GPSFLOW: A Novel Simulator for Modelling Underground Hydrogen and Gas Mixture Storage

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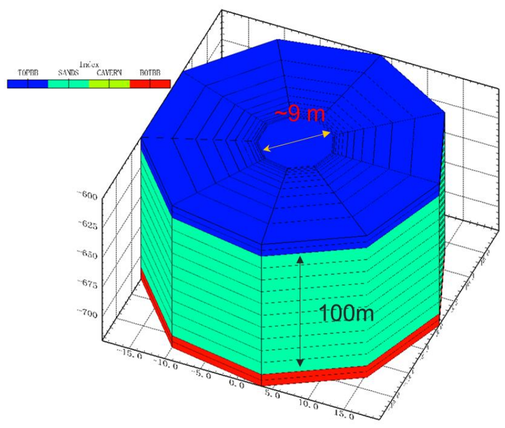
1. Objectives

This work presents a novel simulator with parallel computing capability, which is capable of modelling underground hydrogen storage in different scenarios:

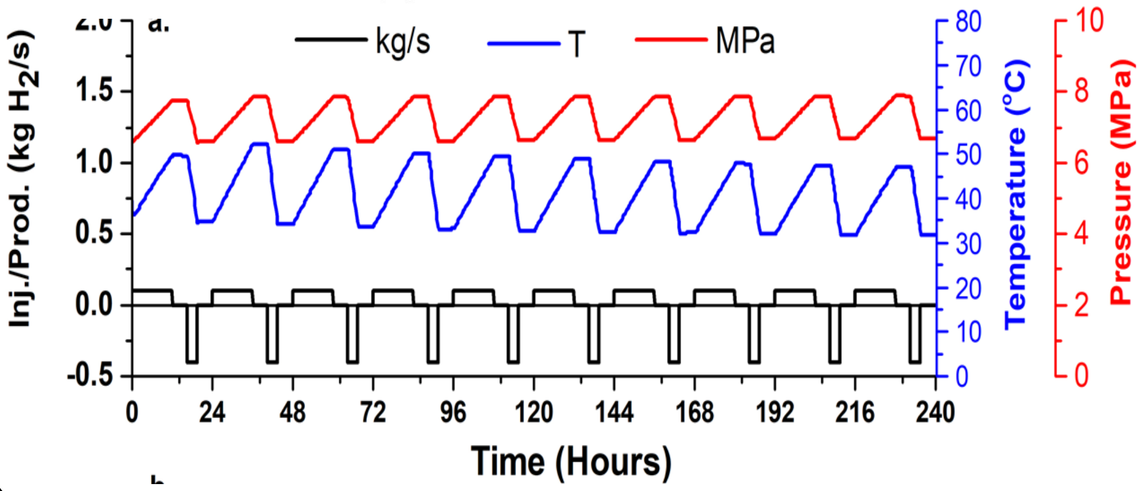
- ✓ Storage conditions up to 200 C and 100 bar
- ✓ Hydrogen storage in salt cavern
- ✓ Hydrogen storage in Aquifers
- ✓ Reservoir-scale hydrogen storage in depleted gas field using CO_2 or N_2 as cushion gas

2. Storage in Cavern

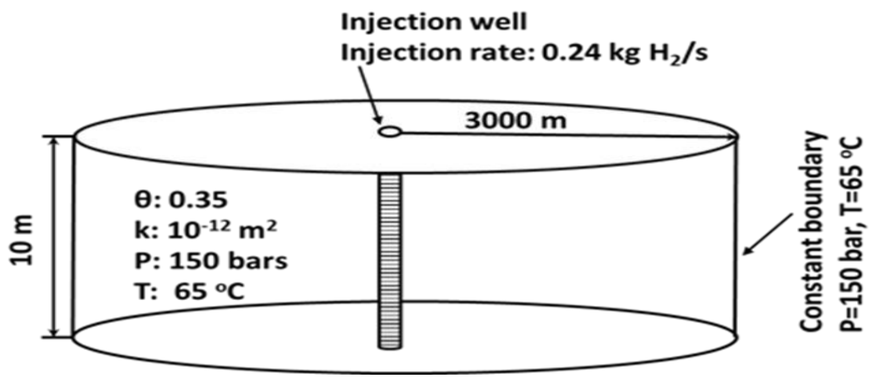


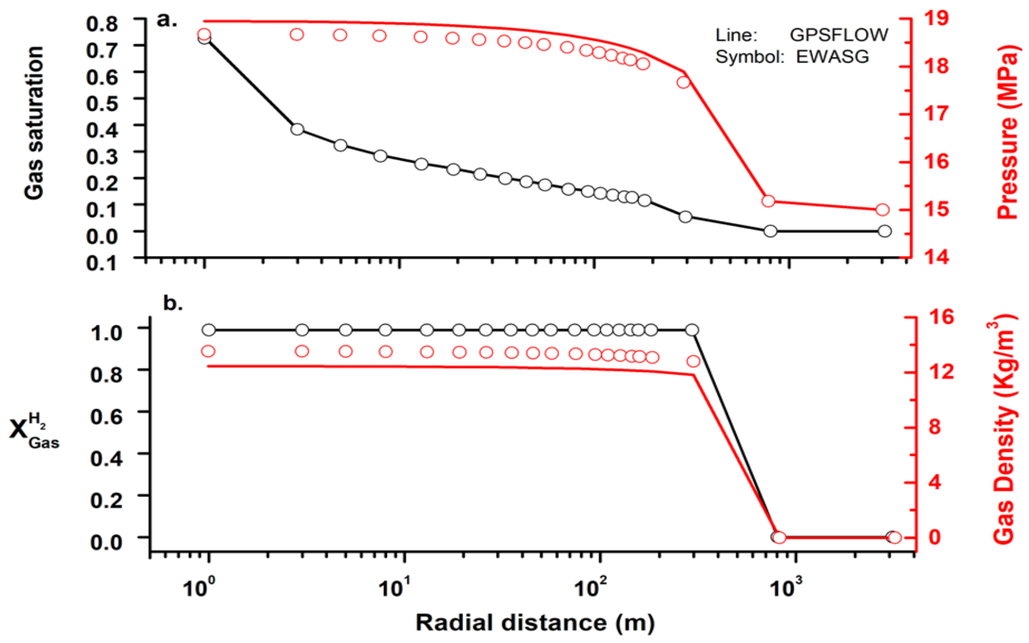
Parameters:

- ✓ Cavern Volume: 7231 m^3
- ✓ 600 m blow ground surface
- ✓ Initial Pressure: 6MPa
- ✓ Initial temperature: 35 C



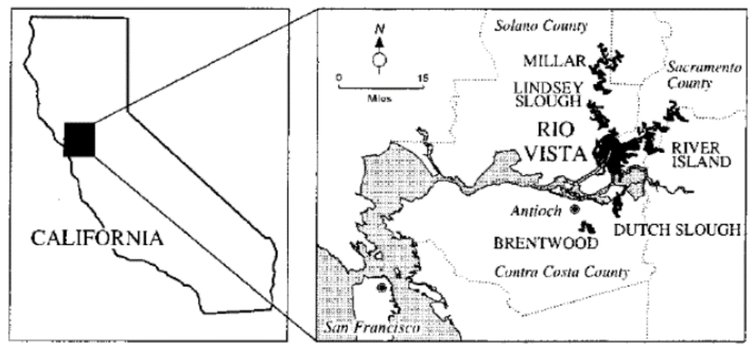
3. Storage in Aquifers



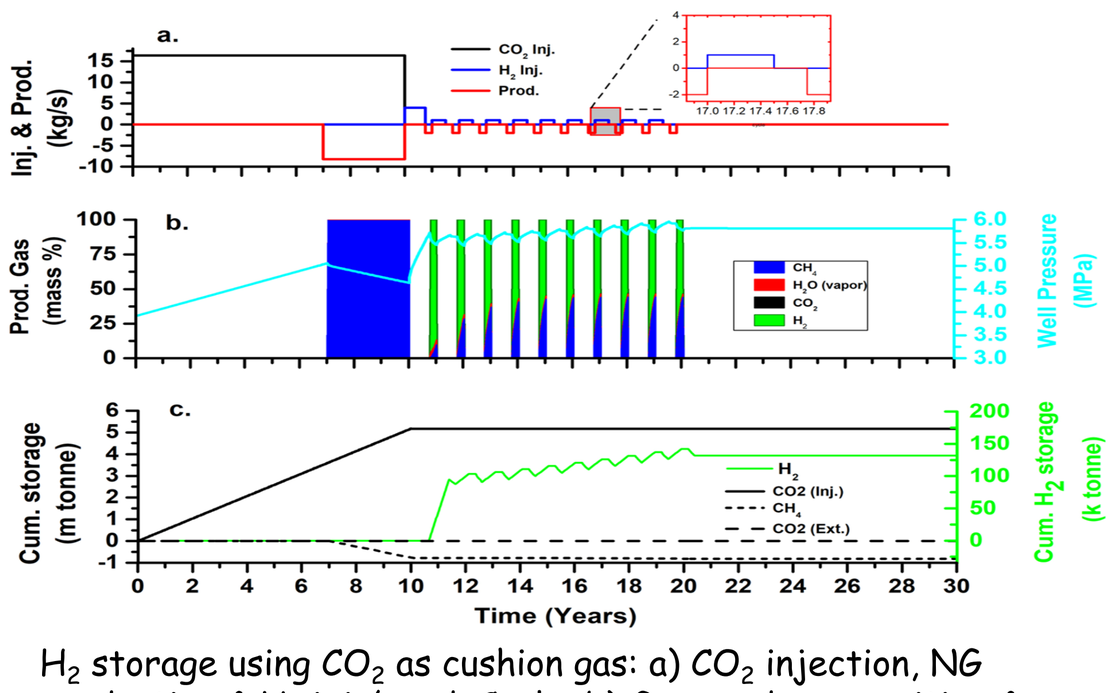


After 5 years injection

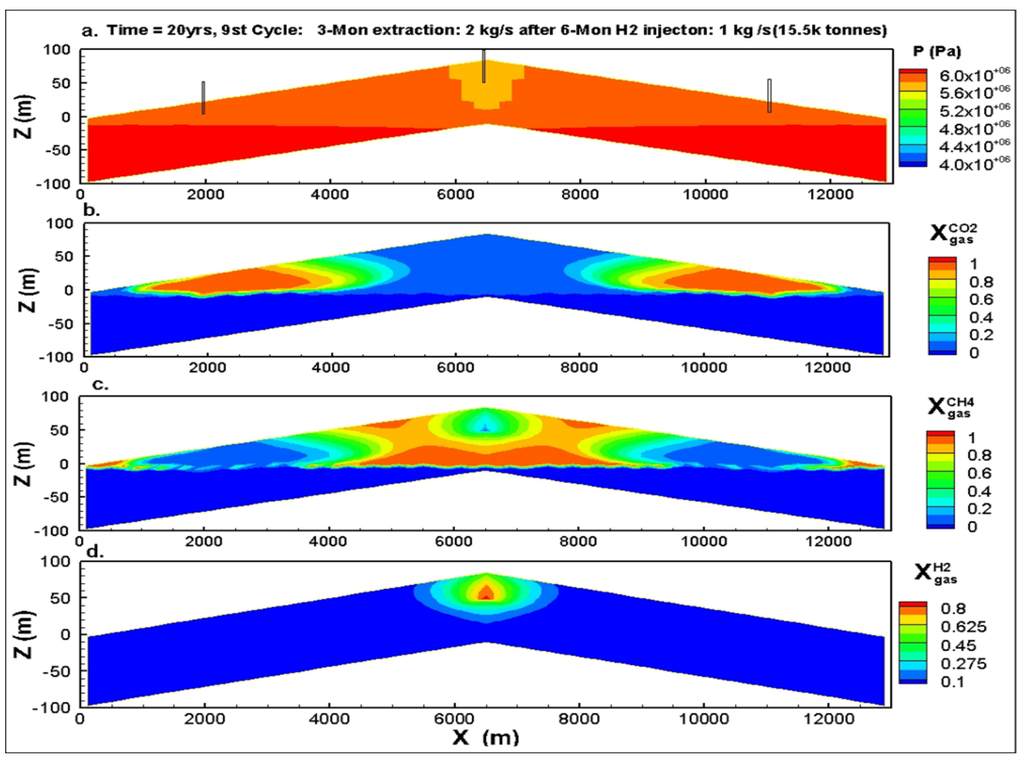
4. Storage in Depleted Gas Field



Rio Vista Gas Field



H_2 storage using CO_2 as cushion gas: a) CO_2 injection, NG production & H_2 inj./prod. Cycle; b) Gas prod. composition & pressure; c) Cumulative gas mass



Pressure, gas mass fraction after 9th inj./prod. Cycle

5. Conclusions

- ✓ GPSFLOW offers a robust numerical tool to model underground hydrogen storage at grid scale.
- ✓ GPSFLOW can run on multiple parallel computing platforms like multi-core PC, workstation, and high-performance computing facility.

6. Acknowledgments & References

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