the  
37 science in the historical and contemporary measurement of climate extremes; (3) examine and  
38 clarify our ability to report on observed changes and variations; (4) examine what, if anything,  
39 we can say about future changes suggested by climate models or other relevant information,  
40 including changes in the frequency, intensity, and duration of extremes; and (5) define the  
41 measurements, analyses, and other actions required to improve our understanding of future  
42 variations and changes in weather and climate extremes. Similar issues will be the focus of the  
43 CCSP Synthesis and Assessment Product 3.3.

## 5. Drafting, Including Materials to Be Used in Preparing the Product

The lead NOAA focal point, Dr. Thomas Karl, is the Editor-in-Chief. The assistant NOAA focal point, Dr. Christopher Miller, serves as the Associate Editor. This report will be prepared in compliance with the Federal Advisory Committee Act and the report development team will be constituted and operated under FACA guidelines. The report will be written in a style consistent with major international scientific assessments [e.g., IPCC assessments, and the Global Ozone Research and Monitoring Project (WMO, 1999)].

The main body of this report will be presented in three chapters, the contents of which will be summarized in an Executive Summary (ES):

### Chapter 1. Why weather and climate extremes matter:

1.1 Why are extremes important?

1.2 Defining extremes in relation to social, economic and environmental impacts?

1.3 Measures of weather and climate extremes and their data limitations

Proposed Convening Lead Author (CLA): Thomas Peterson

Proposed Lead Authors (LA): (8) Dave Phillips, Camille Parmesan, John Stone (also ES), Ray Bradley, Miguel Cortez, Rick Murnane (also ES), Roger Pulwarty, Stewart Cohen (also ES).

### Chapter 2. Observed changes of weather and climate extremes:

2.1 Observed changes and variations in weather and climate extremes

2.2 Key uncertainties related to measuring specific variations and changes

Proposed Convening Lead Author (CLA): Kenneth Kunkel

Proposed Lead Authors (LA): (9) David Levinson, Tereza Cavazos, Art Douglas, Harold Brooks, David Easterling, Kerry Emanuel, Charles Watson, Pavel Groisman, Chris Landsea

### Chapter 3. Do we understand the causes of observed changes in extremes and what are the projected future changes?

3.1 What are the physical mechanisms of observed changes in extremes?

3.2 Attributing observed changes to external forcing

3.3 Projected future changes in extremes, their causes, mechanisms and uncertainties

3.4 Recommendations for improving our understanding.

Proposed Convening Lead Author (CLA): William Gutowski

Proposed Lead Authors (LA): (7) Linda Mearns, Greg Holland, Gabi Hegerl, Francis Zwiers, Ron Stouffer, Peter Webster, Thomas Knutson (also ES)

### Executive Summary

Proposed Convening Lead Authors (CLA): Jerry Meehl, Thomas Karl

Proposed Lead Authors (LA): (7) Thomas Peterson, Kenneth Kunkel, William Gutowski, Rick Murnane, Stewart Cohen, Tom Knutson, John Stone

Under the leadership of a convening lead author for each of the main report chapters, the lead authors and contributors will prepare the scientific/technical analysis section of the synthesis and assessment report. They will draw upon published, peer-reviewed scientific literature in the drafting process, complemented, if necessary and if approved by the CCSP Principals, with

1 information that has not yet been published in the peer-reviewed literature.

2  
3 The synthesis and assessment product will include an Executive Summary that will present key  
4 findings from each of the report chapters. It will be written by a team consisting of convening  
5 lead authors assisted by the convening lead authors from each of the chapters. The synthesis and  
6 assessment product will strive to reach consensus on the issues covered and will seek to avoid the  
7 need to include disparate views in the report chapters and in the Executive Summary. It also will  
8 include a recommendation on steps to better understand and reduce uncertainty about the  
9 frequency and severity of future climate extremes.

10  
11 The strategy for proceeding from the initiation of the effort, through the sequence of draft  
12 versions, to the final version will be in accordance with “Climate Change Science Program  
13 Guidelines for Producing CCSP Synthesis and Assessment Products” as presented on the U.S.  
14 Climate Change Science Program web page.

## 15 16 **6. Review**

17  
18 The CCSP Synthesis and Assessment Products are classified as “highly influential” under the  
19 terms of the Office of Management and Budget’s Final Information Quality Bulletin for Peer  
20 Review (issued 16 December 2004). The review process will be conducted in accordance with  
21 the OMB guidelines, which include making the peer review plan web accessible.

22  
23 NOAA, the lead agency for this product, plans to present Synthesis and Assessment Product 3.3  
24 to the NRC for scientific review. The reviewers, who will be selected by the NRC, will be  
25 charged to focus on the scientific and technical content of the draft report to ensure that the report  
26 adequately answers the questions posed in the approved prospectus, that the report is objective,  
27 unbiased, and does not contain policy recommendations, and that the report is written at a level  
28 appropriate for the intended audience that will include government and private sector managers  
29 and decision makers.

30  
31 Upon receipt of the expert review comments, all comments will be considered and addressed. The  
32 lead agency will disseminate the peer review report, including the agency’s response to the  
33 review, on the agency’s web site. A second draft of the product will be prepared and released for a  
34 45-day public comment period. The lead authors will prepare a third draft of the product in  
35 response to the public comments, incorporating changes, as appropriate.

36  
37 The third draft of the document will be submitted to the CCSP Principals for final review and  
38 subsequent submission to the National Science and Technology Council (NSTC) for approval for  
39 release.

## 40 41 **7. Related activities: Coordination with Other National or International Assessment** 42 **Processes**

43  
44 This CCSP synthesis and assessment product will be coordinated internationally through the  
45 planned direct involvement of international representatives in the author and stakeholder groups.  
46 In addition, the synthesis and assessment product is expected to complement the IPCC Fourth

1 Assessment Report, that is also due for release in 2007. The IPCC Report will focus on the  
2 behavior of extremes from the global perspective, while the CCSP report will emphasize extremes  
3 as experienced primarily on the North American continent.  
4

## 5 **8. Communications**

6

7 The first (peer review version), second (public comment version), and third (post-public  
8 comment version) drafts of the product will be posted on the CCSP web site.

9 Once the NSTC approval has been obtained and the product is finalized, NOAA, the lead agency,  
10 will produce and release the completed product using a standard format for all CCSP synthesis  
11 and assessment products. The final product, the comments received during the expert review  
12 (without attribution unless specific reviewers agree to attribution), the responses to the expert  
13 review comments, and the comments received during the public comment period will be posted  
14 on the CCSP web site.  
15

16 In addition to the formal dissemination requirements listed above, the lead authors will be  
17 encouraged to publish their findings in the scientific literature.  
18

## 19 **9. Chronology**

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### 21 **CY 2005**

22

- 23 1) Aspen Workshop: “North American Weather and Climate Extremes – Progress in  
24 Monitoring and Research” – July 15-21
- 25 2) November CCSP Stakeholder Workshop - November 14-16  
26

### 27 **CY 2006**

28

- 29 3) Draft Prospectus Submitted to CCSP Interagency Committee for Approval – March 3
- 30 4) Draft Prospectus Approved – April 4
- 31 5) Draft Prospectus Released for Public Comment – April 12
- 32 6) Public Comment Period Completed - May 12
- 33 7) Draft FACA Charter Submitted for Approval - May 20
- 34 8) Revised Prospectus Submitted to CCSP Interagency Committee for Approval - June 1
- 35 9) Prospectus Approved by CCSP Interagency Committee - July 1
- 36 10) Draft Prospectus, Public Comments, and Final Prospectus Posted on CCSP Website-July 1
- 37 11) First Draft of the Synthesis and Assessment Product Report Completed – January 15  
38

### 39 **CY 2007**

40

- 41 12) Expert Review of the Synthesis and Assessment Product Report Completed - May 15
- 42 13) Second Draft of the Synthesis and Assessment Product Report Completed –July 15
- 43 14) Second Draft of the Synthesis and Assessment Product Report Released for Public  
44 Comment –August 1
- 45 15) Second Draft Public Comment Period Completed –September 15  
46

- 1 16) Third Draft of the Synthesis and Assessment Product Report Completed and Submitted to
- 2 CCSP Interagency Committee –November 1
- 3 17) CCSP Interagency Committee Review of Third Draft Completed - November 15
- 4 18) Third Draft Report Submitted to NSTC for Final Review and Approval –December 1
- 5 19) NSTC Approval Synthesis and Assessment Product Report Third Draft Received –
- 6 December 15
- 7 20) Web Version of the Synthesis and Assessment Product Report Posted on CCSP Website –
- 8 December 31
- 9
- 10 CY 2008
- 11
- 12 21) Hardcopy of the Synthesis and Assessment Product Report Published – February 15
- 13

1 **APPENDIX A - List of Lead Authors**

2  
3 **Raymond S. Bradley** is a Distinguished Professor in the Department of Geosciences at the  
4 University of Massachusetts. He serves on the Board of Directors for the Arctic Research  
5 Consortium of the United States (ARCUS) and is a member of Max-Planck Institute for  
6 Meteorology (Hamburg) Advisory Council and the Editorial Advisory Boards: *Boreas*, *J.*  
7 *Quaternary Science*, *J. Paleolimnology*, *The Holocene*, *Key Issues in Environmental Change*  
8 *(Arnold)*, *Advances in Global Change Research & ,Developments in Paleoenvironmental*  
9 *Research (Kluwer)*. His current research interests include Paleoclimatology, climate variability,  
10 global change, arctic and alpine environments. Relevant publications include:

11  
12 Bradley, R.S., 2000. 1000 Years of climate change. *Science*, 288, 1353-1354.

13  
14 Bradley, R.S., 2000. Past global changes and their significance for the future.  
15 *Quaternary Science Reviews*, 19, 391-402.

16  
17 Bradley, R.S., K.R. Briffa, J. Cole, M.K. Hughes and T.J. Osborn, 2003: The climate of  
18 the last millennium. In: Alverson, K., *R.S. Bradley* and T.F. Pedersen (eds.)  
19 *Paleoclimate, Global Change and the Future*. Springer Verlag, Berlin, 105-141.

20  
21 Bradley, R.S., M.K Hughes and H.F. Diaz. 2003. Climate in Medieval Time. *Science*,  
22 302, 404-405.

23  
24 **Harold Brooks** is a research meteorologist and Head of the Mesoscale Applications Group of  
25 NOAA's National Severe Storms Laboratory. He was an invited speaker on severe  
26 thunderstorms at the Intergovernmental Panel on Climate Change (IPCC) Extreme Weather and  
27 Climate Change Workshop in Beijing in 2002 and was a contributing author to "Climate Change  
28 2001: The Scientific Basis", produced as a contribution of Working Group 1 to the Third  
29 Assessment Report of the IPCC. His current research interests include understanding the  
30 historical record of severe thunderstorms in the US, and estimation of the distribution of severe  
31 thunderstorms around the world and projections of future changes in that distribution. Relevant  
32 publications include:

33  
34 Brooks, H. E., and C. A. Doswell III, 2001: Normalized damage from major tornadoes in the  
35 United States: 1890-1999. */Wea. Forecasting/*, \*16\*, 168-176.

36  
37 Brooks, H. E., J. W. Lee, and J. P. Craven, 2003: The spatial distribution of severe thunderstorm  
38 and tornado environments from global reanalysis data. */Atmos. Res./*, \*67-68\*, 73-94.

39  
40 Verbout, S. M., H. E. Brooks, L. M. Leslie, and D. M. Schultz, 2006: Comparing daily U.S.  
41 tornado reports over the period 1954-2003. */Wea. Forecasting/*, \*21\*, in press.

42  
43 **Tereza Cavazos** is an Assistant Professor at the Department of Physical Oceanography,  
44 CICESE, Ensenada, Baja California, Mexico. She was a Co-convenor of the Workshop on The  
45 North American Monsoon Experiment (NAME): Oceanographic Component, Baja California,  
46 April 2003, a Co-convenor: 2004 Ocean Sciences Meeting, Oceanographic and Meteorological



1 Processes in the Gulf of California (OS20), Portland, February 2004, a Special Session co-  
2 convener: Climate Modeling in Mexico, Annual Meeting of the Mexican Geophysical Union,  
3 Puerto Vallarta, Mexico October 2005. She has served as a Reviewer for: Journal of Climate,  
4 Monthly Weather Review, Journal of Hydrometeorology, Journal of Atmospheric Sciences,  
5 Journal of Applied Meteorology, International Journal of Climatology, Climate Research,  
6 Geophysical Research, Letters, Theoretical and Applied Climatology, Atmospheric Science  
7 Letters, Annals Geographicae, Geofisica Internacional, Ingeniería Hidráulica, Ciencias Marinas  
8 and has been the author or co-author of 15 peer-reviewed articles including Journal of Climate,  
9 International Journal of Climatology, Climate Research, Geophysical Research, Letters, Journal  
10 of Hydrometeorology. Her current research interests include climate variability and downscaling,  
11 extreme events, and the North American monsoon. Relevant publications on climate extremes:  
12

13 Cerezo-Mota, R., T. Cavazos, and L. M. Farfan, 2005: Numerical simulation of heavy  
14 precipitation in northern Baja California and southern California. J. Hydrometeor. (in press).  
15

16 Cavazos, T. and D. Rivas, 2004: Variability of extreme precipitation events in Tijuana, Mexico.  
17 Climate Res., 25, 229-243.  
18

19 Cavazos, T., A. C. Comrie, and D. M. Liverman, 2002: Intraseasonal variability associated with  
20 wet monsoons in southeast Arizona. J. Climate, 15, 2477-2490.  
21

22 Cavazos, T., 1999: Large-scale circulation anomalies conducive to extreme events and  
23 simulation of daily precipitation in northeastern Mexico and southeastern Texas. J. Climate, 12,  
24 1506-1523.  
25

26 **Stewart J. Cohen** is a research scientist with Adaptation and Impacts Research Group (AIRG),  
27 Environment Canada, and an Adjunct Professor of the Sustainable Development Research  
28 Institute (SDRI) at University of British Columbia (UBC), Vancouver, Canada. Dr. Cohen  
29 received Ph.D. in Geography from the University of Illinois. He has served as a Lead Author for  
30 the IPCC Fourth Assessment Report, an Adviser to the Canadian Climate Impacts & Adaptation  
31 Research Network, a Coordinating Lead Author for the IPCC Third Assessment Report, and as  
32 an adviser/reviewer/contributor to climate impacts programs at United Nations Environment  
33 Programme (1995-8), and in the following countries: United Kingdom (1996-7, 2004),  
34 Netherlands (1994), Norway (2001, 2004), Brazil - ARIDAS (1995), United States (1989).  
35 Relevant publications include:  
36

37 Cohen, S., D. Neilsen, S. Smith, T. Neale, B. Taylor, M. Barton, W. Merritt, Y. Alila, P.  
38 Shepherd, R. McNeill, J. Tansey, and J. Carmichael (in press, Climatic Change). Learning with  
39 Local Help: Expanding the Dialogue on Climate Change and Water Management in the  
40 Okanagan Region, British Columbia, Canada.  
41

42 Cohen, S., D. Neilsen and R. Welbourn (eds.). 2004. Expanding the dialogue on climate  
43 change & water management in the Okanagan Basin, British Columbia. Final Report, Project  
44 A463/433, submitted to Climate Change Action Fund, Natural Resources Canada, Ottawa, 230  
45 pp.  
46

1 Koshida, G., M. Alden, S.J. Cohen, R. Halliday, L.D. Mortsch, V. Wittrock and A.R. Maarouf,  
2 2004, "Drought Risk Management in Canada-U.S. Transboundary Watersheds: Now and in the  
3 Future" in Drought and Water Crises: Science, Technology and  
4 Management Issues, D. A. Wilhite (ed.), CRC Press, Boca Raton, Florida, pp. 287-317.

5  
6 Cohen, S., B. Bass, D. Etkin, B. Jones, J. Lacroix, B. Mills, D. Scott and G.C. van Kooten. 2004.  
7 Regional adaptation strategies. In H. Coward and A. Weaver (eds.), Hard Choices: Climate  
8 Change in Canada, Wilfrid Laurier University Press, 151-178.  
9 Choices: Climate Change in Canada, Wilfrid Laurier University Press, 151-178.

10  
11 **Miguel Cortez** is a climatologist and the lead of the Climate Section at the Mexican National  
12 Meteorological Service and lecturer at the Department of Geography, National University of  
13 Mexico. His current research interests include climate variability, climate extremes and drought  
14 monitoring activities. Miguel also serves as the Mexican principal author for the North American  
15 Drought Monitor. Relevant publications include:

16  
17 Cortez-Vázquez, M., 1999: The annual cycle of the convective activity in Mexico (in Spanish).  
18 *Atmósfera*, **12**, 101-110.

19  
20 Cortez-Vázquez, M., 2000: Intraseasonal variability of the convective activity over Mexico and  
21 Central America (In Spanish). *Atmósfera*, **13**, 95, 108.

22  
23 Cortez-Vázquez, M., and J. Matsumoto, 2001. Intraseasonal changes in the  
24 regional circulation over Mexico. *Investigaciones Geográficas*, **46**, 30-44.

25  
26 Farfán L. M., and M. Cortez, 2005: An observational and modeling analysis of the landfall of  
27 hurricane Marty (2003) in Baja California, Mexico. *Mon. Wea. Rev.*, **133**, 2069-2090.

28  
29 **Art Douglas** is a Professor and Chair, Environmental and Atmospheric Sciences, at Creighton  
30 University. He is an elected member of NOAA's Office of Global Programs North American  
31 Monsoon Experiment Science Working Group. For the past 8 years he has served as a WMO  
32 consultant for Mexico specializing in Climate Change and Prediction. In this position he  
33 coordinates the issuance of seasonal climate outlooks for the Mexican Government and he helps  
34 to formulate strategies for detecting climate change in Mexico. In the 1980s he developed the  
35 GHCN network for Mexico and through current work with OGP's Climate Change Data and  
36 Detection Program he continues to update and add new stations to this network. In the late  
37 1990s as part of the North America Drought Monitoring Initiative, Dr. Douglas helped to  
38 establish a network of operational long-term stations in Mexico for drought monitoring.

39 Relevant climate publications include:

40  
41 Easterling, D. R., H. F. Diaz, A. V. Douglas, W.D. Hogg, K. E. Kunkel, J. C. Rogers, and J. F.  
42 Wilkinson, 1999: Long-Term Observations for Monitoring Extremes in the Americas.

43  
44 Englehart, P.J. and A.V. Douglas, 2002e: Mexico's summer rainfall patterns: an analysis of  
45 regional modes and changes in their teleconnectivity. *Atmósfera* Vol. 15, No.2: 147-164.

1 Englehart, P.J. and A.V. Douglas, 2003a: Assessing warm season drought episodes in the central  
2 United States. *Journal of Climate* Vol. 16, No. 11: 1831-1842.

3  
4 **David Easterling** is currently Chief of the Scientific Services Division at NOAA's National  
5 Climatic Data Center in Asheville, NC. He received his Ph.D. from the University of North  
6 Carolina at Chapel Hill in 1987 and served as an Assistant Professor in the Climate and  
7 Meteorology Program, Department of Geography, Indiana University-Bloomington from 1987 to  
8 1990. In 1990 he moved to the National Climatic Data Center as a research scientist, was  
9 appointed Principal Scientist in 1999, and Chief of Scientific Services in 2002. He has authored  
10 or co-authored more than sixty research articles in journals such as *Science*, *Nature* and the  
11 *Journal of Climate*. Dr. Easterling was also a contributor to the Intergovernmental Panel on  
12 Climate Change (IPCC) Second and Third Assessment Reports, and is currently a Lead Author  
13 for the IPCC Fourth Assessment Report. His research interests include the detection of climate  
14 change in the observed record, particularly changes in extreme climate events. Relevant  
15 publications include:

16  
17 Easterling, D.R. J.L. Evans, P. Ya. Groisman, T.R. Karl, K.E. Kunkel, and P. Ambenje, 2000:  
18 Observed variability and trends in extreme climate events: A brief review, *Bull. Amer. Meteor.*  
19 *Soc.*, Special Section on Climate Extremes. 81, 417-426.

20  
21 Easterling, D.R., G. Meehl, S. Changnon, C. Parmesan, T.R. Karl, and L.O. Mearns, 2000:  
22 Climate extremes: observations, modeling, and impacts, *Science*, 289, 2068-2074.

23  
24 Easterling, D.R., 2002: Recent changes in frost days and the frost-free season in the United  
25 States, *Bull. Amer. Meteor. Soc.*, 83, 1327-1332.

26  
27 Kunkel, K.E., D.R. Easterling, K. Redmond, and K. Hubbard, 2003: Temporal variations of  
28 extreme precipitation events: 1895-2000, *Geophys. Res. Letts.*, **30** (17), 1900, doi:  
29 10.1029/2003GL018052, 2003, 4pp.

30  
31 **Kerry Emanuel** is a professor of atmospheric science at the Massachusetts Institute of  
32 Technology, where he has been on the faculty since 1981, after spending three years as a faculty  
33 member at UCLA. Professor Emanuel's research interests focus on tropical meteorology and  
34 climate, with a specialty in hurricane physics. His interests also include cumulus convection, and  
35 advanced methods of sampling the atmosphere in aid of numerical weather prediction. He is the  
36 author or co-author of over 100 peer-reviewed scientific papers, and two books, including *Divine*  
37 *Wind: The History and Science of Hurricanes*, recently released by Oxford University Press and  
38 aimed at a general audience. Relevant publications include:

39  
40 Emanuel, K.A., 1997: Climate variations and hurricane activity: Some theoretical considerations.  
41 *Hurricanes, Climate and Socioeconomic Impacts*. H.F. Diaz and R.S. Pulwarty (eds.), Springer  
42 Verlag (Heidelberg), 55-65.

43 <[ftp://texmex.mit.edu/pub/emanuel/PAPERS/emanuel\\_et\\_al2004.pdf](ftp://texmex.mit.edu/pub/emanuel/PAPERS/emanuel_et_al2004.pdf)>

1 Emanuel, K., C. DesAutels, C. Holloway and R. Korty, 2004: Environmental control of tropical  
2 cyclone intensity. *J. Atmos. Sci.*, 61  
3 <[ftp://texmex.mit.edu/pub/emanuel/PAPERS/emanuel\\_et\\_al2004.pdf](ftp://texmex.mit.edu/pub/emanuel/PAPERS/emanuel_et_al2004.pdf)>, 843-858  
4

5 Emanuel, K. A., 2005: Increasing destructiveness of tropical cyclones over the past 30 years.  
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8 **Pavel Ya. Groisman** is a UCAR Project Scientist at the NOAA/NESDIS National Climatic Data  
9 Center. During the past three years he has been a Northern Eurasia Earth Science Partnership  
10 Initiative (NEESPI) Project Scientist and editor of the NEESPI Science Plan (<http://neespi.org>).  
11 During the past two decades, Dr. Groisman has been prominent in the Intergovernmental Panel  
12 on Climate Change (IPCC) Scientific Assessment activities. He has been a contributing author  
13 to all four IPCC Assessment Reports and to the recently completed Arctic Climate Impact  
14 Assessment focusing on climatic changes during the period of instrumental observations. His  
15 current research interests include studying changes in extreme events frequency and intensity  
16 over North America and Eurasia. Relevant publications include:  
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30 **William J. Gutowski, Jr.**, is a Professor of Meteorology at Iowa State University. Prof.  
31 Gutowski was a contributing author to "Climate Change 2001: The Scientific Basis", produced  
32 as a contribution of Working Group 1 to the Third Assessment Report of the IPCC, and is also a  
33 contributing author to the upcoming Fourth Assessment Report's chapter on regional climate. He  
34 is a member of a National Academy/Transportation Research Board panel to study impacts of  
35 climate change on transportation. His current research interests include regional climate change  
36 and the water cycle. Relevant publications include:  
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5 **Gabriele Hegerl** is an Associate Research Professor at Duke University. She has been prominent  
6 in the Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment activities. Prof.  
7 Hegerl is a Coordinating Lead Author of the chapter "Understanding and Attributing Climate  
8 Change" of "Climate Change 2007: The Scientific Basis", produced as a contribution of Working  
9 Group 1 to the Fourth Assessment Report of the IPCC, and was a Lead Author of the Third  
10 Assessment Report. Her current research interests include detection and attribution of climate  
11 change, and variability and changes in climate extremes. Three relevant publications:

12  
13 Hegerl, G. C., F. Zwiers, S. Kharin and Peter Stott (2004): Detectability of anthropogenic  
14 changes in temperature and precipitation extremes. *J. Climate*, 17, 3683-3700.

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20 Christidis, N., P.A. Stott, S. Brown, G. C. Hegerl and J. Caesar (2005): Detection of changes in  
21 temperature extremes during the 20th century. *Geophys. Res. Let.*, accepted.

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23 **Greg Holland** is director of the Mesoscale and Microscale Meteorology Division at the National  
24 Center for Atmospheric Research. He is a fellow of the American Meteorological Society as  
25 well as the Australian Meteorological and Oceanographic Society. He is an active member of  
26 the WMO Commission for Atmospheric Science Working Group on Tropical Meteorology  
27 Research and a current member of the NOAA Hurricane Intensity Review Working Group. Dr.  
28 Holland has several areas of research interests which have carried through to applications and  
29 include improved forecasting of tropical cyclone motion, scale interactions associated with  
30 cyclogenesis, establishment of field facilities, establishment of programs on coastal impacts of  
31 tropical cyclones and the development of Unmanned Aerial Vehicles (UAVs). He is a lead  
32 author of the recently published, "Changes in Tropical Cyclone Number, Duration, and Intensity  
33 in a Warming Environment", *Science*, Vol 309, Issue 5742, 1844-1846, 16 September 2005.  
34 Other relevant publications include:

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36 Holland, G.J., 1995: Scale interaction in the western Pacific monsoon. *Met. Atmos. Phys.*, 56,  
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42  
43 **Thomas R. Karl** is the Director of NOAA's National Climatic Data Center, Program Manager  
44 for NOAA's Climate Observations and Analysis Program, and Director of NOAA's Climate  
45 Change Data and Detection Applied Research Center. Dr. Karl is author of many climatic  
46 atlases and has nearly 200 published articles and technical reports in various scientific journals

1 on topics related to changes and variations of a variety of extreme climate and weather events.  
2 He has served as Editor of the *Journal of Climate* and as Lead Author of several scientific  
3 assessments completed by the Intergovernmental Panel on Climate Change (IPCC), Chief Editor  
4 of the CCSP Product and Synthesis Report 1.1, and served as Co-Chair of the US National  
5 Assessment of Climate Variability and Change. Selected relevant publications include:

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7 Karl, T.R. and K. E. Trenberth, 2003: Modern global climate change. *Science*, 302, 1719-1723.

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9 Karl, T.R. and D. R. Easterling, 1999: Climate extremes: Selected review and future research  
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12 Karl, T.R. and R. W. Knight, 1998: Secular trends of precipitation amount, frequency, and  
13 intensity in the United States. *Bulletin of the American Meteorological Society*, 79, 2, 231-241.

14  
15 **Thomas Knutson** is a Research Meteorologist at NOAA's Geophysical Fluid Dynamics  
16 Laboratory. His current research interests include the potential impact of climate change on  
17 hurricanes and climate change detection. He was invited to organize a special session on  
18 "Global Warming and Hurricanes" at the WMO 4th International Workshop on Tropical  
19 Cyclones in Cairns, Australia. He has presented invited lectures on this topic at a National  
20 Research Council Roundtable; an IPCC Special Workshop on Climate Extremes; a special  
21 session at an American Meteorological Society annual meeting;  
22 and other professional meetings, workshops, and universities. Relevant publications include:

23  
24 Knutson, T. R., and R. E. Tuleya, 2004: Impact of CO<sub>2</sub>-induced warming on simulated hurricane  
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34  
35 **Kenneth E. Kunkel** is Director of the Center for Atmospheric Sciences of the Illinois State  
36 Water Survey, a division of the Illinois Department of Natural Resources and an affiliated  
37 agency of the University of Illinois at Urbana-Champaign. He is also an adjunct Professor with  
38 the Department of Atmospheric Sciences of the University of Illinois. He is a member of the  
39 Advisory Committee of the Program for Climate Model Data and Intercomparison and recently  
40 served as a member of the National Academies Committee on "Review of the US Climate  
41 Change Science Program's Synthesis and Assessment Product on Temperature Trends in the  
42 Lower Atmosphere". Dr. Kunkel was a contributing author to "Climate Change 2001: The  
43 Scientific Basis", produced as a contribution of Working Group 1 to the Third Assessment  
44 Report of the IPCC. His current research interests include climate variability and extremes,  
45 regional climate modeling of extremes, and regional climate applications. Relevant publications  
46 include:

1 Kunkel, K. E., D.R. Easterling, K. Redmond, and K. Hubbard, 2003: Temporal variations of  
2 extreme precipitation events in the United States: 1895–2000, *Geophys. Res. Lett.*, 30, 1900,  
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6 events over North America. *J. Climate*, **12**, 2515-2527.

7  
8 **Christopher W. Landsea** is the Science and Operations Officer at the National Hurricane  
9 Center (NHC) in Miami. In addition to forecasting and training duties, he is responsible for  
10 administration and evaluation of Joint Hurricane Test bed projects, which may be implemented  
11 operationally to assist in the monitoring and forecasting of hurricanes. Dr.Landsea's main  
12 expertise is in seasonal forecasting of hurricanes, in hurricane climate variability and change, and  
13 in testing applied research projects for possible use in weather forecasting. He currently is  
14 leading a re-analysis of the Atlantic hurricane database. Dr. Landsea has published over 30 book  
15 chapters and scientific articles and served as the Chair of the AMS Committee on Tropical  
16 Meteorology and Tropical Cyclones for the years 2000-2002. He is currently serving on the  
17 Editorial Board for the *Bulletin of the American Meteorological Society* as the subject matter  
18 editor in tropical meteorology. Recent relevant publications include:

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20 Landsea, C. W., 2005: "Hurricanes and global warming". *Nature*, 438, E11-13,  
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30 *Hurricanes and Typhoons: Past, Present and Future*, R. J. Murname and K.-B. Liu, Eds.,  
31 Columbia University Press, 177-221.

32  
33 **David Levinson** is a Physical Scientist in the Climate Monitoring Branch at NOAA's  
34 National Climatic Data Center, where he performs research on a variety of topics related to  
35 climate extremes and the coastal climate of North America. Before joining NCDC in 2003 ,  
36 Dave worked as a meteorologist for the USDI-Bureau of Land Management in Missoula MT  
37 (from 2000-2003), the USDA-ARS Northwest Watershed Research Center in Boise ID (from  
38 1998-2000), and the NOAA/ERL Environmental Technology Laboratory in Boulder CO (from  
39 1991-1998). Dave is a long-standing member of the American Meteorological Society, and is a  
40 contributing author to the Intergovernmental Panel on Climate Change's (IPCC) Fourth  
41 Assessment Report. For the past two years Dr. Levinson has been the lead author and editor of  
42 the annual "State of the Climate" assessment that is published each year as a special section in  
43 the June issue of the *Bulletin of the American Meteorological Society*. His current research  
44 interests include developing coastal climatologies and studying sea-level rise along coastal areas  
45 of the U.S., determining trends in regional and global precipitation extremes, and development of  
46 climate indices for tropical cyclone activity. Examples of his relevant publications include:

1 Levinson, D. H. (ed.), 2005: State of the Climate in 2004. Bulletin of the American  
2 Meteorological Society, 86, S1-S86.

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4 Levinson, D. H., and A. M. Waple (eds.), 2004: State of the Climate in 2003. Bulletin of the  
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14  
15 **Linda Mearns** is a Senior Scientist at the National Center for Atmospheric Research, and the  
16 Director of the Inst. for the Study of Society and the Environment at NCAR. She is a member of  
17 the National Research Council Climate Research Committee and Human Dimensions of Global  
18 Change Committee, and has been prominent in the Intergovernmental Panel on Climate Change  
19 (IPCC) Scientific Assessment activities. Dr. Mearns was a convening lead author of "Climate  
20 Change 2001: The Scientific Basis", produced as a contribution of Working Group 1 to the Third  
21 Assessment Report of the IPCC, as well as a lead author in Climate Change 2001: Impacts,  
22 Adaptation, and Vulnerability, a contribution of the IPCC Working Group 2. Her role in these  
23 two working groups is continuing in the preparation of the Fourth Assessment Report. Her  
24 current research interests include projections of future climate change, analysis of extreme events  
25 in climate projections, quantification of uncertainty of region climate change, and agriculture-  
26 climate interactions. Relevant publications include:

27  
28 Wettstein, J. J. and L. O. Mearns, 2002: Simulating the influence of the North Atlantic-  
29 Arctic Oscillation on mean, variance, and extremes of temperature in the Northeastern U.S. and  
30 Canada. J. of Climate 15:3586--3600 (December).

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32 Mearns, L.O., R.W. Katz, and S.H. Schneider, 1984, Extreme High Temperature Events:  
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37 Scenarios: Methods, Agricultural Applications, and Measures of Uncertainty.  
38 Climatic Change 35:367--396.

39  
40 **Gerald A. Meehl** is a Senior Scientist at the National Center for Atmospheric Research. He is a  
41 member of the National Research Council Climate Research Committee and has been prominent  
42 in the Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment activities. Dr.  
43 Meehl was a coordinating lead author of "Climate Change 2001: The Scientific Basis", produced  
44 as a contribution of Working Group 1 to the Third Assessment Report of the IPCC, and is  
45 currently a coordinating lead author for the IPCC Fourth Assessment Report. His current  
46 research interests include projections of future climate change. Relevant publications include:



1 Meehl, G.A., and C. Tebaldi, 2004: More intense, more frequent and longer lasting heat waves  
2 in the 21st century. *Science*, 305, 994--997.

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4 Meehl, G.A., C. Tebaldi, and D. Nychka, 2004: Changes in frost days in simulations of 21st  
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7 Meehl, G.A., J.M. Arblaster, and C. Tebaldi, 2005: Understanding future patterns of  
8 precipitation extremes in climate model simulations. *Geophys. Res. Lett.*, in press.

9  
10 **Richard J. Murnane** is an Associate Research Scientist at the Bermuda Biological Station for  
11 Research and Program Manager for the Risk Prediction Initiative (RPI). The RPI brings  
12 scientists and insurers together with the goal of making science understandable and useable so  
13 that insurers can better assess their exposure to risk from natural hazards. He is a Contributing  
14 Author for Chapter 7, "Industry, Settlement, and Society," of the Working Group II (Climate  
15 Change Impacts, Adaptation, and Vulnerability) contribution to the Fourth Assessment Report of  
16 the IPCC. Dr. Murnane's current research interests include understanding how climate  
17 variability alters extreme events and their impacts on the insurance industry. Relevant  
18 publications include:

19  
20 Murnane, R. J., The importance of best-track data for understanding the past, present, and future  
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24 Murnane, R. J., Climate research and reinsurance, *Bulletin of the American Meteorological*  
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29 *Amer. Meteor. Soc.*, 83, 1193-1198, 2002.

30  
31 **Camille Parmesan** is an Assistant Professor at the University of Texas at Austin.  
32 She was a Lead Author on the Intergovernmental Panel on Climate Change (IPCC) Third  
33 Assessment Report (2001), and has served as Co-Organizer of the 2004 SCOPE Assessment:  
34 "Biodiversity, Global Change and Human Health", as Chair of New Task Force on Climate  
35 Change Impacts, the World Conservation Organization (IUCN), and on the NSF Ecology Panel  
36 (fall 2001 and spring 2003). Dr. Parmesan assists with the U.S. Fish and Wildlife Service  
37 Habitat Recovery Plan for Quino Checkerspot ('98-current), and was a participant and reviewer  
38 on the United States National Assessment of the Potential Consequences of Climate Variability  
39 and Change for the United States, (2000). Relevant publications include:

40  
41 Parmesan, C. & H. Galbraith (2004). Observed Impacts of Global Climate Change in the United  
42 States. Pew Center on Global Climate Change.

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3 species' ranges associated with regional warming. *Nature* 399:579-583.

4  
5 **Thomas C. Peterson** is a research meteorologist at NOAA's National Climatic Data Center in  
6 Asheville, NC. He is a lead author on the IPCC Fourth Assessment Report, a member of the  
7 GCOS Atmospheric Observation Panel for Climate, lead author on CCSP Product 1.1  
8 *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling*  
9 *Differences*, and chair of the World Meteorological Organization's Commission for Climatology  
10 Open Programme Area Group on Monitoring and Analysis of Climate Variability and Change.  
11 During 2004 and 2005 he organized four regional workshops that analyzed changes in extremes  
12 in Central America, South America, the Middle East, and south-central Asia. He is an author or  
13 co-author of eight peer-reviewed papers on observed changes in extremes. The international  
14 coordination of a suite of indices of extremes these papers are built on started in 1998 when Dr.  
15 Peterson was serving as the WMO Commission for Climatology's "rapporteur on statistical  
16 methods for climatology with emphasis on analyses of extreme events." Relevant publications  
17 include:

18  
19 Alexander, L. V. X. Zhang, T. C. Peterson, J. Caesar, B. Gleason, A. Klein Tank, M.  
20 Haylock, D. Collins, B. Trewin, F. Rahimzadeh, A. Tagipour, P. Ambenje, K. Rupa  
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24 *Journal of Geophysical Research – Atmospheres*, in press.

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35 half of the 20<sup>th</sup> century, *Climate Research*, **19**, 193-212.

36  
37 **David Phillips** has been employed with Environment Canada's weather service for 37 years, and is  
38 now a Senior Climatologist. In June 2004 he received an honorary Doctor of Environmental Studies  
39 from the University of Waterloo. His work activities relate to the study of the climate of Canada and  
40 to promoting awareness and understanding of weather and climate in Canada. He has published  
41 several books, papers and reports on the climate of Canada, including several essays in The  
42 Canadian Encyclopedia, a book on The Climates of Canada, and two bestsellers: The Day Niagara  
43 Falls Ran Dry and Blame It On The Weather. Dr. Phillips is the originator and author of the  
44 Canadian Weather Trivia Calendar, the most popular calendar sold in Canada, and now in its 18th  
45 year. For nearly ten years he wrote the Weather-wise column in the Canadian Geographic  
46 magazine. Further, he is well-known as the expert on The Weather Network. Dr. Phillips is a fellow

1 of both the Royal Canadian Geographical Society and the Canadian Meteorological and  
2 Oceanographic Society. He has been awarded the Patterson Medal for Distinguished Service to  
3 Meteorology in Canada, the Commemorative Medal for the 125th Anniversary of the Confederation  
4 of Canada, and has twice received the Public Service Merit Award. In 2001, Dr. Phillips was named  
5 to the Order of Canada.

6  
7 **Roger S. Pulwarty** is a research scientist at the NOAA-CIRES Climate Diagnostics Center at  
8 the University of Colorado in Boulder. His interests are on the role of climate and weather in  
9 society-environment interactions and in the design of effective responses to address associated  
10 risks. From 1998 to 2002 he directed the NOAA/Regional Integrated Sciences and Assessments  
11 (RISA) Program. He is a lead and contributing author on the IPCC Fourth Assessment Report  
12 Working Group 2 and directs the vulnerability assessment components of the World Bank  
13 funded program on Mainstreaming Adaptation to Climate in the Caribbean (jointly administered  
14 through an MOU with NOAA/NOS). Relevant publications include:

15  
16 Pulwarty, R., Jacobs, K., Dole, R., 2005: Drought and critical water problems in the  
17 Colorado River Basin. In Wilhite, D., (ed.) 2004: Drought and Water Crises:  
18 Science, Technology and Management. Taylor and Francis Press. New York USA

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20 Poveda, G., Waylen, P., and R. Pulwarty, 2005: Modern climate variability in northern South  
21 America and northern Mesoamerica: Implications for the interpretation of paleorecords.  
22 Palaeogeography, Palaeoclimatology, Palaeoecology (in press)

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24 Pulwarty, R., 2003: Climate and water in the West: Science, Information and Decisionmaking.  
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28 Frerkes, G., and Hilhorst, T., (Eds.) Mapping Vulnerability: Disasters, Development and People.  
29 Earthscan pp. 83-98

30  
31 **John Stone** has recently retired from the position of Executive Director (Climate Change) with  
32 the Canadian government's Department of Environment. Trained in the UK in chemistry,  
33 mathematics and physics, he holds a PhD in molecular spectroscopy. He spent over 30 years  
34 working for the Canadian government assuming increasing responsibilities first in the Ministry  
35 of State for Science and Technology, and later in the Department of Foreign Affairs and  
36 International Trade, the National Research Council's Bureau of International Affairs and finally  
37 Environment Canada. During the last 15 years of his career he directed research programs on  
38 climate and atmospheric sciences as well as developed policy on a range of environmental  
39 issues. He has had considerable experience in international science and policy having served  
40 Canada through his affiliation with the NATO Science Committee, the International Institute for  
41 Applied Systems Analysis, the UN/ECE Senior Advisors on Science and Technology, UN the  
42 Framework Convention on Climate Change, the Scientific Steering Committee for the START  
43 program and as co-Chair for the Canada-Germany S&T Agreement. In 1997 he was appointed to  
44 the Bureau of the Intergovernmental Panel on Climate Change (IPCC), specifically as Vice-  
45 Chair of Working Group I, and has since been re-appointed, now as a Vice-Chair of Working  
46 Group II. Relevant publications include:

1 Climate Change: Science, Politics and the Media, Stone JMR, in Statistics, Science and Public  
2 Policy IX: Government, Science and Politics, Queens University Press, (2005).

3  
4 The Science of Changing Climates: Impacts on Agriculture, Forestry and Wetlands - Synthesis  
5 Paper, Stone JMR, (in press, 2004).

6  
7 The Ancillary Benefits of Tackling Climate Change, Stone JMR, (convening lead author),  
8 internal Environment Canada policy paper (2002).

9  
10 Intergovernmental Panel on Climate Change, Climate Change 2001: Synthesis Report, Review  
11 Editor.

12  
13 Intergovernmental Panel on Climate Change, Third Assessment Report, Summary for  
14 Policymakers, (2001), member of drafting team and of Working Group I Bureau.

15  
16 **Ronald J Stouffer** is a climate scientist at NOAA's Geophysical Dynamics Laboratory (GFDL)  
17 in Princeton, NJ. He is a member of the CMIP (Coupled Model Intercomparison Project) panel  
18 and PMIP (PaleoModeling Intercomparison Project) panels. He has served on a number of  
19 WCRP (World Climate Research Project) committees involving climate modeling. Stouffer has  
20 been a lead author in the past 2 Intergovernmental Panel on Climate Change (IPCC) Scientific  
21 Assessment reports and is a lead author in the current IPCC report under development. His  
22 research interests include projections of future climate change and the study of past and present  
23 climates. Relevant publications include:

24  
25 Braganza, K., D. J. Karoly, A. C. Hirst, M. E. Mann, P. Stott, R. J. Stouffer, and S. F. B. Tett,  
26 2003: Simple indices of global climate variability and change: Part I - variability and correlation  
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32 Knutson, T. R., T. L. Delworth, 1999: Model assessment of regional surface temperature trends  
33 (1949-1997). *Journal of Geophysical Research*, 104(D24), 30,981-30,996.

34  
35 **Charles C Watson Jr.** is the Director of Research and Development of Kinetic Analysis  
36 Corporation, based in Savannah, Georgia. He is presently an advisor on extreme event  
37 climatology and modeling to a wide variety of public and private sector organizations including  
38 the states of Florida and North Carolina, the Organization of American States, the Caribbean  
39 Development Bank, and numerous engineering firms. Mr. Watson has contributed as an expert  
40 reviewer to the IPCC Fourth Assessment Report First Order Draft. His primary research area is  
41 incorporating climate variability, especially extreme events, in engineering design criteria,  
42 insurance and financial analyses, and mitigation planning. Recent relevant publications include:

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8 **Peter Webster** is Professor of Earth and Atmospheric Sciences and Environmental Engineering  
9 at Georgia Institute of Technology. For the last 20 years he has concentrated on the investigation  
10 of tropical atmospheres and oceans with an emphasis on the monsoons of Asia. In recent years  
11 he has directed the Climate Forecast Applications in Bangladesh, which is aimed at producing  
12 forecasts of rainfall and floods on time scales from seasonal to daily and at introducing modern  
13 predictive techniques to developing countries. Part of the CFAB effort is to forecast hurricanes in  
14 regions of low technical resources. Most of Webster's research combines theoretical and  
15 modeling techniques although he has organized many field experiments including TOGA  
16 Coupled Ocean-Atmosphere Response Experiment (a multinational experiment in the western  
17 Pacific Ocean), the Equatorial mesoscale experiment and the Joint Air-Sea Monsoon Interaction  
18 Experiment (JASMINE) in the Bay of Bengal. He has received numerous awards including the J.  
19 G. Charney and the Carl Gustav Rossby medals from the American Meteorological Society, the  
20 two highest research awards presented to an atmospheric scientist in the US. He is a fellow of the  
21 American Meteorological Society, the American Geophysical Union, the Royal Meteorological  
22 Society and the American Association for the Advancement of Science. Webster has written one  
23 textbook, 15 book chapters and in excess of 200 scientific articles. Recent relevant publications  
24 include:

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33 **Francis Zwiers** is a Senior Research Scientist and Chief of the Canadian Centre for Climate  
34 Modelling and Analysis, and an Adjunct Professor at the University of Victoria. He serves on a  
35 number of panels, is co-chair of the CCI/CLIVAR Expert Team on Climate Change Detection,  
36 Monitoring and Indices, has served as an Editor of the Journal of Climate and has been  
37 prominent in the Intergovernmental Panel on Climate Change (IPCC) Scientific Assessment  
38 activities. Dr. Zwiers is a Coordinating Lead Author of the chapter "Understanding and  
39 Attributing Climate Change" of "Climate Change 2007: The Scientific Basis", which is being  
40 produced as a contribution of Working Group 1 to the Fourth Assessment Report of the IPCC,  
41 and was a lead author of the climate change detection chapter of the Third Assessment Report.  
42 His current research interests include the analysis of change in climatic extremes, detection and  
43 attribution of climatic change, and climate forecasting on seasonal to decadal scales. Recent  
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