

Auli Niemi is Professor in Groundwater Modeling at Department of Earth Sciences at Uppsala University, Sweden, leading the geohydrology research. Her research involves modeling and characterization of flow and transport in porous and fractured media, with special interest in multiphase and coupled processes as well as characterizing heterogeneity effects.

1. EDUCATION

DrEng, 1994, Helsinki University of Technology Department of Civil Engineering. Major in Water Resources Engineering and Hydrology.

Other graduate studies (credit used for the doctoral degree in Finland);

Princeton University (Princeton, NJ, USA), Department of Civil Engineering and Operations Research; Graduate level courses in numerical and statistical methods in water resources engineering during spring and fall terms 1984.

Massachusetts Institute of Technology (MIT) (Cambridge, MA, USA)
Department of Civil Engineering, Special Graduate student in Water Resources. Fall terms 1980 and 1981. Studies in US supported e.g. by Academy of Finland, Finnish Cultural Foundation. (Studies interrupted by the birth of child and maternity leave Feb -81)

2. EMPLOYMENT

Uppsala University (Uppsala, Sweden), Department of Earth Sciences
Professor in Groundwater Modeling, May 2006 on
Associate Professor in Groundwater Modeling, June 2000- April 2006

Technical Research Centre of Finland (VTT) (Espoo, Finland)
Research Professor in Environmental Engineering, September 1999 till June 2000
Chief Research Scientist (Ledande forskare) from January 1997 till Aug 1999
Senior Research Scientist March 1989- December 1996)

Royal Institute of Technology (KTH) (Stockholm, Sweden)
Department of Civil and Environmental Engineering, Division of Hydraulic Engineering
Visiting Professor Jan-Aug 1997 part-time, Aug 1997 - Sept 1999 full-time

Eidgenössische Technische Hochschule (Zurich, Switzerland) Versuchsanstalt für Wasserbau,
Hydrologie und Glaziologie **Academic Guest** November 1991 - August 1992.

Saario & Riekkola Consulting Engineers Ltd, (Helsinki, Finland)
Project Manager September 1988 - February 1989

Lawrence Berkeley Laboratory (Berkeley, California, USA); Earth Sciences Division;
Research Associate, April 1986- March 1988, Visitor; February 1986-March 1986

Princeton University, (Princeton, New Jersey, U.S.A) Dept of Civil Engineering and Operations Research, research group of G. Pinder; **Research Assistant** (functional status) /Consultant(formal status), Feb 1985-Dec 1985

National Board of Waters (Helsinki, Finland) Office of Technical Research
Research Engineer August 1982- September 1983

PARENTAL LEAVE

Studies at MIT interrupted by maternity leave Jan -81 to Aug -81. A second maternity leave between employment in National Board of Waters and studies at Princeton Univ., Sept -83 to Dec-83.

3. SPECIAL RECOGNITIONS AND COMMISSIONS

- Receiver of Uppsala University's Björken Prize 2016 (Uppsala University's oldest and 'finest' prize for scientific work <http://www.uu.se/en/about-uu/traditions/prizes/bjorken-prize/>)
- Member of the Royal Society of Sciences in Uppsala (Kungliga Vetenskaps societet i Uppsala, Sweden's oldest learned society) (since 2017)
- Included in AcademiaNet for outstanding female scientists in Europe (fall 2014)
- Coordinator of large-scale EU FP7 project MUSTANG (www.co2mustang.eu) on CO₂ geological storage with budget over 10 MEuro (2009-2014), Work Package leader in EU FP7 projects PANACEA (2012-2014), TRUST (2012-2017) and CO₂QUEST (2013-2015) (all in geological storage of CO₂); in this context also a key developer (together with EWRE, Israel) of the Heletz CO₂ injection site program aimed for scientifically based CO₂ injection experiments
- Member of European Academies Science Advisory Council (EASAC) working group on Carbon Capture and Storage, (2011-2013). Report 'CCS in Europe' to be found www.easac.eu/fileadmin/Reports/Easac_13_CCS_Web_Complete.pdf
- Invited keynote speaker; Gordon Research Conference, Bates College, USA, July 2010, Glogal CCUS Summit, China, 2013 and number of other invited talks (see below)
- One of the six European experts invited by EU to CO₂ collaboration workshops with Canada (Canada, May 2011) and with Japan (Rotterdam, April 2010)

4. CHAIR/ CO-CHAIR IN INTERNATIONAL CONFERENCES AND WORKSHOPS

- Organizer of 'Minisymposium in Fundamental Processes in Geological Storage of CO₂' InterPore 10th Annual Meeting and Jubilee, May 14-17, 2018, New Orleans, USA.
- Session co-chair in Computational Methods in Water Resources CMWR XXII. Bridging gaps between data, models and predictions. June 3-7, 2018. Saint-Malo, France. (Session 'Confrontations of models with field data: applications to CO₂ storage, geothermal production and managed aquifer recharge')
- Co-Organizer of National Geosphere Laboratory (NGL) Conferences 2017, 2018. Oskarshamn, Sweden.
- Session convener and/or co-convener in several CO₂ storage related sessions at European Geosciences Union General Assembly, April 2011, 2012, 2013, 2014, 2015, 2019
- Co-chair of international Workshop on Hydrological Aspects of Deep Drilling, Uppsala, Sept 20-22, 2011
- Scientific Advisory Committee member of International Conference on Groundwater in Fractured Rocks GwFr2012 (Prague 21-24 May 2012)

5. EDITORIAL BOARDS AND GUEST EDITORIALS

- Associate Editor of Hydrogeology Journal (2014-2018)
- Member of Editorial Board, International Journal of Greenhouse Gas Control (2012-)
- Associate Editor to Vadoze Zone Journal (2006-2008)

Guest Editor

- Managing Guest Editor to Special Edition on 'CO₂ residual trapping experiments at Heletz, Israel pilot injection site' Niemi, A., Carrera, J, Tsang, C-F and Gouze, P. (eds). *Intl Journal of Greenhouse Gas Control*. In preparation, to appear 2020.
- Managing Guest Editor to Special Edition on 'Characterization of formation properties for geological storage of CO₂ - Experiences from the Heletz test CO₂ injection site and other sites from the EU project MUSTANG', Niemi, Gouze, Bensabat (eds). *Intl Journal of Greenhouse Gas Control*. (2016). Vol 48.

- Co-editor to Special Issue on ‘CO₂ geological storage at European Geosciences Union (EGU) 2012’. Kuehn, M., Niemi, A. et al (eds.) *Int Jour Greenhouse Gas Control* 19 (2013) Vol 606–608
- Tsang, C-F., Niemi, A. and Larsson, M. (eds) Proceedings of Deep Hydrogeology Workshop, Uppsala University, Sweden, September 20-22. 2011. <http://www.sddp.se/deephydrogeology>.

EXTERNAL EXPERT REVIEWER/ADVISORY COMMITTEE MEMBER (2010-)

- Committee member for selection committee for Paul Witherpoon Lecturer, American Geophysical Union (AGU) Hydrology Section (2019-)
- Member of IEAGHG (International Energy Agency Greenhouse Gas Control) coordinated peer-review panel reviewing US Department of Energy (DOE) financed R&D projects for CO₂ storage in geological formations (March 2015, invited also 2017 but unable to attend)
- External expert evaluator to Norwegian Research Council (2011, 2013, 2015 (general earth science), 2016, 2017, 2018 (CCS) and 2019 (Geothermal Energy)
- External evaluator to EU ACT (Accelerating CCS Technologies) proposals 2019
- External evaluator of IEAHG conference contributions to GHGT-14 (2018) and GHGT-15 (2020) conferences
- Member of the Norwegian CCS program’s SUCCESS advisory board (2014-2018)
- Member of SSM (Swedish Nuclear Safety Authority) research committee (forskningsråd) (2013-)
- Member of the Swedish Research Council’s (VR) evaluation panel on Research Infrastructures - Infrastructure for Research on the Earth and its Near Surroundings (2011-2014)
- Member of the advisory board for Danish Research Council’s program “Environmental Technology for Geological Storage of Carbon Dioxide” (2010 -2014)
- Member of the expert advisory board for research for Swedish Geological Survey (2009-2011)
- Member of the evaluation board (SONEX) for the Finnish Radiation and Nuclear Safety Agency (STUK) evaluating the Finnish Nuclear Waste program (2003-2010),

6. DOCTORAL AND POSTDOCTORAL SUPERVISION

Main supervisor PhD and Lic: Fritjof Fagerlund (PhD, 2007), Johan Öhman (PhD, 2005), Magnus Oden (LicTech 2006), Zhibing Yang (PhD, 2012), Martin Larsson (PhD, 2012), Tian Liang (PhD, 2016), Kristina Rasmusson (PhD, 2017), Farzad Basirat (PhD, 2017), Saba Joodaki (ongoing), Magnus Oden (ongoing), Maryeh Hedayati (ongoing), Ramin Mogadashi (ongoing), Erik Toller (ongoing)

Deputy supervisor Niclas Bockgård (PhD, 2004), Niklas Linde (PhD, 2005), Andrew Frampton (PhD, 2010), Fredrik Hellman (PhD, 2017), Maria Rasmusson (PhD, 2018)

PostDoctor and similar Forskarassistent: Fritjof Fagerlund (2009-2012), Prabhakar Sharma (2010 -2014), Post Docs and other post-PhD researchers: Fuguo Tong (2010-2012), Zhibing Yang (2013 -2017), Byeongju Jung (2013-2014), Bruno Figueiredo (2013-2018), Benoit Dessirier (2016 - 2018), Farzad Basirat (2017-), Mrityunjai Sharma (2019-), Yunzhong Jai (2020-)

7. EXPERT EVALUATOR AND PHD OPPONENT

External expert evaluator for academic positions and promotions (in promotions, individual names not given for integrity reasons): promotion to Senior Lecturer (KTH, 2004), promotion to Associate professor (KTH, 2008), promotion to Associate Professor (Stockholm University, 2008), Assoc. Professor in Engineering Geology, Chalmers (2009), Assoc. Professor in Geohydrology (Stockholm University, 2010), Chair in Engineering Geology

(Chalmers, 2010), promotion to Lecturer (Stockholm Univ., 2014), evaluation for applicants for Juniorprofessor (Freiberg, Germany (2013), evaluation of promotion to Staff Scientist (LBNL, USA, 2013), evaluation of promotion to Staff Scientist (LBNL, USA, 2012), Assoc Prof for River Engineering (KTH, 2015), promotion to Reader (Univ. Edinburgh, 2016), promotion to Adjunct Professor (Stockholm Univ. 2018), promotion to Professor (Soul National Univ., Korea, 2018), Assoc Prof Hydrogeochemistry (Univ. Göteborg, 2020)

PhD Opponent and similar

PhD Opponent for: Leveinen, J. (PhD, Helsinki Univ, 2001), Zhao, Z. (Royal Institute of Technology, KTH 2011), Chair of PhD Defence Committee of V. Vilarrasa (UBC, Barcelona, Spain, 2012); Polak, S.P (NTNU, Trondheim, Norway, 2014); Nörbäck Lassen, R. (Univ Copenhagen, Denmark, 2014), Nawaz Ahmad (Royal Institute of Technology, KTH, 2016), Hossein Fazeli (University of Oslo, 2020)

Lic. Opponent for: Prieto, C. (LicTech, KTH, 2001), Min, K.B. (LicTech, KTH, 2002), Koyama, T (LiTech, KTH, 2005).

Member in over 20 PhD committees in Sweden (register not presently maintained)

8. ADMINISTRATIVE EXPERIENCE (examples)

- Dean of Department of Earth Sciences, Uppsala University (July 2020 on)
- Director of PhD Studies for Hydrology (Forskarutbildningsansvarig Professor), since 2016
- Head of Air, Water and Landscape Sciences Program at Uppsala University (>50 employers) (2007-2008)
- Chairman of the Recruitment committee for Earth Sciences (July 2005-July 2008), member of the same group (2002-2005)

9. DISSEMINATION (examples)

- Interview on CCS in Malou efter 10 (TV4), December 5th 2019
- Koldioxid under jord kan rädda klimatet. *Dagens Nyheter*, Sunday Nov 1st, 2015, <http://www.dn.se/nyheter/vetenskap/koldioxid-under-jord-kan-radda-klimatet/>
- *Pan European Networks* – Gov 8 2013 (European Science News; journal for decision makers etc.)
- *Framtidens Forskning* (Svenska Dagbladet), June 2012;

10. EXAMPLES OF INVITED TALKS IN KEY CONFERENCES

Niemi, A (2018) Invited lecturer on CO2 Geological Storage at *4th Carghese Summer School on Flow and Transport in Porous and Fractured media: Development, Protection, Management and Sequestration of Subsurface Fluids* "Cargèse, Corse, France June 25th July 7th 2018. <https://cargese2018.sciencesconf.org/>

Niemi, A. and Bensabat, J. (2018) Progress at Heletz CO2 injection site and first results of the residual trapping experiments. Invited talk at Venice Open Forum, CO2GeoNet. 24-26 April, 2018.

Niemi, A (2017) Progress at Heletz, Israel site since 2016 and first results for evaluating the in-situ residual trapping test *IEAGHG* (International Energy Agency Greenhouse Gas RD Program) Monitoring Network Meeting. Traverse City, Michigan, USA. 12-14.6.2017

Niemi, A (2016) 'Experiences from Heletz pilot project' *IEAGHG* (International Energy Agency Greenhouse Gas RD Program) Monitoring and Modelling Research Network Combined Meeting Edinburgh, Scotland. 6th to 8th July 2016.

Niemi, A (2016) 'CO2 storage pilots – progress of Heletz project' *11th CO2GeoNet Open Forum*, Venice, May 9-

11th, 2016. Venice, Italy.

Niemi, A. (2015) 'Unlocking the potential for CCs in the Baltic Sea' Global CCS Institute Webinar

(<http://www.globalccsinstitute.com/insights/authors/WebinarOrganiser/>

2015/04/14/bastor2-unlocking-potential-ccs-baltic-sea?author=MTc1OTM%3D).

Niemi (2014) Quantification of Saline Aquifers for CO₂ Geological Storage – Experiences from the Mustang Project. *European Carbon Capture and Storage Research and Development Workshop*. 18th June, 2014, United Kingdom, UKCCS Research centre, Grandfield, UK.

Niemi (2013) Quantification of Saline Aquifers for CO₂ Geological Storage – Experiences from Mustang project. *Global CCUS Summit 2013* - the 4th Annual Conference, 22-23rd October, 2013, Beijing, China

Niemi (2013) Progress of MUSTANG project on quantifying saline aquifers for geological storage of CO₂. *8th CO₂GeoNet Open Forum, Venice*, April 11-14

Niemi (2013) SwedestoreCO₂ and Mustang Projects. CO₂ Capture and Storage in the Baltic Sea Countries *CO₂GeoNet meeting*, GTK, May 23rd, Espoo, Finland

Niemi (2012) Multi-Scale flow and transport in fractured rocks. Invited keynote GwFR'2012 *International Conference on Groundwater in Fractured Rocks*, May 21-24, Prague

Niemi (2012) MUSTANG: Quantification of saline aquifers for CCS. CCS from cradle to grave IChemE Workshop, Birmingham, UK, 22-23 March.

Niemi (2012) MUSTANG – A large scale integrating project for quantifying saline aquifers for geological storage of CO₂. 7th CO₂GeoNet Open Forum, Venice, April 17-19.

Niemi (2011) MUSTANG - A Large-Scale Integrating Project for Developing Methodologies for Quantifying Saline Aquifers for Geological Storage of CO₂. CCS Research & Development to Implementation Conference. 24 - 26 May 2011, London, UK

Niemi (2010) Modeling flow and transport in fractured rocks. Invited talk at *Gordon Research Conferences*. Flow and Transport in Permeable Media. July 11-18, 2010. Bates College, USA.

2007 on

PEER-REVIEWED JOURNAL ARTICLES

1. Rasmusson, Kristina, Maria Rasmusson, Alexandru Tatomir, Yvonne Tsang, Auli Niemi (2020) Estimation of residual CO₂ saturation in Heletz sandstone using pore-network modeling on an extracted network obtained from a scanned core sample. Paper submitted for review to Special Edition 'Heletz Residual Trapping Experiments'. *Greenhouse Gas Science and Technology*. (in review)
2. Basirat, F., Byeongju Jung, Zhibing Yang, Auli Niemi (2020), Numerical simulation of geological storage of CO₂ with impurities (H₂S, CH₄ and N₂) in saline aquifers. *Journal of Natural Gas Science & Engineering*. (accepted with revision)
3. Niemi, Auli, Jacob Bensabat, Saba Joodaki, Farzad Basirat, Maryeh Hedayati, Zhibing Yang, Lily Perez, Stanislav Levchenko, Alon Shklarnik, Rona Ronen, Yoni Goren, Igal Tsarfis, Fritjof Fagerlund, Kristina Rasmusson, Ramin Moghadasi, Jawad Hassan, Martin Sauter, Iulia Ghergut, Philippe Gouze and Barry Freifeld (2020) Characterizing CO₂ Residual Trapping *in-situ* by means of Single-Well Push-Pull Experiments at Heletz, Israel, Pilot Injection Site – Experimental Procedures and Results of the Experiments. *International Journal of Greenhouse Gas Control* 101, 103129 <https://doi.org/10.1016/j.ijggc.2020.103129>
4. Joodaki, Saba, Ramin Moghadasi, Farzad Basirat, Zhibing Yang, Jacob Bensabat, Auli Niemi (2020) Model analysis of CO₂ residual trapping from single-well push pull test – Heletz, Residual Trapping Experiment II. *International Journal of Greenhouse Gas Control*. Vol 101, 103134. <https://doi.org/10.1016/j.ijggc.2020.103134>
5. Martinez-Landa, Lurdes, Jesus Carrera, Auli Niemi, Jacob Bensabat (2020) A methodology for the interpretation of aquifer tests: Application to CO₂ Residual Trapping Experiments at the Heletz site. Paper submitted for review to Special Edition 'Heletz Residual Trapping Experiments'. *International Journal of Greenhouse Gas Control*. (accepted with minor revision)
6. Basirat, Farzad, Zhibing Yang, Jacob Bensabat, Stanislav Levchenko, Lehua Pan and Auli Niemi (2020) Characterization of CO₂ self-release during Heletz Residual Trapping Experiment I (RTE I) using a coupled wellbore-reservoir simulator *International Journal of Greenhouse Gas Control*. (in Press)
7. Joodaki, Saba, Zhibing Yang, Jacob Bensabat, Auli Niemi (2020) Model analysis of CO₂ residual trapping from single-well push pull test based on hydraulic withdrawal tests – Heletz, Residual Trapping Experiment I. *International Journal of Greenhouse Gas Control*. Vol 97, June 2020, 103058. <https://doi.org/10.1016/j.ijggc.2020.103058>
8. Yang, Zhibing, Yi-Feng Chen and Auli Niemi (2020) Gas migration and residual trapping in bimodal heterogeneous media during geological storage of CO₂. *Advances in Water Research*. 142(2020) 103608.
9. Figueiredo, Bruno, Chin-Fu Tsang, and Auli Niemi (2020) The Influence of Coupled Thermomechanical Processes on the Pressure and Temperature due to Cold Water Injection into Multiple Fracture Zones in Deep Rock Formation. *Geofluids* Volume 2020, Article ID 8947258, 14 pages <https://doi.org/10.1155/2020/8947258>

10. Yang, Zhibing, Yves Méheust, Insa Neuweiler, Ran Hu, Auli **Niemi** (2019) Modeling Immiscible Two Phase Flow in Rough Fractures From Capillary to Viscous Fingering. *Water Resources Research*, 2019, 55 (3), pp.2033-2056. 10.1029/2018WR02404
11. Rasmusson, M, K. Rasmusson, F. Fagerlund, Y. Tsang, **A. Niemi** (2018) The impact of co-contaminant SO₂, versus salinity and thermodynamic condition, on residual CO₂ trapping during geological storage. *Greenhouse Gases: Science and Technology* 00, 1-13. <https://doi.org/10.1002/ghg.1816>
12. Rasmusson, K., M. Rasmusson, Y Tsang, S Benson, F Hingerl, F. Fagerlund, **A Niemi** (2018) Residual trapping of carbon dioxide during geological storage—Insight gained through a pore-network modeling. *International Journal of Greenhouse Gas Control*. 74:62-78. <https://doi.org/10.1016/j.ijggc.2018.04.021>
13. Snæbjörnsdóttir, SO, S Tómasdóttir, B Sigfússon, ES Aradóttir, Gunnarsson, G, **Niemi, A.**, Basirat, F., Dessirier, B., Gislason, S., Oelkers EH and Franson, H. (2018) The geology and hydrology of the CarbFix2 site, SW-Iceland. *Energy Procedia* 146, 146-157 <https://doi.org/10.1016/j.egypro.2018.07.019>
14. Hedayati, M., Wigston, A., Wolf, J.L., Rebscher, D and **Niemi, A.** (2018) Impacts of SO₂ gas impurity within a CO₂ stream on reservoir rock of a CCS pilot site: experimental and modelling approach. . *International Journal of Greenhouse Gas Control*. 70, 32-44
15. Tsang, C., Figueiredo, B., **Niemi, A.** (2018). Importance of stress effects on inputs to fracture network models used for subsurface flow and transport studies. *International Journal of Rock Mechanics and Mining Sciences*, 101: 13-17
16. Dessirier, B., Tsang, C., **Niemi, A.** (2018). A new scripting library for modeling flow and transport in fractured rock with channel networks. *Computer and Geosciences*. 2018. Vol. 111, pp 181-189
17. Joodaki, S, Yang, ZB. **Niemi, A** (2017) The effect of designing parameter of WAG injection on enhancement of CO₂ trapping in heterogeneous formations: A numerical study. *Greenhouse Gas Science and Technology*. 7(6), 1008-1019.
18. Rasmusson, M, Fagerlund, F, Rasmusson, K, Tsang, Y, **Niemi, A** (2017) Refractive-Light-Transmission Technique Applied to Density-Driven Convective Mixing in Porous Media With Implications for Geological CO₂ Storage. *Water Resources Research*. Nov 2017. Volume: 53 Issue: 11 Pages: 8760-8780 DOI: 10.1002/2017WR020730
19. Basirat, F., Yang, Z., **Niemi, A.** (2017) Pore-scale modeling of wettability effects on CO₂-brine displacement during geological storage. *Advances in Water Resources*. Nov 2017. Volume: 109 Pages: 181-195. DOI: 10.1016/j.advwatres.2017.09.004
20. Figueiredo, B, Tsang, CF, Rutqvist, J, **Niemi, A** (2017) The effects of nearby fractures on hydraulically induced fracture propagation and permeability changes. *Engineering Geology*. Oct 2017. Volume: 228 Pages: 197-213. DOI: 10.1016/j.enggeo.2017.08.011
21. Tian, L., Richard Wilkinson, Zhibing Yang, Henry Power, Fritjof Fagerlund and **A. Niemi** (2017) ‘Gaussian Process Emulators for Quantifying Uncertainty in CO₂ Spreading Predictions in Heterogeneous Media’ *Computers and Geosciences*. Aug 2017. Volume: 105 Pages: 113-119. DOI: 10.1016/j.cageo.2017.04.006

22. Figueiredo B, Tsang CF, Rutqvist J, **Niemi A**, 2017. Study of hydraulic fracturing processes in shale formations with complex geological settings. *Journal of Petroleum Science and Engineering* 152: 361-74
23. Basirat, F., Fagerlund, F., Denchik, N., Pezard, P. and **Niemi, A.** (2016) Numerical modelling of CO₂ injection at small-scale field experimental site in Maguelone, France. *International Journal of Greenhouse Gas Control*, 2016. 54: 200-210.
24. K. Rasmusson, M. Rasmusson, Y. Tsang, **Niemi, A.** (2016) A simulation study of the effect of trapping model, geological heterogeneity and injection strategies on CO₂ trapping. *International Journal of Greenhouse Gas Control*. Vol 52. pp. 52-72 DOI information: 10.1016/j.ijggc.2016.06.020.
25. Wolf, J.L., **Niemi, A.**, Bensabat, J. and Rebscher, D. (2016) Benefits and restrictions of 2D reactive transport simulations of CO₂ and SO₂ co-injection into a saline aquifer using TOUGHREACT V3.0-OMP. *International Journal of Greenhouse Gas Control*. <http://dx.doi.org/10.1016/j.ijggc.2016.07.005>. Volume: 54 Pages: 610-626
26. Fagerlund, F., Hellman, F., Målqvist, A. and **Niemi, A.** (2016) Multilevel Monte Carlo methods for computing failure probability of porous media flow systems. *Advances in Water Resources*. Volume: 94 Pages: 498-509. AUG 2016.
27. Figueiredo, B, C-F Tsang, **A. Niemi** and G. Lindgren (2016) A review of the state-of-art of sparse channel model and its applicability to radioactive waste repository in deep fractured crystalline formation. *Hydrogeology Journal*. Volume: 24 Issue: 7 Pages: 1607-1622
28. Tsang Chin-Fu, Jan-Erik Rosberg, Prabhakar Sharma, Theo Berthet, Christopher Juhlin, and **A Niemi** (2016). Hydrologic testing during drilling: Application of flowing fluid electric conductivity (FFEC) logging method to drilling of a deep borehole. *Hydrogeology Journal*. Volume: 24 Issue: 6 Pages: 1333-1341
29. **Niemi, A**, Gouze, Philippe and Bensabat, Jacob (2016) ‘Characterization of formation properties for geological storage of CO₂ - Experiences from the Heletz CO₂ injection site and other example sites from the EU FP7 project MUSTANG’. Editorial for a Special Issue to *International Journal of Greenhouse Gas Control*, 2016. Doi: 10.1016/j.ijggc.2016.02.007
30. **Niemi, A.** Bensabat, J, Shtivelman, V, Edlmann K, Gouze P., Luquot L., Hingerl, F, Benson, S.M., Pezard, P.A, Rasmusson, K., Liang, T., Fagerlund, F., Gendler, M., Goldberg, I, Tatomir, A., Lange, T., Sauter, M., and Freifeld, B. (2016) Heletz experimental site overview, characterization and data analysis for CO₂ injection and geological storage *Int. J. of Greenhouse Gas Control*. <http://dx.doi.org/10.1016/j.ijggc.2015.12.030>
31. Luquot, L., Gouze, P., **Niemi, A.**, Bensabat, J. and Carrera, J. (2016) Laboratory CO₂-rich brine percolation experiments through Heletz samples (Israel): Role of the flow rate and brine composition. *International Journal of Greenhouse Gas Control*, DOI:10.1016/j.ijggc.2015.10.023
32. Zhang, F., Juhlin C., **Niemi A.**, Huang F., Bensabat J. (2016). A feasibility and efficiency study of seismic waveform inversion for time-lapse monitoring of onshore CO₂ geological storage sites using reflection seismic acquisition geometries. *International Journal of Greenhouse Gas Control*, doi:10.1016/j.ijggc.2015.11.015
33. Tatomir, A., Halisch, M., Duschl, F., Peche, A., Wiegand, B., Schaffer, M., Licha, T., **Niemi, A.**, Bensabat, J., Sauter, M., (2016). An integrated core-based analysis for the characterization of flow, transport and mineralogical parameters of the Heletz pilot CO₂ storage site reservoir. *International Journal of Greenhouse Gas Control*. doi:10.1016/j.ijggc.2016.01.030.

34. Edlmann K., **Niemi A.**, Bensabat J., Haszeldine R.S. and McDermott C.I. (2016) Mineralogical properties of the caprock and reservoir sandstone of the Heletz field scale experimental CO₂ injection site, Israel; and their initial sensitivity to CO₂ injection. *Int. J. of Greenhouse Gas Control*, 2016. <http://dx.doi.org/10.1016/j.ijggc.2016.01.003>
35. Edlmann, K., Bensabat, **Niemi, A.**, R.S. Haszeldine, C.I. McDermott (2016) Lessons learned from using expert elicitation to identify, assess and rank the potential leakage scenarios at the Heletz pilot CO₂ injection site *Int. J. of Greenhouse Gas Control*, 2016. <http://dx.doi.org/10.1016/j.ijggc.2016.02.018>
36. Porter, RTJ, Mahgerefteh, H, Brown, S, Martynov, S, Collard, A, Woolley, RM, Fairweather, M, Falle, SAEG, Wareing, CJ, Nikolaidis, IK, Boulougouris, GC, Peristeras, LD, Tsangaris, DM, Economou, IG, Salvador, C, Zanganeh, K Wigston, A, Najafali, JN, Shafeen, A, Beigzadeh, A, Farret, R, Gombert, P, Hebrard, J, Proust, C, Ceroni, A, Flauw, Y, Zhang, YC, Chen, SY, Yu, JL, Talemi, RH, Bensabat, J, Wolf, JL, Rebscher, D, **Niemi, A**, Jung, BJ Mac Dowell, N, Shah, N, Kolster, C, Mechleri, E, Krevor, S (2016) Techno-economic assessment of CO₂ quality effect on its storage and transport: CO(2)QUEST An overview of aims, objectives and main findings . *International Journal of Greenhouse gas Control*. Vol: 54 Pp. 662-681. Part: 2. DOI: 10.1016/j.ijggc.2016.08.011
37. Tian, L., Z. Yang, B. Jung, S. Joodaki, M. Erlström, Q. Zhou, and **A. Niemi** (2015). Integrated simulations of CO₂ spreading and pressure response in the multilayer saline aquifer of South Scania Site, Sweden. *Greenhouse Gases: Science and Technology*. <http://dx.doi.org/10.1002/ghg.1583>.
38. Sharma, P., Tsang, C-F, Kukkonen, I and **Niemi, A.** (2015) Analysis of 6-year Fluid Electric Conductivity logs to evaluate the hydraulic structure of the deep drill hole at Outokumpu, Finland. *International Journal of Earth Sciences*. Int J Earth Sci (Geol Rundsch) DOI 10.1007/s00531-015-1268-x. Volume: 105 Issue: 5 Pages: 1549-1562
39. Yang Z., L. Tian, B. Jung, S. Joodaki, F. Fagerlund, R. Pasquali, R. Vernon, N. O'Neill, and **A. Niemi** (2015), Assessing CO₂ storage capacity in the Dalders Monocline of the Baltic Sea Basin using dynamic models of varying complexity. *International Journal of Greenhouse Gas Control* 43, 149-160. <http://dx.doi.org/10.1016/j.ijggc.2015.10.024>.
40. Tian, L, Yang, Z, Fagerlund, F. and **Niemi, A.** (2015) Effects of permeability heterogeneity on CO₂ injectivity and storage efficiency coefficient. *Greenhouse Gases: Science and Technology*. <http://dx.doi.org/10.1002/ghg.1540> 6(11): 112-124
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PEER-REVIEWED CONFERENCE PROCEEDINGS – FULL ARTICLES

76. B. Figueiredo, C. F. Tsang, J. Rutqvist, **A. Niemi** (2017) Study of the Influence of Pre-Existing Bedding Planes and Faults on Hydraulically Induced Fracture Propagation in Shale-Gas Reservoirs. ARMA-2017-0123 American Rock Mechanics Association. Proceedings 51st U.S. Rock Mechanics/Geomechanics Symposium, 25-28 June, San Francisco, California, USA
77. Figueiredo, B, CF. Tsang, **A. Niemi**, J. Rutqvist and J. Bensabat (2015) Study of the Potential Fault Reactivation induced by CO₂ injection in a three-layer storage formation. *Proceedings ISRM* International Society of Rock Mechanics. 13th International ISRM Congress 2015, Montreal, Canada.
78. Yang, **Niemi**, A. et al (2009) Modeling of dense nonaqueous phase liquids entrapment and dissolution in variable aperture fractures. Proc *TOUGH2 Symp*, 2009.
79. Zandin, Illangsekare, **Niemi**, A et al (2007) Partitioning Tracer Test Performance in 3D Heterogeneous Tank Experiment: Influence of Nonaqueous Phase Liquid Source Zone. *ModelCARE 2007* Copenhagen

BOOK CHAPTERS

80. Tsang, C-F and **Niemi**, A. (2017) Chapter 2: Overview of the Processes Occurring during Geological Storage of CO₂. In: Niemi, A., Bear, J. and Bensabat, J. (Editors) *GEOLOGICAL STORAGE OF CO₂ IN DEEP SALINE FORMATIONS*. Publisher Springer. 554p. Pp. 415-519. <http://www.springer.com/gp/book/9789402409949>.
81. **Niemi**, A., Zhibing Yang, Jesus Carrera, Henry Power, Christopher Ian McDermott, Dorothee Rebscher, Jan Lennard Wolff, Franz May, Bruno Figueiredo and Victor Vilarrasa (2017) Chapter 4 Mathematical Modeling – Approaches for Model Solution. IN: Niemi, A., Bear, J. and Bensabat, J. (Editors) (2017) *GEOLOGICAL STORAGE OF CO₂ IN DEEP SALINE FORMATIONS*. Publisher Springer. 554p. pp. 149-207 <http://www.springer.com/gp/book/9789402409949>
82. **Niemi**, A., Jacob Bensabat, Peter Bergmann, Christopher Juhlin, Alexandru Tatomir, Iulia Ghergut, Martin Sauter, Barry Freifeld, Larry Myer, Christine Doughty, Axel Liebscher, Stefan Lüth, Sonja Martens, Fabian Möller, Cornelia Schmidt-Hattenberger and Martin Streibel (2017) Chapter 8: Field

Injection Operations and Monitoring of the Injected CO₂ In: Niemi, A., Bear, J. and Bensabat, J. (Editors) GEOLOGICAL STORAGE OF CO₂ IN DEEP SALINE FORMATIONS. Publisher Springer. 554p. Pp. 415-519. <http://www.springer.com/gp/book/9789402409949>.

83. **Niemi, A.**, Katriona Edlmann, Jesus Carrera, Christopher Juhlin, Alexandru Tatomir, Iulia Ghergut, Martin Sauter, Jacob Bensabat, Fritjof Fagerlund, Kristina Rasmusson, Francois H. Cornet, Victor Vilarrasa and Christopher Ian McDermott (2017) Chapter 7: Site Characterization In: Niemi, A., Bear, J. and Bensabat, J. (Editors) (2017) GEOLOGICAL STORAGE OF CO₂ IN DEEP SALINE FORMATIONS. Publisher Springer. 554p. Pp. 342-416
<http://www.springer.com/gp/book/9789402409949>.

84. Sharma, P., C.F. Tsang, C. Doughty, A. **Niemi**, and J. Bensabat. (2015) Feasibility of Long-term Monitoring of Deep Hydrogeology with Flowing Fluid Electric Conductivity Logging Method. In: *Dynamics of Fluids and Transport in Fractured-Porous Media*, edited by Faybishenko, B., J. Gale, and S. Benson. ISBN: 978-1-118-87720-3264 pages, August 2015, American Geophysical Union Monograph. Pp. 53-65.

EDITORIALSHIPS

BOOKS

85. **Niemi, A.**, Bear, J. and Bensabat, J. (Editors) (2017) GEOLOGICAL STORAGE OF CO₂ IN DEEP SALINE FORMATIONS., Publisher Springer. 554 p.
<http://www.springer.com/gp/book/9789402409949>.

JOURNAL SPECIAL ISSUES AND PROCEEDINGS (AS EDITOR)

86. Managing Guest Editor to Special Edition on 'Results of the CO₂ residual trapping experiments – Heletz, Israel pilot injection site', **Niemi, A.**, Gouze, P, Carrera, J. and Tsang, C-F. (eds) to *Intl Journal of Greenhouse Gas Control*. In preparation. To appear 2020.

87. Managing Guest Editor to Special Edition on 'Characterization of formation properties for geological storage of CO₂ - Experiences from the Heletz test CO₂ injection site and other sites from the EU project MUSTANG', **Niemi**, Gouze, Bensabat (eds) to *Intl Journal of Greenhouse Gas Control*. (2016). Vol 48.

88. Kuehn, M., **Niemi, A.** et al (2013) Guest Editors. Int Jour Greenhouse Gas Control, Special Issue on CO₂ geological storage. Elsevier, 2013

89. Tsang, C-F., **Niemi, A.** and Larsson, M. (editors) Proceedings of Deep Hydrogeology Workshop, Uppsala University, Sweden, September 20-22. 2011. <http://www.sddp.se/deephydrogeology>.

EXAMPLES OF RECENT INVITED INTERNATIONAL CONFERENCE TALKS

Niemi, A. (2018) Residual trapping experiments at Heletz, Israel. Invited talk at CSIRO, Australia. 29th October, 2018.

Niemi, A (2018) Invited lecturer on CO₂ Geological Storage at *4th Carghese Summer School on Flow and Transport in Porous and Fractured media*: Development, Protection, Management and Sequestration of

Subsurface Fluids" *Cargèse*, Corse, France June 25th July 7th 2018. <https://cargese2018.sciencesconf.org/>

Niemi, A. (2018) Overview - our recent activities in R&D in Geological CO₂ Storage in EU funded projects and Heletz pilot injection site. Invited presentation for Total, France. Jan 23rd 2018

Niemi, A. and Bensabat, J. (2018) Progress at Heletz CO₂ injection site and first results of the residual trapping experiments. Invited talk at Venice Open Forum, CO₂GeoNet. 24-26 April, 2018. (preliminary invitation received)

Niemi, A. (2017) Progress at Heletz, Israel site since 2016 and first results for evaluating the in-situ residual trapping test *IEAGHG* (International Energy Agency Greenhouse Gas RD Program) Monitoring Network Meeting. Traverse City, Michigan, USA. 12-14.6.2017

Niemi, A. (2016) 'Experiences from Heletz pilot project' *IEAGHG* (International Energy Agency Greenhouse Gas RD Program) Monitoring and Modelling Research Network Combined Meeting Edinburgh, Scotland. 6th to 8th July 2016.

Niemi, A. (2016) 'CO₂ storage pilots – progress of Heletz project' *11th CO₂GeoNet Open Forum*, Venice, May 9-11th, 2016. Venice, Italy.

Niemi, A. (2015) 'Unlocking the potential for CCs in the Baltic Sea' Global CCS Institute Webinar (<http://www.globalccsinstitute.com/insights/authors/WebinarOrganiser/2015/04/14/bastor2-unlocking-potential-ccs-baltic-sea?author=MTc1OTM%3D>).

Niemi (2014) Quantification of Saline Aquifers for CO₂ Geological Storage – Experiences from the Mustang Project. *European Carbon Capture and Storage Research and Development Workshop*. 18th June, 2014, United Kingdom, UKCCS Research centre, Grandfield, UK.

Niemi (2013) Quantification of Saline Aquifers for CO₂ Geological Storage – Experiences from Mustang project. *Global CCUS Summit 2013* - the 4th Annual Conference, 22-23rd October, 2013, Beijing, China

Niemi (2013) Progress of MUSTANG project on quantifying saline aquifers for geological storage of CO₂. *8th CO₂GeoNet Open Forum, Venice*, April 11-14

Niemi (2013) SwedestoreCO₂ and Mustang Projects. CO₂ Capture and Storage in the Baltic Sea Countries *CO₂GeoNet meeting*, GTK, May 23rd, Espoo, Finland

Niemi (2012) Multi-Scale flow and transport in fractured rocks. Invited keynote GwFR'2012 *International Conference on Groundwater in Fractured Rocks*, May 21-24, Prague

Niemi (2012) MUSTANG: Quantification of saline aquifers for CCS. CCS from cradle to grave IChemE Workshop, Birmingham, UK, 22-23 March.

Niemi (2012) MUSTANG – A large scale integrating project for quantifying saline aquifers for geological storage of CO₂. 7th CO₂GeoNet Open Forum, Venice, April 17-19.

Niemi (2011) MUSTANG - A Large-Scale Integrating Project for Developing Methodologies for Quantifying Saline Aquifers for Geological Storage of CO₂. CCS Research & Development to Implementation Conference. 24 - 26 May 2011, London, UK

Niemi (2010) Modeling flow and transport in fractured rocks. Invited talk at *Gordon Research Conferences*. Flow and Transport in Permeable Media. July 11-18, 2010. Bates College, USA.

Niemi, A. (2010) 'Quantification of deep saline aquifers for CO₂ geological storage' Canada- European Union Energy Workshop, May 3-5, 2010. Ottawa, Canada.

EXAMPLES OF POPULAR SCIENCE ARTICLES AND APPEARANCES

- Interview on CCS in *Malou efter 10* (TV4), December 5th, 2019
- Koldioxid under jord kan rädda klimatet. *Dagens Nyheter*, Sunday Nov 1st, 2015, <http://www.dn.se/nyheter/vetenskap/koldioxid-under-jord-kan-radda-klimatet/>
- *Pan European Networks* – Gov 8 2013 (European Science News; journal for decision makers etc.)
- *Framtidens Forskning* (Svenska Dagbladet), June 2012;
- *Forskarbladet* – Tema Energi, 2013

EXAMPLES OF OTHER DISSEMINATION

- overlooking the dissemination and responsible of the training activities for the CO2 Geological Storage EU FP7 project Mustang (www.co2mustang.eu) as the project coordinator, such as several training courses and e.g. Trondheim Brainstorming day on long term effects on CO2 geological storage <http://www.bsdt2013.org/>. Co-organizer of training courses for EU project TRUST
- appearance in Brussels report release event (for general audience and EU) presenting the EASAC working group's report 'CCS in Europe' and answering the audiences questions on storage (www.easac.eu/home/reports-and-statements/) and presenting the same report to EU officials

EXAMPLES OF HIGH PROFILE REPORTS

- EASAC (European Academies of Science Advisory Council) (2013) 'CCS in Europe'. Member of the working group. (www.easac.eu/home/reports-and-statements/)
- As coordinator of MUSTANG project (www.co2mustang.eu) responsible for and in part co-author of a large number of Deliverable Reports submitted to European commission and available on the project website (<http://www.co2mustang.eu/MustangDeliverables.aspx>), including main author in project summary reports to 18mos, 36mos, 48 mos, 60 mos (http://www.co2mustang.eu/MustangDeliverables.aspx/MUSTANG_final_sceintific_report.pdf) ; with over 70 co-authors; see above webb-site)
- Final Report on Prospective Sites for Geological Storage of CO2 in Southern Baltic Sea. Report prepared for the Energimyndigheten and released by Global CCS Institute, Feb 2014. My group was responsible for the modeling part of the work. (<http://www.globalccsinstitute.com/publications/final-report-prospective-sites-geological-storage-co2-southern-baltic-sea>)
- Benson, S., Pini, R., Krevor, S., Hingerel, F., Reynolds, K., Niu, B., Calvo, R., Niemi, A. and Zuo, L. (2014) Relative Permeability Analyses to describe Multi-Phase Flow in CO2 Storage Reservoir – Part II: Resolving Fundamental Issues and Filling Data Gaps. A research report prepared for the Global Carbon Capture and Storage Institute. December 2014. Stanford University.
- Processindustrin och nollvisionen. Energiforsk rapport 2015:138. Member of the working group. <https://energiforskmedia.blob.core.windows.net/media/18719/processindustrin-och-nollvisionen.pdf>