



## MICHAEL DETTINGER

Michael Dettinger Climate Science, LLC

Visiting Researcher, Scripps Institution of Oceanography

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### ACADEMIC HISTORY

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

**1979 -- MS Civil Engineering, Massachusetts Institute of Technology, "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"**

**Degree committees:** Christine Albano (PhD UNR); Charles Briscoe (MS SIO); Theresa Carpenter (PhD SIO); Helen Fillmore (MS UNR); Betsy Frick (MS UNR); Sam Haber (MS SIO); Maryam Lamjiri (PhD SIO); Jessica Lundquist (PhD SIO); Paul McBeth (MS UNR); Lauren Mancewicz (MS UNR); Cody Poulsen (PhD SIO)\*; Michael Sierks (PhD SIO)\*; Karen Simpson (PhD UNR)\*; Josh Sturtevant (MS UNR); Edwin Sumargo (PhD SIO); Charles Truettner (PhD UNR) \* *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 & representation of USGS to public, Legislature & State Engineer.*

**1990-96: Research Hydrologist, California District, USGS, San Diego, CA:** *Studies of sensitivity of water resources of California to interannual-decadal climate variations & 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. 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:** *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. 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:** *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, 21<sup>st</sup> Century Extreme Storm Observations Network for California. Team leader, ARkStorm scenario development, USGS Multi-Hazards Program. DOI's Southwest Climate Science Center and National Integrated Drought Information System's Southern California Pilot Study.*

**2015-2019: Senior Hydrologist, Water Cycle Branch, USGS; Visiting Researcher, Desert Research Institute; & Research Associate, Climate Research Division, Scripps Institution of Oceanography:** *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, 1<sup>st</sup> & 2<sup>nd</sup> International Atmospheric-Rivers Conferences. Scripps' Center for Western Weather and Water Extremes. NOAA-funded California-Nevada Applications Program (CNAP) and DOI's Southwest Climate Science Center. 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:** *Forecast-informed reservoir operations, climate change, and drought studies at Scripps. Planning for a climate-change institute at Lake Tahoe. Drought impacts/indicators study with Public Policy Institute of California. High-resolution projections of hydrologic impacts of climate change in Lake Tahoe Basin with Desert Research Institute. Assorted mentoring.*

## OTHER ACTIVITIES

- **Fellow**, American Geophysical Union (Hydrology Fellow for “*insightful, societally relevant research in understanding how climate and weather affect the variability of hydrologic systems;*” 2014); **AGU Tyndall History of Global Environmental Change Lecturer** (for “*outstanding contributions to our understanding of global environmental change*”), 2021. **AGU Horton Medal Selection Committee**, 2020-22. **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, 2017-19. **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**, Inaugural US National Phenology Network Implementation, 2005-07. #290 in Reuters' global List of Top 1000 Most Influential Climate Scientists, 2021.
- **Senior Scientist**, USGS, 2015-19. 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. **Vice President's National Performance Review Award**, for physical-science leadership in Mojave Desert

- Ecosystems planning efforts, 1996.
- **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, 2004-08. **Coauthor**, US CCSP Committee for Science & Assessment Product 5.3 (Decision support & evaluations of seasonal-interannual forecasts & observations), 2006-08.
  - **Coordinating Lead Author**, 4<sup>th</sup> California Climate Assessment Sierra Nevada Region, 2017-18. **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 DWR/NOAA 21<sup>st</sup> Century Observations, Modeling & Decision Support Systems for Enhanced Flood Response & Emergency Preparedness Program, 2008-12. **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.
  - **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**, 2018-19. **Lake Tahoe Science Consortium Committee of Scientists**, 2014-16. **Venice Sustainability Advisory Panels**, Venice, Italy, UCSD Sustainability Solutions Institute, 2008-09, 2010-13.
  - **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.
  - **Program chair & fundraiser**, Annual Pacific Climate (PACLIM) Workshops, 1998-2004. **Organizing committees**, biennial MTNCLIM Workshops, 2004-18.
  - **Associate Editor**, Water Resources Research, 1998-2000; J. Hydrometeorology, 2011-12; San Francisco Estuary & Watershed Science, 2012-pres.

#### SELECTED BOOKS, PUBLICATIONS & REPORTS *(w/annotations)*

*[Total numbers of publications: 1 reference book, >150 journal articles & chapters, >30 government reports & >90 other technical publications.*

***Impact:** GoogleScholar lists >30,000 citations to my work in the scientific literature, with 65 cited >100 times (many indicated below by \*\*). Of my first-authored papers, 15 cited >100 times, totaling >5,000 citations. My work has led directly to three new entries to the AMS Glossary of Meteorology since 2018.]*

Ralph, M., **Dettinger**, M., Waliser, D., and Rutz, J. (eds.), 2020, Atmospheric Rivers (*reference book*): Springer International Publishing, 252 p., doi: 10.1007/978-3-030-28906-5.

\*\* **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: J. Hydrology, 106, 55-78. (*First new recharge-estimation method for Nevada since early 1970s; still used*)

\*\* **Dettinger**, M.D., & Cayan, D.R., 1995, Large-scale atmospheric forcing of recent trends toward early snowmelt in California: J. Climate, 8, 606-623. (*Early demonstration of widespread earlier-runoff trends*)

\*\* **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. (*Pre-PDO characterization of interdecadal precipitation variability in western US*)

\*\* McCabe, G.J., & **Dettinger**, M.D., 1999, Decadal variability in the relations between ENSO and

- precipitation in the western United States: *International J. Climatology*, 19, 1399-1410.
- \*\* **Dettinger**, M.D., & Diaz, H.F., 2000, Global characteristics of streamflow seasonality and variability: *J. 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, Amer Meteorol Soc*, 82, 399-415. (*Observed trends toward earlier spring greenup across the western US*)
- \*\* **Dettinger**, M.D., Battisti, D.S., Garreaud, R.D., McCabe, G.J., & Bitz, C.M., 2001, Interhemispheric effects of interannual & decadal ENSO-like climate variations on the Americas, in V. Markgraf (ed.), *Interhemispheric climate linkages: Present & Past Climates in the Americas & their Societal Effects*: Academic Press, 1-16. (*Identifying shared causes of streamflow (and precipitation) variations from Alaska to Tierra del Fuego*)
- \*\* Ghil, M., Allen, M.R., **Dettinger**, M.D., et al., 2002, Advanced spectral methods for climatic time series: *Rev. Geophysics*, 40, 1003, 1-41. (*Reference still used across many scientific fields*)
- \*\* **Dettinger**, M.D., Cayan, D.R., Meyer, M.K., & Jeton, A.E., 2004, Simulated hydrologic responses to climate variations & change in the Merced, Carson, & American River basins, Sierra Nevada, California, 1900-2099: *Clim Chg*, 62, 283-317. (*Early coupling of day-to-day climate-change projections to several hydrologic models*)
- \*\* **Dettinger**, M.D., 2005, From climate-change spaghetti to climate-change distributions for 21<sup>st</sup> Century California: *San Francisco Estuary & Watershed Science*, 3(1), article 4. (*Introducing ensemble climate-change projections to California community.*)
- 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: *J. American Water Resources Assoc*, 41, 517-536. (*Earliest GCM-groundwater model linkage*)
- \*\* Stewart, I., Cayan, D., & **Dettinger**, M., 2005, Changes towards earlier streamflow timing across western North America: *J. Climate*, 18, 1136-1155. (*Western North America-wide observation of streamflow-timing trends associated with ongoing regional warming*)
- \*\* 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: *J. Climate*, 19, 4545-4559. (*Showing west-wide snow-to-rain transition*)
- \*\* 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. (*Demonstrated highly reliable observed AR to flooding linkage*)
- \*\* 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. (*First rigorous attribution of observed snowmelt/streamflow timing trends to ongoing global warming*)
- \*\* Funk, C., **Dettinger**, M., et al., 2008, Warming of the Indian Ocean threatens eastern & southern Africa food security, but could be mitigated by agricultural development: *PNAS*, 105, 11081-11086. (*Brief foray into food security*)
- \*\* Das, T., **Dettinger**, M., Cayan, D., & Hidalgo, H., 2011, Potential increase in floods in California's Sierra Nevada under future climate projections: *Clim Chg*, 109, 71-94. (*One of the first simulation-based evaluations of flood changes under climate change in the West.*)
- \*\* **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. (*First-ever projections of enhanced climate-change ARs*)
- \*\* **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.
- \*\* Ralph, F.M., & **Dettinger**, M.D., 2011, Storms, floods and the science of atmospheric rivers:

- Eos 92(32), 265-266. (*Offering up AR science as a grand challenge for 21<sup>st</sup> C meteorology*)
- 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. (*Scientific basis of ARStorm severe-storm scenario for California*)
- \*\* Ralph, F.M., & **Dettinger, M.D.**, 2012, Historical and national perspectives on extreme west-coast precipitation associated with atmospheric rivers during December 2010: *Bull., Amer. Meteorol. Soc.* 93, 783-790. (*Introducing "R-Cat" extreme precipitation index*)
- Dettinger, M.**, & Ingram, L., 2013, The coming megafloods: *Scientific American*, 308(1), 64-71 (also translated and published in eleven countries internationally).
- White, A, Anderson, M, **Dettinger, M**, Ralph, FM, et al., 2013, A 21<sup>st</sup>Century California observing network for monitoring extreme weather events: *J. Atmos Ocean Tech*, 30, 1585-1603. (*Design & implementation of multimillion dollar severe-storm monitoring network for California*)
- \*\* **Dettinger, M**, 2013, Atmospheric rivers as drought busters on the US West Coast: *J. Hydrometeorology*, 14, 1721-1732. (*First glimpse of AR-to-drought linkage*)
- \*\* **Dettinger, M.D.**, Udall, B., & Georgakakos, A.P., 2015, Western water & climate change: Ecological Applications (*invited ESA Centennial Paper*), 25(8), 25 p.
- Albano, C.M., **Dettinger, M.D.**, McCarthy, M.I., Welborn, T.L., & 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 Haz.*, 80, 879-900. (*ARStorm@Tahoe*)
- Dettinger, M.D.**, 2016, Historical and future relations between large storms and droughts in California: *San Francisco Estuary & Watershed Science*, 14(2), 21 p. (*Detailed depiction of unique linkage between major storms & droughts in California*)
- Healey, M., **Dettinger, M.**, & Norgaard, R. (eds.), 2016, State of Bay-Delta Science 2016: Delta Science Program, 418 p. (*Also co-edited the previous State-of-Science report in 2008*)
- Harpold, A., **Dettinger, M.** & Rajagopal, S., 2017, Defining snow drought & why it matters: *Eos*, 98, 15-17. (*Providing formal definition of snow droughts for the cryosphere community*)
- Dettinger, M.D.**, Ralph, F.M., & Rutz, J., 2018, Empirical return periods of the most intense vapor transports during AR landfalls on the US West Coast: *J. Hydromet.*, 19, 1363-1377. (Evaluating & providing a basis for categorizing magnitudes of the stronger atmospheric rivers on west coast)
- 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.
- Vicuna, S., Redwood, M., **Dettinger, M.**, & 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. (*Also co-authored water-resources chapter in 1<sup>st</sup> Assessment report, 2011.*)
- \*\* Ralph, F.M., Rutz, J., Cordeira, J., **Dettinger, M.**, et al., 2019, A scale to characterize the strength and impacts of atmospheric rivers: *Bull. Amer. Meteor. Soc.*, 100, 269-289. (*Introducing impacts-oriented operational Atmospheric-River scale*)
- Lake Mendocino FIRO Steering Committee, 2020, Lake Mendocino Forecast Informed Reservoir Operations Final Viability Assessment, 141 p. (*Result of >6 yrs of multiagency work*)
- Alex, K., Bolton, R., **Dettinger, M.**, Diamond, J., et al., 2021, Planning & scoping a Tahoe Climate Center: UC Berkeley Center for Law, Energy & the Environment report, 42 p.
- McAfee, S., Restaino, C., Omerod, K.J., **Dettinger, M.**, et al., 2021, Climate change impacts in Nevada: University of Nevada Extension FS21-06, 9 p. (*First Nevada vulnerability assessment*)