BIOGRAPHIES

Unified Synthesis Product Federal Advisory Committee Author Team

David M. Anderson is the Director for the World Data Center for Paleoclimatology, Chief of the Paleoclimatology Branch of NOAA's National Climatic Data Center, and an Associate Professor at the University of Colorado.

Donald F. Boesch is currently Vice Chancellor for Environmental Sustainability for the University System of Maryland. His area of expertise is biological oceanography.

Virginia Rose Burkett is the Chief Scientist for Global Change Research at the U.S. Geological Survey. Her areas of expertise are coastal ecology, wetland management, and forestry.

Lynne M. Carter is the Director of the Adaptation Network, a non-profit organization, and a project of the Earth Island Institute. Through assessment and action, she works to build resilience in communities and ecosystems in the face of a changing climate.

Stewart J. Cohen is senior researcher with the Adaptation and Impacts Research Division of Environment Canada, and an Adjunct Professor with the Department of Forest Resources Management of the University of British Columbia.

Nancy B. Grimm is a Professor of Life Sciences at Arizona State University. She studies how human-environment interactions and climate variability influence biogeochemical processes in both riverine and urban ecosystems.

Jerry L. Hatfield is the Laboratory Director of the USDA-ARS National Soil Tilth Laboratory in Ames, Iowa. His expertise is in the quantifications of spatial and temporal interactions across the soil-plant-atmosphere continuum.

Katharine Hayhoe is a Research Associate Professor in the Department of Geosciences at Texas Tech University and Principal Scientist and CEO of ATMOS Research & Consulting. Her research examines the potential impacts of human activities on the global environment.

Anthony C. Janetos is the Director of the Joint Global Change Research Institute, a joint venture between the Pacific Northwest National Laboratory and the University of Maryland. His area of expertise is biology.

Thomas R. Karl, (Co-Chair), is the Director of NOAA's National Climatic Data Center. His areas of expertise include monitoring for climate change and changes in extreme climate and weather events. He is also president of the American Meteorological Society.

Jack A. Kaye currently serves as Associate Director for Research of the Earth Science Division within NASA's Science Mission Directorate. He is responsible for NASA's research and data analysis programs in Earth System Science.

Jay Lawrimore is Chief of the Climate Monitoring Branch at NOAA's National Climatic Data Center. He has led a team of scientists that monitors the Earth's climate on an operational basis.

James J. McCarthy is Alexander Agassiz Professor of Biological Oceanography. His areas of expertise are biology and oceanogrphy. He is also President of the American Association for the Advancement of Science.

A. David McGuire is a Professor of Ecology in the U.S. Geological Survey's Alaska Cooperative Fish and Wildlife Research Unit located at the University of Alaska Fairbanks. His areas of expertise are ecosystem ecology and terrestrial feedbacks to the climate system.

Jerry M. Melillo, (Co-Chair), is the Director of The Ecosystems Center at the Marine Biological Laboratory in Woods Hole. He specializes in understanding the impacts of human activities on the biogeochemistry of ecological systems.

Edward L. Miles is the Virginia and Prentice Bloedel Professor of Marine Studies and Public Affairs at the University of Washington. His fields of specialization are international science and technology policy, marine policy and ocean management, and the impacts of climate variability and change.

Unified Synthesis Product Federal Advisory Committee Author Team

Evan Mills is currently a Staff Scientist at the U.S. Department of Energy's Lawrence Berkeley National Laboratory. His areas of expertise are energy systems and risk management in the context of climate change.

Jonathan Overpeck is a climate system scientist at the University of Arizona, where he is also the Director of the Institute for the Study of Planet Earth, as well as a Professor of Geosciences and a Professor of Atmospheric Sciences.

Jonathan Patz is a Professor & Director of Global Environmental Health at the University of Wisconsin in Madison. He has earned medical board certification in both Occupational/Environmental Medicine and Family Medicine.

Thomas C. Peterson, (Co-Chair), is a physical scientist at NOAA's National Climatic Data Center in Asheville, North Carolina. His areas of expertise include data fidelity, international data exchange and global climate analysis using both *in situ* and satellite data.

Roger S. Pulwarty is a physical scientist and the Director of the National Integrated Drought Information System Program at NOAA in Boulder, Colorado. His interests are in climate risk assessment and adaptation.

Benjamin Santer is an atmospheric scientist at Lawrence Livermore National Laboratory. His research focuses on climate model evaluation, the use of statistical methods in climate science, and identification of "fingerprints" in observed climate records.

Michael J. Savonis has 25 years of experience in transportation policy, with extensive expertise in air quality and emerging environmental issues. He currently serves as a Senior Policy Advisor at the Federal Highway Administration.

Henry G. "Gerry" Schwartz Jr., is an internationally known expert in environmental and civil engineering. He is past-president of both the Water Environment Federation and the American Society of Civil Engineers, a member of the National Academy of Engineering, and a private consultant.

Eileen L. Shea serves as Director of the NOAA Integrated Data and Environmental Applications Center. Her educational experience focused on marine science, environmental law, and resource management.

John M.R. Stone is an Adjunct Research Professor in the Department of Geography and Environmental Studies at Carleton University. He has spent the last 20 years managing climate research in Canada and helping to influence the dialogue between science and policy.

Bradley H. Udall is the Director of the University of Colorado Western Water Assessment. He was formerly a consulting engineer at Hydrosphere Resource Consultants. His expertise includes water and policy issues of the American West and especially the Colorado River.

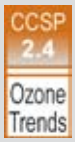
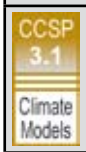
John E. Walsh is a President's Professor of Global Change at the University of Alaska, Fairbanks and Professor Emeritus of Atmospheric Sciences at the University of Illinois. His research interests include the climate of the Arctic, extreme weather events as they relate to climate, and climate-cryosphere interactions.

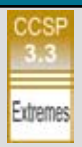
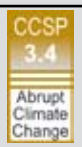
Michael F. Wehner is a member of the Scientific Computing Group at the Lawrence Berkeley National Laboratory in Berkeley, California. He has been active in both the design of global climate models and in the analysis of their output.

Thomas J. Wilbanks is a Corporate Research Fellow at the Oak Ridge National Laboratory and leads the Laboratory's Global Change and Developing Country Programs. He conducts research on such issues as sustainable development and responses to concerns about climate change.

Donald J. Wuebbles is a Professor in the Department of Atmospheric Sciences at the University of Illinois. His research emphasizes the study of chemical and physical processes of the atmosphere towards improved understanding of the Earth's climate and atmospheric composition.

PRIMARY SOURCES OF INFORMATION

Icon	Description
	Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences
	Past Climate Variability and Change in the Arctic and at High Latitudes
	Re-Analyses of Historical Climate Data for Key Atmospheric Features: Implications for Attribution of Causes of Observed Change
	Scenarios of Greehhouse Gas Emissions and Atmospheric Concentrations, Review of Integrated Scenario Development and Application
	North American Carbon Budget and Implications for the Global Carbon Cycle
	Aerosol Properties and their Impacts on Climate
	Trends in Emissions of Ozone-Depleting Substances, Ozone Layer Recovery, & Implications for Ultraviolet Radiation Exposure
	Climate Models: An Assessment of Strengths and Limitations
	Climate Projections Based on Emissions Scenarios for Long-Lived Radiatively Active Trace Gases and Future Climate Impacts of Short-Lived Radiatively Active Gases and Aerosols

Icon	Description
	Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands
	Abrupt Climate Change
	Thresholds of Change in Ecosystems
	The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity
	Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources
	Effects of Climate Change on Energy Production and Use in the United States
	Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems
	Impacts of Climate Variability and Change on Transportation Systems and Infrastructure -- Gulf Coast Study
	Uses and Limitations of Observations, Data, Forecasts, and Other Projections in Decision Support for Selected Sectors and Regions
	Decision Support Experiments and Evaluations Using Seasonal to Interannual Forecasts and Observational Data

Icon	Description
	Working Group I The Physical Science Basis of Climate Change
	Working Group II Impacts, Adaptation and Vulnerability
	Working Group III Mitigation of Climate Change
	National Assessment Synthesis Team Climate Change Impacts on the United States: *The Potential Consequences of Climate Variability and Change*
	Recent Material Articles recently released
	Original Synthesis Material synthesized from existing data
	Arctic Climate Impact Assessment
	National Research Council, Transportation Research Board: The Potential Impacts of Climate Change on U.S. Transportation, *Climate Variability and Change with Implications for Transportation*

ACRONYMS

ARS: Agricultural Research Service
CCSP: Climate Change Science Program
CIESIN: Center for International Earth Science Information Network
CIRES: Cooperative Institute for Research in Environmental Sciences
CMIP: Coupled Model Intercomparison Project
DOE: Department of Energy
EIA: Energy Information Administration
GAO: General Accounting Office
IARC: International Arctic Research Center
IPCC: Intergovernmental Panel on Climate Change
NASA: National Aeronautics and Space Administration
NASS: National Agricultural Statistics Service
NAST: National Assessment Synthesis Team
NCDC: National Climatic Data Center
NESDIS: National Environmental Satellite, Data, and Information Service
NOAA: National Oceanic and Atmospheric Administration
NRCS: Natural Resources Conservation Service
NSIDC: National Snow and Ice Data Center
NWS: National Weather Service
NWFSC: Northwest Fisheries Science Center
PISCO: Partnership for Interdisciplinary Studies of Coastal Oceans
PLJV: Playa Lakes Joint Venture
SAP: Synthesis and Assessment Product
SRH: Southern Regional Headquarter
USACE:United States Army Corps of Engineers
USBR: United States Bureau of Reclamation
USDA: United States Department of Agriculture
USDOE: United States Department of Energy
USEPA: United States Environmental Protection Agency
USFS: United States Forest Service
USGAO: United States Government Accountability Office
USGS: United States Geological Survey

[†]See *Global Climate Change* section on emission scenarios, pages 23-25.

GLOBAL CLIMATE CHANGE

[1] Historical data: Lüthi, D., M. Le Floch, B. Bereiter, T. Blunier, J.-M. Barnola, U. Siegenthaler, D. Raynaud, J. Jouzel, H. Fischer, K. Kawamura, and T.F. Stocker, 2008: High-resolution carbon dioxide concentration record 650,000-800,000 years before present. *Nature*, **453(7193)**, 379-382.

2007 data: Tans, P., 2008: *Trends in Atmospheric Carbon Dioxide: Mauna Loa*. NOAA Earth System Research Laboratory (ESRL). [web site] <http://www.esrl.noaa.gov/gmd/ccgg/trends/> Data available at <ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt>

2100 projected data: International Institute for Applied System Analysis (IIASA) GGI Scenario Database, 2008. <http://www.iiasa.ac.at/Research/GGI/DB/>

[2] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz, and R. Van Dorland, 2007: Changes in atmospheric constituents and in radiative forcing. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 129-234.

[3] Ko, M., J.S. Daniel, J.R. Herman, P.A. Newman, and V. Ramaswamy, 2008: The future and recovery. In: Trends in Emissions of Ozone-depleting Substances, Ozone Layer Recovery, and Implications for Ultraviolet Radiation Exposure. [Ravishankara, A.R., M.J. Kurylo, and C.A. Ennis (eds.)]. Synthesis and Assessment Product 2.4. NOAA's National Climatic Data Center, Asheville, NC, pp. 133-154.

[4] Shindell, D.T., H. Levy II, A. Gilliland, M.D. Schwarzkopf, and L.W. Horowitz, 2008: Climate change from short-lived emissions due to human activities. In: *Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols*. [Levy II, H., D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, and L.W. Horowitz, (eds.)]. Synthesis and Assessment Product 3.2. U.S. Climate Change Science Program, Washington, DC, pp. 27-60.

[5] Hansen, J., M. Sato, R. Ruedy, A. Lacis, and V. Oinas, 2000: Global warming in the twenty-first century: an alternative scenario. *Proceedings of the National Academy of Sciences*, **97(18)**, 9875-9880.

[6] Santer, B.D., J.E. Penner, and P.W. Thorne, 2006: How well can the observed vertical temperature changes be reconciled with our understanding of the causes of these changes? In: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences*. [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 U.S. Climate Change Science Program, Washington, DC, pp. 89-118.

[7] Hansen, J., M. Sato, R. Ruedy, L. Nazarenko, A. Lacis, G.A. Schmidt, G. Russell, I. Aleinov, M. Bauer, S. Bauer, N. Bell, B. Cairns, V. Canuto, M. Chandler, Y. Cheng, A. Del Genio, G. Faluveg E. Fleming, A. Friend, T. Hall, C. Jackman, M. Kelley, N. Kiang, D. Koch, J. Lean, J. Lerner, K. Lo, S. Menon, R. Miller, P. Minnis, T. Novakov, V. Oinas, Ja. Perlwitz, Ju. Perlwitz, D. Rind, A. Romanou, D. Shindell, P. Stone, S. Sun, N. Tausnev, D. Thresher, B. Wielicki, T. Wong, M. Yao, and S. Zhang 2005: Efficacy of climate forcings. *Journal of Geophysical Research*, **110**, D18104, doi:10.1029/2005JD005776.

[8] National Research Council, 2005: *Radiative Forcing of Climate Change: Expanding the Concept and Addressing Uncertainties*. National Academies Press, Washington DC, 207 pp.

[9] Field, C.B., J. Sarmiento, and B. Hales, 2007: The carbon cycle of North America in a global context. In: *The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle* [King, A.W., L. Dilling, G.P. Zimmerman, D.M. Fairman, R.A. Houghton, G. Marland, A.Z. Rose, and T.J. Wilbanks (eds.)]. Synthesis and Assessment Product 2.2. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, pp. 21-28.

[10] Canadell, J.G., C. Le Quéré, M.R. Raupach, C.B. Field, E.T. Buitenhuis, P. Ciais, T.J. Conway, N.P. Gillett, R.A. Houghton, and G. Marland, 2007: Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks. *Proceedings of the National Academy of Sciences*, **104(47)**, 18866-18870.

[11] Karl, T.R., C.D. Miller, and W.L. Murray, 2006: Preface: Report motivation and guidance for using the synthesis/assessment report. In: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences*. [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 U.S. Climate Change Science Program, Washington, DC, pp. v-x.

[12] The spatial average of annual-average surface air temperatures around the globe is commonly referred to as the global average surface air temperature.

[13] Meier, M.F., M.B. Dyurgerov, U.K. Rick, S. O'Neel, W.T. Pfeffer, R.S. Anderson, S.P. Anderson, and A.F. Glazovsky, 2007: Glaciers dominate eustatic sea-level rise in the 21st century. *Science*, **317(5841)**, 1064-1067.

[14] Trenberth**,** K.E., P.D. Jones, P. Ambenje, R. Bojariu, D. Easterling, A. Klein Tank, D. Parker, F. Rahimzadeh, J.A. Renwick, M. Rusticucci, B. Soden, and P. Zhai, 2007: Observations: surface and atmospheric climate change. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 235-335.

[15] Uncertainties in the data are an order of magnitude smaller than the trend according to Karl, T.R., J.R. Christy, R.A. Clarke, G.V. Gruza, J. Jouzel, M.E. Mann, J. Oerlemans, M.J. Salinger, and S.-W. Wang, 2001: Observed climate variability and change. In: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 99-181.

Temperature data:

Smith, T.M. and R.W. Reynolds, 2004: Improved extended reconstruction of SST (1854–1997). *Journal of Climate*, **17(12)**, 2466-2477.

Jones, P.D., M. New, D.E. Parker, S. Martin, and I.G. Rigor, 1999: Surface air temperature and its changes over the past 150 years. *Reviews of Geophysics*, **37(2)**, 173-199.

Carbon dioxide data:

Data from 1974 to present: Tans, P., 2008: *Trends in Atmospheric Carbon Dioxide: Mauna Loa*. NOAA Earth System Research Laboratory (ESRL). [web site] <http://www.esrl.noaa.gov/gmd/ccgg/trends/> Data available at <ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt>

1958-1974 data are from the Scripps Institution of Oceanography (Keeling) Mauna Loa Observatory record. <http://scrippsco2.ucsd.edu/>

Pre-1958 values are annual points taken from a smooth fit to the Law Dome data: Etheridge, D.M., L.P. Steele, R.L. Langenfelds, R.J. Francey, J.-M. Barnola, and V.I. Morgan, 1996: Natural and anthropogenic changes in atmospheric CO_2 over the last 1000 years from air in Antarctic ice and firn. *Journal of Geophysical Research*, **101(D2)**, 4115-4128.

[16] Lanzante, J.R., T.C. Peterson, F.J. Wentz, and K.Y. Vinnikov, 2006: What do observations indicate about the change of temperatures in the atmosphere and at the surface since the advent of measuring temperatures vertically? In: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences* [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 U.S. Climate Change Science Program, Washington, DC, pp. 47-70.

[17] Santer, B.D., P.W. Thorne, L. Haimberger, K.E. Taylor, T.M.L. Wigley, J.R. Lanzante, S. Solomon, M. Free, P.J. Gleckler, P.D. Jones, T.R. Karl, S.A. Klein, C. Mears, D. Nychka, G.A. Schmidt, S.C. Sherwood, and F.J. Wentz, 2008: Consistency of modelled and observed temperature trends in the tropical troposphere. *International Journal of Climatology*, **28(13)**, 1703-1722.

[18] Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger, 2008: Human-induced changes in the hydrology of the western United States. *Science*, **319(5866)**, 1080-1083.

[19] Willett, K.M., N.P. Gillett, P.D. Jones, and P.W. Thorne, 2007: Attribution of observed surface humidity changes to human influence. *Nature*, **449(7163)**, 710-712.

[20] Santer, B.D., C. Mears, F.J. Wentz, K.E. Taylor, P.J. Gleckler, T.M.L. Wigley, T.P. Barnett, J.S. Boyle, W. Brüggemann, N.P. Gillett, S.A. Klein, G.A. Meehl, T. Nozawa, D.W. Pierce, P.A. Stott, W.M. Washington, and M.F. Wehner, 2007: Identification of human-induced changes in atmospheric moisture content. *Proceedings of the National Academy of Sciences*, **104(39)**, 15248-15253.

[21] Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley, and A. Unnikrishnan, 2007: Observations: oceanic climate change and sea level. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 385-432.

[22] Barnett, T.P., D.W. Pierce, K.M. AchutaRao, P.J. Gleckler, B.D. Santer, J.M. Gregory, and W.M. Washington, 2005: Penetration of human-induced warming into the world's oceans. *Science*, **309(5732)**, 284-287.

[23] Pierce, D.W., T.P. Barnett, K.M. AchutaRao, P.J. Gleckler, J.M. Gregory, and W.M. Washington, 2006: Anthropogenic warming of the oceans: observations and model results. *Journal of Climate*, **19(10)**, 1873-1900.

[24] Lemke, P., J. Ren, R.B. Alley, I. Allison, J. Carrasco, G. Flato, Y. Fujii, G. Kaser, P. Mote, R.H. Thomas, and T. Zhang, 2007: Observations: changes in snow, ice and frozen ground. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 337-383.

[25] Luthcke, S.B., H.J. Zwally, W. Abdalati, D.D. Rowlands, R.D. Ray, R.S. Nerem, F.G. Lemoine, J.J. McCarthy, and D.S. Chinn, 2006: Recent Greenland ice mass loss by drainage system from satellite gravity observations. *Science*, **314(5803)**, 1286-1289.

[26] IPCC (Intergovernmental Panel on Climate Change), 1996: Summary for policy makers. In: *Climate Change 1995: The Science of Climate Change*. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change. [Houghton, J.T., L.G. Meiro Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 1-7.

[27] IPCC (Intergovernmental Panel on Climate Change), 2007: Summary for policymakers. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 1-18.

[28] Wigley, T.M.L., V. Ramaswamy, J.R. Christy, J.R. Lanzante, C.A. Mears, B.D. Santer, and C.K. Folland, 2006: Executive summary. In: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences* [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 U.S. Climate Change Science Program, Washington, DC, pp. 1-15.

[29] National Research Council, 2006: *Surface Temperature Reconstructions for the Last 2,000 Years*. National Academies Press, Washington DC, 196 pp.

[30] Mann, M.E., Z. Zhang, M.K. Hughes, R.S. Bradley, S.K. Miller, S. Rutherford, and F. Ni, 2008: Proxy-based reconstructions of hemispheric and global surface temperature variations over the past two millennia. *Proceedings of the National Academy of Sciences*, **105(36)**, 13252-13257.

[31] Hegerl, G.C., F.W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A.

Marengo Orsini, J.E. Penner and P.A. Stott, 2007: Understanding and attributing climate change. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK and New York, pp. 663-745

[32] Santer, B.D. and T.M.L. Wigley, 2008: Progress in detection and attribution research. In: *Climate Change Science and Policy*. [S. Schneider, editor] in press

[33] LeTreut, H., R. Somerville, U. Cubasch, Y. Ding, C. Mauritzen, A. Mokssit, T. Peterson, and M. Prather, 2007: Historical overview of climate changes science. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 93-127.

[34] Santer, B.D., T.M.L. Wigley, T.P. Barnett, and E. Anyamba, 1996: Detection of climate change, and attribution of causes. In: *Climate Change 1995: The Science of Climate Change*. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., L.G. Meiro Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 407-443.

[35] Mitchell, J.F.B., D.J. Karoly, G.C. Hegerl, F.W. Zwiers, M.R. Allen, and J. Marengo, 2001: Detection of climate change and attribution of causes. In: *Climate Change 2001: The Scientific Basis*. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 695-738.

[36] Santer, B.D., M.F. Wehner, T.M.L. Wigley, R. Sausen, G.A. Meehl, K.E. Taylor, C. Ammann, J. Arblaster, W.M. Washington, J.S. Boyle, and W. Brüggemann, 2003: Contributions of anthropogenic and natural forcing to recent tropopause height changes. *Science*, **301(5632)**, 479-483.

[37] Zhang, X., F.W. Zwiers, G.C. Hegerl, F.H. Lambert, N.P. Gillett, S. Solomon, P.A. Stott and T. Nozawa, 2007: Detection of human influence on twentieth-century precipitation trends. *Nature*, **448(7152)**, 461-465.

[38] Burke, E.J., S.J. Brown, and N. Christidis, 2006: Modeling the recent evolution of global drought and projections for the twenty-first century with the Hadley Centre climate model. *Journal of Hydrometeorology*, **7(5)**, 1113-1125.

[39] Gillett, N.P., F.W. Zwiers, A.J. Weaver, and P.A. Stott, 2003: Detection of human influence on sea level pressure. *Nature*, **422(6929)**, 292-294.

[40] Gedney, N., P.M. Cox, R.A. Betts, O. Boucher, C. Huntingford, and P.A. Stott, 2006: Detection of a direct carbon dioxide effect in continental river runoff records. *Nature*, **439(7078)**, 835-838.

[41] Min, S.-K, X. Zhang, F.W. Zwiers, and T. Agnew, 2008: Human influence on Arctic sea ice detectable from early 1990s onwards. *Geophysical Research Letters*, **35**, L21701, doi:10.1029/2008GL035725.

[42] Gillett, N.P., D.A. Stone, P.A. Stott, T. Nozawa, A.Y. Karpechko, G.C. Hegerl, M.F. Wehner, and P.D. Jones, 2008: Attribution of polar warming to human influence. *Nature Geoscience*, **1(11)**, 750-754.

[43] Stott, P.A., 2003: Attribution of regional-scale temperature changes to anthropogenic and natural causes. *Geophysical Research Letters*, **30(14)**, 1724, doi:10.1029/2003GL017324.

[44] Zwiers, F.W. and X. Zhang, 2003: Towards regional-scale climate change detection. *Journal of Climate*, **16(5)**, 793-797.

[45] Santer, B.D., T.M.L. Wigley, P.J. Glecker, C. Bonfils, M.F. Wehner, K. AchutaRao, T.P. Barnett, J.S. Boyle, W. Brüggemann, M. Fiorino, N.P. Gillett, J.E. Hansen, P.D. Jones, S.A. Klein, G.A. Meehl, S.C.B. Raper, R.W. Reynolds, K.E. Taylor, and W.M. Washington, 2006: Forced and unforced ocean temperature changes in Atlantic and Pacific tropical cyclogenesis regions. *Proceedings of the National Academy of Sciences*, **103(38)**, 13905-13910.

[46] Gillett, N.P., P.A. Stott, and B.D. Santer, 2008: Attribution of cyclogenesis region sea surface temperature change to anthropogenic influence. *Geophysical Research Letters*, **35**, L09707, doi:10.1029/2008GL033670.

[47] Root, T.L., D.P. MacMynowski, M.D. Mastrandrea, and S.H. Schneider, 2005: Human-modified temperatures induce species changes: joint attribution. *Proceedings of the National Academy of Sciences*, **102(21)**, 7465-7469.

[48] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008. Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 151-181.

[49] CCSP, 2006: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences* [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 U.S. Climate Change Science Program, Washington, DC, 164 pp.

[50] Smith, T.M., R.W. Reynolds, T.C. Peterson, and J. Lawrimore, 2008: Improvements to NOAA's historical merged land–ocean surface temperature analysis (1880–2006). *Journal of Climate*, **21(10)**, 2283-2296.

[51] Haimberger, L., C. Tavolato, and S. Sperka, 2008: Toward elimination of the warm bias in historic radiosonde temperature records – some new results from a comprehensive intercomparison of upper air data. *Journal of Climate*, **21(18)**, 4587-4606.

[52] Sherwood, S.C., C.L. Meyer, R.J. Allen, and H.A. Titchner, 2008: Robust tropospheric warming revealed by iteratively homogenized radiosonde data. *Journal of Climate*, **21(20)**, 5336-5352.

[53] Titchner H.A., P.W. Thorne, M.P. McCarthy, S.F.B. Tett, L. Haimberger, D.E. Parker, 2008: Critically reassessing tropospheric temperature trends from radiosondes using realistic validation experiments. *Journal of Climate*, Early online release, doi:10.1175/2008JCLI2419.1.

[54] Ramaswamy, V., J.W. Hurrell, G.A. Meehl, A. Phillips, B.D. Santer, M.D. Schwarzkopf, D.J. Seidel, S.C. Sherwood, and P.W. Thorne, 2006: Why do temperatures vary vertically (from the surface to

the stratosphere) and what do we understand about why they might vary and change over time? In: *Temperature Trends in the Lower Atmosphere: Steps for Understanding and Reconciling Differences* [Karl, T.R., S.J. Hassol, C.D. Miller, and W.L. Murray (eds.)]. Synthesis and Assessment Product 1.1 Climate Change Science Program, Washington, DC, pp. 15-28.

[55] Wentz, F.J., L. Ricciardulli, K. Hilburn, and C. Mears, 2007: How much more rain will global warming bring? *Science*, **317(5835)**, 233-235.

[56] Allen, M.R., 2003: Liability for climate change. *Nature*, **421(6926)**, 891-892.

[57] Stott, P.A., D.A. Stone, and M.R. Allen, 2004: Human contribution to the European heatwave of 2003. *Nature*, **432(7017)**, 610-614.

[58] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[59] CCSP, 2008: Introduction. In: *Climate Models: An Assessment of Strengths and Limitations* [Bader, D.C., C. Covey, W.J. Gutowski Jr., I.M. Held, K.E. Kunkel, R.L. Miller, R.T. Tokmakian, and M.H. Zhang (authors)]. Synthesis and Assessment Product 3.1 Department of Energy, Office of Biological and Environmental Research, Washington, DC, pp. 7-12.

[60] Randall, D.A., R.A. Wood, S. Bony, R. Coman, T. Fichefet, J. Fyfe, V. Kattsov, A. Pitman, J. Shukla, J. Srinivasan, R.J. Stouffer, A. Sumi, and K.E. Taylor, 2007: Climate models and their evaluation. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 589-662.

[61] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[62] Nakićenović, N. and R. Swart (eds.), 2000: *Special Report on Emissions Scenarios*. A special report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, 599 pp. http://www.ipcc.ch/ipccreports/sres/emission/index.htm

[63] Seidel, D.J., Q. Fu, W.J. Randel, and T.J. Reichler, 2008: Widening of the tropical belt in a changing climate. *Nature Geoscience*, **1(1)**, 21-24.

[64] Emanuel, K., 2005: Increasing destructiveness of tropical cyclones over the past 30 years. *Nature*, **436(7051)**, 686-688.

[65] Vecchi, G.A., K.L. Swanson, and B.J. Soden, 2008: Whither hurricane activity? *Science*, **322(5902)**, 687-689.

[66] Rahmstorf, S., 2006: A semi-empirical approach to projecting future sea-level rise. *Science*, **315(5810)**, 368-370.

[67] Church, J.A., N.J. White, T. Aarup, W.S. Wilson, P.L. Woodworth, C.M. Domingues, J.R. Hunter, and K. Lambeck, 2008: Understanding global sea levels: past, present and future. *Sustainability Science*, **3(1)**, 9-22.

[68] Pfeffer, W.T., J.T. Harper, and S. O'Neel, 2008: Kinematic constraints on glacier contributions to 21st-century sea-level rise. *Science*, **321(5894)** 1340-1343.

[69] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[70] Raupach, M.R., G. Marland, P. Ciais, C. Le Quéré, J.G.Canadell, G. Klepper, and C.B. Field, 2007: Global and regional drivers of accelerating CO_2 emissions. *Proceedings of the National Academy of Sciences,* **104(24)**, 10288-10293.

[71] O'Neill, B.C. and M. Oppenheimer, 2004: Climate change impacts are sensitive to the concentration stabilization path. *Proceedings of the National Academy of Sciences,* **101(47)**, 16411-16416.

[72] Schneider, S.H. and M.D. Mastrandrea, 2005: Probabilistic assessment of ''dangerous'' climate change and emissions pathways. *Proceedings of the National Academy of Sciences,* **102(44)**, 15728-15735.

[73] Lenton, T.M., H. Held, E. Kriegler, J.W. Hall, W. Lucht, S. Rahmstorf, and H.J. Schellnhuber, 2008: Tipping elements in the Earth's climate system. *Proceedings of the National Academy of Sciences,* **105(6)**, 1786-1793.

[74] Hansen, J., M. Sato, R. Ruedy, P. Kharecha, A. Lacis, R. Miller, L. Nazarenko, K. Lo, G.A. Schmidt, G. Russell, I. Aleinov, S. Bauer, E. Baum, B. Cairns, V. Canuto, M. Chandler, Y. Cheng, A. Cohen, A. Del Genio, G. Faluvegi, E. Fleming, A. Friend, T. Hall, C. Jackman, J. Jonas, M. Kelley, N.Y. Kiang, D. Koch, G. Labow, J. Lerner, S. Menon, T. Novakov, V. Oinas, Ja. Perlwitz, Ju. Perlwitz, D. Rind, A. Romanou, R. Schmunk, D. Shindell, P. Stone, S. Sun, D. Streets, N. Tausnev, D. Thresher, N. Unger, M. Yao, and S. Zhang, 2007: Dangerous human-made interference with climate: a GISS model study. *Atmospheric Chemistry and Physics,* 7(9), 2287-2312.

[75] Ramanathan, V. and Y. Feng, 2008: On avoiding dangerous anthro-

pogenic interference with the climate system: formidable challenges ahead. *Proceedings of the National Academy of Sciences*, **105(38)**, 14245-14250.

[76] Meinshausen, M., 2006: What does a 2°C target mean for greenhouse gas concentrations? - A brief analysis based on multi-gas emission pathways and several climate sensitivity uncertainty estimates. In: *Avoiding Dangerous Climate Change* [Schellnhuber, J.S., W. Cramer, N. Nakićenović, T.M.L. Wigley, and G. Yohe (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 265-280.

[77] Meinshausen, M., B. Hare, T.M.L. Wigley, D. van Vuuren, M.G.J. den Elzen, and R. Swart, 2006: Multi-gas emission pathways to meet climate targets. *Climatic Change*, **75(1)**, 151-194.

[78] Clarke, L., J. Edmonds, H. Jacoby, H. Pitcher, J. Reilly, and R. Richels, 2007: *Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations*. Sub-report 2.1A of Synthesis and Assessment Product 2.1. Department of Energy, Office of Biological & Environmental Research, Washington, DC, 154 pp.

[79] IPCC Emissions Scenarios (Even higher, Higher Emission Scenario, Lower Emission Scenario): Nakićenović, N. and R. Swart (eds.), 2000: Appendix VII: Data tables. In: *Special Report on Emissions Scenarios*. A special report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York. <http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/> Emission trajectories are spline fits as per Raupach, M.R., G. Marland, P. Ciais, C. Le Quéré, J.G. Canadell, G. Klepper, and C.B. Field, 2007: Global and regional drivers of accelerating CO_2 emissions. *Proceedings of the National Academy of Sciences*, **104(24)**, 10288-10293.

Stabilization scenarios (550 ppm, 450 ppm): CCSP 2.1a Scenario Information 070707 data file. From: Clarke, L., J. Edmonds, H. Jacoby, H. Pitcher, J. Reilly, and R. Richels, 2007: *Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations*. Sub-report 2.1A of Synthesis and Assessment Product 2.1. Department of Energy, Office of Biological & Environmental Research, Washington, DC. The emissions and concentrations shown were from MINICAM 1 and 2. See CCSP 2.1a Executive summary for more information. Spread sheet available at <http://www.climatescience.gov/Library/sap/sap2-1/finalreport/default.htm>

Observations of CO_2 emissions (Fossil Fuel CO_2 Emissions graphic) are updates to: Marland, G., B. Andres, T. Boden, 2008: *Global CO_2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring: 1751-2005*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, TN. <http://cdiac.ornl.gov/ftp/ndp030/global.1751_2005.ems>

Observations of CO_2 concentrations (Atmospheric CO_2 Concentrations graphic): Tans, P., 2008: *Trends in Atmospheric Carbon Dioxide: Mauna Loa*. NOAA Earth System Research Laboratory (ESRL). [web site] <http://www.esrl.noaa.gov/gmd/ccgg/trends/> Data available at <ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_annmean_mlo.txt>

[80] Hare, B. and M. Meinshausen, 2006: How much warming are we committed to and how much can be avoided? *Climatic Change*, **75(1)**, 111-149.

[81] den Elzen, M.G.J. and M. Meinshausen, 2006: Multi-gas emission pathways for meeting the EU 2°C climate target. In: *Avoiding Dangerous Climate Change* [Schellnhuber, J.S., W. Cramer, N. Nakićenović, T.M.L. Wigley and G. Yohe (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 299-310.

[82] Clark, P.U., A.J. Weaver, E. Brook, E.R. Cook, T.L. Delworth, and K. Steffen, 2008: Introduction: Abrupt changes in the Earth's climate system. In: *Abrupt Climate Change*. Synthesis and Assessment Product 3.4. U.S. Geological Survey, Reston, VA, pp. 19-59.

NATIONAL CLIMATE CHANGE

[1] Smith, T.M., R.W. Reynolds, T.C. Peterson, and J. Lawrimore, 2008: Improvements to NOAA's historical merged land–ocean surface temperature analysis (1880–2006). *Journal of Climate*, **21(10)**, 2283-2296.

[2] Temperatures for the contiguous U.S. are based on data from the US Historical Climatology Network Version 2 (Menne *et al*. 2008). Temperatures for Alaska, Hawaii, and Puerto Rico are based on data from the Cooperative Observers Network adjusted to remove non-climatic influences such as changes in instruments and observer practices and changes in the station environment (Menne and Williams, 2008).

US time series on page 27 is calculated with data for the contiguous US, Alaska, and Hawaii. US map on page 28 lower left includes observed temperature change in Puerto Rico. Winter temperature trend map in the agriculture section, page 76, is for the contiguous US only.

References for this endnote:

Menne, M.J., C.N. Williams, and R.S. Vose, 2008: The United States Historical Climatology Network Monthly Temperature Data - Version 2. *Bulletin of the American Meteorological Society*, in review.

Menne, M.J. and C.N. Williams Jr., 2008: Homogenization of temperature series via pairwise comparisons. *Journal of Climate*, Early online release, doi: 10.1175/2008JCLI2263.1.

[3] CMIP3-C: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

The Alaskan projections are based on 14 models that best captured the present climate of Alaska; see Walsh, J.E., W.L. Chaman, V. Romanovsky, J.H. Christensen, and M. Stendel, 2008: Global climate model performance over Alaska and Greenland. *Journal of Climate*, **21(23)**, 6156-6174.

Caribbean and Pacific islands analyses use 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1,

INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[4] Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton, 2007: Regional climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 847-940.

[5] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[6] Nakićenović, N. and R. Swart (eds.), 2000: *Special Report on Emissions Scenarios*. A special report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, 599 pp. <http://www.ipcc.ch/ipccreports/sres/emission/index.htm>

[7] Detailed local-scale projections about temperature and precipitation changes displayed in this report were generated using well-documented "statistical downscaling" techniques [Wood *et al*., 2002] for the contiguous U.S. and Alaska. These techniques use statistical relationships between surface observations and climate simulations of the past to develop modifications for the global model results. These modifications are then applied to the climate projections for the future scenarios. The approach is also used to drive daily simulations by a well-established hydrological modeling framework for the contiguous U.S. [Liang *et al*., 1994]. This method, which modifies global climate model simulations to better account for landscape variations and other features affecting climate at the regional to local scale, has been previously applied to generate high-resolution regional climate projections for the Northeast, Midwest, Northwest, and Southwest [Wood *et al*., 2004; Hayhoe *et al*., 2004; Hayhoe *et al*., 2008; Cayan *et al*., 2008; Cherkauer *et al*., 2009]. Comparison of these methods with dynamically downscaled projections generated using regional climate model simulations provide strong justification for the use of such techniques [Wood *et al*., 2004; Hayhoe *et al*., 2008].

References for this endnote:

Cayan, D., E. Maurer, M. Dettinger, M. Tyree, and K. Hayhoe, 2008: Climate change scenarios for the California region. *Climatic Change*, **87(Supplement 1)**, S21-S42.

Cherkauer, K. et al. 2009: Hydrology paper in special issue of *Journal of Great Lakes Research*.

Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427.

Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436.

Liang, X., D. Lettenmaier, E. Wood, and S. Burges, 1994: A simple hydrologically-based model of land surface water and energy fluxes for general circulation models. *Journal of Geophysical Research*, **99(D7)**, 14415-14428.

Maurer, E.P., A.W. Wood, J.C. Adam, D.P. Lettenmaier, and B. Nijssen, 2002: A long-term hydrologically-based data set of land surface fluxes and states for the conterminous United States. *Journal of Climate*, **15(22)**, 3237-3251.

Wood, A.W., L.R. Leung, V. Sridhar, and D.P. Lettenmaier, 2004: Hydrologic implications of dynamical and statistical approaches to downscaling climate model outputs. *Climatic Change*, **62(1-3)**, 189-216.

Wood, A.W., E.P. Maurer, A. Kumar, and D.P. Lettenmaier, 2002: Long range experimental hydrologic forecasting for the eastern U.S. *Journal of Geophysical Research*, **107(D20)**, 4429, doi:10.1029/2001JD000659.

[8] Trenberth, K.E., P.D. Jones, P. Ambenje, R. Bojariu, D. Easterling, A. Klein Tank, D. Parker, F. Rahimzadeh, J.A. Renwick, M. Rusticucci, B. Soden, and P. Zhai, 2007: Observations: surface and atmospheric climate change. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 235-335.

[9] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[10] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily

precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[11] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[12] Groisman, P.Ya., R.W. Knight, T.R. Karl, D.R. Easterling, B. Sun, and J.H. Lawrimore, 2004: Contemporary changes of the hydrological cycle over the contiguous United States, trends derived from *in situ* observations. *Journal of Hydrometeorology*, **5(1)**, 64-85. The climate regions are different than those used in this article but the methodology is identical.

[13] Karl, T.R., G.A. Meehl, T.C. Peterson, K.E. Kunkel, W.J. Gutowski Jr., and D.R. Easterling, 2008: Executive summary. In: *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 1-9.

[14] Lemke, P., J. Ren, R.B. Alley, I. Allison, J. Carrasco, G. Flato, Y. Fujii, G. Kaser, P. Mote, R.H. Thomas, and T. Zhang, 2007: Observations: changes in snow, ice and frozen ground. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 337-383.

[15] Data from Guttman, N.B. and R.G. Quayle, 1996: A historical perspective of U.S. climate divisions. *Bulletin of the American Meteorological Society*, **77(2)**, 293-303.

[16] USGS, 2005: *Changes in Streamflow Timing in the Western United States in Recent Decades*. USGS fact sheet 2005-3018. U.S. Geological Survey, National Streamflow Information Program, La Jolla, CA, 4 pp. <http://pubs.usgs.gov/fs/2005/3018/>

[17] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[18] Vecchi, G.A., K.L. Swanson, and B.J. Soden, 2008: Whither hurricane activity? *Science*, **322(5902)**, 687-689.

[19] Number of strongest hurricanes, number of landfalling strongest hurricanes, and number of landfalling hurricanes are based on data obtained from NOAA's Oceanographic and Meteorological Laboratory: <http://www.aoml.noaa.gov/hrd/hurdat/ushurrlist18512005-gt.txt> with updates. The total number of named storms are adjusted to account for missing tropical storms and hurricanes in the pre-satellite era using the method of Vecchi and Knutson (2008). Basin and landfalling totals are displayed in 5-year increments (pentads) from 1881 through 2010. The final 5-year period was standardized to a comparable 5-year period assuming the level of activity from 2006 to 2008 persists through 2010.

Vecchi, G.A. and T.R. Knutson, 2008: On estimates of historical North Atlantic tropical cyclone activity. *Journal of Climate*, **21(14)**, 3580-3600.

[20] Elsner, J.B., J.P. Kossin, and T.H. Jagger, 2008: The increasing intensity of the strongest tropical cyclones. *Nature*, **455(7209)**, 92-95.

[21] Emanuel, K., 2007: Environmental factors affecting tropical cyclone power dissipation. *Journal of Climate*, **20(22)**, 5497-5509.

[22] Bell, G.D. and M. Chelliah, 2006: Leading tropical modes associated with interannual and multidecadal fluctuations in North Atlantic hurricane activity. *Journal of Climate*, **19(4)**, 590-612.

[23] Levinson, D.H. and J. Lawrimore (eds.), 2008: State of the climate in 2007. *Bulletin of the American Meteorological Society*, **89(7, Supplement)**, S1-S179.

[24] Kossin, J.P., K.R. Knapp, D.J. Vimont, R.J. Murnane, and B.A. Harper, 2007: A globally consistent reanalysis of hurricane variability and trends. *Geophysical Research Letters*, **34**, L04815, doi:10.1029/2006GL028836.

[25] Elsner, J.B., J.P. Kossin, and T.H. Jagger, 2008: The increasing intensity of the strongest tropical cyclones. *Nature*, **455(7209)**, 92-95.

[26] Rahmstorf, S., A. Cazenave, J.A. Church, J.E. Hansen, R.F. Keeling, D.E. Parker, and R.C.J. Somerville, 2007: Recent climate observa-

tions compared to projections. *Science*, **316(5825)**, 709.

[27] Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley, and A. Unnikrishnan, 2007: Observations: oceanic climate change and sea level. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 385-432.

[28] Clark, P.U., A.J. Weaver, E. Brook, E.R. Cook, T.L. Delworth, and K. Steffen, 2008: Introduction: Abrupt changes in the Earth's climate system. In: *Abrupt Climate Change*. Synthesis and Assessment Product 3.4. U.S. Geological Survey, Reston, VA, pp. 19-59.

[29] Zervas, C., 2001: *Sea Level Variations of the United States 1985-1999*. NOAA technical report NOS CO-OPS 36. National Oceanic and Atmospheric Administration, Silver Spring, MD, 66 pp. <http://tidesandcurrents.noaa.gov/publications/techrpt36doc.pdf>

[30] Sea-level rise numbers are calculated based on an extrapolation of NOAA tide gauge stations with records exceeding 50 years, as reported in Zervas, C., 2001: *Sea Level Variations of the United States 1985-1999*. NOAA technical report NOS CO-OPS 36. National Oceanic and Atmospheric Administration, Silver Spring, MD, 66 pp. <http://tidesandcurrents.noaa.gov/publications/techrpt36doc.pdf>

[31] Kunkel, K.E., N.E. Westcott, and D.A.R. Knistovich, 2002: Assessment of potential effects of climate changes on heavy lake-effect snowstorms near Lake Erie. *Journal of Great Lakes Research*, **28(4)**, 521-536.

[32] Burnett, A.W., M.E. Kirby, H.T. Mullins, and W.P. Patterson, 2003: Increasing Great Lake-effect snowfall during the twentieth century: a regional response to global warming? *Journal of Climate*, **16(21)**, 3535-3542.

[33] ACIA, 2005: *Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 1042 pp. <http://www.acia.uaf.edu/pages/scientific.html>

[34] L'Heureux, M.L., A. Kumar, G.D. Bell, M.S. Halpert, and R.W. Higgins, 2008: Role of the Pacific-North American (PNA) pattern in the 2007 Arctic sea ice decline. *Geophysical Research Letters*, **35**, L20701, doi:10.1029/2008GL035205.

[35] Min, S.-K, X. Zhang, F.W. Zwiers, and T. Agnew, 2008: Human influence on Arctic sea ice detectable from early 1990s onwards. *Geophysical Research Letters*, **35**, L21701, doi:10.1029/2008GL035725.

[36] Johannessen, O.M., 2008: Decreasing Arctic sea ice mirrors increasing CO_2 on decadal time scale. *Atmospheric and Oceanic Science Letters*, **1(1)**, 51-56.

[37] Polyak, L., J. Andrews, J. Brigham-Grette, D. Darby, A. Dyke, S. Funder, M. Holland, A. Jennings, J. Savelle, M. Serreze, and E. Wolff, _____: History of sea ice in the Arctic. In: *Past Climate Variability and Change in the Arctic and at High Latitude* [__ (eds.)]. Synthesis and Assessment Product 1.2. U.S. Climate Change Science Program, Washington, DC. {Not yet published}

[38] Images from *Sea Ice Yearly Minimum 1979-2007.* [website] NASA/Goddard Space Flight Center Scientific Visualization Studio. Thanks to Rob Gerston (GSFC) for providing the data. <http://svs.gsfc.nasa.gov/goto?3464>

[39] Modified from Pacala, S., R. Birdsey, S. Bridgham, R.T. Conant, K. Davis, B. Hales, R. Houghton, J.C. Jenkins, M. Johnston, G. Marland, and K. Paustian, 2007: The North American carbon budget past and present. In: *The First State of the Carbon Cycle Report (SOCCR): The North American Carbon Budget and Implications for the Global Carbon Cycle* [King, A.W., L. Dilling, G.P. Zimmerman, D.F. Fairman, R.A. Houghton, G. Marland, A.Z. Rose, and T.J. Wilbanks (eds.)]. Synthesis and Assessment Product 2.2. U.S. Climate Change Science Program, Washington, DC, pp. 29-36.

CLIMATE CHANGE IMPACTS BY SECTOR

WATER RESOURCES

[1] Bates, B.C., Z.W. Kundzewicz, S. Wu, and J.P. Palutikof (eds.), 2008: *Climate Change and Water*. Technical paper of the Intergovernmental Panel on Climate Change. IPCC Secretariat, Geneva, Switzerland, 210 pp.

[2] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[3] Hegerl, G.C., F.W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J. Marengo Orsini, N. Nicholls, J.E. Penner, and P.A. Stott, 2007: Understanding and attributing climate change. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 663-745.

[4] Feng, S. and Q. Hu, 2007: Changes in winter snowfall/precipitation ratio in the contiguous United States. *Journal of Geophysical Research*, **112**, D15109, doi:10.1029/2007JD008397.

[5] Knowles, N., M.D. Dettinger, and D.R. Cayan, 2006: Trends in snowfall versus rainfall in the western United States. *Journal of Climate*, **19(18)**, 4545-4559.

[6] Guttman, N.B. and R.G. Quayle, 1996: A historical perspective of U.S. climate divisions. *Bulletin of the American Meteorological Society*, **77(2)**, 293-303.

[7] Groisman, P.Ya., R.W. Knight, D.R. Easterling, T.R. Karl, G.C. Hegerl, and V.N. Razuvaev, 2005: Trends in intense precipitation in the climate record. *Journal of Climate*, **18(9)**, 1326-1350.

[8] Kundzewicz, Z.W., L.J. Mata, N.W. Arnell, P. Döll, P. Kabat, B. Jiménez, K.A. Miller, T. Oki, Z. Sen, and I.A. Shiklomanov, 2007: Freshwater resources and their management. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 173-210.

[9] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Re-

port of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[10] Milly, P.C.D., J. Betancourt, M. Falkenmark, R.M. Hirsch, Z. Kundzewicz, D.P. Lettenmaier, and R.J. Stouffer, 2008: Stationarity is dead: Whither water management? *Science*, **319(5863)**, 573-574.

[11] Lettenmaier, D., D. Major, L. Poff, and S. Running, 2008: Water resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 121-150.

[12] Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H.P. Huang, N. Harnik, A. Leetmaa, N.C. Lau, C. Li, J. Velez, and N. Naik, 2007: Model projections of an imminent transition to a more arid climate in southwestern North America. *Science*, **316(5828)**, 1181-1184.

[13] Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton, 2007: Regional climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 847-940.

[14] Christensen, N.S., A.W. Wood, N. Voisin, D.P. Lettenmaier, and R.N. Palmer, 2004: The effects of climate change on the hydrology and water resources of the Colorado River basin. *Climatic Change*, **62(1-3)**, 337-363.

[15] Mote, P., A. Hamlet, and E. Salathé, 2008: Has spring snowpack declined in the Washington Cascades? *Hydrology and Earth System Sciences*, **12(1)**, 193-206.

[16] Stewart, I.T., D.R. Cayan, and M.D. Dettinger, 2004: Changes in snowmelt runoff timing in western North America under a 'business as usual' climate change scenario. *Climatic Change*, **62(1-3)**, 217-232.

[17] Stewart, I.T., D.R. Cayan, and M.D. Dettinger, 2005: Changes toward earlier streamflow timing across western North America. *Journal of Climate*, **18(8)**, 1136-1155.

[18] Rauscher, S.A., J.S. Pal, N.S. Diffenbaugh, and M.M. Benedetti, 2008: Future changes in snowmelt-driven runoff timing over the western US. *Geophysical Research Letters*, **35**, L16703, doi:10.1029/2008GL034424.

[19] Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger, 2008: Human-induced changes in the hydrology of the western United States. *Science*, **319(5866)**, 1080-1083.

[20] Ebi, K.L., J. Balbus, P.L. Kinney, E. Lipp, D. Mills, M.S. O'Neill, and M. Wilson, 2008: Effects of global change on human health. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 2-1 to 2-78.

[21] Bull, S.R., D.E. Bilello, J. Ekmann, M.J. Sale, and D.K. Schmalzer, 2007: Effects of climate change on energy production and distribution in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States*. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 45-80.

[22] Hyman, R.C., J.R. Potter, M.J. Savonis, V.R. Burkett and J.E. Tump, 2008: Why study climate change impacts on transportation? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Department of Transportation, Washington, DC, [48 pp.]

[23] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 21-74.

[24] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008. Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 151-181.

[25] EPA, 2008: *National Water Program Strategy: Response to Climate Change*. U.S. Environmental Protection Agency, Washington, DC, 97 pp. <http://www.epa.gov/water/climatechange/>

[26] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[27] Winter, J., J.W. Harvey, O.L. Franke, and W.M. Alley, 1998: *Ground Water and Surface Water: A Single Resource*. USGS circular 1139. U.S. Geological Survey, Denver, CO, 79 pp. <http://pubs.usgs.gov/

circ/circ1139/>

[28] Alley, W.M., T.E. Reilly, and O.L. Franke, 1999: *Sustainability of Ground-water Resources*. USGS circular 1186. U.S. Geological Survey, Denver, CO, 79 pp. <http://pubs.usgs.gov/circ/circ1186/>

[29] Alley, W.M., R.W. Healy, J.W. LaBaugh, and T.E. Reilly, 2002: Flow and storage in groundwater systems. *Science*, **296(5575)**, 1985-1990.

[30] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[31] Holzer, T.L. and D. Galloway, 2005: Impacts of land subsidence caused by withdrawal of underground fluids in the United States. *Reviews in Engineering Geology*, **16**, 87-99.

[32] Austin, J.A. and S.M. Colman, 2007: Lake Superior summer water temperatures are increasing more rapidly than regional air temperatures: a positive ice-albedo feedback. *Geophysical Research Letters*, **34**, L06604, doi:10.1029/2006GL029021.

[33] General Accounting Office, 2003: *Freshwater Supply: States' Views of How Federal Agencies Could Help Them Meet the Challenges of Expected Shortages*. GAO-03-514. General Accounting Office, Washington, DC, 110 pp. <http://www.gao.gov/new.items/d03514.pdf>

[34] EPA, 2002: *The Clean Water and Drinking Water Infrastructure Gap Analysis*. EPA-816-R-02-020. U.S. Environmental Protection Agency, Washington, DC, 50 pp. <http://www.epa.gov/safewater/gapreport.pdf>

[35] National Research Council, 2004: *Confronting the Nation's Water Problems: The Role of Research*. National Academies Press, Washington, DC, 310 pp.

[36] Yohe, G.W., R.D. Lasco, Q.K. Ahmad, N.W. Arnell, S.J. Cohen, C. Hope, A.C. Janetos, and R.T. Perez, 2007: Perspectives on climate change and sustainability. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 811-841.

[37] Bureau of Reclamation, 2005: *Water 2025: Preventing Crises and Conflict in the West*. Bureau of Reclamation, U.S. Department of the Interior, Washington, DC, 32 pp.

[38] Wilbanks, T.J., P. Romero Lankao, M. Bao, F. Berkhout, S. Cairncross, J.-P. Ceron, M. Kapshe, R. Muir-Wood, and R. Zapata-Marti, 2007: Industry, settlement and society. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 357-390.

[39] Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit, and K. Takahashi, 2007: Assessment of adaptation practices, options, constraints and capacity. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 717-743.

[40] Hartmann, H.C., 2008: Decision support for water resources management. In: *Uses and Limitations of Observations, Data, Forecasts and Other Projections in Decision Support for Selected Sectors and Regions*. Synthesis and Assessment Product 5.1. U.S. Climate Change Science Program, Washington, DC, pp. 45-55.

[41] Feldman, D.L., K.L. Jacobs, G. Garfin, A. Georgakakos, B. Morehouse, R. Webb, B. Yarnal, J. Kochendorfer, C. Rosenzweig, M. Sale, B. Udall, and C. Woodhouse, 2008: Decision-support experiments within the water resource management sector. In: *Decision-Support Experiments and Evaluations using Seasonal-to-Interannual Forecasts and Observational Data: A Focus on Water Resources* [Beller-Simms, N., H. Ingram, D. Feldman, N. Mantua, K.L. Jacobs, and A.M. Waple (eds.)]. Synthesis and Assessment Product 5.3. NOAA's National Climatic Data Center, Asheville, NC, pp. 65-100.

[42] Cook, E.R., C. Woodhouse, C.M. Eakin, D.M. Meko, and D.W. Stahle, 2004: Long-term aridity changes in the western United States. *Science*, **306(5698)**, 1015-1018.

[43] Cook, E.R., P.J. Bartlein, N. Diffenbaugh, R. Seager, B.N. Shuman, R.S. Webb, J.W. Williams, and C. Woodhouse, 2008: Hydrological variability and change. In: *Abrupt Climate Change*. Synthesis and Assessment Product 3.4. U.S. Geological Survey, Reston, VA, pp. 143-257.

[44] Ingram, H., D. Feldman, N. Mantua, K.L. Jacobs, D. Fort, N. Beller-Simms, and A.M. Waple, 2008: The changing context. In: *Decision-Support Experiments and Evaluations using Seasonal-to-Interannual Forecasts and Observational Data: A Focus on Water Resources* [Beller-Simms, N., H. Ingram, D. Feldman, N. Mantua, K.L. Jacobs, and A.M. Waple (eds.)]. Synthesis and Assessment Product 5.3. NOAA's National Climatic Data Center, Asheville, NC, pp. 7-28.

[45] Medellin-Azuara, J., J.J. Harou, M.A. Olivares, K. Madani, J.R. Lund, R.E. Howitt, S.K. Tanaka, M.W. Jenkins, and T. Zhu, 2008: Adaptability and adaptations of California's water supply system to dry climate warming. *Climatic Change*, **87(Supplement 1)**, S75-S90.

[46] Tanaka, S.K., T. Zhu, J.R. Lund, R.E. Howitt, M.W. Jenkins, M.A. Pulido, M. Tauber, R.S. Ritzema, and I.C. Ferreira, 2006: Climate warming and water management adaptation for California. *Climatic Change*, **76(3-4)**, 361-387.

[47] McCabe, G.J. and D.M. Wolock, 2007: Warming may create substantial water supply shortages in the Colorado River basin. *Geophysical Research Letters*, **34**, L22708, doi:10.1029/2007GL031764.

[48] Brekke, L., B. Harding, T. Piechota, B. Udall, C. Woodhouse, and D. Yates (eds.), 2007: Appendix U: Climate Technical Work Group Report: Review of science and methods for incorporating climate change information into Bureau of Reclamation's Colorado River Basin planning studies. In: *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead: Final Environmental Impact Statement*. Bureau of Reclamation, Boulder City, NV, 110 pp. <http://www.usbr.gov/lc/region/programs/strategies/FEIS/index.html>

[49] Department of Energy, 2006: *Energy Demands on Water Resources. Report to Congress on the Interdependency of Energy and Water*. Sandia National Laboratories, Albuquerque, NM, 80 pp. <http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf>

[50] California Energy Commission, 2005: *California's Water -- Energy Relationship*. CEC-700-2005-011-SF. California Energy Commission, [Sacramento], 174 pp. <http://www.energy.ca.gov/2005publications/CEC-700-2005-011/CEC-700-2005-011-SF.PDF>

[51] California Energy Commission, 2006: *Refining Estimates of Water-related Energy Use in California*. CEC-500-2006-118. California Energy Commission, [Sacramento]. <http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF

ENERGY SUPPLY AND USE

[1] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D.W. Fahey, J. Haywood, J. Lean, D.C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz, and R. Van Dorland, 2007: Changes in atmospheric constituents and in radiative forcing. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 129-234.

[2] U.S. Energy Information Administration, 2008: *Energy in Brief: What are Greenhouse Gases and How Much are Emitted by the United States?* [website] Energy Information Administration, Washington, DC. <http://tonto.eia.doe.gov/energy_in_brief/greenhouse_gas.cfm>

[3] Wilbanks, T.J., *et al*., 2007: Executive summary. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. x-xii.

[4] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[5] From *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2003*, U.S. EPA (using the CRF document). Allocations from "Electricity & Heat" and "Industry" to end uses are WRI estimates based on energy use data from the International Energy Agency (IEA, 2005). All data is for 2003. All calculations are based on CO_2 equivalents, using 100-year global warming potentials from the IPCC (1996).

[6] Energy Information Administration, 2008: *Annual Energy Review 2007*. U.S. Department of Energy, Washington, DC, 400 pp. <http://www.eia.doe.gov/emeu/aer/pdf/aer.pdf>

[7] Bhatt, V., J. Eckmann, W.C. Horak, and T.J. Wilbanks, 2007: Possible indirect effects on energy production and distribution in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 81-97.

[8] Scott, M.J. and Y.J. Huang, 2007: Effects of climate change on energy use in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 8-44.

[9] U.S. Department of Energy, 2008: *Buildings Energy Data Book*. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, [Washington, DC]. <http://buildingsdatabook.eere.energy.gov/>

[10] Owen, T.W. and K.P. Gallo, 2000: Updated population metadata for the United States Historical Climatology Network stations. *Journal of Climate*, **13(22)**, 4028-4033. <http://www.ncdc.noaa.gov/oa/climate/research/population/>

[11] Bull, S.R., D.E. Bilello, J. Ekmann, M.J. Sale, and D.K. Schmalzer, 2007: Effects of climate change on energy production and distribution in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 45-80.

[12] Feldman, D.L., K.L. Jacobs, G. Garfin, A. Georgakakos, B. Morehouse, R. Webb, B. Yarnal, J. Kochendorfer, C. Rosenzweig, M. Sale, B. Udall, and C. Woodhouse, 2008: Decision-support experiments within the water resource management sector. In: *Decision-Support Experiments and Evaluations using Seasonal-to-Interannual Forecasts and Observational Data: A Focus on Water Resources* [Beller-Simms, N., H. Ingram, D. Feldman, N. Mantua, K.L. Jacobs, and A.M. Waple (eds.)]. Synthesis and Assessment Product 5.3. NOAA's National Climatic Data Center, Asheville, NC, pp. 65-100.

[13] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 model-

ling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[14] Hightower, M. and S.A. Pierce, 2008: The energy challenge. *Nature*, **452(7185)**, 285-286.

[15] Wilbanks, T.J., et al., 2007: Conclusions and research priorities. In: *Effects of Climate Change on Energy Production and Use in the United States*. [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 98-108.

[16] Maulbetsch, J.S. and M.N. DiFilippo, 2006: *Cost and Value of Water Use at Combined Cycle Power Plants*. CEC-500-2006-034. California Energy Commission, PIER Energy-Related Environmental Research. <http://www.energy.ca.gov/2006publications/CEC-500-2006-034/CEC-500-2006-034.PDF>

[17] Energy Information Administration, 2002: *National Trends in Coal Transportation*. [web site] Energy Information Administration, Washington, DC. <http://www.eia.doe.gov/cneaf/coal/ctrdb/natl-trends.html>

[18] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[19] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[20] CBO Testimony, 2005: *Macroeconomic and Budgetary Effects of Hurricanes Katrina and Rita*. Statement of Douglas Holtz-Easkin, Director, before the Committee on the Budget, U.S. House of Representatives. Congressional Budget Office, Washington, DC, 21 pp. <http://www.cbo.gov/doc.cfm?index=6684>

[21] Potter, J.R., V.R. Burkett, and M.J. Savonis, 2008: Executive summary. In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M. J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Climate Change Science Program, Washington, DC, pp. ES-1 to ES-10.

[22] Energy Information Administration, U.S. Department of Energy [data]; assembled by E. Mills, Lawrence Berkley National Laboratory. Data available at <http://www.eia.doe.gov/cneaf/electricity/page/disturb_events.html>

[23] Kafalenos, R.S., K.J. Leonard, D.M. Beagan, V.R. Burkett, B.D. Keim, A. Meyers, D.T. Hunt, R.C. Hyman, M.K. Maynard, B. Fritsche, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and M.J. Savonis, 2008: What are the implications of climate change and variability for Gulf coast transportation? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Climate Change Science Program, Washington, DC, [104 pp.]

[24] Energy Information Administration, 2008: *Monthly Energy Review*. U.S. Department of Energy, Energy Information Administration, Washington, DC. <http://www.eia.doe.gov/emeu/mer/contents.html>

[25] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[26] ACIA, 2004: *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 139 pp. <http://amap.no/acia/>

TRANSPORTATION

[1] EPA, 2008: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. USEPA # 430-R-08-005. U.S. Environmental Protection Agency, Washington, DC, 473 pp. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

[2] National Research Council (NRC), 2008: *Potential Impacts of Climate Change on U.S. Transportation*. Transportation Research Board special report 290. Transportation Research Board, Washington, DC, 218 pp.

[3] Schimel, D., A. Janetos, P. Backlund, J. Hatfield, M.G. Ryan, S.R. Archer, and D. Lettenmaier, 2008: Synthesis. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 183-193.

[4] Potter, J.R., V.R. Burkett, and M.J. Savonis, 2008: Executive summary. In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. Department of Transportation, Washington, DC, pp. ES-1 to ES-10.

[5] Kafalenos, R.S., K.J. Leonard, D.M. Beagan, V.R. Burkett, B.D. Keim, A. Meyers, D.T. Hunt, R.C. Hyman, M.K. Maynard, B. Fritsche, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and M.J. Savonis, 2008: What are the implications of climate change and variability for Gulf Coast transportation? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. Department of Transportation, Washington, DC, [104 pp.]

[6] Burkett, V.R., R.C. Hyman, R. Hagelman, S.B. Hartley, M. Sheppard, T.W. Doyle, D.M. Beagan, A. Meyers, D.T. Hunt, M.K. Maynard, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and N.N. Srinivasan, 2008: Why study the Gulf Coast? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. Department of Transportation, Washington, DC, [66 pp.]

[7] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[8] Hay, J.E., R. Warrick, C. Cheatham, T. Manarangi-Trott, J. Konno, and P. Hartley, 2005: *Climate Proofing: A Risk-based Approach to Adaptation*. Asian Development Bank, Manila, The Philippines, 191 pp. <http://www.adb.org/Documents/Reports/Climate-Proofing/default.asp>

[9] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[10] OSHA, 2008: Heat stress. In: *OSHA Technical Manual, Section III: Chapter 4.* Occupational Safety & Health Administration, Washington, DC. <http://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_4.html>

[11] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[12] Landsea, C.W., 1993: A climatology of intense (or major) Atlantic hurricanes. *Monthly Weather Review*, **121(6)**, 1710-1713.

[13] NOAA (National Oceanic and Atmospheric Administration), 2008: *Billion Dollar U.S. Weather Disasters* [website] <http://www.ncdc.noaa.gov/oa/reports/billionz.html>

[14] ACIA, 2004: *Impacts of a Warming Arctic: Arctic Climate Impact Assessment.* Cambridge University Press, Cambridge, UK, and New York, 139 pp. <http://www.acia.uaf.edu>

[15] ACIA, 2005: *Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 1042 pp. <http://www.acia.uaf.edu/pages/scientific.html>

[16] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change.* Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[17] Polyak, L., J. Andrews, J. Brigham-Grette, D. Darby, A. Dyke, S. Funder, M. Holland, A. Jennings, J. Savelle, M. Serreze, and E. Wolff, ____: History of sea ice in the Arctic. In: Past Climate Variability and Change in the Arctic and at High Latitude. [(eds.)]. Synthesis and Assessment Product 1.2. U.S. Climate Change Science Program, Washington, DC. {Not yet published}

[18] Trenberth**,** K.E., P.D. Jones, P. Ambenje, R. Bojariu, D. Easterling, A. Klein Tank, D. Parker, F. Rahimzadeh, J.A. Renwick, M. Rusticucci, B. Soden, and P. Zhai, 2007: Observations: surface and atmospheric climate change. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 235-335.

[19] Larsen, P.H., S. Goldsmith, O. Smith, M.L. Wilson, K. Strzepek, P. Chinowsky, and B. Saylor, 2008: Estimating future costs for Alaska public infrastructure at risk from climate change. *Global Environmental Change*, **18(3)**, 442-457.

[20] Fetterer, F., K. Knowles, W. Meier, and M. Savoie, 2002: updated 2008: *Sea Ice Index*. [web site] National Snow and Ice Data Center, Boulder, CO. <http://nsidc.org/data/seaice_index/>

AGRICULTURE

[1] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States.* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 21-74.

[2] EPA, 2008: *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006*. USEPA 430-R-08-005. U.S. Environmental Protection Agency, Washington, DC, 473 pp. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

[3] National Agricultural Statistics Service, 2002: *2002 Census of Agriculture*. USDA National Agricultural Statistics Service, Washington, DC. <http://www.agcensus.usda.gov/Publications/2002/index.asp>

[4] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[5] Wolfe, W., L. Ziska, C. Petzoldt, A. Seaman, L. Chase, and K. Hay-

hoe, 2007: Projected change in climate thresholds in the northeastern U.S.: implications for crops, pests, livestock, and farmers. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 555-575.

[6] Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles, 2007: *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions*. Synthesis report of the Northeast Climate Impacts Assessment. Union of Concerned Scientists, Cambridge, MA, 146 pp.

[7] Gu, L., P.J. Hanson, W.M. Post, D.P. Kaiser, B. Yang, R. Nemani, S.G. Pallardy, and T. Meyers, 2008: The 2007 eastern U.S. spring freeze: increased cold damage in a warming world? *BioScience*, **58(3)**, 253-262.

[8] Inouye, D.W., 2008: Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. *Ecology*, **89(2)**, 353-362.

[9] Either hydrogen dioxide or oxygenated hydrocarbons.

[10] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[11] National Assessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[12] Peet, M.M. and D.W. Wolf, 2000: Crop ecosystem responses to climate change: vegetable crops. In: *Climate Change and Global Crop Productivity* [Reddy, K.R. and H.F. Hodges (eds.)]. CABI Publishing, New York, and Wallingford, UK, 472 pp.

[13] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[14] Bridges, D.C. (ed.), 1992: *Crop Losses Due to Weeds in the United States*. Weed Science Society of America, Champaign, IL, 403 pp.

[15] Joyce, L.A., G.M. Blate, J.S. Littell, S.G. McNulty, C.I. Millar, S.C. Moser, R.P. Neilson, K. O'Halloran, and D.L. Peterson, 2008: National forests. In: *Preliminary Review of Adaptation Options for Climate-sensitive Ecosystems and Resources.* [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (authors)]. Synthesis and Assessment Product 4.4. U.S. Environmental Protection Agency, Washington, DC, USA, pp. 3-1 to 3-127.

[16] Kiely, T., D. Donaldson, and A. Grube, 2004: *Pesticides Industry Sales and Usage: 2000 and 2001 Market Estimates*. U.S. Environmental Protection Agency, Washington DC, 33 pp. <http://www.epa.gov/oppbead1/pestsales/>

[17] Temperatures for the contiguous U.S. are based on data from the US Historical Climatology Network Version 2 (Menne *et al*. 2008). Temperatures for Alaska, Hawaii, and Puerto Rico are based on data from the Cooperative Observers Network adjusted to remove non-climatic influences such as changes in instruments and observer practices and changes in the station environment (Menne and Williams, 2008).

US time series on page 27 calculated with data for the contiguous US, Alaska, and Hawaii. US map on page 28 lower left includes observed temperature change in Puerto Rico. Winter temperature trend map in the agriculture section, page 76, is for the contiguous US only.

Menne, M.J., C.N. Williams, and R.S. Vose, 2008: The United States Historical Climatology Network Monthly Temperature Data - Version 2. *Bulletin of the American Meteorological Society*, in review.

Menne, M.J. and C.N. Williams Jr., 2008: Homogenization of temperature series via pairwise comparisons. *Journal of Climate*, Early online release, doi:10.1175/2008JCLI2263.1.

[18] Natural Resources Conservation Service, 1997: *1997 Five-Year Natural Resources Inventory*. USDA Natural Resources Conservation Service, Washington, DC. <http://www.nrcs.usda.gov/technical/NRI/1997/index.html>

ECOSYSTEMS

[1] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008: Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 151-181.

[2] Ryan, M.G., S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, and W. Schlesinger, 2008: Land resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 75-120.

[3] Parmesan, C., 1996: Climate and species range. *Nature,* **382(6594)**, 765-766.

[4] Hinzman, L.D., N.D. Bettez, W.R. Bolton, F.S. Chapin, M.B. Dyurgerov, C.L. Fastie, B. Griffith, R.D. Hollister, A. Hope, H.P. Huntington, A.M. Jensen, G.J. Jia, T. Jorgenson, D.L. Kane, D.R. Klein, G. Kofinas, A.H. Lynch, A.H. Lloyd, A.D. McGuire, F.E.

Nelson, M. Nolan, W.C. Oechel, T.E. Osterkamp, C.H. Racine, V.E. Romanovsky, R.S. Stone, D.A. Stow, M. Sturm, C.E. Tweedie, G.L. Vourlitis, M.D. Walker, D.A. Walker, P.J. Webber, J.M. Welker, K.S. Winker, and K. Yoshikawa, 2005: Evidence and implications of recent climate change in northern Alaska and other Arctic regions. *Climatic Change,* **72(3)**, 251-298.

[5] Mimura, N., L. Nurse, R.F. McLean, J. Agard, L. Briguglio, P. Lefale, R. Payet, and G. Sem, 2007: Small islands. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 687-716.

[6] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[7] ACIA, 2004: *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 139 pp. <http://amap.no/acia/>

[8] National Interagency Fire Center, [2008]: *Total Wildland Fires and Acres (1960-2007).* National Interagency Coordination Center, Boise, ID. Data at <http://www.nifc.gov/fire_info/fire_stats.htm>

[9] Carroll, A.L., J. Régnière, J.A. Logan, S.W. Taylor, B.J. Bentz, and J.A. Powell, 2006: *Impacts of Climate Change on Range Expansion by the Mountain Pine Beetle*. Mountain Pine Beetle Initiative working paper 2006-14. Canadian Forest Service, Victoria, BC, 20 pp. <http://mpb.cfs.nrcan.gc.ca/papers_e.html>

[10] CCSP, 2009: Case studies. In: *Thresholds of Climate Change in Ecosystems* [D.B. Fagre (lead author), C.W. Charles, C.D. Allen, C. Birkeland, F.S. Chapin III, P.M. Groffman, G.R. Guntenspergen, A.K. Knapp, A.D. McGuire, P.J. Mulholland, D.P.C. Peters, D.D. Roby and G. Sugihara] Synthesis and Assessment Product 4.2. U.S. Climate Change Science Program, Washington, DC. {not yet published}

[11] Pounds, J.A., M.R. Bustamante, L.A. Coloma, J.A. Consuegra, M.P. L. Fogden, P.N. Foster, E. La Marca, K.L. Masters, A. Merino-Viteri, R. Puschendorf, S.R. Ron, G.A. Sánchez-Azofeifa, C.J. Still, and B.E. Young, 2006: Widespread amphibian extinctions from epidemic disease driven by global warming. *Nature*, **439(7073)**, 161-167.

[12] Lettenmaier, D., D. Major, L. Poff, and S. Running, 2008: Water resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States*. [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 121-150.

[13] Polyak, L., J. Andrews, J. Brigham-Grette, D. Darby, A. Dyke, S. Funder, M. Holland, A. Jennings, J. Savelle, M. Serreze, and E. Wolff, ____: History of sea ice in the Arctic. In: *Past Climate Variability and Change in the Arctic and at High Latitude* [__ (eds.)]. Synthesis and Assessment Product 1.2. U.S. Climate Change Science Program, Washington, DC. {Not yet published}

[14] Millennium Ecosystem Assessment, 2005: *Ecosystems and Human Well-being: Biodiversity Synthesis*. World Resources Institute, Washington, DC, 86 pp.

[15] Burkett, V.R., D.A. Wilcox, R. Stottlemeyer, W. Barrow, D. Fagre, J. Baron, J. Price, J.L. Nielsen, C.D. Allen, D.L. Peterson, G. Ruggerone, and T. Doyle, 2005: Nonlinear dynamics in ecosystem response to climatic change: case studies and policy implications. *Ecological Complexity,* **2(4)**, 357-394.

[16] Park, R.A., M.S. Trehan, P.W. Mausel, and R.C. Howe, 1989: *The Effects of Sea Level Rise on U.S. Coastal Wetlands.* U.S. Environmental Protection Agency, Washington, DC, 55 pp.

[17] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008: Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 151-181.

[18] Feely, R.A., C.L. Sabine, J.M. Hernandez-Ayon, D. Ianson, and B. Hales, 2008: Evidence for upwelling of corrosive "acidified" water onto the continental shelf. *Science*, **320(5882)**, 1490-1492.

[19] ACIA, 2005: *Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 1042 pp. <http://www.acia.uaf.edu/pages/scientific.html>

[20] Beever, E.A., P.F. Brussard, and J. Berger, 2003: Patterns of apparent extirpation among isolated populations of pikas (*Ochotona princeps*) in the Great Basin. *Journal of Mammology*, **84(1)**, 37-54.

[21] Inouye, D.W., 2008: Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. *Ecology*, **89(2)**, 353-362.

[22] Beckage, B., B. Osborne, D.G. Gavin, C. Pucko, T. Siccama, and T. Perkins, 2008: A rapid upward shift of a forest ecotone during 40 years of warming in the Green Mountains of Vermont. *Proceedings of the National Academy of Sciences*, **105(11),** 4197-4202.

[23] Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki, 2007: Projected impacts of climate change on salmon habitat restoration. *Proceedings of the National Academy of Sciences*, **104(16)**, 6720-6725.

[24] Williams, J.E., A.L. Haak, N.G. Gillespie, H.M. Neville, and W.T. Colyer, 2007: *Healing Troubled Waters: Preparing Trout and Salmon Habitat for a Changing Climate*. Trout Unlimited, Arlington, VA, 12 pp. <http://www.tu.org/climatechange>

[25] Daily, G.C., T. Soderqvist, S. Aniyar, K. Arrow, P. Dasgupta, P.R. Ehrlich, C. Folke, A. Jansson, B.O. Jansson, N. Kautsky, S. Levin, J. Lubchenco, K.G. Maler, D. Simpson, D. Starrett, D. Tilman, and B. Walker, 2000: Ecology - The value of nature and the nature of value. *Science*, **289(5478)**, 395-396.

[26] Hamilton, J.M. and R.S.J. Tol, 2004: The impact of climate change on tourism and recreation. In: *Human-Induced Climate Change - An Interdisciplinary Assessment* [Schlesinger, M., H.S. Kheshgi, J.

Smith, F.C. de la Chesnaye, J.M. Reilly, T. Wilson, and C. Kolstad (eds.)]. Cambridge University Press, Cambridge (UK), pp. 147-155.

[27] Cordell, H.K., B. McDonald, R.J. Teasley, J.C. Bergstrom, J. Martin, J. Bason, and V.R. Leeworthy, 1999: Outdoor recreation participation trends. In: *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends* [Cordell, H.K. and S.M. McKinney (eds.)]. Sagamore Publishing, Champaign, IL, pp. 219-321.

[28] Pileus Project, Undated: *Which factors are typically believed to have the greatest influence on tourists' behaviors?* [web site] Pileus Project, Michigan State University, East Lansing. <http://www.pileus.msu.edu/tourism/tourism_influencefactor.htm>

[29] Wall, G., 1998: Implications of global climate change for tourism and recreation in wetland areas. *Climatic Change,* **40(2)**, 371-389.

[30] Kareiva, P., C. Enquist, A. Johnson, S.H. Julius, J. Lawler, B. Petersen, L. Pitelka, R. Shaw, and J.M. West, 2008: Synthesis and conclusions. In: *Preliminary Review of Adaptation Options for Climate-sensitive Ecosystems and Resources* [Julius, S.H., J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (authors)]. Synthesis and Assessment Product 4.4. U.S. Environmental Protection Agency, Washington, DC, pp. 9-1 to 9-66.

HUMAN HEALTH

[1] Ebi, K.L., J. Balbus, P.L. Kinney, E. Lipp, D. Mills, M.S. O'Neill, and M. Wilson, 2008: Effects of global change on human health. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 2-1 to 2-78.

[2] Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich, and A. Woodward, 2007: Human health. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 391-431.

[3] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[4] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[5] Kalkstein, L.S. and J.S. Greene, 2007: *An Analysis of Potential Heat-Related Mortality Increases in U.S. Cities Under a Business-As-Usual Climate Change Scenario*. [Environment America, Boston, MA], 12 pp. <http://www.environmentamerica.org/home/reports/report-archives/global-warming-solutions/global-warming-solutions/an-analysis-of-potential-heat-related-mortality-increases-in-u_s_-cities-under-a-business-as-usual-climate-change-scenario#7Wru-uKroADPukI3BDUAkA>

[6] Brikowski, T.H., Y. Lotan, and M.S. Pearle, 2008: Climate-related increase in the prevalence of urolithiasis in the United States. *Proceedings of the National Academy of Sciences*, **105(28)**, 9841-9846.

[7] Semenza, J.C., 1999: Acute renal failure during heat waves. *American Journal of Preventive Medicine*, **17(1)**, 97.

[8] Davis, R.E., P.C. Knappenberger, P.J. Michaels, and W.M. Novicoff, 2003: Changing heat-related mortality in the United States. *Environmental Health Perspectives,* **111(14)**, 1712-1718.

[9] Energy Information Administration, U.S. Department of Energy, 2005: Table HC10.6: Air conditioning characteristics by U.S. census region, 2005. In: *2005 Residential Energy Consumption Survey*. Data available at <http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/detailed_tables2005.html>

[10] Energy Information Administration, U.S. Department of Energy, 2005: Table 2: Type of air-conditioning equipment by census region and survey year. In: *2005 Residential Energy Consumption Survey*. Data available at <http://www.eia.doe.gov/emeu/consumptionbriefs/recs/actrends/recs_ac_trends_table2.html>

[11] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[12] Sheridan, S.C., A.J. Kalkstein, and L.S. Kalkstein, 2008: Trends in heat-related mortality in the United States, 1975–2004. *Natural Hazards*, Online First™, doi:10.1007/s11069-008-9327-2.

[13] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[14] Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K.N. Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emissions pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences,* **101(34)**, 12422-12427.

[15] Vavrus, S. and J. van Dorn, 2008: Projected future temperature and precipitation extremes in Chicago. *Journal of Great Lakes Research* (in press, nyp 10/22/08).

[16] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P.

Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[17] Hayhoe, K., D. Wuebbles, and the Climate Science Team, 2008: *Climate Change and Chicago: Projections and Potential Impacts*. City of Chicago, [175 pp.] <http://www.chicagoclimateaction.org/>

[18] Medina-Ramon, M. and J. Schwartz, 2007: Temperature, temperature extremes, and mortality: a study of acclimatisation and effect modification in 50 U.S. cities. *Occupational and Environmental Medicine*, **64(12)**, 827-833.

[19] Lemmen, D.S. and F.J. Warren (eds.), 2004: *Climate Change Impacts and Adaptation: A Canadian Perspective*. Climate Change Impacts and Adaptation Program, Natural Resources Canada, Ottawa, ON, 174 pp. <http://adaptation.nrcan.gc.ca/perspective/index_e.php>

[20] Ebi, K.L., J. Smith, I. Burton, and J. Scheraga, 2006: Some lessons learned from public health on the process of adaptation. *Mitigation and Adaptation Strategies for Global Change*, **11(3)**, 607-620.

[21] Ebi, K.L., T.J. Teisberg, L.S. Kalkstein, L. Robinson, and R.F. Weiher, 2004: Heat watch/warning systems save lives: estimated costs and benefits for Philadelphia 1995-98. *Bulletin of the American Meteorological Society,* **85(8)**, 1067-1073.

[22] Shindell, D.T., H. Levy II, A. Gilliland, M.D. Schwarzkopf, and L.W. Horowitz, 2008: Climate change from short-lived emissions due to human activities. In: *Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols*. [Levy II, H., D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, and L.W. Horowitz, (eds.)]. Synthesis and Assessment Product 3.2. U.S. Climate Change Science Program, Washington, DC, pp. 27-60.

[23] Wuebbles, D.J., H. Lei, and J.-T. Lin, 2007: Intercontinental transport of aerosols and photochemical oxidants from Asia and its consequences. *Environmental Pollution*, **150**, 65-84.

[24] Bell, M.L., R. Goldberg, C. Hogrefe, P. Kinney, K. Knowlton, B. Lynn, J. Rosenthal, C. Rosenzweig, and J.A. Patz, 2007: Climate change, ambient ozone, and health in 50 U.S. cities. *Climatic Change*, **82(1-2),** 61-76.

[25] Tao Z., A. Williams, H.-C. Huang, M. Caughey, and X.-Z. Liang, 2007: Sensitivity of U.S. surface ozone to future emissions and climate changes. *Geophysical Research Letters*, **34**, L08811, doi:10.1029/2007GL029455.

[26] California Air Resources Board, 2007: *Recent Research Findings: Health Effects of Particulate Matter and Ozone Air Pollution*. [Online fact sheet] California Air Resources Board, [Sacramento], 7 pp. <http://www.arb.ca.gov/research/health/fs/pm_ozone-fs.pdf>

[27] California Climate Change Center, 2006: *Our Changing Climate: Assessing the Risks to California*. California Climate Change Center, Sacramento, CA, 15 pp. http://www.energy.ca.gov/2006publications/CEC-500-2006-077/CEC-500-2006-077.PDF

[28] Friedman, M.S., K.E. Powell, L. Hutwagner, L.M. Graham, and W.G. Teague, 2001: Impact of changes in transportation and commuting behaviors during the 1996 Summer Olympic Games in Atlanta on air quality and childhood asthma. *Journal of the American Medical Association,* **285(7)**, 897-905.

[29] NOAA (National Oceanic and Atmospheric Administration), 2008: *Billion Dollar U.S. Weather Disasters* [website] <http://www.ncdc.noaa.gov/oa/reports/billionz.html>

[30] National Climatic Data Center, 2009: *NCDC Climate Monitoring: U.S. Records* [web site] <http://www.ncdc.noaa.gov/oa/climate/research/records/> .

[31] National Research Council, 1991: *Rethinking the Ozone Problem in Urban and Regional Air Pollution*. National Academy Press, Washington, DC, 500 pp.

[32] Travis, W.R., S.A. Changnon Jr., and T.R. Karl, 1991: *Drought and Natural Resources Management in the United States: Impacts and Implications of the 1987–89 Drought*. Westview Press, Boulder, CO, 174 pp.

[33] Wang, J.X.L. and J.K. Angell, 1999: *Air Stagnation Climatology for the United States (1948-1998)*. NOAA/Air Resources Laboratory atlas no.1. NOAA Air Resources Laboratory, Silver Spring, MD, 74 pp.

[34] Miller, N.L., K. Hayhoe, J. Jin, and M. Auffhammer, 2008: Climate, extreme heat, and electricity demand in California. *Journal of Applied Meteorology and Climatology*, **47(6)**, 1834-1844.

[35] Daily data were used for both air stagnation and heat waves:

1. Heat waves:

• The GHCN-Daily dataset from NCDC was used <http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/>

• Data from 979 U.S. stations having long periods of record and high quality.

• At each station, a day was considered hot if the maximum temperature for that day was at or above the 90% of daily maximum temperatures at that station.

2. Air stagnation:

• For each day in summer and at each air-stagnation grid point, it was determined if that location had stagnant air:

◦ The stagnation index was formulated by Wang, J.X.L. and J.K. Angell, 1999: *Air Stagnation Climatology for the United States (1948-1998).* NOAA/Air Resources Laboratory atlas no.1 NOAA Air Resources Laboratory, Silver Spring, MD, 74 pp. <http://www.arl.noaa.gov/documents/reports/atlas.pdf>

◦ Operational implementation of this index is described at

<http://www.ncdc.noaa.gov/oa/climate/research/stagnation/index.php>

Note: Although Wang and Angell used a criteria of four day stagnation periods, single stagnation days were used for this analysis.

3. For each location in the air stagnation grid, the nearest station (of the aforementioned 979 U.S. stations) was used to determine the coincidence of summer days having stagnant air and excessive heat as a percentage of the number of days having excessive heat.

[36] Tibbetts, J., 2005: Combined sewer systems: down, dirty, and out of date. *Environmental Health Perspectives*, **113(7)**, A464-A467.

[37] Patz, J.A., S.J. Vavrus, C.K. Uejio, and S.L. McClellan, 2008: Climate change and waterborne disease risk in the Great Lakes region of the U.S. *American Journal of Preventive Medicine*, **35(5)**, 451-458.

[38] Westerling A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam, 2006: Warming and earlier spring increase western U.S. forest wildfire activity. *Science*, **313(5789),** 940-943.

[39] Sussman, F.G., M.L. Cropper, H. Galbraith, D. Godschalk, J. Loomis, G. Luber, M. McGeehin, J.E. Neumann, W.D. Shaw, A. Vedlitz, and S. Zahran, 2008: Effects of global change on human welfare. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 4-1 to 4-74.

[40] Smith, J.B. and D. Tirpak (eds.), 1989: *The Potential Effects of Global Climate Change on the United States* U.S. Environmental Protection Agency, Washington, DC, 413 pp.

[41] University of Minnesota, College of Veterinary Medicine, 2006: *Fact Sheet: West Nile Virus Information for Equine Owners and Veterinarians*. Center for Animal Health and Food Safety, St. Paul, MN, 2 pp. <http://www.cahfs.umn.edu/img/assets/8961/WNV_Info_for_Equine_Owners_and_Vets5-29-06.pdf>

[42] Kilpatrick, A.M., M.A. Meola, R.M. Moudy, and L.D. Kramer, 2008: Temperature, viral genetics, and the transmission of West Nile virus by *Culex pipiens* mosquitoes. *PLoS Pathogens*, **4(6)**, e1000092. doi:10.1371/journal.ppat.1000092

[43] Garbutt, K. and F.A. Bazzaz, 1984: The effects of elevated CO_2 on plants: III. Flower, fruit and seed production and abortion. *New Phytologist*, **98(3)**, 433-446.

[44] Randolph, C., 2003: Allergy and asthma connection—from the American Academy of Allergy, Asthma and Immunology. *Asthma Magazine*, **8(2)**, 24-26.

[45] Mohan J.E., L.H. Ziska, W.H. Schlesinger, R.B. Thomas, R.C. Sicher, K. George, and J.S. Clark, 2006: Biomass and toxicity responses of poison ivy (*Toxicodendron radicans*) to elevated atmospheric CO_2. *Proceedings of the National Academy of Sciences*, **103(24)**, 9086-9089.

[46] Hunt, R., D.W. Hand, M.A. Hannah, and A.M. Neal, 1991: Response to CO_2 enrichment in 27 herbaceous species. *Functional Ecology*, **5(3)**, 410-421.

[47] Ziska, L.H., 2003: Evaluation of the growth response of six invasive species to past, present and future atmospheric carbon dioxide. *Journal of Experimental Botany*, **54(381)**, 395-404.

[48] Ziska, L.H. and F.A. Caulfield, 2000: Rising CO_2 and pollen production of common ragweed (*Ambrosia artemisiifolia L.*), a known allergy-inducing species: implications for public health. *Australian Journal of Plant Physiology*, **27(10)**, 893-898.

[49] CDC, 2007: *2007 National Diabetes Fact Sheet*. Centers for Disease Control and Prevention, Atlanta, GA, 14 pp. <http://www.cdc.gov/diabetes/pubs/factsheet07.htm>

[50] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

SOCIETY

[1] Wilbanks, T.J., P. Kirshen, D. Quattrochi, P. Romero-Lankao, C. Rosenzweig, M. Ruth, W. Solecki, J. Tarr, P. Larsen, and B. Stone, 2008: Effects of global change on human settlements. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 3-1 to 3-31.

[2] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[3] Gamble, J.L., K.L. Ebi, A. Grambsch, F.G. Sussman, T.J. Wilbanks, C.E. Reid, K. Hayhoe, J.V. Thomas, and C.P. Weaver, 2008: Introduction. In: *Analyses of the effects of global change on human health and welfare and human systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 1-1 to 1-41.

[4] Wilbanks, T.J., P. Romero Lankao, M. Bao, F. Berkhout, S. Cairncross, J.-P. Ceron, M. Kapshe, R. Muir-Wood, and R. Zapata-Marti, 2007: Industry, settlement and society. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 357-390.

[5] U.S. Census Bureau, 2005*: Domestic Net Migration in the United States: 2000 to 2004: Population Estimates and Projections.* <http://www.census.gov/prod/2006pubs/p25-1135.pdf>

[6] Crossett, K., T.J. Culliton, P. Wiley, and T.R. Goodspeed, 2004: *Population Trends along the Coastal United States, 1980–2008*. National Oceanic and Atmospheric Administration, Silver Spring, MD, 47 pp.

[7] Burkett, V.R., R.C. Hyman, R. Hagelman, S.B. Hartley, M. Sheppard, T.W. Doyle, D.M. Beagan, A. Meyers, D.T. Hunt, M.K. Maynard, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and N.N. Srinivasan, 2008: Why study the Gulf Coast? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S.

Department of Transportation, Washington, DC, pp. 2-1 to 2F-26. [66 pp.]

[8] Savonis, M.J., V.R. Burkett, J.R. Potter, T.W. Doyle, R. Hagelman, S.B. Hartley, R.C. Hyman, R.S. Kafalenos, B.D. Keim, K.J. Leonard, M. Sheppard, C. Tebaldi, and J.E. Tump, 2008: What are the key conclusions of this study? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Department of Transportation, Washington, DC, [10 pp.]

[9] Sussman, F.G., M.L. Cropper, H. Galbraith, D. Godschalk, J. Loomis, G. Luber, M. McGeehin, J.E. Neumann, W.D. Shaw, A. Vedlitz, and S. Zahran, 2008: Effects of global change on human welfare. In: *Analyses of the effects of global change on human health and welfare and human systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, USA, p. 4-1 to 4-74.

[10] U.S. General Accounting Office (GAO), 2003: *Alaska Native Villages: Most Are Affected by Flooding and Erosion, but Few Qualify for Federal Assistance*. GAO-04-142. U.S. General Accounting Office, Washington, DC, 82 pp. <http://purl.access.gpo.gov/GPO/LPS42077>

[11] ACIA, 2004: *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 139 pp. <http://www.acia.uaf.edu>

[12] ACIA, 2005: *Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 1042 pp. <http://www.acia.uaf.edu/pages/scientific.html>

[13] Cordova, R., M. Gelobter, A. Hoerner, J. Love, A. Miller, C. Saenger, and D. Zaidi, 2006: *Climate Change in California: Health, Economic and Equity Impacts*. Redefining Progress, Oakland, CA, 119 pp. <http://www.rprogress.org/publications/2006/CARB_Full_0306.pdf>

[14] Congressional Black Caucus Foundation, 2004: *African Americans and Climate Change: An Unequal Burden*. Redefining Progress, Washington, DC.

[15] Hoerner, J.A. and N. Robinson, 2008: *A Climate of Change: African Americans, Global Warming, and a Just Climate Policy for the U.S.* A report of the Environmental Justice and Climate Initiative. Redefining Progress, Oakland, CA, 69 pp. <http://www.rprogress.org/publications/2008/climateofchange.pdf>

[16] Borden, K.A., M.C. Schmidtlein, C.T. Emrich, W.W. Piegorsch, and S.L. Cutter, 2007: Vulnerability of U.S. cities to environmental hazards. *Journal of Homeland Security and Emergency Management,* **4(2)**, article 5. <http://www.bepress.com/jhsem/vol4/iss2/5>

[17] van Kamp, I., K. Leidelmeijer, G. Marsman, and A. de Hollander, 2003: Urban environmental quality and human well-being: towards a conceptual framework and demarcation of concepts; a literature study. *Landscape and Urban Planning,* **65(1-2)**, 5-18.

[18] Grimmond, S., 2007: Urbanization and global environmental change: local effects of urban warming. *Geographical Journal*, **173(1)**, 83-88.

[19] Anderson, C.A., 2001: Heat and violence. *Current Directions in Psychological Science,* **10(1)**, 33-38.

[20] Anderson, C.A., B.J. Bushman, and R.W. Groom, 1997: Hot years and serious and deadly assault: empirical test of the heat hypothesis. *Journal of Personality and Social Psychology,* **73(6)**, 1213-1223.

[21] Milly, P.C.D., R.T. Wetherald, K.A. Dunne, and T.L. Delworth, 2002: Increasing risk of great floods in a changing climate. *Nature*, **415(6871)**, 514-517.

[22] Kundzewicz, Z.W., L.J. Mata, N.W. Arnell, P. Döll, P. Kabat, B. Jiménez, K.A. Miller, T. Oki, Z. Sen, and I.A. Shiklomanov, 2007: Freshwater resources and their management. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 173-210.

[23] Miller, N., K. Hayhoe, J. Jin, and M. Auffhammer, 2008: Climate, extreme heat, and electricity demand in California. *Journal of Applied Meteorology and Climatology*, **47(6)**, 1834-1844.

[24] Hoerner, J.A. and N. Robinson, 2008: *A Climate of Change: African Americans, Global Warming, and a Just Climate Policy for the U.S.* A report of the Environmental Justice and Climate Initiative. Redefining Progress, Oakland, CA, 69 pp. <http://www.rprogress.org/publications/2008/climateofchange.pdf>

[25] Ingram, H., D. Feldman, N. Mantua, K.L. Jacobs, D. Fort, N. Beller-Simms, and A.M. Waple, 2008: The changing context. In: *Decision-Support Experiments and Evaluations using Seasonal-to-Interannual Forecasts and Observational Data: A Focus on Water Resources* [Beller-Simms, N., H. Ingram, D. Feldman, N. Mantua, K.L. Jacobs, and A.M. Waple (eds.)]. Synthesis and Assessment Product 5.3. NOAA's National Climatic Data Center, Asheville, NC, pp. 7-28.

[26] Solecki, W.D. and C. Rosenzweig, 2006: Climate change and the city: observations from metropolitan New York. In: *Cities and Environmental Change*, [Bai, X. (ed.)]. Yale University Press, New York.

[27] Rosenzweig, C. and W. Solecki (eds.), 2001: *Climate Change and a Global City: The Potential Consequences of Climate Variability and Change – Metro East Coast*. Columbia Earth Institute, New York.

[28] Kirshen, P., M. Ruth, W. Anderson, T.R. Lakshmanan, S. Chapra, W. Chudyk, L. Edgers, D. Gute, M. Sanayei, and R. Vogel, 2004: *Climate's Long-term Impacts on Metro Boston*. Final report to the U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

[29] Grimm, N.B., S.H. Faeth, N.E. Golubiewski, C.L. Redman, J. Wu, X. Bai, and J.M. Briggs, 2008: Global change and the ecology of cities. *Science*, **319(5864)**, 756-760.

[30] Kuo, F.E. and W.C. Sullivan, 2001: Environment and crime in the inner city: Does vegetation reduce crime? *Environment and Behavior*, **33(3)**, 343-367.

[31] Julius, S.H., J.M. West, G. Blate, J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M. Palmer, C. Peterson, and J.M. Scott, 2008: Executive summary. In: *Preliminary Review of Adaptation Options for Climate-sensitive Ecosystems and Resources* [Julius, S.H. and J.M. West (eds.), J.S. Baron, B. Griffith, L.A. Joyce, P. Kareiva, B.D. Keller, M.A. Palmer, C.H. Peterson, and J.M. Scott (authors)]. Synthesis and Assessment Product 4.4. U.S. Environmental Protection Agency, Washington, DC, pp. 1-1 to 1-6.

[32] Baker, L.A., A.J. Brazel, N. Selover, C. Martin, N. McIntyre, F.R. Steiner, A. Nelson, and L. Musacchio, 2002: Urbanization and warming of Phoenix (Arizona, USA): impacts, feedbacks, and

mitigation. *Urban Ecosystems*, **6(3)**, 183-203.

[33] Centers for Disease Control and Prevention, 2005: Heat-related mortality – Arizona, 1993-2002, and United States, 1979-2002. *Morbidity and Mortality Weekly Report*, **54(25)**, 628-630.

[34] Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles, 2007: *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions*. Synthesis report of the Northeast Climate Impacts Assessment. Union of Concerned Scientists, Cambridge, MA, 146 pp.

[35] Scott, D., J. Dawson, and B. Jones, 2008: Climate change vulnerability of the US Northeast winter recreation–tourism sector. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 577-596.

[36] Bin, O., C. Dumas, B. Poulter, and J. Whitehead, 2007: *Measuring the Impacts of Climate Change on North Carolina Coastal Resources*. [Appalachian State University, Boone, NC], 91 pp. <http://econ.appstate.edu/climate>

[37] Mills, E., 2005: Insurance in a climate of change. *Science*, **309(5737)**, 1040-1044.

[38] Adapted from U.S. Government Accountability Office (GAO), 2007: *Climate Change: Financial Risks to Federal and Private Insurers in Coming Decades are Potentially Significant*. Government Accountability Office, Washington, DC, 68 pp. <http://purl.access.gpo.gov/GPO/LPS89701> Data shown are not adjusted for inflation.

[39] Pielke Jr., R.A., J. Gratz, C.W. Landsea, D. Collins, M. Saunders, and R. Musulin, 2008: Normalized hurricane damages in the United States: 1900-2005. *Natural Hazards Review*, **9(1)**, 29-42.

[40] Rosenzweig, C., G. Casassa, D.J. Karoly, A. Imeson, C. Liu, A. Menzel, S. Rawlins, T.L. Root, B. Seguin, and P. Tryjanowski, 2007: Assessment of observed changes and responses in natural and managed systems. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 79-131.

[41] Pielke Jr., R.A., 2005: Response to: "Attribution of Disaster Losses" by E. Mills. *Science,* **310(5754)**, 1615.

[42] Trapp, R.J., N.S. Diffenbaugh, H.E. Brooks, M.E. Baldwin, E.D. Robinson, and J.S. Pal, 2007: Changes in severe thunderstorm environment frequency during the 21st century caused by anthropogenically enhanced global radiative forcing. *Proceedings of the National Academy of Sciences*, **104(50)**, 19719-19723.

[43] Meehl, G.A. and C. Tebaldi, 2004: More intense, more frequent, and longer lasting heat waves in the 21st century. *Science,* **305(5686)**, 994-997.

[44] Peterson, T.C., D.M. Anderson, S.J. Cohen, M. Cortez-Vázquez, R.J. Murnane, C. Parmesan, D. Phillips, R.S. Pulwarty, and J.M.R. Stone, 2008: Why weather and climate extremes matter. In: *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 11-34.

[45] Ross, C., E. Mills, and S. Hecht, 2007: Limiting liability in the greenhouse: insurance risk-management in the context of global climate change. *Stanford Environmental Law Journal and Stanford Journal of International Law, Symposium on Climate Change Risk*, **26A/43A**, 251-334.

[46] Nutter, F.W., 1996: Insurance and the natural sciences: partners in the public interest. *Research Review: Journal of the Society of Insurance Research*, **Fall**, 15-19.

[47] Federal Emergency Management Agency, 2008: *Emergency Management Institute*. [website] <http://training.fema.gov/EMIWeb/CRS/>

[48] Klein, R.J.T., S. Huq, F. Denton, T.E. Downing, R.G. Richels, J.B. Robinson, and F.L. Toth, 2007: Inter-relationships between adaptation and mitigation. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 745-777.

[49] Mills, E., 2006: Synergisms between climate change mitigation and adaptation: an insurance perspective. *Mitigation and Adaptation Strategies for Global Change*, **12(5)**, 809-842.

[50] U.S. Government Accountability Office, 2007 [data]; assembled by Evan Mills, Lawrence Berkley National Laboratory.

[51] Reeve, N. and R. Toumi, 1999: Lightning activity as an indicator of climate change. *Quarterly Journal of the Royal Meteorological Society,* **125(555)**, 893-903.

[52] Price, C. and D. Rind, 1994: Possible implications of global climate change on global lightning distributions and frequencies. *Journal of Geophysical Research*, **99(D5)**, 10823-10831.

[53] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[54] Bernstein, L., J. Roy, K.C. Delhotal, J. Harnisch, R. Matsuhashi, L. Price, K. Tanaka, E. Worrell, F. Yamba, and Z. Fengqi, 2007: Industry. In: *Climate Change 2007: Mitigation of Climate Change*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Metz, B., O.R. Davidson, P.R. Bosch, R. Dave, and L.A. Meyer (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 447-496.

REGIONAL CLIMATE CHANGE IMPACTS

NORTHEAST

[1] Hayhoe, K., C.P. Wake, T.G. Huntington, L. Luo, M.D. Schwartz, J. Sheffield, E. Wood, B. Anderson, J. Bradbury, A. DeGaetano, T.J. Troy, and D. Wolfe, 2007: Past and future changes in climate and hydrological indicators in the U.S. Northeast. *Climate Dynamics*, **28(4)**, 381-407.

[2] Hayhoe, K., C.P. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A. Hertel, and D. Wuebbles, 2008: Regional climate change projections for the northeast U.S. *Mitigation and Adaptation Strategies for Global Change,* **13(5-6)**, 425-436.

[3] Ebi, K.L., J. Balbus, P.L. Kinney, E. Lipp, D. Mills, M.S. O'Neill, and M. Wilson, 2008: Effects of global change on human health. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 2-1 to 2-78.

[4] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[5] New York City Department of Health and Mental Hygiene, 2006: Deaths associated with heat waves in 2006. In: *NYC Vital Signs: Investigation Report, Special Report*. Department of Health and Mental Hygiene, New York, 4 pp. <http://www.nyc.gov/html/doh/downloads/pdf/survey/survey-2006heatdeaths.pdf>

[6] Kunkel, K.E., H.-C. Huang, X.-Z. Liang, J.-T. Lin, D. Wuebbles, Z. Tao, A. Williams, M. Caughey, J. Zhu, and K. Hayhoe, 2008: Sensitivity of future ozone concentrations in the northeast U.S. to regional climate change. *Mitigation and Adaptation Strategies for Global Change,* **13(5-6)**, 597-606.

[7] Hauagge, R. and J.N. Cummins, 1991: Phenotypic variation of length of bud dormancy in apple cultivars and related malus species. *Journal of the American Society for Horticultural Science,* **116(1)**, 100-106.

[8] DeMoranville, C., 2007: Personal communication from May 29, 2008. Experts at the University of Massachusetts Cranberry Station estimate cranberry chilling requirements to be around 1,200-1,400 hours, but they advise growers to seek 1,500 hours to avoid crop failure. There are 4-5 commonly grown cultivars but no low-chill varieties. Dr. Carolyn DeMoranville is the director of the UMass Cranberry Station, a research and extension center of UMass-Amherst.

[9] Iverson, L., A. Prasad, and S. Matthews, 2008: Potential changes in suitable habitat for 134 tree species in the northeastern United States. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 487-516.

[10] United States Department of Agriculture (USDA) National Agriculture Statistics Service (NASS), 2002: *Statistics by State.* [web site] <http://www.nass.usda.gov/Statistics_by_State/>

[11] St. Pierre, N.R., B. Cobanov, and G. Schnitkey, 2003: Economic losses from heat stress by U.S. livestock industries. *Journal of Dairy Science*, **86(E Sup)**, E52- E77.

[12] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. Department of Agriculture, Washington, DC, pp. 21-74.

[13] Gornitz, V., S. Couch, and E.K. Hartig, 2001: Impacts of sea level rise in the New York City metropolitan area. *Global and Planetary Change*, **32(1)**, 61-88.

[14] Georgia Insurance Information Service, 2004: *1999-2007 Value of Insured Coastal Properties Vulnerable to Hurricanes by State.* <http://www.giis.org/giis/giis_pc_facts_losses10.shtml>

[15] Kirshen, P., C. Watson, E. Douglas, A. Gontz, J. Lee, and Y. Tian, 2008: Coastal flooding in the northeastern United States due to climate change. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 437-451.

[16] Bowman, M., D. Hill, F. Buonaiuto, B. Colle, R. Flood, R. Wilson, R. Hunter, and J. Wang, 2008: Threats and responses associated with rapid climate change in metropolitan New York. In: *Sudden and Disruptive Climate Change: Exploring the Real Risks and How We Can Avoid Them*. [MacCracken, M.C., F. Moore, and J.C. Topping Jr. (eds.)]. Earthscan, London and Sterling, VA, pp. 119-142.

[17] Scott, D., J. Dawson, and B. Jones, 2008: Climate change vulnerability of the US northeast winter recreation tourism sector. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 577-596.

[18] Northeast Climate Impact Assessment (NECIA), 2006: *Climate Change in the U.S. Northeast: A Report of the Northeast Climate Impacts Assessment.* Union of Concerned Scientists, Cambridge, MA, 35 pp.

[19] International Snowmobile Manufacturers Association, 2006: *International Snowmobile Industry Facts and Figures.* [web site] <http://www.snowmobile.org/pr_snowfacts.asp>

[20] Atlantic States Marine Fisheries Commission, 2005: *American Lobster.* [website] <http://www.asmfc.org/americanLobster.htm>

[21] Fogarty, M.J., 1995: Populations, fisheries, and management. In: *The Biology of the American Lobster* Homarus americanus. [Factor, J.R. (ed.)]. Academic Press, San Diego, CA, pp. 111-137.

[22] Glenn, R.P. and T.L. Pugh, 2006: Epizootic shell disease in American lobster (*Homarus americanus*) in Massachusetts coastal waters: interactions of temperature, maturity, and intermolt duration. *Journal of Crustacean Biology*, **26(4)**, 639-645.

[23] Fogarty, M., L. Incze, R. Wahle, D. Mountain, A. Robinson, A. Pershing, K. Hayhoe, A. Richards, and J. Manning, 2008: Potential climate change impacts on Atlantic cod (*Gadus morhua*) off the northeastern United States. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 453-466.

[24] Dutil, J.-D. and K. Brander, 2003: Comparing productivity of North Atlantic cod (*Gadus morhua*) stocks and limits to growth production. *Fisheries Oceanography*, **12(4-5)**, 502-512.

[25] Drinkwater, K.F., 2005: The response of Atlantic cod (G*adus morhua*) to future climate change. *ICES Journal of Marine Science*, **62(7)**, 1327-1337.

[26] Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles, 2007: *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions.* Synthesis report of the Northeast Climate Impacts Assessment. Union of Concerned Scientists, Cambridge, MA, 146 pp.

SOUTHEAST

[1] Karl, T.R. and R.W. Knight, 1998: Secular trends of precipitation amount, frequency, and intensity in the United States. *Bulletin of the American Metrological Society,* **79(2)**, 231-241.

[2] Keim, B.D., 1997: Preliminary analysis of the temporal patterns of heavy rainfall across the southeastern United States. *Professional Geographer,* **49(1)**, 94-104.

[3] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[4] Observed changes in precipitation for the Southeast were calculated from the US Historical Climatology Network Version 2. See Menne, M.J., C.N. Williams, and R.S. Vose, 2008: The United States Historical Climatology Network Monthly Temperature Data - Version 2. *Bulletin of the American Meteorological Society*, in review.

[5] Emanuel, K., 2005: Increasing destructiveness of tropical cyclones over the past 30 years. *Nature,* **436(7051)**, 686-688.

[6] Hoyos, C.D., P.A. Agudelo, P.J. Webster, and J.A. Curry, 2006: Deconvolution of the factors contributing to the increase in global hurricane intensity. *Science,* **312(577)**, 94-97.

[7] Mann, M.E. and K.A. Emanuel, 2006: Atlantic hurricane trends linked to climate change. *EOS Transactions of the American Geophysical Union,* **87(24)**, 233, 244.

[8] Trenberth, K.E. and D.J. Shea, 2006: Atlantic hurricanes and natural variability in 2005. *Geophysical Research Letters,* **33**, L12704, doi:10.1029/2006GL026894.

[9] Webster, P.J., G.J. Holland, J.A. Curry, and H.-R. Chang, 2005: Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science,* **309(5742)**, 1844-1846.

[10] Komar, P.D. and J.C. Allan, 2007: Higher waves along U.S. East Coast linked to hurricanes. *EOS Transactions of the American Geophysical Union*, **88(30)**, 301.

[11] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[12] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[13] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[14] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[15] Change calculated from daily minimum temperatures from NCDC's Global Historical Climatology Network-Daily data set. <http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/>

[16] World Health Organization, 2008: *Protecting Health in Europe from Climate Change* [Menne, B.F. Apfel, S. Kovats, and F. Racioppi (eds.)]. World Health Organization, Copenhagen, Denmark, 51 pp. <http://www.euro.who.int/Document/GCH/Protecting_health.pdf>

[17] Nicholls, R.J., P.P. Wong, V.R. Burkett, J.O. Codignotto, J.E. Hay, R.F. McLean, S. Ragoonaden, and C.D. Woodroffe, 2007: Coastal systems and low-lying areas. In: *Climate Change 2007: Impacts, Adaptations and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 316-356.

[18] Kafalenos, R.S., K.J. Leonard, D.M. Beagan, V.R. Burkett, B.D. Keim, A. Meyers, D.T. Hunt, R.C. Hyman, M.K. Maynard, B. Fritsche, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and M.J. Savonis, 2008: What are the implications of climate change and variability for Gulf coast transportation? In: *Impacts of Climate Change and Variability on Transportation Systems and Infra-*

structure: Gulf Coast Study, Phase I [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Climate Change Science Program, Washington, DC, [104 pp.]

[19] National Research Council (NRC), 2008: *Potential Impacts of Climate Change on U.S. Transportation*. Transportation Research Board special report 290. Transportation Research Board, Washington, DC, 218 pp.

[20] Boyles, S., 2008: *Heat Stress and Beef Cattle*. Ohio State University Extension Service. <http://beef.osu.edu/library/heat.html>

[21] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 21-74.

[22] Bates, B.C., Z.W. Kundzewicz, S. Wu, and J.P. Palutikof (eds.), 2008: *Climate Change and Water*. Technical paper of the Intergovernmental Panel on Climate Change. IPCC Secretariat, Geneva, 210 pp.

[23] Convention on Biodiversity, 2006: *Guidance for Promoting Synergy Among Activities Addressing Biological Diversity, Desertification, Land Degradation and Climate Change*. CBD technical series 25. Secretariat of the Convention on Biodiversity, Montreal, Canada, 43 pp. <http://www.biodiv.org/doc/publciations/cbd-ts-25.pdf>

[24] Burkett, V., 2008: The northern Gulf of Mexico coast: human development patterns, declining ecosystems, and escalating vulnerability to storms and sea level rise. In: *Sudden and Disruptive Climate Change: Exploring the Real Risks and How We Can Avoid Them*. [MacCracken, M.C., F. Moore, and J.C. Topping (eds.)]. Earthscan Publications, London [UK], and Sterling, VA, pp. 101-118.

[25] Twilley, R.R., E. Barron, H.L. Gholz, M.A. Harwell, R.L. Miller, D.J. Reed, J.B. Rose, E. Siemann, R.G. Welzel, and R.J. Zimmerman, 2001: *Confronting Climate Change in the Gulf Coast Region: Prospects for Sustaining Our Ecological Heritage*. Union of Concerned Scientists, Cambridge, MA, and Ecological Society of America, Washington, DC, 82 pp.

[26] Barras, J.A., 2006: *Land Area Change in Coastal Louisiana After the 2005 Hurricanes: A Series of Three Maps*. U.S. Geological Survey open-file report 2006-1274. <http://pubs.usgs.gov/of/2006/1274>

[27] USGS, photos and images:
Photos on the left:
Tihansky, A.B., 2005: Before-and-after aerial photographs show coastal impacts of Hurricane Katrina. *Sound Waves*, September. <http://soundwaves.usgs.gov/2005/09/fieldwork2.html>
Images on the right:
Adapted from Fauver, L., 2007: Predicting flooding and coastal hazards: USGS hydrologists and geologists team up at the National Hurricane Conference to highlight data collection. *Sounds Waves*, June. <http://soundwaves.usgs.gov/2007/06/meetings.html>

[28] Sea surface temperatures from Smith, T.M., R.W. Reynolds, T.C. Peterson, and J. Lawrimore, 2008: Improvements to NOAA's historical merged land-ocean surface temperature analysis (1880-2006). *Journal of Climate*, **21(10)**, 2283-2296.

Calculated within the North Atlantic Main Development Region for hurricanes (8.5N-21.5N, 20W-85W).

Hurricane totals for category 4 and 5 storms within 5-year windows. From NOAA's Oceanographic and Meteorological Laboratory: <http://www.aoml.noaa.gov/hrd/hurdat/ushurrlist18512005-gt.txt> with updates.

[29] Burkett, V.R., D.A. Wilcox, R. Stottlemeyer, W. Barrow, D. Fagre, J. Baron, J. Price, J.L. Nielsen, C.D. Allen, D.L. Peterson, G. Ruggerone, and T. Doyle, 2005: Nonlinear dynamics in ecosystem response to climatic change: case studies and policy implications. *Ecological Complexity,* **2(4)**, 357-394.

[30] Williams, K.L., K.C. Ewel, R.P. Stumpf, F.E. Putz, and T.W. Workman, 1999: Sea-level rise and coastal forest retreat on the west coast of Florida. *Ecology*, **80(6)**, 2045-2063.

[31] McNulty, S.G., J.M. Vose, and W.T. Swank, 1996: Potential climate change affects on loblolly pine productivity and hydrology across the southern United States. *Ambio,* **25(7)**, 449-453.

[32] Zimmerman, R.J., T.J. Minello, and L.P. Rozas, 2002: Salt marsh linkages to productivity of penaeid shrimps and blue crabs in the northern Gulf of Mexico. In: *Concepts and Controversies in Tidal Marsh Ecology* [Weinstein, M.P. and D.A. Kreeger (eds.)]. Kluwer, Dordrecht and Boston, pp. 293-314.

[33] Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit, and K. Takahashi, 2007: Assessment of adaptation practices, options, constraints and capacity. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 717-743.

[34] U.S. Army Corps of Engineers, 2009: *Risk Reduction Plan: Levees/Floodwalls/Armoring*. [web site] U.S. Army Corps of Engineers New Orleans District. <http://www.mvn.usace.army.mil/hps2/hps_levees_flood_armor.asp>

[35] Peterson, T.C., D.M. Anderson, S.J. Cohen, M. Cortez-Vázquez, R.J. Murnane, C. Parmesan, D. Phillips, R.S. Pulwarty, and J.M.R. Stone, 2008: Why weather and climate extremes matter. In: *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp.11-34.

MIDWEST

[1] Kling, G.W., K. Hayhoe, L.B. Johnson, J.J. Magnuson, S. Polasky, S.K. Robinson, B.J. Shuter, M.M. Wander, D.J. Wuebbles, and D.R. Zak, 2003: *Confronting Climate Change in the Great Lakes Region: Impacts on Our Communities and Ecosystems*. Union of Concerned Scientists, Cambridge, MA, and Ecological Society of America, Washington, DC, 92 pp. <http://www.ucsusa.org/greatlakes/>

[2] Hayhoe, K., D. Wuebbles, and the Climate Science Team, 2008: *Climate Change and Chicago: Projections and Potential Impacts*. City of Chicago, [175 pp.] <http://www.chicagoclimateaction.org/>

[3] Wuebbles, D.J. and K. Hayhoe, 2004: Climate change projections for the United States Midwest. *Mitigation and Adaptation Strategies for Global Change*, **9(4)**, 335-363.

[4] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[5] Ebi, K.L. and G.A. Meehl, 2007: The heat is on: climate change and heat waves in the Midwest. In: *Regional Impacts of Climate Change: Four Case Studies in the United States*. Pew Center on Global Climate Change, Arlington, VA, pp. 8-21. <http://www.pewclimate.org/regional_impacts>

[6] Kalkstein, L.S., J.S. Green, D.M. Mills, A.D. Perrin, J.P. Samenow, and J.-C. Cohen, 2008: Analog European heat waves for U.S. cities to analyze impacts on heat-related mortality. *Bulletin of the American Meteorological Society*, **89(1)**, 75-85.

[7] Xuezhi, B., J. Wang, C. Sellinger, and A. Clites, 2008: The impacts of the AO and ENSO on the Great Lakes ice cover (submitted to J. Climate or J. Great Lakes Res.)

[8] Lin, J.-T., K.O. Patten, X.-Z. Liang, and D.J. Wuebbles, 2008: Climate change effects on ozone air quality in the United States and China with constant precursor emissions. *Journal of Applied Meteorology and Climatology*, **47(7)**, 1888-1909.

[9] Holloway, T., S.N. Spak, D. Barker, M. Bretl, K. Hayhoe, J. Van Dorn, and D. Wuebbles, 2008: Change in ozone air pollution over Chicago associated with global climate change. *Journal of Geophysical Research*, **113**, D22306, doi:10.1029/2007JD009775.

[10] Tao, Z., A. Williams, H.-C. Huang, M. Caughey, and X.-Z. Liang, 2007: Sensitivity of U.S. surface ozone to future emissions and climate changes. *Geophysical Research Letters*, **34**, L08811, doi:10.1029/2007GL029455.

[11] Hedegaard, G.B., J. Brandt, J.H. Christensen, L.M. Frohn, C. Geels, K.M. Hansen, and M. Stendel, 2008: Impacts of climate change on air pollution levels in the Northern Hemisphere with special focus on Europe and the Arctic. *Atmospheric Chemistry and Physics*, **8(12)**, 3337-3367.

[12] Ebi, K.L., J. Balbus, P.L. Kinney, E. Lipp, D. Mills, M.S. O'Neill, and M. Wilson, 2008: Effects of global change on human health. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 2-1 to 2-78.

[13] Several different city of Chicago analyses have substantiated the finding of up to 77 degree difference – for example, see <http://afp.google.com/article/ALeqM5g8EYMiBGrnv2HJ_QEb2baeio2R-wA>

[14] Extension of analyses in Hayhoe, Wuebbles *et al.* (reference 2), using same techniques, but including all of the Great Lakes (journal article in preparation).

[15] VanDorn, J., T. Croley, K. Hayhoe, and D. Wuebbles, 2008: Projected 21st century transient changes in Great Lake levels under higher and lower emission scenarios. *Journal of Great Lakes Research*, submitted.

[16] Annin, P., 2006: *The Great Lakes Water Wars*. Island Press, Washington, DC, 303 pp.

[17] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[18] Changnon, S.A. (ed.), 1996: *The Great Flood of 1993: Causes, Impacts and Responses*. Westview Press, Boulder, CO, 321 pp.

[19] Changnon, S.A. and K.E. Kunkel, 2006: *Severe Storms in the Midwest*. Illinois State Water Survey, Champaign, IL, 74 pp. <http://www.sws.uiuc.edu/pubdoc/IEM/ISWSIEM2006-06.pdf>

[20] Kunkel, K.E., K. Andsager, G. Conner, W.L. Decker, H.J. Hilaker Jr., P.N. Knox, F.V. Nurnberger, J.C. Rogers, K. Scheeringa, W.M. Wendland, J. Zandlo, and J.R. Angel, 1998: An expanded digital daily database for climatic resources applications in the midwestern United States. *Bulletin of the American Meteorological Society*, **79(7)**, 1357-1366.

[21] National Research Council (NRC), 2008: *Potential Impacts of Climate Change on U.S. Transportation*. Transportation Research Board special report 290. Transportation Research Board, Washington, DC, 234 pp. <http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf>

[22] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 21-74.

[23] Ryan, M.G., S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, and W. Schlesinger, 2008: Land resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 75-120.

[24] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008: Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D.

Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 151-181.

GREAT PLAINS

[1] Woodhouse, C. and J. Overpeck, 1998: 2000 years of drought variability in the central United States. *Bulletin of the American Meteorological Society*, **79(12)**, 2693-2714.

[2] DeGaetano, A.T. and R.J. Allen, 2002: Trends in twentieth-century temperature extremes across the United States. *Journal of Climate*, **15(22)**, 3188-3205.

[3] Garbrecht, J., M. Van Liew, and G.O. Brown, 2004: Trends in precipitation, streamflow, and evapotranspiration in the Great Plains of the United States. *Journal of Hydrologic Engineering*, **9(5)**, 360-367.

[4] Lettenmaier, D., D. Major, L. Poff, and S. Running, 2008: Water resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 121-150.

[5] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[6] McGuire, V., 2007: *Water-level Changes in the High Plains Aquifer, Predevelopment to 2005 and 2003 to 2005*. U.S. Geological Survey scientific investigations report 2006–5324. U.S. Geological Survey, Reston, VA, 7 pp. <http://pubs.usgs.gov/sir/2006/5324/>

[7] Dennehy, K. 2000: *High Plains Regional Ground-Water Study*. U.S. Geological Survey fact sheet FS-091-00, 6 pp. <http://pubs.er.usgs.gov/usgspubs/fs/fs09100>

[8] Backlund, P., D. Schimel, A. Janetos, J. Hatfield, M.G. Ryan, S.R. Archer, and D. Lettenmaier, 2008: Introduction. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 11-20.

[9] Gurdak, J.J., R.T. Hanson, P.B. McMahon, B.W. Bruce, J.E. McCray, G.D. Thyne, and R.C. Reedy, 2007: Climate variability controls on unsaturated water and chemical movement, High Plains aquifer, USA. *Vadose Zone Journal*, **6(3)**, 533-547.

[10] Green, T.R., M. Taniguchi, and H. Kooi, 2007: Potential impacts of climate change and human activity on subsurface water resources. *Vadose Zone Journal*, **6(3)**, 531-532.

[11] Mahmood, R., S.A. Foster, T. Keeling, K.G. Hubbard, C. Carlson, and R. Leeper, 2006: Impacts of irrigation on 20th century temperature in the northern Great Plains. *Global and Planetary Change*, **54(1-2)**, 1-18.

[12] Moore, N. and S. Rojstaczer, 2002: Irrigation's influence on precipitation: Texas High Plains, USA. *Geophysical Research Letters*, **29(16)**, 1755, doi:10.1029/2002GL014940.

[13] Schubert, S.D., M.J. Suarez, P.J. Pegion, R.D. Koster, and J.T. Bacmeister, 2004: On the cause of the 1930s Dust Bowl. *Science*, **303(5665)**, 1855-1859.

[14] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007:

The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[15] Motha, R.P. and W. Baier, 2005: Impacts of present and future climate change and climate variability on agriculture in the temperate regions: North America. *Climatic Change*, **70(1-2)**, 137-164.

[16] Izaurralde, R.C., N.J. Rosenberg, R.A. Brown, and A.M. Thomson, 2003: Integrated assessment of Hadley Center (HadCM2) climate-change impacts on agricultural productivity and irrigation water supply in the conterminous United States: Part II. Regional agricultural production in 2030 and 2095. *Agricultural and Forest Meteorology*, **117(1-2)**, 97-122.

[17] Ziska, L. and K. George, 2004: Rising carbon dioxide and invasive, noxious plants: potential threats and consequences. *World Resource Review*, **16**, 427-447.

[18] Parton, W., M. Gutmann, and D. Ojima, 2007: Long-term trends in population, farm income, and crop production in the Great Plains. *Bioscience*, **57(9)**, 737-747.

[19] Reilly, J., F. Tubiello, B. McCarl, D. Abler, R. Darwin, K. Fuglie, S. Hollinger, C. Izaurralde, S. Jagtap, J. Jones, L. Mearns, D. Ojima, E. Paul, K. Paustian, S. Riha, N. Rosenberg, and C. Rosenzweig, 2003: U.S. agriculture and climate change: new results. *Climatic Change*, **57(1-2)**, 43-69.

[20] Allen, V.G., C.P. Brown, R. Kellison, E. Segarra, T. Wheeler, P.A. Dotray, J.C. Conkwright, C.J. Green, and V. Acosta-Martinez, 2005: Integrating cotton and beef production to reduce water withdrawal from the Ogallala aquifer in the southern high plains. *Agronomy Journal*, **97(2)**, 556-567.

[21] Hanson, J.D., M.A. Liebig, S.D. Merrill, D.L. Tanaka, J.M. Krupinsky, and D.E. Stott, 2007: Dynamic cropping systems: increasing adaptability amid an uncertain future. *Agronomy Journal*, **99(4)**, 939-943.

[22] Cameron, G.N. and D. Scheel, 2001: Getting warmer: effect of global climate change on distribution of rodents in Texas. *Journal of Mammalogy*, **82(3)**, 652-680.

[23] Levia, D.F. and E.E. Frost, 2004: Assessment of climatic suitability for the expansion of *Solenopsis invicta* Buren in Oklahoma using three general circulation models. *Theoretical and Applied Climatology*, **79(1-2)**, 23-30.

[24] Peterson, A.T., 2003: Projected climate change effects on Rocky Mountain and Great Plains birds: generalities of biodiversity consequences. *Global Change Biology*, **9(5)**, 647-655.

[25] Niemuth, N.D. and J.W. Solberg, 2003: Response of waterbirds to number of wetlands in the prairie pothole region of North Dakota, USA. *Waterbirds*, **26(2)**, 233-238.

[26] Conway, W.C., L.M. Smith, and J.D. Ray, 2005: Shorebird breeding biology in wetlands of the Playa Lakes, Texas, USA. *Waterbirds*, **28(2)**, 129-138.

[27] Scanlon, B., R. Reedy, and J. Tachovsky, 2007: Semiarid unsaturated zone chloride profiles: archives of past land use change impacts on water resources in the southern High Plains, United States. *Water Resources Research*, **43**, W06423, doi:10.1029/2006WR005769.

[28] Haukos, D.A. and L.M. Smith, 2003: Past and future impacts of wetland regulations on playa ecology in the southern Great Plains. *Wetlands*, **23(3)**, 577-589.

[29] Matthews, J., 2008: *Anthropogenic Climate Change in the Playa Lakes Joint Venture Region: Understanding Impacts, Discerning Trends, and Developing Responses*. Playa Lakes Joint Venture, Lafayette, CO, 40 pp. <http://www.pljv.org/cms/climate-change>

[30] Playa Lakes Joint Venture, Undated: *Playas and the Ogallala Aquifer – What's the Connection?* Playa Lakes Joint Venture, Lafayette, CO, 2 pp. <http://www.pljv.org/assets/Media/Recharge.pdf>

[31] Wilbanks, T.J., P. Kirshen, D. Quattrochi, P. Romero-Lankao, C. Rosenzweig, M. Ruth, W. Solecki, J. Tarr, P. Larsen, and B. Stone, 2008: Effects of global change on human settlements. In: *Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems* [Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, and T.J. Wilbanks (authors)]. Synthesis and Assessment Product 4.6. U.S. Environmental Protection Agency, Washington, DC, pp. 3-1 to 3-31.

[32] U.S. Census Bureau, 2007: *Census Bureau Announces Most Populous Cities*. Press release June 28, 2007. <http://www.census.gov/Press-Release/www/releases/archives/population/010315.html>

[33] Ebi, K.L., D.M. Mills, J.B. Smith, and A. Grambsch, 2006: Climate change and human health impacts in the United States: an update on the results of the US national assessment. *Environmental Health Perspectives*, **114(9)**, 1318-1324.

[34] Bull, S.R., D.E. Bilello, J. Ekmann, M.J. Sale, and D.K. Schmalzer, 2007: Effects of climate change on energy production and distribution in the United States. In: *Effects of Climate Change on Energy Production and Use in the United States* [Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J. Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott (eds.)]. Synthesis and Assessment Product 4.5. U.S. Climate Change Science Program, Washington, DC, pp. 45-80.

[35] Nielsen, D.C., P.W. Unger, and P.R. Miller, 2005: Efficient water use in dryland cropping systems in the Great Plains. *Agronomy Journal*, **97(2)**, 364-372.

[36] National Asessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[37] Hatfield, J., K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, and D. Wolfe, 2008: Agriculture. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Department of Agriculture, Washington, DC, pp. 21-74.

SOUTHWEST

[1] National Climatic Data Center, 2008: Southwest region Palmer Hydrological Drought index (PHDI). In: *Climate of 2008 – October: Southwest Region Moisture Status*. [web site] NOAA National Climatic Data Center, Asheville, NC. <http://www.ncdc.noaa.gov/img/climate/research/prelim/drought/Reg107Dv00_palm06_pg.gif>

[2] Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger, 2008: Human induced changes in the hydrology of

the western United States. *Science*, **319(5866),** 1080-1083.

[3] Bonfils, C., B.D. Santer, D.W. Pierce, H.G. Hidalgo, G. Bala, T. Das, T.P. Barnett, D.R. Cayan, C. Doutriaux, A.W. Wood, A. Mirin, and T. Nozawa, 2008: Detection and attribution of temperature changes in the mountainous western United States. *Journal of Climate*, **21(23)**, 6404-6424.

[4] Pierce, D.W., T.P. Barnett, H.G. Hidalgo, T. Das, C. Bonfils, B.D. Santer, G. Bala, M.D. Dettinger, D.R. Cayan, A. Mirin, A.W. Wood, and T. Nozawa, 2008: Attribution of declining western U.S. snowpack to human effects. *Journal of Climate*, **21(23)**, 6425-6444.

[5] Guhathakurta, S. and P. Gober, 2007: The impact of the Phoenix urban heat island on residential water use. *Journal of the American Planning Association*, **73(3)**, 317-329.

[6] Rauscher, S.A., J.S. Pal, N.S. Diffenbaugh, and M. Benedetti, 2008: Future changes in runoff timing over the western United States. *Geophysical Research Letters*, **35**, L16703, doi:10.1029/2008GL034424.

[7] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[8] Gleick, P.H., 1988: Regional hydrologic consequences of increases in atmospheric CO_2 and other trace gases. *Climatic Change*, **10(2)**, 137-160.

[9] Milly, P.C.D., J. Betancourt, M. Falkenmark, R.M. Hirsch, Z.W. Kundzewick, D.P. Lettenmaier, and R.J. Stouffler, 2008: Stationarity is dead: whither water management. *Science*, **319(5863)**, 573-574.

[10] Woodhouse, C.A., S.T. Gray, and D.M. Meko, 2006: Updated streamflow reconstructions for the upper Colorado River basin. *Water Resources Research*, **42,** W05415, doi:10.1029/2005WR004455.

[11] CMIP3-B: Analysis for the CONUS was based on methods described in: Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff, E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emission pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427; and Hayhoe, K., C. Wake, B. Anderson, X.-Z. Liang, E. Maurer, J. Zhu, J. Bradbury, A. DeGaetano, A.M. Stoner, and D. Wuebbles, 2008: Regional climate change projections for the Northeast USA. *Mitigation and Adaptation Strategies for Global Change*, **13(5-6)**, 425-436. This analysis uses 16 models simulations from the WCRP CMIP3. Where models had multiple runs, only the first run available from each model was used. See <http://gdo-dcp.ucllnl.org/downscaled_cmip3_projections/dcpInterface.html> for more information.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[12] Woodhouse, C.A. and J.T. Overpeck, 1998: 2000 years of drought variability in the central United States. *Bulletin of the American Meteorological Society*, **79(12)**, 2693-2714.

[13] Cook, E.R., C.A. Woodhouse, C.M. Eakin, D.M. Meko, and D.W. Stahle, 2004: Long-term aridity changes in the western United States. *Science*, **306(5698)**, 1015-1018.

[14] Meko, D.M., C.A. Woodhouse, C.A. Basisan, T. Knight, J.J. Lukas, M.K. Hughes, and M.W. Salzer, 2007: Medieval drought in the upper Colorado River basin. *Geophysical Research Letters*, **34**, L10705, doi:10.1029/2007GL029988.

[15] Stine, S., 1994: Extreme and persistent drought in California and Patagonia during mediaeval time. *Nature*, **369(6481)**, 546-549.

[16] Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Hastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, and C.W. Meyer, 2005: Regional vegetation die-off in response to global-change drought. *Proceedings of the National Academy of Sciences*, **102(42)**, 15144-15148.

[17] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[18] Seager, R., M. Ting, I. Held, Y. Kushnir, J. Lu, G. Vecchi, H.-P. Huang, N. Harnik, A. Leetmaa, N.-C. Lau, C. Li, J. Velez, and N. Naik, 2007: Model projections of an imminent transition to a more arid climate in southwestern North America. *Science*, **316(5828)**, 1181-1184.

[19] Seidel, D.J., Q. Fu, W.J. Randel, and T.J. Reichler, 2008: Widening of the tropical belt in a changing climate. *Nature Geoscience*, **1(1)**, 21-24.

[20] Archer, C.L. and K. Caldiera, 2008: Historical trends in the jet streams. *Geophysical Research Letters*, **35**, L08803, doi:10.1029/2008GL033614.

[21] McAfee, S.A. and J.L. Russell, 2008: Northern annular mode impact on spring climate in the western United States. *Geophysical*

Research Letters, **35**, L17701, doi:10.1029/2008GL034828.

[22] Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam, 2006: Warming and earlier spring increase western U.S. forest fire activity. *Science*, **313(5789)**, 940-943.

[23] Lenihan, J.M., D. Bachelet, R.P. Neilson, and R. Drapek, 2008: Response of vegetation distribution, ecosystem productivity, and fire to climate change scenarios for California. *Climatic Change*, **87(Supplement 1)**, S215-S230.

[24] Westerling, A.L. and B.P. Bryant, 2008: Climate change and wildfire in California. *Climatic Change*, **87(Supplement 1)**, S231-S249.

[25] Fried, J.S., J.K. Gilless, W.J. Riley, T.J. Moody, C.S. de Blas, K. Hayhoe, M. Moritz, S. Stephens and M. Torn, 2008: Predicting the effect of climate change on wildfire behavior and initial attack success. *Climatic Change*, **87(Supplement 1)**, S251-S264.

[26] Moritz, M.A. and S.L. Stephens, 2008: Fire and sustainability: considerations for California's altered future climate. *Climatic Change*, **87(Supplement 1)**, S265-S271.

[27] Rehfeldt, G.E., N.L. Crookston, M.V. Warwell, and J.S. Evans, 2006: Empirical analyses of plant-climate relationships for the western United States. *International Journal of Plant Sciences*, **167(6)**, 1123-1150.

[28] Hayhoe, K., D. Cayan, C.B. Field, P.C. Frumhoff , E.P. Maurer, N.L. Miller, S.C. Moser, S.H. Schneider, K. Nicholas Cahill, E.E. Cleland, L. Dale, R. Drapek, R.M. Hanemann, L.S. Kalkstein, J. Lenihan, C.K. Lunch, R.P. Neilson, S.C. Sheridan, and J.H. Verville, 2004: Emissions pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences*, **101(34)**, 12422-12427.

[29] Weiss, J. and J.T. Overpeck, 2005: Is the Sonoran Desert losing its cool? *Global Change Biology*, **11(12)**, 2065-2077.

[30] Dole, K.P., M.E. Loik, and L.C. Sloan, 2003: The relative importance of climate change and the physiological effects CO_2 on freezing tolerance for the future distribution of *Yucca brevifolia*. *Global and Planetary Change*, **36(1-2),** 137-146.

[31] Loarie, S.R., B.E. Carter, K. Hayhoe, S. McMahon, R. Moe, C.A. Knight, and D.D. Ackerley, 2008: Climate change and the future of California's endemic flora. *PLoS ONE*, **3(6)**, e2502, doi:10.1371/journal.pone.0002502.

[32] Owen, T.W. and K.P. Gallo, 2000: Updated population metadata for the United States Historical Climatology Network stations. *Journal of Climate*, **13(22)**, 4028-4033. <http://www.ncdc.noaa.gov/oa/climate/research/population/>

[33] Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. daFonseca, and J. Kent, 2000: Biodiversity hotspots for conservation priorities. *Nature*, **403(6772)**, 853-858.

[34] Mittermeier R.A., P. Robles Gil, M. Hoffman, J. Pilgrim, T. Brooks, C. Goettsch Mittermeier, J. Lamoreux, and G.A.B. da Fonseca, 2005: *Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions*. Conservation International, Washington DC, 392 pp.

[35] Farjon, A. and C.N. Page (eds.), 1999: *Conifers: Status Survey and Conservation Action Plan*. IUCN/SSC Conifer Special Group. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland, and Cambridge, UK, 121 pp.

[36] Nixon, K.C., 1993: The genus *Quercus* in Mexico. In: *Biological Diversity of Mexico: Origins and Distribution* [Ramamoorthy, T.P., R. Bye, A. Lot, and J. Fa (eds.)]. Oxford University Press, New York, 812 pp.

[37] Brower, L.P., G. Castilleja, A. Peralta, J. López-García, L. Bojórquez-Tapia, S. Díaz, D. Melgarejo, and M. Missrie, 2002: Quantitative changes in forest quality in a principal overwintering area of the monarch butterfly in Mexico, 1971–1999. *Conservation Biology*, **16(2)**, 346-359.

[38] Goodrich, G. and A. Ellis, 2008: Climatic controls and hydrologic impacts of a recent extreme seasonal precipitation reversal in Arizona. *Journal of Applied Meteorology and Climatology*, **47(2)**, 498-508.

[39] Allan, R.P. and B.J. Soden, 2008: Atmospheric warming and the amplifications of precipitation extremes. *Science*, **321(5895)**, 1481-1484.

[40] Knowles, N., M.D. Dettinger, and D.R. Cayan, 2006: Trends in snowfall versus rainfall in the western United States. *Journal of Climate*, **19(18)**, 4545-4559.

[41] Bales, R.C., N.P. Molotch, T.H. Painter, M.D. Dettinger, R. Rice, and J. Dozier, 2006: Mountain hydrology of the western United States. *Water Resources Research*, **42**, W08432, doi:10.1029/2005WR004387.

[42] Delta Risk Management Strategy, 2008: Section 2: Sacramento/San Joaquin Delta and Suisun Marsh. In: *Phase I Report: Risk Analysis*. California Department of Water Resources, [13 pp.] <http://www.drms.water.ca.gov>

[43] Delta Risk Management Strategy, 2008: Summary report. In: *Phase I Report: Risk Analsysis*. California Department of Water Resources, [42 pp.]. <http://www.drms.water.ca.gov>

[44] Zimmerman, G., C. O'Brady, and B. Hurlbutt, 2006: Climate change: modeling a warmer Rockies and assessing the implications. In: *The 2006 State of the Rockies Report Card*. Colorado College, Colorado Springs, pp. 89-102. <http://www.coloradocollege.edu/stateoftherockies/06ReportCard.html>

[45] Lazar, B. and M. Williams, 2008: Climate change in western ski areas: potential changes in the timing of wet avalanches and snow quality for the Aspen ski areas in the years 2030 and 2100. *Cold Regions Science and Technology*, **51(2-3)**, 219-228.

[46] Miller, N., K. Hayhoe, J. Jin, and M. Aufhammer, 2008: Climate, extreme heat, and electricity demand in California. *Journal of Applied Meteorology and Climatology*, **47(6)**, 1834-1844.

[47] Kleeman, M.J., 2008: A preliminary assessment of the sensitivity of air quality in California to global change. *Climatic Change*, **87(Supplement 1)**, S273-S292.

[48] Vicuna, S., R. Leonardson, M.W. Hanemann, L.L. Dale, and J.A. Dracup, 2008: Climate change impacts on high elevation hydropower generation in California's Sierra Nevada: a case study in the upper American River. *Climatic Change*, **87(Supplement 1)**, S123-S137.

[49] Medellín-Azuara, J., J.J. Harou, M.A. Olivares, K. Madani, J.R. Lund, R.E. Howitt, S.K. Tanaka, M.W. Jenkins, and T. Zhu, 2008: Adaptability and adaptations of California's water supply system to dry climate warming. *Climatic Change*, **87(Supplement 1)**, S75-S90.

[50] Baldocchi, D. and S. Wong, 2008: Accumulated winter chill is decreasing in the fruit growing regions of California. *Climatic Change*, **87(Supplement 1)**, S153-S166.

[51] Lobell, D., C. Field, K. Nicholas Cahill, and C. Bonfils, 2006: Impacts of future climate change on California perennial crop yields: model projections with climate and crop uncertainties. *Agricultural and Forest Meteorology,* **141(2-4)**, 208-218.

[52] Reisman, C., K. Hayhoe, J. VanDorn, K. Nicholas Cahill, E. Maurer, M. Matthews, and D. Block, 2009: Climatic impacts on California Cabernet Sauvignon wine quality. Env. Sci. submitted.

[53] Purkey, D.R., B. Joyce, S. Vicuna, M.W. Hanemann, L.L. Dale, D. Yates, and J.A. Dracup, 2008: Robust analysis of future climate change impacts on water for agriculture and other sectors: a case study in the Sacramento Valley. *Climatic Change*, **87(Supplement 1)**, S109-S122.

NORTHWEST

[1] Barnett, T.P., D.W. Pierce, H.G. Hidalgo, C. Bonfils, B.D. Santer, T. Das, G. Bala, A.W. Wood, T. Nozawa, A.A. Mirin, D.R. Cayan, and M.D. Dettinger, 2008: Human induced changes in the hydrology of the western United States. *Science*, **319(5866),** 1080-1083.

[2] Mote, P.W., 2003: Trends in temperature and precipitation in the Pacific Northwest during the twentieth century. *Northwest Science*, **77(4)**, 271-282.

[3] Mote, P., E. Salathé, V. Dulière, and E. Jump, 2008: *Scenarios of Future Climate for the Pacific Northwest*. Climate Impacts Group, University of Washington, Seattle, 12 pp. <http://cses.washington.edu/db/pubs/abstract628.shtml>

[4] Hamlet, A.F., P.W. Mote, M. Clark, and D.P. Lettenmaier, 2005: Effects of temperature and precipitation variability on snowpack trends in the western United States. *Journal of Climate,* **18(21)**, 4545-4561.

[5] Christensen, J.H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, R.K. Kolli, W.-T. Kwon, R. Laprise, V. Magaña Rueda, L. Mearns, C.G. Menéndez, J. Räisänen, A. Rinke, A. Sarr, and P. Whetton, 2007: Regional climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 847-940.

[6] Mote, P.W., 2006: Climate-driven variability and trends in mountain snowpack in western North America. *Journal of Climate,* **19(23)**, 6209-6220.

[7] Payne, J.T., A.W. Wood, A.F. Hamlet, R.N. Palmer, and D.P. Lettenmaier, 2004: Mitigating the effects of climate change on the water resources of the Columbia River basin. *Climatic Change*, **62(1-3)**, 233-256.

[8] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[9] Peterson, T.C., D.M. Anderson, S.J. Cohen, M. Cortez-Vázquez, R.J. Murnane, C. Parmesan, D. Phillips, R.S. Pulwarty, and J.M.R. Stone, 2008: Why weather and climate extremes matter. In: *Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 11-34.

[10] Stewart, I.T., D.R. Cayan, and M.D. Dettinger, 2004: Changes in snowmelt runoff timing in western North America under a 'business as usual' climate change scenario. *Climatic Change,* **62(1-3),** 217-232.

[11] Figure provided by the Climate Impacts Group, University of Washington, Seattle. <http://cses.washington.edu/cig/>

[12] Mote, P.W., A.F. Hamlet, M.P. Clark, and D.P. Lettenmaier, 2005: Declining mountain snowpack in western North America. *Bulletin of the American Meteorological Society*, **86(1)**, 39-49.

[13] Hamlet, A.F. and D.P. Lettenmaier, 2007: Effects of 20th century warming and climate variability on flood risk in the western U.S. *Water Resources Research,* **43**, W06427, doi:10.1029/2006WR005099.

[14] Bonneville Power Administration, 2001: *The Columbia River System Inside Story*. Internal report DOE/BP-3372. Bonneville Power Administration, Portland OR, 2nd edition, 78 pp. <http://www.bpa.gov/corporate/Power_of_Learning/docs/columbia_river_inside_story.pdf>

[15] Casola, J.H., J.E. Kay, A.K. Snover, R.A. Norheim, L.C. Whitely Binder, and Climate Impacts Group, 2005: *Climate Impacts on Washington's Hydropower, Water Supply, Forests, Fish, and Agriculture*. Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Ocean, University of Washington, Seattle, 43 pp. <http://cses.washington.edu/db/pdf/kc05whitepaper459.pdf>

[16] Ryan, M.G., S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren,J. Randerson, and W. Schlesinger, 2008: Land resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 75-120.

[17] Ministry of the Environment, British Columbia, Canada, 2007: *Environmental Trends 2007: The Mountain Pine Beetle in British Columbia*. <http://www.env.gov.bc.ca/soe/et07/pinebeetle.html>

[18] Francis, R.C. and N.J. Mantua, 2003: Climatic influences on salmon populations in the northeast Pacific. In: *Assessing Extinction Risk for West Coast Salmon* [MacCall, A.D. and T.C. Wainwright (eds.)]. NOAA technical memo NMFS-NWFSC-56. National Marine Fisheries Service, [Washington, DC], pp. 37-67. <http://www.nwfsc.noaa.gov/assets/25/3946_06162004_130044_tm56.pdf>

[19] Salathé, E.P., 2005: Downscaling simulations of future global climate with application to hydrologic modelling. *International Journal of Climatology*, **25(4)**, 419-436.

[20] Mote, P.W., A. Petersen, S. Reeder, H. Shipman, and L. Whitely Binder, 2008: *Sea Level Rise Scenarios for Washington State*. Center for Science in the Earth System, Joint Institute for the Study of the Atmosphere and Oceans, University of Washington, Seattle, and Washington Department of Ecology, Lacey, 11 pp. <http://www.cses.washington.edu/db/pdf/moteetalslr579.pdf>

[21] Petersen, A.W., 2007: *Anticipating Sea Level Rise Response in Puget Sound*. M.M.A. thesis, School of Marine Affairs. University of Washington, Seattle, 73 pp.

ALASKA

[1] Fitzpatrick, J., R.B. Alley, J. Brigham-Grette, G.H. Miller, L. Polyak, and M. Serreze, 2008: Preface: Why and how to use this synthesis and assessment report. In: *Past Climate Variability and Change in the Arctic and at High Latitude*. [(eds.)]. Synthesis and Assessment Product 1.2. U.S. Climate Change Science Program, Washington, DC. {Not yet published}

[2] ACIA, 2004: *Impacts of a Warming Arctic: Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, 139 pp. <http://www.acia.uaf.edu>

[3] Meehl**,** G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[4] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[5] Data provided by Dr. Glenn Juday, School of Natural Resources and Agricultural Science, Agricultural and Forestry Experiment Station, University of Alaska, Fairbanks.

[6] Euskirchen, E.S., A.D. McGuire, D.W. Kicklighter, Q. Zhuang, J.S. Clein, R.J. Dargaville, D.G. Dye, J.S. Kimball, K.C. McDonald, V.E. Melillo, V.E. Romanovsky, and N.V. Smith, 2006: Importance of recent shifts in soil thermal dynamics on growing season length, productivity, and carbon sequestration in terrestrial high-latitude ecosystems. *Global Change Biology,* **12(4)**, 731-750.

[7] Euskirchen, E.S., A.D. McGuire, and F.S. Chapin III, 2007: Energy feedbacks of northern high-latitude ecosystems to the climate system due to reduced snow cover during 20th century warming. *Global Change Biology,* **13(11)**, 2425-2438.

[8] Barber, V.A., G.P. Juday, and B.P. Finney, 2000: Reduced growth of Alaskan white spruce in the twentieth century from temperature-induced drought stress. *Nature,* **405 (6787)**, 668-673.

[9] Juday, G.P., V. Barber, P. Duffy, H. Linderholm, T.S. Rupp, S. Sparrow, E. Vaganov, and J. Yarie, 2005: Forests, land management, and agriculture. In: *Arctic Climate Impact Assessment.* Cambridge University Press, Cambridge, UK, and New York, pp. 781-862. <http://www.acia.uaf.edu/pages/scientific.html>

[10] Balshi, M.S., A.D. McGuire, P. Duffy, M. Flannigan, J. Walsh, and J.M. Melillo, 2008: Assessing the response of area burned to changing climate in western boreal North America using a Multivariate Adaptive Regression Splines (MARS) approach. *Global Change Biology,* Early View (online in advance of print), doi:10.1111/j.1365-2486.2008.01679.x

[11] Ryan, M.G., S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, and W. Schlesinger, 2008: Land resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 75-120.

[12] Berman, M., G.P. Juday, and R. Burnside, 1999: Climate change and Alaska's forests: people, problems, and policies. In: *Assessing the Consequences of Climate Change in Alaska and the Bering Sea Region*. Proceedings of a workshop at the University of Alaska Fairbanks, 29-30 October 1998. Center for Global Change and Arctic System Research, University of Alaska, pp. 21-42.

[13] Fleming, R.A. and W.J.A. Volney, 1995: Effects of climate change on insect defoliator population processes in Canada's boreal forest: some plausible scenarios. *Water, Soil, and Air Pollution,* **82(1-2)**, 445-454.

[14] Kasischke, E.S. and M.R. Turetsky, 2006: Recent changes in the fire regime across the North American boreal region - spatial and temporal patterns of burning across Canada and Alaska. *Geophysical Research Letters,* **33**, L09703, doi:10.1029/2006GL025677.

[15] Chapin, F.S., III, S.F. Trainor, O. Huntington, A.L. Lovecraft, E. Zavaleta, D.C. Natcher, A.D. McGuire, J.L. Nelson, L. Ray, M. Calef, N. Fresco, H. Huntington, T.S. Rupp, L. DeWilde, and R.A. Naylor, 2008: Increasing wildfire in Alaska's boreal forest: pathways to potential solutions of a wicked problem. *BioScience,* **58(6)**, 531-540.

[16] Berner, J. and C. Furgal, 2005: Human health. In: *Arctic Climate Impact Assessment*. Cambridge University Press, Cambridge, UK, and New York, pp. 863-906. <http://www.acia.uaf.edu/pages/scientific.html>

[17] Klein, E., E.E. Berg, and R. Dial, 2005: Wetland drying and succession across the Kenai Peninsula Lowlands, south-central Alaska. *Canadian Journal of Forest Research*, **35(8)**, 1931-1941.

[18] Riordan, B., D. Verbyla, and A.D. McGuire, 2006: Shrinking ponds in subarctic Alaska based on 1950–2002 remotely sensed images. *Journal of Geophysical Research*, **111**, G04002, doi:10.1029/2005JG000150.

[19] Lettenmaier, D., D. Major, L. Poff, and S. Running, 2008: Water resources. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort,

W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J. Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 121-150.

[20] Osterkamp, T., 2007: Characteristics of the recent warming of permafrost in Alaska. *Journal of Geophysical Research*, **112**, F02S02, doi:10.1029/2006JF000578.

[21] Instanes, A., O. Anisimov, L. Brigham, D. Goering, L.N. Khrustalev, B. Ladanyi, and J.O. Larsen, 2005: Infrastructure: buildings, support systems, and industrial facilities. In: *Arctic Climate Impact Assessment.* Cambridge University Press, Cambridge, UK, and New York, pp. 907-944. <http://www.acia.uaf.edu/pages/scientific.html>

[22] Larsen, P.H., S. Goldsmith, O. Smith, M.L. Wilson, K. Strzepek, P. Chinowsky, and B. Saylor, 2008: Estimating future costs for Alaska public infrastructure at risk from climate change. *Global Environmental Change*, **18(3)**, 442-457.

[23] Hinzman, L.D., N.D. Bettez, W.R. Bolton, F.S. Chapin, M.B. Dyurgerov, C.L. Fastie, B. Griffith, R.D. Hollister, A. Hope, H.P. Huntington, A.M. Jensen, G.J. Jia, T. Jorgenson, D.L. Kane, D.R. Klein, G. Kofinas, A.H. Lynch, A.H. Lloyd, A.D. McGuire, F.E. Nelson, M. Nolan, W.C. Oechel, T.E. Osterkamp, C.H. Racine, V.E. Romanovsky, R.S. Stone, D.A. Stow, M. Sturm, C.E. Tweedie, G.L. Vourlitis, M.D. Walker, D.A. Walker, P.J. Webber, J.M. Welker, K.S. Winker, and K. Yoshikawa, 2005: Evidence and implications of recent climate change in northern Alaska and other Arctic regions. *Climatic Change,* **72(3)**, 251-298.

[24] Brown, J. and V.E. Romanovsky, 2008: Report from the International Permafrost Association: state of permafrost in the first decade of the 21st century. *Permafrost and Periglacial Processes*, **19(2)**, 255-260.

[25] Busey, R.C., L.D. Hinzman, J.J. Cassano, and E. Cassano, 2008: Permafrost distributions on the Seward Peninsula: past, present, and future. In: *Proceedings of the Ninth International Conference on Permafrost*, University of Alaska Fairbanks, June 29-July 3, 2008 [Kane, D.L. and K.M. Hinkel (eds.)]. Institute of Northern Engineering, University of Alaska, Fairbanks, pp. 215-220.

[26] Shumaker, V.O., 1979: *The Alaska Pipeline*. Julian Messner, New York, 64 pp.

[27] Bengtsson, L., K.I. Hodges, and E. Roeckner, 2006: Storm tracks and climate change. *Journal of Climate*, **19(15)**, 3518-3543.

[28] U.S. Army Corps of Engineers, 2008: *Newtok Evacuation Center, Mertarvik, Nelson Island, Alaska*. Revised environmental assessment. U.S. Army Corps of Engineers, Alaska District, [Elmendorf AFB, 64 pp.]

[29] Yin, J.H., 2005: A consistent poleward shift of the storm tracks in simulations of 21st century climate. *Geophysical Research Letters*, **32**, L18701, doi:10.1029/2005GL023684.

[30] Salathé, E.P., Jr., 2006: Influences of a shift in North Pacific storm tracks on western North American precipitation under global warming. *Geophysical Research Letters,* **33**, L19820, doi:10.1029/2006GL026882.

[31] Data provided by Dr. David Atkinson, International Arctic Research Center, University of Alaska, Fairbanks.

[32] Feely, R.A., C.L. Sabine, K. Lee, W. Berelson, J. Kleypas, V.J. Fabry and F.J. Millero, 2004: Impact of anthropogenic CO_2 on $CaCO_3$ system in the oceans. *Science,* **305(5682)**, 362-366.

[33] Orr, J.C., V.J. Fabry, O. Aumont, L. Bopp, S.C. Doney, R.A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, R.M. Key, K. Lindsay, E. Maier-Reimer, R. Matear, P. Monfray, A. Mouchet, R.G. Najjar, G.-K. Plattner, K.B. Rodgers, C.L. Sabine, J.L. Sarmiento, R. Schlitzer, R.D. Slater, I.J. Totterdell, M.-F. Weirig, Y. Yamanaka, and A. Yool, 2005: Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. *Nature*, **437(7059)**, 681-686.

[34] Grebmeier, J.M., J.E. Overland, S.E. Moore, E.V. Farley, E.C. Carmack, L.W. Cooper, K.E. Frey, J.H. Helle, F.A. McLaughlin, and S.L. McNutt, 2006: A major ecosystem shift in the northern Bering Sea. *Science,* **311(5766)**, 1461-1464.

[35] Ray, G.C., J. McCormick-Ray, P. Berg, and H.E. Epstein, 2006: Pacific walrus: benthic bioturbator of Beringia. *Journal of Experimental Marine Biology and Ecology*, **330(1)**, 403-419.

[36] Mueter, F.J. and M.A. Litzow, 2007: Sea ice retreat alters the biogeography of the Bering Sea continental shelf. *Ecological Applications*, **18(2)**, 309-320.

ISLANDS

[1] Shea, E.L., G. Dolcemascolo, C.L. Anderson, A. Barnston, C.P. Guard, M.P. Hamnett, S.T. Kubota, N. Lewis, J. Loschnigg, and G. Meehl, 2001: *Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change: Pacific Islands.* East-West Center, Honolulu, HI, 102 pp. <http://www2.eastwestcenter.org/climate/assessment/>

[2] Guidry, M.W. and F.T. Mackenzie, 2006: *Climate Change, Water Resources, and Sustainability in the Pacific Basin: Emphasis on O'ahu, Hawai'I and Majuro Atoll, Republic of the Marshall Islands*. University of Hawaii Sea Grant Program, Honolulu, 100 pp. <http://nsgl.gso.uri.edu/hawau/hawaut06001.pdf>

[3] CEO, 2004: *Caribbean Environmental Outlook.* [Heileman, S., L.J. Walling, C. Douglas, M. Mason, and M. Chevannes-Creary (eds.)]. United Nations Environmental Programme, Kingston, Jamaica, 114 pp. <http://www.unep.org/geo/pdfs/caribbean_eo.pdf>

[4] Church, J.A., N.J. White, and J.R. Hunter, 2006: Sea-level rise at tropical Pacific and Indian Ocean islands. *Global and Planetary Change*, **53(3)**, 155-168.

[5] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis.* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[6] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[7] CMIP3-A: This analysis uses 15 models simulations from the WCRP CMIP3 that were available at resolutions finer than 4 degrees (CCSM3.0, CSIRO, UKMO-HadCM3, IPSL, ECHAM5/MPI, CGCM3.1(T47), GFDL2.0, UKMO-HadGEM1, MIROC3.2(medres), MRI-CGCM2.3.2a, CNRM, GFDL2.1, INM-CM3, ECHO-G, PCM). See Wehner, M., 2005: Changes in daily precipitation and surface air temperature extremes in the IPCC AR4 models. *US CLIVAR Variations*, **3(3)**, 5-9.

Hatching indicates at least two out of three models agree on the sign of the projected change in precipitation.

We acknowledge the modeling groups, the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the WCRP's Working Group on Coupled Modelling (WGCM) for their roles in making available the WCRP CMIP3 multi-model dataset, <http://www-pcmdi.llnl.gov/projects/cmip/index.php>. Support of this dataset is provided by the Office of Science, U.S. Department of Energy. For an overview and documentation of the CMIP3 modelling activity, see Meehl, G.A., C. Covey, T. Delworth, M. Latif, B. McAvaney, J.F.B. Mitchell, R.J. Stouffer, and K.E. Taylor, 2007: The WCRP CMIP3 multi-model dataset: a new era in climate change research. *Bulletin of the American Meteorological Society*, **88(9)**, 1383-1394.

[8] Burns, W.C.G., 2002: Pacific island developing country water resources and climate change. In: *The World's Water* [Gleick, P. (ed.)]. Island Press, Washington, DC, 3rd edition, pp. 113-132.

[9] Baker, J.D., C.L. Littnan, and D.W. Johnston, 2006: Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna in the northwestern Hawaiian Islands. *Endangered Species Research*, **2**, 21-30.

[10] Merrifield, M.A., Y.L. Firing, and J.J. Marra, 2004: Annual climatologies of extreme water levels. In: *Extreme Events*, the 15th 'Aha Huliko'a Hawaiian Winter Workshop, University of Hawaii at Manoa, January 23-26, 2007. [Müller, P., C. Garrett, and D. Henderson (eds.)]. SOEST special publication. University of Hawaii, Honolulu, pp. 27-32. <http://www.soest.hawaii.edu/PubServices/Aha_2007_final.pdf>

[11] Firing, Y. and M.A. Merrifield, 2004: Extreme sea level events at Hawaii: influence of mesoscale eddies. *Geophysical Research Letters*, **31**, L24306, doi:10.1029/2004GL021539.

[12] Scott, D., M. Overmars, T. Falkland, and C. Carpenter, 2003: *Pacific Dialogue on Water and Climate, Synthesis Report.* South Pacific Applied Geoscience Commission, Fiji Islands, 28 pp. <http://www.oas.org/CDWC/Documents/SIDS%20Paper/Pacific%20Report%20-%20Final.pdf>

[13] Mimura, N., L. Nurse, R.F. McLean, J. Agard, L. Briguglio, P. Lefale, R. Payet, and G. Sem, 2007: Small islands. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 687-716.

[14] Hay, J., N. Mimura, J. Campbell, S. Fifita, K. Koshy, R.F. McLean, T. Nakalevu, P. Nunn, and N. deWet, 2003: *Climate Variability and Change and Sea Level Rise in the Pacific Islands Regions: A Resource Book for Policy and Decision Makers, Educators and Other Stakeholders.* South Pacific Regional Environmental Programme (SPREP), Apia, Samoa, 94 pp. <http://www.sprep.org/publication/pub_detail.asp?id=181>

[15] Kundzewicz, Z.W., L.J. Mata, N.W. Arnell, P. Döll, P. Kabat, B. Jiménez, K.A. Miller, T. Oki, Z. Sen, and I.A. Shiklomanov, 2007: Freshwater resources and their management. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 173-210.

[16] Gillespie, R.G., E.M. Claridge, and G.K. Roderick, 2008: Biodiversity dynamics in isolated island communities: interaction between natural and human-mediated processes. *Molecular Ecology*, **17(1)**, 45-57.

[17] Becken, S. and J.E. Hay, 2007: *Tourism and Climate Change: Risks and Opportunities.* Channel View Publications, Clevedon, UK, and Buffalo, NY, 329 pp.

[18] State of Hawaii, Division of Business, Economic Development, and Tourism, 2008: *Facts and Figures: State of Hawaii.* [web site] <http://hawaii.gov/dbedt/info/economic/library/facts/state>

[19] Cesar, H.S.F. and F.H. van Beukering, 2004: Economic valuation of the coral reefs of Hawaii. *Pacific Science*, **58(2)**, 231-242.

[20] Hoegh-Guldberg, O., P.J. Mumby, A.J. Hooten, R.S. Steneck, P. Greenfield, E. Gomez, C.D. Harvell, P.F. Sale, A.J. Edwards, K. Caldeira, N. Knowlton, C.M. Eakin, R. Iglesias-Prieto, N. Muthiga, R.H. Bradbury, A. Dubi, and M.E. Hatziolos, 2007: Coral reefs under rapid climate change and ocean acidification. *Science*, **318(5857)**, 1737-1742.

[21] Donner, S.D., W.J. Skirving, C.M. Little, M. Oppenheimer, and O. Hoegh-Guldberg, 2005: Global assessment of coral bleaching and required rates of adaptation under climate change. *Global Change Biology*, **11(12)**, 2251-2265.

[22] Paulay, G., L. Kirkendale, G. Lambert, and C. Meyer, 2002: Anthropogenic biotic interchange in a coral reef ecosystem: a case study from Guam. *Pacific Science,* **56(4)**, 403-422.

[23] Hotta, M., 2000: The sustainable contribution of fisheries to food security in the Asia and Pacific region: regional synthesis. In: *Sustainable Contribution of Fisheries to Food Security.* Food and Agriculture Organization of the United Nations, Bangkok, Thailand, pp. 1-28. <http://www.fao.org/DOCREP/003/X6956E/x6956e02.htm>

[24] Graham, N.A.J., S.K. Wilson, S. Jennings, N.V.C. Polunin, J.P. Bijoux, and J. Robinson, 2006: Dynamic fragility of oceanic coral reef ecosystems. *Proceedings of the National Academy of Sciences*, **103(22)**, 8425-8429.

[25] Lehodey, O., M. Bertignac, J. Hampton, A. Lewis, and J. Picaut, 1997: El Niño Southern Oscillation and tuna in the western Pacific. *Nature*, **389(6652)**, 715-718.

[26] Smith, T.M., R.W. Reynolds, T.C. Peterson, and J. Lawrimore, 2008: Improvements to NOAA's historical merged land–ocean surface temperature analysis (1880–2006). *Journal of Climate*, **21(10)**, 2283-2296.

COASTS

[1] Crowell, M., S. Edelman, K. Coulton, and S. McAfee, 2007: How many people live in coastal areas? *Journal of Coastal Research*, **23(5)**, iii-vi.

[2] U.S. Commission on Ocean Policy, 2004: *An Ocean Blueprint for the 21st Century*. U.S. Commission on Ocean Policy, Washington, DC. <http://www.oceancommission.gov/documents/full_color_rpt/welcome.html>

[3] Burkett, V.R., R.C. Hyman, R. Hagelman, S.B. Hartley, M. Sheppard, T.W. Doyle, D.M. Beagan, A. Meyers, D.T. Hunt, M.K. Maynard, R.H. Henk, E.J. Seymour, L.E. Olson, J.R. Potter, and N.N. Srinivasan, 2008: Why study the Gulf Coast? In: *Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I* [Savonis, M.J., V.R. Burkett, and J.R. Potter (eds.)]. Synthesis and Assessment Product 4.7. U.S. Department of Transportation, Washington, DC, pp. 2-1 to 2F-26. [66 pp.]

[4] Kunkel, K.E., P.D. Bromirski, H.E. Brooks, T. Cavazos, A.V. Douglas, D.R. Easterling, K.A. Emanuel, P.Ya. Groisman, G.J. Holland, T.R. Knutson, J.P. Kossin, P.D. Komar, D.H. Levinson, and R.L. Smith, 2008: Observed changes in weather and climate extremes In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 35-80.

[5] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

[6] Bindoff, N.L., J. Willebrand, V. Artale, A. Cazenave, J. Gregory, S. Gulev, K. Hanawa, C. Le Quéré, S. Levitus, Y. Nojiri, C.K. Shum, L.D. Talley, and A. Unnikrishnan, 2007: Observations: oceanic climate change and sea level. In: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 385-432.

[7] Rosenzweig, C., G. Casassa, D.J. Karoly, A. Imeson, C. Liu, A. Menzel, S. Rawlins, T.L. Root, B. Seguin, and P. Tryjanowski, 2007: Assessment of observed changes and responses in natural and managed systems. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 79-131.

[8] Orr, J.C., V.J. Fabry, O. Aumont, L. Bopp, S.C. Doney, R.A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, R.M. Key, K. Lindsay, E. Maier-Reimer, R. Matear, P. Monfray, A. Mouchet, R.G. Najjar, G.-K. Plattner, K.B. Rodgers, C.L. Sabine, J.L. Sarmiento, R. Schlitzer, R.D. Slater, I.J. Totterdell, M.-F. Weirig, Y. Yamanaka, and A. Yool, 2005: Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. *Nature*, **437(7059)**, 681-686.

[9] Boesch, D.F. (ed.), 2008: *Global Warming and the Free State: Comprehensive Assessment of Climate Change Impacts in Maryland*. University of Maryland Center for Environmental Science, Cambridge, MA, 85 pp.

[10] Peterson, T.C., M. McGuirk, T.G. Houston, A.H. Horvitz and M.F. Wehner, 2008: *Climate Variability and Change with Implications for Transportation*. National Research Council, Washington, DC, 90 pp. <http://onlinepubs.trb.org/onlinepubs/sr/sr290Many.pdf>

[11] Day, J.W., Jr., D.F. Boesch, E.J. Clairain, G.P. Kemp, S.B. Laska, W.J. Mitsch, K. Orth, H. Mashriqui, D.J. Reed, L. Shabman, C.A. Simenstad, B.J. Streever, R.R. Twilley, C.C. Watson, J.T. Wells, and D.F. Whigham, 2007: Restoration of the Mississippi Delta: lessons from hurricanes Katrina and Rita. *Science*, **315(5819)**, 1679-1684.

[12] Rahmstorf, S., 2007: A semi-empirical approach to projecting future sea-level rise. *Science*, **315(5810)**, 368-370.

[13] Field, C.B., L.D. Mortsch, M. Brklacich, D.L. Forbes, P. Kovacs, J.A. Patz, S.W. Running, and M.J. Scott, 2007: North America. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 617-652.

[14] Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles, 2007: *Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions*. Synthesis report of the Northeast Climate Impacts Assessment. Union of Concerned Scientists, Cambridge, MA, 146 pp.

[15] Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver, and Z.-C. Zhao, 2007: Global climate projections. In: *Climate Change 2007: The Physical Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, pp. 747-845.

[16] Justić, D., N.N. Rabalais, and R.E. Turner, 2003: Simulated responses of the Gulf of Mexico hypoxia to variations in climate and anthropogenic nutrient loading. *Journal of Marine Systems*, **42(2-3)**, 115-126.

[17] Boesch, D.F., V.J. Coles, D.G. Kimmel, and W.D. Miller, 2007: Coastal dead zones and global climate change. In: *Regional Impacts of Climate Change: Four Case Studies in the United States.* Pew Center for Global Climate Change, Arlington, VA, pp.

[18] Janetos, A., L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw, 2008. Biodiversity. In: *The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States* [Backlund, P., A. Janetos, D. Schimel, J. Hatfield, K. Boote, P. Fay, L. Hahn, C. Izaurralde, B.A. Kimball, T. Mader, J. Morgan, D. Ort, W. Polley, A. Thomson, D. Wolfe, M.G. Ryan, S.R. Archer, R. Birdsey, C. Dahm, L. Heath, J.

Hicke, D. Hollinger, T. Huxman, G. Okin, R. Oren, J. Randerson, W. Schlesinger, D. Lettenmaier, D. Major, L. Poff, S. Running, L. Hansen, D. Inouye, B.P. Kelly, L. Meyerson, B. Peterson, and R. Shaw (eds.)]. Synthesis and Assessment Product 4.3. U.S. Climate Change Science Program, Washington, DC, pp. 151-181.

[19] Kimmerer, W.J., E. Garside, and J.J. Orsi, 1994: Predation by an introduced clam as the likely cause of substantial declines in zooplankton of San Francisco Bay. *Marine Ecology Progress Series*, **113**, 81-93.

[20] Wicks, C., D. Jasinski, and B. Longstaff, 2007: *Breath of Life: Dissoved Oxygen in Cheaspeake Bay*. EcoCheck, Oxford, MD, 4 pp. <http://www.eco-check.org/pdfs/do_letter.pdf>

[21] Feely, R.A., C.L. Sabine, J.M. Hernandez-Ayon, D. Ianson, and B. Hales, 2008: Evidence for upwelling of corrosive "acidified" water onto the continental shelf. *Science*, **320(5882)**, 1490-1492.

[22] Carpenter, K.E., M. Abrar, G. Aeby, R.B. Aronson, S. Banks, A. Bruckner, A. Chiriboga, J. Cortés, J.C. Delbeek, L. DeVantier, G.J. Edgar, A.J. Edwards, D. Fenner, H.M. Guzmán, B.W. Hoeksema, G. Hodgson, O. Johan, W.Y. Licuanan, S.R. Livingstone, E.R. Lovell, J.A. Moore, D.O. Obura, D. Ochavillo, B.A. Polidoro, W.F. Precht, M.C. Quibilan, C. Reboton, Z.T. Richards, A.D. Rogers, J. Sanciangco, A. Sheppard, C. Sheppard, J. Smith, S. Stuart, E. Turak, J.E.N. Veron, C. Wallace, E. Weil, and E. Wood, 2008: One-third of reef-building corals face elevated extinction risk from climate change and local impacts. *Science*, **321(5888)**, 560-563.

[23] National Assessment Synthesis Team (NAST), 2001: *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*. Cambridge University Press, Cambridge, UK, and New York, 612 pp. <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/>

[24] Chan, F., J.A. Barth, J. Lubchenco, A. Kirincich, H. Weeks, W.T. Peterson, and B.A. Menge, 2008: Emergence of anoxia in the California current large marine ecosystem. *Science*, **319(5865)**, 920.

PHOTOGRAPHY CREDITS

Cover: Leaf droplet,©iStockphotos.com/Andrejs Zemdega; Los Angeles traffic©iStockphotos.com/EG Digital; Hospital scene, ©iStockphotos.com/Jeffrey Smith; New York City, ©iStockphotos.com/Daniel Stein; Planet Earth, NASA
Inside Cover: Planet Earth, NASA
Table of Contents: National thumbnail; ©iStockphotos.com/Karl Dolenc; Society thumbnail, Grant Goodge, STG Inc.
Page 11,13: Planet Earth, NASA
Page 27: U.S. graphic, ©iStockphotos.com/Karl Dolenc
Page 38: Lake Effect snow, Dave Kelly, NOAA/NSSL
Page 41: Skagit River, Philip Mote PhD, JISAO/CSES Climate Impacts Group
Page 47: Turbidity in New York City's Ashokan, Thurlough Smyth, Climate Change Planning,New York City Department of Environmental Protection, Bureau of Environmental Planning & Assessment
Page 48: Flood water road damage, Grant Goodge, STG Inc.
Page 50: Lake Powell, Brad Udall
Page 51: Two Lake Powell photos, John C. Dohrenwend
Page 52: Cyclic cartoon, USDOE
Page 59: St. Lucie power plant, CCSP SAP 4.5
Page 60: Hydro-electric dam, Philip Mote PhD, JISAO/CSES Climate Impacts Group; Ship, NOAA
Page 61: Houses against bridge, Associated Press/Jeff Roberson
Page 65: Kosrae Island photo, John E. Hay
Page 68: Broken bridge, Joe Furr
Page 75: CO_2 plant photos, Lewis Ziska, USDA ARS
Page 81: Edith's checkerspot butterfly, Camille Parmesan, University of Texas at Austin
Page 83: Beetle, and beetle damage, CCSP SAP 4.3
Page 85: Rob Wu, CCSP SAP 4.3
Page 87: Adult walrus, Captain Budd Christman, NOAA; Polar bear, Mike Dunn, North Carolina Museum of Natural Sciences
Page 88: Pika, ©iStockphotos.com/Global Exposure; Forest species shift, James Abundis, Boston Globe
Page 94: New York and Atlanta smog, Paul Grabhorn
Page 95: Los Angeles smog, ©iStockphotos.com/Stein Photo
Page 98: Mosquito, ©iStockphotos.com/Julie Le de Leseleuc; Virus cycle illustration, Deborah Misch, STG Inc.
Page 101: Chapter and thumbnail photo, Grant Goodge, STG Inc., Midwest flood, Associated Press/Jeff Roberson
Page 112: Boston Deer Island sewage plant, Massachusetts Water Resources Authority
Page 117: Dry Lake Lanier, Kent Frantz, SRH NOAA
Page 118: Barrier islands , USGS
Page 119: Fish plant, Barataria Terrebonne; Flooded area, USGS
Page 120: Flood levee, USACE
Page 122: Chicago map, City of Chicago; Thermal image, Chicago Police Department and the Cook County Sheriff's Department
Page 125: Flooded highway, Missouri Highway & Transportation Department/USGS; Flood of 1993, NOAA
Page 129: Dust bowl, NOAA
Page 130: Mallard duck, ©iStockphotos.com/Andy Gehrig
Page 131: Playa lakes, Katharine Hayhoe, Texas Tech University
Page 146: Alaska pipeline, SSgt. Joshua Strang, USAF
Page 151: El Niño Billboard, US NWS Pacific Region Headquarters
Page 152: Micronesia, Eric L. Gilman
Page 154: Ghost swamp, USGS, National Wetlands Research Center
Page 156: Sea wall, Jack Pellette, NWS

Contact Information

Global Change Research Information Office
c/o Climate Change Science Program Office
1717 Pennsylvania Avenue, NW
Suite 250
Washington, DC 20006
202-223-6262 (voice)
202-223-3065 (fax)

The Climate Change Science Program incorporates the U.S. Global Change Research Program and the Climate Change Research Initiative.

To obtain a copy of this document, place an order at the Global Change Research Information Office (GCRIO) web site:
http://www.gcrio.org/orders

Climate Change Science Program and the Subcommittee on Global Change Research

William J. Brennan, Chair
Department of Commerce
National Oceanic and Atmospheric Administration
Director, Climate Change Science Program

Jack Kaye, Vice Chair
National Aeronautics and Space Administration

Allen Dearry
Department of Health and Human Services

Anna Palmisano
Department of Energy

Mary Glackin
National Oceanic and Atmospheric Administration

Patricia Gruber
Department of Defense

William Hohenstein
Department of Agriculture

Linda Lawson
Department of Transportation

Mark Myers
U.S. Geological Survey

Tim Killeen
National Science Foundation

Patrick Neale
Smithsonian Institution

Jacqueline Schafer
U.S. Agency for International Development

Joel Scheraga
Environmental Protection Agency

Harlan Watson
Department of State

EXECUTIVE OFFICE AND OTHER LIAISONS

Robert Marlay
Climate Change Technology Program

Katharine Gebbie
National Institute of Standards & Technology

Stuart Levenbach
Office of Management and Budget

Margaret McCalla
Office of the Federal Coordinator for Meteorology

Robert Rainey
Council on Environmental Quality

Daniel Walker
Office of Science and Technology Policy

U.S. Climate Change Science Program
1717 Pennsylvania Avenue, NW • Suite 250 • Washington, DC 20006 USA
1-202-223-6262 (voice) • 1-202-223-3065 (fax)
http://www.climatescience.gov

2nd Public Review Draft, January 2009
Do Not Cite Or Quote