

**PHILIP B. DUFFY**  
**President and Executive Director**  
**Woods Hole Research Center**  
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## **EDUCATION**

**Stanford University (1986)**  
PhD, Applied Physics

**Harvard University (1979)**  
AB, *magna cum laude*, Astronomy and Astrophysics

## **PROFESSIONAL POSITIONS**

**White House Office of Science and Technology Policy (OSTP)**  
Consultant (2015- )

**Woods Hole Research Center**  
President and Executive Director (2015)

**White House National Science and Technology Council (NSTC)**  
Senior Advisor to the U.S. Global Change Research Program (2014 - 2015)

**White House Office of Science and Technology Policy (OSTP)**  
Senior Policy Analyst, Environment and Energy Division (2011- 2012)

**Carnegie Institution for Science, Stanford CA.**  
Visiting Investigator, Dept. of Global Ecology (2013)  
Visiting Scholar, Dept. of Global Ecology (2008 - 2011)

**Woods Institute for the Environment, Stanford University**  
Visiting Scholar (2010 - 2011)

**Climate Central, Inc.**  
Chief Scientist (2010 - 2011)  
Principal Research Scientist (2009 - 2010)  
Senior Research Scientist (2008 - 2009)  
Palo Alto Office Director (2008 - 2011)

**Lawrence Livermore National Laboratory (LLNL)**  
Senior Scientist, Physics and Life Sciences Directorate (2011 - 2015)  
Leave of absence (2008 - 2011)  
Deputy Leader, Atmospheric Science Division (2004 - 2005)  
Leader, Climate and Carbon Cycle Modeling Group (1996 - 2004)  
Physicist (1986 - 2008)

**University of California Institute for Research on Climate Change and its Societal Impacts**  
Founding Director (2003 - 2008)

**University of California, Merced**  
Adjunct Associate Professor (2003 - 2009)

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### RESEARCH INTERESTS

Climate change adaptation and mitigation (theory and practice); extreme weather risk, including drought; climate modeling, climate policy.

### INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) INVOLVEMENT

Contributing Author, 3rd Assessment Report. Review Editor, 5th Assessment Report. Co-led the US government review of the entire AR5 (Working Groups 1, 2, and 3 contributions, plus Synthesis Report). US delegate to finalization sessions for Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX), AR5 Working Groups 1, 2, and 3, and Synthesis Report.

### NATIONAL AND INTERNATIONAL POLICY

**U.S. Department of State:** Special Advisor to US delegation to IPCC-42.

**U.S. Department of State:** Senior Technical Advisor on matters relating to the Intergovernmental Panel on Climate Change.

**U.S. Department of State:** Delegate to Approval Sessions for Intergovernmental Panel on Climate Change (1) Special Report on “Managing the risks of extreme events and disasters to advance climate change adaptation,” (2) 5<sup>th</sup> Assessment Report Working Group 1 contribution, (3) 5<sup>th</sup> Assessment Report Working Group 2 contribution, (4) 5<sup>th</sup> Assessment Report Working Group 3 contribution, (5) 5<sup>th</sup> Assessment Report, Synthesis Report.

**U.S. Department of State:** Side Event Organizer for at UNFCCC COP-15 Climate Conference.

**White House National Science and Technology Council,** Subcommittee on Global Change Research, Interagency Task Group on Science for Catastrophe Risk Assessment (Chair).

**U.S. House of Representatives Committee on Water and Power:** Testimony

### PROFESSIONAL SERVICE

Argonne National Laboratory, Computing, Environment and Life Science Directorate external review committee

World Climate Research Program: Task Force on Regional Climate Downscaling

IPCC Working Group II: 5th Assessment Report, Review Editor

US Army Corps of Engineers: Numerical Modeling Review Group (post-Sandy risk assessment)

The Nature Conservancy: Climate Change Advisory Panel

*The Open Atmospheric Journal:* Editorial Board Member

California Department of Water Resources: Climate Change Technical Advisory Group

Water Utility Climate Alliance: Modeling Advisory Committee

California Dept. of Water Resources: Delta Risk Management Strategy Project, Climate Team Leader

CalFed Science Program: expert review panel on Endangered Species Act Biological Opinion

Conservation Biology Institute: Climate Data Basin Advisory Board Member

## AWARDS

Lawrence Livermore National Laboratory Science and Technology Award

United Nations Association Global Citizen Award

Contributor to Nobel Peace Prize-winning Intergovernmental Panel on Climate Change (IPCC) **CLIMATE CHANGE ADAPTATION EXPERIENCE**

**California Dept. of Water Resources:** Delta Risk Management Strategy Project, Climate Change Team Leader. Assessed risk to levees in the Sacramento-San Joaquin Delta from climate change and other threats.

**Pacific Hydro, Inc.** Evaluated impacts of climate change on hydropower development in the Chilean Andes.

**CalFed Bay Delta Program:** Independent Review of the National Marine Fisheries Service (NMFS) 2008 Draft Biological Opinion on listed (i.e. endangered) species of Chinook Salmon, Steelhead and Green Sturgeon.

**U.S. Environmental Protection Agency:** Advisor to assessment of climate change risk to ecosystems in the San Francisco Bay.

**San Francisco Public Utilities Commission:** Analyzed impacts of climate change on water quality in the Hetch-Hetchy system.

## TEACHING EXPERIENCE

### Students Mentored

- Jason Bartlett – University of California, Berkeley
- Jason Bell – University of California, Santa Cruz
- Jeremy Coquard<sup>1</sup> – University of California, Berkeley
- Ian Ferguson – University of California, Berkeley
- Nicholas Gentile<sup>2</sup> – University of California, Davis
- Nancy Grumet-Prouty<sup>1</sup> – Stanford University
- Matthew Huber<sup>3</sup> – University of California, Santa Cruz
- John Iorio – Stanford University
- Colin McKellar – San Jose State University
- Michael Mastrandrea – Stanford University
- Miguel Fernandez<sup>3</sup> – University of California, Merced
- George Perry<sup>1</sup> – San Jose State University
- Jerry Selvaggi – New York University
- Michael Wickett<sup>1</sup> – University of California, Davis
- Esther Zeledon – Swarthmore College

<sup>1</sup> DOE Graduate Student Fellow

<sup>2</sup> UC Davis Department of Applied Science

<sup>3</sup> PhD committee member

### Post-Docs Mentored

- Celine Bonfils – University of California, Merced
- Alfred Bourgeois – Lawrence Livermore National Lab
- Donald Eliason – Lawrence Livermore National Lab
- David Lobell – Lawrence Livermore National Lab, *Lawrence Fellow*
- Huaxiao Wang – Lawrence Livermore National Lab
- Michael Wickett – University of California, Davis

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**“Climate Change 101”**

With faculty members from UC Davis, co-organized a semester-long informal course on climate change science and societal impacts for California state employees involved in implementing climate policy (e.g. AB32).

**PEER-REVIEWED PUBLICATIONS**

- Duffy, P. B., P. Brando, G. Asner, and C. Field, CMIP5 projections of meteorological drought in the Amazon. (*Proceedings of the National Academy of Sciences*, in press)
- Duffy, P. B., J. Arnold, M. Bender, T. Knutson, M. Morin, C. Massey, D. Stone, and M. Wehner, Effects of anthropogenic climate change on Sandy-like storms (in prep.)
- Maurer, E., L. Brekke, T. Pruitt, B. Thrasher, J. Long, P. Duffy, M. Dettinger, D. Cayan, and J. Arnold 2014. An enhanced archive facilitating climate impacts and adaptation analysis. *Bull. Amer. Meteor. Soc.* doi: <http://dx.doi.org/10.1175/BAMS-D-13-00126.1>.
- Cayan, D. *et al.* Future Climate: Projected average climate in the Southwestern US, in Garfin G. ed. 2013. *Assessment of Climate Change in the Southwestern U.S.*, A Report Prepared for the National Climate Assessment. 509 pp. Island Press.
- Thrasher, B. L., E. P. Maurer, C. McKellar, and P. B. Duffy, 2012. Technical Note: Bias correcting climate model simulated daily temperature extremes with quantile mapping, *Hydrol. Earth Syst. Sci. Discuss.*, 9, 5515-5529, doi:10.5194/hessd-9-5515-2012.
- Duffy, P. B., and C. Tebaldi, 2012. Increasing prevalence of extreme summer temperatures in the U.S., *Climatic Change Letters*, 111 (2): 487 DOI:10.1007/s10584-012-0396-6.
- Ferguson, I. M., P. B. Duffy, T. J. Phillips, X. Liang, J. A. Dracup, S. Schubert and P. Pegion, 2011. Non-stationarity of the signal and noise characteristics of seasonal precipitation anomalies, *Climate Dynamics*, DOI: 10.1007/s00382-010-0850-y
- Mote, P., L. Brekke, P. B. Duffy, and E. Maurer, 2010. "Guidelines for constructing climate scenarios. EOS, *Transactions of the American Geophysical Union*. 92(31), 257, doi:10.1029/2011EO310001.
- Wehner, M. F., G. Bala, P. B. Duffy, A. M. Mirin and R. Romano, 2010. "Towards direct simulation of future tropical cyclone statistics in a high resolution global atmospheric model," *Advances in Meteorology*, Volume 2010, Article ID 915303, doi: 10.1155/2010/915303.
- Wehner, M. F., R. L. Smith, G. Bala, and P. B. Duffy, 2010. The effect of horizontal resolution on simulation of very extreme U.S. precipitation events, *Climate Dynamics*, DOI 10.1007/s00382-009-0656-y
- Ferguson, I.M., J. A. Dracup, P. B. Duffy, P. Pegion, S. Schubert, 2010. Influence of SST forcing on stochastic characteristics of simulated precipitation and drought, *J. Hydrometeorology* 11:3, 754-769
- Loarie, S., P. B. Duffy, H. Hamilton. G. Asner, C. Field, and D. Ackerly, 2009. The velocity of climate change, *Nature*, 462, 1052-1055, doi: 10.1038/nature08649.
- Miller, J. Jin, N. J. Schlegel, M. A. Snyder, T. O'Brien, L. C. Sloan, P. B. Duffy, H. Hidalgo, Kanamaru, M. Kanamitsu, K. Yoshimura, D. R. Cayan. An analysis of simulated California climate using multiple dynamical and statistical techniques, California Energy Commission CEC-500-2009-017-F August 2009.
- Bala, G., P. B. Duffy, and K. Taylor, 2008. Impact of Geoengineering Schemes on the Global Hydrological Cycle. *Proceedings of the National Academy of Sciences*, 105, 7664–7669.
- Kim, S-J. T. Crowley, P. B. Duffy, and G. Bala, 2008. High-Resolution Climate Simulation of the Last Glacial Maximum, *Climate Dynamics* 31, pp. 1-16. 10.1007/s00382-007-0332-z.
- Bonfils, C., P. B. Duffy, B. Santer, D. Lobell, Thomas J. Phillips, T.M.L. Wigley, Charles Doutriaux, 2007. Identification of external influences on temperatures in California, *Climatic Change*.
- Bonfils, C., P. B. Duffy, and D. Lobell.: 2007, ‘Comments on ‘Methodology and Results of Calculating

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- Central California Surface Temperature Trends: Evidence of a Human-Induced Climate Change?”, *J. Climate*, 20, 4486-4498.
- Maurer, E.P., L. Brekke, T. Pruitt, and P. B. Duffy, 2007, Fine-resolution climate change projections enhance regional climate change impact studies, *Eos, Transactions, American Geophysical Union*, 88(47), 504 (online at [http://www.agu.org/eos\\_elec/2007/47-504.html](http://www.agu.org/eos_elec/2007/47-504.html))
- Duffy, P. B., C. Bonfils, D. Lobell, 2007: Interpreting Recent Temperature Trends in California, *Eos, Transactions, American Geophysical Union*, 88, NO. 41, doi: 10.1029/2007EO410001.
- Maurer, E. P., I. T. Stewart, C. Bonfils, P. B. Duffy, and D. Cayan 2007, Detection, attribution, and sensitivity of trends toward earlier streamflow in the Sierra Nevada, *J. Geophys. Res.*, 112, D11118, doi: 10.1029/2006JD008088.
- “Climate Action Team Report to the Governor and Legislature,” available at [http://www.climatechange.ca.gov/climate\\_action\\_team/reports/index.html](http://www.climatechange.ca.gov/climate_action_team/reports/index.html). Contributing author.
- “Our changing climate: Assessing the Risks to California” A summary report from the California Climate Change Center CEC-500-2006-077. Contributing author.
- Cole, K.L., K. Ironside, S. Arundel, P. Duffy, and J. Shaw. 2007. Modeling future plant distributions on the Colorado Plateau: An example using *Pinus edulis*. In, *The Colorado Plateau III*, C. van Riper III and M. Sogge (eds), The University of Arizona Press.
- Lobell, D. B., C. Bonfils, and P. B. Duffy 2007. Climate change uncertainty for daily minimum and maximum temperatures: A model inter-comparison, *Geophys. Res. Lett.*, 34, L05715, doi: 10.1029/2006GL028726.
- Lobell, D. B., G. Bala, C. Bonfils, and P. B. Duffy. 2006. Potential bias of model projected greenhouse warming in irrigated regions. *Geophysical Research Letters* 33:L13709, doi: 10.1029/2006GL026770.
- Lobell, D. B., G. Bala, and P. B. Duffy. 2006. Biogeophysical impacts of cropland management changes on climate. *Geophysical Research Letters* 33:L06708 10.1029/2005GL025492.
- Gettelman, A., W. D. Collins, E. J. Fetzer, A. Eldering, F. W. Irion, P. B. Duffy and G. Bala, 2006. A Satellite Climatology of Upper Tropospheric Relative Humidity and Implications for Climate, *J. Climate*, 19, pp. 6104-6121.
- Maurer, E.P., S. Gibbard, and P. B. Duffy, 2006. Amplification of streamflow impacts during El Nino conditions in California under a warming climate, *Geophys Res Lett.*, 33, No. 2, L02707 10.1029/2005GL025100.
- Cayan, D., E. Maurer, M. Dettinger, M. Tyree, K. Hayhoe, C. Bonfils, P. Duffy, and B. Santer, Climate Change Scenarios for California; appendix to the California Energy Commission report # CEC-500-2005-203-SF, available at <http://www.energy.ca.gov/2005publications/CEC-500-2005-203/CEC-500-2005-203-SF.PDF>
- Maurer, E.P., and P. B. Duffy, Uncertainty in Projections of Hydrologic Impacts of Climate Change in California, *Geophys. Res. Lett.*, 32, doi: 10.1029/2004GL021462, 2005.
- Duffy, P. B., R. W. Arritt, J. Coquard, W. Gutowski, J. Han, J. Iorio, J. Kim, L-R Leung, J. Roads, E. Zeledon, 2006. Simulations of present and future climates in the western U.S. with four nested regional climate models, *J. Climate*, 19, No. 6, pp. 873-895.
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- Coquard, J., P. B. Duffy, and K. E. Taylor, 2004: Present and future surface climate in the western U.S. as simulated by 15 global climate models, *Climate Dynamics*, 23, pp. 455-472.
- Iorio, J., P. B. Duffy, M. Khairoutdinov, and D. Randall, 2004: Effect of model resolution and subgrid scale physics on daily precipitation in the continental United States; *Climate Dynamics*, 23, 243-258, 2004.
- Bell, J. L., L. C. Sloan, J. Revenaugh and P. B. Duffy, 2003: Evaluation of Northern Hemisphere natural

- climate variability in multiple temperature reconstructions and global climate model simulations. *Global and Planetary Change*, 37, Issues 1-2, 10 June 2003, pp. 19-31.
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- Govindasamy, B., P. B. Duffy, and J. Coquard 2003: High Resolution Simulations of Global Climate, Part 2: Effects of Increased Greenhouse Gases. *Climate Dynamics*, 21, 391-404, 2003.
- Duffy, P. B., M. E. Wickett, and K. Caldeira, Effect of horizontal grid resolution on the near-equilibrium solution of a global ocean/sea ice model, *J. Geophys. Res.*, 108(C6): 3189, 2003.
- Govindasamy, B., K. Caldeira and P. B. Duffy, Geoengineering Earth's radiation balance to mitigate climate change from a quadrupling of CO<sub>2</sub>, *Global & Planetary Change*. 37(1-2): 157-168, 2003.
- Wickett, M. E., K. Caldeira, and P. B. Duffy, Effect of horizontal grid resolution on simulations of oceanic CFC-11 uptake and direct injection of anthropogenic CO<sub>2</sub>, 2003. *J. Geophys. Res.* 108, No. C6, 3189, 10.1029/2001JC001130.
- Govindasamy, B., S. Thompson, P. B. Duffy, and K. Caldeira, 2002. Impact of climate stabilization schemes on the terrestrial biosphere, *Geophys. Res. Lett.*, 29 (22): 2061.
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- Duffy, P. B., C. Doutriaux, I. Fodor, and B. Santer, 2001. Effect of Missing Data on Estimates of Near-Surface Temperature Change Since 1900, *J. Climate*, 14, 2809-2814.
- Govindasamy, B., K. E. Taylor, P. B. Duffy, B. J. Santer, A. S. Grossman, and K. E. Grant, 2001. Limitations of the equivalent CO<sub>2</sub> approximation in climate change simulations; *J. Geophys. Res.*, 106, p. 22593-22603.
- McAvaney, B. J. et al, 2001 "Model Evaluation", in *Climate Change: The Scientific Basis*; IPCC Third Assessment Report, Cambridge University Press.
- Duffy, P. B., M. Eby, and A.J. Weaver, Climate Model Simulations of Effects of Increased Atmospheric CO<sub>2</sub> and Loss of Sea Ice on Ocean Salinity and Tracer Uptake, *J. Climate*, 14, 520-532, 2001.
- Govindasamy, B., P. B. Duffy, and K. Caldeira, 2001. Land Use Changes and Northern Hemisphere Cooling, *Geophys. Res. Lett.*, 28, 291-294.
- Weaver, A. J., M. Eby, E. C. Wiebe, C. M. Bitz, P. B. Duffy, T. L. Ewen, A. F. Fanning, M. M. Holland, A. MacFadyen, H. D. Matthews, K. J. Meissner, O. Saenko, A. Schmittner, H. Wang and M. Yoshimori, 2001: The UVic Earth System Climate Model: Model description, climatology and application to past, present and future climates. *Atmosphere-Ocean*, 38. 271-301.
- Wickett, M. E., P. B. Duffy, and G. Rodrigue, 2000. A reduced grid for a parallel global ocean general circulation model, *Ocean Modeling*, 2, 85-107.
- Guilderson, T., K. Caldeira, and P. B. Duffy, 2000. Radiocarbon as a diagnostic tracer in ocean and carbon cycle modeling, *Global Biogeochemical Cycles*, 14, 887-902.
- Bell, J., P. B. Duffy, C. Covey, and L. Sloan, Analysis of Temperature Variability in Sixteen Climate Model Simulations, *Geophysical Research Letters*, 27, 261-264, 2000.
- Duffy, P. B., J. Bell, C. Covey, and L. Sloan, 2000. Effect of flux adjustments on temperature variability in coupled models, *Geophysical Research Letters*, 27, 763-766.
- Caldeira, K. and P. B. Duffy, 2000. The role of the Southern Ocean in uptake and storage of anthropogenic carbon dioxide, *Science*, 287, 620-622.

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- Duffy, P. B., M. Eby, and A.J. Weaver, 1999. Effects of Sinking of Salt Rejected During Formation of Sea Ice on Results of a Global Ocean-Atmosphere-Sea Ice Climate Model, *Geophys. Res. Lett.*, 26, 1739-1742.
- Hoffert, M. I., K. Caldeira, C. Covey, P.B. Duffy, B. Santer, 1999. Solar variability and the Earth's climate, *Nature*, 401, 764-764.
- Duffy, P. B. and K. Caldeira, 1999. Sensitivity of Simulated Salinities in a Three-Dimensional Ocean General Circulation Model to Vertical Mixing of Destabilizing Surface Fluxes, *Climate Dynamics*, 15, 81-88.
- Govindasamy, B., M. F. Wehner, C. R. Mechoso, and P. B. Duffy, 1999. The Influence of a Land Surface Scheme on Simulated Climate by LLNL/UCLA AGCM, *Global and Planetary Change*, 20, 67-86.
- Caldeira, K., G. H. Rau, and P. B. Duffy, 1998. Predicted oceanic degassing of radiocarbon and increase in atmospheric radiocarbon content, *Geophys. Res. Lett.* 25, 3811-3814.
- Caldeira, K., and P. B. Duffy, 1998. Sensitivity of simulated CFC-11 distributions in a global ocean model to the treatment of salt rejected during sea-ice formation, *Geophys. Res. Lett.* 25, 1003-1006..
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- Duffy, P. B., and K. Caldeira, 1997. Sensitivity of Simulated Salinity in a Three-dimensional Ocean Model to Upper-Ocean Transport of Salt From Sea-Ice Formation, *Geophys. Res. Lett.* 24, 1323-1326.
- Duffy, P. B., K. Caldeira, J. Selvaggi, and M. Hoffert, 1997. Effect of Subgrid Scale Mixing Parameterizations on Simulated Distributions of Natural  $^{14}\text{C}$ , Temperature, and Salinity in a Three-Dimensional Ocean General Circulation Model, *J. Phys. Oceanogr*, 27, 498-523.
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- Duffy, P. B., P. Eltgroth, A. J. Bourgeois, and K. Caldeira, 1995. Effect of Improved Subgrid Scale Transport of Tracers on Uptake of Bomb Radiocarbon in the GFDL Ocean General Circulation Model, *Geophysical Review Letters*, 22, 1065-1068.
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- Klapisch, M. P. B. Duffy, and W. H. Goldstein, 1991, A Monte Carlo Model of Complex Spectra for Opacity Calculations, *Zeitschrift fur Physik D - Atoms, Molecules, and Clusters*, 21, S185-S186.
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Wilcox, J. M., P. B. Duffy, K. H. Schatten, L. Svalgaard, P. S. Scherrer, W. O. Roberts, and R. Olson, 1979. "Interplanetary Magnetic Field Polarity and the Size of Low Pressure Troughs near 180 deg. W longitude", *Science*, 204, p. 60.

### SELECTED OTHER PUBLICATIONS

Duffy, P.B, J. Sheffield, and E. Maloney, Global Climate Simulations of North America, in *Climate Change in North America*, Elsevier, 2014.

Duffy, P. B., B. D. Santer, and T.M.L. Wigley, Solar variability does not explain late-20<sup>th</sup> century warming. *Physics Today*, January 2009. pp. 48-49.

Lemonick, M. *et al.*, 2012. *Global Weirdness: Severe Storms, Deadly Heat Waves, Relentless Drought, Rising Seas, and the Weather of the Future*. (P. Duffy, lead reviewer)