



Michael Dettinger

(Retired) Senior Scientist, U.S. Geological Survey
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ACADEMIC HISTORY

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1977 -- BA Physics, U.C. San Diego (Revelle College), *summa cum laude*.

1979 -- MS Civil Engineering, Massachusetts Institute of Technology, advisor: John Wilson
"Numerical Modeling of Aquifer Systems under Uncertainty: A Second Moment Analysis"

1991 -- MS Atmospheric Sciences, University of California, Los Angeles

1997 -- Ph.D., Atmospheric Sciences, University of California, Los Angeles, advisor: Michael Ghil, *"Variations of Continental Climate and Hydrology on Diurnal-to-Interdecadal Scales"*

Master's committees: Betsy Frick (UNR); Paul McBeth (UNR); Sam Haber (SIO); Charles Briscoe (SIO); Lauren Mancewicz (UNR); Helen Fillmore (UNR)

Doctoral committees: Jessica Lundquist (SIO); Theresa Carpenter (SIO); Edwin Sumargo (SIO); Christine Albano (UNR); Charles Truettner (UNR)*; Karen Simpson (UNR)*; Michael Sierks (SIO)*; Cody Poulsen (SIO)*
* still in process

PROFESSIONAL HISTORY

1979-81: Engineer-scientist, Camp Dresser & McKee, Inc., Walnut Creek, California: Water resources consulting & groundwater modeling

Resource evaluations, groundwater flow/transport modeling, and water quality management studies for DOE nuclear-waste programs, Guam EPA, water-quality districts, and chemical industry.

1981-89: Hydrologist, U.S. Geological Survey, Carson City, Nevada: Groundwater

Assessments, modeling & hydrogeologic framework of groundwater resources, flow and chemistry in Great Basin bedrock and alluvial aquifers; District Groundwater Specialist, including program review, and representation of USGS to public, Legislature and State Engineer.

1990-96: Research Hydrologist, California District, USGS, San Diego, CA: Hydroclimatology

Studies of sensitivity of water resources of California to interannual-decadal climate variations and change by historical analyses and simulations of snowmelt/watersheds. Analyses of freshwater-inflow variations to San Francisco Bay. Analysis of large-scale basis and predictability of global, hemispheric, and Western US hydroclimatic variations using historical and paleo-records of atmospheric circulations, trace gases, ocean temperatures, streamflow, ground water, and water quality. Nonlinear dynamics of land-air interactions. Co-developer of UCLA Singular-Spectrum-Analysis Toolkit, 1995. Developer of NOAA CDC Global Streamflow dataset, 1996.

1997-2001: Research Hydrologist, California District, USGS, & Research Associate, Climate Research Division, Scripps Institution of Oceanography, La Jolla, CA: Hydroclimatology

Continuation of studies of global, Western, and Sierra Nevada hydroclimatology of precipitation and streamflow. Weather and climate downscaling. Medium-range streamflow forecasting, Sierra Nevada, and long-range streamflow forecasting nationwide. Simulations of streamflow & aquifer responses to climate, including use of insolation variations. Co-PI, NOAA-funded California-Nevada Applications Program (CNAP) for regional integrated science and assessment of climate applications.

2002-2015: Research Hydrologist, Branch of Western Regional Research, USGS, & Research Associate, Climate Research Division, Scripps Institution of Oceanography, La Jolla, CA: Hydroclimatology & climate change

Studies of global, Western North American, and Sierra Nevada hydroclimatology of precipitation, snowpack, streamflow & groundwater. Developed constructed-analogs downscaling, component-resampling, & derived-distribution approaches as tools for evaluating global-change and short-term climate predictions and consequences. Evaluation of climate-change projections for changes in western climates, large-scale Pacific-basin climate modes, flood statistics, streamflow & groundwater recharge. Development of innovative hydrometeorological monitoring methods, Yosemite National

Park. Continuation of climate-applications assessments within CNAP & extension to State-funded California Climate Change Center. Co-designer, 21st Century Extreme Storm Observations Network for California. Team leader, ARkStorm scenario development, USGS Multi-Hazards Program. Co-PI, DOI's Southwest Climate Science Center and National Integrated Drought Information System's Southern California Pilot Study. Methods contributor, Climate Central/US Bureau of Reclamation Bias-corrected & Downscaled CMIP3/CMIP5 Climate Projections archive.

2015-2019: Senior Hydrologist, Water Cycle Branch, USGS; Visiting Researcher, Desert Research Institute; & Research Associate, Climate Research Division, Scripps Institution of Oceanography: Hydroclimatology & climate change

Continuation of studies of climate change and water resources of the West, and atmospheric-rivers processes and impacts, along with cold-air pooling in the Sierra Nevada, and other hydrologic and hydroclimatic problems in California and Nevada. Organizer & editor, International Atmospheric-Rivers Conference, 2015-16. Co-PI, Scripps' Center for Western Weather and Water Extremes. Co-PI, NOAA-funded California-Nevada Applications Program (CNAP) and DOI's Southwest Climate Science Center. Co-PI, UNR Water for the Seasons Water Sustainability and Climate Project on Truckee-Carson River System and Native Waters Project across the Southwest. Leading elements of USGS Science Applications for (climatic- hazards) Risk Reduction Program.

2020-pres: Visiting Researcher, Scripps Institution of Oceanography; and Michael Dettinger Climate Science, LLC

OTHER ACTIVITIES

- **Senior Scientist**, USGS, 2015-2019. **Member**, Science Advisory Board, USGS John Wesley Powell Center for Analysis and Synthesis, 2019. **Department of Interior Superior Service Award**, 2005, for exceptional contributions to hydroclimatology. **Research Advisor**, USGS Surface-Water Hydrology Discipline, 2009-14. **USGS Global Change Strategic Science Planning Team**, 2010-12. **USGS Committee**, Report to Congress on a Program for Periodic Assessments of the Nation's Water Availability, Fall 2001 & Summer 2003. **Member**, USGS National Groundwater Climate-Response Network Design Committee, 1995-97. **Internal Review Team** for USGS Water Resources Division Strategic Plan, 1997.
- **Lead author**, Water Resources chapter of National Climate Assessment Report, 2012-13. **Organizing committee & contributing author**, Southwest Regional Climate Assessment, 2011-2012. **Steering & Selection Committee**, NOAA PACE Postdoctoral Program, 2008-12. **Science Steering Group**, US Global Water Cycle Interagency Working Group, 2004-2008. **Coauthor**, US CCSP Committee for Science & Assessment Product 5.3 (Decision support & evaluations of seasonal-interannual forecasts & observations), 2006-08.
- **Coordinating Lead Author**, 4th California Climate Assessment Sierra Nevada Region, 2017-2018. **California Department of Water Resources (DWR) Climate Science Service Awards**, 2007 & 2014. **California DWR Climate Change Technical Advisory Group**, 2008-09, 2012-14. **Project management team**, California Department of Water Resources 21st Century Observations, Modeling & Decision Support Systems for Enhanced Flood Response & Emergency Preparedness Program, 2008-2012. **Central Valley Flood Management Planning Program Climate-Change Working Group**, 2009-11. **Climate Change Advisor**, CALFED Bay-Delta Program, 2006-09. **Editor**, CALFED/Delta Science Program State of Bay-Delta Science reports, 2007-08, 2014-16. **Member**, CALFED Water-Management Science Board, 2004-05.
- **NASA Standing Review Board**, Surface-Water Oceanic Topography (SWOT) Mission, 2014-pres. **Program committee and contributing author**, NOAA Research Council Water Cycle Science Challenge Workshop, 2011. **NOAA Office of Oceanic and Atmospheric Research Outstanding Scientific Paper Awards**, 2007 & 2009.
- **Special Recognition Award**, California Extreme Precipitation Symposium, 2020. Sierra Business Council's **Sierra Nevada Vulnerability Assessment Technical Advisory Group**, 2020-pres. **Lake Tahoe Science to Action Subcommittee**, 2018-2019. **Lake Tahoe Science Consortium Committee of Scientists**, 2014-2016. **Venice Sustainability Advisory Panels**, Venice, Italy, UCSD Sustainability Solutions Institute, 2008-09, 2010-13.

- **Fellow**, American Geophysical Union (Hydrology Fellow for “*insightful, societally relevant research in understanding how climate and weather affect the variability of hydrologic systems;*” 2014). **Fellow**, American Association for the Advancement of Science for “*seminal contributions to the understanding of the hydroclimatology of the Western US,*” 2018. **Water Resources Committee chair**, American Meteorological Society, 2017-2019. **Invited lead author** for Ecological Society of America Centennial paper, *Western Water & Climate Change*, 2015. **Contributing author**, Urban Climate Change Research Network (UCCRN) Assessment Reports on Climate Change in Cities (ARC3), 2008-09, 2014-15. **Contributing author**, Seasonal-to-Interannual Climate Forecast Needs--Users’ Perspectives, Third World Climate Conference, 2009. **Executive committee**, USA National Phenology Network Implementation Team, 2005-2007.
- **Program chair & fundraiser**, Annual Pacific Climate (PACLIM) Workshops, 1998-2004. **Organizing committees**, biennial MTNCLIM Workshops, 2004-18.
- **Vice President’s National Performance Review Award**, 1996, for physical-science leadership in Mojave Desert Ecosystems planning efforts.
- **Associate Editor**, Water Resources Research, 1998-2000; J. Hydrometeorology, 2011-12; San Francisco Estuary & Watershed Science, 2012-pres.

SELECTED PUBLICATIONS & REPORTS

[Total numbers of publications: >150 journal articles & book chapters, >30 government reports & >85 other technical publications. Impact: GoogleScholar lists >26,000 citations to my work in the scientific literature (over 11,000 in the past five yrs), with 59 cited 100 or more times (many indicated below by **).]

- ** Dettinger, M.D., & Wilson, J.L., 1981, First-order analysis of uncertainty in numerical models of groundwater flow, 1, Mathematical development: Water Resources Research, 17, 149-161.
- ** Dettinger, M.D., 1989, Reconnaissance estimates of natural recharge to desert basins in Nevada, U.S.A., by using chloride-balance calculations: Journal of Hydrology, 106, 55-78.
- Dettinger, M.D., 1989, Distribution of carbonate-rock aquifers in southern Nevada and the potential for their development--Summary of findings, 1985-88: Special Summary Publication of the Nevada Carbonate Aquifers Program, 20 p.
- ** Dettinger, M.D., & Cayan, D.R., 1995, Large-scale atmospheric forcing of recent trends toward early snowmelt in California: Journal of Climate, 8, 606-623.
- ** Dettinger, M.D., Ghil, M., Strong, C.M., Weibel, W., & Yiou, P., 1995, Software expedites singular-spectrum analysis of noisy time series: Eos, Trans. AGU 76, pp. 12, 14, 21.
- ** Jeton, A.E., Dettinger, M.D., & Smith, J.L., 1996, Potential effects of climate change on streamflow, eastern and western slopes of the Sierra Nevada, California and Nevada: U.S. Geological Survey Water Resources Investigations Report 95-4260, 44 p.
- ** White, W.B., Lean, J., Cayan, D.R., & Dettinger, M.D., 1997, Response of global upper ocean temperature to changing solar irradiance: Journal of Geophysical Research, 102, 3255-3266.
- ** Cayan, D.R., Dettinger, M.D., Diaz, H.F., & Graham, N., 1998, Decadal variability of precipitation over western North America: Journal of Climate, 11, 3148-3166.
- ** Dettinger, M., Cayan, D., Diaz, H., & Meko, D., 1998, North-south precipitation patterns in western North America on interannual-to-decadal time scales: J. Climate, 11, 3095-3111.
- ** McCabe, G.J., & Dettinger, M.D., 1999, Decadal variability in the relations between ENSO and precipitation in the western United States: International Journal of Climatology, 19, 1399-1410.
- ** Dettinger, M.D., & Diaz, H.F., 2000, Global characteristics of streamflow seasonality and variability: Journal of Hydrometeorology, 1, 289-310.
- ** Cayan, D.R., Kammerdiener, S., Dettinger, M.D., Caprio, J.M., & Peterson, D.H., 2001, Changes in the onset of spring in the western United States: Bulletin, American Meteorological Society, 82, 399-415.
- ** Dettinger, M.D., Battisti, D.S., Garreaud, R.D., McCabe, G.J., & Bitz, C.M., 2001, Interhemispheric effects of interannual and decadal ENSO-like climate variations on the

- Americas, in V. Markgraf (ed.), *Interhemispheric climate linkages: Present and Past Climates in the Americas and their Societal Effects*: Academic Press, 1-16.
- ** Ghil, M., Allen, M.R., Dettinger, M.D., Ide, K., Kondrashov, D., Mann, M.E., Robertson, A.W., Saunders, A., Y.Tian, Varadi, F., & Yiou, P., 2002, Advanced spectral methods for climatic time series: *Reviews of Geophysics*, 40, 1003, 1-41.
- ** Dettinger, M.D., Cayan, D.R., Meyer, M.K., & Jeton, A.E., 2004, Simulated hydrologic responses to climate variations and change in the Merced, Carson, and American River basins, Sierra Nevada, California, 1900-2099: *Climatic Change*, 62, 283-317.
- ** Stewart, I., Cayan, D.R., & Dettinger, M.D., 2004, Changes in snowmelt runoff timing in western North America under a 'Business as Usual' climate change scenario: *Climatic Change*, 62, 217-232.
- ** Dettinger, M.D., 2005, From climate-change spaghetti to climate-change distributions for 21st Century California: *San Francisco Estuary and Watershed Science*, 3(1), article 4.
- Hanson, R.T., & Dettinger, M.D., 2005, Ground-water/surface-water responses to ensembles of global climate simulations, Santa Clara-Calleguas basin, Ventura County, California, 1950-93: *Journal of the American Water Resources Association*, 41, 517-536.
- ** Stewart, I., Cayan, D., & Dettinger, M., 2005, Changes towards earlier streamflow timing across western North America: *Journal of Climate*, 18, 1136-1155.
- ** Bales, R., Molotch, N., Painter, T., Dettinger, M., Rice, R., & Dozier, J., 2006, Mountain hydrology of the western US: *Water Resources Research*, 42, W08432, 13 p.
- ** Knowles, N., Dettinger, M., & Cayan, D., 2006, Trends in snowfall versus rainfall for the Western United States: *Journal of Climate*, 19(18), 4545-4559.
- ** Ralph, F.M., Neiman, P.J., Wick, G., Gutman, S., Dettinger, M., Cayan, D., & White, A.B., 2006, Flooding on California's Russian River—Role of atmospheric rivers: *Geophysical Research Letters*, 33 (L13801), 5 p. [NOAA OAR Outstanding Paper Award, 2007]
- Florsheim, J.L., & Dettinger, M., 2007, Climate and floods still govern California levee breaks: *Geophysical Research Letters*, 34(L22403), 5 p.
- Malamud-Roam, F., Dettinger, M.D., Ingram, B.L., Hughes, M., & Florsheim, J., 2007, Holocene climates and connections between the San Francisco Bay estuary and its watershed—A review: *San Francisco Estuary & Watershed Science*, 5(1), article 3.
- ** Barnett, T.P., Pierce, D.W., Hidalgo, H., Bonfils, C., Santer, B., Das, T., Bala, G., Wood, A., Nozawa, T., Mirin, A., Cayan, D., & Dettinger, M., 2008, Human-induced changes in the hydrology of the western United States: *Science*, 316, 1080-1083.
- ** Cayan, D.R., Maurer, E.P., Dettinger, M.D., Tyree, M., & Hayhoe, K., 2008, Climate change scenarios for the California region: *Climatic Change*, 87(Suppl 1), S21-S42.
- ** Funk, C., Dettinger, M., Brown, M., Verdin, J., Michaelsen, J., Barlow, M., & Hoell, A., 2008, Warming of the Indian Ocean threatens eastern and southern Africa food security, but could be mitigated by agricultural development: *PNAS*, 105, 11081-11086.
- ** Hidalgo H.G., Das T., Dettinger M.D., Cayan D.R., Pierce D.W., Barnett T.P., et al., 2009, Detection and attribution of stream flow timing changes to climate change in the western United States: *J. Climate*, 22, 3838-3855.
- ** Cloern, J.E., Knowles, N., Brown, L.R., Cayan, D., Dettinger, M.D., et al., 2011, Projected evolution of California's San Francisco Bay-Delta river system in a century of climate change: *PLoS One*, 26 p.
- ** Das, T., Dettinger, M., Cayan, D., & Hidalgo, H., 2011, Potential increase in floods in California's Sierra Nevada under future climate projections: *Climatic Change*, 109, 71-94.
- ** Dettinger, M.D., 2011, Climate change, atmospheric rivers and floods in California—A multimodel analysis of storm frequency and magnitude changes: *J. American Water Resources Association*, 47, 514-523.
- ** Dettinger, M.D., Ralph, F.M., Das, T., Neiman, P.J., & Cayan, D., 2011, Atmospheric rivers,

- floods, and the water resources of California: *Water*, 3, 455-478.
- Major, D.C., Omojola, A., Dettinger, M., Hanson, R., & Sanchez-Rodriguez, R., 2011, Climate change, water and wastewater in cities, in Rosenzweig, C., Solecki, W., Hammer, S., and Mehrotra, S. (eds.), *Climate Change and Cities--First Assessment Report of the Urban Climate Change Research Network*: Cambridge University Press, 113-143.
- ** Ralph, F.M., & Dettinger, M.D., 2011, Storms, floods and the science of atmospheric rivers: *Eos*, *Transactions of AGU*, 92(32), 265-266.
- Dettinger, M.D., et al., 2012, Design and quantification of an extreme winter storm scenario for emergency preparedness and planning exercises in California: *Natural Haz.*, 60, 1085-1111.
- ** Ralph, F.M., & Dettinger, M.D., 2012, Historical and national perspectives on extreme west-coast precipitation associated with atmospheric rivers during December 2010: *Bulletin, American Meteorological Society* 93, 783-790.
- Dettinger, M., & Ingram, L., 2013, The coming megafloods: *Scientific American*, 308(1), 64-71 (also *translated and published in eleven countries internationally*).
- Overpeck, J., Garfin, G., Jardine, A., Busch, D., Cayan, D., Dettinger, M., et al., 2013, Assessment of climate change in the southwest United States—Summary for decisionmakers: in *Assessment of Climate Change in the Southwest United States*, eds. G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 1–20. Washington, DC: Island Press.
- White, A.B., Anderson, M.L., Dettinger, M.D., Ralph, F.M., et al., 2013, A 21st Century California observing network for monitoring extreme weather events: *J. Atmos & Oceanic Tech*, 30, 1585-1603.
- Dettinger, M.D., 2013, Atmospheric rivers as drought busters on the US West Coast: *J. Hydrometeorology*, 14, 1721-1732.
- ** Dettinger, M.D., Udall, B., and Georgakakos, A.P., 2015, Western water and climate change: *Ecological Applications (invited ESA Centennial Paper)*, 25(8), 25 p.
- Albano, C.M., Dettinger, M.D., McCarthy, M.I., Welborn, T.L., and Cox, D.A., 2016, Application of an extreme winter storm scenario to identify vulnerabilities, mitigation options, and science needs in the Sierra Nevada mountains, USA: *Natural Hazards*, 80, 879-900.
- Dettinger, M.D., 2016, Historical and future relations between large storms and droughts in California: *San Francisco Estuary and Watershed Science*, 14(2), 21 p.
- Healey, M., Dettinger, M., & Norgaard, R. (eds.), 2016, *State of Bay-Delta Science 2016: Delta Science Program*, 418 p.
- Harpold, A., Dettinger, M., and Rajagopal, S., 2017, Defining snow drought and why it matters: *Eos*, *Transactions of the AGU*, 98(5), 15-17.
- Dettinger, M.D., Ralph, F.M., and Rutz, J.J., 2018, Empirical return periods of the most intense historical atmospheric-river vapor transports on the US West Coast: *J. Hydrometeorology*, 19, 1363-1377.
- Dettinger, M., et al., 2018, *Fourth California Climate Assessment--Sierra Nevada Region Report: California's Fourth Climate Change Assessment report SUM-CCCA4-2018-004*, 94 p.
- Ralph, F.M., Dettinger, M.D., Cairns, M.M., Galarneau, T.J., and Eylander, J., 2018, Defining "atmospheric river"--How the Glossary of Meteorology helped resolve a debate: *Bull. Amer. Meteor. Soc.*, 99, 837-839.
- Vicuna, S., Redwood, M., Dettinger, M., and Noyola, A., 2018, Urban Water Systems, in Rosenzweig, C., et al. (eds.), *Climate Change and Cities—2nd Assessment Report of the Urban Climate Change Research Network*: Cambridge University Press, New York, 519-552.
- Ralph, F.M., Rutz, J., Cordeira, J., Dettinger, M., Anderson, M., et al., 2019, A scale to characterize the strength and impacts of atmospheric rivers: *Bull. Amer. Meteor. Soc.*, 100, 269-289.
- Ralph, M., Dettinger, M., Rutz, J., and Waliser, D. (eds.), 2020, *Atmospheric Rivers (book)*: Springer International Publishing, 282 p.