

George Hornberger



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Hydrology
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I previously was a professor at the University of Virginia for many years and also have been a visiting scholar at the Australian National University, Lancaster University, Stanford University, the United States Geological Survey (USGS), the University of Colorado, and the University of California at Berkeley. I was President of the Hydrology Section of AGU from 2006-2008. I have been a member of the Nuclear Waste Technical Review Board (a Presidential appointment) since April 2004. I have served on numerous National Research Council -- the operating arm of the National Academies -- boards and committees including as chair of the Commission on Geosciences, Environment, and Resources (1996-2000) and chair of the Board on Earth Sciences and Resources (2003-present).

General Interests

Understanding how hydrological processes affect the transport of dissolved and suspended constituents through catchments and aquifers is one of the main aims of the current interest studies of Earth surface processes. Water is "the universal solvent." Water chemically weathers rocks and soils, carrying dissolved salts from the continents to

the seas. It interacts with decaying vegetation and carries organic carbon seaward. Water readily carries chemicals that humans use to the sea, including fertilizers and other agrochemicals. The global water cycle is thus linked to other element cycles, for example, to carbon and nitrogen cycles, and is inextricably linked with a host of ecosystem functions. Moving water carries suspended solids as well as dissolved salts, so the water cycle is also closely tied to cycles of erosion and sedimentation.

Current Research

My work has centered on the coupling of field observations with mathematical modelling. The focus has been to understand how water is routed physically through soils and rocks to streams and how hydrological processes and geochemical processes combine to produce observed stream dynamics. Currently I am working on dissolved organic carbon dynamics with colleagues at Stroud Water Research Center, on nitrate dynamics in coastal-plain streams and catchments with colleagues at University of Virginia, and on several projects related to energy-environment interactions with colleagues here at Vanderbilt.

What Students Do

Students working with me for the past ten years or so have done work in either catchment hydrochemistry or in transport of colloids. For concrete examples, see the selected publications below with former students as co-authors. Temple Lee worked with me when he was an undergraduate student; he is currently a graduate student at the Uni-



versity of Virginia studying atmospheric sciences. Janna Levin is now an Assistant Professor at the North Carolina School of the Arts. Danny Welsch is an Assistant Professor at Frostburg State University. Carl Bolster is a research scientist with USDA. Chuanhui Gu is a post-doctoral fellow at the Berkeley Water Center. Justin Lawrence is a Ph.D. student at Berkeley.

Selected Publications

Book And Book Chapter

Hornberger, G.M. and P.L. Wiberg 2006. Numerical Methods in the Hydrological Sciences, American Geophysical Union, Special Publications Series, Volume 57, 233 pages, e-book, 2006, ISBN 0-87590-725-1, AGU SP057F251

Hornberger, G.M. and J. Stetkar 2008. Abrupt Climate Change. In: Garrick, B. J. Quantifying and Controlling Catastrophic Risks, Academic Press.



Journal Articles

Lee, T. R., and G. M. Hornberger 2006. Inferred bimodality in the distribution of soil moisture at Big Meadows, Shenandoah National Park, Virginia, *Geophys. Res. Lett.*, 33, L06407, doi:10.1029/2005GL025536.

Levin, JM, Herman, JS, Hornberger, GM, and JE Saiers, 2006. Colloid Mobilization from a Variably Saturated, Intact Soil Core, *Vadose Zone Journal* 5:564-569. DOI: 10.2136/vzj2005.0102

Welsch, D. L. Cosby, B. J. and G. M. Hornberger 2006. Simulation of Stream Water Alkalinity Concentrations using Coupled Models of Soil air CO₂ and Stream Water Chemistry. *Biogeochemistry* 79: 339 - 360, DOI 10.1007/s10533-005-5480-9.

Welsch, D.L., Cosby, B.J. and G. M. Hornberger 2006. Simulation of future stream alkalinity under changing deposition and climate scenarios. *Science of The Total Environment* 367:800-810, doi:10.1016/j.scitotenv.2006.01.019

Deviney, F. A., Jr., K. C. Rice, and G. M. Hornberger 2006.

Time series and recurrence interval models to predict the vulnerability of streams to episodic acidification in Shenandoah National Park, Virginia. *Water Resour. Res.* 42: W09405, doi:10.1029/2005WR004740.

Bolster, C.H. and G.M. Hornberger 2007. On the Use of Linearized Langmuir Equations. *Soil Sci. Soc. Am.*, 71:1796-1806, doi:10.2136/sssaj2006.0304.

Gu, C., Hornberger, G.M., Mills, A.L., Herman, J.S., and S. A. Flewelling. 2007. Nitrate Reduction in Streambed Sediments: Effects of Flow and Biogeochemical Kinetics, *Water Resour. Res.*, 43: W12413, doi:10.1029/2007WR006027.

Lawrence, J.E. and G.M. Hornberger. 2007. Soil-moisture variability across climate zones. *Geophys. Res. Lett.*, 34: L20402, doi:10.1029/2007GL031382.

Gu, C., Hornberger, G.M., Mills, A.L., and J.S. Herman 2008. The Effect of Freshets on the Flux of Groundwater Nitrate Through Streambed Sediments, *Water Resour. Res.*, 44: W05415, doi:10.1029/2007WR006488.

Maggi F., Gu, C., Riley, W.J., Hornberger, G.M., Venterea, R.T., Xu, T., Spycher, N., Steefel, C., Miller, N.L., Rubin, Y. and C.M. Oldenburg 2008. Mechanistic modeling of biogeochemical nitrogen cycling: model development and application in an agricultural system., *JGR-Biogeosciences*, 113: G02016, doi:10.1029/2007JG000578.

Ajami, N.K., Hornberger, G.M., and D. L. Sunding. Effect of Water Resource Management on Characteristics of Hydrological Uncertainties, *Water Resour. Res.*, In press.

Gu, C., Hornberger, G.M., Mills, A.L., and J.S. Herman. Influence of stream-aquifer interactions in the riparian zone on NO₃- flux to a low-relief coastal stream, *Water Resour. Res.*, In press.

