

Dr. Scott K. Hansen

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Curriculum vitae

Work experience

- 2018 –** **Senior Lecturer, Zuckerberg Institute for Water Research**, Ben-Gurion University, Israel
- 2015 – 2018** **Postdoctoral Research Associate, Computational Earth Science Group**, Los Alamos National Laboratory, USA
Mentors: Dr. Velimir (Monty) Vesselinov; Dr. Satish Karra
- 2012 – 2015** **Postdoctoral Fellow, Earth and Planetary Sciences Department**, Weizmann Institute of Science, Israel
Mentor: Prof. Brian Berkowitz

Education

- 2008 – 2012** **PhD, Civil Engineering**, Queen's University, Canada
Supervisor: Prof. Bernard H. Kueper
- 2006 – 2007** **MSc, Mathematics**, University of Toronto, Canada
Coursework; Inverse problems focus
- 1999 – 2004** **BSc, Mathematics and Engineering**, Queen's University, Canada
First class honours

Refereed journal publications

H-index: 12 (according to [Google Scholar](https://scholar.google.com/citations?user=skh))

S.K. Hansen (2022). *Experimental support for a simplified approach to CTRW transport models and exploration of parameter interpretation*. Water Resources Research 58(5), e2021WR031350.

Y. Teitelbaum, T. Shimony, E.S. Cifuentes, J. Dallmann, C.B. Phillips, A.I. Packman, R. Schumer, N.L. Sund, **S.K. Hansen**, S. Arnon (2022). *A Novel Framework for Simulating Particle Deposition with Moving Bedforms*. Geophysical Research Letters 49 (4), e2021GL097223.

M. Garrido, **S.K. Hansen**, R. Yaari, H. Hawlena (2022). *A model selection approach to structural equation modelling: A critical evaluation and a road map for ecologists*. Methods in Ecology and Evolution 13(1), 42-53.

Y. Teitelbaum, J. Dallmann, C.B. Phillips, A.I. Packman, R. Schumer, N.L. Sund, **S.K. Hansen**, S. Arnon (2021). *Dynamics of Hyporheic Exchange Flux and Fine Particle Deposition Under Moving Bedforms*. Water Resources Research 57 (4), e2020WR028541

S.K. Hansen, B. Berkowitz (2020). *Aurora: A non-Fickian (and Fickian) particle tracking package for modeling groundwater contaminant transport with MODFLOW*. Environmental Modelling & Software 134, 104871

S.K. Hansen, B. Berkowitz (2020). *Modeling Non-Fickian Solute Transport Due to Mass Transfer and Physical Heterogeneity on Arbitrary Groundwater Velocity Fields*. Water Resources Research 56(10), e2019WR026868.

- S.K. Hansen** (2020). *Simplified calibration of continuous-time random walk solute transport models*. *Advances in Water Resources* 137, 103521.
- S.K. Hansen** (2019). *Exploring compatibility of Sherwood-Gilland NAPL dissolution models with micro-scale physics using an alternative volume averaging approach*. *Water* 11(7) 1525.
- S.K. Hansen**, C.P. Haslauer, O.A. Cirpka and V.V. Vesselinov (2018). *Direct breakthrough curve prediction from statistics of heterogeneous conductivity fields*. *Water Resources Research* 54(1), 271-285.
- V.G. Stanev, F.L. Iliev, **S. Hansen**, V.V. Vesselinov, B.S. Alexandrov (2018). *Identification of release sources in advection–diffusion system by machine learning combined with Green’s function inverse method*. *Applied Mathematical Modelling* 60, 64-76.
- D.K. Burnell, J. Xiu, **S.K. Hansen**, L.S. Sims, C.R. Faust (2018). *A Practical Modeling Framework for Non-Fickian Transport and Multi-Species Sequential First-Order Reaction*. *Groundwater* 56(4), 524-540.
- S.K. Hansen**, J. He and V.V. Vesselinov (2018). *Characterizing the impact of model error in geophysical time series recovery inverse problems*. *Advances in Water Resources* 111, 372-380.
- S.K. Hansen**, and V.V. Vesselinov (2018). *Local Equilibrium and Retardation Revisited*. *Groundwater* 56(1), 109-117.
- S.K. Hansen**, S. Pandey, S. Karra and V.V. Vesselinov (2017). *CHROTRAN 1.0: A mathematical and computational model for in situ heavy metal remediation in heterogeneous aquifers*. *Geoscientific Model Development* 10, 4525-4538.
- S.K. Hansen**, V.V. Vesselinov, Z. Lu, P.W. Reimus (2017). *Inferring subsurface heterogeneity from push-drift tracer tests*. *Water Resources Research* 53(7).
- D.K. Burnell, **S.K. Hansen** and J. Xu (2017). *Transient modeling of non-Fickian transport and first-order reaction*. *Advances in Water Resources* 107, 370-392.
- S.K. Hansen**, B. Berkowitz, V.V. Vesselinov, D. O'Malley and S. Karra (2016). *Push-pull tracer tests: their information content and use for characterizing non-Fickian, mobile-immobile behavior*. *Water Resources Research* 52(12), 9565-9585.
- S.K. Hansen** and V.V. Vesselinov (2016). *Contaminant point source localization error estimates as functions of data quantity and model quality*. *Journal of Contaminant Hydrology* 193, 74-85.
- B. Berkowitz, I. Dror, **S.K. Hansen**, and H. Scher (2016). *Measurements and models of reactive transport in geological media*. *Reviews of Geophysics* 54(4), 930-986.
- S.K. Hansen** (2015). *Effective ADE models for first-order mobile-immobile solute transport: limits on validity and modeling implications*. *Advances in Water Resources* 86 Part A, 184–192.
- S.K. Hansen** and B. Berkowitz (2015). *Integrodifferential formulations of the continuous-time random walk for solute transport subject to bimolecular $A + B \rightarrow 0$ reactions*. *Physical Review E* 91, 032113.
- S.K. Hansen** and B. Berkowitz (2014). *Interpretation and nonuniqueness of CTRW transition distributions: insights from an alternative solute transport formulation*. *Advances in Water Resources* 74, 54–63.
- S.K. Hansen**, H. Scher and B. Berkowitz (2014). *First-principles derivation of reactive transport modeling parameters for particle tracking and PDE approaches*. *Advances in Water Resources* 69, 146–158.

S.K. Hansen and B.H. Kueper (2014). *A new model for coupled multicomponent NAPL dissolution and aqueous-phase transport, with application to creosote dissolution in discrete fractures*. Water Resources Research 50, 58–70.

S.K. Hansen (2013). *Semianalytic solution for transport of a two-member decay chain in discrete parallel fractures*. Water Resources Research 49, 6105–6110.

S.K. Hansen (2011). *On the effects of a totally reflecting barrier on an unbiased 1D random walk*. Physica Status Solidi B 248(9), 2112–2119.

S.K. Hansen and B.H. Kueper (2011). *Forensic misidentification of Aroclor sources in fractured bedrock due to "chromatographic" polychlorinated biphenyl (PCB) congener separation*. Environmental Forensics 12(1), 25–34.

S.K. Hansen and B.H. Kueper (2009). *An efficient method for asymptotic solution to some linear PDEs having arbitrary time-varying type I boundary conditions*. Applied Mathematics and Computation 207(1) 273–278.

S.K. Hansen and B.H. Kueper (2007). *An analytical solution to multi-component NAPL dissolution equations*. Advances in Water Resources 30(3), 382–388.

R.K. Rowe, T. Mukunoki, R.J. Bathurst, S. Rimal, P. Hurst and **S. Hansen** (2007). *Performance of a geocomposite liner for containing Jet A-1 spill in an extreme environment*. Geotextiles and Geomembranes 25(2), 68–77.

Invited talks

Oct 30, 2019 at Agricultural Research Organization (ARO) - Volcani Center, Israel

May 24, 2019 at Department of Civil & Environmental Engineering, Northwestern University, USA; Guest of Prof. James P. Hambleton.

October 9, 2018 at Northwestern Center for Water Research, Northwestern University, USA.

April 12, 2017 at Zuckerberg Institute for Water Research, Ben-Gurion University of the Negev, Israel.

February 27, 2017 at School of Engineering, University of Guelph, Canada.

February 21, 2017 at Department of Geology, Kansas State University, USA.

February 16, 2017 at Department of Geology, Wayne State University, USA.

April 29, 2015 at University of Hohenheim, Germany; Guest of Prof. Thilo Streck.

March 31, 2015 at IRTG/WESS seminar, University of Tübingen, Germany; Guest of Prof. Olaf Cirpka.

Conference presentations

S.K. Hansen and D.K. Burnell (2021). *Incorporating Stochastic Models of Small-Scale Heterogeneity into Deterministic Field-Scale Reactive Contaminant Transport Simulations*. Oral presentation at AGU Fall Meeting, Online, December 2021.

Y. Tao, S. Karra, and **S.K. Hansen** (2021). *Effects of Heterogeneous Permeability and Background Flow on Supercritical CO₂ Behaviour in the Deep Subsurface*. Oral presentation at AGU Fall Meeting, Online, December 2021.

S.K. Hansen (2021). *Computational approaches to subsurface heterogeneity*. Interpore Israel 2021, Tel Aviv, July 2021.

S.K. Hansen (2021). *Adjoint-State Monte Carlo Quantification of Hydraulic Information Contained in Point Subsurface Measurements*. Oral Presentation at SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS21), Online, June 2021.

Y. Teitelbaum, T. Shimony, E.S. Cifuentes, J. Dahlmann, C.B. Phillips, A.I. Packman, R. Schumer, N.L. Sund, **S.K. Hansen**, S. Arnon (2020). *Simulating Accumulation of Low-Conductivity Layer in Streambeds Under Moving-Bedform Conditions*. Oral presentation at AGU Fall Meeting, Online, December 2020.

S.K. Hansen, J. P. Hambleton (2019). *Quantifying Predictive Uncertainty as a Function of Calibration Data Quantity and Model Resolution Using an Adjoint State Monte Carlo Technique*. Oral presentation at AGU Fall Meeting, San Francisco CA, December 2019.

Y. Teitelbaum, J. Dahlmann, C.B. Phillips, A.I. Packman, R. Schumer, N.L. Sund, **S.K. Hansen**, S. Arnon (2019). Impact of Clay Addition Size on Hyporheic Exchange During Bedform Migration. AGU Fall Meeting, San Francisco CA, December 2019.

S.K. Hansen (2018). *Modeling Chemical and Physical Sources of Non-Fickian Contaminant Transport on Arbitrary Groundwater Velocity Fields*. Oral presentation at American Geophysical Union Fall Meeting, Washington DC, December 2018.

S.K. Hansen, V.V. Vesselinov, Z. Lu, P.W. Reimus, D. Katzman (2017). *A New Kind of Single-Well Tracer Test for Assessing Subsurface Heterogeneity*. Oral presentation at AGU Fall Meeting, New Orleans, December 2017.

E.E. Wright, **S.K. Hansen**, D. Bolster, D.H. Richter, V.V. Vesselinov (2017). *Predicting Upscaled Behavior of Aqueous Reactants in Heterogeneous Porous Media*. AGU Fall Meeting, New Orleans LA, December 2017.

S.K. Hansen (2017). *Aurora: a partner package for MODFLOW that enables non-Fickian transport modeling of real aquifers*. Oral presentation at MODFLOW and More, Golden CO, May 2017.

S.K. Hansen, C.P. Haslauer, O.A. Cirpka and V.V. Vesselinov (2016). *Prediction of Breakthrough Curves for Conservative and Reactive Transport from the Structural Parameters of Highly Heterogeneous Media*. Oral presentation at American Geophysical Union Fall Meeting, San Francisco CA, December 2016.

J. He, **S.K. Hansen** and V.V. Vesselinov (2016). *Analysis of Hydrologic Time Series Reconstruction Uncertainty Due to Inverse Model Inadequacy Using the Laguerre Expansion Method*. Oral presentation at American Geophysical Union Fall Meeting, San Francisco CA, December 2016.

B. Berkowitz, I. Dror, **S.K. Hansen** and H. Scher (2016). *Integrating Measurements and Models of Reactive Transport in Geological Media*. Invited oral presentation at American Geophysical Union Fall Meeting, San Francisco CA, December 2016.

S.K. Hansen and V.V. Vesselinov (2016). *Good data, bad models? Inverting the paradigm for hydrogeologic inverse problems*. Oral presentation at XXI International Conference on Computational Methods in Water Resources, Toronto ON, June 2016.

S.K. Hansen, V.V. Vesselinov, and B. Berkowitz (2015). *Characterization of Anomalous Contaminant Transport via Push-Pull Tracer Tests*. Oral Presentation at American Geophysical Union Fall Meeting, San Francisco CA, December 2015.

S.K. Hansen and B. Berkowitz (2014). *Large-Scale CTRW Analysis of Push-Pull Tracer Tests and Other Transport in Heterogeneous Porous Media*. American Geophysical Union Fall Meeting, San Francisco CA, December 2014.

B. Berkowitz and **S.K. Hansen** (2014). *Formulation and Evaluation of CTRW Governing Equations for Irreversible, Bimolecular Reactions During Transport*. American Geophysical Union Fall Meeting, San Francisco CA, December 2014.

S.K. Hansen, H. Scher and B. Berkowitz (2014). *Integrodifferential Formulations of the CTRW for Reactive Transport: Single- and Multi-Scale Approaches*. Oral presentation at XX International Conference on Computational Methods in Water Resources, Stuttgart, Germany, June 2014.

S.K. Hansen, H. Scher and B. Berkowitz (2013). *First Principles Modeling of Bimolecular Reactions with Diffusion*. American Geophysical Union Fall Meeting, San Francisco CA, December 2013.

S.K. Hansen and B.H. Kueper (2012). *Separation of phenolic and PAH plumes from weathering creosote NAPL: Coupled effects of Raoult's Law and differential sorption*. Oral presentation at 39th International Association of Hydrogeologists Congress, Niagara Falls ON, September 2012.

S.K. Hansen and B.H. Kueper (2012). *Employing Laguerre Function Bases to Extend Analytic Transport Solutions to Arbitrary Boundary Conditions: Mathematical Underpinnings of a New Modelling Technique for Multi-component Dissolution with Reactive Transport*. Oral presentation at XIX International Conference on Computational Methods in Water Resources, Champaign IL, June 2012.

S.K. Hansen and B.H. Kueper (2011). *Challenges in Forensic Identification of Multi-Component NAPL Sources—A New Model and Some Results*. Oral presentation at International Conference on Environmental Pollution and Remediation, Ottawa ON, August 2011.

S.K. Hansen and B.H. Kueper (2009). *Contaminant Source Misidentification due to "Chromatographic" Separation in Fractured Bedrock*, American Geophysical Union Joint Assembly, Toronto ON, May 2009.

R.K. Rowe, T. Mukunoki, R.J. Bathurst, S. Rimal, P. Hurst, **S. Hansen** (2005). *The performance of a composite liner for retaining hydrocarbons under extreme environmental conditions*. ASCE Geo-Frontiers, Austin TX, January 2005.

S. Rimal, R.K. Rowe and **S. Hansen** (2004). *Durability of geomembrane exposed to jet fuel A-1*, 57th Canadian Geotechnical Conference, Quebec City QC, October 2004.

Competitive research funding (as PI)

2023 – 2026	Israel Water Authority Research grant ≈360,000 total, for three years
2022	New Jersey Institute of Technology / Ben Gurion University Inter-University Faculty Seed Grant Awards Program \$10000 (USD) / annum, renewable once
2019 – 2023	Israel Science Foundation Personal Research Grant 1872/19 ≈137,000 / annum, renewable for four years
2019	Israel Science Foundation New Faculty Equipment Grant 2868/19 ≈169,000

2019 Northwestern University Water Center / Zuckerberg Institute
Seed funding for project with Prof. James P. Hambleton
\$36,000 (USD) shared for one year, renewable once

Graduate student and postdoctoral supervision

2022– Sayan Sen, PhD student
Impact of model error on geophysical inverse analyses.

2022– Marcia Frempong, MSc student
Machine inference of missing data for water budget estimation

2022 Hyekyeng Jung, YSEP visiting MSc student from TU Darmstadt, Germany

2021 – Dr. Lian Zhou, Postdoctoral fellow

2020 –2021 Dr. Abhimanyu Sharma, Postdoctoral fellow

2019 – Yoni Teitelbaum, PhD candidate
Streambed clogging and coupled sand-clay motion under losing and gaining flow conditions

2019 – 2021 Yichen Tao, MSc
Numerical modeling of supercritical CO₂ uptake in flowing heterogeneous aquifers

Scholarships, awards, and recognition

2019 – Ben-Gurion University of the Negev
Helen Unger Career Development Chair in Desert Hydrogeology

2015 University of Tübingen
Teach@Tübingen Fellowship

2013 – 2015 Azrieli Foundation
Postdoctoral Fellowship

2013 Weizmann Institute of Science
Dean of Faculty Postdoctoral Fellowship [declined for Azrieli fellowship]

2009 – 2012 Natural Science and Engineering Research Council [Canada]
Alexander Graham Bell Canada Graduate Scholarship

2008 – 2009 Ministry of Training, Colleges and Universities [Ontario]
Ontario Graduate Scholarship in Science and Technology

2006 – 2007 Ministry of Training, Colleges and Universities [Ontario]
Ontario Graduate Scholarship

2006 – 2007 Massey College, affiliated with the University of Toronto
Elected Resident Junior Fellow

2006 – 2007 University of Toronto
Tuition Fee Waiver Scholarship

2005 – 2006 Natural Science and Engineering Research Council [Canada]
NSERC Postgraduate Scholarship B

2004 – 2005 Queen’s University
R.S. McLaughlin Fellowship

2004 award Ministry of Training, Colleges and Universities [Ontario]
[declined]

	Ontario Graduate Scholarship
2003 – 2004	Queen's University Dean's Award
2003	Natural Science and Engineering Research Council [Canada] Undergraduate Student Research Award
2002 – 2003	Queen's University Dean's Award
1999 – 2001	Queen's University Principal's Scholarship

Publicly-available software

Aurora: Sole developer of a suite of tools for performing CTRW-on-a-streamline particle tracking on arbitrary, heterogeneous, transient groundwater velocity fields produced using MODFLOW. Available at: <https://aurora-hub.gitlab.io>

CHROTRAN: Lead developer of a flow and transport model allowing the design of chemical and biological remediation schemes for heavy metal contamination, including two-way flow/transport coupling and bio-clogging capability. Available at: <https://github.com/chrotran/release> OSTI record: <https://www.osti.gov/biblio/1351891-chrotran>

periodicgw: Python package for generating spatially periodic Darcy flow fields on randomly heterogeneous permeability fields. Enforces conservation of mass and allows for arbitrarily specified mean flow angle. Available at <https://pypi.org/project/periodicgw/>

ilap: Python package for numerical inversion of the Laplace transform via the Fixed Talbot method, using arbitrary numerical precision. Available at <https://pypi.org/project/ilap/>

Commercial consulting, review, and professional service

2022	Peer reviews of articles for Hydrogeology Journal, Water Research, Water Resources Research.
2021	Peer reviews of articles for Journal of Fluid Mechanics, Transport in Porous Media, Water Resources Research.
2020	Peer reviews of articles for Advances in Water Resources, Sustainability, Nuclear Engineering and Design, Scientific Reports.
2019	Peer reviews of articles for Advances in Water Resources and Journal of Hydrology.
2018	Peer reviews of articles for Water Resources Research and Journal of Hydrology.
2017	Primary session convener , AGU Fall Meeting, New Orleans, December 2017. H21H: Prediction of Hydrologic Behavior from Sparse Information Using Statistical and Machine Learning Techniques.
2017	Peer reviews of articles for <i>Water Resources Research</i> (2x), <i>Groundwater</i> , <i>Journal of Hydrology</i> , and <i>Physical Review E</i> .
2016	National Science Foundation proposal review <i>Evaluated grant proposal for NSF Division of Earth Sciences (Hydrologic Sciences Program).</i>

- 2016** **Peer review** of article for *Advances in Water Resources*.
- 2015** **Peer reviews** of articles for *Water Resources Research (2x)* and *Advances in Water Resources*.
- 2014** **Peer reviews** of articles for *Water Resources Research*, *Transport in Porous Media*, *Journal of Geophysical Exploration*, and *Journal of Hydrology*.
- 2013** **Peer review** of article for *Environmental Forensics*.
- 2012** **Hydrogeologic consulting** for Dr. D.A. Reynolds, Geosyntec
Advised the client on attaching a time-variant boundary condition to an analytic transport model, wrote code implementing this and verified his model.
- 2012** **Hydrogeologic consulting** for Dr. B.H. Kueper, Queen's University
Developed for the client a 2D semi-analytic model of plume development in layered regions with different hydrogeologic parameters.
- 2011** **Scientific editor / reviewer for IAEA technical report**
Reviewed the technical content and mathematics of the proposed revision of International Atomic Energy Agency Technical Reports Series No. 474: Measurement and Calculation of Radon Releases from NORM Residues.