

HILARY KATHERINE McMILLAN

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HIGHER EDUCATION

- 2002-2006 **PhD** Department of Geography, Cambridge University, UK
Thesis '*End-to-End Flood Risk Assessment: A Coupled Model Cascade with Uncertainty Estimation*'
- 2001-2002 **MRes Science of the Environment, Distinction** Lancaster University, UK
Thesis '*Discharge Estimation in ungauged sub-catchments of the River Eden, UK*'
- 1996-1999 **MA Mathematics, 1st Class** Cambridge University, UK

WORK HISTORY

- 2018 to date **Associate Professor of Water Resources.** Dept of Geography, San Diego State University, US.
- 2016-2018 **Associate Professor of Water Resources (without Tenure).** Dept of Geography, San Diego State University, US.
- 2007-2016 **Hydrological Scientist.** Hydrological Processes group, National Institute of Water and Atmospheric Research (NIWA), Christchurch, New Zealand.
- 2006-2007 **Marsden Postdoctoral Fellow.** Massey University, Palmerston North, New Zealand.
'*Hyperconcentrated flow dynamics in volcanic lahars*'

RESEARCH GRANTS HELD

[All figures given in US\$ equivalents if awarded overseas; value given is portion of grant awarded to SDSU for multi-institute grants]

- 2019-2021 \$31,006, AI. *Evaluation and Improvement of Snowmelt Processes in the National Water Model During Extreme Atmospheric River Events.* National Oceanic and Atmospheric Administration.
- 2019-2020 \$7,917, Subcontract PI. *Hydrologic Model Evaluation for Forecast Informed Reservoir Operations,* Center for Western Weather and Water Extremes, UC San Diego.
- 2019-2020 \$56,684. Subcontract PI. *Atmospheric Rivers Hydrology Research,* Center for Western Weather and Water Extremes, UC San Diego.
- 2019-2020 \$9,919, PI. *Mapping how urban landscapes control flood magnitude in Southern California.* SDSU University Grants Program.
- 2017-2019 \$65,216, PI. *Surface Water Isotope Composition in Mission Valley.* City of San Diego.
- 2018-2019 \$9,988, PI. *Urban agriculture: Environmental resource or environmental pressure?,* SDSU University Grants Program.
- 2012-2016 \$2,800,000, PI. *Waterscape 2,* MBIE (Ministry for Business, Innovation and Employment) research grant (NZ)
- 2010-2016 \$2,600,000, AI. *Reducing the impacts of Weather Related Hazards,* MBIE research grant (NZ). [Dollar value quoted is the portion of the total grant for which I was project leader]
- 2015-2016 \$11,600, PI. *Accounting for the uncertainty of streamflow records in unstable rivers for water resource modelling.* Dumont D'Urville Fund, Royal Society of NZ, for NZ-France collaboration.
- 2010-2012 \$350,000, AI. *Catchment Hydrology,* AI, MBIE research grant (NZ).
- 2012-2013 \$23,000, PI. *Waterscape Hawkes Bay.* National Institute for Water and Atmospheric Research (NIWA, NZ).
- 2011-2012 \$46,000, PI. *Water tracking hydrological model for contaminant transfer.* NIWA, NZ

- 2010-2011 \$40,000, PI. *Water and Contaminant Tracking*. NIWA, NZ
- 2009-2010 \$112,000, PI. '*Flood Risk under Climate Change*'. Ministry for Agriculture and Forestry (NZ).
- 2009-2010 \$54,000, PI. '*Improvements in hydrological process modelling for applications in flow forecasting*', NIWA, NZ.
- 2008-2009 \$54,000, PI. '*Hydrological model calibration in catchments with heterogeneous geology*', NIWA, NZ
- 2009 \$4,000. International Science and Technology Linkages Fund, Royal Society of NZ.

INVITED/KEYNOTE PRESENTATIONS

- 2019 Invited speaker at American Geophysical Union conference (AGU), San Francisco. "*Process-based diagnostics for hydrologic models*"
- 2018 Invited speaker at American Geophysical Union conference (AGU), San Francisco. "*Using hydrologic signatures to extract information from data and evaluate models across scales*"
- 2017 Seminar Speaker at UC Santa Barbara and UC Irvine, '*Hydrological Signatures: Windows into a Watershed*'. [Many earlier seminar presentations omitted]
- 2017 Keynote speaker to workshop on Improving the theoretical underpinnings of hydrologic models, Sopron, Hungary "*Towards hydrologic models for a world of human impacts*"
- 2016 Invited speaker at European Geosciences Union conference (EGU), Vienna, Austria, "*Catchment water storage: Models vs Measurements*"
- 2015 Keynote speaker to Berkeley Catchment Symposium, San Francisco, "*Where do national hydrology models perform well or badly and why?*"
- 2015 Invited speaker at AGU, San Francisco, "*Hydrological Uncertainty: Reasons to Be Cheerful*"
- 2015 Keynote speaker to Gordon Research Conference on Catchment Science, Boston, '*Hydrological signatures: use and abuse*'.
- 2013 Invited speaker at AGU, San Francisco, '*Benchmarking Uncertainty for Hydrology*'
- 2013 Invited speaker at EGU, Vienna, Austria, '*Spatial organisation in hydrological model structures*'
- 2012 Keynote speaker '*Making the most of hydrological data*' and invited speaker '*Using data from research basins to identify appropriate model structures*' at IAHS Conference in Delft, Netherlands

SCHOLARLY AWARDS

- 2018 Excellence in Research Award for Tenure-Track Faculty, SDSU College of Arts and Letters
- 2012 American Geophysical Union 2012 Editor's Citation for Excellence in Refereeing
- 2002 - 2003 Selwyn College Graduate Scholarship (for distinction in postgraduate study)
- 2002 - 2005 Natural Environment Research Council UK (NERC) PhD Scholarship with NERC PhD CASE Award (Co-operative Award in Science and Engineering).
- 2001 - 2002 Natural Environment Research Council UK (NERC) Masters Scholarship.

TEACHING EXPERIENCE

Instruction (at San Diego State University)

Practical Hydrologic Modeling

Postgraduate/Undergraduate, Spring 2019, Spring 2020.

CUAHSI Virtual University

Postgraduate, Fall 2020.

Hydrology and Global Environmental Change Postgraduate/Undergraduate, Spring 2017, Spring 2018, Fall 2018.

Environmental Hydrology Undergraduate, Fall 2016, Fall 2017, Fall 2018.

Doctoral Advising

- 2020 to date PhD Internship Advisor, S. Gnann, Bristol University, UK. '*Linking baseflow generating processes to catchment attributes*'
- 2018 to date PhD Committee Chair, D. Kim, San Diego State University. '*Hydrologic modeling of heterogeneous urban landscapes*'
- 2016 to date PhD Committee External Member, I. Horner, IRSTEA, France. '*Diagnostic-evaluation of distributed models using hydrological signatures*'.
- 2015 PhD Internship Advisor, T. Euser, TU Delft, Netherlands. '*Influence of soil and climate on root zone storage capacity*'.

Masters Advising (at San Diego State University/MS Watershed Science unless specified)

- 2019 to date MS Committee Chair, R. Araki. '*Quantifying temporal surface-subsurface dynamics from in-situ soil moisture network observation under different land uses*'
- 2017 -2019 MS Committee Chair, S. Wallace. '*Isotopic separation of groundwater recharge sources, San Diego*'
- 2017 - 2019 MS Committee Chair, A. Scurlock. '*Hydrologic benefits and stressors of urban agriculture*'
- 2018 to date MS Committee Member, S. Roberts. '*Hydrologic Change Along the All-American Canal*'
- 2017 - 2019 MS Committee Member, C. Monteverde. '*Climate Change Impacts on Winegrowing Regions in Southern California: From the Perspective of a Regional Climate Model.*'
- 2018 - 2019 MS Committee Member, F. Farhang. '*Human Health Risk Assessment of Heavy Metals and Pathogens in the Olifants River, South Africa*. Master of Public Health.
- 2018 - 2019 MS Committee Member, G. McGurk. '*Geochemical Sediment Source Identification in a Semi-Arid Urbanized Watershed: Implications for improved soil loss modelling.*'
- 2018 - 2019 MS Committee Member, L. De La Torre. '*Characterizing hyporheic exchange and nutrient retention in restored urban streams*'
- 2016 - 2018 MS Committee Member, R. Feddema. '*Groundwater quality change in the Mexicali valley, Mexico*'
- 2016 - 2018 MS Committee Member, L. Barrett. '*Runoff Sensitivity to Climate Variability in California.*'
- 2018 to date MS Thesis Advisor, M. Ende, U. Amsterdam, '*Urban irrigation in the WRF-Hydro model*'
- 2011 MS Committee Co-Chair, D. Gawith, Otago University, NZ. '*Climate change effects on runoff in the Lindis and Matukituki catchments, Otago, NZ*'
- 2010 MS Thesis Advisor, M. Gaj, Freiburg University, Germany. '*Hydrological soil response in NZ*'

Bachelors Honors Advising (Overseas students undertaking theses at NIWA Research Institute, NZ)

- 2014 M. Douziech, ETH Zürich, Switzerland. '*Analysis of high and low resolution numerical weather prediction model inputs and their influence on hydrological model flow predictions*'.
- 2013 A. Gago, Montpellier University, France. '*Storm responses of soil moisture, groundwater and flow*'
- 2013 T. Finucane, Birmingham University, UK. '*Groundwater and surface water interactions interpreted from piezometer, flow gauge and shallow well data*'
- 2012 M. Gueguen, Montpellier SupAgro, France. '*Controls on runoff ratio in Mahurangi Catchment, NZ*'.
- 2010 E. Grimon, Birmingham University, UK. '*Hydrologic recession behaviour in small catchments*'.

Workshop Organisation

- 2010 *Hydrologic Impacts of Climate Change*. New Zealand Hydrological Society, Dunedin, NZ.
2009 *Managing with Uncertainty*. New Zealand Hydrological Society, Whangerei, NZ.

PROFESSIONAL SERVICE

- 2020 – 2021 Interim Director of the SDSU Masters Program in Geography
2019 – date Co-Chair (for 2021)/Chair (for 2023) of the Gordon Research Conference (GRC) in Catchment Science: Interactions of Hydrology, Biology and Geochemistry
2019 Theme Leader for CUAHSI National Water Center Innovators Program Summer Institute, ‘Scaling hydrologic and hydraulic models from small basins to regional watersheds’
2019 NSF Hydrologic Sciences Program, Panel Member.
2018 to date Member of American Geophysical Union Technical Committee on *Catchment Hydrology*
2018 External expert advisor on search committee for Associate Senior Lecturer in Surface Water Hydrology (Tenure-track) at Uppsala University, Sweden
2017 External PhD examiner for Dr. T. de Boer-Euser, TU Delft, Netherlands
2016 to date Associate Editor for *Hydrological Processes* and *Hydrology and Earth System Sciences*
2015 - 2017 Chair of International Association of Hydrological Sciences (IAHS) Flagship project ‘*Panta Rhei: Hydrology, Society and Change*’
2014 - 2017 Hydrology Editor for EGU/Copernicus journal *Geoscientific Model Development*
2013 - 2016 Invited member of USGS Powell Center international working group on ‘*Water Availability for Ungauged Rivers*’
2013 - 2015 Objective Leader ‘Science Understanding’ IAHS *Panta Rhei* Biennium 2013-2015
2010 to date Grant proposal reviewer for NSF, Swiss National Science Foundation, Luxembourg National Research Fund, and Netherlands Organisation for Scientific Research.
2007 to date Regular reviewer for *Water Resources Research*, *Journal of Hydrology*, *Hydrological Processes*, and *Hydrology and Earth System Sciences*

PUBLICATIONS

Journal articles

1. Horner, I., Branger, F., **McMillan, H.**, Vannier, O., Braud, I., (2020). Information content of snow hydrological signatures based on streamflow, precipitation and air temperature. *Hydrol. Process.*
2. **McMillan, H.**, (2020). Linking hydrologic signatures to hydrologic processes: A review. *Hydrological Processes*. 34: 1393– 1409.
3. Branger, F, **McMillan, H.**, (2020). Deriving hydrological signatures from soil moisture data. *Hydrological Processes*. 34: 1410– 1427.
4. Adusumilli, S., Borsa, A. A., Fish, M. A., **McMillan, H.**, & Silverii, F. (2019). A decade of water storage changes across the contiguous United States from GPS and satellite gravity. *Geophysical Research Letters*, 46, 13006– 13015.
5. Kiang, J., Gazorian, C., **McMillan, H.**, et al. (2018). A Comparison of Methods for Streamflow Uncertainty Estimation. *Water Resources Research*, 54, 7149–7176. [Article selected by the journal for a feature write-up in *EOS* science news magazine].
6. **McMillan, H.**, Westerberg, I., Krueger, T. (2018). Hydrological data uncertainty and its implications. *WIREs Water*, 2018(5) doi: 10.1002/wat2.1319
7. Horner, I., Renard, B., Le Coz, J., Branger, F., **McMillan, H.**, Pierrefeu, G. (2018). Impact of stage measurement errors on streamflow uncertainty. *Water Resources Research*, 54 (3): 1952-1976.

8. **McMillan, H.**, Westerberg, I., & Branger, F. (2017). Five Guidelines for Selecting Hydrological Signatures. *Hydrological Processes* 2017, 1-5.
9. **McMillan, H.**, Seibert, J., Petersen-Overleir, A., et al. (2017). How uncertainty analysis of streamflow data can reduce costs and promote robust decisions in water management applications. *Water Resources Research* 53, 5220–5228.
10. **McMillan, H.**, Booker, D.J., Cattoën, C., (2016). Validation of a national hydrological model. *Journal of Hydrology*. 51 (b): 800:815.
11. de Boer-Euser, T., **McMillan, H.**, Hrachowitz, M., Winsemius, H. C., Savenije, H. H. (2016). Influence of soil and climate on root zone storage capacity. *Water Resources Research* 52, 2009–2024.
12. Yang, J., **McMillan, H.**, Zammit, C. (2016) Modeling surface water–groundwater interaction in New Zealand: Model development and application. *Hydrological Processes*, doi: 10.1002/hyp.11075.
13. Kreibich, H., Krueger, T., Van Loon, A., Mejia, A., Liu, J., **McMillan, H.**, & Castellarin, A. (2016). Scientific debate of Panta Rhei research—how to advance our knowledge of changes in hydrology and society? *Hydrological Sciences Journal* 0, 0:1-3.
14. Singh, S.K., **McMillan, H.**, Bárdossy, A., Chebana, F., (2016). Non-parametric catchment clustering using the data depth function. *Hydrological Sciences Journal* 61, 15: 2649-2667.
15. **McMillan, H.**, Montanari, A., Cudennec, C., et al. (2016). Panta Rhei 2013–2015: global perspectives on hydrology, society and change. *Hydrological Sciences Journal*, 61(7), pp.1174-1191.
16. Cattoen, C., **McMillan, H.**, Moore, S. (2016) Coupling a high-resolution weather model with a hydrological model for flood forecasting in New Zealand, *Journal of Hydrology (NZ)* 55 (1), 1
17. Archfield, S., Clark, M., [...] **McMillan, H.** et al. (2016) *Water Resources Research*. Accelerating advances in continental domain hydrologic modeling. 51(12): 10078-10091
18. Westerberg, I., Wagener, T., Coxon, G., **McMillan, H.**, et al. (2016) Uncertainty in hydrological signatures for gauged and ungauged catchments. *Water Resources Research*. 52, 1847–1865
19. Srinivasan, MS., Duncan, M., **McMillan, H.**, (2016) Field measurement of recharge under irrigation in Canterbury, New Zealand, using drainage lysimeters. *Agricultural Water Management* 166, 17 – 32.
20. Mizukami, N., Clark, M. [...] **McMillan, H.** (2016) mizuRoute (version 1) - river network routing tool for continental domain water resources applications. *Geoscientific Model Development* 9 (6), 2223-2238.
21. Westerberg, I., **McMillan, H.** (2015) Uncertainty in hydrological signatures, *Hydrol. Earth Syst. Sci.*, 12, 4233-4270, doi:10.5194/hessd-12-4233-2015, 2015.
22. Pechlivanidis, I., Jackson, B., **McMillan, H.**, Gupta, H. (2016). Robust informational entropy-based descriptors of flow in catchment hydrology. *Hydrological Sciences Journal*. 61 (1), 1 – 18
23. **McMillan, H.**, Srinivasan MS. (2015) Characteristics and controls of variability in surface and groundwaters in a headwater catchment. *Hydrology and Earth System Sciences* 19, p 1767-1786.
24. **McMillan, H.**, Westerberg, I. (2015) Rating curve estimation under epistemic uncertainty. *Hydrological Processes* 29: 1873–1882.
25. Pechlivanidis, I., Jackson, B., **McMillan, H.**, Gupta, H. (2014). Use of an entropy-based metric in multi-objective calibration to improve model performance. *Water Resources Research* 50(10): 8066–8083.
26. **McMillan H.**, Guegen M, Grimon E, Woods R, Clark M, Rupp D, (2014). Spatial variability of processes and model structure diagnostics in a 50 km² catchment. *Hydrological Processes* 28(18): 4896–4913.
27. Ackerley D, Bell RG, Mullan AB, **McMillan H.** (2013) Estimation of regional departures from global-average sea-level rise around New Zealand from AOGCM simulations. *Weather and Climate*. 33(1):2-22.
28. Montanari, A., [...] **McMillan, H.** et al. (2013) “Panta Rhei – Everything Flows”: Change in hydrology and society – The IAHS Scientific Decade 2013-2022. *Hydrological Sciences Journal* 58(6): 1256–1275.
29. **McMillan H.**, Hreinsson E, Clark M., Singh S., Zammit C., Uddstrom M. (2013) Operational hydrological data assimilation with the Recursive Ensemble Kalman Filter. *Hydrology & Earth System Sciences* 17:21-38
30. Singh SK, **McMillan H.**, Bardossy A. (2013) Use of the data depth function to differentiate between cases of interpolation and extrapolation in hydrological model prediction. *Journal of Hydrology*, 477: 213–228

31. **McMillan H.**, M. Duncan, G. Smart, et al. (2013) The Urban Impacts Toolbox: An example of modelling the effect of climate change and sea level rise on future flooding. *Weather and Climate (NZ)*. 32(2), 21-39
32. **McMillan, H.**, T. Krueger, J. Freer (2012) Benchmarking observational uncertainties for hydrology: Rainfall, river discharge and water quality. *Hydrological Processes*, 26 (26): 4078 -4111
33. Gawith, D., Kingston, D.G., **McMillan, H.** (2012) The effects of climate change on runoff in the Lindis and Matukituki catchments, Central Otago, New Zealand. *Journal of Hydrology (NZ)* 51(2): 121-136
34. **McMillan, H.**, D. Tetzlaff, M. Clark, C. Soulsby (2012) Do time variable tracers aid the evaluation of hydrological model structure? A multi-model approach. *Water Resources Research*. 48, W05501
35. **McMillan, H.** (2012) Effect of spatial variability and seasonality in soil moisture on drainage thresholds and fluxes in a conceptual hydrological model. *Hydrological Processes* 26(18): 2838–2844
36. Pechlivanidis, I.G., Jackson, B., **McMillan, H.** Gupta, H. (2012). Using an informational entropy-based metric as a diagnostic of flow duration to drive model parameter identification. *GNEST* 14(3): 325-334
37. Poyck, S., Hendriks, J., **McMillan, H.**, Hreinsson, E., Woods, R. (2011) Combined snow- and streamflow modelling to estimate impacts of climate change on water resources in the Clutha, New Zealand. *Journal of Hydrology (NZ)* 50: 293-312
38. **McMillan, H.**, Clark M., Bowden W., Duncan M., Woods R. (2011). Hydrological field data from a modeller's perspective: Part 1. Diagnostic tests for model structure. *Hydrological Processes*. 25: 511-522
39. Clark M., **McMillan, H.**, Collins D., Kavetski D., Woods R. (2011). Hydrological field data from a modeller's perspective: Part 2. Process-based evaluation of model hypotheses. *Hydrol. Proc.* 25: 523-543
40. **McMillan, H.**, Jackson B., Clark M., Kavetski D., Woods R. (2011) Rainfall Uncertainty in Hydrological Modelling: An Evaluation of Multiplicative Error Models. *Journal of Hydrology*. 400(1-2): 83-94
41. **McMillan, H.**, Freer, J., Pappenberger, F., Krueger, T., Clark, M. (2010). Impacts of Uncertain River Flow Data on Rainfall-Runoff Model Calibration and Discharge Predictions. *Hydrol Processes* 24(10):1270-1284.
42. **McMillan, H.**, Clark, M. (2009), Rainfall-runoff model calibration using informal likelihood measures within a Markov Chain Monte Carlo sampling scheme, *Water Resources Research*, 45, W04418.
43. **McMillan, H.**, Brasington, J. (2008). End-to-End Flood Risk Assessment: A Coupled Model Cascade with Uncertainty Estimation. *Water Resources Research* 44, W03419, doi:10.1029/2007WR005995.
44. **McMillan, H.**, Brasington J. (2006). Reduced Complexity Strategies for Modelling Urban Floodplain Inundation. *Geomorphology*, 90: 3-4, p 226-243.
45. Freer, J., **McMillan, H.**, McDonnell, J.J., Beven, K.J. (2004). Constraining dynamic TOPMODEL responses for imprecise water table information using fuzzy rule based performance measures. *Journal of Hydrology* 291, p 254-277.

Book Chapters

1. **McMillan, H.**, Caruso, B., Srinivasan, M.S. (2016). *Lateral hydrological processes*. In: Advances in New Zealand Freshwater Science, Eds: Jellyman, P., et al. NZ Hydrologic & Freshwater Sciences Societies.
2. Srinivasan, M.S., Wohling, T., Campbell, D. **McMillan, H.** (2016). *Vertical hydrology*. In: Advances in New Zealand Freshwater Science, Eds: Jellyman, P., et al. NZ Hydrologic & Freshwater Sciences Societies.