



INTEGRATED ENVIRONMENTAL MODELLING FRAMEWORK FOR CUMULATIVE EFFECTS ASSESSMENT

Authors: Anil Gupta, Babak Farjad, George Wang,
Hyung Eum, and Monique Dubé

ISBN 978-1-77385-199-0

THIS BOOK IS AN OPEN ACCESS E-BOOK. It is an electronic version of a book that can be purchased in physical form through any bookseller or on-line retailer, or from our distributors. Please support this open access publication by requesting that your university purchase a print copy of this book, or by purchasing a copy yourself. If you have any questions, please contact us at ucpress@ucalgary.ca

Cover Art: The artwork on the cover of this book is not open access and falls under traditional copyright provisions; it cannot be reproduced in any way without written permission of the artists and their agents. The cover can be displayed as a complete cover image for the purposes of publicizing this work, but the artwork cannot be extracted from the context of the cover of this specific work without breaching the artist's copyright.

COPYRIGHT NOTICE: This open-access work is published under a Creative Commons licence. This means that you are free to copy, distribute, display or perform the work as long as you clearly attribute the work to its authors and publisher, that you do not use this work for any commercial gain in any form, and that you in no way alter, transform, or build on the work outside of its use in normal academic scholarship without our express permission. If you want to reuse or distribute the work, you must inform its new audience of the licence terms of this work. For more information, see details of the Creative Commons licence at: <http://creativecommons.org/licenses/by-nc-nd/4.0/>

UNDER THE CREATIVE COMMONS LICENCE YOU MAY:

- read and store this document free of charge;
- distribute it for personal use free of charge;
- print sections of the work for personal use;
- read or perform parts of the work in a context where no financial transactions take place.

UNDER THE CREATIVE COMMONS LICENCE YOU MAY NOT:

- gain financially from the work in any way;
- sell the work or seek monies in relation to the distribution of the work;
- use the work in any commercial activity of any kind;
- profit a third party indirectly via use or distribution of the work;
- distribute in or through a commercial body (with the exception of academic usage within educational institutions such as schools and universities);
- reproduce, distribute, or store the cover image outside of its function as a cover of this work;
- alter or build on the work outside of normal academic scholarship.



Acknowledgement: We acknowledge the wording around open access used by Australian publisher, **re.press**, and thank them for giving us permission to adapt their wording to our policy <http://www.re-press.org>

7.0 REFERENCES

- Abatzoglou, J. T., & Brown, T. J. (2012). A comparison of statistical downscaling methods suited for wildfire applications. *International Journal of Climatology*, 32(5), 772-780.
- Ackermann, J. (1997). *Deposition of air pollutants to the Great Waters. Second report to Congress*. Research Triangle Park, NC: Office of Air Quality Planning and Standards, Environmental Protection Agency.
- Agarwal, C., Green, G. M., Grove, J. M., Evans, T. P., & Schweik, C. M. (2002). *A review and assessment of land-use change models: Dynamics of space, time, and human choice* (Vol. 297): Citeseer.
- Ahmed, F. (2013). Cumulative hydrologic impact of wetland loss: Numerical modelling study of the Rideau River Watershed, Canada. *Journal of Hydrologic Engineering*, 19(3), 593-606.
- Ahuja, L. R., Ascough II, J. C., & David, O. (2005). Developing natural resource models using the object modelling system: Feasibility and challenges. *Advances in Geosciences*, 4, 29-36.
- Aitken, B., & Sapach, R. (1994). *Northern River Basins Study Project Report No. 43, Hydraulic modelling of the Peace-Athabasca delta under modified and natural flow conditions*. Edmonton, AB: Northern River Basins Study. Prepared by Water Planning and Management Branch, Environment Canada.
- Alamdari, N., Sample, D. J., Steinberg, P., Ross, A. C., & Easton, Z. M. (2017). Assessing the Effects of Climate Change on Water Quantity and Quality in an Urban Watershed Using a Calibrated Stormwater Model. *Water*, 9(7), 464.
- Alberta Environment. (2000). *Industrial Release Limits Policy*. Edmonton, AB: Environmental Services Division, Alberta Environment.
- Alberta Environment. (2005). *Technology Based Standards for Pulp and Paper Mill Wastewater Releases*. Edmonton, AB: Government Alberta.
- Alberta Geological Survey (AGS). (2005). *Regional Groundwater Resource Appraisal, Cold Lake-Beaver River Drainage Basin, AB*. EUB/AGS Special Report 74, February 2005, 240 pp.

- Alberta Environmental Protection. (1995). *Water Quality Based Effluent Limits Procedures Manual*. Edmonton, AB.
- Al-Khudhairy, D., Thompson, J., Gavin, H., & Hamm, N. (1999). Hydrological modelling of a drained grazing marsh under agricultural land use and the simulation of restoration management scenarios. *Hydrological Sciences Journal*, 44(6), 943-971.
- Allam, A., Tawfik, A., Yoshimura, C., & Fleifle, A. (2016). Multi-objective models of waste load allocation toward a sustainable reuse of drainage water in irrigation. *Environmental Science and Pollution Research International*, 23(12), 11823-11834. doi:10.1007/s11356-016-6331-z
- Ambrose, R., & Wool, T. (2009). *WASP7 Stream transport-model theory and user's guide, supplement to water quality analysis simulation program (WASP) user documentation*. Athens, GA: National Exposure Research Laboratory, Office of Research and Development, US Environmental Protection Agency.
- Ambrose, R., Wool, T., Connolly, J., & Schanz, R. (1988). *WASP. 4, A hydrodynamic and water quality model, Report No. EPA/600/3-87/039*. Athens, GA: USEPA.
- AMEC Earth and Environment and Northwest Hydraulic Consultants Ltd. (AMEC-nhc). (2009). *Winter and summer hydrometric surveys and modelling in the Athabasca Delta – Hydrodynamic & habitat modelling report*. Edmonton, AB: Submitted to Cumulative Environmental Management Association (CEMA) for the Wood Buffalo Region, Edmonton, AB.
- Ameli, A. A., & Creed, I. F. (2017). Quantifying hydrologic connectivity of wetlands to surface water systems. *Hydrology and Earth System Sciences*, 21(3), 1791-1808. doi:10.5194/hess-21-1791-2017
- Amin, M. G. M., Veith, T. L., Collick, A. S., Karsten, H. D., & Buda, A. R. (2017). Simulating hydrological and nonpoint source pollution processes in a karst watershed: A variable source area hydrology model evaluation. *Agricultural Water Management*, 180, 212-223. doi:10.1016/j.agwat.2016.07.011
- Andrishak, R., Abarca, J. N., Wojtowicz, A., & Hicks, F. (2008). Freeze-up study on the lower Athabasca River (Alberta, Canada). Paper presented at the Proceedings of the 19th IAHR International Symposium on Ice: Using New Technology to Understand Water-Ice Interaction, Vancouver, BC, July 6 to 11, 2008.
- Andrishak, R., & Hicks, F. (2009). *Users' manual for the River1D Routing Model for the upper Peace-Athabasca Delta (PAD)*. Edmonton, AB: University of Alberta.
- Andrishak, R., & Hicks, F. (2011). Ice effects on flow distributions within the Athabasca Delta, Canada. *River Research and Applications*, 27(9), 1149-1158.
- Aquanty. (2015). *HGS User Manual*. Waterloo, ON: Aquanty Inc.
- Aquanty Inc. (2013). *High-resolution 3D analysis of the impact of climate change on surface water and groundwater resources in the Athabasca River Basin*. Waterloo, ON: Submitted to Suncor Energy Inc.

- Arnell, N., Hudson, D., & Jones, R. (2003). Climate change scenarios from a regional climate model: Estimating change in runoff in southern Africa. *Journal of Geophysical Research: Atmospheres*, 108(D16).
- Arnell, N. W. (1994). Hydrology and Climate Change. In P. Calow & G. E. Petts (Eds.), *The rivers handbook: Hydrological and ecological principles*, vol. 2 (pp. 173-186). Hoboken, NJ: Wiley.
- Arnold, C. L., Jr. & Gibbons, C. J. (1996). Impervious surface coverage: The emergence of a key environmental indicator. *Journal of the American Planning Association*, 62(2), 243-258, doi: 10.1080/01944369608975688
- Arnold, J., Williams, J., Srinivasan, R., King, K., & Griggs, R. (1994). *SWAT: Soil and water assessment tool*. Temple, TX: US Department of Agriculture, Agricultural Research Service, Grassland, Soil and Water Research Laboratory.
- Arnold, J. G., Srinivasan, R., Muttiah, R. S., & Williams, J. R. (1998). Large area hydrologic modelling and assessment part I: Model development. *JAWRA Journal of the American Water Resources Association*, 34(1), 73-89.
- ASCE (American Society of Civil Engineers). (2017). *Total maximum daily load analysis and modelling assessment of the practice*. Reston, VA: American Society of Civil Engineers.
- Ashraf, A., & Ahmad, Z. (2008). Regional groundwater flow modelling of Upper Chaj Doab of Indus Basin, Pakistan, using finite element model (Feflow) and geoinformatics. *Geophysical Journal International*, 173(1), 17-24. doi:10.1111/j.1365-246X.2007.03708.x
- Babendreier, J. E., & Castleton, K. J. (2005). Investigating uncertainty and sensitivity in integrated, multimedia environmental models: Tools for FRAMES-3MRA. *Environmental Modelling & Software*, 20(8), 1043-1055.
- Bahadur, R., Amstutz, D. E., & Samuels, W. B. (2013). Water contamination modeling—A review of the state of the science. *Journal of Water Resource and Protection*, 5(02), 142-155. doi:10.4236/jwarp.2013.52016
- Bahreman, A., De Smedt, F., Corluy, J., Liu, Y., Poorova, J., Velcicka, L., & Kunikova, E. (2007). WetSpa model application for assessing reforestation impacts on floods in Margecany–Hornad Watershed, Slovakia. *Water Resources Management*, 21(8), 1373-1391.
- Bajracharya, A. R., Bajracharya, S. R., Shrestha, A. B., & Maharjan, S. B. (2018). Climate change impact assessment on the hydrological regime of the Kaligandaki Basin, Nepal. *Science of the Total Environment*, 625, 837-848.
- Bailey, G. W., Mulkey, L. A., & Swank Jr, R. R. (1985). Environmental implications of conservation tillage: A systems approach. In F. M. D'Itri (Ed.), *A systems approach to conservation tillage* (pp. 239-265). Boca Raton, FL: Lewis Publishers, Inc.
- Di Baldassarre, G., Elshamy, M., van Griensven, A., Soliman, E., Kigobe, M., Ndomba, P., Mutemi, J., Mutua, F., Moges, S., Xuan, Y., Solomatine, D., & Uhlenbrook,

- S. (2011). Future hydrology and climate in the River Nile basin: A review. *Hydrological Sciences Journal*, 56(2), 199-211, DOI: Classification: Protected A. Retrieved from <https://doi.org/10.1080/02626667.2011.557378>
- Barron, O., Silberstein, R., Ali, R., Donohue, R., McFarlane, D., Davies, P., Donn, M. (2012). Climate change effects on water-dependent ecosystems in south-western Australia. *Journal of Hydrology*, 434, 95-109.
- Barthel, R., & Banzhaf, S. (2016). Groundwater and Surface Water Interaction at the Regional-scale—A Review with Focus on Regional Integrated Models. *Water Resources Management*, 30(1), 1-32. doi:10.1007/s11269-015-1163-z
- Bartholow, J. (2010). *Stream network and stream segment temperature models software*. Fort Collins, CO: Fort Collins Science Center. Retrieved from <https://www.sciencebase.gov/catalog/item/53ea4091e4b008eaa4f4c457>
- Bastin, L., Cornford, D., Jones, R., Heuvelink, G. B. M., Pebesma, E., Stasch, C., Williams, M. (2013). Managing uncertainty in integrated environmental modelling: The UncertWeb framework. *Environmental Modelling & Software*, 39, 116-134. doi:10.1016/j.envsoft.2012.02.008
- Baxter, W., Ross, W. A., & Spaling. (2001). Improving the practice of cumulative effects assessment in Canada. *Impact Assessment and Project Appraisal*, 19(4), 253-262.
- Beck, L., & Bernauer, T. (2011). How will combined changes in water demand and climate affect water availability in the Zambezi river basin? *Global Environmental Change*, 21(3), 1061-1072.
- Bedekar, V., Morway, E. D., Langevin, C. D., & Tonkin, M. J. (2016). *MT3D-USGS version 1: A US Geological Survey release of MT3DMS updated with new and expanded transport capabilities for use with MODFLOW*. Reston, VA: US Department of the Interior, US Geological Survey. doi:10.3133/tm6A53
- Bedri, Z., Corkery, A., O'Sullivan, J. J., Alvarez, M. X., Erichsen, A. C., Deering, L. A., & Masterson, B. (2014). An integrated catchment-coastal modelling system for real-time water quality forecasts. *Environmental Modelling & Software*, 61, 458-476. doi:10.1016/j.envsoft.2014.02.006
- Belete, G. F., Voinov, A., & Laniak, G. F. (2017). An overview of the model integration process: From pre-integration assessment to testing. *Environmental Modelling & Software*, 87, 49-63. doi:10.1016/j.envsoft.2016.10.013
- Benestad, R. E. (2011). A new global set of downscaled temperature scenarios. *Journal of Climate*, 24(8), 2080-2098.
- Bennett, K. E., Werner, A. T., & Schnorbus, M. (2012). Uncertainties in hydrologic and climate change impact analyses in headwater basins of British Columbia. *Journal of Climate*, 25(17), 5711-5730.
- Berger, C., & Wells, S. (2014). *Updating the CEMA Oil Sands Pit Lake Model*. Fort McMurray, AB: Cumulative Environmental Management Association (CEMA). Prepared by Scott A. Wells and Associates.

- Bergström, S., Carlsson, B., Gardelin, M., Lindström, G., Pettersson, A., & Rummukainen, M. (2001). Climate change impacts on runoff in Sweden—assessments by global climate models, dynamical downscaling and hydrological modelling. *Climate Research*, 16(2), 101-112.
- Bérubé, M. (2007). Cumulative effects assessments at Hydro-Québec: What have we learned? *Impact Assessment and Project Appraisal*, 25(2), 101-109.
- Betts, A. K., Ball, J. H., Beljaars, A., Miller, M. J., & Viterbo, P. A. (1996). The land surface-atmosphere interaction: A review based on observational and global modelling perspectives. *Journal of Geophysical Research: Atmospheres*, 101(D3), 7209-7225.
- Betts, R. A. (2000). Offset of the potential carbon sink from boreal forestation by decreases in surface albedo. *Nature*, 408(6809), 187.
- Beven, K., & Binley, A. (1992). The future of distributed models: Model calibration and uncertainty prediction. *Hydrological Processes*, 6(3), 279-298.
- Beven, K. (2001). How far can we go in distributed hydrological modelling? *Hydrology and Earth System Sciences Discussions, European Geosciences Union*, 5(1), 1-12.
- Bhattacharjya, R. K. (2011). Solving Groundwater Flow Inverse Problem Using Spreadsheet Solver. *Journal of Hydrologic Engineering*, 16(5). Retrieved from [https://doi.org/10.1061/\(ASCE\)HE.1943-5584.0000329](https://doi.org/10.1061/(ASCE)HE.1943-5584.0000329)
- Bhowmick, A., Irvine, K., & Jindal, R. (2017). Mathematical modeling of effluent quality of Cha-Am Municipality wastewater treatment pond system using PCSWMM. *Journal of Water Management Modelling*, 25(C423). doi: 10.14796/JWMM.C423
- Bicknell, B., Imhoff, J., Kittle, J., Jobs, T., & Donigan, A. (2005). *Hydrological Simulation Program—FORTRAN: HSPF version 12.2 user's manual*, Athens, GA.
- Bingli, L., Huang, S., Min, Q., Tianyun, L., & Zijian, W. (2008). Prediction of the environmental fate and aquatic ecological impact of nitrobenzene in the Songhua River using the modified AQUATOX model. *Journal of Environmental Sciences*, 20(7), 769-777.
- Bingner, R., Theurer, F., & Yuan, Y. (2015). *AnnAGNPS Technical Processes: Technical Documentation. Version 5.4*. Retrieved from https://www.wcc.nrcs.usda.gov/ftpref/wntsc/H&H/AGNPS/downloads/AnnAGNPS_Technical_Documentation.pdf
- Bixio, A., Gambolati, G., Paniconi, C., Putti, M., Shestopalov, V., Bublías, V., & Rudenko, Y. (2002). Modelling groundwater-surface water interactions including effects of morphogenetic depressions in the Chernobyl exclusion zone. *Environmental Geology*, 42(2-3), 162-177. doi:10.1007/s00254-001-0486-7
- Blöschl, G., Ardoin-Bardin, S., Bonell, M., Dorninger, M., Goodrich, D., Gutknecht, D., & Szolgay, J. (2007). At what scales do climate variability and land cover change impact on flooding and low flows? *Hydrological Processes*, 21(9), 1241-1247.

- Bockstael, N. E., & Irwin, E. G. (2000). Economics and the land use. Environment link I. In T. Tietinberg & H. Folmer, (Eds.), *International yearbook of environmental and resource economics*. Cheltenham, UK: Edward Edgar.
- Bobba, A. G. (2012). Ground water-surface water interface (GWSWI) modelling: Recent advances and future challenges. *Water Resources Management*, 26(14), 4105-4131.
- Bonan, G. B. (1997). Effects of land use on the climate of the United States. *Climatic Change*, 37(3), 449-486.
- Bonan, G. B. (1999). Frost followed the plow: Impacts of deforestation on the climate of the United States. *Ecological Applications*, 9(4), 1305-1315.
- Bonsal, B. R., & Cuell, C. (2017). Hydro-climatic variability and extremes over the Athabasca River basin: Historical trends and projected future occurrence. *Canadian Water Resources Journal*, 42(4), 1-21. doi:10.1080/07011784.2017.1328288
- Booty, W., & Benoy, G. (2009). Multicriteria review of nonpoint source water quality models for nutrients, sediments, and pathogens. *Water Quality Research Journal*, 44(4), 365-377.
- Borah, D. K., & Bera, M. (2004). Watershed-scale hydrologic and nonpoint-source pollution models: Review of applications. *Transactions of the ASAE*, 47(3), 789-803. doi:https://doi.org/10.13031/2013.16110
- Bormann, H., Breuer, L., Gräff, T., Huisman, J., & Croke, B. (2009). Assessing the impact of land use change on hydrology by ensemble modelling (LUCHEM) IV: Model sensitivity to data aggregation and spatial (re-) distribution. *Advances in Water Resources*, 32(2), 171-192.
- Bosch, J. M., & Hewlett, J. (1982). A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration. *Journal of Hydrology*, 55(1-4), 3-23.
- Bosson, E., Sassner, M., Sabel, U., & Gustafsson, L.-G. (2010). *Modelling of present and future hydrology and solute transport at Forsmark. SR-Site Biosphere*. Stockholm, Sweden: Swedish Nuclear Fuel and Waste Management Co.
- Bourauoi, F., Vachaud, G., Li, L., Le Treut, H., & Chen, T. (1999). Evaluation of the impact of climate changes on water storage and groundwater recharge at the watershed scale. *Climate Dynamics*, 15(2), 153-161.
- Box, G., & Draper, N. (1987). *Empirical model-building and response surfaces*. Wiley series in probability and statistics, vol. 157. Hoboken, NJ: Wiley.
- Boyer, C., Chaumont, D., Chartier, I., & Roy, A. G. (2010). Impact of climate change on the hydrology of St. Lawrence tributaries. *Journal of Hydrology*, 384(1-2), 65-83.
- Boyer, E. W., Goodale, C. L., Jaworski, N. A., & Howarth, R. W. (2002). Anthropogenic nitrogen sources and relationships to riverine nitrogen export in the

- northeastern USA. In E. W. Boyer & R. W. Haworth (Eds.), *The nitrogen cycle at regional to global scales* (pp. 137-169). Dordrecht: Springer.
- Braimoh, A. K. (2007). Spatial determinants of land-use change in Lagos, Nigeria. *Land Use Policy* 24(2), 502-515.
- Braimoh, A. K., & Vlek, P. L. G. (2004). Scale-dependent relationships between land-use change and its determinants in the Volta Basin of Ghana. *Earth Interact* 8(4), 1-23.
- Breuer, L., Huisman, J., Willems, P., Bormann, H., Bronstert, A., Croke, B., & Jakeman, A. (2009). Assessing the impact of land use change on hydrology by ensemble modelling (LUCHEM). I: Model intercomparison with current land use. *Advances in Water Resources*, 32(2), 129-146.
- Brown, D. G., Pijanowski, B. C., & Duh, J. (2000). Modelling the relationships between land use and land cover on private lands in the Upper Midwest, USA. *Journal of Environmental Management*, 59(4), 247-263.
- Brown, K. G., & Flach, G. P. (2009). *Review of integrating programs and code structures used for DOE environmental assessment* (CBP-TR-2009-002, Rev 0). Retrieved from http://www-pub.iaea.org/MTCD/Publications/PDF/TE-1701_add-CD/PDF/USA%20Attachment%2011.pdf
- Brown, L. C., & Barnwell, T. O. (1987). *The enhanced stream water quality models QUAL2E and QUAL2E-UNCAS: Documentation and user model*. Athens, GA: Environmental Research Laboratory, Office of Research and Development, US Environmental Protection Agency.
- Brown, S., Saito, L., Knightes, C., & Gustin, M. (2007). Calibration and evaluation of a mercury model for a western stream and constructed wetland. *Water, Air, and Soil Pollution*, 182(1-4), 275-290.
- Bruijnzeel, L. A. (1990). *Hydrology of moist tropical forests and effects of conversion: A state of knowledge review*. Amsterdam, Netherlands: Faculty of Earth Sciences, Free University.
- Brunner, G. W. (2016). *HEC-RAS river analysis system user's manual version 5.0*. Davis, CA: US Army Corps of Engineers Institute for Water Resources, Hydrologic Engineering Center.
- Bryan, R. B. (2000). Soil erodibility and processes of water erosion on hillslope. *Geomorphology*, 32(3-4), 385-415.
- Burian, S. J., McPherson, T. N., Brown, M. J., Streit, G. E., & Turin, H. (2002). Modelling the effects of air quality policy changes on water quality in urban areas. *Environmental Modelling and Assessment*, 7(3), 179-190.
- Burris, R., & Canter, L. W. (1997). Cumulative impacts are not properly addressed in environmental assessments. *Environmental Impact Assessment Review*, 17(1), 5-18.

- Cabrejo, E. (2011). Mercury interactions with suspended solids at the Upper East Fork Poplar Creek, Oak Ridge, Tennessee. FIU Electronic Theses and Dissertations. 1953. <https://digitalcommons.fiu.edu/etd/1953>
- Calder, I. R. (1998). *Water-resource and land-use issues*. SWIM paper no. 3. Colombo, Sri Lanka: International Water Management Institute.
- Calder, I. R. (2003). Assessing the water use of short vegetation and forests: Development of the Hydrological Land Use Change (HYLUC) model. *Water Resources Research*, 39(11).
- Campbell, J. L., Driscoll, C. T., Pourmokhtarian, A., & Hayhoe, K. (2011). Streamflow responses to past and projected future changes in climate at the Hubbard Brook Experimental Forest, New Hampshire, United States. *Water Resources Research*, 47(2). Retrieved from <https://doi.org/10.1029/2010WR009438>
- Canter, L.W. (1999). "Cumulative Effects Assessment." In J. Petts (Ed.), *Handbook of environmental impact assessment*, vol. 1 (pp. 405-440). Oxford: Blackwell Science.
- Chambers, P. A., Pietroniro, A., Scrimgeour, G. J., & Ferguson, M. (1996). *Assessment and validation of modelling under-ice dissolved oxygen using DOSTOC, Athabasca River, 1988 to 1994*. Northern River Basins Study Project Report No. 95. Edmonton, AB: Northern River Basins Study. Prepared by National Hydrology Research Institute, Environment Canada.
- Cañón, J., Domínguez, F., & Valdés, J. B. (2011). Downscaling climate variability associated with quasi-periodic climate signals: New statistical approach using MSSA. *Journal of Hydrology*, 398(1-2), 65-75.
- Carpenter, T. M., & Georgakakos, K. P. (2006). Intercomparison of lumped versus distributed hydrologic model ensemble simulations on operational forecast scales. *Journal of Hydrology*, 329(1), 174-185.
- Castendyk, D. N., Balistrieri, L. S., Gammons, C., & Tucci, N. (2015). Modelling and management of pit lake water chemistry 2: Case studies. *Applied Geochemistry*, 57, 289-307. doi:10.1016/j.apgeochem.2014.09.003
- Castendyk, D. N., Eary, L. E., & Balistrieri, L. S. (2015). Modelling and management of pit lake water chemistry 1: Theory. *Applied Geochemistry*, 57, 267-288. doi:10.1016/j.apgeochem.2014.09.004
- Castronova, A. M., Goodall, J. L., & Ercan, M. B. (2013). Integrated modeling within a Hydrologic Information System: An OpenMI based approach. *Environmental Modelling & Software*, 39, 263-273. <https://doi.org/10.1016/j.envsoft.2012.02.011>
- CEMA (Cumulative Environmental Management Association). (2014). *Review of potential cumulative impacts to surface water and groundwater from current and proposed in-situ oil sands operations*. Report prepared by SNC-Lavalin for the Groundwater Technical Group CEMA.

- CEMA (Cumulative Environmental Management Association). (2016). *Phase 2 review of potential cumulative effects to surface water and groundwater from in-situ oil sands operations, focusing on the MacKay River Watershed*. Report prepared by Earth FX for CEMA-Water Working Group.
- CEQ (Council on Environmental Quality). (1997). *Considering cumulative effects under the National Environmental Policy Act*. Washington DC: Council on Environmental Quality, Executive Office of the President.
- Cerco, C. F., & Cole, T. (1995). *User's guide to the CE-QUAL-ICM three-dimensional eutrophication model: Release version 1.0*. Vicksburg, MS: US Army Engineer Waterways Experiment Station.
- Chambers, P. A., Pietroniro, A., Scrimgeour, G. J., & Ferguson, M. (1996). *Assessment and validation of modelling under-ice dissolved oxygen using DOSTOC, Athabasca River, 1988 to 1994*. Northern River Basins Study project report no. 95. Edmonton, AB: Northern River Basins Study. Prepared by National Hydrology Research Institute, Environment Canada.
- Chang, H., & Jung, I.-W. (2010). Spatial and temporal changes in runoff caused by climate change in a complex large river basin in Oregon. *Journal of Hydrology*, 388(3-4), 186-207.
- Chapra, S. C., & Pelletier, G. (2003). *QUAL2K: A modelling framework for simulating river and stream water quality: Documentation and users manual*. Medford, MA: Civil and Environmental Engineering Dept., Tufts University.
- Charles Howard and Associates Ltd. (1984). *Athabasca River Basin implementation of the WQRRS model*. Prepared for Alberta Environment.
- Chen, J., Brissette, F. P., Poulin, A., & Leconte, R. (2011). Overall uncertainty study of the hydrological impacts of climate change for a Canadian watershed. *Water Resources Research*, 47(12).
- Chen, S.-T., Yu, P.-S., & Tang, Y.-H. (2010). Statistical downscaling of daily precipitation using support vector machines and multivariate analysis. *Journal of Hydrology*, 385(1-4), 13-22. Retrieved from <https://doi.org/10.1016/j.jhydrol.2010.01.021>
- Chen, Y., Ale, S., Rajan, N., & Munster, C. (2017). Assessing the hydrologic and water quality impacts of biofuel-induced changes in land use and management. *GCB Bioenergy*, 9(9), 1461-1475. doi:10.1111/gcbb.12434
- Cheng, G. H., Huang, G. H., Dong, C., Zhu, J. X., Zhou, X., & Yao, Y. (2017). An evaluation of CMIP5 GCM simulations over the Athabasca River Basin, Canada. *River Research and Applications*, 33(5), 823-843. doi:10.1002/rra.3136
- Cherkauer, K. A., & Sinha, T. (2010). Hydrologic impacts of projected future climate change in the Lake Michigan region. *Journal of Great Lakes Research*, 36, 33-50.
- Chinyama, A., Ochieng, G. M., Nhapi, I., & Otieno, F. A. O. (2014). A simple framework for selection of water quality models. *Reviews in Environmental Science and Bio/Technology*, 13(1), 109-119. doi:10.1007/s11157-013-9321-3

- Cho, E., Arhonditsis, G. B., Khim, J., Chung, S., & Heo, T.-Y. (2016). Modelling metal-sediment interaction processes: Parameter sensitivity assessment and uncertainty analysis. *Environmental Modelling & Software*, 80, 159-174.
- Cho, K. H., Pachepsky, Y. A., Oliver, D. M., Muirhead, R. W., Park, Y., Quilliam, R. S., & Shelton, D. R. (2016). Modelling fate and transport of fecally-derived microorganisms at the watershed scale: State of the science and future opportunities. *Water Research*, 100, 38-56.
- Cho, S., Vijayaraghavan, K., Spink, D., Jung, J., Morris, R., & Pauls, R. (2017). Assessment of regional acidifying pollutants in the Athabasca oil sands area under different emission scenarios. *Atmospheric Environment*, 156, 160-168. doi:10.1016/j.atmosenv.2017.02.038
- Chowdhury, E. H., Hassan, Q. K., Achari, G., & Gupta, A. (2017). Use of bathymetric and LiDAR data in generating digital elevation model over the Lower Athabasca River Watershed in Alberta, Canada. *Water*, 9,19.
- Christensen, J. H., Carter, T. R., Rummukainen, M., & Amanatidis, G. (2007). Evaluating the performance and utility of regional climate models: The PRUDENCE project. *Climatic Change*, 81, 1-6.
- Christensen, N., & Lettenmaier, D. P. (2006). A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River Basin. *Hydrology and Earth System Sciences Discussions*, 3(6), 3727-3770.
- Chunn, D., Faramarzi, M., Smerdon, B., & Alessi, D. S. J. W. (2019). Application of an integrated SWAT-MODFLOW model to evaluate potential impacts of climate change and water withdrawals on groundwater-Surface water interactions in West-Central Alberta. *Water*, 11(1), 110.
- Clark, M. P., et al. (2017). The evolution of process-based hydrologic models: Historical challenges and the collective quest for physical realism. *Hydrology and Earth System Sciences (online)*, 21(LA-UR-17-27603). doi:10.5194/hess-2016-693
- Coe, M. T., Latrubesse, E. M., Ferreira, M. E., & Amsler, M. L. The effects of deforestation and climate variability on the streamflow of the Araguaia River, Brazil. *Biogeochemistry* 105(1-3), 119-131. doi: 10.1007/s10533-011-9582-2
- Cohen, Y. (2012). *Pollutants in a multimedia environment*. Berlin & New York: Springer Science & Business Media.
- Cole, T. M., & Wells, S. A. (2017). *CE-QUAL-W2: A two-dimensional, laterally averaged, hydrodynamic and water quality model, version 4.1*. Portland, OR: Department of Civil and Environmental Engineering, Portland State University.
- Connolly, J. P., Zahakos, H. A., Benaman, J., Ziegler, C. K., Rhea, J. R., & Russell, K. (2000). A model of PCB fate in the Upper Hudson River. *Environmental Science & Technology*, 34(19), 4076-4087.
- Cools, J., Broekx, S., Vandenbergh, V., Sels, H., Meynaerts, E., Vercaemst, P., & Huygens, M. (2011). Coupling a hydrological water quality model and an

economic optimization model to set up a cost-effective emission reduction scenario for nitrogen. *Environmental Modelling & Software*, 26(1), 44-51. doi:10.1016/j.envsoft.2010.04.017

- Cooper, L. M. (2004). *Guidelines for cumulative effects assessment in SEA of plans*. EPMG occasional paper 04/LMC/CEA. London, UK: Imperial College London.
- Cooper, C. F., & Jolly, W. C. (1969). *Ecological effects of weather modification: A problem analysis*. Ann Arbor, MI: The University of Michigan School of Natural Resources. Department of Resource Planning and Conservation.
- Cooper, L. M., & Sheate, W. R. (2002). Cumulative effects assessment: A review of UK environmental impact statements. *Environmental Impact Assessment Review*, 22(4), 415-439.
- Cormier, S. M., Smith, M., Norton, S, and Neiheisel, T. (2000). Assessing ecological risk in watersheds: A case study of problem formulation in the Big Darby Creek watershed, Ohio, USA. *Environmental Toxicology and Chemistry*, 19, 1082-1096. doi:10.1002/etc.5620190439
- Cornelissen, T., Diekkrüger, B., & Giertz, S. (2013). A comparison of hydrological models for assessing the impact of land use and climate change on discharge in a tropical catchment. *Journal of Hydrology*, 498, 221-236.
- Cox, T. J., Rutherford, J. C., Kerr, S. C., Smeaton, D. C., & Palliser, C. C. (2013). An integrated model for simulating nitrogen trading in an agricultural catchment with complex hydrogeology. *Journal of Environmental Management*, 127, 268-277. doi:10.1016/j.jenvman.2013.05.022
- Craig, J., Hamrick, J., King, A., Carter, S., Kozelka, P., & Nye, L. (2007). Development of a linked watershed and receiving water modelling system of Los Angeles and Long Beach Harbors for TMDL development. *Proceedings of the Water Environment Federation*, 2007(5), 1326-1346.
- Craig, P. M. (2006). *Tenkiller Ferry Lake water quality modeling analysis in support of TMDL development for Tenkiller Ferry Lake and the Illinois River Watershed in Oklahoma: EFDC model calibration*. Seattle, WA: Prepared by Dynamic Solutions, LLC for Oklahoma Department of Environmental Quality.
- Croke, B. F., & Jakeman, A. J. (2004). A catchment moisture deficit module for the IHACRES rainfall-runoff model. *Environmental Modelling & Software*, 19(1), 1-5.
- Croke, B. F., & Jakeman, A. J. (2004). Use of the IHACRES rainfall-runoff model in arid and semi-arid regions. In H. Whrater, S. Sorooshian, & K. Sharma (Eds.), *Hydrological Modelling in Arid and Semi-arid Areas* (International Hydrology series) (pp. 41-48). Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511535734.005
- Culp, J. M., & Chambers, P. A. (1994). *Proceedings of a workshop on water quality modelling for the Northern River Basins Study, March 22-23, 1993*. Northern River Basins Study project report no. 37. Edmonton, AB: Northern River Basins

Study. Prepared by National Hydrology Research Institute, Environment Canada.

- Cuo, L., Beyene, T. K., Voisin, N., Su, F., Lettenmaier, D. P., Alberti, M., & Richey, J. E. (2011). Effects of mid-twenty-first century climate and land cover change on the hydrology of the Puget Sound basin, Washington. *Hydrological Processes*, 25(11), 1729-1753.
- Cuo, L., Lettenmaier, D. P., Alberti, M., & Richey, J. E. (2009). Effects of a century of land cover and climate change on the hydrology of the Puget Sound basin. *Hydrological Processes*, 23(6), 907-933.
- Dai, T., & Labadie, J. W. (1997). *Integration of water quantity/quality in river basin network flow modeling*. Fort Collins, CO: Colorado Water Resources Research Institute, Colorado State University.
- Dai, T., & Labadie, J. W. (2001). River basin network model for integrated water quantity/quality management. *Journal of Water Resources Planning and Management*, 127(5), 295-305.
- Daloğlu, I., Nassauer, J. I., Riolo, R., & Scavia, D. (2014). An integrated social and ecological modelling framework—Impacts of agricultural conservation practices on water quality. *Ecology and Society*, 19(3), 12. doi:10.5751/es-06597-190312
- Dams, J., Woldeamlak, S., & Batelaan, O. (2008). Predicting land-use change and its impact on the groundwater system of the Kleine Nete catchment, Belgium. *Hydrology and Earth System Sciences*, 12, 1369-1385.
- Daniel, C. (2011). *State-and-transition models: Potential role in the development of a reclamation classification system*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Apex Resource Management Solutions Ltd.
- Das, A., Rokaya, P., & Lindenschmidt, K.-E. (2017). Assessing the impacts of climate change on ice jams along the Athabasca River at Fort McMurray, Alberta, Canada. Paper presented at the 19th CRIPE workshop on the Hydraulics of Ice Covered Rivers, Whitehorse, YT, Canada.
- Davies, M., & Boulton, W. (2003). *Predicted ambient concentrations and deposition of priority substances released to the air in the oil sands region*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by RWDI West Inc.
- Davison, J. H., Hwang, H.-T., Sudicky, E. A., Mallia, D. V., & Lin, J. C. (2017). Full coupling between the atmosphere, surface, and subsurface for integrated hydrologic simulation. *Journal of Advances in Modeling Earth Systems*, 10(1), 43-53. Retrieved from <https://doi.org/10.1002/2017MS001052>
- Dayyani, S., Daly, G., & Vandenberg, J. (2016). Approach to assessing the effects of aerial deposition on water quality in the Alberta Oil Sands Region. *Water Environment Research*, 88(2), 175-189.

- DeFries, R., & Eshleman, K. N. (2004). Land-use change and hydrologic processes: A major focus for the future. *Hydrological Processes*, 18(11), 2183-2186.
- Deitch, M. J., Merenlender, A. M., & Feirer, S. (2013). Cumulative effects of small reservoirs on streamflow in Northern Coastal California catchments. *Water Resources Management*, 27(15), 5101-5118.
- Dennis, R. L. (1997). Using the regional acid deposition model to determine the nitrogen deposition airshed of the Chesapeake Bay watershed. In J. E. Baker (Ed.), *Atmospheric deposition of contaminants to the Great Lakes and coastal waters* (pp. 393-413). Pensacola, FL: Society of Environmental Toxicology and Chemistry Press.
- Déqué, M., Rowell, D., Lüthi, D., Giorgi, F., Christensen, J., Rockel, B., & van den Hurk, B. (2007). An intercomparison of regional climate simulations for Europe: Assessing uncertainties in model projections. *Climatic Change*, 81, 53-70.
- Dhami, B. S., & Pandey, A. (2013). Comparative review of recently developed hydrologic models. *Journal of Indian Water Resources Society*, 33(3).
- DHI. (2016). *FEFLOW 7.0 user guide* (November 2015 ed.). Horsholm, Denmark: DHI Water & Environment.
- DHI. (2017a). *MIKE 11—a modelling system for rivers and channels: Reference manual*. Horsholm, Denmark: DHI Water & Environment.
- DHI. (2017b). *MIKE HYDRO river user guide*. Horsholm, Denmark: DHI Water & Environment.
- DHI. (2017c). *MIKE SHE user manual, volume 1: User guide*. Horsholm, Denmark: DHI Water & Environment.
- DHI. (2017d). *MIKE SHE user manual, volume 2: Reference guide*. Horsholm, Denmark: DHI Water & Environment.
- Di Baldassarre, G., Elshamy, M., van Griensven, A., Soliman, E., Kigobe, M., Ndomba, P., & Xuan, Y. (2011). Future hydrology and climate in the River Nile basin: A review. *Hydrological Sciences Journal—Journal des Sciences Hydrologiques*, 56(2), 199-211.
- Dibike, Y., Shakibaeinia, A., Eum, H., Prowse, T., & Droppo, I. (2018). Effects of projected climate on the hydrodynamic and sediment transport regime of the lower Athabasca River in Alberta, Canada. *River Research and Applications*, 34(5), 417-429.
- Di Toro, D. M., Fitzpatrick, J. J., & Thomann, R. V. (1983). *Documentation for water quality analysis simulation program (WASP) and model verification program (MVP)*. Washington, DC: US Environmental Protection Agency, EPA/600/3-81/044.
- Diersch, H.-J. (2014). *FEFLOW*. Berlin & Heidelberg: Springer-Verlag.
- Dinar, A., Rosegrant, M. W., & Meinzen-Dick, R. S. (1997). *Water allocation mechanisms: Principles and examples*. Washington, DC: The World Bank.

- Dobler, C., Bürger, G., & Stötter, J. (2012). Assessment of climate change impacts on flood hazard potential in the Alpine Lech watershed. *Journal of Hydrology*, 460, 29-39. <https://doi.org/10.1016/j.jhydrol.2012.06.027>
- Dochinger, L. S. (1968). The impact of air pollution on eastern white pine: The chlorotic dwarf disease. *Journal of the Air Pollution Control Association*, 18(12), 814-816.
- Douglas-Mankin, K., Srinivasan, R., & Arnold, J. (2010). Soil and Water Assessment Tool (SWAT) model: Current developments and applications. *Transactions of the ASABE*, 53(5), 1423-1431.
- Droppo, I. G., & Krishnappan, B. G. (2016). Modelling of hydrophobic cohesive sediment transport in the Ells River, Alberta, Canada. *Journal of Soils and Sediments*, 16(12), 2753-2765.
- Droppo, I. G., Prowse, T., Bonsal, B., Dibike, Y., Beltaos, S., Krishnappan, B., Eum, H-I., Kashyap, S., Shakibaenia, A., & Gupta, A. (2018). *Regional hydro-climatic and sediment modelling*. Oil Sands Monitoring Program Technical Series no. 1.6.
- DSI (Dynamic Solutions-International LLC). (2012). *Lower Athabasca River water quality model scoping study-Draft*. Seattle, WA: Submitted to Government of Alberta Environment and Water.
- DSI. (2017). *EEMS knowledge base*. Retrieved from <https://www.eemodellingsystem.com/ee-modelling-system>.
- DSI. (2019). *Two-dimensional hydrodynamic, sediment transport and water quality model development for the Lower Athabasca River-Model calibration and validation report*. Submitted to Environmental Monitoring and Science Division, Alberta Environment and Parks, Calgary, AB. September 2019.
- Dubé, M., & Munkittrick, K. (2001). Integration of effects-based and stressor-based approaches into a holistic framework for cumulative effects assessment in aquatic ecosystems. *Human and Ecological Risk Assessment*, 7(2), 247-258.
- Dubé, M. G., Duinker, P., Greig, L., Carver, M., Servos, M., McMaster, M., & Munkittrick, K. R. (2013). A framework for assessing cumulative effects in watersheds: An introduction to Canadian case studies. *Integrated Environmental Assessment and Management*, 9(3), 363-369.
- Dunn, S., Brown, I., Sample, J., & Post, H. (2012). Relationships between climate, water resources, land use and diffuse pollution and the significance of uncertainty in climate change. *Journal of Hydrology*, 434, 19-35.
- Dunn, S., & Mackay, R. (1995). Spatial variation in evapotranspiration and the influence of land use on catchment hydrology. *Journal of Hydrology*, 171(1-2), 49-73.
- Edinger, J., & Buchak, E. (1975). *A hydrodynamic, two-dimensional reservoir model: The computational basis*. Cincinnati, OH: US Army Engineer Division.
- Ekström, M., Grose, M. R., & Whetton, P. H. (2015). An appraisal of downscaling methods used in climate change research. *Wiley Interdisciplinary Reviews: Climate Change*, 6(3), 301-319.

- El-Nasr, A. A., Arnold, J. G., Feyen, J., & Berlamont, J. (2005). Modelling the hydrology of a catchment using a distributed and a semi-distributed model. *Hydrological Processes*, 19(3), 573-587.
- England, C. B. (1975). Soil moisture accounting component of the USDAHL-74 model of watershed hydrology. *Journal of the American Water Resources Association*, 11(3), 559-657. Retrieved from <https://doi.org/10.1111/j.1752-1688.1975.tb00709.x>
- Environmental and Hydraulics Laboratory. (1986). *CE-QUAL-W2: A numerical two-dimensional, laterally averaged model of hydrodynamics and water quality: User's manual*. Vicksburg, MS: US Army Engineer Waterways Experiment Station.
- ENVIRON International Corporation, & Stantec Consulting Ltd. (2012). *Comparison of CALPUFF and CMAQ applications for 2006 in the context of the CEMA acid deposition management framework*. Prepared for Cumulative Environmental Management Association Air Working Group, Fort McMurray, AB. April 13, 2012.
- Erler, A. R., Peltier, W. R., & D'Orgeville, M. (2015). Dynamically downscaled high-resolution hydroclimate projections for western Canada. *Journal of Climate*, 28(2), 423-450.
- Exponent Inc. (2014). *CALPUFF modeling to estimate acid deposition inputs for the MAGIC model*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Exponent Inc.
- Eum, H.-I., Yonas, D., & Prowse, T. (2014). Uncertainty in modelling the hydrologic responses of a large watershed: A case study of the Athabasca River basin, Canada. *Hydrological Processes*, 28(14), 4272-4293. doi:10.1002/hyp.10230
- Famiglietti, J., & Wood, E. (1994). Multiscale modelling of spatially variable water and energy balance processes. *Water Resources Research*, 30(11), 3061-3078.
- Fan, M., & Shibata, H. (2015). Simulation of watershed hydrology and stream water quality under land use and climate change scenarios in Teshio River watershed, northern Japan. *Ecological Indicators*, 50, 79-89. doi:10.1016/j.ecolind.2014.11.003
- Fant, C., Srinivasan, R., Boehlert, B., Rennels, L., Chapra, S., Strzepek, K., & Martinich, J. (2017). Climate change impacts on US water quality using two models: HAWQS and US basins. *Water*, 9(2), 118. doi:10.3390/w9020118
- Faramarzi, M., Abbaspour, K. C., Adamowicz, W. L., Lu, W., Fennell, J., Zehnder, A. J. B., & Goss, G. G. (2017). Uncertainty based assessment of dynamic freshwater scarcity in semi-arid watersheds of Alberta, Canada. *Journal of Hydrology: Regional Studies*, 9, 48-68. doi:10.1016/j.ejrh.2016.11.003
- Farjad, B., Gupta, A., & Marceau, D. J. (2015). Hydrological regime responses to climate change for the 2020s and 2050s periods in the Elbow River watershed in southern Alberta, Canada. In M. Ramkumar, K. Kumaraswamy & R. Mohanraj (Eds.), *Environmental management of river basin ecosystems* (pp. 65-89). Springer Earth System Sciences.

- Farjad, B., Gupta, A., & Marceau, D. J. (2016). Annual and seasonal variations of hydrological processes under climate change scenarios in two sub-catchments of a complex watershed. *Water Resources Management*, 30(8), 2851-2865.
- Farjad, B., Gupta, A., Razavi, S., Faramarzi, M., & Marceau, D. (2017a). An integrated modelling system to predict hydrological processes under climate and land-use/cover change scenarios. *Water*, 9(10), 767. doi:10.3390/w9100767
- Farjad, B., Pooyandeh, M., Gupta, A., Motamedi, M., & Marceau, D. (2017b). Modelling interactions between land use, climate, and hydrology along with stakeholders' negotiation for water resources management. *Sustainability*, 9(11), 2022.
- Farjad, B., Gupta, A., Sartipzadeh, H., & Cannon, A. J. (2019). A novel approach for selecting extreme climate change scenarios for climate change impact studies. *Science of The Total Environment*, 678, 476-485.
- Faucher, M., Burrows, W. R., & Pandolfo, L. (1999). Empirical-statistical reconstruction of surface marine winds along the western coast of Canada. *Climate Research*, 11(3), 173-190.
- Feddema, J. J., Oleson, K. W., Bonan, G. B., Mearns, L. O., Buja, L. E., Meehl, G. A., & Washington, W. M. (2005). The importance of land-cover change in simulating future climates. *Science*, 310(5754), 1674-1678.
- Feyen, L., Vázquez, R., Christiaens, K., Sels, O., & Feyen, J. (2000). Application of a distributed physically-based hydrological model to a medium size catchment. *Hydrology and Earth System Sciences*, 4(1), 47-63.
- Filipović, V. (2013). Numerical modelling of water flow and contaminant (nitrates) transport in agriculture. *Agriculturae Conspectus Scientificus*, 78(2), 79-84.
- Findell, K. L., Shevliakova, E., Milly, P. C. D., & Stouffer, R. J. (2007). Modeled impact of anthropogenic land cover change on climate. *Journal of Climate*, 20(14), 3621-3634. Retrieved from <https://doi.org/10.1175/JCLI4185.1>
- Findell, K. L., Pitman, A. J., England, M. H., & Pegion, P. J. (2009). Regional and global impacts of land cover change and sea surface temperature anomalies. *Journal of Climate*, 22(12), 3248-3269.
- Findell, K. L., Shevliakova, E., Milly, P., & Stouffer, R. J. (2007). Modeled impact of anthropogenic land cover change on climate. *Journal of Climate*, 20(14), 3621-3634.
- Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Gibbs, H. K. (2005). Global consequences of land use. *Science*, 309(5734), 570-574.
- Forbes, K. A., Kienzle, S. W., Coburn, C. A., Byrne, J. M., & Rasmussen, J. (2011). Simulating the hydrological response to predicted climate change on a watershed in southern Alberta, Canada. *Climatic Change*, 105(3-4), 555-576. <https://doi.org/10.1007/s10584-010-9890-x>
- Forster, P., Ramaswamy, V., Artaxo, P., Berntsen, T., Betts, R., Fahey, D. W., & Myhre, G. (2007). Changes in atmospheric constituents and in radiative forcing. Chapter

2 in S. Solomon et al. (Eds.), *Climate change 2007–The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the IPCC.* Published for the Intergovernmental Panel on Climate Change by Cambridge University Press.

- Four Elements Consulting Ltd. (2014). *Regional substance load allocation study for the Athabasca River–Phase 2.* (S. t. C. s. O. S. I. Alliance Ed.). Calgary, AB.
- Four Elements Consulting Ltd. (2014). *Regional Substance Load Allocation Study for the Athabasca River Supporting Information* (S. t. C. s. O. S. I. Alliance Ed.). Calgary, AB.
- Fowler, H. J., Blenkinsop, S., & Tebaldi, C. (2007). Linking climate change modelling to impacts studies: Recent advances in downscaling techniques for hydrological modelling. *International Journal of Climatology*, 27(12), 1547-1578.
- Fredkin, E. (1990). An informational process based on reversible universal cellular automata. *Physica D: Nonlinear Phenomena*, 45(1-3), 254-270. [https://doi.org/10.1016/0167-2789\(90\)90186-S](https://doi.org/10.1016/0167-2789(90)90186-S)
- Freeze, R. A., & Harlan, R. L. (1969). Blueprint for a physically-based, digitally-simulated hydrologic response model. *Journal of Hydrology*, 9(3), 237-258. doi:10.1016/0022-1694(69)90020-1
- Frid, L., & Daniel, C. *Development of a state-and-transition mode in support of reclamation planning.* Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Apex Resource Management Solutions Ltd.
- Fung, C. F., Lopez, A., & New, M. (2011). *Modelling the impact of climate change on water resources:* Hoboken, NJ: Wiley.
- Gaber, N., Laniak, G., & Linker, L. (2008). *Integrated modelling for integrated environmental decision making:* EPA-100/R-08/010. Washington, DC: US Environmental Protection Agency.
- Gardner, L. R. (2009). Assessing the effect of climate change on mean annual runoff. *Journal of Hydrology*, 379(3-4), 351-359. <https://doi.org/10.1016/j.jhydrol.2009.10.021>
- Georgakakos, K. P., & Smith, D. E. (2001). Soil moisture tendencies into the next century for the coterminous United States. *Journal of Geophysical Research: Atmospheres*, 106(D21), 27367-27382.
- Gessel, S. P., & Cole, D. W. (1965). Influence of removal of forest cover on movement of water and associated elements through soil. *Journal AWWA (American Water Works Association)*, 57(10), 1301-1310.
- Ghoraba, S. M., Zyedan, B. A., & Rashwan, I. M. H. (2013). Solute transport modelling of the groundwater for quaternary aquifer quality management in Middle Delta, Egypt. *Alexandria Engineering Journal*, 52(2), 197-207. doi:10.1016/j.aej.2012.12.007

- Goderniaux, P., Brouyère, S., Fowler, H. J., Blenkinsop, S., Therrien, R., Orban, P., & Dassargues, A. (2009). Large scale surface–subsurface hydrological model to assess climate change impacts on groundwater reserves. *Journal of Hydrology*, 373(1-2), 122-138. <https://doi.org/10.1016/j.jhydrol.2009.04.017>
- Golden, H. E., Lane, C. R., Amatya, D. M., Bandilla, K. W., Kiperwas, H. R., Knightes, C. D., & Ssegane H. (2014). Hydrologic connectivity between geographically isolated wetlands and surface water systems: A review of select modeling methods. *Environmental Modelling & Software*, 53, 190-206.
- Golder Associates Ltd. (1997a). *Contaminant fate modelling, Athabasca, Wapiti and Smoky Rivers*. Northern River Basins Study Project report no. 112. Edmonton, AB: Northern River Basins Study.
- Golder Associates Ltd. (1997b). *Contaminant fate modelling for the Athabasca River: Implementation of new sediment flux routines*. Northern River Basins study project report no. 136. Edmonton, AB: Northern River Basins Study.
- Golder Associates Ltd. (2003a). *Calibration of the HSPF water quality model for the oil sands region in Northeastern Alberta*. Calgary, AB.
- Golder Associates Ltd. (2003b). *Regional surface water hydrology study for re-calibration of HSPF model*. Calgary, AB: Submitted to Canadian National Resources Limited, Shell Canada Limited, Suncor Energy Inc., and Syncrude Canada Ltd.
- Golder Associates Ltd. (2004a). Athabasca River model update and reach segmentation. Calgary, AB: Submitted to the Cumulative Environmental Management Association.
- Golder Associates Ltd. (2004b). *Modelling assessment of End Pit Lakes meromictic potential*. Calgary, AB: Submitted to the End Pit Lake Sub-group, Reclamation Working Group, Cumulative Environmental Management Association.
- Golder Associates Ltd. (2007). *Pit Lake model phase II*. Fort McMurray, AB: Cumulative Environmental Management Association.
- Golder Associates Ltd. (2009). *Hydro-climate model selection and application on the Athabasca and Beaver River basins*. Calgary, AB: Submitted to Oil Sands Environmental Management Division, Alberta Environment.
- Golder Associates Ltd., & ERM. (2012). *CEMA oil sands Pit Lake model*. Fort McMurray, Alberta: Cumulative Environmental Management Association (CEMA). Prepared by Golder Associates Ltd.
- Gordon, L., Dunlop, M., & Foran, B. (2003). Land cover change and water vapour flows: Learning from Australia. *Philosophical Transactions of the Royal Society B*, 358(1440). <https://doi.org/10.1098/rstb.2003.1381>
- Graham, D. N., & Butts, M. B. (2005). Flexible, integrated watershed modelling with MIKE SHE. In V. P. Singh & D. K. Frevert (Eds.), *Watershed models* (pp. 245-272). Boca Raton, FL: CRC Press.

- Green, T. R., Taniguchi, M., Kooi, H., Gurdak, J. J., Allen, D. M., Hiscock, K. M., & Aureli, A. (2011). Beneath the surface of global change: Impacts of climate change on groundwater. *Journal of Hydrology*, 405(3-4), 532-560. <https://doi.org/10.1016/j.jhydrol.2011.05.002>
- Gregersen, J. B., Gijssbers, P. J. A., & Westen, S. J. P. (2007). OpenMI: Open Modelling Interface. *Journal of Hydroinformatics*, 9(3), 175-191. doi:10.2166/hydro.2007.023
- Grillakis, M., Koutroulis, A., & Tsanis, I. (2011). Climate change impact on the hydrology of Spencer Creek watershed in Southern Ontario, Canada. *Journal of Hydrology*, 409(1-2), 1-19.
- Guo, W., & Langevin, C. D. (2002). *User's guide to SEAWAT; a computer program for simulation of three-dimensional variable-density ground-water flow*. Retrieved from https://www.researchgate.net/publication/237367099_User's_Guide_to_SEAWAT_A_Computer_Program_for_Simulation_of_Three-Dimensional_Variable-Density_Ground-Water_Flow
- Guzman, J. A., Moriasi, D., Gowda, P. H., Steiner, J. L., Starks, P., Arnold, J. G., Srinivasan, & R. (2015). A model integration framework for linking SWAT and MODFLOW. *Environmental Modelling & Software*, 73, 103-116.
- Hamrick, J. M. (1992). *A three-dimensional environmental fluid dynamics computer code: Theoretical and computational aspects*. Gloucester Point, VA: Special report in applied marine science and ocean engineering, no. 317. Virginia Institute of Marine Science, College of William and Mary.
- Harbaugh, A. W. (2005). *MODFLOW-2005, the U.S. Geological Survey modular ground-water model -- the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16*. Retrieved from <https://pubs.er.usgs.gov/publication/tm6A16>
- Harbor, J. M. (1994). A practical method for estimating the impact of land-use change on surface runoff, groundwater recharge and wetland hydrology. *Journal of the American Planning Association*, 60(1), 95-108.
- Harr, R. D. (1981). Some characteristics and consequences of snowmelt during rainfall in western Oregon. *Journal of Hydrology*, 53(3-4), 277-304.
- Harr, R. D. (1986). Effects of clearcutting on rain-on-snow runoff in western Oregon: A new look at old studies. *Water Resources Research*, 22(7), 1095-1100.
- Harr, R. D., Harper, W. C., Krygier, J. T., & Hsieh, F. S. (1975). Changes in storm hydrographs after road building and clear-cutting in the Oregon Coast Range. *Water Resources Research*, 11(3), 436-444.
- Hatfield Consultants. (2014). *Winter ecology in the delta—hydrology and hydraulics: 2014 winter survey and modelling*. Fort McMurray, AB: Cumulative Environmental Management Association.
- Hayashi, M., & Rosenberry, D. O. (2002). Effects of ground water wxchange on the hydrology and ecology of surface water. *Ground Water*, 40(3), 309-316. doi:10.1111/j.1745-6584.2002.tb02659.x

- He, M., & Hogue, T. S. (2012). Integrating hydrologic modelling and land use projections for evaluation of hydrologic response and regional water supply impacts in semi-arid environments. *Environmental Earth Sciences*, 65(6), 1671-1685.
- Healy, R. W., & Scanlon, B. R. (2010). *Estimating Groundwater Recharge*. Cambridge, UK: Cambridge University Press.
- Hempel, S., Frieler, K., Warszawski, L., Schewe, J., & Piontek, F. (2013). A trend-preserving bias correction—the ISI-MIP approach. *Earth System Dynamics*, 4(2), 219-236.
- Henderson-Sellers, A., Irannejad, P., & McGuffie, K. (2008). Future desertification and climate change: The need for land-surface system evaluation improvement. *Global and Planetary Change*, 64(3-4), 129-138.
- Hertig, E., & Jacobeit, J. (2008). Downscaling future climate change: Temperature scenarios for the Mediterranean area. *Global and Planetary Change*, 63(2-3), 127-131.
- Hesse, C., & Krysanova, V. (2016). Modelling climate and management change impacts on water quality and in-stream processes in the Elbe River Basin. *Water*, 8(2), 40. doi:10.3390/w8020040
- Heydari, F., Saghafian, B., & Delavar, M. (2016). Coupled quantity-quality simulation-optimization model for conjunctive surface-groundwater use. *Water Resources Management*, 30(12), 4381-4397. doi:10.1007/s11269-016-1426-3
- Hien, H. N., Hoang, B. H., Huong, T. T., Than, T. T., Ha, P. T. T., Toan, T. D., & Son, N. M. (2015). Study of the climate change impacts on water quality in the upstream portion of the Cau River basin, Vietnam. *Environmental Modelling & Assessment*, 21(2), 261-277. doi:10.1007/s10666-015-9476-0
- Holtan, H. N., Siltner, G. J., Henson, W. H., & Lopez, N. C. (1975). *USDAHL-74 Revised Model of Watershed Hydrology: A United States Contribution to the International Hydrological Decade*. Technical Bulletin no. 1518. US Department of Agriculture, Agricultural Research Service. doi:10.22004/ag.econ.158531
- Hornbeck, J. W., Pierce, R., & Federer, C. (1970). Streamflow changes after forest clearing in New England. *Water Resources Research*, 6(4), 1124-1132.
- Hosseini, N., Chun, K. P., Wheeler, H., & Lindenschmidt, K.-E. (2016). Parameter sensitivity of a surface water quality model of the Lower South Saskatchewan River—Comparison between ice-on and ice-off periods. *Environmental Modelling & Assessment*, 22(4), 291-307. doi:10.1007/s10666-016-9541-3
- Houghton, J. T., et al. (1996). *Climate change 1995: The science of climate change*. Contribution of working group I to the second assessment report of the Intergovernmental Panel on Climate Change (Vol. 2): Cambridge University Press.

- Houghton, J. T., et al. (2001). *Climate change 2001: The scientific basis*. Cambridge, UK: Published for the Intergovernmental Panel on Climate Change by Cambridge University Press.
- Hua, R., & Zhang, Y. (2017). Assessment of water quality improvements using the hydrodynamic simulation approach in regulated cascade reservoirs: A case study of drinking water sources of Shenzhen, China. *Water*, 9(11), 825. doi:10.3390/w9110825
- Huang, G., Falconer, R. A., & Lin, B. (2017). Integrated hydro-bacterial modelling for predicting bathing water quality. *Estuarine, Coastal and Shelf Science*, 188, 145-155. doi:10.1016/j.ecss.2017.01.018
- Huisman, J., Breuer, L., Bormann, H., Bronstert, A., Croke, B., Frede, H.-G., & Kite, G. (2009). Assessing the impact of land use change on hydrology by ensemble modelling (LUCHEM) III: Scenario analysis. *Advances in Water Resources*, 32(2), 159-170.
- Hundecha, Y., & Bárdossy, A. (2004). Modelling of the effect of land use changes on the runoff generation of a river basin through parameter regionalization of a watershed model. *Journal of Hydrology*, 292(1-4), 281-295.
- Hunt, R. J., Walker, J. F., Selbig, W. R., Westenbroek, S. M., & Regan, R. S. (2013). *Simulation of climate-change effects on streamflow, lake water budgets, and stream temperature using GSFLOW and SNTMP, Trout Lake Watershed, Wisconsin*. US Geological Survey Scientific Investigations Report 2013-5159. doi:10.3133/sir20135159
- Hunter, R. D., & Meentemeyer, R. K. (2005). Climatologically aided mapping of daily precipitation and temperature. *Journal of Applied Meteorology*, 44(10), 1501-1510.
- Huttunen, I., Lehtonen, H., Huttunen, M., Piirainen, V., Korppoo, M., Veijalainen, N., & Vehvilainen, B. (2015). Effects of climate change and agricultural adaptation on nutrient loading from Finnish catchments to the Baltic Sea. *Science of The Total Environment*, 529, 168-181. doi:10.1016/j.scitotenv.2015.05.055
- Hwang, S., & Graham, W. D. (2013). Development and comparative evaluation of a stochastic analog method to downscale daily GCM precipitation. *Hydrology and Earth System Sciences*, 17(11), 4481-4502.
- Hwanga, H. T., Parka, Y. J., & Sudicky, E. A. (2015). Importance of incorporating peatlands and winter processes into integrated surface-subsurface models of the Athabasca River Basin. Paper presented at the IAH-CNC, Waterloo, ON, Canada.
- Hwang, H. T., Park, Y. J., Sudicky, E. A., Berg, S. J., McLaughlin, R., & Jones, J. P. (2018). Understanding the water balance paradox in the Athabasca River Basin, Canada. *Hydrological Processes*, 32(6), 729-746.
- HydroQual Consultants Inc., & Gore and Storrie Ltd. (1989). *Stochastic river quality model: Manual version 2.0*. Prepared for Alberta Environment, Planning Division.

- IPCC-TGICA (Intergovernmental Panel on Climate Change–Task Group on Data and Scenario Support for Impact and Climate Assessment). (2007). *General guidelines on the use of scenario data for climate impact and adaptation assessment, version 2*. Retrieved from http://www.ipcc-data.org/guidelines/TGICA_guidance_sdciaa_v2_final.pdf
- Integrated Sustainability Consultants Ltd. (2013). *Groundwater assessment activities in the oil sands*. Report prepared for Alberta Environment and Parks.
- Irwin, E. G., & Geoghegan, J. (2001). Theory, data, methods: Developing spatially explicit economic models of land use change. *Agriculture, Ecosystems & Environment*, 85(1-3), 7-24.
- Jakeman, A. J., & Letcher, R. A. (2003). Integrated assessment and modelling: Features, principles and examples for catchment management. *Environmental Modelling & Software*, 18(6), 491-501. [https://doi.org/10.1016/S1364-8152\(03\)00024-0](https://doi.org/10.1016/S1364-8152(03)00024-0)
- Jakeman, A. J., Littlewood, I.G. & Whitehead, P. J. (1990). Computation of the instantaneous unit hydrograph and identifiable component flows with application to two small upland catchments. *Journal of Hydrology*, 117(1-4), 275-300. [https://doi.org/10.1016/0022-1694\(90\)90097-H](https://doi.org/10.1016/0022-1694(90)90097-H)
- Jasper, K., Calanca, P., Gyalistras, D., & Fuhrer, J. (2004). Differential impacts of climate change on the hydrology of two alpine river basins. *Climate Research*, 26(2), 113-129.
- Jha, M., Pan, Z., Takle, E. S., & Gu, R. (2004). Impacts of climate change on streamflow in the Upper Mississippi River Basin: A regional climate model perspective. *Journal of Geophysical Research: Atmospheres*, 109(D9). Retrieved from <https://doi.org/10.1029/2003JD003686>
- Ji, Z. G. (2017). Introduction to EFDC_Explorer. *Hydrodynamics and Water Quality: Modelling Rivers, Lakes, and Estuaries*, 539-543. doi:10.1002/9781119371946
- Jia, H., Liang, S., & Zhang, Y. (2015). Assessing the impact on groundwater safety of inter-basin water transfer using a coupled modelling approach. *Frontiers of Environmental Science & Engineering*, 9(1), 84-95. doi:10.1007/s11783-014-0741-2
- Jia, Y., & Culver, T. B. (2004). A methodology for robust Total Maximum Daily Load allocations. Paper presented at the Proceedings of World Water and Environmental Resources Congress 2004, Reston, VA.
- Jia, Y., & Culver, T. B. (2006). Robust optimization for total maximum daily load allocations. *Water Resources Research*, 42(2). doi:10.1029/2005WR004079
- Jia, Y., & Culver, T. B. (2008). Uncertainty analysis for watershed modelling using generalized likelihood uncertainty estimation with multiple calibration measures. *Journal of Water Resources Planning and Management*, 134(2), 97-106.
- Johnston, J. M., Barber, M. C., Wolfe, K., Galvin, M., Cyterski, M., & Parmar, R. (2017). An integrated ecological modeling system for assessing impacts of multiple stressors on stream and riverine ecosystem services within river basins. *Ecological Modelling*, 354, 104-114. doi:10.1016/j.ecolmodel.2017.03.021

- Johnston, J. M., McGarvey, D. J., Barber, M. C., Laniak, G., Babendreier, J., Parmar, R., & Ambrose, R. (2011). An integrated modelling framework for performing environmental assessments: Application to ecosystem services in the Albemarle-Pamlico basins (NC and VA, USA). *Ecological Modelling*, 222(14), 2471-2484. doi:10.1016/j.ecolmodel.2011.03.036
- Jones, J. P., & Mendoza, C. (2012). *Alberta Oil Sands Groundwater Modelling Guidelines*. Edmonton, Alberta: Submitted to CEMA Groundwater Working Group, Fort McMurray, AB.
- Jones, J. P., Sudicky, E. A., & McLaren, R. G. (2008). Application of a fully-integrated surface-subsurface flow model at the watershed-scale: A case study. *Water Resources Research*, 44(3). doi:10.1029/2006wr005603
- Jones, R. N., Chiew, F. H., Boughton, W. C., & Zhang, L. (2006). Estimating the sensitivity of mean annual runoff to climate change using selected hydrological models. *Advances in Water Resources*, 29(10), 1419-1429. https://doi.org/10.1016/j.advwatres.2005.11.001
- Julien, P. Y., Saghafian, B., & Ogden, F. L. (1995). Raster-based hydrologic modeling of spatially-varied surface runoff. *Journal of the American Water Resources Association*, 31(3), June 1995, 523-536. Retrieved from https://doi.org/10.1111/j.1752-1688.1995.tb04039.x
- Kaimowitz, D., & Angelsen, A. (1998). Economic models of tropical deforestation: A review. Jakarta, ID: Cifor (Center for International Forestry Research).
- Kalnay, E., Kanamitsu, M., Kistler, R., Collins, W., Deaven, D., Gandin, L., & Woollen, J. (1996). The NCEP/NCAR 40-year reanalysis project. *Bulletin of the American Meteorological Society*, 77(3), 437-471.
- Kalinin, G. P., & Milyukov, P.I. (1958). Approximate calculation of unsteady flow of water masses. *Trudy TsIP*, 66.
- Kamga, F. M. (2001). Impact of greenhouse gas induced climate change on the runoff of the Upper Benue River (Cameroon). *Journal of Hydrology*, 252(1-4), 145-156.
- Kannel, P. R., & Gan, T. Y. (2013). Application of WASP for modelling and management of naphthenic acids along Athabasca River, Alberta, Canada. *Water, Air, & Soil Pollution*, 224(11). doi:10.1007/s11270-013-1764-1
- Kashyap, S., Dibike, Y., Shakibaenia, A., Prowse, T., & Droppo, I. (2017). Two-dimensional numerical modelling of sediment and chemical constituent transport within the lower reaches of the Athabasca River. *Environmental Science and Pollution Research International*, 24(3), 2286-2303. doi:10.1007/s11356-016-7931-3.
- Kassenaar D. (2016). *Review of potential cumulative effects to surface water and groundwater from in-situ oil sands operations, focusing on the MacKay River watershed*. No. 1128897. CEMA

- Kastens, K. A., Manduca, C. A., Cervato, C., Frodeman, R., Goodwin, C., Liben, L. S., & Titus, S. (2009). How geoscientists think and learn. *Eos, Transactions American Geophysical Union*, 90(31), 265-266.
- Katopodis, C., & Ghamry, H. (2005). Ice-covered hydrodynamic simulation: Model calibration and comparisons for three reaches of the Athabasca River, Alberta, Canada. Paper presented at the 13th Workshop on the Hydraulics of Ice-Covered Rivers, September 15-16, 2005, Hanover, NH.
- Katsavounidis, I., Kuo, C.-C. J., & Zhang, Z. (1994). A new initialization technique for generalized Lloyd iteration. *IEEE Signal processing letters*, 1(10), 144-146.
- Katzav, J., Dijkstra, H. A., & de Laat, A. J. (2012). Assessing climate model projections: State of the art and philosophical reflections. *Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics*, 43(4), 258-276.
- Kay, A., Davies, H., Bell, V., & Jones, R. (2009). Comparison of uncertainty sources for climate change impacts: Flood frequency in England. *Climatic Change*, 92(1), 41-63.
- Kerkhoven, E., & Gan, T. Y. (2006). A modified ISBA surface scheme for modelling the hydrology of Athabasca River basin with GCM-scale data. *Advances in Water Resources*, 29(6), 808-826. doi:10.1016/j.advwatres.2005.07.016
- Kerkhoven, E., & Gan, T. Y. (2011). Differences and sensitivities in potential hydrologic impact of climate change to regional-scale Athabasca and Fraser River basins of the leeward and windward sides of the Canadian Rocky Mountains respectively. *Climatic Change*, 106(4), 583-607. doi:10.1007/s10584-010-9958-7
- Kettle, H., & Thompson, R. (2004). Statistical downscaling in European mountains: Verification of reconstructed air temperature. *Climate Research*, 26(2), 97-112.
- Khaliq, M. N., Sushama, L., Monette, A., & Wheeler, H. (2014). Seasonal and extreme precipitation characteristics for the watersheds of the Canadian Prairie provinces as simulated by the NARCCAP multi-RCM ensemble. *Climate Dynamics*, 44(1-2), 255-277. doi:10.1007/s00382-014-2235-0
- Khanna, V. K., & Herrera, W. V. (2002). *Application of the cdg1-D model in the Lower Athabasca River basin to estimate high flows during open-water season*. Fort McMurray, AB: Report submitted to Cumulative Environmental Management Association (CEMA).
- Kienzle, S. W., Nemeth, M. W., Byrne, J. M., & MacDonald, R. J. (2012). Simulating the hydrological impacts of climate change in the upper North Saskatchewan River basin, Alberta, Canada. *Journal of Hydrology*, 412, 76-89.
- Kim, M. K., Kang, I. S., Park, C. K., & Kim, K. M. (2004). Superensemble prediction of regional precipitation over Korea. *International Journal of Climatology*, 24(6), 777-790.

- Kistler, R., Collins, W., Saha, S., White, G., Woollen, J., Kalnay, E., & Kousky, V. (2001). The NCEP–NCAR 50–year reanalysis: Monthly means CD–ROM and documentation. *Bulletin of the American Meteorological Society*, 82(2), 247-267.
- Kite, G. (2001). Modelling the Mekong: Hydrological simulation for environmental impact studies. *Journal of Hydrology*, 253(1), 1-13.
- Kite, G. W. (1997). *Manual for the SLURP hydrological model V. 11*. Saskatoon, SK: National Hydrology Research Institute.
- Klammler, G., Kupfersberger, H., Rock, G., & Fank, J. (2013). Modelling coupled unsaturated and saturated nitrate distribution of the aquifer Westliches Leibnitzer Feld, Austria. *Environmental Earth Sciences*, 69(2), 663-678. doi:10.1007/s12665-013-2302-6
- Knebl, M., Yang, Z.-L., Hutchison, K., & Maidment, D. (2005). Regional scale flood modelling using NEXRAD rainfall, GIS, and HEC-HMS/RAS: A case study for the San Antonio River basin summer 2002 storm event. *Journal of Environmental Management*, 75(4), 325-336.
- Knightes, C. D., Sunderland, E. M., Barber, M. C., Johnston, J. M., & Ambrose, R. B. (2009). Application of ecosystem-scale fate and bioaccumulation models to predict fish mercury response times to changes in atmospheric deposition. *Environmental Toxicology and Chemistry*, 28(4), 881-893.
- Koh, E.-H., Lee, E., & Lee, K.-K. (2016). Impact of leaky wells on nitrate cross-contamination in a layered aquifer system: Methodology for and demonstration of quantitative assessment and prediction. *Journal of Hydrology*, 541, 1133-1144.
- Kolditz, O., Bauer, S., Bilke, L., Böttcher, N., Delfs, J. O., Fischer, T., & Zehner, B. (2012). OpenGeoSys: An open-source initiative for numerical simulation of thermo-hydro-mechanical/chemical (THM/C) processes in porous media. *Environmental Earth Sciences*, 67(2), 589-599. doi:10.1007/s12665-012-1546-x
- Kollet, S., Sulis, M., Maxwell, R. M., Paniconi, C., Putti, M., Bertoldi, G., & Sudicky, E. (2017). The integrated hydrologic model intercomparison project, IH-MIP2: A second set of benchmark results to diagnose integrated hydrology and feedbacks. *Water Resources Research*, 53(1), 867-890. doi:10.1002/2016wr019191
- Kollet, S. J., Maxwell, R. M., Woodward, C. S., Smith, S., Vanderborght, J., Vereecken, H., & Simmer, C. (2010). Proof of concept of regional scale hydrologic simulations at hydrologic resolution utilizing massively parallel computer resources. *Water Resources Research*, 46(4).
- Kollet, S. J., & Maxwell, R. M. (2006). Integrated surface–groundwater flow modelling: A free-surface overland flow boundary condition in a parallel groundwater flow model. *Advances in Water Resources*, 29(7), 945-958. doi:10.1016/j.advwatres.2005.08.006
- Kotamarthi, R., Mearns, L., Hayhoe, K., Castro, C. L., & Wuebbles, D. (2016). *Use of climate information for decision-making and impacts research: State of our understanding*. Prepared for the US Department of Defense, Strategic

Environmental Research and Development Program. Retrieved from <https://apps.dtic.mil/dtic/tr/fulltext/u2/1029525.pdf>

- Kouwen, N. (2001). *WATFLOOD/SPL8 flood forecasting system*. Waterloo, ON: University of Waterloo.
- Krishnappan, B. G., Stephens, R., Kraft, J. A., & Moore, B. H. (1995). *Size distribution and transport of suspended particles, Athabasca River, February and September, 1993*. Prepared for the Northern River Basins Study, Edmonton, AB. Report no. 51.
- Krysanova, V., Hattermann, F., & Wechsung, F. (2005). Development of the ecohydrological model SWIM for regional impact studies and vulnerability assessment. *Hydrological Processes*, 19(3), 763-783.
- Kuhn, N. J., Baumhauer, R., & Schütt, B. (2011). Managing the impact of climate change on the hydrology of the Gallocanta Basin, NE-Spain. *Journal of Environmental Management*, 92(2), 275-283. <https://doi.org/10.1016/j.jenvman.2009.08.023>
- Kumar, D., & Bahattacharjya, R. K. (2011). *Distributed rainfall runoff modeling using WMS and HEC-HMS*. Lambert Academic Publishing.
- Kumar, J., Brooks, B.-G. J., Thornton, P. E., & Dietze, M. C. (2012). Sub-daily statistical downscaling of meteorological variables using neural networks. *Procedia Computer Science*, 9, 887-896.
- Kurylyk, B. L., MacQuarrie, K. T. B., Linnansaari, T., Cunjak, R. A., & Curry, R. A. (2015). Preserving, augmenting, and creating cold-water thermal refugia in rivers: Concepts derived from research on the Miramichi River, New Brunswick (Canada). *Ecohydrology*, 8(6), 1095-1108. doi:10.1002/eco.1566
- Kustas, W. P., Rango, A., & Uijlenhoet, R. (1994). A simple energy budget algorithm for the snowmelt runoff model. *Water Resources Research*, 30(5), 1515-1527. <https://doi.org/10.1029/94WR00152>
- Kwapien, J., & Drożdż, S. (2012). Physical approach to complex systems. *Physics Reports*, 515(3-4), 115-226.
- Labadie, J. (1995). *River basin network model for water rights planning, MODSIM: Technical manual*. Fort Collins, CO: Department of Civil Engineering, Colorado State University.
- Lambin, E. F., Rounsevell, M. D. A., & Geist, H. J. (2000). Are agricultural land-use models able to predict changes in land-use intensity? *Agriculture, Ecosystems & Environment*, 82(1-3), 321-331. Retrieved from [https://doi.org/10.1016/S0167-8809\(00\)00235-8](https://doi.org/10.1016/S0167-8809(00)00235-8)
- Landis, J. D. (1995). Imagining land use futures: Applying the California urban futures model. *Journal of the American Planning Association*, 61(4), 438-457. Retrieved from <https://doi.org/10.1080/01944369508975656>
- Langevin, C. D., Hughes, J. D., Banta, E. R., Niswonger, R. G., Panday, S., & Provost, A. M. (2017). Documentation for the MODFLOW 6 groundwater flow model

- (Report 6-A55). *US Geological Survey Techniques and Methods*, book 6, chap. A55. Retrieved from <https://doi.org/10.3133/tm6A55>
- Langevin, C. D., Thorne Jr, D. T., Dausman, A. M., Sukop, M. C., & Guo, W. (2008). SEAWAT Version 4: A computer program for simulation of multi-species solute and heat transport. *US Geological Survey Techniques and Methods*, book 6, chap. A22.
- Laniak, G. F., Olchin, G., Goodall, J., Voinov, A., Hill, M., Glynn, P., & Hughes, A. (2013). Integrated environmental modelling: A vision and roadmap for the future. *Environmental Modelling & Software*, 39, 3-23. doi:10.1016/j.envsoft.2012.09.006
- Lauzon, N., Vandenberg, J., & Bechtold, J. (2011). Probabilistic modelling applied to the mining industry to address water quality uncertainty. Paper presented at the Proceedings, 19th International Congress of the Modelling and Simulation Society of Australia and New Zealand, Perth.
- Leavesley, G., & Stannard, L. (1995). The precipitation-runoff modelling system-PRMS. Chapter 9 in V. P. Singh (Ed.), *Computer models of watershed hydrology* (pp. 281-310). Highlands Ranch, CO: Water Resources Publications.
- LeBlanc, S. F., & Sloover, J. D. (1970). Relation between industrialization and the distribution and growth of epiphytic lichens and mosses in Montreal. *Canadian Journal of Botany*, 48(8), 1485-1496.
- Ledoux, E., Girard, G., Marsily, G., Villeneuve, J. P., & Deschenes, J. (1989). Spatially distributed modeling: Conceptual approach, coupling surface water and groundwater. In H. J. Morel-Seytoux (Ed.), *Unsaturated flow in hydrologic modelling*. NATO ASI Series (Series C: Mathematical and Physical Sciences), vol 275 (pp. 435-454): Dordrecht: Springer.
- Leong, D. N., & Donner, S. D. (2015). Climate change impacts on streamflow availability for the Athabasca Oil Sands. *Climatic Change*, 133(4), 651-663.
- Lerner, D. N., & Harris, B. (2009). The relationship between land use and groundwater resources and quality. *Land Use Policy*, 26, S265-S273.
- Li, Z., & Mölders, N. (2008). Interaction of impacts of doubling CO₂ and changing regional land-cover on evaporation, precipitation, and runoff at global and regional scales. *International Journal of Climatology*, 28(12), 1653-1679.
- Li, Z., Zheng, F.-L., Liu, W.-Z., & Jiang, D.-J. (2012). Spatially downscaling GCMs outputs to project changes in extreme precipitation and temperature events on the Loess Plateau of China during the 21st Century. *Global and Planetary Change*, 82, 65-73.
- Liang, X. (1994). *A two-layer variable infiltration capacity land surface representation for general circulation models*. Water Resource series, technical report 140. Seattle, WA: Department of Civil Engineering, University of Washington.

- Liang, J., Yang, Q., Sun, T., Martin, J., Sun, H., & Li, L. (2015). MIKE 11 model-based water quality model as a tool for the evaluation of water quality management plans. *Journal of Water Supply: Research and Technology-Aqua*, 64(6), 708-718.
- Lievens, H., De Lannoy, G. J. M., Al Bitar, A., Drusch, M., Dumedah, G., Franssen, H. J. H. & Pan, M. (2016). Assimilation of SMOS soil moisture and brightness temperature products into a land surface model. *Remote Sensing of Environment*, 180, 292-304.
- Lin, Y.-P., Hong, N.-M., Wu, P.-J., Wu, C.-F., & Verburg, P. H. (2007). Impacts of land use change scenarios on hydrology and land use patterns in the Wu-Tu watershed in Northern Taiwan. *Landscape and Urban Planning*, 80(1-2), 111-126.
- Lin, Y. P., Lin, Y. B., Wang, Y. T., & Hong, N. M. (2008). Monitoring and predicting land-use changes and the hydrology of the urbanized Paochiao watershed in Taiwan using remote sensing data, urban growth models and a hydrological model. *Sensors*, 8(2), 658-680. Retrieved from <https://doi.org/10.3390/s8020658>
- Lindström, G., Johansson, B., Persson, M., Gardelin, M., & Bergström, S. (1997). Development and test of the distributed HBV-96 hydrological model. *Journal of Hydrology*, 201(1-4), 272-288.
- Liu, D., Guo, S., Shao, Q., Jiang, Y., & Chen, X. (2013). Optimal allocation of water quantity and waste load in the Northwest Pearl River Delta, China. *Stochastic Environmental Research and Risk Assessment*, 28(6), 1525-1542. doi:10.1007/s00477-013-0829-4
- Liu, Z., Kingery, W. L., Huddleston, D. H., Hossain, F., Chen, W., Hashim, N. B., & Kieffer, J. M. (2008). Modelling nutrient dynamics under critical flow conditions in three tributaries of St. Louis Bay. *Journal of Environmental Science and Health, Part A*, 43(6), 633-645.
- Lokke, H., Ragas, A. M., Schüürmann, G., Spurgeon, D. J., & Sorenson, P. B. (2010). Cumulative Stressors-Risk assessment of mixtures of chemicals and combinations of chemicals and natural stressors. *Science of the Total Environment*, 408(18). Retrieved from <http://pascalfrancis.inist.fr/vibad/index.php?action=getRecordDetail&idt=23058347>
- Macdonald, G., & Hamilton, H. (1989). *Model calibration and receiving water evaluation for pulp mill developments on the Athabasca River. I Dissolved oxygen*. Calgary, AB: Prepared for the Standards & Approvals Division, Alberta Environment, Edmonton, AB, by HydroQual Consultants Inc.
- Macdonald, G., & Radermacher, A. (1992). *Athabasca River water quality modelling 1990 update*. Calgary, AB: Prepared for by Standards & Approvals division, Alberta Environment, Edmonton, AB, by Environmental Management Associates.
- MacDonald, G. A., & Radermacher, A. (1993). *An evaluation of dissolved oxygen modelling of the Athabasca River and the Wapiti-Smoky River system*. Edmonton, AB: Northern River Basins Study. Prepared by Environmental Management Associates under under Project 2231-B1.

- Mackay, D. (1991). *Multimedia ecological models: The fugacity approach*. New York: CRC Press.
- Mahjouri, N., & Abbasi, M. R. (2015). Waste load allocation in rivers under uncertainty: Application of social choice procedures. *Environmental Monitoring and Assessment*, 187(2), 5. doi:10.1007/s10661-014-4194-7
- Makar, P. A., Akingunola, A., Aherne, J., Cole, A. S., Aklilu, Y., Zhang, J., & Jeffries, D. S. (2018). Estimates of exceedances of critical loads for acidifying deposition in Alberta and Saskatchewan. *Atmospheric Chemistry and Physics*, 18(13), 9897-9927. doi:10.5194/acp-18-9897-2018
- Makropoulos, C., Safiolea, E., Baki, S., Douka, E., Stamou, A., & Mimikou, M. (2010). An integrated, multi-modelling approach for the assessment of water quality: Lessons from the Pinos River case in Greece. Paper presented at the Proceedings of the Fifth Biennial Conference of the International Environmental Modelling and Software Society (iEMSs), 2010 International Congress on Environmental Modelling and Software, Modelling for Environment's Sake. Ottawa, ON. Retrieved from <http://www.iemss.org/iemss2010/Volume1.pdf>
- Malek-Mohammadi, S., Tachiev, G., Cabrejo, E., & Lawrence, A. (2012). Simulation of flow and mercury transport in Upper East Fork Poplar Creek, Oak Ridge, Tennessee. *Remediation Journal*, 22(2), 119-131.
- Maloney, E. D., Camargo, S. J., Chang, E., Colle, B., Fu, R., Geil, K. L., & Karnauskas, K. B. (2014). North American climate in CMIP5 experiments: Part III: Assessment of twenty-first-century projections. *Journal of Climate*, 27(6), 2230-2270.
- Mankin, K. R., Koelliker, J., & Kalita, P. (1999). Watershed and lake water quality assessment: An integrated modelling approach. *JAWRA Journal of the American Water Resources Association*, 35(5), 1069-1080.
- Maraun, D. (2012). Nonstationarities of regional climate model biases in European seasonal mean temperature and precipitation sums. *Geophysical Research Letters*, 39(6).
- Mareuil, A., Leconte, R., Brissette, F., & Minville, M. (2007). Impacts of climate change on the frequency and severity of floods in the Châteauguay River basin, Canada. *Canadian Journal of Civil Engineering*, 34(9), 1048-1060. Retrieved from <https://doi.org/10.1139/l07-022>
- Martin, N., McEachern, P., Yu, T., & Zhu, D. Z. (2013). Model development for prediction and mitigation of dissolved oxygen sags in the Athabasca River, Canada. *Science of the Total Environment*, 443, 403-412. doi:10.1016/j.scitotenv.2012.10.030
- Marsik, M., & Waylen, P. (2006). An application of the distributed hydrologic model CASC2D to a tropical montane watershed. *Journal of Hydrology*, 330(3-4), 481-495. Retrieved from <https://doi.org/10.1016/j.jhydrol.2006.04.003>

- Martinec, J. (1975). Snowmelt-runoff model for stream flow forecasts. *Nordic Hydrology*, 6(3),145-154. Retrieved from <https://search.proquest.com/docview/1944625093?fromopenview=true&pqorigsite=gscholar>
- Masud, M. B., Khaliq, M. N., & Wheeler, H. S. (2016). Projected changes to short- and long-duration precipitation extremes over the Canadian Prairie provinces. *Climate Dynamics*, 49(5-6), 1597-1616. doi:10.1007/s00382-016-3404-0
- Matondo, J. I., Peter, G., & Msibi, K. M. (2004). Evaluation of the impact of climate change on hydrology and water resources in Swaziland: Part I. *Physics and Chemistry of the Earth, Parts A/B/C*, 29(15-18), 1181-1191. Retrieved from <https://doi.org/10.1016/j.pce.2004.09.033>
- Matott, L. S., Babendreier, J. E., & Purucker, S. T. (2009). Evaluating uncertainty in integrated environmental models: A review of concepts and tools. *Water Resources Research*, 45(6). doi:10.1029/2008wr007301
- Matrix Solutions Inc. (2016). *Construction and calibration of the regional groundwater solutions Southern Athabasca Oil Sands numerical model of groundwater flow*. Calgary, AB: Report prepared for Canada's Oil Sands Innovation Alliance / Government of Alberta.
- Maurer, E. P., & Hidalgo, H. G. (2008). Utility of daily vs. monthly large-scale climate data: An intercomparison of two statistical downscaling methods. *Hydrology and Earth System Sciences*, 14, 1125-1138, doi:10.5194/hess-14-1125-2010
- Maurer, E. P., Hidalgo, H. G., Das, T., Dettinger, M. D., & Cayan, D. R. (2010). The utility of daily large-scale climate data in the assessment of climate change impacts on daily streamflow in California. *Hydrology and Earth System Sciences*, 14(6), 1125-1138. doi:10.5194/hess-14-1125-2010
- Maurer, E. P., & Pierce, D. W. (2014). Bias correction can modify climate model simulated precipitation changes without adverse effect on the ensemble mean. *Hydrology and Earth System Sciences*, 18(3), 915-925.
- Maxwell, R. M., & Miller, N. L. (2005). Development of a Coupled Land Surface and Groundwater Model. *Journal of Hydrometeorology*, 6(3), 233-247. doi:10.1175/jhm422.1
- Maxwell, R. M., Putti, M., Meyerhoff, S., Delfs, J.-O., Ferguson, I. M., Ivanov, V., & Sulis, M. (2014). Surface-subsurface model intercomparison: A first set of benchmark results to diagnose integrated hydrology and feedbacks. *Water Resources Research*, 50(2), 1531-1549. doi:10.1002/2013wr013725
- Maxwell, R. M. (2013). A terrain-following grid transform and preconditioner for parallel, large-scale, integrated hydrologic modelling. *Advances in Water Resources*, 53, 109-117.
- Maxwell, R. M., Condon, L. E., & Kollet, S. J. (2015). A high-resolution simulation of groundwater and surface water over most of the continental US with the integrated hydrologic model ParFlow v3. *Geoscientific Model Development*, 8(3), 923.

- McCauley, E. (1997). *A review and evaluation of water quality and quantity models used by the Northern River Basins Study*. Northern River Basins Study Project report no. 82. Edmonton, AB: Northern River Basins Study.
- McCull, C., & Aggett, G. (2007). Land-use forecasting and hydrologic model integration for improved land-use decision support. *Journal of Environmental Management*, 84(4), 494-512.
- McDonald, M. G., & Harbaugh, A. W. (1984). *A modular three-dimensional finite-difference ground-water flow model* (Open-File Report 83-875). Retrieved from <http://pubs.er.usgs.gov/publication/ofr83875>
- McGrane, S. J. (2016). Impacts of urbanisation on hydrological and water quality dynamics, and urban water management: A review. *Hydrological Sciences Journal*, 61(13), 2295-2311.
- McKinney, D. C., Cai, X., Rosegrant, M. W., Ringler, C., & Scott, C. A. (1999). *Modelling water resources management at the basin level: Review and future directions* (Vol. 6). Colombo, Sri Lanka: International Water Management Institute (IWMI).
- Mearns, L. O., Gutowski, W., Jones, R., Leung, R., McGinnis, S., Nunes, A., & Qian, Y. (2009). A regional climate change assessment program for North America. *Eos, Transactions American Geophysical Union*, 90(36), 311-311.
- Meehl, G. A., Covey, C., Taylor, K. E., Delworth, T., Stouffer, R. J., Latif, M., & Mitchell, J. F. (2007). The WCRP CMIP3 multimodel dataset: A new era in climate change research. *Bulletin of the American Meteorological Society*, 88(9), 1383-1394.
- Meher-Homji, V. (1991). Probable impact of deforestation on hydrological processes. In N. Myers (Ed.), *Tropical forests and climate* (pp. 163-173). Dordrecht: Springer.
- Mejia, J. F., Huntington, J., Hatchett, B., Koracin, D., & Niswonger, R. G. (2012). Linking global climate models to an integrated hydrologic model: Using an individual station downscaling approach. *Journal of Contemporary Water Research & Education*, 147(1), 17-27.
- Mentzafou, A., & Dimitriou, E. (2011). Distributed hydrological and water quality modelling to analyze the fate of Nitrate along a transboundary river. Paper presented at the Proceedings of the 6th International Conference on Energy and Development, Environment - Biomedicine (EDEB'12) Recent Researches in Environment and Biomedicine. Athen, Greece.
- Merrill, L., Henry, T., Golliday, G., Pollison, D., Greene, R., Mirsajadi, H., & Morton, M. (2002). Nutrient and dissolved oxygen TMDL for Christina River Basin. *Proceedings of the Water Environment Federation*, 2002(2), 1183-1212.
- Mesinger, F., DiMego, G., Kalnay, E., Mitchell, K., Shafran, P. C., Ebisuzaki, W., & Berbery, E. H. (2006). North American regional reanalysis. *Bulletin of the American Meteorological Society*, 87(3), 343-360.
- Meyer, W. B., & BL Turner, I. (1994). *Changes in land use and land cover: A global perspective* (Vol. 4): Cambridge, UK: Cambridge University Press.

- Michael Baker Jr. Inc, Aqua Terra Consultants, & Dynamic Solutions LLC. (2015). *Setup, calibration, and validation for Illinois River watershed nutrient model and Tenkiller Ferry Lake EFDC water quality model* (EPA Contract EP-C-12-052 Order No. 0002). Retrieved from https://www.epa.gov/sites/production/files/2016-03/documents/final-watershed_lake_model_main_report_08_07_15_0.pdf
- Mingers, J., & White, L. (2010). A review of the recent contribution of systems thinking to operational research and management science. *European Journal of Operational Research*, 207(3), 1147-1161.
- Misson, L., Rasse, D. P., Vincke, C., Aubinet, M., & François, L. (2002). Predicting transpiration from forest stands in Belgium for the 21st century. *Agricultural and Forest Meteorology*, 111(4), 265-282.
- Mitasova, H., & Mitas, L. (1998). Process modeling and simulations. NCGIA GISCC Unit, 130. Retrieved from <http://fatra.cnr.ncsu.edu/~hmitaso/gmslab/papers/u130/u130.html>
- Mizuta, R., Oouchi, K., Yoshimura, H., Noda, A., Katayama, K., Yukimoto, S., & Nakagawa, M. (2006). 20-km-mesh global climate simulations using JMA-GSM model—mean climate states. *Journal of the Meteorological Society of Japan. Ser. II*, 84(1), 165-185.
- Monninkhoff, B. L., & Li, Z. (2009). Coupling FEFLOW and MIKE11 to optimise the flooding system of the Lower Havel polders in Germany. *International Journal of Water*, 5(2), 163. doi:10.1504/ijw.2009.028724
- Mooney, P. A., Mulligan, F. J., & Fealy, R. (2011). Comparison of ERA-40, ERA-Interim and NCEP/NCAR reanalysis data with observed surface air temperatures over Ireland. *International Journal of Climatology*, 31(4), 545-557. doi:10.1002/joc.2098
- Mottes, C., Lesueur-Jannoyer, M., Le Bail, M., & Malézieux, E. (2013). Pesticide transfer models in crop and watershed systems: A review. *Agronomy for Sustainable Development*, 34(1), 229-250. doi:10.1007/s13593-013-0176-3
- Mugunthan, P., Russell, K. T., Gong, B., Riley, M. J., Chin, A., McDonald, B. G., & Eastcott, L. J. (2017). A coupled groundwater-surface water modeling framework for simulating transition zone processes. *Ground Water*, 55(3), 302-315. doi:10.1111/gwat.12475
- Müller, M., Werner, F., Eulitz, K., & Graupner, B. (2008). *Water quality modelling of pit lakes: Development of a multiply-coupled groundwater lake circulation and chemical model*. Paper presented at the Proceedings of the 10th IMWA Congress, Karlovy Vary, Ostrava, Czech Republic. Retrieved from https://www.imwa.info/docs/imwa_2008/IMWA2008_063_Mueller.pdf
- Murdock, T., & Spittlehouse, D. (2011). *Selecting and using climate change scenarios for British Columbia*. Pacific Climate Impacts Consortium, University of Victoria, Victoria, BC.

- Murphy, J. M., Sexton, D. M., Barnett, D. N., Jones, G. S., Webb, M. J., Collins, M., & Stainforth, D. A. (2004). Quantification of modelling uncertainties in a large ensemble of climate change simulations. *Nature*, 430(7001), 768-772.
- Nagare, R., Park, Y. J., & Pal, J. (2015). *Integrated surface water and groundwater modelling for oil sands reclamation*. WorleyParson Canada Services Ltd. Retrieved from <http://www.esaa.org/wp-content/uploads/2015/04/W15-SS3.pdf>
- Najafi, M., Moradkhani, H., & Jung, I. (2011). Assessing the uncertainties of hydrologic model selection in climate change impact studies. *Hydrological Processes*, 25(18), 2814-2826.
- Nakicenovic, N., Alcamo, J., Grubler, A., Riahi, K., Roehrl, R., Rogner, H.-H., & Victor, N. (2000). *Special Report on Emissions Scenarios (SRES): A special report of working group III of the Intergovernmental Panel on Climate Change*. Published for the Intergovernmental Panel on Climate Change by Cambridge University Press.
- Narula, K. K., & Gosain, A. K. (2013). Modelling hydrology, groundwater recharge and non-point nitrate loadings in the Himalayan Upper Yamuna basin. *Science of the Total Environment*, 468-469 Suppl, S102-116. doi:10.1016/j.scitotenv.2013.01.022
- Ndomba, P., Mtalo, F., & Killingtveit A. (2008) SWAT model application in a data scarce tropical complex catchment in Tanzania. *Physics and Chemistry of the Earth, Parts A/B/C*, 33(8-13), 626-632. <https://doi.org/10.1016/j.pce.2008.06.013>
- Neitsch, S. L., Arnold, J. G., Kiniry, J. R., & Williams, J. R. (2011). *Soil and water assessment tool theoretical documentation version 2009*. College Station, TX: Texas Water Resources Institute.
- NEIWPCC (New England Interstate Water Pollution Control Commission). (2017). *From air to water: The challenge of atmospheric deposition - A primer for water quality and air quality professionals*. Retrieved from http://www.neiwpcc.org/neiwpcc_docs/air2water.pdf
- Niazi, A., Bentley, L. R., & Hayashi, M. (2017). Estimation of spatial distribution of groundwater recharge from stream baseflow and groundwater chloride. *Journal of Hydrology*, 546, 380-392. doi:10.1016/j.jhydrol.2017.01.032
- Niazi, A., Prasher, S., Adamowski, J., & Gleeson, T. (2014). A system dynamics model to conserve arid region water resources through aquifer storage and recovery in conjunction with a dam. *Water*, 6(8), 2300-2321. doi:10.3390/w6082300
- Niehoff, D., Fritsch, U., & Bronstert, A. (2002). Land-use impacts on storm-runoff generation: Scenarios of land-use change and simulation of hydrological response in a meso-scale catchment in SW-Germany. *Journal of Hydrology*, 267(1), 80-93.
- Nielsen, S. A., & Hansen, E. (1973). Numerical simulation of the rainfall-runoff process on a daily basis. *Hydrology Research*, 4(3), 171-190.

- Nikolic, V. V., & Simonovic, S. P. (2015). Multi-method modeling framework for support of integrated water resources management. *Environmental Processes*, 2(3), 461-483. doi:10.1007/s40710-015-0082-6
- Nikoo, M. R., Beiglou, P. H. B., & Mahjouri, N. (2016). Optimizing multiple-pollutant waste load allocation in rivers: An interval parameter game theoretic model. *Water Resources Management*, 30(12), 4201-4220. doi:10.1007/s11269-016-1415-6
- Noble, B. F., Skwaruk, J. S., & Patrick, R. J. (2014). Toward cumulative effects assessment and management in the Athabasca watershed, Alberta, Canada. *The Canadian Geographer/Le Géographe canadien*, 58(3), 315-328.
- Northwest Hydraulics Consultants Ltd. (2007a). *Lower Athabasca River habitat surveys - 2007 winter flow simulations at Embarras (reach #2)*. Project no. 1-6890 Lower Athabasca River Habitat Surveys. Fort McMurray, AB: CEMA.
- Northwest Hydraulics Consultants Ltd. (2007b). *Lower Athabasca River habitat surveys - 2007 winter flow simulations at Poplar Point (reach #3)*. Project no. 1-6890 Lower Athabasca River Habitat Surveys. Fort McMurray, AB: CEMA.
- Notebaert, B., Verstraeten, G., Ward, P., Renssen, H., & Van Rompaey, A. (2011). Modelling the sensitivity of sediment and water runoff dynamics to Holocene climate and land use changes at the catchment scale. *Geomorphology*, 126(1-2), 18-31.
- Ontario Ministry of Natural Resources. (2011). *Integrated Surface and Groundwater Model Review and Technical Guide*. Prepared by AquaResource Inc. for The Ontario Ministry of Natural Resources.
- Osmi, S. C., Ishak, W. W., Kim, H., Azman, M., & Ramli, M. (2016). Development of total maximum daily load using water quality modelling as an approach for watershed management in Malaysia. *World Academy of Science, Engineering and Technology, International Journal of Environmental, Chemical, Ecological, Geological and Geophysical Engineering*, 10(10), 1013-1021.
- Ott, B., & Uhlenbrook, S. (2004). Quantifying the impact of land-use changes at the event and seasonal time scale using a process-oriented catchment model. *Hydrology and Earth System Sciences Discussions, European Geosciences Union*, 8(1), 62-78. Retrieved from <https://hal.archives-ouvertes.fr/hal-00304790/document>
- Paerl, H. W., Dennis, R. L., & Whittall, D. R. (2002). Atmospheric deposition of nitrogen: Implications for nutrient over-enrichment of coastal waters. *Estuaries*, 25(4), 677-693.
- Painter, S. L., Coon, E. T., Atchley, A. L., Berndt, M., Garimella, R., Moulton, J. D., & Wilson, C. J. (2016). Integrated surface/subsurface permafrost thermal hydrology: Model formulation and proof-of-concept simulations. *Water Resources Research*, 52(8), 6062-6077. doi:10.1002/2015wr018427
- Pak, J. H., Fleming, M., Scharffenberg, W., Gibson, S., & Brauer, T. (2015). Modelling surface soil erosion and sediment transport processes in the Upper North

- Bosque River Watershed, Texas. *Journal of Hydrologic Engineering*, 20(12), 04015034.
- Panagopoulos, Y., Gassman, P. W., Arritt, R. W., Herzmann, D. E., Campbell, T. D., Valcu, A., & White, M. (2015). Impacts of climate change on hydrology, water quality and crop productivity in the Ohio-Tennessee River Basin. *International Journal of Agricultural and Biological Engineering*, 8(3), 36.
- Paraska, D. W., Hipsey, M. R., & Salmon, S. U. (2014). Sediment diagenesis models: Review of approaches, challenges and opportunities. *Environmental Modelling & Software*, 61, 297-325. doi:10.1016/j.envsoft.2014.05.011
- Parker, P., et al., Progress in integrated assessment and modelling. *Environmental Modelling & Software*, 3(17): 209–217, 2002.
- Patel, D. P., Ramirez, J. A., Srivastava, P. K., Bray, M., & Han, D. (2017). Assessment of flood inundation mapping of Surat city by coupled 1D/2D hydrodynamic modelling: A case application of the new HEC-RAS 5. *Natural Hazards*, 89(1), 93-130.
- Patro, S., Chatterjee, C., Mohanty, S., Singh, R., & Raghuvanshi, N. (2009). Flood inundation modelling using MIKE FLOOD and remote sensing data. *Journal of the Indian Society of Remote Sensing*, 37(1), 107-118.
- Pelletier, G., & Chapra, S. (2005). *QUAL2Kw theory and documentation (version 5.1), a modelling framework for simulating river and stream water quality*. Washington, DC: US Department of Ecology.
- Peng, S., Fu, G., Zhao, X., & Moore, B. C. (2011). Integration of Environmental Fluid Dynamics Code (EFDC) model with geographical information system (GIS) platform and its applications. *Journal of Environmental Informatics*, 17(2).
- Petts, J. (1999). *Handbook of environmental impact assessment. Vol. 1, Environmental impact assessment: Process, methods and potential*. Oxford, UK: Blackwell Science Osney Mead.
- Phatak, A., Bates, B. C., & Charles, S. P. (2011). Statistical downscaling of rainfall data using sparse variable selection methods. *Environmental Modelling & Software*, 26(11), 1363-1371.
- Pielke, R. A., Avissar, R., Raupach, M., Dolman, A. J., Zeng, X., & Denning, A. S. (1998). Interactions between the atmosphere and terrestrial ecosystems: Influence on weather and climate. *Global Change Biology*, 4(5), 461-475.
- Pietroniro, A., Chambers, P. A., & Ferguson, M. E. (1998). Application of a dissolved oxygen model to an ice-covered river. *Canadian Water Resources Journal*, 23(4), 351-368. doi:10.4296/cwrj2304351
- Pietroniro, A., Leconte, R., Toth, B., Peters, D. L., Kouwen, N., Conly, F. M., & Prowse, T. (2006). Modelling climate change impacts in the Peace and Athabasca catchment and delta: III—Integrated model assessment. *Hydrological Processes*, 20(19), 4231-4245. doi:10.1002/hyp.6428

- Pignotti, G., Rathjens, H., Cibin, R., Chaubey, I., & Crawford, M. (2017). Comparative analysis of HRU and grid-based SWAT Models. *Water*, 9(4), 272. doi:10.3390/w9040272
- Pitman, A. (2003). The evolution of, and revolution in, land surface schemes designed for climate models. *International Journal of Climatology*, 23(5), 479-510.
- Pollock, D. W. (2016). User guide for MODPATH Version 7—A particle-tracking model for MODFLOW. doi:10.3133/ofr20161086
- Pontius, R. G., Jr., R. Gil, & Schneider, L. C. (2001). Land-cover change model validation by an ROC method for the Ipswich watershed, Massachusetts, USA. *Agriculture, Ecosystems & Environment* 85(1-3), 239-248. Retrieved from [https://doi.org/10.1016/S0167-8809\(01\)00187-6](https://doi.org/10.1016/S0167-8809(01)00187-6)
- Poulin, A., Brissette, F., Leconte, R., Arsenault, R., & Malo, J.-S. (2011). Uncertainty of hydrological modelling in climate change impact studies in a Canadian, snow-dominated river basin. *Journal of Hydrology*, 409(3), 626-636.
- Prakash, S., Vandenberg, J. A., & Buchak, E. M. (2015). Sediment diagenesis module for CE-QUAL-W2. Part 2: Numerical formulation. *Environmental Modelling & Assessment*, 20(3), 249-258. doi:10.1007/s10666-015-9459-1
- Praskievicz, S., & Chang, H. (2009). A review of hydrological modelling of basin-scale climate change and urban development impacts. *Progress in Physical Geography*, 33(5), 650-671. doi:10.1177/0309133309348098
- Privette, C. V., & Smink, J. (2017). Assessing the potential impacts of WWTP effluent reductions within the Reedy River watershed. *Ecological Engineering*, 98, 11-16. doi:10.1016/j.ecoleng.2016.10.058
- Privette, C. V., Taylor, S. W., Hayes, J. C., Hallo, L. S., & Nix, H. B. (2015). Forecasting the impacts of future development on water quantity and quality within the Reedy River Watershed. *Land Use Policy*, 44, 1-9. doi:10.1016/j.landusepol.2014.11.016
- Prommer, H., Barry, D. A., & Zheng, C. (2003). MODFLOW/MT3DMS-based reactive multicomponent transport modeling. *Ground Water*, 41(2), 247-257. doi:10.1111/j.1745-6584.2003.tb02588.x
- Pulido-Velazquez, M., Peña-Haro, S., García-Prats, A., Mocholi-Almudever, A. F., Henriquez-Dole, L., Macian-Sorribes, H., & Lopez-Nicolas, A. (2015). Integrated assessment of the impact of climate and land use changes on groundwater quantity and quality in the Mancha Oriental system (Spain). *Hydrology and Earth System Sciences*, 19(4), 1677-1693. doi:10.5194/hess-19-1677-2015
- Rathjens, H., Oppelt, N., Bosch, D., Arnold, J. G., & Volk, M. (2015). Development of a grid-based version of the SWAT landscape model. *Hydrological Processes*, 29(6), 900-914.
- Refsgaard, J., & Knudsen, J. (1996). Operational validation and intercomparison of different types of hydrological models. *Water Resources Research*, 32(7), 2189-2202. Retrieved from <https://doi.org/10.1029/96WR00896>

- Refsgaard, J., Thorsen, M., Jensen, J. B., Kleeschulte, S., & Hansen, S. (1999). Large scale modelling of groundwater contamination from nitrate leaching. *Journal of Hydrology*, 221(3), 117-140.
- Regnery, J., Lee, J., Drumheller, Z. W., Drewes, J. E., Illangasekare, T. H., Kitanidis, P. K., & Smits, K. M. (2017). Trace organic chemical attenuation during managed aquifer recharge: Insights from a variably saturated 2D tank experiment. *Journal of Hydrology*, 548, 641-651.
- Ricks, M. D. (2015). *Development of computer simulation model for urban region using XP-SWMM in Savannah, Georgia*. Columbia, SC: University of South Carolina. Retrieved from <https://scholarcommons.sc.edu/etd/3607>
- Rinke, A., Marbaix, P., & Dethloff, K. (2004). Internal variability in Arctic regional climate simulations: Case study for the SHEBA year. *Climate Research*, 27(3), 197-209.
- Rivard, C., Lefebvre, R., & Paradis, D. (2013). Regional recharge estimation using multiple methods: An application in the Annapolis Valley, Nova Scotia (Canada). *Environmental Earth Sciences*, 71(3), 1389-1408. doi:10.1007/s12665-013-2545-2
- Rode, M., Arhonditsis, G., Balin, D., Kebede, T., Krysanova, V., van Griensven, A., & van der Zee, S. E. A. T. M. (2010). New challenges in integrated water quality modelling. *Hydrological Processes*, 24(24), 3447-3461. doi:10.1002/hyp.7766
- Rose, S., & Peters, N. E. (2001). Effects of urbanization on streamflow in the Atlanta area (Georgia, USA): A comparative hydrological approach. *Hydrological Processes*, 15(8), 1441-1457.
- Ross, W. A. (1998). Cumulative effects assessment: Learning from Canadian case studies. *Impact Assessment and Project Appraisal*, 16(4), 267-276.
- Rossman, L. A. (2015). *Storm water management model user's manual version 5.1*. Cincinnati, Ohio: National Risk Management Laboratory, Office of Research and Development, US Environmental Protection Agency.
- Rost, S., Gerten, D., Bondeau, A., Lucht, W., Rohwer, J., & Schaphoff, S. (2008). Agricultural green and blue water consumption and its influence on the global water system. *Water Resources Research*, 44(9).
- Rothman, D. S., & Robinson, J. B. (1997). Growing pains: A conceptual framework for considering integrated assessments. *Environmental Monitoring and Assessment*, 46(1), 23-43.
- RWDI West Inc. (2003). *Predicted ambient concentrations and deposition of priority substances released to the air in the oil sands region*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by RWDI West Inc.
- Sachindra, D., Huang, F., Barton, A., & Perera, B. (2014). Statistical downscaling of general circulation model outputs to precipitation—Part 2: Bias-correction and future projections. *International Journal of Climatology*, 34(11), 3282-3303.

- Saha, S., Moorthi, S., Pan, H.-L., Wu, X., Wang, J., Nadiga, S., & Behringer, D. (2010). The NCEP climate forecast system reanalysis. *Bulletin of the American Meteorological Society*, 91(8), 1015-1057.
- Saha, S., Moorthi, S., Wu, X., Wang, J., Nadiga, S., Tripp, P., & Iredell, M. (2014). The NCEP climate forecast system version 2. *Journal of Climate*, 27(6), 2185-2208.
- Sahoo, G. B., Ray, C., & De Carlo, E. H. (2006). Calibration and validation of a physically distributed hydrological model, MIKE SHE, to predict streamflow at high frequency in a flashy mountainous Hawaii stream. *Journal of Hydrology*, 327(1-2), 94-109. doi:10.1016/j.jhydrol.2005.11.012
- Salla, M. R., Paredes-Arquiola, J., Solera, A., Álvarez, J. A., Pereira, C. E., Alamy Filho, J. E., & De Oliveira, A. L. (2014). Integrated modelling of water quantity and quality in the Araguari River basin, Brazil. *Latin American Journal of Aquatic Research*, 42(1).
- Salvai, A., & Bezdan, A. (2008). Water quality model QUAL2K in TMDL development. *Balwois Ohrid, Republic of Macedonia*, 27, 1-8.
- Sanford, W. (2002). Recharge and groundwater models: An overview. *Hydrogeology Journal*, 10(1), 110-120. doi:10.1007/s10040-001-0173-5
- Santos, R., Fernandes, L. S., Pereira, M., Cortes, R., & Pacheco, F. (2015). Water resources planning for a river basin with recurrent wildfires. *Science of the Total Environment*, 526, 1-13.
- Scanlon, B. R., Reedy, R. C., Stonestrom, D. A., Prudic, D. E., & Dennehy, K. F. (2005). Impact of land use and land cover change on groundwater recharge and quality in the southwestern US. *Global Change Biology*, 11(10), 1577-1593.
- Scharffenberg, W. A. (2016). *Hydrologic modeling system HEC-HMS: User's manual* (Vol. CPD-74A). Davis, CA: US Army Corps of Engineers, Hydrologic Engineering Center.
- Schoff, S. L., & Sayan, M. (1969). *Ground-water resources of the Lambayeque Valley, Department of Lambayeque, northern Peru*. US Government Printing Office.
- Schroeder, P. R., Dozier, T. S., Zappi, P. A., McEnroe, B. M., Sjostrom, J. W., & Peyton, R. L. (1994). *The Hydrologic Evaluation of Landfill Performance (HELP) model: Engineering documentation for version 3*. Cincinnati, OH: Risk Reduction Engineering Laboratory, Office of Research and Development, US Environmental Protection Agency.
- Schwede, D. B., Dennis, R. L., & Bitz, M. A. (2009). The watershed deposition tool: A tool for incorporating atmospheric deposition in water-quality analyses. *JAWRA Journal of the American Water Resources Association*, 45(4), 973-985.
- Scire, J., & Schulman, L. (2014). *CALPUFF modeling to estimate acid deposition inputs for the MAGIC model*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Exponent Inc.

- Scott, M., Beckers, J., & Fennell, J. (2015). Development of a numerical model to support regional cumulative effects groundwater management within the NAOS area. Retrieved from <http://www.esaa.org/wp-content/uploads/2015/01/WaterTech2012-P15.pdf>
- Seguí, P. Q., Ribes, A., Martin, E., Habets, F., & Boé, J. (2010). Comparison of three downscaling methods in simulating the impact of climate change on the hydrology of Mediterranean basins. *Journal of Hydrology*, 383(1-2), 111-124.
- Seo, D., Sigdel, R., Kwon, K., & Lee, Y. (2010). 3D hydrodynamic modelling of Yongdam Lake, Korea using EFDC. *Desalination and Water Treatment*, 19(1-3), 42-48.
- Shabani, A., Zhang, X., & Ell, M. (2017). Modelling water quantity and sulfate concentrations in the Devils Lake watershed using coupled SWAT and CE-QUAL-W2. *JAWRA Journal of the American Water Resources Association*, 53(4), 748-760. doi:10.1111/1752-1688.12535
- Shakibaenia, A., Dibike, Y. B., Kashyap, S., Prowse, T. D., & Droppo, I. G. (2016). A numerical framework for modelling sediment and chemical constituents transport in the Lower Athabasca River. *Journal of Soils and Sediments*, 17(4), 1140-1159. doi:10.1007/s11368-016-1601-4
- Shakibaenia, A., Kashyap, S., Dibike, Y. B., & Prowse, T. D. (2016). An integrated numerical framework for water quality modelling in cold-region rivers: A case of the lower Athabasca River. *Science of the Total Environment*, 569-570, 634-646. doi:10.1016/j.scitotenv.2016.06.151
- Sharma, D., & Kansal, A. (2013). Assessment of river quality models: A review. *Reviews in Environmental Science and Bio/Technology*, 12(3), 285-311. doi:10.1007/s11157-012-9285-8
- Sharma, R. H., & Shakya, N. M. (2006). Hydrological changes and its impact on water resources of Bagmati watershed, Nepal. *Journal of Hydrology*, 327(3), 315-322.
- Shaw, R., & Macdonald, G. (1993). *A review of rate coefficients and constants used in nutrient and dissolved oxygen models for the Peace, Athabasca and Slave River Basins*. Northern River Basins Study project report no. 18. Edmonton, AB: Northern River Basins Study. Prepared by Environmental Management Associates.
- Shaw, R. D., Shaw, J. F. H., Fricker, H., & Prepas, E. E. (1990). An integrated approach to quantify groundwater transport of phosphorus to Narrow Lake, Alberta. *Limnology and Oceanography*, 35(4), 870-886. doi:10.4319/lo.1990.35.4.0870
- Shen, H., Cunderlik, J., Godin, G., Coombs, A., Rimer, A., & Dobrindt, I. (2014). Thermal effects of the proposed water reclamation centre discharge on the East Holland River. *Journal of Water Management Modeling*, C366. doi: 10.14796/JWMM.C366
- Shin, M.-J., Guillaume, J. H., Croke, B. F., & Jakeman, A. J. (2013). Addressing ten questions about conceptual rainfall-runoff models with global sensitivity analyses in R. *Journal of Hydrology*, 503, 135-152.

- Shortle, J., Abler, D., Kaufman, Z., & Zipp, K. Y. (2016). Simple vs. complex: Implications of lags in pollution delivery for efficient load allocation and design of water-quality trading programs. *Agricultural and Resource Economics Review*, 45(02), 367-393. doi:10.1017/age.2016.18
- Shrestha, N. K., Du, X., & Wang, J. (2017). Assessing climate change impacts on fresh water resources of the Athabasca River Basin, Canada. *Science of the Total Environment*, 601-602, 425-440. doi:10.1016/j.scitotenv.2017.05.013
- Shrestha, N. K., Leta, O. T., De Fraine, B., van Griensven, A., & Bauwens, W. (2013). OpenMI-based integrated sediment transport modelling of the river Zenne, Belgium. *Environmental Modelling & Software*, 47, 193-206. doi:10.1016/j.envsoft.2013.05.004
- Silva, E., & Wu, N. (2012). Surveying models in urban land studies. *Journal of Planning Literature*, 27(2), 139-152. Retrieved from <https://doi.org/10.1177%2F0885412211430477>
- Simms, R., Boutin, L., & Martin, P. (2017). *Predictive simulations using the 3D Southern Athabasca oil sands groundwater flow model regional groundwater solutions project*. Report prepared for Canada's Oil Sands Alliance by Matrix Solutions Inc., Calgary, AB. Retrieved from <https://www.cosia.ca/uploads/documents/id47/COSIA%20Predictive%20Simulations%20Using%20the%203D%20SAOS%20GW%20Flow%20Model.pdf>
- Singh, A. (2014). Simulation–optimization modelling for conjunctive water use management. *Agricultural Water Management*, 141, 23-29.
- Sinkó, Z. (2005). *Modelling land use change in the Volta Basin of Ghana* (Vol. 14): Göttingen: Cuvillier Verlag.
- Sivapalan, M. (2003). Prediction in ungauged basins: A grand challenge for theoretical hydrology. *Hydrological Processes*, 17(15), 3163-3170.
- Sivapalan, M., Ruprecht, J. K., & Viney, N. R. (1996). Water and salt balance modelling to predict the effects of land-use changes in forested catchments. 1. Small catchment water balance model. *Hydrological Processes*, 10(3), 393-411.
- Smelser, N. J., & Baltes, P. B. (2001). *International encyclopedia of the social & behavioral sciences* (Vol. 11). Amsterdam: Elsevier.
- Smit, B., & Spaling, H. (1995). Methods for cumulative effects assessment. *Environmental Impact Assessment Review*, 15(1), 81-106.
- Smith, M., Koren, V., Zhang, Z., Moreda, F., Cui, Z., Cosgrove, B., & Staggs, S. (2013). The distributed model intercomparison project – Phase 2: Experiment design and summary results of the western basin experiments. *Journal of Hydrology*, 507, 300-329. doi:10.1016/j.jhydrol.2013.08.040
- Smith, M. B., & Gupta, H. V. (2012). The distributed model intercomparison project (DMIP)–phase 2 experiments in the Oklahoma Region, USA. *Journal of Hydrology*, 418-419, 1-2. Retrieved from <https://doi.org/10.1016/j.jhydrol.2011.09.036>

- Smith, M. B., Seo, D.-J., Koren, V. I., Reed, S. M., Zhang, Z., Duan, Q., & Cong, S. (2004). The distributed model intercomparison project (DMIP): Motivation and experiment design. *Journal of Hydrology*, 298(1), 4-26.
- Sood, A., & Ritter, W. F. (2010). Evaluation of Best Management Practices in Millsboro Pond Watershed Using Soil and Water Assessment Tool (SWAT) Model. *Journal of Water Resource and Protection*, 2(05), 403-412.
- Sophocleous, M., & Perkins, S. P. (2000). Methodology and application of combined watershed and ground-water models in Kansas. *Journal of Hydrology*, 236(3-4), 185-201. doi:10.1016/s0022-1694(00)00293-6
- Starodub, M. E., & Ferguson, G. (1996). *A bioenergetic model of food chain uptake and accumulation of organic chemicals, Athabasca River*. Northern River Basins Study project report no. 137. Edmonton, AB: Northern River Basins Study. Prepared by CanTox Inc.
- Steele-Dunne, S., Lynch, P., McGrath, R., Semmler, T., Wang, S., Hanafin, J., & Nolan, P. (2008). The impacts of climate change on hydrology in Ireland. *Journal of Hydrology*, 356(1-2), 28-45. Retrieved from <https://doi.org/10.1016/j.jhydrol.2008.03.025>
- Steffler, P., & Blackburn, J. (2002). River2D: Two-dimensional depth averaged model of river hydrodynamics and fish habitat. Introduction to depth averaged modelling and user's manual. Fort McMurray, AB: Cumulative Environmental Management Association. Retrieved from <http://library.cemaonline.ca/ckan/dataset/e443c00f-c03f-4288-b2a6-0da82af63b34/resource/ad1e95c1-4541-43be-b545-ff42e68b54e9/download/river2d.pdf>
- Steyaert, L. T., & Knox, R. G. (2008). Reconstructed historical land cover and biophysical parameters for studies of land-atmosphere interactions within the eastern United States. *Journal of Geophysical Research: Atmospheres*, 113(D02101).
- Stoner, A. M., Hayhoe, K., Yang, X., & Wuebbles, D. J. (2013). An asynchronous regional regression model for statistical downscaling of daily climate variables. *International Journal of Climatology*, 33(11), 2473-2494.
- Streeter, H. W., & Phelps, E. B. (1925). *A study of the pollution and natural purification of the Ohio River, River, III. Factors concerned in the phenomena of oxidation and reaeration* (Vol. Public Health Bulletin No. 146). Washington, DC: Reprinted by U.S. Department of Health, Education, & Welfare, Public Health Service, 1958.
- Styczen, M., Thorsen, M., Refsgaard, A., Christiansen, J. S., & Hansen, S. (1999, June 7-11). Non-point pollution modelling at different scales and resolution, based on MIKE SHE. Paper presented at the Proceedings of 3rd DHI Software Conference, Helsingør, Denmark.
- Sullivan, T., Cosby, B., Webb, J., Dennis, R., Bulger, A., & Deviney, F. (2008). Streamwater acid-base chemistry and critical loads of atmospheric sulfur deposition in Shenandoah National Park, Virginia. *Environmental Monitoring and Assessment*, 137(1), 85-99.

- Sun, Z., Huang, Q., Opp, C., Hennig, T., & Marold, U. (2012). Impacts and implications of major changes caused by the Three Gorges Dam in the middle reaches of the Yangtze River, China. *Water Resources Management*, 26(12), 3367-3378.
- Sunyer, M., Madsen, H., & Ang, P. (2012). A comparison of different regional climate models and statistical downscaling methods for extreme rainfall estimation under climate change. *Atmospheric Research*, 103, 119-128.
- Surfleet, C. G., Tullios, D., Chang, H., & Jung, I.-W. (2012). Selection of hydrologic modelling approaches for climate change assessment: A comparison of model scale and structures. *Journal of Hydrology*, 464-465, 233-248. doi:10.1016/j.jhydrol.2012.07.012
- Sutula, M., Butcher, J., Boschen, C., & Molina, M. (2016). *Application of watershed loading and estuary water quality models to inform nutrient management in the Santa Margarita River Watershed* (SCCWRP Technical Report 933, Southern California Coastal Water Research Project). Retrieved from Costa Mesa, CA. Retrieved from www.sccwrp.org
- Taghavi, A., Namvar, R., Najmus, S., & Cayar, M. (2013). Integrated water resources models to support analysis of integrated regional water management programs in California. *British Journal of Environment and Climate Change*, 3(3), 333.
- Tang, Z., Engel, B. A., Pijanowski, B. C., & Lim, K. J. (2005). Forecasting land use change and its environmental impact at a watershed scale. *Journal of Environmental Management*, 76(1), 35- 45. Retrieved from <https://doi.org/10.1016/j.jenvman.2005.01.006>
- Tavakoli, A., Kerachian, R., Nikoo, M. R., Soltani, M., & Estalaki, S. M. (2014). Water and waste load allocation in rivers with emphasis on agricultural return flows: Application of fractional factorial analysis. *Environmental Monitoring and Assessment*, 186(9), 5935-5949. doi:10.1007/s10661-014-3830-6
- Taylor, B., Macdonald, G., & Hamilton, H. (1990). *Model calibration and receiving water evaluation for pulp mill developments on the Athabasca River. II Nutrients, resin acids, chelators, phenols, color, suspended solids*. Calgary, AB: Prepared for the Standards & Approvals Division, Alberta Environment. Prepared by HydroQual Consultants Inc.
- Taylor, K. E., Stouffer, R. J., & Meehl, G. A. (2012). An overview of CMIP5 and the experiment design. *Bulletin of the American Meteorological Society*, 93(4), 485-498.
- Teck Resources Limited (2011). *Frontier oil sands mine project environmental impact assessment*. Calgary, AB: Submitted to the Energy Resources Conservation Board and Alberta Environment.
- Teller, H. (1968). Impact of forest land use on floods. *Unasylva*, 22(1), 18-20.
- Teng, J., Chiew, F., Timbal, B., Wang, Y., Vaze, J., & Wang, B. (2012). Assessment of an analogue downscaling method for modelling climate change impacts on runoff. *Journal of Hydrology*, 472, 111-125.

- Tetra Tech. (2006). *The environmental fluid dynamics code: Theory and computation: Vol. 2: Sediment and Contaminant Transport and Fate*. Fairfax, VA: Tetra Tech Inc.
- Tetra Tech. (2007a). *The environmental fluid dynamics code: Theory and computation: Vol. 1: Hydrodynamics and mass transport*. Fairfax, VA: Tetra Tech.
- Tetra Tech. (2007b). *The environmental fluid dynamics code: Theory and computation: Vol. 3: Water Quality Module*. Fairfax, VA: Tetra Tech, Inc.
- Tetra Tech. (2007c). *The environmental fluid dynamics code: User manual, USEPA version 1.01*. Athens, GA: US Environmental Protection Agency.
- Tetra Tech. (2009). *Loading simulation program C++(LSPC) version 3.1 user's manual*. Fairfax, VA: Tetra Tech.
- Teuling, A. J., Seneviratne, S. I., Stöckli, R., Reichstein, M., Moors, E., Ciais, P., & Bernhofer, C. (2010). Contrasting response of European forest and grassland energy exchange to heatwaves. *Nature Geoscience*, 3(10), 722.
- Thanh, P., Grace, M., & James, S.C. (2008). *Sandia National Laboratories environmental fluid dynamics code: sediment transport user manual*. No. SAND2008-5621. Sandia National Laboratories.
- Therivel, R., & Ross, B. (2007). Cumulative effects assessment: Does scale matter? *Environmental Impact Assessment Review*, 27(5), 365-385.
- Therrien, R., McLaren, R., Sudicky, E., & Panday, S. (2010). *HydroGeoSphere: A three-dimensional numerical model describing fully-integrated subsurface and surface flow and solute transport*. Groundwater Simulations Group, University of Waterloo, Waterloo, ON. Retrieved from <https://www.ggl.ulaval.ca/fileadmin/ggl/documents/rtherrien/hydrogeosphere.pdf>
- Therrien, R., & Sudicky, E. A. (1996). Three-dimensional analysis of variably-saturated flow and solute transport in discretely-fractured porous media. *Journal of Contaminant Hydrology*, 23(1-2), 1-44. doi:10.1016/0169-7722(95)00088-7
- Thompson, J., Sørensen, H. R., Gavin, H., & Refsgaard, A. (2004). Application of the coupled MIKE SHE/MIKE 11 modelling system to a lowland wet grassland in southeast England. *Journal of Hydrology*, 293(1), 151-179.
- Thompson, R., Mooder, R., Conlan, M., & Cheema, T. (2011). Groundwater flow and solute transport modelling of an oil sands mine to aid in the assessment of the performance of the planned closure landscape. Paper presented at the Fourie A. Tibbett, M. & Beersing A.(Eds.), *Mine Closure 2011: Proceedings of the Sixth International Conference on Mine Closure*.
- Toth, B., Pietroniro, A., Conly, F. M., & Kouwen, N. (2006). Modelling climate change impacts in the Peace and Athabasca catchment and delta: I—hydrological model application. *Hydrological Processes*, 20(19), 4197-4214. doi:10.1002/hyp.6426
- Trillium Engineering and Hydrographics Inc. (2003). *Tracer dye studies in the Lower Athabasca River*. Fort McMurray, AB: Cumulative Environmental Management Association.

- Trillium Engineering and Hydrographics Inc. (2004). *Open water survey of the Athabasca River at Bitumount (reach #4)*. Project no. 03-560 Lower Athabasca River habitat surveys. Fort McMurray, AB: Cumulative Environmental Management Association.
- Trillium Engineering and Hydrographics Inc. (2005). *Flow simulations and fish habitat evaluation for the Athabasca River at Bitumount (reach #4)*. Project no. 04-568 Lower Athabasca River habitat surveys. Fort McMurray, AB: Cumulative Environmental Management Association.
- Tripathi, O. P., & Dominguez, F. (2013). Effects of spatial resolution in the simulation of daily and subdaily precipitation in the southwestern US. *Journal of Geophysical Research: Atmospheres*, 118(14), 7591-7605.
- Tripathi, S., Srinivas, V., & Nanjundiah, R. S. (2006). Downscaling of precipitation for climate change scenarios: A support vector machine approach. *Journal of Hydrology*, 330(3-4), 621-640.
- Tsakiris, G., & Alexakis, D. (2012). Water quality models: An overview. *European Water*, 37, 33-46.
- Tsanis, I. (2006). Modelling leachate contamination and remediation of groundwater at a landfill site. *Water Resources Management*, 20(1), 109-132.
- Tshimanga, R., & Hughes, D. (2012). Climate change and impacts on the hydrology of the Congo Basin: The case of the northern sub-basins of the Oubangui and Sangha Rivers. *Physics and Chemistry of the Earth, Parts A/B/C*, 50, 72-83.
- Tu, J. (2009). Combined impact of climate and land use changes on streamflow and water quality in eastern Massachusetts, USA. *Journal of Hydrology*, 379(3-4), 268-283.
- Turner, B. L., Skole, D., Sanderson, S., Fischer, G., Fresco, L., & Leemans, R. (1995). *Land-use and land-cover change: Science/research plan*. International Geosphere-Biosphere Programme, Stockholm; Report, 35.
- Turner, B. L., Villar, S. C., Foster, D., Geoghegan, J., Keys, E., Klepeis, P., & Ogneva-Himmelberger, Y. (2001). Deforestation in the southern Yucatán peninsular region: An integrative approach. *Forest Ecology and Management*, 154(3), 353-370.
- UN-ESCAP (United Nations, E. a. S. C. f. A. a. t. P. (2000). *Principles and practices of water allocation among water-use sectors*. Bangkok, Thailand.
- Uppala, S. M., KÅllberg, P. W., Simmons, A. J., Andrae, U., Bechtold, V. D. C., Fiorino, M., Woollen, J. (2005). The ERA-40 re-analysis. *Quarterly Journal of the Royal Meteorological Society*, 131(612), 2961-3012. doi:10.1256/qj.04.176
- USEPA. (2001). *Better assessment science integrating point and nonpoint sources BASINS Version 3.0 user's manual*. Washington, DC: Office of Water, US Environmental Protection Agency.

- USEPA. (2008). *Handbook for developing watershed TMDLs (draft)*. Washington, DC: Office of Wetlands, Oceans, and Watersheds, US Environmental Protection Agency.
- Van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., & Lamarque, J.-F. (2011). The representative concentration pathways: An overview. *Climatic Change*, 109(1-2), 5.
- Vandenberg, J., Lauzon, N., Prakash, S., & Salzsauler, K. (2011). Use of water quality models for design and evaluation of pit lakes. Paper presented at Mine Pit Lakes: Closure and Management, Australian Centre for Geomechanics, Perth, Australia.
- Vandenberg, J., Mackenzie, I., & Buchak, E. (2012). *CEMA oil sands pit lake model*. Prepared by Golder Associates Ltd. Fort McMurray, AB: Cumulative Environmental Management Association (CEMA).
- Vandenberg, J., McCullough, C., & Castendyk, D. (2015). Key issues in mine closure planning related to pit lakes. Paper presented at the Agreeing on solutions for more sustainable mine water management—Proceedings of the 10th ICARD & IMWA Annual Conference (paper 156), Santiago, Chile. Retrieved from https://www.researchgate.net/profile/Cherie_Mccullough/publication/275634327_Key_issues_in_Mine_Closure_Planning_Related_to_Pit_Lakes/links/55408fe20cf2320416ed0bdf/Key-issues-in-Mine-Closure-Planning-Related-to-Pit-Lakes.pdf
- Vandenberg, J., Prakash, S., & Buchak, E. M. (2014). Sediment diagenesis module for CE-QUAL-W2. Part 1: Conceptual formulation. *Environmental Modelling and Assessment*, 20(3), 239-247. doi:10.1007/s10666-014-9428-0
- Vansteenkiste, T., Tavakoli, M., Ntegeka, V., Willems, P., De Smedt, F., & Batelaan, O. (2013). Climate change impact on river flows and catchment hydrology: A comparison of two spatially distributed models. *Hydrological Processes*, 27(25), 3649-3662.
- Veijalainen, N. (2012). *Estimation of climate change impacts on hydrology and floods in Finland*. Aalto University publication series doctoral dissertations. Espoo, Finland: Aalto University. School of Engineering. Department of Civil and Environmental Engineering. Retrieved from <http://urn.fi/URN:ISBN:978-952-60-4614-3>
- Velázquez, J., Schmid, J., Ricard, S., Muerth, M., St-Denis, B. G., Minville, M., & Turcotte, R. (2013). An ensemble approach to assess hydrological models' contribution to uncertainties in the analysis of climate change impact on water resources. *Hydrology and Earth System Sciences*, 17(2), 565-578.
- Veldkamp, A., & Verburg, P. H. (2004). Modelling land use change and environmental impact. *Journal of Environmental Management*, 72(1-2), 1-3. <https://doi.org/10.1016/j.jenvman.2004.04.004>

- Verry, E. S., Lewis, J. R., & Brooks, K. N. (1983). Aspen clearcutting increases snowmelt and storm flow peaks in north central Minnesota. *JAWRA Journal of the American Water Resources Association*, 19(1), 59-67.
- Viney, N. R., Bormann, H., Breuer, L., Bronstert, A., Croke, B. F., Frede, H., & Jakeman, A. J. (2009). Assessing the impact of land use change on hydrology by ensemble modelling (LUCHEM) II: Ensemble combinations and predictions. *Advances in Water Resources*, 32(2), 147-158.
- Voss, C. (1999). USGS SUTRA code—History, practical use, and application in Hawaii. In J. Bear, A. H.-D. Cheng, S. Sorek, D. Ouazar, & I. Herrera (Eds.), *Seawater intrusion in coastal aquifers—concepts, methods and practices* (pp. 249-313). Dordrecht: Springer.
- Voss, C. I., & Provost, A. M. (2010). *Sutra: A model for saturated-unsaturated, variable-density ground-water flow with solute or energy transport, version of September 22, 2010 (SUTRA version 2.2)*. Reston, VA: USGS.
- Wang, H., Ting, M., & Ji, M. (1999). Prediction of seasonal mean United States precipitation based on El Niño sea surface temperatures. *Geophysical Research Letters*, 26(9), 1341-1344.
- Wang, J., Han, Y., Stein, M. L., Kotamarthi, V. R., & Huang, W. K. (2016). Evaluation of dynamically downscaled extreme temperature using a spatially-aggregated generalized extreme value (GEV) model. *Climate Dynamics*, 47(9-10), 2833-2849.
- Wang, L., Fang, L., & Hipel, K. W. (2007). Mathematical programming approaches for modelling water rights allocation. *Journal of Water Resources Planning and Management*, 133(1), 50-59.
- Wang, L., Fang, L., & Hipel, K. W. (2008). Basin-wide cooperative water resources allocation. *European Journal of Operational Research*, 190(3), 798-817.
- Wang, M., Overland, J. E., & Stabenro, P. (2012). Future climate of the Bering and Chukchi Seas projected by global climate models. *Deep Sea Research part II: Topical Studies in Oceanography*, 65, 46-57.
- Wang, Q., Li, S., Jia, P., Qi, C., & Ding, F. (2013). A review of surface water quality models. *Scientific World Journal*, 2013, Article ID 231768. doi:10.1155/2013/231768
- Wang, S., Kang, S., Zhang, L., & Li, F. (2008). Modelling hydrological response to different land-use and climate change scenarios in the Zamu River basin of northwest China. *Hydrological Processes*, 22(14), 2502-2510.
- Wang, S. H., Huggins, D. G., Frees, L., Volkman, C. G., Lim, N. C., Baker, D. S., & Smith, V., & Denoyelles, F. Jr. (2005). An integrated modelling approach to total watershed management: Water quality and watershed assessment of Cheney Reservoir, Kansas, USA. *Water, Air, and Soil Pollution*, 164(1-4), 1-19.
- Weatherhead, E., & Howden, N. (2009). The relationship between land use and surface water resources in the UK. *Land Use Policy*, 26, S243-S250.

- Wegener, M. (1986). *Integrated forecasting models of urban and regional systems* (Vol. 9-24). London: Pion.
- Weisse, R., & Oestreicher, R. (2001). Reconstruction of potential evaporation for water balance studies. *Climate Research*, 16(2), 123-131.
- Wellen, C., Kamran-Disfani, A. R., & Arhonditsis, G. B. (2015). Evaluation of the current state of distributed watershed nutrient water quality modelling. *Environmental Science & Technology*, 49(6), 3278-3290. doi:10.1021/es5049557
- Welsh, W. D., Vaze, J., Dutta, D., Rassam, D., Rahman, J. M., Jolly, I. D., & Lerat, J. (2013). An integrated modelling framework for regulated river systems. *Environmental Modelling & Software*, 39, 81-102. doi:10.1016/j.envsoft.2012.02.022
- Werth, D., & Avissar, R. (2002). The local and global effects of Amazon deforestation. *Journal of Geophysical Research: Atmospheres*, 107(D20), 8087.
- Whelan, G., Kim, K., Pelton, M. A., Castleton, K. J., Laniak, G. F., Wolfe, K., & Galvin, M. (2014). Design of a component-based integrated environmental modelling framework. *Environmental Modelling & Software*, 55, 1-24. doi:10.1016/j.envsoft.2014.01.016
- White, M. D., & Greer, K. A. (2006). The effects of watershed urbanization on the stream hydrology and riparian vegetation of Los Penasquitos Creek, California. *Landscape and Urban Planning*, 74(2), 125-138.
- White, D. A., & King, K. W. (2003). Use of SWAT to quantify TMDL load allocations for a large watershed in western Ohio (USA). In *Total Maximum Daily Load (TMDL) environmental regulations II* (p.1). American Society of Agricultural and Biological Engineers.
- Whitehead, P. G., Wilby, R. L., Battarbee, R. W., Kernan, M., & Wade, A. J. (2009). A review of the potential impacts of climate change on surface water quality. *Hydrological Sciences Journal*, 54(1), 101-123. doi:10.1623/hysj.54.1.101
- Whitfield, C. J., Aherne, J., Cosby, J. B., & Watmough, S. A. (2010). Modelling boreal lake catchment response to anthropogenic acid deposition. *Journal of Limnology*, 69(1s), 135-146.
- Whitfield, C. J., Aherne, J., & Watmough, S. A. (2009). Modelling soil acidification in the Athabasca Oil Sands Region, Alberta, Canada. *Environmental Science & Technology*, 43(15), 5844-5850.
- Whitfield, C. J., & Watmough, S. A. (2010). *Regional application of MAGIC to lake catchments and soils in the Regional Municipality of Wood Buffalo*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Environmental and Resource Science, Trent University.
- Whitfield, C. J., Watmough, S. A., & Aherne, J. (2011). *Uncertainty-based modelling of soil chemical response to acidic deposition*. Fort McMurray, AB: Cumulative Environmental Management Association. Prepared by Environmental and Resource Studies, Trent University.

- Wigley, T., Jones, P., Briffa, K., & Smith, G. (1990). Obtaining sub-grid-scale information from coarse-resolution general circulation model output. *Journal of Geophysical Research: Atmospheres*, 95(D2), 1943-1953.
- Wigmosta, M. S., Vail, L. W., & Lettenmaier, D. P. (1994). A distributed hydrology-vegetation model for complex terrain. *Water Resources Research*, 30(6), 1665-1679.
- Wijesekara, G. N., Gupta, A., Valeo, C., Hasbani, J.-G., Qiao, Y., Delaney, P., & Marceau, D. J. (2012). Assessing the impact of future land-use changes on hydrological processes in the Elbow River watershed in southern Alberta, Canada. *Journal of Hydrology*, 412-413, 220-232. Retrieved from <https://doi.org/10.1016/j.jhydrol.2011.04.018>
- Wilby, R. (1998). Modelling low-frequency rainfall events using airflow indices, weather patterns and frontal frequencies. *Journal of Hydrology*, 212, 380-392.
- Wilby, R., Barnsley, N., & O'Hare, G. (1995). Rainfall variability associated with Lamb weather types: The case for incorporating weather fronts. *International Journal of Climatology*, 15(11), 1241-1252.
- Wilby, R. L., Wigley, T., Conway, D., Jones, P., Hewitson, B., Main, J., & Wilks, D. (1998). Statistical downscaling of general circulation model output: A comparison of methods. *Water Resources Research*, 34(11), 2995-3008.
- Willems, P., & Vrac, M. (2011). Statistical precipitation downscaling for small-scale hydrological impact investigations of climate change. *Journal of Hydrology*, 402(3-4), 193-205.
- Wilson, A. G. (1974). *Urban and regional models in geography and planning*. Melbourne, AU: ARRB.
- Winston, R. B., & Voss, C. I. (2004). *SutraGUI, a graphical-user interface for SUTRA, a model for ground-water flow with solute or energy transport*. Reston, VA: US Department of the Interior, US Geological Survey.
- Wojtowicz, A., Hicks, F., Andrishak, R., Brayall, M., Blackburn, J., & Maxwell, J. (2009). 2D modeling of ice cover formation processes on the Athabasca River, AB. Paper presented at the CGU HS Committee on River Ice Processes and the Environment 15th Workshop on River Ice, St. John's, Newfoundland and Labrador.
- Wong, I., Lam, D. C.-L., Booty, W. G., & Fong, P. (2009). A loosely-coupled collaborative integrated environmental modelling framework. Paper presented at the Proceedings of the 15th Americas Conference on Information Systems, AMCIS 2009, San Francisco, CA.
- Wood, A. W., Leung, L. R., Sridhar, V., & Lettenmaier, D. (2004). Hydrologic implications of dynamical and statistical approaches to downscaling climate model outputs. *Climatic Change*, 62(1), 189-216.
- Wood, W. W. (2012). Reductionism to integrationism: A paradigm shift. *Groundwater*, 50(2), 167. doi:10.1111/j.1745-6584.2011.00900.x

- WorleyParsons Resources & Energy (WorleyParsons). 2010. *Groundwater flow model for the Athabasca Oil Sands (in-situ) Area south of Fort McMurray Phase 2*. Report prepared for Alberta Environment. December 17, 2010.
- Wu, C.-Y., & Fan, C. (2017). Integrated application of river water quality modelling and cost-benefit analysis to optimize the environmental economical value based on various aquatic waste load reduction strategies. Paper presented at the 19th EGU General Assembly Conference Abstracts, Vienna, Austria.
- Xiong, Y. (2011). A dam break analysis using HEC-RAS. *Journal of Water Resource and Protection*, 3(06), 370.
- Xu, C., Zhang, J., Bi, X., Xu, Z., He, Y., & Gin, K. Y. (2017). Developing an integrated 3D-hydrodynamic and emerging contaminant model for assessing water quality in a Yangtze Estuary Reservoir. *Chemosphere*, 188, 218-230. doi:10.1016/j.chemosphere.2017.08.121
- Yao, L., Xu, J., Zhang, M., Lv, C., & Li, C. (2016). Waste load equilibrium allocation: A soft path for coping with deteriorating water systems. *Environmental Science and Pollution Research International*, 23(15), 14968-14988. doi:10.1007/s11356-016-6593-5
- Yasarer, L. M., Bingner, R. L., Garbrecht, J., Locke, M., Lizotte, R., Momm, H., & Busteded, P. (2017). Climate change impacts on runoff, sediment, and nutrient loads in an agricultural watershed in the Lower Mississippi River Basin. *Applied Engineering in Agriculture*, 33(3), 379.
- Yates, D. N. (1996). WatBal: An integrated water balance model for climate impact assessment of river basin runoff. *International Journal of Water Resources Development*, 12(2), 121-140, doi: 10.1080/07900629650041902
- Yeo, K., & Jung, Y. (2015). Cost allocation of river water quality management based on the Separable Cost Remaining Benefit (SCRB) method. *Journal of Environmental Planning and Management*, 59(6), 1040-1053. doi:10.1080/09640568.2015.1053561
- Yoder, R. E. (1936). A direct method of aggregate analysis of soils and a study of the physical nature of erosion losses 1. *Agronomy Journal*, 28(5), 337-351.
- Yu, W., Zang, S., Wu, C., Liu, W., & Na, X. (2011). Analyzing and modelling land use land cover change (LUCC) in the Daqing City, China. *Applied Geography*, 31(2), 600-608.
- Yue, P., & Derichsweiler, M. (2005). *TMDL development for Fort Cobb Creek Watershed and Fort Cobb Lake*. Paper presented at the Proceedings of Oklahoma Water Conference 2005, Stillwater, OK.
- Yulianti, J. S., & Burn, D. H. (1998). Investigating links between climatic warming and low streamflow in the Prairies region of Canada. *Canadian Water Resources Journal*, 23(1), 45-60. doi: 10.4296/cwrj2301045

- Zhang, G. (2007). *Modelling Hydrological Response at the Catchment Scale: Application and Extension of the Representative Elementary Watershed (REW) Approach*. Delft, NL: Eburon Academic Publishers.
- Zhang, H., Xu, W. L., & Hiscock, K. M. (2013). Application of MT3DMS and geographic information system to evaluation of groundwater contamination in the Sherwood Sandstone aquifer, UK. *Water, Air, & Soil Pollution*, 224(2). doi:10.1007/s11270-013-1438-z
- Zhang, M., Wei, X., & Li, Q. (2016). A quantitative assessment on the response of flow regimes to cumulative forest disturbances in large snow-dominated watersheds in the interior of British Columbia, Canada. *Ecohydrology*, 9(5), 843-859.
- Zhang, X., Alexander, L., Hegerl, G. C., Jones, P., Tank, A. K., Peterson, T. C., & Zwiers, F. W. (2011). Indices for monitoring changes in extremes based on daily temperature and precipitation data. *Wiley Interdisciplinary Reviews: Climate Change*, 2(6), 851-870.
- Zhang, X., Tang, Q., Zhang, X., & Lettenmaier, D. P. (2014). Runoff sensitivity to global mean temperature change in the CMIP5 Models. *Geophysical Research Letters*, 41(15), 5492-5498.
- Zhang, X.-C. (2005). Spatial downscaling of global climate model output for site-specific assessment of crop production and soil erosion. *Agricultural and Forest Meteorology*, 135(1-4), 215-229.
- Zhang, Y. Y., Shao, Q. X., Ye, A. Z., Xing, H. T., & Xia, J. (2016). Integrated water system simulation by considering hydrological and biogeochemical processes: Model development, with parameter sensitivity and autocalibration. *Hydrology and Earth System Sciences*, 20(1), 529-553. doi:10.5194/hess-20-529-2016
- Zhao, H., Zhang, J., James, R., & Laing, J. (2012). Application of MIKE SHE/MIKE 11 model to structural BMPs in S191 basin, Florida. *Journal of Environmental Informatics*, 19(1).
- Zhao, Q., Ye, B., Ding, Y., Zhang, S., Yi, S., Wang, J. & Han, H. (2013). Coupling a glacier melt model to the Variable Infiltration Capacity (VIC) model for hydrological modelling in north-western China. *Environmental Earth Sciences*, 68(1), 87-101.
- Zheng, C., & Wang, P. P. (1999). *MT3DMS: A modular three-dimensional multispecies transport model for simulation of advection, dispersion, and chemical reactions of contaminants in groundwater systems; documentation and user's guide*. Tuscaloosa, AL: University of Alabama.
- Zhou, F., Dong, Y., Wu, J., Zheng, J., & Zhao, Y. (2015). An indirect simulation-optimization model for determining optimal TMDL allocation under uncertainty. *Water*, 7(12), 6634-6650. doi:10.3390/w7116634
- Zhou, J., Hu, B. X., Cheng, G., Wang, G., & Li, X. (2011). Development of a three-dimensional watershed modelling system for water cycle in the middle part of the Heihe rivershed, in the west of China. *Hydrological Processes*, 25(12), 1964-1978. doi:10.1002/hyp.7952

- Zhou, Q., Driscoll, C. T., Moore, S. E., Kulp, M. A., Renfro, J. R., Schwartz, J. S., & Lynch, J. A. (2015). Developing critical loads of nitrate and sulfate deposition to watersheds of the Great Smoky Mountains National Park, USA. *Water, Air, & Soil Pollution*, 226(8), 255.
- Zolfagharipoor, M. A., & Ahmadi, A. (2016). A decision-making framework for river water quality management under uncertainty: Application of social choice rules. *Journal of Environmental Management*, 183, 152-163. doi:10.1016/j.jenvman.2016.07.094
- Zou, R., Carter, S., Shoemaker, L., Parker, A., & Henry, T. (2006). Integrated hydrodynamic and water quality modelling system to support nutrient total maximum daily load development for Wissahickon Creek, Pennsylvania. *Journal of Environmental Engineering*, 132(4), 555-566.

Investigating the complex nature of environmental problems requires the integration of different environmental processes across major components of the environment. Cumulative effects assessment (CEA) not only includes analyzing and modelling environmental changes, but also supports planning alternatives that promote environmental monitoring and management.

The adoption of integrated modelling approaches requires the development of frameworks which may be used to investigate individual environmental processes and their interactions with each other. Integrated modelling frameworks are often the only way to examine important environmental processes and interactions, relevant spatial and temporal scales, and feedback mechanisms of complex systems for CEA.

This book examines the ways in which interactions and relationships between environmental components are understood, paying special attention to climate, land, water quantity and quality, and both anthropogenic and natural stressors. It reviews modelling approaches for each component and existing integrated modelling systems for CEA. Finally, it proposes an integrated modelling framework and provides perspectives on future research avenues for cumulative effects assessment.

ANIL GUPTA is a professional engineer with more than 25 years of experience in senior management, regulatory systems, environmental science, integrated environmental modelling for cumulative effects assessments, climate change and big data analytics.

BABAK FARJAD is a senior HydroGeospatial scientist with experience in numerical modelling, as well as applications of GeoInformatics and machine learning in environmental modelling.

GEORGE WANG is a water quality modeller with over twenty years of research and consulting experience in surface water quality, water resources, and environmental management.

HYUNG EUM is a surface water modeller and currently works on climate change impacts on hydrologic systems in Alberta.

MONIQUE DUBÉ is an environmental scientist with 28 years experience in executive management, environmental science, global sustainability research, cumulative effects assessment, and multi-stakeholder negotiations of high profile, nexus issues.



UNIVERSITY OF CALGARY
LCR Publishing Services

press.ucalgary.ca

