

# Martin P. Hoerling

*Meteorologist*

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## Education

- Ph.D. 1987 (Meteorology), University of Wisconsin
- M.S. 1982 (Meteorology), University of Wisconsin
- B.S. 1980 (Meteorology), University of Wisconsin

## Positions

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|--------------|---|
| 2005-Present | Meteorologist, NOAA/ESRL Physical Sciences Division, Boulder, Colorado <ul style="list-style-type: none"><li>• Deputy Branch Chief for Research, Climate Analysis Branch</li><li>• Lead, NOAA Interpreting Climate Conditions Team</li></ul>  |
| 1999-2005    | Meteorologist, NOAA/CDC, Boulder, Colorado <ul style="list-style-type: none"><li>• Project Leader on Seasonal-to-Interannual Research</li><li>• Decadal climate variability and climate change</li></ul>  |
| 1989-1999    | Research Associate, Cooperative Institute for Research in the Environmental Sciences (CIRES), University of Colorado, Boulder, Colorado <ul style="list-style-type: none"><li>• Climate variability and the role of air-sea interactions</li><li>• General circulation modeling of the atmospheric response to tropical sea surface temperature anomalies</li></ul> |
| 1987-1989    | Research Associate, Space Science and Engineering Center, University of Wisconsin, Madison, Wisconsin <ul style="list-style-type: none"><li>• Climate variations related to tropical diabatic forcing</li><li>• Diagnosing diabatic heating and its role in climate</li><li>• Stratospheric-tropospheric exchange</li></ul>   |

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| 1987-1988 | Lecturer, Department of Meteorology, University of Wisconsin, Madison, Wisconsin  |
| 1983-1987 | Research Assistant, Doctoral Student, Department of Meteorology, University of Wisconsin, Madison, Wisconsin. <ul style="list-style-type: none"> <li>• Ph.D. awarded May, 1987, thesis titled "The global balance of dynamic vorticity in relation to heat sources and sinks."</li> </ul> |

## Grants

- NOAA's EPOCS Grant Award, 1991-93 (Co-Principal Investigator)
- NOAA's Climate and Global Change Grant Award - TOGA Program: 1994-96 (PI)
- NOAA's Climate and Global Change Grant Award - GOALS Program: 1997-01 (PI)
- NOAA's Climate and Global Change Grant Award - PACS Program: 1998-00 (PI)
- NOAA's Climate and Global Change Grant Award - CLIVAR Atlantic: 2000-01 (PI)
- NOAA's Climate and Global Change Grant Award - CLIVAR-Pacific: 2001-03 (PI)
- NOAA's Climate and Global Change Grant Award - CLIVAR Atlantic: 2003-05 (PI)
- NASA Grant Award - Ocean, Ice, and Climate: 2002-2004 (PI)

## Awards

- NOAA Research Employee of the Year (2001): For his work on the advancement of understanding our seasonal climate predictability, the advancement progress on NOAA's seasonal-to-interannual climate prediction effort, and the advancement of understanding on the dynamics of climate change.
- NOAA Office of Oceanic and Atmospheric Research Outstanding Scientific Paper Award (2000): For "Understanding and Predicting Extratropical Teleconnections Related to ENSO."
- NOAA Office of Oceanic and Atmospheric Research Outstanding Scientific Paper Award (2002): For "The Perfect Ocean for Drought"
- Department of Commerce Group Bronze Medal Award: 2007, For superior federal service for designing and implementing the consolidation of six research organizations in Boulder, Colorado into the new NOAA Earth System Research Laboratory.
- NOAA Administrator's Award: 2008, For outstanding dedication to developing U.S. Climate Change Science Program synthesis and assessment products integrating climate research for decision support.
- WMO Norbert Gerbier–Mumm International Award for 2009: Best paper award for the study "Unraveling the Mystery of Indian Monsoon Failure During El Nino."

- NOAA Administrator's Award: 2011, For support to the Interagency Working Group addressing flooding and development of a NOAA Decision Support System for Devils Lake

## **Service Activities**

- FSU-COAPS Review Panel, 7-9 February 2001 (T. Busalacchi, Chair).
- Los Alamos-IGPP Advisory Board, 7-9 March 2001 (Freeman Gilbert, Chair).
- U.S. CLIVAR Atlantic Science Conference, Scientific Organizing Committee (D. Legler, Organizer) Conference held 12-14 June 2001 in Boulder, CO, at the NOAA Climate Diagnostics Center.
- Workshop on "Regional Climate Research: Needs and Opportunities", Invited Session Chair, (R. Lai-Yung, Organizer; co-sponsored by the U.S. National Science Foundation and the U.S. Department of Energy), 2-4 April 2001 at NCAR.
- Harvard University Advisory Board for Tenure Appointment in Climate Dynamics, 15 December 2002, Department of Planetary and Atmospheric Sciences.
- Editor, *Journal of Climate*, American Meteorological Society: 2002-2005
- Invited Attendee to the NOAA Corporate Mid-Level Staff Retreat. 21-22 October 2003, Washington, D.C.
- FSU-COAPS Review Panel, April 2004 (T. Busalacchi, Chair).
- Lead Author, U.S. Climate Change Science Program, Goal 1.3 "Reanalyses of historical climate data for key atmospheric features. Implications for attribution of causes of observed change: 2005
- Panel Member, US CLIVAR Prediction, Predictability, and Applications Interface: 2005-2007
- IPCC, Fourth Assessment: Contributing Author on Attribution, and Modeling, 2007.
- Chair, US CLIVAR: 2007-

## **Principal Refereed Journal Publications**

Hoerling, M. P., T. K. Schaack and A. J. Lenzen, 1991: Global objective tropopause analysis. *Mon. Wea. Rev.*, 119, 1816-1831.

Hoerling, M. P., M. L. Blackmon and M. Ting, 1992: Simulating the atmospheric response to the 1985-87 El Niño cycle. *J. Climate.*, 5, 665-682.

Hoerling, M. P., 1992: Diabatic sources of potential vorticity in the general circulation. *J. Atmos. Sci.*, 49, 2282-2292.

Hoerling, M. P., T. K. Schaack and A. J. Lenzen, 1993: A global analysis of stratospheric-tropospheric exchange during northern winter. *Mon. Wea. Rev.*, 121, 162-172.

- Ting, M., and M. P. Hoerling, 1993: Dynamics of stationary wave anomalies during the 1986/87 El Niño. *Climate Dynamics*, 9, 147-164.
- Hoerling, M. P., L. Sanford, and J. Hurrell, 1993: Diagnosis and sensitivity of the wintertime 200mb circulation in NCAR CCMs. NCAR Tech. Report, NCAR/TN-394+STR, Boulder, CO., 68 pp.
- Hoerling, M. P., and M. Ting, 1994: On the organization of extratropical transients during El Niño. *J. Climate*, 7, 745-766.
- Kumar, A., and M. P. Hoerling, 1995: Prospects and limitations of seasonal atmospheric GCM predictions. *Bull. Amer. Meteor. Soc.*, 76, 335-345.
- Hoerling, M. P., M. Ting, and A. Kumar, 1995: Zonal flow-stationary wave relationship during El Niño: Implications for seasonal forecasting. *J. Climate*, 8, 1838-1852.
- Kumar, A., M. P. Hoerling, M. Ji, A. Leetmaa, and P. D. Sardeshmukh, 1996: Assessing a GCM's suitability for making seasonal predictions. *J. Climate*, 9, 115-129.
- Ting, M., M. P. Hoerling, T.-Y. Xu, and A. Kumar, 1996: Northern Hemisphere teleconnection patterns during extreme phases of the zonal mean circulation. *J. Climate*, 9, 2614-2623.
- Kumar, A., and M. P. Hoerling, 1997: Interpretation and implications of observed inter-El Niño variability. *J. Climate*, 10, 83-91.
- Hoerling, M. P., and A. Kumar, 1997: Why do North American climate anomalies differ from one El Niño event to another? *Geophys. Res. Lett.*, 24, 1059-1062.
- Hoerling, M. P., A. Kumar, and M. Zhong, 1997: El Niño, La Niña, and the nonlinearity of their teleconnections. *J. Climate*, 10, 1769-1786.
- Peng, S., W. A. Robinson, and M. P. Hoerling, 1997: The modeled atmospheric response to midlatitude SST anomalies and its dependence on background circulation states. *J. Climate*, 10, 971-987.
- Hoerling, M. P., and A. Kumar, 1997: Origins of extreme climate states during the 1982-83 ENSO winter. *J. Climate*, 10, 2859-2870.
- Kumar, A., and M. P. Hoerling, 1998: On the specification of regional SSTs in AGCM simulations. *J. Geophys. Res.*, 8901-8907.
- Kumar, A., and M. P. Hoerling, 1998: Annual cycle of Pacific/North American seasonal predictability associated with different phases of ENSO. *J. Climate*, 11, 3295-3308.
- Hoerling, M. P., and A. Kumar, 2000: Understanding and Predicting Extratropical Teleconnections Related to ENSO. Chapter 2 (pp 57-88) in "El Niño and the Southern Oscillation: Multi-scale Variability, and Global and Regional Impacts [eds. H. Diaz and V. Markgraf], Cambridge University Press, 496 pp.

- Kumar, A, and M. P. Hoerling, 2000: Analysis of a conceptual model of seasonal climate variability and implications for seasonal prediction. *Bull. Amer. Meteor. Soc.*, 81, 255-264.
- Ting, M., M. P. Hoerling, T. Xu, and A. Kumar, 2000: Reply to Comments on "Northern Hemisphere teleconnections patterns during extreme phases of the zonal-mean circulation". *J. Climate*, 13, 1040-1043.
- Kumar, A, A. Barnston, P. Peng, M. Hoerling, and L. Goddard, 2000: Changes in the spread of the seasonal mean atmospheric states associated with ENSO. *J. Climate*, 13, 3139-3151.
- Kumar, A., A. G. Barnston, and M. P. Hoerling, 2000: Seasonal predictability, probabilistic verifications, and ensemble size. *J. Climate*, 14, 1671-1676.
- Hoerling, M. P., A. Kumar, and T.-Y. Xu, 2001: Robustness of the nonlinear atmospheric response to opposite phases of ENSO. *J. Climate*, 14, 1277-1293.
- Kumar, A, W. Wang, M. P. Hoerling, A. Leetmaa, and M. Ji, 2001: The sustained North American warming of 1997 and 1998. *J. Climate*, 14, 345-353.
- Hoerling, M. P., A. Kumar, J. S. Whitaker, and W. Wang, 2001: The midlatitude warming during 1998-2000. *Geophys. Res. Letters*, 28, 755-758.
- Hoerling, M. P., J. Hurrell, and T. Xu, 2001: Tropical origins for North Atlantic climate change. *Science*, 292, 90-92.
- Chen, P., M. P. Hoerling, and R. M. Dole, 2000: On the origin of summertime subtropical anticyclones. *J. Atmos. Sci.*, 58, 1827-1835.
- Bates, G. T., M. P. Hoerling, and A. Kumar, 2001: Central US Springtime precipitation extremes: Teleconnections and relationships with sea surface temperatures. *J. Climate*, 14, 3751-3766.
- Diaz, H. F., M. P. Hoerling, and J. K. Eischeid, 2001: ENSO variability, teleconnections, and climate change. *Int. J. Climatol.*, 21, 1869-1886.
- Hurrell, J., M. Hoerling, and C. Folland, 2002: Climate variability over the North Atlantic. Part 2. (pp. 143-150) in "Meteorology at the Millennium" [ed. R. Pearce], Academic Press 330 pp.
- Hoerling, M. P., and A. Kumar, 2002: Atmospheric response patterns associated with tropical forcing. *J. Climate*, 15, 2184-2203.
- Kumar, A., and M. P. Hoerling, 2003: The nature and causes for the delayed atmospheric response to El Niño. *J. Climate*, 16, 1391-1403.
- Hoerling, M. P., and A. Kumar, 2003: Seasonal and interannual weather prediction. In *Encyclopedia of Atmospheric Sciences*, J. R. Holton, J. Pyle, and J. A. Curry (Eds.), Academic Press, 2562-2567.
- Hoerling, M. P., and A. Kumar, 2003: The perfect ocean for drought. *Science*, 299, 691-694.

Hurrell J.W., M. P. Hoerling, A. Phillips, and T. Xu, 2004: Twentieth Century North Atlantic climate change. Part I: Assessing determinism. *Climate Dyn.* 23, 375-390.

Hoerling M.P., J. W. Hurrell , T. Xu , G. T. Bates, and A. Phillips, 2004: Twentieth Century North Atlantic climate change. Part II: Understanding the effect of Indian Ocean warming. *Climate Dyn.* 23, 391-405.

Liebmann, B., C. Vera, L. Carvalho, I. Camilloni, M. Hoerling, D. Allured, M. Bidegain, J. Baez, and V. Barros, 2004: An observed trend in Central South American precipitation. *J. Climate*, 17, 4357-4367.

Quan, X.W., H.F. Diaz, and M.P. Hoerling, 2004: Change of the Hadley circulation since 1950.

The Hadley Circulation: Past, Present, and Future edited by H.F. Diaz and R.S. Bradley, Cambridge University Press. (Chapter 3).

Barnston A, A Kumar, L Goddard, and M Hoerling, 2005: Improving seasonal prediction practices through attribution of climate variability. *Bull. Amer. Meteor. Soc.*, 86, 59-72.

Peng, S, W. Robinson, S. Li, and M. Hoerling, 2005: Tropical Atlantic SST forcing of coupled North Atlantic seasonal responses. *J. Climate*, 18, 480-496.

Jain, S., M. Hoerling, and J. Eischeid, 2005: Decreasing reliability and increasing synchronicity of western North American stream flow. *Journal of Climate*, 18, 613-618.

Krishna Kumar, K, M Hoerling, and B. Rajagopalan: 2005: Advancing Indian monsoon rainfall predictions. *Geophys. Res. Letters*, 32, L08704, doi:10.1029/2004GL021979.

Li, S, M Hoerling, and S. Peng: 2006: Coupled ocean-atmosphere response to Indian Ocean warmth. *Geophys. Res. Letters*, 33, L07713, doi:10.1029/2005GL025558.

Li, S., M. Hoerling, S. Peng and K. Weickmann, 2006: The annular response to tropical Pacific SST forcing. *J. Climate*, 19, 1802-1819.

Quan, X., M. Hoerling, J. Whitaker, G. Bates, and T. Xu, 2006: Diagnosing sources of U.S. seasonal forecast skill. *J. Climate*, 19, 3279-3293.

Hoerling, M., J. Hurrell, and J. Eischeid, 2006: Detection and attribution of 20th Century northern and southern African rainfall change. *J. Climate*, 19, 3989-4008.

Goddard, L., A. Kumar, M. Hoerling, and A. Barnston, 2006: Diagnosis of anomalous winter temperatures over the eastern United States during the 2002/03 El Niño. *J. Climate*, 19: 5624-5636.

Hoerling, M. P., A. Kumar, T. Xu, G. Bates and B. Jha, 2006: Warm oceans warm land temperatures. *Eos Trans. AGU*, 87, 189-193.

Krishna Kumar, K., B. Rajagopalan, M. Hoerling, G. Bates, and M. Cane, 2006: Unraveling the mystery of Indian Monsoon Failure during El Niño. *Science*, 314, 115-119.

- Goddard, L. and M. Hoerling, 2006: Practices for seasonal-to-interannual climate prediction. *CLIVAR Variations*, 4, 1-5.
- Hoerling, M, J.Eischeid, X. Quan, and T. Xu, 2007: Explaining the record 2006 US warmth. *Geophys. Res. Letters*, 34, doi:10.1029/2007GL030643.
- Hoerling, M., and J. Eischeid, 2007: Past peak water in the West. *Southwest Hydrology*, Vol 6, No. 1, 18-19.
- Li, S., J. Perlwitz, X. Quan, and M. P. Hoerling. 2008: Modelling the influence of North Atlantic multidecadal warmth on the Indian summer rainfall, *Geophys. Res. Lett.*, 35, L05804, doi:10.1029/2007GL032901.
- Krishna Kumar, K., K. Kamala, B.Rajagopalan, M. Hoerling J. Eischeid, S. K. Patwardhan, G. Srinivasan, and R. Nemani, 2008: The Once and Future Pulse of Indian Monsoonal Climate. *Proc. Nat. Acad. Sci*, conditionally accepted.
- Hoerling, M., A. Kumar, J. Eischeid, and B. Jha, 2008: What is causing the variability in global land temperature? *Geophys. Res. Letters*, in review.
- Neff, W., J. Perlwitz, and M. Hoerling, 2008: Observational Evidence for Asymmetric Changes in Tropospheric Heights over Antarctica on Decadal Time Scales. *Geophys. Res. Letters*, in press.
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- CCSP SAP 1.3, 2008: Reanalysis of Historical Climate Data for Key Atmospheric Features Implications for Attribution of Causes of Observed Change. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Randall Dole, Martin Hoerling, and Siegfried Schubert (eds.)]. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC, 156 pp.
- Wang, H., S. Schubert, M. Suarez, J. Chen, M. Hoerling, A. Kumar, P. Pegion, 2009: Attribution of the seasonality and regionality in climate trends over the United States during 1950-2000. *J. Climate*, 22, 2571-2590.
- Hoerling, M., X. Quan, and J. Eischeid: 2009: Distinct causes for principal US droughts of the 20th Century. *Geophys. Res. Lett.*, 36, in review.
- NOAA CSI Team, 2008: The influence of SSTs on global land temperatures. [in "State of the Climate in 2007. *Bull. Amer. Meteor. Soc.*, S1-S135.
- NOAA CSI Team, 2008: Diagnosis of cause(s) for 2007 US precipitatin [in "State of the Climate in 2007. *Bull. Amer. Meteor. Soc.*, S1-S135.
- Rajagolpolan, B., K. Nowak, J.Prairie, M. Hoerling, B. Harding, J. Barsugli, A. Ray, and B. Udall, 2009: Water supply risk on the Colorado River: Can management mitigate? *Water Resources Res.*, 45, W08201, doi:10.1029/2008WR007652

Neff, W., J. Perlwitz, and M. Hoerling (2008), Observational evidence for asymmetric changes in tropospheric heights over Antarctica on decadal time scales, *Geophys. Res. Lett.*, 35, L18703, doi:10.1029/2008GL035074.

NOAA CSI Team, 2009: Factors causing the 2008 U.S. coolness. [in "State of the Climate in 2008"]. *Bull. Amer. Meteor. Soc.*, 90 (7), S1-S196.

Hoerling, M., X. Quan, and J. Eischeid (2009), Distinct causes for two principal U.S. droughts of the 20th century, *Geophys. Res. Lett.*, 36, L19708, doi:10.1029/2009GL039860.

Perlwitz, J., M. Hoerling, J. Eischeid, T. Xu, and A. Kumar (2009), A strong bout of natural cooling in 2008, *Geophys. Res. Lett.*, 36, L23706, doi:10.1029/2009GL041188.

IPCC, 2009: Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Detection and Attribution Related to Anthropogenic Climate Change [Stocker, T.F., C.B. Field, D. Qin, V. Barros, G.-K. Plattner, M. Tignor, P.M. Midgley, and K.L. Ebi (eds.)]. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland, pp. xx.

Hegerl, G.C., O. Hoegh-Guldberg, G. Casassa, M.P. Hoerling, R.S. Kovats, C. Parmesan, D.W. Pierce, P.A. Stott, 2009: Good Practice Guidance Paper on Detection and Attribution Related to Anthropogenic Climate Change. In: Meeting Report of the Intergovernmental Panel on Climate Change Expert Meeting on Detection and Attribution of Anthropogenic Climate Change [Stocker, T.F., C.B. Field, D. Qin, V. Barros, G.-K. Plattner, M. Tignor, P.M. Midgley, and K.L. Ebi (eds.)]. IPCC Working Group I Technical Support Unit, University of Bern, Bern, Switzerland.

Hoerling, M., Lettenmaier, D., Cayan D., and B. Udall (2009). "Reconciling Future Colorado River Flows." *Southwest Hydrology* 8(3).

Rajagopalan, B., Nowak, K., Prairie, J., Hoerling, M., Harding, B., Barsugli, J., Ray, A., and B. Udall (2009). "Water Supply Risk on the Colorado River: Can Management Mitigate?" *Water Resources Research* 45.

Schubert, et. al. (M. Hoerling, R. Pulwarty), 2009 (October): A U.S. CLIVAR Project to Assess and Compare the Responses of Global Climate Models to Drought-Related SST Forcing Patterns: Overview and Results. *J. Climate*, 22(19), 5251-5272. doi:10.1175/2009JCLI3060.1

Wang, H., S. Schubert, M. Suarez, J. Chen, M. Hoerling, A. Kumar, and P. Pegion, 2009: Attribution of the Seasonality and Regionality in Climate Trends over the United States during 1950–2000. *J. Climate*, 22(10), 2571-2590. doi:10.1175/2008JCLI2359.1

Hoerling, M., J. Eischeid, and J. Perlwitz, 2010 (April): Regional Precipitation Trends: Distinguishing Natural Variability from Anthropogenic Forcing. *J. Climate*, 23(8), 2131-2145. doi:10.1175/2009jcli3420.1

Kumar, A., J. Perlwitz, J. Eischeid, X. Quan, T. Xu, T. Zhang, M. Hoerling, B. Jha, W. Wang, 2010 (November): Contribution of sea ice loss to Arctic amplification. *Geophys. Res. Lett.*, 37, L21701. doi:10.1029/2010GL045022



Li, S. L., J. Perlwitz, M. P. Hoerling, X. T. Chen, 2010 (July): Opposite Annular Responses of the Northern and Southern Hemispheres to Indian Ocean Warming. *J. Climate*, 23(13), 3720-3738. [doi:10.1175/2010jcli3410.1](https://doi.org/10.1175/2010jcli3410.1)

Dole, R., M. Hoerling, J. Perlwitz, J. Eischeid, P. Pegion, T. Zhang, X.-W. Quan, T. Xu, and D. Murray, 2011 (March): Was there a basis for anticipating the 2010 Russian heat wave? *Geophys. Res. Lett.*, 38, L06702. [doi:10.1029/2010GL046582](https://doi.org/10.1029/2010GL046582)

Hoerling, M, D. Easterling, J. Perlwitz, J. Eischeid, P. Pegion, and D. Murray, 2011: Assessment of 2010 North American Regional Temperature [in State of the Climate in 2010.]. *Bull. Amer. Meteor. Soc.*, 92 (6), S161-S163.

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Kumar, K., K. Kamala, B. Rajagopalan, M. Hoerling, J. Eischeid, S. Patwardhan, G. Srinivasan, B. Goswami, R. Nemani, 2011 (June): The once and future pulse of Indian monsoonal climate, *Clim. Dyn.*, 36, 2159-2170. [doi:10.1007/s00382-010-0974-0](https://doi.org/10.1007/s00382-010-0974-0)

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