

Dr. Kathrin Menberg

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Date of birth: April 28th, 1985
Marital status: married

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**Education and Research Experience**

- 09/2017-
present **Assistant Professor**
Engineering Geology, Institute of Applied Geosciences, Karlsruhe Institute of Technology, Germany
- Research topics: shallow geothermal energy, life-cycle assessment and simulation of energy systems
 - Co-supervision of PhD students (current: 2, graduated: 1)
 - Teaching in Applied Geosciences (Master and Bachelor level)
- 02/2015-
08/2017 **Postdoctoral Research Associate**
Engineering Department, University of Cambridge, United Kingdom
B-bem: The Bayesian Building Energy Management Portal (EPSRC funded)
- Adaption of a Bayesian calibration framework for energy system models
 - Development of a detailed thermodynamic model for exergy analysis of hybrid heating and cooling system
 - Improvement and adaption of statistical sensitivity analysis methods for building energy models
- 10/2014-
12/2014 **Postdoctoral Research Associate**
Institute for Applied Geosciences, Karlsruhe Institute of Technology, Karlsruhe, Germany
- contribution to preparation of research proposal on district-scale application of geothermal energy use of subsurface urban heat islands
 - involvement in collaborative work on spatial assessment of anthropogenic heat fluxes into the urban subsurface
- 01/2014-
06/2014 **Postdoctoral Research Associate**
Department of Earth Sciences, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland
GEO THERM 2 – Geothermal Reservoir Processes: Towards the implementation of research into the creation and sustainable use of Enhanced Geothermal Systems
- employment of life-cycle assessment (LCA) to enhanced geothermal systems
 - development of a novel approach to visualize LCA results as function of uncertain parameters

- 12/2010-12/2013 **PhD (with distinction), Applied Geoscience**
 Institute for Applied Geosciences, Karlsruhe Institute of Technology (KIT), Germany
Anthropogenic and natural alterations of shallow groundwater temperatures
- first report in literature of the quantitative contribution of various anthropogenic heat sources to urban groundwater warming
 - identification of anthropogenic effects on the subsurface thermal environment by employing analytical modelling techniques and geostatistical methods
 - revelation of the effect of climate change on rural groundwater temperatures
- 10/2007-04/2010 **Diploma (MSc.-Level), Hydrogeology and Engineering Geology**
 Institute for Applied Geosciences, Karlsruhe Institute of Technology (KIT), Germany (Grade: 1.5, on 1 to 4 scale)
- Diploma-Thesis: *Influence of specific subsurface parameters on the Thermal Response Test (TRT)* (in German)
- involved in collaborative project (KIT, Bavarian Center for Applied Energy Research & European Institute for Energy Research) on quality assurance of borehole heat exchangers
 - monitoring of geothermal drilling activities and thermal field testing
 - characterization of rock samples with various laboratory tests
- 10/2004-09/2007 **Pre-Diploma (BSc.-Level), Geology**
 Institute for Applied Geology, Karlsruhe Institute of Technology (KIT), Germany (Grade: 1.5)

International collaborations

- 2018-present Dr. Asal Bidarmaghz (Lecturer, School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australian)
- coupled numerical simulation of thermos-hydraulic processes in the urban subsurface
 - joint publication and planned joint research proposals and PhD students
- 2017-present Dr. Ruchi Choudhary (Senior Reader, University of Cambridge & Group Leader, The Alan Turing Institute, Großbritannien)
- studies in the field of Bayesian calibration of numerical heat transport models under deep uncertainty
 - cooperation in research project „Modelling and Monitoring of Urban Underground Climate Change MUC2“, funded by NSF (US) and EPSRC (UK)
- 2016-present Dr. Adrian Chong (Assistant Professor, National University of Singapore)
- collaborative work on calibration of building energy models, development of an optimized code for a Bayesian calibration framework
 - joint journal paper, code package for Bayesian calibration in R available on Github
- 2014-present Dr. Stefan Pfister (Senior Research Associate, ETH Zürich)
- collaborative work on life-cycle assessment of energy systems
- 2016-2018 Prof. Masanori Shukuya (Tokyo City University, Japan) and Prof. Ryoza Ooka (Tokyo University)
- collaborative work on exergy modelling and performance analysis of hybrid ground source heat pump systems

International Visits

- 07/2019 & 02/2020 Data-Centric Engineering Group, The Alan Turing Institute, London, UK
- 07-08/2015 High Performance Building Lab, School of Architecture, Georgia Institute of Technology, Atlanta, USA
- 11/2011 Hydrogeology Group, College of Engineering, University of Saskatchewan, Saskatoon, Canada

Awards and Scholarships

- 2019 Award for best lecture in Session 4 of the KIT-AUTh Summer School on Clean Energy and Sustainability, Thessaloniki, Griechenland (out of 8 contributions).
Title: *Subsurface heat islands - geothermal usage of groundwater resources*
- 2014 Young Research Scientist Award, Urban Environmental Pollution Conference, Toronto, Canada
Title: *Subsurface Urban Heat Islands: Thermal impact of urbanization on groundwater*
- 2013 Winner Energy Campus 2013, Energy and Climate Protection Foundation Baden-Württemberg (out of 40 contributions).
Title: *Elevated temperatures beneath cities: A sustainable energy source*
- 2010-2013 PhD scholarship from the German Environmental Foundation (DBU)

Contribution to International Conferences

- 2021 European Geoscience Union (EGU) General Assembly, Co-Convener der Session *Thermal energy applications and associated processes in porous and fractured aquifers* (HS8.1.9) (submitted)
- 2020 European Geoscience Union (EGU) General Assembly, Co-Convener der Session *Thermal processes and sustainable heat in porous and fractured aquifers* (HS8.2.4)
- 2018 Building Simulation and Optimization 2018, 4th IBPSA England Conference, Cambridge, UK, Member of the Scientific Review Committee
- 2017 15th International Conference of the International Building Performance Simulation Association (IBPSA), San Francisco, USA, Member of the Scientific Review Committee

Reviewer for International Journals

- 2013-present Renewable and Sustainable Energy Reviews, Hydrological Processes, Science of the Total Environment, Hydrogeology Journal, Geothermics, Applied Energy, Energy and Buildings, Renewable Energy, Journal of Buildings Performance Simulation, Journal of Heat and Mass Transfer, Advances in Geosciences, Sustainable Cities and Society, Sustainable Energy Technologies and Assessments.

Teaching Experience

- 2017-present
- Master courses in Applied Geosciences**
- Processing of Geospatial data (2 hr., compulsory)
 - Geospatial Data Analysis I: Programming and Geostatistics (2 hr., compulsory)
 - Engineering Geology I: Laboratory and Field Methods (4 hr.)
 - Engineering Geology II: Mass Movements and Modelling (4 hr.)
- Bachelor courses in Applied Geosciences**
- Geoscience Seminar (1 hr.)
 - Geological Field Methods II (1 hr.)
 - Field Trip: Urban Heat Island Karlsruhe (1 day)
- Bachelor courses in Civil Engineering**
- Geology for Civil Engineers (1 hr., 150-200 students)
- 2017
- Supervisor** (small group teaching): Building Physics (3rd Year Engineering)
- Two-to-one supervisions on papers with example questions
 - Explain underlying physical concepts and applied mathematical approaches
- 2011-2017
- Supervisor of graduate dissertations and undergraduate projects (KIT, ETH, Cambridge)**
- 8 dissertations (Diploma, M.Sc., B.Sc.), 3 undergraduate projects
 - Explain theory behind experimental and methodological approaches
 - Assist students with data analysis and interpretation
- 2012
- Tutor:** Engineering Geology Field course (4th Year Applied Geoscience)
- Demonstrate geotechnical field techniques
 - Marking of reports
- 2006-2008
- Teaching Assistant:** Introduction to Rock Identification (1st Year Applied Geoscience)
- Explain geological and mineralogical classification concepts
 - Demonstrate identification techniques

Personal Development

- 2019
- Planning, Structuring and Designing Lectures, Motivation in Teaching
- 2018
- Fit for teaching 1 & 2, laboratory didactics, competence-orientated exams, E-Assessments
- 2016
- Masterclass on Leadership Skills for Postdocs, Teaching for Postdocs
- 2015
- Introduction to Lecturing, Lecturing Performance, Supervising Graduate Students, Introduction to Leadership

Bibliometric Information

Publications (peer-reviewed): 18

citations: 718

h-index¹: 11¹ Google Scholar (December 2020)

Publications (peer-reviewed)

- 20XX Stemmler, R., Blum, P., Schüppler S., Fleuchaus, P., Limoges, M., Bayer, P., **Menberg, K.** Environmental impacts of aquifer thermal energy storage (ATES), Renewable and Sustainable Energy Reviews (submitted).
- 20XX Koch, F., **Menberg, K.**, Schweikert, S., Spengler, C., Hahn, H.J., Blum, P. Groundwater fauna in an urban area: natural or affected? Hydrology and Earth System Sciences (pending major revisions)
- 20XX Fleuchaus, P., Schüppler, S., Stemmler, R., **Menberg, K.**, Blum, P. Aquiferspeicher in Deutschland. Grundwasser (pending minor revisions)
- 20XX Würth, A., **Menberg, K.**, Martus, P., Blum, P. Quantifying biodegradation rate constants of o-xylene by combining compound specific isotope analysis and groundwater dating. Journal of Contaminant Hydrology (pending major revisions)
- 20XX Blum, P., **Menberg, K.**, Koch, F., Benz, S.A., Tissen, C., Hemmerle, H., Bayer, P. Is thermal use of groundwater a pollution? Journal of Contaminant Hydrology (under review)
- 2021 Tissen, C., **Menberg, K.**, Benz, S.A., Bayer, P., Steiner, C., Götzl, G., Blum, P. Identifying key locations for shallow geothermal use in Vienna. Renewable Energy (in press)
- 2021 **Menberg, K.**, Heberle, F., Bott, C., Brüggemann, D., Bayer, P. Environmental performance of a geothermal power plant using a hydrothermal resource in the Southern German Molasse Basin. Renewable Energy (in press)
- 2020 **Menberg, K.**, Bidarmaghz, A., Gregory, A., Choudhary, R., Girolami, M. Multi-fidelity approach to Bayesian parameter estimation in subsurface heat and fluid transport models. Science of the Total Environment 119, 140846
- 2020 Wilke, S., **Menberg, K.**, Steger, H., Blum, P. Advanced thermal response tests: A review. Renewable and Sustainable Energy Reviews 119, 109575
- 2019 Tissen, C., Benz, S.A., **Menberg, K.**, Bayer, P., Blum, P. Groundwater temperature anomalies in central Europe. Environmental Research Letters 14 (10), 104012
- 2019 Tissen, C., **Menberg, K.**, Bayer, P., Blum, P. Meeting the demand: geothermal heat supply rates for an urban quarter in Germany. Geothermal Energy 7 (1), 9
- 2019 Bayer, P., Attard, G., Blum, P., **Menberg, K.** The geothermal potential of cities. Renewable and Sustainable Energy Reviews 106, 17-30
- 2019 **Menberg, K.**, Heo, Y., Choudhary, R. Influence of error terms in Bayesian calibration of energy system models. Journal of Building Performance Simulation 12, 82-96
- 2018 Choi, W., **Menberg, K.**, Kikumoto, H., Heo, Y., Choudhary, R., Ooka, R. Bayesian inference of structural error in inverse models of thermal response tests. Applied Energy 228, 1473-1485
- 2018 Chong, A., **Menberg, K.** Guidelines for the Bayesian calibration of building energy models: A Tutorial and Guidelines. Energy and Building 174, 527-547
- 2017 **Menberg, K.**, Heo, Y., Choi, W., Ooka, R., Choudhary, R., Shukuya, M. Exergy analysis of a hybrid ground-source heat pump system. Applied Energy 204, 31-46
- 2016 **Menberg, K.**, Heo, Y., Choudhary, R. Sensitivity analysis methods for building energy models: comparing computational costs and extractable information. Energy and Buildings 133, 433-445

- 2016 **Menberg, K.**, Pfister, S., Blum, P., Bayer, P. A matter of meters: state of the art in the life cycle assessment of enhanced geothermal systems. **Energy and Environmental Science** 9, 2720-2743 (**Impact factor 2019 = 30.289**)
- 2015 Benz, S., Bayer, P., **Menberg, K.**, Jung, S., Blum, P. Spatial resolution of anthropogenic heat fluxes into urban aquifers. *Science of the Total Environment* 524, 427-439
- 2014 **Menberg, K.**, Blum, P., Kurylyk, B.L., Bayer, P. Observed groundwater temperature response to recent climate change. *Hydrology and Earth System Sciences* 18 (11), 4453-4466
- 2013 **Menberg, K.**, Blum, P., Schaffitel, A., Bayer, P. Long Term Evolution of Anthropogenic Heat Fluxes into a Subsurface Urban Heat Island. *Environmental Science & Technology* 47, 9747-9755
- 2013 **Menberg, K.**, Bayer, P., Zosseder, K., Rumohr, S., Blum, P. Subsurface urban heat islands in German cities. *Science of the Total Environment* 442, 123-133
- 2013 **Menberg, K.**, Steger, H., Zorn, R., Reuss, M., Proell, M., Bayer, P., Blum, P. Bestimmung der Wärmeleitfähigkeit im Untergrund durch Labor-und Feldversuche und anhand theoretischer Modelle. *Grundwasser* 18(2), 103-116

Conference Proceedings (peer-reviewed)

- 2018 **Menberg, K.**, Heo, Y. & Choudhary, R. Learning about error terms in energy models by Bayesian calibration. *Building Simulation and Optimization – 4th IBPSA England Conference*
- 2018 Loizide, S., **Menberg, K.** & Choudhary, R. Simulation of a ground-source heat pump system for simultaneous heating and cooling. *Building Simulation and Optimization – 4th IBPSA England Conference*
- 2017 **Menberg, K.**, Heo, Y. & Choudhary, R. Efficiency and Reliability of Bayesian Calibration of Energy Supply System Models. *IBPSA Building Simulation Conference 2017*
- 2017 **Menberg, K.**, Heo, Y., Choi, W., Ooka, R., Choudhary, R & Shukuya, M. Exergy Analysis of a Ground-Source Heat Pump System. *IBPSA Building Simulation Conference 2017*
- 2016 **Menberg, K.**, Heo, Y., Augenbroe, G. & Choudhary, R. New Extension of Morris method for sensitivity analysis of building energy models. *Building Simulation and Optimization – 3rd IBPSA England Conference*
- 2016 **Menberg, K.**, Blum, P., Pfister, S., Rybach, L. & Bayer, P. Life cycle assessment of geothermal power generation. *Proceedings European Geothermal Congress 2016*
- 2015 **Menberg, K.**, Blum, P., Rivera, J., Benz, S. & Bayer P. Exploring the Geothermal Potential of Waste Heat Beneath Cities. *Proceedings World Geothermal Congress 2015*
- 2013 **Menberg, K.**, Bayer, P., Blum, P. Elevated temperatures beneath cities: An enhanced geothermal resource. *Proceedings European Geothermal Congress 2013*
- 2013 **Menberg, K.**, Bayer, P., Zosseder, K., Rumohr, S., Blum, P. Urbane Wärmeinseln im Untergrund deutscher Städte. *19. Tagung für Ingenieurgeologie 2013*
- 2013 **Menberg, K.**, Blum, P., Limberg, A., Bayer, P. Urbane Wärmeinseln im Untergrund deutscher Städte. *Niedersächsisches Grundwasserkolloquium 2013*

Other Publications

- 2014 **Menberg, K.** Erhöhte Grundwassertemperaturen unter Städten – eine nachhaltige Energiequelle. *Energiewirtschaftliche Tagesfragen* 64(3), 56-57