#### **KAUST VIRTUAL RESEARCH CONFERENCE 2021**

Enabling CO2 Geological Storage within a Low-Carbon Economy

### **CO**<sub>2</sub> Storage Potential of the Unayzah Formation (Saudi Arabia)

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# Motivation



#### **World** 33,513 Mton CO<sub>2</sub>



- Electricity and Heat Producers
- Industry
- Residential
- Agriculture

- s Other Energy Industries
  - Transport
  - Commercial and Public Services
  - Fishing

Worldwide  $CO_2$  Emissions by sector in 2018. Source: IEA, 2018.

#### Riyadh 45.8 Mton CO<sub>2</sub> (11% Total)



 $CO_2$  Emissions in Saudi Arabia Data Base ANPERC, 2020.

### **Problem Statement**



### Oil and Gas Reservoirs Deep Saline Aquifers Basalts

#### Geological media to Storage CO<sub>2</sub>

Bachu et al. 2007

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## **Problem Statement**





Regional map of the Arabian peninsula, showing the total depth of the sedimentary basins, corresponding to the depth of the crystalline basement, modified from Konert et al. 2001.

Maps of Central Arabia highlighting the Fields of the area of study from Al-Husseini, M. I. 2004.

# **Project Workflow**





# **Trapping mechanisms**





CO2 Trapping mechanisms, adapted from Bradshaw et al. 2007, Juanes et al. 2006, Gershenzon et al. 2017.





Appelo et al. 2014, Mantovani et al. 2012, Rumpf et al. 1994.





Geological model of the Unayzah Formation (A) including Hawtah and Nuayyim fields. Aquifer selected for the study (B)







CO<sub>2</sub> injection into the modeled aquifer. It captures the complex heterogeneity of the Unayzah reservoir and the physics of the trapping mechanisms described.



- First simulation study to assess the CO<sub>2</sub> storage potential in aquifers to contribute to the vision of the Kingdom.
- Detailed geological model to capture the complex heterogeneity and the main physics involved in CO<sub>2</sub> Storage.
- Evaluate the integrity of the regional seals and probable leakage scenarios.
- Associate the model with uncertainties to deliver a probabilistic forecast of the CO<sub>2</sub> storage in the area of study.
- Expand the study to the whole Riyadh area.

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