Imperial College London

Global CO_2 storage capacity: Modelling limitations of geography and injectivity

Supervisors: Dr Sam Krevor (s.krevor@imperial.ac.uk) and other TBA

Department: Department of Earth Science and Engineering

Funding and Deadline: Deadline for applications is January 8, 2024. Funding through the Grantham Institute Science & Solutions for a Changing Planet, Departmental Scholarships or the President's scholarship depending on eligibility

The importance of carbon capture and storage in the mitigation of climate changes arises from the potential capacity for the injection of large volumes of CO2 into suitable subsurface geologic formations. The assessment reports of the Intergovernmental Panel on Climate Change estimate that in the average of scenarios where CO2 concentration is stabilised at 450 ppm by 2100, storage demand approaches 15 Gt CO2 per year by 2050, and persists at around 20 Gt per year from 2060-2100. This represents approximately 1200 Gt CO2 stored underground by 2100. However, these modeled estimates disregard potential limitations to achieving these rates and volumes of storage from either the geographic availability of subsurface storage reservoirs, or the pressure limitations to allowable rates of injection.

The PhD project will evaluate the potential for geographic and reservoir injectivity constraints to lead to bottlenecks in the development of large scale CO2 storage globally. Ultimately, we will construct models for plausible development trajectories that may be incorporated into energy systems models of the type used by the IPCC to outline techno-economic pathways for mitigating climate change.

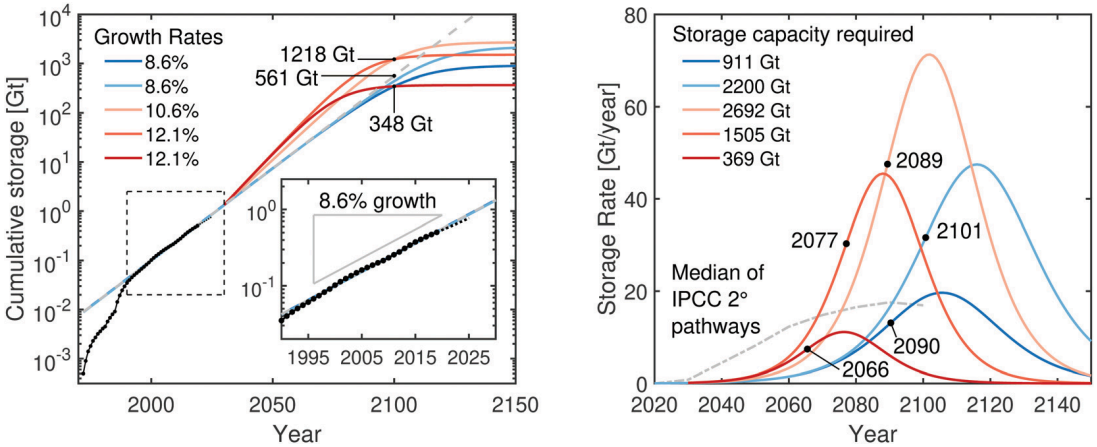

Figure 1. Plausible growth trajectories and associated storage capacity for CO2 storage to meet 2100 climate change mitigation targets outlined by the IPCC. From: Zahasky, C., & Krevor, S. (2020). Global geologic carbon storage requirements of climate change mitigation scenarios. Energy & Environmental Science.

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Research Environment: The researcher will be based within the Subsurface CO_2 Research Group. We are a diverse group of individuals with background in geology, geochemistry, reservoir engineering, environmental engineering, applied mathematics, and numerical modelling. Researchers from the group have gone on to highly successful careers in academia, industry (CO_2 storage and otherwise), consulting, law, finance, and government. The researcher will be supported to participate in international conferences and encouraged to participate in internships and secondments as per their professional interests.

References:

Zhang, Y., Jackson, C., & Krevor, S. (2022). An Estimate of the Amount of Geological CO2 Storage over the Period of 1996–2020. Environmental science & technology letters, 9(8), 693-698.

Zhang, Y., Jackson, C., Zahasky, C., Nadhira, A., & Krevor, S. (2022). European carbon storage resource requirements of climate change mitigation targets. International Journal of Greenhouse Gas Control, 114, 103568.

Zahasky, C., & Krevor, S. (2020). Global geologic carbon storage requirements of climate change mitigation scenarios. Energy & Environmental Science, 13(6), 1561-1567.