

**Ciaran Harman**  
Assistant Professor of Landscape Hydrology

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**EDUCATION**

PhD, Civil and Environmental Engineering University of Illinois at Urbana-Champaign	2011
M. Sc., Geography University of Illinois at Urbana-Champaign	2007
B. Eng, Environmental Engineering (First Class Honours) University of Western Australia, Perth, Australia	2003
B. Arts, Asian Studies University of Western Australia, Perth, Australia	2003

**PROFESSIONAL APPOINTMENTS**

Assistant Professor Johns Hopkins University, Baltimore	2012-
Postdoctoral Research Associate University of Arizona, Tucson	2011 - 2012
Research Assistant CRC for Catchment Hydrology, Univ. of Melbourne	2003-2005
Research Engineer EarthTech Engineering, Melbourne, Australia	2003

**AWARDS & HONORS**

Editors Citation for Excellence in Refereeing for <i>Geophysical Research Letters</i>	2016
Ross J. Martin Award for graduate research achievement University of Illinois College of Engineering	2010
Horton (Hydrology) Research Grant American Geophysical Union	2010
Mavis Future Faculty Fellowship University of Illinois Engineering College	2010
Excellence in Teaching Univ. of Illinois Dept. of Civil and Environmental Engineering	2008
Beatty Fellowship University of Illinois Department of Geography	2005, 2006
Undergraduate Groundwater Prize Centre for Groundwater Studies	2002

## PUBLICATIONS

Underline indicates supervised students

### In review or revision

1. Kim, M., L. Pangle, C. Cardoso, M. Lora, T. Volkmann, T. Wang, **C. J. Harman**, P. A. Troch, (in revision), Transit time distributions and StorAge Selection functions in a variably-saturated sloping soil lysimeter: Direct observation of internal and external transport variability, submitted to *Water Resources Research*
2. **Harman, C. J.**, A. Ward, A. Ball, (in review), How does reach-scale stream-hyporheic transport vary with discharge? Insights from rSAS analysis of sequential tracer injections in a headwater mountain stream, submitted to *Water Resources Research*

### Peer-reviewed journal papers

1. Clair, J. St, S. Moon, W. S. Holbrook, J. T. Perron, C. S. Riebe, S. J. Martel, B. Carr, **C. Harman**, and K. Singha. "Geophysical imaging reveals topographic stress control of bedrock weathering." *Science* 350, no. 6260 (2015): 534-538, doi:10.1126/science.aab2210
2. Ward, A. S., N. M. Schmadel, S. M. Wondzell, **C. J. Harman**, M. N. Gooseff, and K. Singha (2016), Hydrogeomorphic controls on hyporheic and riparian transport in two headwater mountain streams during base flow recession, *Water Resources Research*, (in press), doi:10.1002/2015WR018225.
3. Rinaldo, A., P. Benettin, **C. J. Harman**, M. Hrachowitz, K. J. McGuire, Y. van der Velde, E. Bertuzzo, and G. Botter (2016), Reply to comment by Porporato and Calabrese on Storage selection functions: A coherent framework for quantifying how catchments store and release water and solutes, *Water Resources Research*, 52(1), 616618, doi:10.1002/2015WR018045.
4. Rinaldo, A., P. Benettin, **C. J. Harman**, M. Hrachowitz, K. J. McGuire, Y. van der Velde, E. Bertuzzo, and G. Botter (2015), Storage selection functions: A coherent framework for quantifying how catchments store and release water and solutes, *Water Resour. Res.*, 51(6), 48404847, doi:10.1002/2015WR017273.
5. **Harman, C. J.** (2015), Time-variable transit time distributions and transport: Theory and application to storage-dependent transport of chloride in a watershed, *Water Resour. Res.*, doi:10.1002/2014WR015707.
6. Ehret, U., H. V. Gupta, M. Sivapalan, S. V. Weijis, S. J. Schymanski, G. Blöschl, A. N. Gelfan, **C. J. Harman**, A. Kleidon, T. A. Bogaard, D. Wang, T. Wagener, U. Scherer, E. Zehe, M. F. P. Bierkens, G. Di Baldassarre, J. Parajka, L. P. H. van Beek, A. van Griensven, M. C. Westhoff, and H. C. Winsemius (2014), Advancing catchment hydrology to deal with predictions under change, *Hydrology and Earth System Sciences*, 18(2), 649671, doi:10.5194/hess-18-649-2014.
7. **Harman, C. J.**, and M. Kim (2014), An efficient tracer test for time-variable transit time distributions in periodic hydrodynamic systems, *Geophysical Research Letters*, 41, doi:10.1002/2013GL058980.
8. Li, H.-Y., M. Sivapalan, F. Tian, and **Harman, C. J.** (2014), Functional approach to exploring climatic and landscape controls of runoff generation: 1. Behavioral constraints on runoff volume, *Water Resour. Res.*, 50(12), 93009322, doi:10.1002/2014WR016307.
9. **Harman, C. J.**, K. Lohse, P. A. Troch, and M. Sivapalan (2014), Spatial patterns of vegetation, soils, and microtopography from terrestrial laser scanning on two semiarid hillslopes of contrasting lithology, *Journal of Geophysical Research - Biogeosciences*, 119, doi:10.1002/2013JG002507.

10. **Harman, C. J.**, and P. A. Troch (2014), What makes Darwinian hydrology "Darwinian"? Asking a different kind of question about landscapes, *Hydrology and Earth System Sciences*, 18(2), 417433, doi:10.5194/hess-18-417-2014.
11. Montanari, A., Young, G., Savenije, H. H., Hughes, D., Wagener, T., Ren, L., Koutsoyiannis, D., Cudennec, C., Grimaldi, S., Blöschl, G., Sivapalan, M., Beven, K., Gupta, H., Arheimer, B., Huang, Y., Schumann, A., Post, D., Srinivasan, V., Boegh, E., Hubert, P., **Harman, C.**, Thompson, S., Rogger, M., Hipsey, M., Toth, E., Viglione, A., Di Baldassarre, G., Schaeffli, B., McMillan, H., Schymanski, S., Characklis, G., Yu, B., Pang, Z., Belyaev, V. (2013), "Panta Rhei Everything Flows": Change in hydrology and society The IAHS Scientific Decade 2013-2022, *Hydrological Sciences Journal*, 58(6), doi:10.1080/02626667.2013.809088
12. Pelletier, J. D., G. A. Barron-Gafford, D. D. Breshears, P. D. Brooks, J. Chorover, M. Durcik, **C. J. Harman**, T. E. Huxman, K. A. Lohse, R. Lybrand, T. Meixner, J. C. McIntosh, S. A. Papuga, C. Rasmussen, M. Schaap, T. L. Swetnam, P. A. Troch (2013). Coevolution of nonlinear trends in vegetation, soils, and topography with elevation and slope aspect: A case study in the sky islands of southern Arizona. *Journal of Geophysical Research-Earth Surface*, doi:10.1002/jgrf.20046
13. Thompson, S. E., M. Sivapalan, **Harman, C. J.**, V. Srinivasan, M. R. Hipsey, P. Reed, A. Montanari, and G. Blöschl (2013), Developing predictive insight into changing water systems: use-inspired hydrologic science for the Anthropocene, *Hydrology and Earth System Sciences*, 17(12), 50135039, doi:10.5194/hess-17-5013-2013.
14. Gall, H. E., J. Park, **C. J. Harman**, J. W. Jawitz, and P. S. C. Rao (2012), Landscape filtering of hydrologic and biogeochemical responses in managed catchments. *Landscape Ecology*, 1-14, doi:10.1007/s10980-012-9829-x.
15. Troch, P., Berne, A., Bogaart, P., **Harman, C.**, Hilberts, A., Lyon, S., Paniconi, C., Pauwels, V., Rupp, D., Selker, J., Teuling, A., Uijlenhoet, R., Verhoest N., (2013), The importance of hydraulic groundwater theory in catchment hydrology: The legacy of Wilfried Brutsaert and Jean-Yves Parlange, *Water Resources Research*, 49, 50995116, doi: 10.1002/wrcr.20407.
16. Patil, S., M. Sivapalan, M. A. Hassan, S. Ye, **C. J. Harman**, X. Xu, (2012). A network model for prediction and diagnosis of sediment dynamics at the watershed scale. *Journal of Geophysical Research: Earth Surface*, 117, F00A04, doi:10.1029/2012JF002400
17. Zanardo, S., **C. J. Harman**, P. A. Troch, P. S. C. Rao, and M. Sivapalan (2012), Intra-annual rainfall variability control on interannual variability of catchment water balance: A stochastic analysis, *Water Resources Research*, 48(1), W00J16, doi:10.1029/2010WR009869.
18. Carrillo, G., P. A. Troch, M. Sivapalan, T. Wagener, **C. J. Harman**, and K. Sawicz (2011), Catchment classification: Hydrological analysis of catchment behavior through process-based modeling along a climate gradient, *Hydrology and Earth System Sciences*, 15(11), 34113430.
19. **Harman, C. J.**, P. S. C. Rao, N. B. Basu, G. S. McGrath, P. Kumar, and M. Sivapalan, (2011), Climate, soil, and vegetation controls on the temporal variability of vadose zone transport, *Water Resources Research*, 47, W00J13, doi:10.1029/2010WR010194
20. Thompson, S. E., **C. J. Harman**, A. G. Konings, M. Sivapalan, A. Neal, and P. A. Troch, (2011), Comparative hydrology across AmeriFlux sites: The variable roles of climate, vegetation, and groundwater, *Water Resources Research*, 47, W00J07, doi:10.1029/2010WR009797
21. Sivapalan, M., M. A. Yaeger, **C. J. Harman**, X. Xu, and P. A. Troch (2011), Functional model of water balance variability at the catchment scale: 1. Evidence of hydrologic similarity and space-time symmetry, *Water Resources Research*, 47(2), W02522, doi:10.1029/2010WR009568

22. **Harman, C. J.**, P. A. Troch, and M. Sivapalan (2011), Functional model of water balance variability at the catchment scale: 2. Elasticity of fast and slow runoff components to precipitation change in the continental United States, *Water Resources Research*, 47(2), W02523, doi:10.1029/2010WR009656.
23. Schaeffli, B., **C. J. Harman**, M. Sivapalan and S. J. Schymanski. HESS Opinions: Hydrologic predictions in a changing environment: behavioral modeling, (2011), *Hydrology and Earth System Sciences*, 15(2), 635-646, doi:10.5194/hess-15-635-2011
24. Thompson, S. E., **C. J. Harman**, R. Schumer, J. S. Wilson, N. B. Basu, P. D. Brooks, S. D. Donner, M. A. Hassan, A. I. Packman, and P. Rao (2011). Patterns, puzzles and people: implementing hydrologic synthesis. *Hydrological Processes*, 25(20), 3256-3266.
25. Thompson, S. E., **C. J. Harman**, P. A. Troch, P. D. Brooks, and M. Sivapalan, (2011), Spatial scale dependence of ecohydrologically mediated water balance partitioning: A synthesis framework for catchment ecohydrology, *Water Resources Research*, 47, W00J03, doi:10.1029/2010WR009998
26. Guan, K., S. E. Thompson, **C. J. Harman**, N. B. Basu, P. S. C. Rao, M. Sivapalan, A. I. Packman, and P. K. Kalita, (2011), Spatiotemporal scaling of hydrological and agrochemical export dynamics in a tiledrained Midwestern watershed, *Water Resources Research*, 47, W00J02, doi:10.1029/2010WR009997
27. Sivapalan, M., S. E. Thompson, **C. J. Harman**, N. B. Basu, and P. Kumar (2011), Water cycle dynamics in a changing environment: Improving predictability through synthesis. *Water Resources Research*, 47(10), W00J01, doi:10.1029/2011WR011377
28. **Harman, C. J.**, D. M. Reeves, B. Baeumer, M. Sivapalan (2009) A Subordinated Kinematic Wave Equation for Heavy-Tailed Flow Responses from Heterogeneous Hillslopes, *Journal of Geophysical Research* 115, F00A08, doi:10.1029/2009JF001273.
29. Wagener, T., M. Sivapalan, P. A. Troch, B. L. McGlynn, **C. J. Harman**, H. V. Gupta, P. Kumar, P. S. C. Rao, N. Basu and J. S. Wilson (2009), The Future of Hydrology - An Evolving Science for a Changing World, *Water Resources Research* 46, W05301, doi:10.1029/2009WR008906.
30. Thompson, S. E., **C. J. Harman**, P. Heine and G. G. Katul (2010) Vegetation - infiltration relationships across climatic and soil type gradients, *Journal of Geophysical Research - Biogeosciences* 115, G02023, doi:10.1029/2009JG001134
31. **Harman, C. J.**, M. Sivapalan, (2009), Similarity framework to assess controls on shallow subsurface flow dynamics, *Water Resources Research*, 45, W01417, doi:10.1029/2008WR007067
32. Troch P. A. , G. F. Martinez, V. R. N. Pauwels, M. Durcik, M. Sivapalan, **C. J. Harman**, P. D. Brooks, H. Gupta, T. Huxman, (2009) Climate and vegetation water use efficiency at catchment scales, *Hydrological Processes* 23, 16, doi:10.1002/hyp.7358
33. **Harman, C. J.**, M. Sivapalan (2009), Effects of hydraulic conductivity variability on hillslope-scale shallow subsurface flow response and storage-discharge relations, *Water Resources Research*, 45, W01421, doi:10.1029/2008WR007228
34. Hopp, L., **C. J. Harman**, S. L. E. Desilets, C. B. Graham, J. J. McDonnell, and P. A. Troch (2009), Hillslope hydrology under glass: confronting fundamental questions of soil-water-biota co-evolution at Biosphere 2, *Hydrology and Earth System Sciences*, 13, 2105-2118, doi:10.5194/hess-13-2105-2009
35. **Harman, C. J.**, M. Sivapalan, Kumar, P. (2009), Power law catchment scale recessions arising from heterogeneous linear small-scale dynamics, *Water Resources Research*, 45, 9, doi:10.1029/2008WR007392

36. **Harman, C. J.**, M. Sivapalan, and P. Kumar (2009), Reply to comment by J. Szilagyi on “Power law catchment-scale recessions arising from heterogeneous linear small-scale dynamics”, *Water Resources Research*, 45, W12602, doi:10.1029/2009WR008750.
37. De Rose, R. C., M. J. Stewardson and **C. J. Harman** (2008), Downstream hydraulic geometry of rivers in Victoria, Australia, *Geomorphology*, 99(1-4) p302-316, doi:10.1016/j.geomorph.2007.11.00
38. **Harman, C. J.**, M. Stewardson, and R. De Rose, (2008), Variability and uncertainty in reach bankfull hydraulic geometry, *Journal of Hydrology*, 351(1-2), p 13-25, doi:10.1016/j.jhydrol.2007.11.
39. **Harman, C. J.** and M. Stewardson, (2005), Optimizing dam release rules to meet environmental flow targets, *River Research and Applications*, 21, 113-129

#### **Non-refereed publications**

1. **Harman, C.**, & Stewardson, M., (2003), Operating rules for the implementation of the Lederberg environmental flows recommendations, *Report to Southern Rural Water and the Department of Sustainability and Environment*, Project Number: 2003-095, Melbourne University, Vic Australia.
2. **Harman, C.**, & Stewardson, M., (2004) Post-fire coarse sediment yield in the upper Tambo river basin: results and analysis of a preliminary field survey and literature review, *Report to The East Gippsland Catchment Management Authority*, University of Melbourne, Australia.
3. **Harman, C.**, Stewardson, M. and De Rose, R. (2005) Regional models of stream channel metrics, *Co-operative Research Center for Catchment Hydrology*, Report No 5/16, Melbourne, Australia

#### **PRESENTATIONS**

##### **Invited and keynote conference presentation**

1. **Harman, C. J.**, 2015, *Internal versus external controls on age variability: Definitions, origins and implications in a changing climate*, American Geophysical Union Fall Meeting, San Francisco, CA, **Invited**, 2015
2. **Harman, C. J.**, 2015, *Getting the tail to wag the dog: Incorporating groundwater transport into catchment solute transport models using rank StorAge Selection (rSAS) functions*, American Geophysical Union Fall Meeting, San Francisco, CA, **Invited**, 2015
3. **Harman, C. J.**, 2015, *Upscaled solute transport theory as a frontier of understanding: Are StorAge Selection functions merely curve fitting?*, 2015, Workshop on “Terrestrial systems: Frontiers of our understanding”, Freudenstadt, Germany, **Invited keynote**, September 2015
4. **Harman, C. J.**, 2014, *StorAge Selection functions as a bridge between groundwater transport and integrated watershed models*, Workshop on Integrated Environmental Modeling of Estuarine Systems, Davis, CA, May 2015
5. **Harman, C. J.**, 2014, *Recent advances in transport modeling using transit time distributions*, 2014 Annual Public Meeting, Interagency Steering Committee on Multimedia Environmental Models (ISCMEM), U.S. Army Corps of Engineers, Baltimore, MD, **Invited**, October 2014
6. **Harman, C. J.**, 2014, *Recent advances towards a theory of catchment hydrologic transport: age-ranked storage and the rSAS-functions*, American Geophysical Union Fall Meeting, San Francisco, CA, **Invited**, 2014
7. **Harman, C. J.**, P. A. Troch, 2012, *Can co-evolved spatial patterns of soils and topography improve upscaled representations of hydrologic processes?*, 2nd International Conference on Hydopedology, Leipzig, Germany, **Invited**

8. **Harman, C. J.**, P. A. Troch, K. A. Lohse, M. Sivapalan, 2012, *Connections between transport in events and transport at landscape-structuring timescales*, American Geophysical Union Fall Meeting, San Francisco, CA, **Invited**, 2012
9. **Harman, C. J.**, 2011, *Laplace's Demon and Dooge's Laws: Why hydrology is more than water running downhill*, Vienna Catchment Science Symposium, TU-Wien, Vienna, Austria, **Invited keynote**
10. **Harman, C. J.**, M. Sivapalan, 2010, *Scaling up hydrologic predictions from heterogeneous soils to heterogeneous catchments - challenges and new approaches*, CUAHSI Biennial Colloquium, Boulder Colorado, **Invited**
11. **Harman, C. J.**, M. Sivapalan, 2010, *Scaling up from heterogeneous soils to heterogeneous catchments*, Soil Science Society of America Annual Meeting, Long Beach, CA, **Invited**

#### **Invited lectures**

1. **Harman, C. J.**, 2016, *rSAS: The new theory of water age, and what it can teach us about how catchments function*, Department of Biological and Ecological Engineering, Oregon State University, Corvallis, OR
2. **Harman, C. J.**, 2015, *rSAS: The new theory of water age, and what it can teach us about how catchments function*, Department of Geology Seminar, Kent State University, Kent, OH
3. **Harman, C. J.**, 2015, *rank StorAge Selection (rSAS) functions: A unified framework for modeling solute transport at the catchment scale*, International conference on hydrobiogeochemical processes: mechanisms, coupling and impact, Wuhan, China, **Invited**, October 2015
4. **Harman, C. J.**, 2015, *Upscaled solute transport theory as a frontier of understanding: Are StorAge Selection functions merely curve fitting?*, UFZ, Leipzig, Germany, **Invited**, September 2015
5. **Harman, C. J.**, 2015, *StorAge Selection functions as a bridge between groundwater transport and integrated watershed models*, Workshop on Integrated Environmental Modeling of Estuarine Systems, University of California, Davis, CA, **Invited**, May 2015
6. **Harman, C. J.**, 2015, *Solute transport in a non-stationary world: New theory for hydrologic transit times in transient flows*, Towson University, April 2015
7. **Harman, C. J.**, 2015, *Transit time distributions in a changing world: New theory for hydrologic transport under non-stationarity*, University of Minnesota, March 2015
8. **Harman, C. J.**, 2015, *Transit time distributions in a changing world: New theory for hydrologic transport under non-stationarity*, US Geological Survey, National Research Program Seminar, February 2015
9. **Harman, C. J.**, 2015, *Modeling unsteady lumped transport with time-varying transit time distributions*, Chesapeake Bay Program Office, Modeling Workgroup, Annapolis MD, January 2015
10. **Harman, C. J.**, 2015, *Modeling unsteady lumped transport with time-varying transit time distributions*, National Water Quality Assessment, Integrated Watershed Studies Team Meeting, USGS National Center, Reston, VA, January 2015
11. **Harman, C. J.**, 2014, *Modeling unsteady lumped transport with time-varying transit time distributions*, University of Delaware, Department of Geological Sciences Seminar, October 2014
12. University of Melbourne, 2014

13. University of Western Australia, 2014
14. University of Maryland Baltimore County, Center for Urban Environmental Research and Education seminar, 2014
15. Johns Hopkins University, Department of Geography and Environmental Engineering, Environmental Engineering and Chemistry seminar, 2014
16. Johns Hopkins University, Earth and Planetary Sciences Bromery Lecture, 2014
17. University of Iowa, Department of Earth & Environmental Sciences seminar, 2013
18. Johns Hopkins University, Department of Geography and Environmental Engineering Wolman seminar, 2012
19. Johns Hopkins University, Center for Environmental and Applied Fluid Mechanics lecture series, 2012
20. University of Arizona, Hydrology and Water Resources lecture series, 2012
21. Penn State University, Civil Engineering department seminar, 2011
22. Duke University, Civil and Environmental Engineering department seminar, 2011
23. Johns Hopkins University, Department of Geography and Environmental Engineering Wolman seminar, 2011

#### Conference presentations & posters

\*indicates presenting author

Underline indicates supervised student

1. Putnam, S.\*, C. J. Harman, 2015, *The Relative Importance of Time-Variable Transport through Hillslope and Riparian Hydrogeomorphic Units on the Emergent TTD of a Small Forested Piedmont Watershed*, American Geophysical Union Fall Meeting, San Francisco, CA
2. Kim, M., L.\*, Pangle, C. Cardoso, M. Lora, A. Meira, T. Volkmann, Y. Wang, C. J. Harman, P. A. Troch, 2015, *Relative controls of external and internal variability on time-variable transit time distributions, and the importance of StorAge Selection function approaches*, American Geophysical Union Fall Meeting, San Francisco, CA
3. Ward, A.\*, N. Schmadel, S. Wondzell, C. J. Harman, M. Gooseff, K. Singha, 2015, *Hyporheic transport in headwater mountain streams is time-invariant in locations where geologic controls dominate hydrologic forcing*, American Geophysical Union Fall Meeting, San Francisco, CA
4. Wilusz, D.\*, C. J. Harman, W. Ball, 2015, *Implications of an "Inverse Storage Effect" on the Sensitivity of Watershed Transit Times to Rainfall Variability at Plynlimon, Wales*, American Geophysical Union Fall Meeting, San Francisco, CA
5. **Harman, C. J.**, 2015, *Observation and physical interpretation of the rank storage selection (rSAS) function of a weighing lysimeter*, Gordon Conference on Catchment Science: Interactions of Hydrology, Biology & Geochemistry, Andover, NH
6. Putnam, S. M.\*, **Harman, C. J.**, *Combining multiscale observations and new transport theory to explore time variability in hydrologic transport processes operating in nested Piedmont watersheds*, Geological Society of America, Northeastern Section Meeting, Bretton Woods, NH
7. Wilusz, D. C.\*, **Harman, C. J.**, Ball, W. P., 2015 *Modeling the linkages between transit time distributions, nitrate transport, and climate variability: opportunities and chal-*

- allenges in the Chesapeake Bay watershed (poster), Geological Society of America, North-eastern Section Meeting, Bretton Woods, NH
8. \***Harman, C. J.**, 2014, *Distinguishing sources of variability in catchment transit time distributions: climate, water balance partitioning, and flow-path dynamics*, American Geophysical Union Fall Meeting, San Francisco, CA
  9. Zhang, Q, **Harman, C. J.**, Ball, W, 2014, *Evaluation of Methods for Estimating Long-Range Dependence in Water Quality Time Series with Missing Data and Irregular Sampling (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  10. Ball, A, **Harman, C. J.**, Ward, A, 2014, *Modeling hyporheic exchange and in-stream transport with time-varying transit time distributions (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  11. Wilusz. D, **Harman, C. J.**, Ball, W, 2014, *Modeling of Time-Varying Stream Water Age Distributions: Preliminary Investigations with Non-Conservative Solutes*, American Geophysical Union Fall Meeting, San Francisco, CA
  12. Pangle. L, Cardoso, C, Kim, M, Lora, M, Wang, Y, Troch, P, **Harman, C. J.**, 2014, *An experimental application of the Periodic Tracer Hierarchy (PERTH) method to quantify time-variable water and solute transport in a sloping soil lysimeter (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  13. Putnam, S, **Harman, C. J.**, 2014, *Combining New Theory and Multi-Scale Observations to Explore Hydrologic Transport Processes and Their Relationship to Catchment Structure in a Small Piedmont Watershed (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  14. Kim, M, Pangle, L, Cardoso, C, Lora, M, Wang, Y, **Harman, C. J.**, Troch, P, 2014, *Using New Theory and Experimental Methods to Understand the Relative Controls of Storage, Antecedent Conditions and Precipitation Intensity on Transit Time Distributions through a Sloping Soil Lysimeter (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  15. \***Harman, C. J.**, M. Kim, 2013, *The PERiodic Tracer Hierarchy (PERTH) - an experimental method for observing time-variable transit-time distributions through long-memory systems and transient flows*, American Geophysical Union Fall Meeting, San Francisco, CA
  16. \***Harman, C. J.**, M. Kim, 2013, *Dynamic Age Functions and the PERiodic Tracer Hierarchy (PERTH)*, Gordon conference on Catchment Science: Interactions of Hydrology, Biology & Geochemistry, Andover, New Hampshire
  17. \***Harman, C. J.**, M. Kim, 2013, *PERTH and the Dynamic Age Function: A theoretical and experimental framework for understanding residence and transit times in transient, complex flows*, AGU Chapman Conference on Soil-mediated Drivers of Coupled Biogeochemical and Hydrological Processes Across Scales, Tucson, Arizona
  18. \***Harman, C. J.**, P. A. Troch, 2012, *Darwinian Hydrology: can the methodology Charles Darwin pioneered help hydrologic science?*, Prediction in Ungauged Basins (PUB) Symposium, Delft, Netherlands
  19. \***Harman, C. J.**, P. A. Troch, J. Pelletier, C. Rasmussen, J. Chorover, 2012, *Critical zone evolution and the origins of organised complexity in watersheds*, European Geophysical Union General Assembly, Vienna, Austria
  20. \*Zapata-Rios, X., P. Troch, P. Broxton, J. McIntosh, **C. J. Harman**, A. Harpold, P. D. Brooks , 2012, *Water storage dynamics in high elevation semi-arid catchments (Poster)*, Geological Society of America, Rocky Mountain Section, Albuquerque, NM



21. \***Harman, C. J.**, P. A. Troch, K. A. Lohse, M. Sivapalan, 2011, *Co-evolution of Vegetation, Sediment Transport and Infiltration on semi-arid hillslopes (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
22. \*Troch, P. A., G. A. Carrillo, M. Sivapalan, **C. J. Harman**, T. Wagener, K. A. Sawicz, 2011, *Hydrological Analysis of Catchment Behavior through Process-based Modeling along a Climate Gradient*, American Geophysical Union Fall Meeting, San Francisco, CA
23. \***Harman, C. J.**, P. S. C. Rao, N. B. Basu, G. McGrath, P. Kumar, and M. Sivapalan, 2011, *Climate, soil and vegetation controls on the temporal variability of recharge and solute delivery to groundwater*, European Geophysical Union General Assembly, Vienna, Austria
24. \***Harman, C. J.**, K. A. Lohse, P. A. Troch, M. Sivapalan, 2011, *Vegetation controls on soil hydraulic properties and and co-evolution in semi-arid hillslopes: fieldwork and modelling (Poster)*, European Geophysical Union General Assembly, Vienna, Austria
25. \*Sivapalan, M., S. Patil, M. Hassan, S. Ye, **C. J. Harman**, 2011, *Process controls on scaling behavior of sediment delivery: Exploration with a physically based network scale coupled flow and sediment model*, European Geophysical Union General Assembly, Vienna, Austria
26. \*Thompson, S. E., **C. J. Harman**, R. Schumer, J. Wilson, and M. Sivapalan, 2011, *Hydrologic Science for a Changing World: A Learning Framework Based on Hydrologic Synthesis and Team Science*, European Geophysical Union General Assembly, Vienna, Austria
27. \*Rao, P. S. C., N. B. Basu, S. Zanarado, **C. J. Harman**, M. Sivapalan, A. Rinaldo, 2010, *Modelling hydrologic and geochemical filtering of reactive solute transport in catchments*, GQ10: Groundwater Quality Management in a Rapidly Changing World (Proc. 7th International Groundwater Quality Conference held in Zurich, Switzerland, 1318 June 2010). IAHS Publ 342, 2011, 451-454.
28. \***Harman, C. J.**, K. A. Lohse, P. A. Troch, M. Sivapalan, 2010, *Vegetation controls on soil hydraulic properties and implications for the hydrologic variability of soils: observations and modeling. (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
29. \*Lohse, K. A., J. E. McLain, **C. J. Harman**, M. Sivapalan, P. A. Troch, 2010, *Role of vegetation and edaphic factors in controlling diversity and use of different carbon sources in semi-arid ecosystems, (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
30. \*Ran, L., T. Garcia, S. Ye, **C. J. Harman**, M. A. Hassan, A. Simon, 2010, *Reach Scale Sediment Balance of Goodwin Creek Watershed, Mississippi (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
31. \*Patil, S., S. Ye, X. Xu, **C. J. Harman**, M. Sivapalan, M. A. Hassan, 2010, *A network model for simulating sediment dynamics within a small watershed (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
32. \*Sivapalan, M., **C. J. Harman**, 2010, *Classification of recharge regimes based on measures of hydrologic similarity*, European Geophysical Union General Assembly, Vienna, Austria
33. \*Sivapalan, M., M. A. Yaeger, **C. J. Harman**, X. Xu, and P. A. Troch, 2010, *A functional model of annual water balance variability and similarity for regionalization studies: Horton, Budyko and L'vovich revisited*, European Geophysical Union General Assembly, Vienna, Austria
34. \***Harman, C. J.**, N. B. Basu, P. S. C. Rao, M. Sivapalan, 2009, *HEIST: An eventscale*

- model of cascading water and solute fronts through the vadose zone*, American Geophysical Union Fall Meeting, San Francisco, CA
35. \*Zanardo, S., **C. J. Harman**, P. D. Brooks, M. Durcik, M. Sivapalan, P. A. Troch, 2009, *Landscape and climate controls on the Horton index revealed through a stochastic analytical model (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  36. \*Guan, K., **C. J. Harman**, N. B. Basu, P. S. C. Rao, M. Sivapalan, P. K. Kalita, A. I. Packman, 2009, *Biogeochemical Signatures of Contaminant Transport at the Watershed Scale: Spectral and Wavelet Analysis (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  37. \*Yaeger, M. A., **C. J. Harman**, P. A. Troch M. Sivapalan, 2009, *A functional model of watershed-scale annual water balance partitioning: Lvovich, Ponce and Shetty revisited (Poster)*, American Geophysical Union Fall Meeting, San Francisco, CA
  38. \*Thompson, S. E., **C. J. Harman**, K. Guan, A. Neal, P. Troch and M. Sivapalan, 2009, *Predicting seasonal evapotranspiration: comparative hydrology across FLUXNET sites*, American Geophysical Union Fall Meeting, San Francisco, CA, *Invited speaker*
  39. \***Harman, C. J.**, P. S. C. Rao, N. B. Basu, M. Sivapalan, 2009, *Cascading water and solute transport through the vadose zone: advection, dispersion, and transformations in highly non-steady flow*, Stochastic Transport and Emergent Scaling in Earth-surface Processes Workshop, Incline Village, NV
  40. \*Hopp, L., P. A. Troch, T. Huxman, **C. J. Harman**, S. Desilets, K. Dontsova, J. Chorover, S. Edin, J. Pelletier, C. Paniconi, V. Ivanov, D. Jenerette, M. Sivapalan, J. J. McDonnell, 2009, *Artificial Hillslopes at Biosphere 2: Exploring Soil-Water-Atmosphere-Plant Interactions in a Changing Environment*, European Geophysical Union General Assembly, Vienna, Austria
  41. \***Harman, C. J.**, Reeves D. M., Baeumer B., Sivapalan, M., 2009, *Time subordination: a way forward for the closure problem in hydrologic prediction?*, European Geophysical Union General Assembly, Vienna, Austria
  42. \***Harman, C. J.**, Sivapalan, M. A, Kumar, P., 2009, *Emergent effects of heterogeneity on discharge at hillslope and catchment scales, and implications for prediction*, European Geophysical Union General Assembly, Vienna, Austria
  43. \***Harman, C. J.**, Sivapalan, M. A, Kumar, P., 2009, *Dimensionless classification of modes of hydrologic behavior based on characteristic rates and timescales of processes and inputs*, European Geophysical Union General Assembly, Vienna, Austria
  44. \***Harman, C. J.**, Sivapalan, M. A, Kumar, P., 2009, *Potential feedbacks between hydrology, ecosystem dynamics and soil properties (Poster)*, MYRES Meeting of Young Researchers in Earth Sciences, New Orleans, LA
  45. \***Harman, C. J.**, & Sivapalan M., 2008 *Classification and the role of topography, recharge and boundary conditions on the effects of heterogeneity on subsurface flow in hillslopes*, European Geophysical Union General Assembly, Vienna, Austria
  46. **Harman, C. J.**, \*Reeves D. M., Baeumer B., Sivapalan, M., 2009, *Subordinated Kinematic Subsurface Flow in Hillslopes*, American Geophysical Union Fall Meeting, San Francisco, CA
  47. \*Sivapalan, M., and **Harman, C. J.**, 2007 *The closure problem in watershed hydrology*, Stochastic Transport and Emergent Scaling in Earth-surface Processes, Incline Village, NV
  48. \***Harman, C. J.**, & Sivapalan M., 2007 *The effects of spatial structure and connectivity*

on hydrologic response: non-linear response timescales as an emergent property in subsurface hillslope runoff, American Geophysical Union, Acapulco, Mexico

49. \*Sivapalan, M., Schaefli, B. & **Harman, C. J.**, 2007, *Behavioral modeling: a new theoretical framework for hydrological prediction*, European Geophysical Union General Assembly, Vienna, Austria
50. \***Harman, C. J.**, & Sivapalan, M., 2006 *What effect does subsurface variability have on flows? Using storm response regimes to characterize the effect of spatial heterogeneity within a hillslope (Poster)*, American Geophysical Union Fall Meeting, San Francisco
51. \*Sivapalan M. & **Harman, C. J.**, 2006 *Interactions of spatial heterogeneity in bedrock elevation, soil depth and permeability with climate variability: A regime approach to assessing process complexity at hillslope or catchment scale*, Preferential flow and transport processes in soil, Centro Stefano Franscini, Monte Verit Ascona, Switzerland
52. \***Harman, C. J.**, Stewardson, M. & De Rose, R. 2005, *Regional Models of Stream Channel Metrics (Poster)*, American Association of Geographers 2006 Annual Meeting, Chicago, Illinois, May 7-11 2006
53. \***Harman, C. J.** & Stewardson, M. J., 2004 *Casting spells: high flow spells analysis methodology and parameterising the frequency distribution*, 4th Australian Stream Management Conference, Launceston, Australia, Oct 19 22 2004
54. \***Harman, C. J.** & Stewardson, M. J., 2005 *Improving spells analysis: methodology and parameterising the frequency distribution*, Proceedings of the 29th Hydrology and Water Resources Symposium, Canberra, Australia

## RESEARCH FUNDING

**Grants and contracts awarded and pending** *Budget numbers on collaborative proposals are for JHU component only*

1. Current (PI): EAR-1344664 Collaborative Research: Hillslope hydrology under glass: Controlled experimental testing of hillslope-scale hydrologic transport theories at Biosphere2, NSF Hydrologic Sciences (Co-PI Peter Troch, U Arizona), \$230,056, (2014-03-01 – 2017-03-01)
2. Current (Co-PI): EAR-1417175 Collaborative Research: Coupled Hydrological And Geochemical Process Evolution At The Landscape Evolution Observatory, (PI Peter Troch, U Arizona; Co-PIs Jon Chorover, U Arizona; Katerina Dontsova, U Arizona; Guo-Yue Niu, U Arizona), \$188,855.00, (2014-09-01 – 2017-09-01)
3. Current (Co-PI): EAR-1360415 WSC Category 3 Collaborative: Impacts of Climate Change on the Phenology of Linked Agriculture-Water Systems, (PI William Ball, JHU; Co-PIs Damian C. Brady, U Maine; Lisa Wainger, UMCES; Ariel Ortiz Bobeia, Resources for the Future; Michael Kemp, UMCES; Jeremy Testa, UMCES), \$790,689.00, (2014-09-01 – 2018-09-01)
4. Recommended for funding (Co-PI): CNH-L: Adaptation, Mitigation, and Biophysical Feedbacks in the Changing Bonneville Salt Flats, (PI Brenda Bowen, Utah; Co-PIs Matthew Brownlee, Utah; Betsy Kleba, Westminster College), \$343,377.00, (2016-07-01 – 2020-07-01)

## TEACHING ACTIVITIES

### Courses

<i>Title</i>	<i>Enrollment</i>	<i>Year</i>
570.412 Landscape hydrology and watershed analysis	8	2016
570.353 Hydrology	18	2015

570.647 Hydrologic Transport in the Environment	11	2015
570.353 Hydrology	23	2014
570.412 Landscape hydrology and watershed analysis	12	2014
570.353 Hydrology	15	2013
570.521 Landscape hydrology and watershed analysis	10	2013

### Teaching assistant

U. Illinois, Water Resources Engineering (awarded Excellence in Teaching)	2008
U. Illinois, Engineering Risk and Uncertainty	2007

### Workshops and short courses

Watershed Science Master Class, Biosphere2, Tucson, Arizona	January 2016
CUAHSI Virtual Short Course: Theory and application of time-variable transit times, online ( <a href="http://www.cuahsi.org/harman.transittimes">http://www.cuahsi.org/harman.transittimes</a> ),	July 2015
River Analysis Package - Advanced Users Workshop, Brisbane, Australia	2004

### Development and Pedagogy

Technology Fellowship Grant, JHU Center for Educational Resources	2014 - 2015
<i>Awarded a CER Technology Fellowship to work with an undergraduate student on a project entitled "IPython Notebooks on Landscape Hydrology: Synthesizing Theory and Applications with Interactive Code".</i>	

## MENTORING AND ADVISING ACTIVITIES

### Graduate student supervision

<i>Present</i>	<i>Degree sought</i>	<i>Start year</i>	
Shane Putnam	PhD	2012	
Minseok Kim	PhD	2012	
Dano Wilusz (co-advise with B. Ball)	PhD	2012	
Cassandra Consans	PhD	2015	
Tianqi Liu	PhD	2015	
Amadan Darrow	MSE	2015	
<i>Past</i>			<i>Graduated</i>
Ashley Ball	MSE	2013	2015
Holly Guest	MSE	2014	2015
Yifan Zhou	MSE	2013	2015

### Undergraduate independent study / research

Peter Bai	Design and construction of a field-portable rainfall simulator	2012
Tiffany Wei	Stable water isotope variability in an urban stream	2013
Celine Cua	Time-variable transit time distribution theory and modeling	2013
Joshua Barza	Hydrologic transport using stable water isotopes in an urban stream	2015
Emily Stoll	Measuring hyporheic volume of urban streams using tracer injections and rSAS analysis	2015

### Graduate board exam committee membership

Dana Brenner	EPS	scheduled
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Nathan Towles	EPS	scheduled
Jihua Hao	EPS	scheduled
Anna Scott	EPS	scheduled
Jordan Thomas	EPS	scheduled
Eshwan Ramudu	EPS	scheduled
Huanting Hu	EPS	2015
Grace Kim	EPS	2015
Kirby Runyon	EPS	2015
Se Jong Cho	DoGEE	2014
Fisseha Berhane	EPS	2014
Qian Zhang	DoGEE	2013
Scott Pitz	EPS	2013
Shuning Li	EPS	2012

### **Department qualifying exam**

Dano Wilusz	DoGEE	2016
Chris Kelley	DoGEE	2015
Gina Tonn	DoGEE	2014
Andrea Staid	DoGEE	2014
Qian Zhang	DoGEE	2013
Se Jong Cho	DoGEE	2013
Julie Shortridge	DoGEE	2013

## **PROFESSIONAL AND PUBLIC SERVICE ACTIVITIES**

### **Service to the department**

Department fellowship committee	2013
Department fellowship committee	2014
Department fellowship committee	2015
Department fellowship committee	2016
Faculty search committee	2016

### **Service to the university**

E <sup>2</sup> SHI fellowship committee	2013
Committee on DoGEE-EHS Collaboration	2014-2015
WSE IT faculty advisory group	2015
WSE Design Center Vision Committee	2015

### **Service to the profession**

International Association of Hydrologic Sciences “The New Scientific Decade of IAHS” task force	2012-13
NSF Center for Hydrologic Synthesis “Predictions Under Change (PUC)” working group member	2009-11
Student Leader/Mentor, Hydrological Synthesis Summer Schools, Vancouver, BC	2009-10
Biosphere2 hillslope experiment working group member (now B2 Landscape Evolution Observatory)	2007-8

### **Journal reviewer and editor**

Hydrologic Sciences Journal	2012-
Editor for Hydrology and Earth Systems Science	2011-
Journal of Hydrology	2011-
Hydrological Processes	2011-
Water Resources Research	2009-
Groundwater	2009-
Hydrology and Earth Systems Science	2009-
Vadose Zone Journal	2007-

### **Outreach**

City Springs Science Outreach Program, Center for Educational Outreach, Johns Hopkins University (teaching science curricular to elementary students in inner-city Baltimore)	2012-
STEM Achievement in Baltimore Elementary Schools (SABES) (water-cycle curriculum review)	2013-
STEM Achievement in Baltimore Elementary Schools (SABES) (STEM Academy program)	2014-

### **Professional association membership**

European Geosciences Union  
American Geophysical Union  
Soil Science Society of America  
International Association of Hydrologic Sciences  
National Association of Geoscience Teachers