

se-2019-45

Title: "Uncertainty in regional estimates of capacity for carbon capture and storage"

This paper describes the uncertainty in storage capacity estimates found by a group of experts for a set of CO₂ storage reservoirs (saline aquifers) in the North Sea. The experts are graduate students who were given access to a library and the internet. Limited data for many of the reservoirs leads to wide estimates of storage capacity. The work is interesting, and highlights the need for site specific data and probabilistic methods to make better estimates. I am suggesting that references be added for completeness.

Specific Comments:

- 1) Line 38. Remove the ‘so-called’. Although I believe that these should be called brine reservoirs (not potable water), the ship has left the dock on this one, and saline aquifer is used extensively in the literature and has redefined the original definition of an aquifer as being potable water.
- 2) Somewhere in lines 41-51 you should discuss the NatCarb database that was created by the US Department of Energy for the entire US.
<https://www.netl.doe.gov/coal/carbon-storage/strategic-program-support/natcarb-atlas>
- 3) Somewhere in the introduction you should reference some of the early work on storage capacity by Stefan Bachu, for example:

Bachu, S. Sequestration of CO₂ in geological media: criteria and approach for site selection in response to climate change. *Energy Convers. Manage.* 2000, 41, 953–970.

- 4) Line 59, another ‘so-called’
- 5) Consider adding references to the following papers that describe probabilistic approaches to estimating storage capacity for multiple regional sinks, perhaps even a short paragraph on the topic:

2011 Keating, G, R.S. Middleton, P.H. Stauffer, H.S. Viswanathan, B.C. Letellier, P Pasqualini, R. Pawar, A.W. Wolfsberg, Meso-scale carbon sequestration site screening and CCS infrastructure analysis, *Environ. Sci. Technol.*, (JAN 1 2011) Vol.45, iss.1, p.215-222

2012 Middleton, R.S., G. Keating, P.H. Stauffer, A. Jordan, H. Viswanathan, Q. Kang, B. Carey, M. Mulkey, J. Sullivan, S.P. Chu, and R. Esposito, The multiscale science of CO₂ capture and storage: From the pore scale to the regional scale. *Energy and Environmental Science*, 5,7328 | doi:10.1039/C2EE03227A.

2012 Middleton, R.S., Keating, G.N., Stauffer, P.H., Viswanathan, H.S., Pawar, R.J., Effects of geologic reservoir uncertainty on CO₂ transport and storage infrastructure. *Int. J. Greenhouse Gas Control*, doi:10.1016/j.ijggc.2012.02.005.

2016 Pawar, R.J., G. Bromhal, S.P. Chu, R.M. Dillmore, C. Oldenburg, P.H. Stauffer, Y. Zhang, G. Guthrie, The National Risk Assessment Partnership's Integrated Assessment Model for Carbon Storage: A Tool to Support Decision Making Amidst Uncertainty, *Int. J. Greenhouse Gas Control*, 52, 175–189.

- 6) Line 82. Instead of saying ‘too small’ perhaps it would be more precise to say “may be rejected as having too low a storage capacity . . . ”
- 7) Line 339 Consider referencing studies that show how regional estimates often over-estimate storage capacity when refined to include site specific data

2012 Deng, H., P.H. Stauffer, Z. Dai, Zunsheng Jiao, R.S. Surdam, Simulation of Industrial-Scale CO₂ Storage: Multi-Scale Heterogeneity and its Impacts on Storage Capacity, Injectivity and Leakage, *Int. J. Greenhouse Gas Control*, Volume 10, September 2012, Pages 397–418.

2014 Dai, Z., P. H. Stauffer, J.W. Carey, R.S. Middleton, Z. Lu, J.F. Jacobs, K. Hnottavange-Telleen, L.H. Spangler, Pre-site characterization risk assessment for commercial-scale carbon sequestration, *Environ. Sci. Technol*, DOI: 10.1021/es405468.

2019 Onishi, T., M.C. Nguyen, J.W. Carey, B. Will, W. Zaluski, D.W. Bowen, B.C. Devault, A. Duguid, Quanlin Zhou, S.H. Fairweather, L.H. Spangler, and P.H. Stauffer, Potential CO₂ and brine leakage through wellbore pathways for geological CO₂ sequestration using the National Risk Assessment Partnership Tools: Application to the Big Sky Regional Partnership, *Int. J. Greenhouse Gas Control*, <https://doi.org/10.1016/j.ijggc.2018.12.002>