James R. Craig, Ph.D., P.Eng.

Associate Professor
Canada Research Chair in Hydrologic Modelling and Analysis

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EDUCATION

Ph.D. in Civil, Structural and Environmental Engineering, 2005
University at Buffalo, Buffalo, NY
-Dissertation: "*Reactive contaminant transport modeling using analytic element flow solutions"*
-Advanced graduate certificate in Geographic Information Science

B.S. in Civil Engineering, 1999
Bucknell University, Lewisburg, PA

RESEARCH INTERESTS

Numerical and analytical method development for modelling of environmental systems, with a focus on groundwater flow, surface water hydrology, permafrost hydrology, and subsurface heat transport:

- Numerical methods, model structural assessment, upscaling approaches, and parameterization/discretization issues in surface water hydrologic modeling
- Modelling regional- and local-scale groundwater flow with the analytic element method, series solution, and extended finite element approaches

Other interests include model and submodel evaluation, spatial analysis, and decision-making support with environmental models.

AWARDS / FELLOWSHIPS

UW Engineering Society Teaching Excellence Award (2018)
Student-nominated award for contributions to student academic success in UW engineering

Canada Research Chair (Tier II) in Hydrologic Modelling and Analysis (2016)
Awarded to emerging high-quality Canadian scholars by NSERC

University of Waterloo Outstanding Performance Award (2016)
For outstanding contributions in teaching and scholarship by a UW professor

Sandford Fleming Foundation Teaching Excellence Award (2014)
For UW Engineering faculty members with a continued record of excellence in undergraduate teaching

UW Faculty of Engineering Distinguished Performance Award (2012)
Awarded for outstanding contribution in teaching, scholarship and service.

Early Researcher Award (2011)
Awarded by the Ontario Ministry of Research and Innovation to promising researchers in the first five years of their academic career.

CSEE Departmental Chair's Recognition Award (2004)
For high scholastic achievement as a graduate student and dedication to the Civil, Structural, and Environmental Engineering department of the University at Buffalo

IGERT Fellowship in Geographic Information Science (1999-2004)
Interdisciplinary NSF-sponsored Integrative Graduate Education and Research Training fellowship in the field of geographic information science under the supervision of University at Buffalo's National Center for Geographic Information and Analysis

Don Rennie Memorial Award (2002)
For outstanding environmental modeling presentation at the 12th annual Great Lakes Research Consortium Student/Faculty Conference

PEER-REVIEWED PUBLICATIONS

A49. Devoie*, É., **J.R. Craig**, W. Quinton, and R. Connon, *Subsurface flow measurements using passive flux meters in variably-saturated cold-regions landscapes*, Hydrological Processes, 1-6, doi:10.1002/hyp.13900, 2020

A48. Chernos, M., R. MacDonald, M.W. Nemeth, and **J.R. Craig**, *Current and future projections of glacier contributions to streamflow in the Upper Athabasca River basin*, Canadian Water Resources Journal, 2020

A47. Spieler, D., B.A. Tolson, J. Mai, **J.R. Craig**, and N. Schuetze, *Automatic model structure identification for conceptual hydrologic models*, Water Resources Research, doi:10.1029/2019WR027009, 2020

A46. Brown, G.*, and **J.R. Craig**, *Multi-gauge calibration of a hydrological model of the Liard river basin*, Canadian Water Resources Journal, doi:10.1080/07011784.2020.1803143, 2020

A45. Devoie, É.*, and **J.R. Craig**, *A semi-analytical interface model of soil freeze/thaw and permafrost evolution*, Water Resources Research, 56, doi:10.1029/2020WR027638, 2020

A44. Han, M., J. Mai, B.A. Tolson, **J.R. Craig**, É. Gaborit, H. Liu, and K. Lee*, *Subwatershed-based lake and river routing products for hydrologic and land surface models applied over Canada*, Canadian Water Resources Journal, doi:10.1080/07011784.2020.1772116, 2020

A43. **Craig, J.R.**, G. Brown*, W. Jenkinson, G. Jost, J. Mai, M.Serrer, M. Shafii, N. Sgro*, A. Snowdon*, and B.A. Tolson, *Flexible watershed simulation with the Raven hydrological modelling framework,* Environmental Modelling and Software, 129, 104728, doi:10.1016/j.envsoft.2020.104728, July 2020

A42. MacVicar, B., A. Clow, C. Muirhead, R. Al-Hammoud, and **J.R. Craig**, *Design, construction, and destruction in the classroom: Experiential learning using an earth dam for second year geological and environmental engineering students*, Journal of Hydraulic Engineering 146(6), doi:10.1061/(ASCE)HY.1943-7900.0001745, 2020

A41. Devoie*, É., **J.R. Craig**, W. Quinton, and R. Connon, *Taliks: A tipping point in discontinuous permafrost degradation in peatlands*, Water Resources Research, 55(11), doi:10.1029/2018WR024488, 2019

A40. **Craig, J.R.**, M. Ramadhan*, and C. Muffels, *Reply to comment on "A particle tracking algorithm for arbitrary unstructured grids"*, Groundwater, 2019

A39. Amiri, E.A.*, **J.R. Craig**, and M. Hirmand, *A trust region approach for numerical modelling of non-isothemal phase-change*, Computers and Geosciences, doi:10.1007/s10596-019-09846-3, 2019

A38. **Craig, J.R.**, M. Ramadhan*, and C. Muffels, *A particle tracking algorithm for arbitrary unstructured grids*, Groundwater, 58, p19-26, doi:10.1111/gwat.12894, 2019

A37. Quinton, W., A. Berg, M. Braverman, O. Carpino, L. Chasmer, R. Connon, **J.R. Craig**, É. Devoie*, M. Hayashi, K. Haynes, D. Olefeldt, A. Pietroniro, F. Rezanezhad, R. Schincariol, and O. Sonnentag, *A synthesis of three decades of eco-hydrological research at Scotty Creek, NWT, Canada*, Hydrology and Earth System Science, 23, p2015-2039, doi:10.5194/hess-23-2015-2019, 2019

A36. Shafii M., N.B. Basu, **J.R. Craig**, M.L. Macrae, S.L. Schiff, P. Van Cappellen, *Can improved flow partitioning in hydrologic models increase biogeochemical predictability?*, Water Resources Research, 55, doi: 10.1029/2018WR024487, 2019

A35. Ranjram, M.,* and **J.R. Craig**, *Closed analytic elements with flexible geometry*, Groundwater, 56(5), p816-822, 2018

A34. Amiri, E.A.*, **J.R. Craig**, and B. Kurylyk, *A theoretical extension of the soil freezing curve paradigm*, Advances in Water Resources, 111, p319-328, 2018

A33. Chernos, M., R. MacDonald, **J.R. Craig**, *Efficient semi-distributed hydrological modelling workflow for simulating streamflow and characterizing hydrologic processes*, Confluence: Journal of Watershed Science and Management, 1(3), doi: 10.22230/jwsm.2017v1n1a3, 2017

A32. Shafii, M., N. Basu, **J.R. Craig,** P. van Cappellen, S. Schiff, *A diagnostic approach to constraining flow partitioning in hydrologic models using a multi-objective optimization framework*, Water Resources Research, 53, p3279–3301, doi:10.1002/2016WR019736, 2017

A31. Ameli, A.*, and **J.R. Craig**, *Semi-analytical 3D solution for assessing radial collector well pumping impacts on groundwater-surface water interaction*, Hydrology Research, 49(1), p17-26, 2017

A30. Liu, H., B.A. Tolson, **J.R. Craig**, M. Shafii, A priori *discretization quality metrics for semi-distributed hydrological models*, Journal of Hydrology, 543(part B), p873-891, 2016

A29. Snowdon, A.*, and **J.R. Craig**, *Effective groundwater-surface water exchange at the watershed scale*, Hydrological Processes, 30, p1849-1861, 2016

A28. Ameli, A.*, **J.R. Craig,** and J.J. McDonnell, *Are all runoff processes the same? Numerical experiments comparing a Darcy-Richards solver to an overland flow-based approach for subsurface storm runoff simulation*, Water Resources Research, 51(12), p10008-10028, doi: 10.1002/2015WR017199, 2015

A27. Connon, R., W. Quinton, **J.R. Craig**, J. Hanisch, and O. Sonnentag *The hydrology of interconnected bog complexes in discontinuous permafrost regions*, Hydrological Processes, 29(18), p3831–3847, 2015

A26. Haghnegahdar, A., B.A. Tolson, **J.R. Craig, and** K. Paya*, *Assessing the performance of a semi-distributed hydrological model under various watershed discretization schemes*, Hydrological Processes, 29(18), p4018-4031, 2015

A25. **Craig, J.R.**, *A general analytical solution for steady flow in heterogeneous porous media*, Water Resources Research, 51(6), doi:10.1002/2014WR016449, 2015

A24. Ladubec, C.*, R. Gracie, and **J.R. Craig**, *An XFEM formulation for carbon sequestration*, Int. Journal of Numerical Methods in Engineering, 102(3-4), p316-331, doi: 10.1002/nme.4737, 2014.

A23. Ameli, A.*, and **J.R. Craig**, *Semi-analytical series solutions for three-dimensional groundwater-surface water interaction*, Water Resources Research, 50(5), p3893-3906, 2014

A22. Connon, R., W. Quinton, **J.R. Craig**, and M. Hayashi, *Changing hydrologic connectivity due to permafrost thaw in the lower Liard River valley, NWT, Canada*, Hydrological Processes, 28, p4163–4178 , doi:10.1002/hyp.10206, 2014

A21. Simms, R.*, S. Haslam*, and **J.R. Craig**, *Impact of soil heterogeneity on the functioning of horizontal ground heat exchangers*, Geothermics, 50, p35-43, doi:10.1016/j.geothermics.2013.08.007, 2014

A20. Ameli, A.*, **J.R. Craig**, and S. Wong*, *Series solutions for saturated-unsaturated flow in multi-layer unconfined aquifers*, Advances in Water Resources, 60, p24-33, doi: 10.1016/j.advwatres.2013.07.004, 2013

A19. Rezanezhad, F., J. Price, and **J.R. Craig**, *Movement and adsorption of oil sands process-affected water through dual porosity peat soils: A laboratory experiment*, Canadian Journal of Soil Science, 92(5): 723-732, 10.4141/cjss2011-050, 2012

A18. Nettasana, T.*, **J.R. Craig**, and B.A. Tolson, *Conceptual and numerical model for sustainable groundwater management in the Thaphra area, Chi River Basin, Thailand*, Hydrogeology Journal, 20(7), p1355-1374, 2012

A17. **Craig, J.R.** and R. Gracie, *Using the extended finite element method for simulation of transient well leakage in multilayer aquifers*, Advances in Water Resources, 34(9), p1207-1214, doi:10.1016/j.advwatres.2011.04.00, 2011

A16. Liu, G.*, **J.R. Craig**, and E.D. Soulis, *Applicability of the Green-Ampt infiltration model under non-ideal conditions,* Journal of Hydrologic Engineering, 16(3), p266-273, 2011

A15. Soulis, E.D., **J.R. Craig**, V. Fortin, and G. Liu*, *A simple expression for the bulk field capacity of a sloping soil horizon*, Hydrological Processes, 25(1), p112-116, 2011

A14. Gracie, R. and **J.R. Craig**, *Modeling well leakage in multilayer aquifer systems using the extended finite element method*, Finite Elements in Analysis and Design, 46(6), p504-513, doi:10.1016/j.finel.2010.01.006, 2010

A13. **Craig, J.R.**, G. Liu*, and E.D. Soulis, *Runoff-infiltration partitioning using an upscaled Green-Ampt solution,* Hydrologic Processes, 24(16), p2328–2334, doi:10.1002 / hyp.7601, 2010

A12. Wong, S*. and **J.R. Craig**, *Series solutions for flow in stratified aquifers with natural geometry,* Advances in Water Resources, 33(1), p48-54, January 2010

A11. **Craig, J.R.**, *Analytic elements for flow in harmonically heterogeneous aquifers,* Water Resources Research, 45, W06422, doi:10.1029/2009WR007800, 2009

A10. **Craig, J.R.,** and T. Heidlauf*, *Coordinate mapping of analytical contaminant transport solutions to non-uniform flow fields*, Advances in Water Resources, 32(3), p353-360, March 2009

A9. **Craig, J.R.**, *Analytical solutions for 2D topography-driven flow in stratified sloping and syncline aquifers,* Advances in Water Resources, 31(8), p1066-1073, August 2008

A8. Rabideau, A.J., **J.R. Craig**, W. Silaviserith, D.M. Flewelling, K. Frederick, M.W. Becker, L.S. Matott, I. Janković, and K. Bandilla, *Analytic element modeling of supraregional groundwater flow I. Concepts and Tools for automated model configuration*, Journal of Hydrologic Engineering 12(1), p83-96, Jan-Feb 2007

A7. **Craig, J.R.** and A.J. Rabideau, *Finite element modeling of contaminant transport using analytic element flow solutions*. Water Resources Research 42, W10420, doi:10.1029/2005WR004695, 2006

A6. **Craig, J.R.** and A.J. Rabideau, *Finite difference modeling of contaminant transport using analytic element flow solutions*, Advances in Water Resources 29(7), p1075-1087, July 2006

A5. Matott, L.S., A.J. Rabideau**,** and **J.R. Craig**, *Pump-and-treat optimization using analytic element flow models*, Advances in Water Resources 29(5), p760-775, May 2006

A4. **Craig, J.R.**, I. Janković, and R. Barnes, *The nested superblock approach for regional scale modeling using the analytic element method,* Ground Water, 44(1), p76-80, Jan-Feb 2006

A3. **Craig, J.R.**, A.J. Rabideau, and R. Suribhatla, *Analytical expressions for the hydraulic design of continuous permeable reactive barriers*, Advances in Water Resources 29(1), p99-111, Jan 2006

A2. Rabideau, A.J., R. Suribhatla, and **J.R. Craig**, *Analytical models for the design of iron-based permeable reactive barriers*, Journal of Environmental Engineering 131(11), p1589-1597, Nov 2005

A1. Rabideau, A.J., L.S. Matott, I. Janković, and **J.R. Craig**, M. Becker, *Influence of numerical precision on the calibration of AEM-based groundwater flow models*, Environmental Geology 48(1), p57-67, Jun. 2005

PAPERS IN REVIEW

B1. Mai, J., **J.R. Craig**, and B.A. Tolson, *Extended Sobol' Sensitivity Analysis (xSSA): Simultaneously determining global sensitivities of model parameters and model structure*, submitted to Hydrology and Earth System Science (HESS)

B2. Carpino, O., K. Haynes, R. Connon, **J.R. Craig**, É. Devoie*, and W. Quinton, *The trajectory of landcover change in peatland complexes with discontinuous permafrost, northwestern Canada*, submitted to Hydrology and Earth System Science (HESS)

B3. Jansen, K., L.A. Melsen, R. Teuling, P. Coulibaly, **J.R. Craig**, M. Dal Molin, W. Knoben, J. Seibert, A. Viglione, *Model mimicry: What's in the name?* submitted to Environmental Modelling and Software

PAPERS IN PREPARATION

B4. Ranrjam, M.*, and **J.R. Craig**, *The hillslope-storage Boussinesq proxy: an upscaling application* to be submitted to Water Resources Research

B5. Taheri, M.*, M. Ranjram*, and **J.R. Craig**, *Probabilistic-analytic runoff event model for cascading fill-and-spill wetland systems*, to be submitted to Water Resources Research

B6. Chlumsky, R.*, J. Mai, **J.R. Craig**, and B.A. Tolson, *Simultaneous calibration of hydrologic model structure and parameters: a case study using MOPEX catchments*, to be submitted to HESS

B7. Han, M., H. Shen, S. Lin*, N. Basu, **J.R. Craig**, and B.A. Tolson, *A GIS toolbox for automated watershed delineation with lakes*, to be submitted to Environmental Modelling and Software

B8. Mai, J., **J.R. Craig**, B. Tolson, and R. Arsenault, *Hydrologic process sensitivity across North America*, to be submitted to Nature Geoscience

B9 **Craig**, **J.R.**, B.A. Tolson, and R. Chlumsky*, *Decision Crash Testing: a methodology for evaluating model decision support skill I. Basis*, to be submitted to Environmental Modelling and Software

B10. Tolson, B.A. **J.R. Craig**, K. Lee*, and R. Chlumsky*, *Decision Crash Testing: a methodology for evaluating model decision support skill II. Application*, to be submitted to Environmental Modelling and Software

B11. Liu, H., G. Brown*, **J.R. Craig**, B.A. Tolson, A. Wood, A. Newman, *Discretization metrics and strategies for snow-dominated basins*, to be submitted to HESS

B12. Sondheim, M., and **J.R. Craig**, *A robust scalable spatial data model for hydrologic feature representation*, to be submitted to Journal of Hydrology X

B13. **Craig, J.R.**, É. Devoie*, J. Leach, R. MacDonald, (and others), *A model structure-independent general thermal simulation wrapper for a hydrologic modelling framework*, to be submitted to Geoscientific Model Development

B14. Chlumsky, R.*, G. Brown*, S. Grass*, S. Lin*, L. Scantlebury*, S. Lin*, and **J.R. Craig**, *RavenR: an R library for pre- and post-processing for hydrological modelling*, to be submitted to Geoscientific Modelling and Development

B15. Scantlebury, L.*, and **J.R. Craig**, *A polylinear feature package for MODFLOW-USG*, to be submitted to Groundwater

CONFERENCE PAPERS

C16. Devoie, É.*, **J.R. Craig**, *Interface model of soil freezing and thawing for use in discontinuous permafrost hydrological modelling,* 18th Intl. Conf. on Cold Regions Engineering (ICCRE) 2019, Quebec City, QC, Aug 18-22, 2019

C15. Amiri, E.A.*, **J.R. Craig**, *Effect of soil thermal heterogeneity on permafrost evolution,* 18th Intl. Conf. on Cold Regions Engineering (ICCRE) 2019, Quebec City, QC, Aug 18-22, 2019

C14. Ramadhan, M.*, **J.R. Craig**, and C. Muffels, *A semi-analytical particle tracking algorithm for arbitrary unstructured grids,* Modflow and More 2015: Modeling a complex world, Golden, CO, May 31-Jun 3, 2015

C13. Ameli, A.*, and **J.R. Craig**, *Three-dimensional series solutions for subsurface flow in a regional multi-layer unconfined aquifer with naturally complex geometry*, Modflow and More 2013: Translating science into practice, Golden, CO, June 2-5, 2013

C12. **Craig, J.R.** and M. Tonkin, *Handling impermeable and specified-head boundaries in kriged water table maps using supplemental analytic element solutions*, Modflow and More 2013: Translating science into practice, Golden, CO, June 2-5, 2013

C11. **Craig, J.R.**, and S. Wong*, *Recent advances in series solution methods for groundwater flow simulation*, Modflow and More 2011: Integrated Hydrologic Modeling, Golden, CO, June 5-8, 2011

C10. Luba, L.D., **J.R. Craig**, C.A. Russell, and T.D. Graham, *Application of the analytic element method for conjunctive water management and impact assessment*, 34th IAHR Biennial Congress, Brisbane, Australia, June 26-July 1, 2011

C9. **Craig, J.R.**, and W.W. Read, *The future of analytic solution methods for groundwater flow and transport simulation*, Computational Methods in Water Resources (CMWR) 2010 International Conference, Barcelona, Spain, June 21-24, 2010

C8. Wong, S.*, **Craig, J.R.**, and W.W. Read, *An iterative series solution approach for solving the free-boundary condition in groundwater flow systems*, Computational Methods in Water Resources (CMWR) 2010 International Conference, Barcelona, Spain, June 21-24, 2010

C7. **Craig, J.R.**, *Combining the strengths of analytic element and finite element methods for mixed-scale simulation modeling*, Modflow and More 2006: Managing Ground-water Systems, Golden, CO, May 22-24, 2006

C6. **Craig, J.R.**, A.J. Rabideau, and K. Bandilla, *An overview of using analytic element flow solutions for contaminant transport simulation*, 5th International Conference on the Analytic Element Method (ICAEM), Manhattan, KS, May 14-18, 2006

C5. **Craig, J.R.**, *The area vortex for modeling flow through smoothly heterogeneous aquifers*, 5th International Conference on the Analytic Element Method (ICAEM), Manhattan, KS, May 14-18, 2006

C4. Sinha, G., W. Silaviserith, **J.R. Craig**, and D.M. Flewelling, *Quantifying the efficacy of multicriteria generalization (MCG) of geospatial data for AEM groundwater modeling*. TIES 2004: The Fifteenth Annual Conference of the International Environmetrics Society / ACCURACY 2004: The Sixth International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Sciences, Portland, ME, Jun. 28 - Jul. 1, 2004

C3. **Craig, J.R.**, and A.J. Rabideau, *Discretization of analytic element flow solutions for transport simulation.* Computational Methods in Water Resources (CMWR) 2004 International Conference, Chapel Hill, NC, Jun. 13-17, 2004

C2. **Craig, J.R.**, K. Bandilla, and I. Janković, *Iterative solutions for the analytic element method: Recent computational advances and object-oriented design*. 4th International Conference on the Analytic Element Method (ICAEM), St. Etienne, France, November 20-21, 2003

C1. **Craig, J.R.**, and A.J. Rabideau, *Linking the analytic element method to reactive contaminant transport models.* Modflow and More 2003, Golden, CO, September 16-19, 2003

OTHER PAPERS AND REPORTS

O1. Quinton, W.L., Berg, A.A., Carpino, O., Connon, R.F., **Craig, J.R.,** Devoie, E. and Johnson, E. (2018): *Toward understanding the trajectory of hydrological change in the southern Taiga Plains, northeastern British Columbia and southwestern Northwest Territories*; in Geoscience BC Summary of Activities 2017: Energy, Geoscience BC, Report 2018-4, p. 77–86

O2. Quinton, W.L., Adams, J.R., Baltzer, J.L., Berg, A.A., **Craig, J.R.** and Johnson, E., *Consortium for Permafrost Ecosystems in Transition: traversing the southern margin of discontinuous permafrost with hydrological, ecological and remote sensing research, northeastern British Columbia and southwestern Northwest Territories*; in Geoscience BC Summary of Activities 2016, Geoscience BC, Report 2017-1, p. 79-86, 2017

O3. Quinton, W.L., Adams, J.R., Baltzer, J.L., Berg, A.A., **Craig, J.R.** and Johnson, E., *Permafrost ecosystems in transition: understanding and predicting hydrological and ecological change in the southern Taiga Plains, northeastern*

British Columbia and southwestern Northwest Territories; in Geoscience BC Summary of Activities 2015, Geoscience BC, Report 2016-1, p. 89–94, 2016

INVITED CONFERENCE PRESENTATIONS

D1. **Craig, J.R.,** J. Mai, G. Brown, B. Tolson, M. Han, K. Lee, R. Arsenault, *Recent evolution and application of the Raven hydrological modelling framework in Canada*, Invited, Floodnet Annual General Meeting, MacMaster University, Hamilton, ON, Jun 20, 2019

D2. **Craig, J.R.**, A. Snowdon, and B.A. Tolson, *A framework for evaluating the net impact of algorithm decisions on hydrological model output: Numerical and conceptual abstractions*, Computational Methods in Water Resources (CMWR) 2012 International Conference, Urbana-Champaign, June 21-24, 2012

D3. **Craig, J.R.**, *Extending the applicability of analytical contaminant transport models*, EGU General Assembly 2007, Vienna, Austria, Apr. 15-20, 2007

CONFERENCE PRESENTATIONS –ABSTRACTS ONLY–

D4. Devoie, É., O. Carpino, R. F. Connon, **J. R. Craig**, and W. L. Quinton, *Permafrost thaw mechanisms and talik function in discontinuous permafrost peatlands* (invited), AGU Fall Meeting 2020, San Francisco, CA, Dec. 13-17, 2004

D5. Carpino, O., K. Haynes, R. Connon, **J.R. Craig**, É. Devoie, and W. Quinton, *The trajectory of landcover change in the discontinuous permafrost zone, northwestern Canada*, 41st Canadian Symposium on Remote Sensing, Yellowknife, NT, July 13-17, 2020

D6. **J.R. Craig**, M. Taheri, and M. Ranjram, *Analytical upscaling of fill-and-spill hydrology*, EGU General Assembly 2020, Vienna, Austria, May 3-8, 2020

D7. J.Mai, and 47 others, *The runoff model-intercomparison project over Lake Erie and the Great Lakes*, EGU General Assembly 2020, Vienna, Austria, May 3-8, 2020

D8. J.Mai, **J.R. Craig,** B. Tolson, and R. Arsenault, *The sensitivity of hydrologic processes across North America considering model structure and parametric uncertainty*, EGU General Assembly 2020, Vienna, Austria, May 3-8, 2020

D9. Spieler, D., J. Mai, B.A. Tolson**, J.R. Craig**, and N. Schütze, *Towards conditional parameter estimation for automatic model structure identification: Using mixed-integer calibration for model development*, EGU General Assembly 2020, Vienna, Austria, May 3-8, 2020

D10. Devoie, É., **J.R. Craig**, W. Quinton, Predicting the future of permafrost: An efficient interface model of soil freeze-thaw, ArcticNet Annual Scientific Meeting, Halifax, NS, Dec. 2-5, 2019

D11. Mai, J., (and 40 co-authors), *The runoff model-intercomparison project over Lake Erie and the Great Lakes*, AGU Fall Meeting 2019, San Francisco, CA, Dec 9-13, 2019

D12. Liu, H., G. Brown, J.R., Craig, B.A. Tolson, A. Neuman, and A. Wood, *Discretization strategies for semi-distributed models of montane watersheds*, AGU Fall Meeting 2019, San Francisco, CA, Dec 9-13, 2019

D13. Quinton, W., D. Tsetso, R. Connon, **J. Craig**, L. Chasmer, C. Hopkinson, J. Korosi, M. Sioui, J. Thienpont. *The Dehcho Collaborative on Permafrost*, 22nd Northern Research Basins Symposia/Workshop, Aug 18-23, 2019

D14. Brown, G.., and **J.R. Craig** *A regional hydrologic model of the Liard river basin*, 22nd Northern Research Basins Symposia/Workshop, Aug 18-23, 2019

D15. Carpino, O., K. Haynes, R. Connon, J.Craig, É. Devoie, W. Quinton, *The future trajectory of permafrost environments in northwestern Canada's discontinuous permafrost zone*, 27th IUGG General Assembly, Montréal, QC, July 8-18, 2019

D16. Amiri, E., **J.R. Craig**, and É. Devoie, *Soil heterogeneity and talik formation in discontinuous permafrost: A numerical study*, 27th IUGG General Assembly, Montréal, QC, July 8-18, 2019

D17. Ranjram, M., and **J.R. Craig**, *Upscaling hillslope subsurface flow to watershed scales*, 27th IUGG General Assembly, Montréal, QC, July 8-18, 2019

D18. Devoie, É., **J.R. Craig**, *Predicting changes in discontinuous permafrost using an interface model of soil freezing and thawing*, 27th IUGG General Assembly, Montréal, QC, July 8-18, 2019

D19. Brown, G., **J.R., Craig**, B.A. Tolson, and H. Liu, *Discretization strategies for semi-distributed models of montane watersheds*, 27th IUGG General Assembly, Montréal, QC, July 8-18, 2019

D20. **J.R. Craig**, J. Mai, B. Tolson, M. Han, K. Lee, G. Brown, and R. Arsenault, *Recent evolution of the Raven hydrological modelling framework*, Canadian Water Resources Association (CWRA) Annual Meeting, Collingwood, ON, May 26-31, 2019

D21. G. Brown*, and **J.R. Craig,** *Calibration of a large scale hydrological model in a data sparse region*, Canadian Water Resources Association (CWRA) Annual Meeting, Collingwood, ON, May 26-31, 2019

D22. **J.R. Craig**, J. Mai, B. Tolson, M. Han, K. Lee, G. Brown, and R. Arsenault, *Recent evolution of the Raven hydrological modelling framework*, GWF Annual Open Science Meeting, Saskatoon, SK, May 15-17, 2019

D23. M. Han, J. Mai, B.A. Tolson, N. Basu, and **J.R. Craig**, *A flexible vegetation growth library for hydrology models and application in the Nith River*, GWF Annual Open Science Meeting, Saskatoon, SK, May 15-17, 2019

D24. Spieler, D., J. Mai, **J.R. Craig**, B.A. Tolson, and N. Schütze, *Automatic model structure identification: Using mixed-integer calibration for model development*, European Geophysical Union 2019 conference, Vienna, Austria, Apr. 7-12, 2019

D25. Spieler, D., J. Mai, **J.R. Craig**, B.A. Tolson, and N. Schütze, *Automatische model struktur identifikation für konzeptionelle hydrologische modelle*, Tag der Hydrologie 2019 conference, Karlsruhe, Germany, Mar. 28-29, 2019

D26. Spieler, D., J. Mai, **J.R. Craig**, B.A. Tolson, and N. Schütze, *Towards automatic model structure identification for conceptual hydrologic models*, American Geophysical Union (AGU) Fall Meeting, Washington D.C., Dec. 10-14 2018

D27. Quinton, W., M. Braverman, O. Carpino, L. Chasmer, R. Connon, **J.R. Craig**, É. Devoie, B. Disher, K. Haynes, C. Hopkinson, J. Smart, *Permafrost thaw–induced hydrological change in Northwestern Canada*, 5th European Conference on Permafrost (EUCOP5), Chamonix Mont-Blanc, France, Jun 23-Jul 1, 2018

D28. Devoie, É., **J.R. Craig**, W.L. Quinton, R.F. Connon, E.A. Amiri, *Taliks, a tipping point in permafrost degradation,* 5th European Conference on Permafrost (EUCOP5), Chamonix Mont-Blanc, France, Jun 23-Jul 1, 2018

D29. Amiri, E.A., **J.R. Craig**, Devoie, É., and W.L. Quinton, *Numerical simulation of lateral permafrost thaw in the Northwest Territories*, 5th European Conference on Permafrost (EUCOP5), Chamonix Mont-Blanc, France, Jun 23-Jul 1, 2018

D30. Muirhead, C., R. Al-Hammoud, **J.R. Craig**, and B. MacVicar, *Linking academic courses with practical hands-on experience for civil, environmental and geological engineering students*, 2018 Canadian Engineering Education Association Conference (CEEA-ACEG18), June 17-20, Winnipeg, MB, 2018

D31. Han, M., J. Mai, **J.R. Craig**, B.A. Tolson, E. Gaborit, K. Lee, and H. Liu, *Developing a pan-Canadian hydrologic routing network of lakes and rivers*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D32. Lee., K., R. Chlumsky, **J.R. Craig**, B.A. Tolson, *Addressing hydrologic modelling needs in the Canadian Shield*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D33. Ranjram, M., and **J.R. Craig**, *Upscaling spatially-variable groundwater discharge into streams using flowlength probability distributions*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D34. Amiri, E., and **J.R. Craig**, and É. Devoie, *Controlling factors on lateral permafrost thaw in the Northwest Territories: a numerical study*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D35. Brown, G., and **J.R. Craig**, *Extending a general hydrologic modelling framework to TIN-discretized landscapes*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D36. Devoie, É., R.F. Connon, **J.R. Craig**, and W.L. Quinton, *Modelling controls on local talik formation in discontinuous permafrost*, Canadian Geophysical Union Joint Meeting, Niagara Falls, Jun 10-14, 2018

D37. Devoie, É., **J.R. Craig**, W.L. Quinton, and R.F. Connon, *Quantifying thaw mechanisms in discontinuous permafrost: Is talik formation a tipping point?* 45th Annual Yellowknife Geoscience Forum, Yellowknife, NT, Nov 14-16, 2017

D38. **Craig, J.R.**, B.A. Tolson, R. Chlumsky, *Decision Crash Testing: Assessing and improving model skill for informing management decisions*, Canadian Water Resources Association (CWRA) National Conference, Lethbridge, AB, June 5-7, 2017

D39. Chlumsky, R., **J.R. Craig**, B.A. Tolson, and H. Liu, A novel approach for inflow matching and prediction in support of reservoir management, Canadian Water Resources Association (CWRA) National Conference, Lethbridge, AB, June 5-7, 2017

D40. **Craig, J.R.**, N. Sgro, B.A. Tolson, *How to appraise "new and improved" hydrological model algorithms? – An uncertainty-based evaluation approach*, Canadian Geophysical Union (CGU) Annual Meeting, Vancouver, BC May 29-31, 2017

D41. Chernos, M., R.J. MacDonald, and **J.R. Craig**, *Current and future projections of glacier contribution to streamflow in the upper Athabasca River Basin*, Canadian Geophysical Union (CGU) Annual Meeting, Vancouver, BC May 29-31, 2017

D42. M. Shafii, N. Basu, **J.R. Craig**, S.L. Schiff, and P. van Cappellen, *Catchment-scale simulation of nitrate loss using a modular hydrological modelling framework*, American Geophysical Union, Fall Meeting, San Francisco, California, USA, Dec. 12-16, 2016

D43. Connon, R., É. Devoie, **J.R. Craig**, M. Hayashi, O. Sonnentag, T. Veness, W. Quinton, *Changing runoff patterns due to permafrost thaw in discontinuous permafrost terrains*, XI International Conference on Permafrost, Potsdam, Germany, June 20-24, 2016

D44. Chowdhury, M., and **J.R. Craig**, *Mapping groundwater-surface water connections volumetrically using FlowSource*, Computational Methods in Water Resources (CMWR) 2016 International Conference, Toronto, ON, Jun. 20-24, 2016

D45. **Craig, J.R.**, M. Shafii, N. Basu, *Adding contaminant transport capabilities to a modular hydrological modelling framework*, Computational Methods in Water Resources (CMWR) 2016 International Conference, Toronto, ON, Jun. 20-24, 2016

D46. Shafii, M., N. Basu, **J.R. Craig**, P. Van Cappellen, *Hydrologic model development based on diagnostic data analysis utilized to identify flow pathways*, Computational Methods in Water Resources (CMWR) 2016 International Conference, Toronto, ON, Jun. 20-24, 2016

D47. Craig, J.R., N. Sgro, and B.A. Tolson, *Evaluating prospective hydrological model improvements with consideration of data and model uncertainty*, European Geophysical Union General Assembly 2016, Vienna, Austria, April 17-22, 2016

D48. Tolson, B.A., and J.R. Craig, *A new fit-for-purpose model testing framework: Decision Crash Tests*, European Geophysical Union General Assembly 2016, Vienna, Austria, April 17-22, 2016

D49. Shafii, M., N. Basu, and **J.R. Craig** *Towards diagnostic approaches to hydrologic model development: a framework based on functional hydrologic partitioning*, European Geophysical Union General Assembly 2016, Vienna, Austria, April 17-22, 2016

D50. Tolson, B.A., L. S. Matott, T.A. Gaffoor, M. Asadzadeh, M. Shafii1, P. Pomorski, X. Xu, M. Jahanpour, S. Razavi, A. Haghnegahdar, and **J. R. Craig,** *Parallel and preemptable Dynamically Dimensioned Search algorithms for single and multi-objective optimization in water resources*, American Geophysical Union, Fall Meeting, San Francisco, California, USA, Dec. 9-13, 2015

D51. **Craig, J.R.**, *Series solution methods for irregular domains: A primer*, 7th International Conference on the Analytic Element Method, May 30-31, 2015

D52. Ameli, A. and **J. R. Craig**, *Transient groundwater flow simulation using Laplace transform series solution methods*, 7th International Conference on the Analytic Element Method, May 30-31, 2015

D53. Shafii, M., N. Basu, **J.R. Craig**, S. Schiff, P. Van Cappellen, and H. Durr, *Assessment of hydrological behaviour of a snowmelt-dominated catchment at different scales*, AGU-GAC-CGU-MAC Joint Meeting, Montreal, QC, May 3-7 2015

D54. W. Quinton, J. Baltzer, A. Berg, M. Braverman, L. Chasmer, R. Connon, **J.R. Craig**, A. McManus, O. Sonnentag, *Multi-scale hydrological studies in thawing permafrost terrain: some insights for modelling*, AGU-GAC-CGU-MAC Joint Meeting, Montreal, QC, May 3-7 2015

D55. Connon R.F., W.L. Quinton, **J.R. Craig**, and J. Hanisch, *Hydrologic response of a bog cascade with a dynamic contributing area in discontinuous permafrost*, AGU-GAC-CGU-MAC Joint Meeting, Montreal, QC, May 3-7 2015

D56. Soulis, E.D., **J.R. Craig**, B.A. Tolson, A. Haghnegahdar, *The TILE approach—Closing the hydrologic cycle*, AGU-GAC-CGU-MAC Joint Meeting, Montreal, QC, May 3-7 2015

D57. Shafii, M., N. Basu, and **J.R. Craig**, *Interactive model evaluation and selection via an optimization-based top-down approach using hydrological signatures,* EGU General Assembly, Vienna, Austria, Apr 12-17, 2015

D58. MacDonald, R.J., A. Anderson, U. Silins, and **J.R. Craig**, *Applying physically representative watershed modelling to assess peak and low flow response to timber harvest: application for watershed assessments,* American Geophysical Union, Fall Meeting, San Francisco, California, USA, Dec. 15-19, 2014

D59. Ameli, A., and **J.R. Craig**, *Three-dimensional analytical solution for pumping impacts in naturally complex stratified unconfined aquifers*, CWRA 2014 Canada Water Resources Congress, Hamilton, ON, Jun 2-4, 2014

D60. Connon, R., W. Quinton, O. Sonnentag, **J.R. Craig**, and M. Hayashi, *Changing hydrologic connectivity due to permafrost thaw in the lower Liard River valley, Northwest Territories, Canada*, Canadian Geophysical Union Annual Meeting, Banff, Alberta, May 4-7, 2014

D61. Haghnegahdar, A., B.A. Tolson, and **J.R. Craig**, *A novel framework to assess the effect of watershed discretization on land-surface hydrological models*, CWRA 2014: Canada Water Resources Congress, 2-4 June 2014, Hamilton, Canada.

D62. Haghnegahdar, A., B.A. Tolson, and **J.R. Craig**, *A novel framework to assess the effect of watershed discretization on land-surface hydrological models*, American Geophysical Union, Fall Meeting, San Francisco, California, USA, 9-13 Dec., 2013

D63. Ameli, A., and **J.R. Craig**, *Series solutions for modeling three-dimensional lake-aquifer interactions*, American Geophysical Union, Fall Meeting, San Francisco, California, USA, Dec. 9-13, 2013

D64. Ameli, A., and **J.R. Craig**, *Modeling saturated-unsaturated subsurface flow with the semi-analytical series solutions method*, 6th International Conference on the Analytic Element Method, May 31-Jun 2, 2013

D65. **Craig, J.R.**, *Simulating groundwater flow in aquifers with continuously varying properties*, 6th International Conference on the Analytic Element Method, May 31-Jun 2, 2013

D66. Ameli, A., and **J.R. Craig**, *Capillary fringe flow and thickness in naturally complex regional valley aquifers*, CGU-CWRA-CMOS 2013 Joint Scientific Conference, Saskatoon, SK, May 26-30, 2013

D67. Haghnegahdar, A., B.A. Tolson, **J.R. Craig**, and K. Paya, *Assessing the performance of a distributed land-surface hydrologic model (MESH) under various watershed discretization schemes*, CGU-CWRA-CMOS 2013 Joint Scientific Conference, Saskatoon, SK, May 26-30, 2013

D68. Connon, R., J. Baltzer, **J.R. Craig**, M. Hayashi, W. Quinton, *Rising stream flows in the lower Liard River valley, NWT, Canada: examining potential causes*, CGU-CWRA-CMOS 2013 Joint Scientific Conference, Saskatoon, SK, May 26-30, 2013

D69. **Craig, J.R.**, W. Jenkinson, M. Serrer, G. Jost, *The UBC Watershed Model revitalized: The use of a flexible hydrological modelling framework to emulate and enhance model capability*, CGU-CWRA-CMOS 2013 Joint Scientific Conference, Saskatoon, SK, May 26-30, 2013

D70. Haslam, S., R. Simms, D. Broderecht and **J.R. Craig**, *Improved tools and methods for ground source heat pump design and optimization*, 39th IAH Congress, Niagara Falls, ON, September 16-21, 2012

D71. Simms, R., S. Haslam, D. Broderecht and **J.R. Craig**, *Performance of ground loop heat exchangers in soils with heterogeneous thermal properties*, 39th IAH Congress, Niagara Falls, ON, September 16-21, 2012

D72. A. Snowdon, and **J.R. Craig**, V*erification of a new approach for upscaling 2-dimensional groundwater-surface water interactions*, 39th IAH Congress, Niagara Falls, ON, September 16-21, 2012

D73. Ameli, A., M. Ranjram, and **J.R. Craig**, *Series solutions for 2-D steady saturated/unsaturated flow in unconfined aquifers with irregular boundaries*, 39th IAH Congress, Niagara Falls, ON, September 16-21, 2012

D74. **Craig, J.R.**, A. Snowdon, B.A. Tolson, *Using a flexible hydrologic modelling framework to test the impact of model decisions*, CGU-CWRA National Conference, Banff, Alberta, Jun 5-8. 2012

D75. Ameli, A., and **J.R. Craig**, *Series Solutions for steady flow in a stratified vadose zone with arbitrary geometry*, CGU-CWRA National Conference, Banff, Alberta, Jun 5-8. 2012

D76. Soulis, E.D., **J.R. Craig**, B. Davison, M. Mekonnen and G. Liu, *A simple yet rigorous approximation of Richards' Equation applied to the soil-water balance for streamflow simulation*, CGU-CWRA National Conference, Banff, Alberta, Jun 5-8. 2012

D77. Princz, D., **J.R. Craig**, and B.A. Tolson, *The impact of parameter granularity of the land surface on the predictive capacity of fully distributed, physically-based models*, CMOS/AMS Congress 2012, Montreal, Quebec, May 29-Jun 1, 2012

D78. Mirhamed, S., C. Ladubec, R. Gracie, M. B. Dusseault, and **J.R. Craig**, *Development of a modelling framework for adaptive monitoring and risk analysis of carbon sequestration systems*, Carbon Management Canada Annual Conference 2012, Gatineau, QC, May 23-25, 2012

D79. Zhao, Y., E.L. Jones, **J.R. Craig**, and R.E.H. Smith, *Modeling hydrodynamic contributions to inter-annual variation of recruitment success in walleye of west basin Lake Erie.* IAGLR 2012: 55th Annual Conference for Great Lakes Research, Cornwall, ON, May 13-17, 2012

D80. **Craig, J.R.**, A.P. Snowdon, and B.A. Tolson, *Determining the "Why's" of good and bad model performance: comparing hydrological modelling decisions with the Raven framework.* American Geophysical Union, Fall Meeting, San Francisco, California, USA, 5-9 Dec., 2011

D81. Snowdon, A.P., and **J.R. Craig**, *An upscaling approach for surface boundary conditions in 2-dimensional surface water/ groundwater models*, American Geophysical Union, Fall Meeting, San Francisco, California, USA, 5-9 Dec., 2011

D82. Quinton, W.L., M. Hayashi, J. Baltzer and **J.R. Craig**. *Runoff from wetland-dominated terrains with thawing permafrost* (Invited). American Geophysical Union, Fall Meeting, San Francisco, California, USA, 5-9 Dec., 2011

D83. Snowdon, A.P., and **J.R. Craig**, *Validation of an upscaling approach for surface boundary conditions in 2-dimensional surface water/ groundwater models*, 64th CWRA National Conference, St. John's, Newfoundland-Labrador, June 27-30, 2011

D84. **Craig, J.R.** and A.P. Snowdon, *Development of a robust and flexible semi-distributed hydrological modelling framework: Abstraction and step-wise application*, 64th CWRA National Conference, St. John's, Newfoundland-Labrador, June 27-30, 2011

D85. Soulis, E.D., **J.R. Craig,** and G. Liu, *A simple yet rigorous approximation of Richards' Equation applied to the soil-water balance*, CGU 2011 Annual Meeting, Banff, Alberta, May 15-18, 2011

D86. **Craig, J.R.** and A.P. Snowdon, *Redesigning distributed hydrological models to overcome numerical errors*, Water 2010-joint ISSH and ICWRER Symposium, Quebec City, QC, July 5-7, 2010

D87. Soulis, E.D., G. Liu, and **J.R. Craig**, *Avoiding the field capacity question: Determining retained soil moisture on a hillslope using fundamental soil physics and topography*, 3rd Joint CMOS-CGU Congress, Ottawa, ON, May 31-June 4, 2010

D88. Jones, E.L. , L.F. Leon, R.E. Smith, and **J.R. Craig**, *One- and three-dimensional modeling of nutrient-phytoplankton-zooplankton dynamics in Lake Erie*, ASLO Summer Meeting 2010, Santa Fe, NM, June 6-11, 2010

D89. Liu, G., E.D. Soulis, and **J.R. Craig**, *An analytical interflow scheme for distributed hydrological models I: Tests in homogenous soil*, ModelCARE 2009: Managing Groundwater and the Environment, Wuhan, China, September 20-23, 2009

D90. Liu, G., E.D. Soulis, and **J.R. Craig**, *Evaluation of an explicit solution to the Green-Ampt infiltration equation*, ModelCARE 2009: Managing Groundwater and the Environment, Wuhan, China, September 20-23, 2009

D91. Jones, E.L. , L.F. Leon, Y. Zhao, R.E. Smith, and **J.R. Craig**, *Three-dimensional modelling of Walleye nursery habitat in the West Basin, Lake Erie.* IAGLR 2009: 52st Annual Conference for Great Lakes Research, Toledo, OH, May 18-22, 2009

D92. Snowdon, A.P., and **J.R. Craig**, *Impacts of operation order in hydrological models.* AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D93. Liu, G., **J.R. Craig**, and E.D. Soulis, *Applicability of the Green-Ampt model under non-ideal conditions*. AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D94. Dunning, C., and **J.R. Craig**, and E.D. Soulis, *A methodology for calibrating a WATFLOOD model of the upper South Saskatchewan River.* AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D95. Wong, S., and **J.R. Craig**, A *comparison of series and finite element solutions for flow in multi-layer aquifers with contiguous layers*. AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D96. Nettasana, T., **J.R. Craig**, B.A. Tolson, and J. Sykes, *The development of multiple conceptual models for the high risk saline water upconing area in the Chi River Basin, Thailand.* AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D97. Soulis, E.D., **J.R. Craig**, G. Liu, and V. Fortin, *Modelling IP3 watersheds: Determining retained soil moisture using both field capacity and topography*, AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D98. **Craig, J.R.**, *Semi-analytical solutions for flow in heterogeneous media represented using pilot points.* AGU-CGU 2009 Joint Assembly, Toronto, ON, May 24-27, 2009

D99. Soulis, E.D., **J.R. Craig**, G. Liu, and V. Fortin, *IP3 watersheds: Determining retained soil moisture using both field capacity and topography*, EGU General Assembly 2009, Vienna, Austria, April 19-24, 2009

D100. **Craig, J.R.,** and A.P. Snowdon, *Upscaling threshold non-linearities in distributed surface water models.* AGU Fall Meeting 2008, San Francisco, CA, Dec 15-19, 2008

D101. Snowdon, A.P. and **J.R. Craig**, *An investigation of operator splitting errors in surface water models.* AGU Fall Meeting 2008, San Francisco, CA, Dec 15-19, 2008

***2008 AGU Fall Meeting Outstanding Student Paper Award (Hydrology Section)**

D102. Wong, S., and **J.R. Craig**, *Addressing normal fault stratification in series solutions for multilayer groundwater flow.* AGU Fall Meeting 2008, San Francisco, CA, Dec 15-19, 2008

D103. **Craig, J.R.,** and A.P. Snowdon, *Upscaling threshold behaviour in distributed surface water models.* IP3 Fall Workshop 2008, Whitehorse, Yukon, Nov 12-13, 2008

D104. Soulis, E.D., G. Liu, **J.R. Craig**, and V. Fortin, *Update on IP3 soil water budget: Verification of a revised analytical soil moisture parameterization scheme.* IP3 Fall Workshop 2008, Whitehorse, Yukon, Nov 12-13, 2008

D105. Soulis, E.D., G. Liu, and **J.R. Craig**, *Update on IP3 soil water budget: Progress towards an analytical solution for shallow aquifers,* IP3 Fall Workshop 2008, Whitehorse, Yukon, Nov 12-13, 2008

D106. Snowdon, A.P., and J.R. Craig, *RAVEN: A rigorous numerical approach toward distributed surface water modelling,* IP3 Fall Workshop 2008, Whitehorse, Yukon, Nov 12-13, 2008

D107. **Craig, J.R.**, and S. Wong, *Three-dimensional series solutions for regional multi-layer flow in sloping aquifers*, Computational Methods in Water Resources (CMWR) XVII Conference, San Francisco, CA, Jul. 6-10, 2008

D108. Wong, S., and J.R. Craig, *A series solution for multi-layer aquifers with natural geometry*, Computational Methods in Water Resources (CMWR) XVII Conference, San Francisco, CA, Jul. 6-10, 2008

D109. Dunning, C., E.D. Soulis, and **J.R. Craig**, *Using precipitable water vapour data for hydrologic modeling of the Red Deer, Bow, and Oldman River basins*, GEOIDE 10th Annual Scientific Conference, Niagara Falls, ON, May 28-30, 2008

D110. Jones, E.L., L.F. Leon, R.E.H. Smith, **J.R. Craig**, and H.J. Carrick, *Three-dimensional modelling of lake-wide nutrient and chlorophyll dynamics in Lake Erie using ELCOM-CAEDYM*, IAGLR 2008: 51st Annual Conference for Great Lakes Research, Peterborough, ON, May 19-23, 2008

D111. Soulis, E. D., **J.R. Craig**, and G. Liu, *Modelling IP3 watersheds: Determining retained soil moisture using both field capacity and topography*, Canadian Geophysical Union Conference, Banff, AB, May 11-14, 2008

D112. **Craig, J.R.,** *Coordinate mapping of analytical transport solutions to non-uniform flow fields*, AGU Fall Meeting 2007, San Francisco, CA, Dec. 10-14, 2007

D113. Kraemer, S. R., M. Bakker, and **J.R. Craig**, *An open-source community web site to support groundwater model testing*, AGU Fall Meeting 2007, San Francisco, CA, Dec. 10-14, 2007

D114. Tolson, B.A., **J.R. Craig**, and M.A. Esfahani, *Incorporating search history into the Dynamically Dimensioned Search (DDS) optimization algorithm*, AGU Fall Meeting 2007, San Francisco, CA, Dec. 10-14, 2007

D115. **Craig, J.R.,** *Handling continuous and singular parameter fields in mixed finite element-analytic element models of flow and transport*, ModelCARE 2007: Calibration and Reliability in Groundwater Modeling, Copenhagen, Denmark, Sept. 9-13, 2007

D116. **Craig, J.R.**, *Topography-driven flow in a stratified sloping aquifer: A general semi-analytical solution*, AGU Fall Meeting 2006, San Francisco, CA, Dec. 11-15, 2006

D117. **Craig, J.R.**, A.J. Rabideau, M.W. Becker, K. Bandilla, D.M. Flewelling, K.C. Fredrick, I. Jankovic, L.S. Matott, and W. Silaviserith, *Development of a regional-scale groundwater modeling system for research, education, and outreach*, 2005 AEESP Research and Education Conference, Potsdam, NY, July 24-27, 2005

D118. **Craig, J.R.**, A.J. Rabideau, and L.S. Matott, *Optimal mesh generation for AEM-based transport simulators*, AGU Fall Meeting 2004, San Francisco, CA, Dec. 13-17, 2004

D119. **Craig, J.R.**, G. Sinha, D.M. Flewelling, W. Silaviserith, and A.J. Rabideau, *Automated geographic simplification tools for development of regional scale groundwater models*. AGU Fall Meeting 2003, San Francisco, CA, Dec. 8-12, 2003

D120. Janković, K. Bandilla, **Craig, J.R.**, and A.J. Rabideau, *Role of the analytic element method in regional-scale GIS-based modeling of groundwater flow and transport*. AGU Fall Meeting 2003, San Francisco, CA, Dec. 8-12, 2003

D121. **Craig, J.R.**, A.J. Rabideau, and I. Janković, *Visual Bluebird: software for teaching groundwater modeling and potential flow to undergraduate students*. Frontiers in Assessment Methods for the Environment (FAME), Minneapolis, MN, August 10-13, 2003

D122. **Craig, J.R.**, and A.J. Rabideau, *Vertically-averaged contaminant transport with the streamline method in near-surface aquifers*. Spring 2003 EGU-AGU-EGS Joint Assembly, Nice, France, April 7-11, 2003

D123. **Craig, J.R.**, and A.J. Rabideau, *Reducing dependence upon "the Grid": a framework for contaminant transport modeling using analytic flow solutions*. AGU Fall Meeting 2002, San Francisco, CA, December 6-10, 2002

D124. **Craig, J.R.**, and I. Janković, *An overview of the object-oriented iterative model for the analytic element method*. AGU Spring Meeting 2002, Washington D.C., May 28-31, 2002

D125. **Craig, J.R.**, I. Janković, and A.J. Rabideau, *Modeling groundwater/surface water interaction with the analytic element method*. 12th annual Great Lakes Research Consortium Student/Faculty Conference, Syracuse, NY, March 15-16, 2002

D126. **Craig, J.R.**, I. Janković, and R. Barnes, *Accommodating multi-scale analytic element models with the nested superblock approach*. AGU Fall Meeting 2001, San Francisco, CA, December 10-14, 2001

RESEARCH AND EQUIPMENT GRANTS

Emergency Management Strategy Grant, Natural Resources Canada (NRCan), (PI w/ B. Tolson)
Hydrologic modelling support for post-wildfire water resource integrity and flood risk assessment, $231,242 (~50%), 2021-2023

Canada First Excellence Research Fund (CFREF) Global Water Futures Program (GWF) Sub-grant, (co-PI with P. van Cappellen and others)
Managing urban eutrophication risks under climate change: An integrated modeling and decision support framework, $273, 930 (~15%), 2020-2023

Natural Resources Canada (NRCan) Small Scale Research Program, (PI w/ J. Leach)
Developing dynamic forest vegetation algorithms to understand resource development impacts on water resources, $50,000 (100%), 2019-2021

Environment and Climate Change Canada Research Grants, (PI w/ B. Tolson)
Lake, reservoir, and streamflow routing for flow forecasting across Canada, $100,000 (50%), 2019-2021

NSERC Collaborative Research and Development Grant, (PI w/ B. Tolson; OPG)
Improved hydrologic modelling strategies for reservoir management, $144,349 (50%), 2019-2022

Strategic Research Program Grant, ArcticNet Network Centre of Excellence (NCE) (co-I with W. Quinton (PI))
Dehcho collaborative on permafrost, $369,000 (20%), 2019-2022

Sponsored Research Agreement, City of Calgary (PI)
Improved flood forecasting in the Elbow river basin, $30,000 (100%), 2018-2019

Canada First Excellence Research Fund (CFREF) Global Water Futures Program (GWF) Sub-grant, (co-I with J. Baltzer and others)
Northern Water Futures, $7,800,380 (~2%), 2017-2020

Polar Knowledge Canada – Science and Technology Program, (co-PI with W. Quinton (PI))
Consortium for Permafrost Ecosystems in Transition (CPET), $250,000 (42%), 2017-2019

NSERC Discovery Grant, Individual (PI)
Scale issues in connected landscapes: Resolving emergent behaviour for improved hydrologic modelling, $170,000 (100%), 2017-2022

Nexen Energy ULC Research Grant, (co-Investigator with W. Quinton (PI)),
Assessing the impacts of permafrost thaw driven changes to water resources in Canada's sub-Arctic using remote sensing and hydrological modeling, $70,000 ($36%), 2017

Canada Foundation for Innovation (CFI) John R. Evans Leaders fund and
Ontario Research Fund (ORF) (PI),
Computing infrastructure to support the Canada Research Chair in Hydrologic modelling and analysis, $184,833 (100%), 2016

NSERC Canada Research Chairs Program (PI), $520,000 (100%)
Canada Tier II Research Chair in Hydrologic Modelling and Analysis, 2016-2021

NSERC Engage Grant (PI, with industrial partner Ontario Power Generation), $25,000 (100%)
Improved modelling of managed watersheds in the Canadian Shield in support of hydropower reservoir management, 2016

UW Water Institute Seed Grant (Co-applicant with P. Van Cappellen and 9 others), $23,000 (<5%)
Do watershed biogeochemical models really inform coastal ecology and environmental policy?(workshop), 2016

NSERC Collaborative Research & Development Grant (Co-PI With W. Quinton/J. Baltzer (WLU), M. Hayashi (U Calgary), O. Sonnentag (U Montreal), A. Berg (U Guelph)), $294,000 (20%)
Consortium for Permafrost Ecosystems in Transition (CPET), 2015-2017

NSERC Discovery Grant, Individual (PI), $120,000 (100%)
Hybrid numerical-analytical methods for subsurface flow simulation, 2012-2017

Early Researcher Award (ERA), Ontario Ministry of Research and Innovation (PI), $150,000 (100%)
Assessing the vulnerability and environmental impact of pumping wells near wetlands and streams, 2011-2016

Carbon Management Canada, (Co-PI with D. Krewski/M. Fall (U Ottawa), J. Nathwani/R. Gracie/L.S. Matott/M Dusseault (U Waterloo) and J. Arvai (U Calgary)), $930,000 (5%)
Risk assessment and management of carbon capture and storage in a Canadian context, 2011-2014

Environment Canada, Contribution Program, (Co-PI with B.A. Tolson), $170,000 (40%)
Dealing with heterogeneity in distributed hydrological models and atmospheric land surface schemes, 2010-2014

Ontario Centres of Excellence (OCE) Technical Problem Solving (TPS) Grant (PI), $23,345 (100%)
Improving accessibility of geothermal energy for urban and residential users, 2010-2012
Partner: NextEnergy, Inc.

NSERC Discovery Grant, Individual (PI), $114,000 (100%)
Mixed local and regional-scale groundwater flow modeling, 2006-2012

INDUSTRY-MATCHED SCHOLARSHIP FUNDING SECURED

NSERC IPS-1 MASc Scholarship for Nicholas Sgro (BC Hydro), $46 000

NSERC IPS-1 MASc. Scholarship for Simon Haslam (NextEnergy, Inc.), $42 000

NSERC IPS-1 MASc. Scholarship for Richard Simms (NextEnergy, Inc.), $42 000

NSERC IPS-2 Ph.D. Scholarship for Andy Snowdon (AquaResource, Inc.), $76 000

TEACHING EXPERIENCE

University of Waterloo

Advanced Mathematics (ENVE 321)
Advanced Mathematics for Environmental Engineering (CIVE 673)
Contaminant Transport (ENVE 573)
Differential Equations and Balance Laws (ENVE 223)
Digital Computation (CIVE 121)
Energy and the Environment (ENVE 279)
GIS applications in Civil Engineering (CIVE 497/770)
Frontiers in Hydrology (CIVE 770)
Hydrology (CIVE 486)
Principles of Hydrologic Modelling (CIVE 781)

University at Buffalo

Civil Engineering Applications of GIS (CIE 507)
Modern Methods of Engineering Computation (EAS 451)
Introduction to Environmental Engineering (CIE 440) [Co-Instructor]

GRADUATE STUDENT SUPERVISION (CURRENT STUDENTS)

1. Devoie , É., Civil Engineering (Collaborative Water Program) (Ph.D.) (co-advisor: Dr. W. Quinton)
   Title: "The changing influence of permafrost on peatlands hydrology"
2. Ranjram, M., Civil Engineering (Collaborative Water Program) (Ph.D.)
   Title: "Upscaling of lateral flow processes in watershed models"
3. Akbarpour, S., Civil Engineering (Collaborative Water Program) (Ph.D.)
   Topic: Modelling the evolution of discontinuous permafrost
4. Taheri, M., Civil Engineering (Collaborative Water Program) (Ph.D.)
   Title: "Upscaling fill and spill hydrological processes"
5. Scantlebury, L., Civil Engineering (Collaborative Water Program) (MASc.)
   Topic: Groundwater surface water interaction
6. Chlumsky, R., Civil Engineering (Collaborative Water Program) (Ph.D.) (co-advisor: Dr. B. Tolson)
   Topic: Structural optimization of hydrological models
7. Burdett, H., Civil Engineering (Collaborative Water Program) (Ph.D.)
   Topic: Machine learning methods for hydrologic upscaling
8. Lin, S., Civil Engineering (Collaborative Water Program) (MASc.) (co-advisor: Dr. N. Basu)

Topic: Simulating forest hydrology

GRADUATE STUDENT SUPERVISION (FORMER STUDENTS)

1. Amiri, E.A., Civil Engineering (Ph.D., 2020)
   Title: "Numerical modelling of permafrost in heterogeneous media"
2. Brown, G., Civil Engineering (Collaborative Water Program) (MASc., 2019)
   "Application of a hydrological model for predicting river ice breakup"
3. Lee, K., Civil Engineering (Collaborative Water Program) (MASc., 2018) (co-advisor: Dr. B. Tolson)
   "Assessing the utility of hydrologic model diagnostics for decision support"
4. Grass, S., Civil Engineering (Collaborative Water Program) (MASc., 2018)
   "Evaluating conceptual numerical models of boreal plains hydrology"
5. Chlumsky, R., Civil Engineering (Collaborative Water Program) (MASc., 2017)
   "Rigorous validation of hydrologic models in support of decision-making"
6. Sgro, N., Civil Engineering (MASc., 2016)
   "Formal hypothesis testing for prospective hydrological model improvements"
7. Chowdhury, M., Civil Engineering (Collaborative Water Program) (MASc., 2016)
   "Assessing the connectivity of groundwater wells to surface-water using a volumetric capture delineation tool"
8. Snowdon, A.P., Civil Engineering (PhD., 2016)
   "Upscaling of coupled models with topography-driven surface-water/groundwater interactions"
9. Princz, D., Civil Engineering (MASc., 2016) (co-advisor Dr. E.D. Soulis)
   "The CRANE framework for building integrated modelling systems"
10. Ramadhan, M., Civil Engineering (MASc., 2015)
    "A semi-analytical particle tracking algorithm for arbitrary unstructured grids"
11. Ameli, A.A., Civil Engineering (Ph.D., 2014)
    "Semi-analytical methods for simulating the groundwater-surface water interface"
12. Sheffield, P., Civil Engineering (MASc., 2014)
    "The utility of using multiple conceptual models for the design of groundwater remediation systems"
13. Simms, R., Civil Engineering (MASc. 2013)
    "The effects of soil heterogeneity on the performance of horizontal ground loop heat exchangers"
14. Haslam, S., Civil Engineering (MASc. 2013)
    "Informing the practice of ground heat exchanger design through numerical simulations"
15. Wong, S., Civil Engineering (Ph.D., withdrawn) (co-advisor: Dr. J. Sykes*)
    "Series solution methods for regional groundwater systems with natural stratigraphy"
16. Nettasana, T., Civil Engineering (Ph.D. 2012) (co-advisors: Dr. B. Tolson, Dr. J. Sykes*)
    "Conceptual model uncertainty in the management of the Chi River Basin, Thailand"
17. Jones, E.L., Biology/Civil Engineering (MASc. 2011) (co-advisor: Dr. R. Smith)
    "Ecological modelling of Lake Erie : Sensitivity analysis and simulation of nutrient, phytoplankton, and zooplankton dynamics"
18. Huo, C., Civil Engineering (MASc., 2010) (co-advisor: Dr. N.R. Thomson)
    "Mathematical simulation of a dipole delivery system for in situ remediation",
19. Liu, G., Civil Engineering (Ph.D., 2010) (co-advisor: Dr. E.D. Soulis)
    "Improved interflow and infiltration algorithms for distributed hydrological models",
20. Snowdon, A.P., Civil Engineering (MASc., 2010)
    "Improved numerical methods for distributed hydrological models"
21. Dunning, C., Civil Engineering (MASc., 2009) (co-advisor: Dr. E.D. Soulis)
    "Hydrologic modeling of the Upper South Saskatchewan River Basin: Multi-basin calibration and gauge de-clustering analysis"

POST-DOCTORAL FELLOW SUPERVISION

1. Awol, F. (2020-)
   Large system lake routing simulation (co-supervised with B.A. Tolson)
2. Liu, H. (2019)

Support for City of Calgary research (co-supervised with B.A. Tolson)
3. Mai, J., (2016-2018)
Support for Consortium for Permafrost Ecosystems in Transition (CPET) research (co-supervised with B.A. Tolson)

AWARDS TO GRADUATE STUDENTS

1. 2019 Don Gray Student Paper Award at CGU Annual conference (Canadian Geophysical Union) [É. Devoie]
2. 2019 Bill Stolte Award for Best Student Paper at CWRA Annual conference [G. Brown]
3. 2018 Don Gray Scholarship for PhD studies in Hydrology (Canadian Geophysical Union) [É. Devoie]
4. 2008 AGU Fall Meeting Outstanding Student Paper Award (Hydrology Section) [A.P. Snowdon]

OTHER HQP SUPERVISION

1. Lin, S., Undergraduate Research Assistant (Winter 2019)
Snow cover depletion curve theoretical analysis
2. Hagen, D., Undergraduate Research Assistant (Winter 2019)
Snow model intercomparison project
3. Lin, S., Co-op Research Assistant (Fall 2018)
Interflow modelling and software analysis
4. Maan, N., Undergraduate Research Assistant (Fall 2018)
Snow data analysis
5. Tan, D., Co-op Research Assistant (co-supervised with R. Soulis) (Summer 2018)
Hydrologic modelling support and time series comparison
6. Boyadjian, P., S. Kabir, B. Lui, T. Uhlenbruck, and A. Verma, 4th year design advisees (2017-2018)
Continuous acoustic monitoring of steam traps for failure detection
7. Song, J., Undergraduate Research Assistant (Winter 2018)
SNODAS data integration in hydrologic models
8. Hah, D., Undergraduate Research Assistant (Fall 2017)
Simulating spill-and-fill using stochastic methods
9. Liu, B. Undergraduate Research Assistant (Winter 2017)
Hydrological model support for stochastic bog systems
10. Franklin, R., Z. Schenk, N. Wennyk, and F. Zaman, Env. Eng. 4th year design advisees (2015-2016)
Plastic pollution cleanup of the Great Lakes
11. Devoie, E., Co-op Research Assistant (co-supervised with W. Quinton, WLU) (Summer 2015)
Field and modelling investigations of cascading bog systems in the NWT
12. Shamalisham, N., Co-op Research Assistant (co-supervised with N.Basu/M. Shafiei) (Winter 2015)
Hydrological modelling of the Grand River watershed
13. Cooper, J., Undergraduate Research Assistant (Fall 2014)
Hydrological model development of the Grand River; Downscaling daily precipitation data
14. Chandrakumaran, T., Undergraduate Research Assistant (Fall 2014)
Hydrological model development of the Grand River; Downscaling daily precipitation data
15. Luczko, E., Research Assistant (Summer 2014)
Three-dimensional visualization for groundwater models
16. Dhother, R., J. Dickhout, S. Ferguson, and N. Mallick, Env. Eng. 4th year design advisees (2013-2014)
End pit lake remediation
17. Brown, G., T. Granger, R. Reid, L. van Waterschoot, Env. Eng. 4th year design advisees (2013-2014)
Project Title: "Fen Design for Reclamation of Oil Sands Developed Land"
18. Werstuck, C., Co-op Research Assistant (co-supervised with B.A. Tolson) (Spring 2013)
Hydrologic Modelling Tool Development
19. Zhang, M., R. Wan, V. Wei, Env. Eng. 4th year design project advisees (2012-2013)
Pump and treat optimization near surface water features
20. Chen, E., J. Khasakia, A. Kranyak, and H-S. Yoon, Civ. Eng. 4th year design advisees (2012-2013)
Project Title: "Implementing geothermal heating and cooling at the Columbia Icefield"

21. Ranjram, M., Undergraduate Research Assistant (Fall 2012)
    3D Models of stratigraphy for semi-analytical series solution methods
22. Huang, S., Undergraduate Research Assistant (Fall 2012)
    Benchmarking of routing algorithms, hydrological code development
23. Zhang, C., Undergraduate Research Assistant (Spring 2012)
    Interfacing atmospheric and surface water models using ArcGIS
24. Huang, S., Co-op Research Assistant (Spring 2012)
    Hydrological modelling of the Speed and Eramosa rivers; Geodatabase development
25. Ranjram, M., Co-op Research Assistant (Spring 2012)
    3D Models of stratigraphy for semi-analytical series solution methods
26. Paya, Karol, Co-op Research Assistant (Winter 2012) [co-supervisor: B.A. Tolson]
    GIS analysis for hydrological modelling support; assembly of a Great lakes watershed database
27. Hillier, C., Geo. Eng. 4th year design project advisee (2011-2012)
    Project title: "A water supply system for Finse, Norway"
28. Stonebridge, G., Undergraduate Research Assistant (Fall 2011)
    Benchmarking, testing, and application of hydrological simulation models
29. Spraakman, S., Research Assistant (Spring 2011)
    Preparation of technical documentation for hydrological simulation model
30. Pearson, S., Undergraduate Research Assistant (Spring 2011)
    Hydrological model preprocessor development
31. Ranjram, M., Undergraduate Research Assistant (Spring 2011, Winter 2012)
    Representational software for layered stratigraphic systems
32. Khedr, A., Undergraduate Research Assistant (Winter 2011)
    Development of statistical output modules for surface water modelling software
33. Arlos, M., J. Chan, K. Chan, and H. Lo, Env. Eng. 4th year design project advisees (2010-2011)
    Project title: "TCE and PHC groundwater remediation alternatives for Simmons Lake Gas Station"
34. Zhang, Bo, Visiting Scholar (2010)
    Research into topography-based hydrologic modeling
35. Snowdon, A.P., Research Assistant (Winter 2010)
    Hydrologic algorithm development and design
36. Chen, W., Undergraduate Research Assistant (Winter 2010) [co-supervisor: L.S. Matott]
    Optimization software development to handle netCDF and MS Access formats
37. Haslam, S., Geological engineering 4th year design project advisee (2009-2010)
    Project title: "Design of a culvert system for Too Much Gold creek in Whitehorse, Yukon"
38. Haslam, S., Undergraduate Research Assistant (Winter 2009)
    Analysis of flow bypassing in single well reactive dipole flow tests
39. Chung, S., A. Mohino-Barrie, and N. Nalliah, Environmental/Civil engineering 4th year design project advisees (2008-2009)
    Project title: "Prioritization of borehole capping in the Great Artesian Basin, Australia"
40. Simms, R., Undergraduate Research Assistant (Winter 2008)
    Software and algorithm development for groundwater flow, contaminant transport, and distributed surface water modeling
41. Chevalier, L., R. Reaume, and A. Tymec, Env. Eng. 4th year design project advisees (2007-2008)
    Project title: "Optimization of sorption liners in landfill design"
42. De Laplante, N., Geological engineering 4th year design project advisee (2007-2008)
    Project title: "Optimization of remediation response functions for an MTBE contaminated aquifer"
43. Zheng, Y., Geological engineering 4th year design project advisee (2007-2008)
    Project title: "Design of a data calibration and reduction system for dynamically-tuned gyroscopes"
44. Labalestra, J., Geological engineering 4th year design project advisee (2007-2008)
    Project title: "Non-destructive hydroelectric power generation"
45. Heidlauf, T., Visiting Scholar/Intern (Summer 2007)
    Software and method development for groundwater flow and contaminant transport in conjunction with Waterloo Hydrogeologic, Inc., a Schlumberger Company

46. Zhu, P., Co-op Research Assistant (Winter 2006)
Developed a library of analytical contaminant transport solutions in C++
47. Dunning, C., and S. Mathew, Environmental engineering 4th year design project advisee (2005-2006)
Project title: "A pipe network modelling code"

RELATED PROFESSIONAL EXPERIENCE

2013- **Technical Consultant**, Various Employers
Provided logistical, modelling, and software development support for development of improved flood and reservoir inflow models using the Raven Hydrological Modelling Framework. Worked on modelling of natural and managed watershed systems in British Columbia, Alberta, Ontario, and New Brunswick. Provided software review for ECCC.

2012-16 **Technical Consultant,** for the Canadian National Research Council- Oceans, Coastal, and River Engineering Division (NRC-OCRE)
Software development, documentation, and technical advice in support of reservoir inflow and flood forecasting for BC Hydro, TransAlta, and New Brunswick ELG. Implemented a state-of-the art version of the UBC Watershed model as part of the Canadian Hydrological Model Stewardship project.

2005 **Senior Research Associate,** CSEE Dept., University at Buffalo, Buffalo, NY
Developed and implement approaches for linking reactive contaminant transport models to analytic element flow solutions, developed batch reaction modules for simulation of reactive transport.

2004 **Research Assistant,** CSEE Dept., University at Buffalo, Buffalo, NY
Gathered data and developed a regional groundwater model of the entire Susquehanna Basin and participated in distributing Grid-based calibration models across universities in the northeast US.

Curriculum Consultant, National Center for Geographic Information and Analysis, Buffalo, NY
Developed a comprehensive educational program to fulfill mathematics proficiency requirements for in the NSF-funded IGERT program in geographic information science.

Research Assistant, Environment and Society Institute, Buffalo, NY
Developed databases and managed web sites for an interdepartmental university research institute.

2000 **Research Assistant,** University at Buffalo, Buffalo, NY
Investigated application of parallel computing and object-orientation to regional scale groundwater software. Implemented genetic algorithms for optimization of pump and treat remediation strategies.

1997-8 **Draftsman/Architectural Assistant,** Catapano Engineering, P.C. Permit Research, Melville, NY
Designed, revised, and edited architectural, structural, and mechanical plans using AutoCAD. (summers)

PROFESSIONAL SHORT COURSES AND WORKSHOPS

Craig, J.R, K. Shook, and B.A. Tolson, *Principles of hydrologic modelling short course*, Co-sponsored by the Canadian Society for Hydrological Sciences (CSHS) and the Canadian Water Resources Association (CWRA), Waterloo, ON, Jun 3-8, 2019

Craig, J.R., *Raven hydrological modelling workshop*, Sponsored by Engineers and Geoscientists British Columbia (EGBC), Kelowna, B.C., Nov 19, 2018

Craig, J.R, K. Shook, and B.A. Tolson, *Principles of hydrologic modelling short course*, Co-sponsored by the Canadian Society for Hydrological Sciences (CSHS) and the Canadian Water Resources Association (CWRA), Waterloo, ON, Jun 4-9, 2018

Craig, J.R., *Raven hydrological modelling workshop*, Sponsored by Engineers and Geoscientists British Columbia (EGBC), Vancouver, B.C., Jan 22, 2018

Craig, J.R, K. Shook, and B.A. Tolson, *Principles of hydrologic modelling short course*, Co-sponsored by the Canadian Society for Hydrological Sciences (CSHS), Canadian Water Resources Association (CWRA) and FloodNet Strategic Network, Waterloo, ON, July 19-24, 2017

Craig, J.R., *Raven hydrological modelling workshop*, Co-sponsored by Carleton University, the Canadian Society for Hydrological Sciences, and the Canadian Water Resources Assoc., Ottawa, ON, Oct 14, 2016

Craig, J.R., *Raven-UBCWM hydrological modelling workshop*, Co-sponsored by BC Hydro and the British Columbia branch of the Canadian Water Resources Assoc., Burnaby, B.C., Feb 18, 2016

Craig, J.R., *Raven hydrological modelling workshop*, Yellowknife, NT, June 15-16, 2015

Craig, J.R., *Conceptual groundwater model development with the Analytic Element Method*, Short course for groundwater practitioners, Matrix Solutions, Inc., Breslau, ON, December 15, 2013

Craig, J.R., *Conceptual groundwater model development with the Analytic Element Method*, Short course for groundwater practitioners, S.S. Papadopulos & Associates, Bethesda, MD, August 6-7, 2009

Craig, J.R., (primary instructor), A.J. Rabideau, I. Janković, and L.S. Matott, *Modeling regional groundwater flow with the Analytic Element Method: Source water assessment and GIS*, Short course for groundwater practitioners (1.6 CEUs), University at Buffalo, June 28-29, 2004

INVITED SEMINARS AND ACADEMIC WORKSHOPS

Craig, J.R., *The Raven Hydrological Modelling Framework: An overview*, Invited, University of British Columbia, Vancouver, BC, Apr 25, 2019

Craig, J.R., *Upscaling in computational hydrology: Chasing after the "holy grail"*, Invited, University of British Columbia, Vancouver, BC, Apr 26, 2019

Craig, J.R., *Hydrologic modelling and model calibration*, 2-day workshop, Invited, TU Dresden, Dresden, Germany, Aug 20-21, 2018

Craig, J.R., *The Raven Hydrological Modelling Framework: An overview*, Invited, University of Saskatchewan, Saskatoon, SK, May 24, 2018

Craig, J.R., *Upscaling in computational hydrology: Chasing after the "holy grail"*, Invited, Global Water Futures Seminar Series, Saskatoon, SK, May 23, 2018

Craig, J.R., *The Raven Hydrological Modelling Framework: An overview*, Invited, Ouranos Seminar Series, Montreal, QC, April 25, 2018

Craig, J.R., *the Raven Hydrological Modelling Framework: A Brief Overview*, Invited, Ontario Floodplain Mapping Knowledge Transfer Workshop, Vaughan, ON, March 5, 2018

Craig, J.R., *Towards more trustworthy hydrologic models: Evaluating model choices and learning from data*, Warren Lecture (Invited), University of Minnesota, March 4, 2016

Craig, J.R., *Developing trustworthy hydrological models,* University of Waterloo Ecohydrology research group seminar series, Invited, October 28, 2014

Craig, J.R., *Developing trustworthy hydrological models,* NRC- Canadian Hydraulics Centre brown bag seminar series, Invited, May 12, 2011

Craig, J.R., *Analytical models of porous media flow in heterogeneous media (an engineer's hobby problem),* University of Waterloo Applied Mathematics Seminar Series, November 18, 2010

Craig, J.R., *Pseudoanalytic function theory and its potential application to groundwater flow problems*, Invited seminar, James Cook University, August 22, 2008

Craig, J.R., *Regional groundwater modeling: Meeting the computational challenge*, Invited seminar, University of Waterloo, July 8, 2004

Craig, J.R., *Advances in regional groundwater modeling*, Invited seminar, Drexel University, March 16, 2004

INTERNAL SERVICE

Chair, Strategic Planning Committee, Dept. of Civil and Environmental Engineering, 2018-2019

Member, Tenure and Promotion Committee, Faculty of Engineering, 2019-

Member, UG Curriculum Committee, Dept. of Civil and Environmental Engineering, 2018-

Member, Wellness Committee, Dept. of Civil and Environmental Engineering, 2018-

Member, Outcomes Planning Committee, Dept. of Civil and Environmental Engineering, 2016-

Member, Strategic Planning Committee, UW Water Institute, 2009-2016, 2018-

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Member, Department Advisory Committee for Appointments (DACA), Urb. Water Hire, 2019

Member, Department Advisory Committee for Appointments (DACA), Hydrol. Hire, 2018-2019

Designate Chairs Pool, University of Waterloo, 2017-2018

Member, Department Advisory Committee for Appointments (DACA), Arch. Hire, 2017-2018

E&WR Group Coordinator, Dept. of Civil and Environmental Engineering, 2010-2015, 2017-2019

Member, Department Tenure and Promotion Committee, Dept. of Civil and Environmental Engineering, 2013-2015, 2016-2018

Member, Strategic Planning Committee, Dept. of Civil and Environmental Engineering, 2017-2018

Member, Department Advisory Committee for Appointments (DACA), Building Hire, 2016-2017

Member, Department Advisory Committee for Appointments (DACA), Geotech Hire, 2015-2017

Interim Coordinator, Environmental Engineering Option, Dept. of Civil and Environmental Engineering, 2016

Chair, Outcomes Planning Committee, Dept. of Civil and Environmental Engineering, 2014-2016

Member, Strategic Management Committee, UW Water Institute, 2012-2016

Member, Outcomes Planning Committee (formerly SpFOPs), Faculty of Engineering, 2012-2015

EnvE/GeoE Class of 2015 Class Professor, Dept. of Civil and Environmental Engineering, 2012-15

Member, Department Advisory Committee for Appointments (DACA), Grad Attributes Lecturer, 2014-2015

Member, Department Advisory Committee for Appointments (DACA), Enviro. Hire, 2013-2015

Member, World Water Day Graduate Research Fair Organizing Committee, UW Water Institute, 2013-2014

Chair, Communications Committee, UW Water Institute, 2010-2014

Member, Curriculum Renewal Committee, Dept. of Civil and Environmental Engineering, 2011-2014

Associate Chair of Computing, Dept. of Civil and Environmental Engineering, 2008-2013

Member, Vision 2015 Planning Committee, Dept. of Civil and Environ. Engineering, 2010-2011

Organizer, World Water Day Graduate Research Fair 2011/2012, UW Water Institute, 2011-2012

Enviro/Geo 4A Class Professor, Dept. of Civil and Environmental Engineering, Fall 2010

Coordinator, Environmental Lab Space Assessment, Dept. of Civil and Environmental Engineering, 2009

Environ. Seminar Series Coordinator, Dept. of Civil and Environmental Engineering, 2007-2009

Explorations / March Break Open House Departmental Representative, Faculty of Engineering, 2008-2009

Graduate Open House Coordinator, Dept. of Civil and Environmental Engineering, 2007-2008

Sandford Fleming Foundation Technical Speaking Competition Coordinator, Faculty of Engineering, 2006-2008

Member of Engineering Faculty Council, Faculty of Engineering, 2007-2008

Civil 2B Class Professor, Dept. of Civil and Environmental Engineering, Spring 2007

Representative to the Mathematics Faculty Council, Faculty of Engineering, 2006-2007

ExpecTAtions Faculty Mentor, Dept. of Civil and Environmental Engineering, 2006

EXTERNAL SERVICE

Member, American Geophysical Union (AGU) Hydrologic Sciences Meeting Chair Selection committee, 2020-

Member and Contributor, the Canadian hydRology Project, 2017-

Member, Canadian Geophysical Union (CGU) Large Scale Watershed Modelling & Analysis committee, 2017-

Vice President, Canadian Society for Hydrological Sciences (CSHS), 2017-

Board Member, Canadian Water Resources Association (CWRA), 2017-

Chair, External Advisory Committee, NRCan/ECCC Hydro Data Model Harmonisation (CHyF) Project, 2017-

Associate Editor, *Groundwater,* 2014-

Executive Committee Member, Canadian Society for Hydrological Sciences (CSHS), 2012-

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Conference Technical Committee Member, 8th Intl. Conference on the Analytic Element Method (ICAEM), Golden, CO, May 30-31, 2017

Participant (Invited), *1st Workshop on improving the theoretical underpinnings of hydrologic models,* Bertinoro, Italy, April 24-27, 2016

Conference Technical Committee Member, 7th Intl. Conference on the Analytic Element Method (ICAEM), Golden, CO, May 30-31, 2015

High School Outreach, Presentation on Environmental Models, Waterloo-Oxford District Secondary School, April 2014

Conference Session Co-Chair, *Hydrological modelling*, CWRA 2014 Canada Water Resources Congress, Hamilton, ON, Jun. 2-4 2014

Conference Organizing Committee Member, 6th Intl. Conference on the Analytic Element Method (ICAEM), Golden, CO, May 2013

Conference Session Co-Chair, *Hydrological modelling innovation in Canada*, CWRA/CGU Joint Meeting 2012, Banff, AB, Jun. 5-8 2012

Conference Session Co-Chair, *Translating watersheds into trustworthy hydrological models*, AGU Fall Meeting 2011, San Francisco, CA, Dec. 5-9 2011

Conference Session Co-Chair, *Analytical and semi-analytical models of subsurface flow and transport***,** AGU Fall Meeting 2007, San Francisco, CA, Dec. 10-14 2007

Conference Technical Committee Member, 5th Intl. Conference on the Analytic Element Method (ICAEM), Manhattan, KS, May 14-18, 2006

Peer Reviewer (Manuscripts): Water Resources Research, Advances in Water Resources, Journal of Hydrology, Ground Water, Journal of Contaminant Hydrology, Hydrological Sciences Journal, Journal of Hydraulic Engineering, Journal of Environmental Engineering, Journal of Hydrologic Engineering, Hydrogeology Journal, Computers and Geotechnics (*Recognized Reviewer*), Computers and Geosciences, Journal of Environmental Engineering and Science, Journal of Hazardous Materials, Open Hydrology Journal; Applied Mathematical Modelling (*Recognized Reviewer*), Quarterly Journal of Mechanics and Applied Mathematics; Mathematical Problems in Engineering

Peer Reviewer (Grant Proposals): Canada Foundation for Innovation (CFI), NSERC Discovery Grant Program, NSERC Strategic Project Grant Program, Mitacs Accelerate Program, OMAFRA New Directions Research Program, Qatar National Research Fund (QNRF).

SOFTWARE

Craig, J.R., and the Raven Development Team, **RAVEN 2.9**: An open-source, object-oriented, numerically rigorous hydrological modelling framework for simulating the water cycle at catchment and sub-catchment scales.

Muffels, C., M. Ramadhan, X Wang, M. Tonkin, C. Neville, **J.R. Craig**, **MODPATH-3DU**: A general particle tracking tool for arbitrary cell geometries with Modflow-USG, including nested grids, quadpatch grids, quadtree grids, and Voronoi tessellations.

Craig, J.R., and L.S. Matott, **VISUAL AEM 1.0**: A Windows-based graphical user interface for analytic element modeling of groundwater flow and transport, post processing, and analysis.

Craig, J.R., **BLUEBIRD 3.31**: Object-oriented library for analytic-based modeling of multi-layer groundwater flow in heterogeneous aquifers with particle tracking and surface water interaction module.

Craig, J.R., **CARDINAL 2.0**: Object-oriented library for analytical and numerical 2D multi-species aqueous solute transport modeling using analytic element flow solutions from the Bluebird library.

Craig, J.R., **RXNLIB 0.8**: Object-oriented library for simulation of multi-species aqueous batch reactions, equilibrium and non-equilibrium sorption. Currently includes modules for generic Cation Exchange and parent-daughter decay, and a variety of sorption and partitioning models.

L.S. Matott, **Craig, J.R.**, Tolson, B.A.: **OSTRICH DDS MODULE**: Dynamically-dimensioned search optimization algorithm module for multi-engine optimization software OSTRICH.

Craig, J.R., **DIPOLE3D 1.0**: Numerical implementation of a three-dimensional analytical solution for a single-well dipole flow field with particle tracking.

PROFESSIONAL AFFILIATIONS

Member, Professional Engineers Ontario (PEO)
Member, American Geophysical Union (AGU)
Member, Canadian Geophysical Union (CGU)
Member, Canadian Water Resources Association (CWRA)
Member, Canadian Society for Hydrological Sciences (CSHS)
Member, National Ground Water Association (NGWA)
Member, Chi Epsilon Honor Fraternity
Member, Taiga Plains Research Network (TPRN)
Member, the Water Institute at UW
Collaborator, NSERC FloodNet network
Member, Waterloo Institute for Sustainable Energy (WISE)

TECHNICAL SKILLS

Extensive scientific programming experience (100,000+ lines of code) using C++, Visual Basic, VB.NET, R, Python, Matlab, Fortran, Perl, and Javascript
Expert-level user of SQL, HTML/CSS, ArcGIS, Surfer, LaTeX, and Excel (w/VBA)

HOBBIES

In addition to my love for teaching and research, I am a husband and father of two, a musician (I play electric bass and acoustic guitar), an illustrator (primarily with pen and ink), an avid reader of popular science and historical fiction, and a lover of the New York Times Sunday crossword puzzle.