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Modelling Results from the Lithium Valley Project in the Salton Sea geothermal field

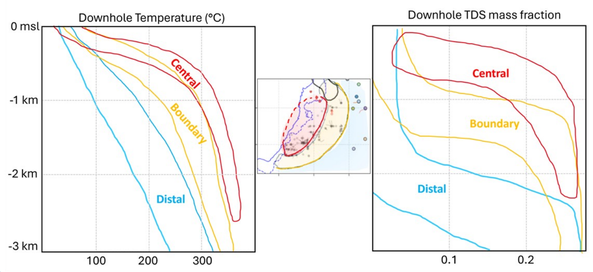
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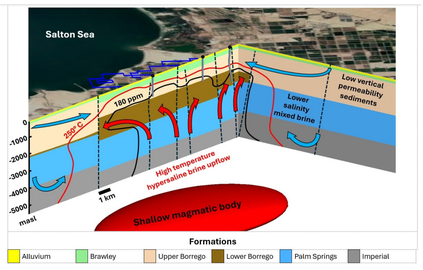
INTRODUCTION

- Estimated resource potential of nearly 3 GW with dissolved lithium in the brine.
- Continental rift zone with dextral and normal faults with spreading centers in the extensional gaps (Hulen et al. 2002).

Reactive-Transport Modelling

- Reactions of relatively stable lithium-bearing metamorphic minerals are slow even at high temperatures.
- Injection of a lithium-depleted brine is not significantly enriched by mineral-water reactions over time periods of hundreds of years (Dobson et al. 2023).
- High temperature plume around 350°C up to -1000 mRl.
- High numbers of local and regional faulted structures with low shallow vertical permeabilities from alterations and nature of the sedimentary deposits.
- **Central** region with 300-320°C at 500-700 mRl and >20 wt.% TDS, Chloride.
- **Boundary** region intermediate downhole temperature profiles and chemical composition, transition zone below -1000 m mRl.
- **Distal** region with a conductive regimes and low salinity gradient until 2 km depth.





METHODS

- Tight coupling for deep and surface formations, faulted structures for best heterogeneities distribution.
- Mass and Energy balance calculations using the open source Waiwera geothermal simulator.
- 93,186 blocks grid dimensions of 24 x 24 x 3 km with local refinements down to -3km mRl.
- Complex fluid thermodynamics including Water, Energy, Salt, CO_2, Lithium as a passive tracer.
- Atmospheric boundary conditions on top.
- Localized heat flux, water, salt, lithium and CO_2 upflows at the bottom.
- 62 Production wells and 57 Reinjection wells using a Dual Porosity model

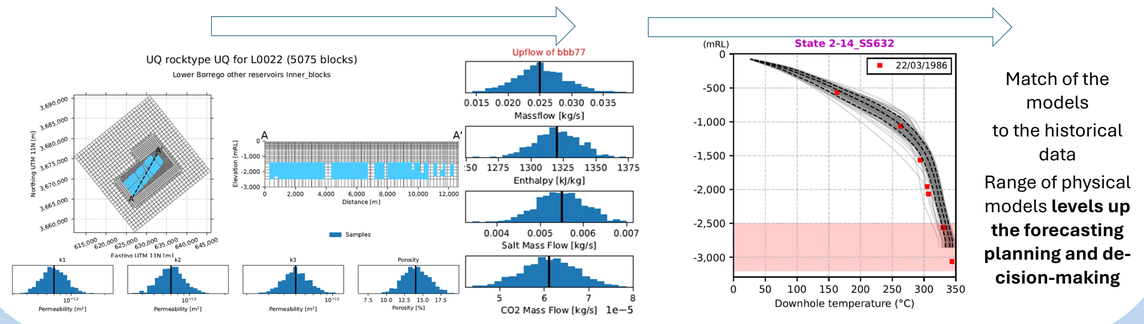
Uncertainty Quantification Method

Samples generation for Uncertainty quantification

Generation of samples based on distribution of permeabilities, porosities and upflows (Dekkers et al. 2022)

2000 samples run with HPC cloud solutions

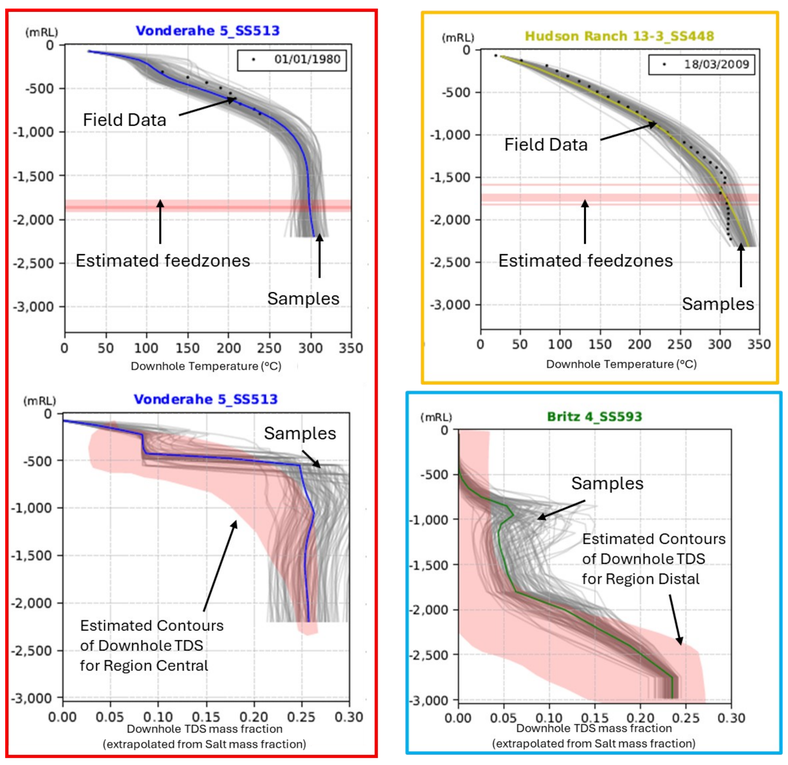
ABC method used to filter on the data available (temperature transient enthalpy, COP2,salt and lithium mass fraction



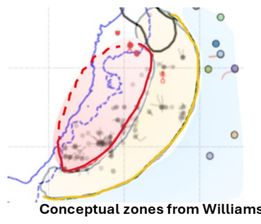
Match of the models to the historical data

Range of physical models **levels up the forecasting planning and decision-making**

RESULTS



Examples of samples results in the regions for Downhole temperature and TDS mass fraction extrapolated from Salt Mass fraction

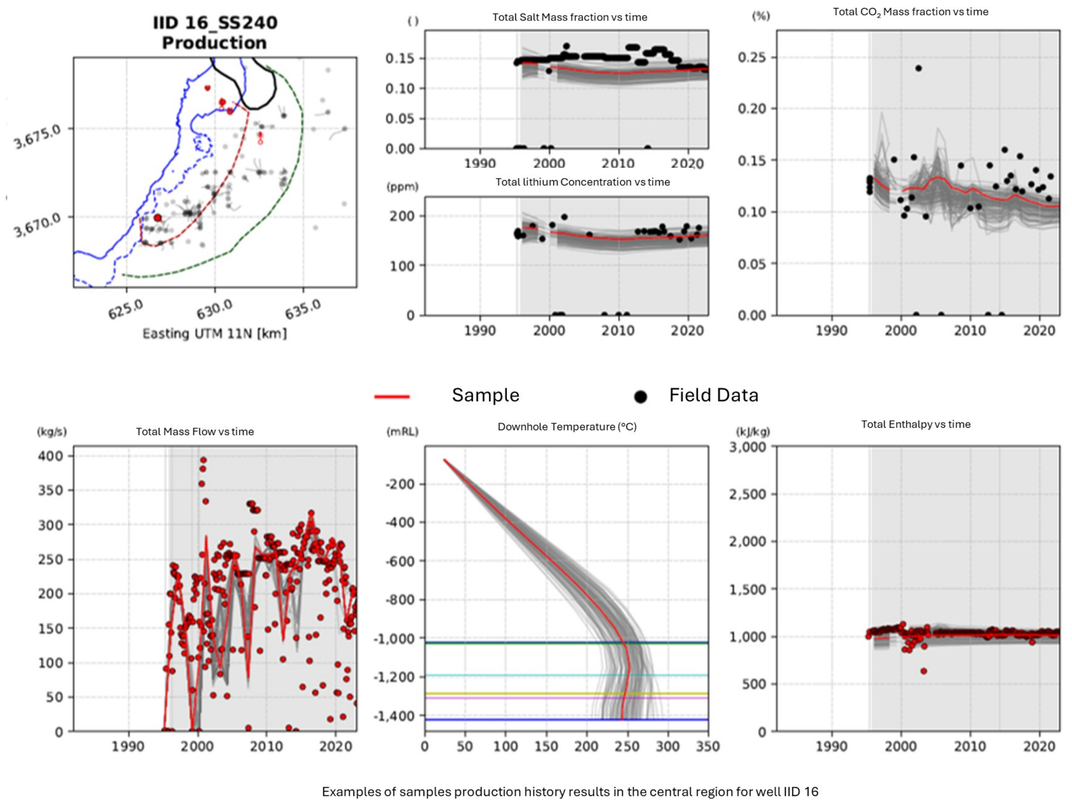


Conceptual zones from Williams and McKibben 1989

Temperature, Pressures and Salt distribution matching data and conceptual model

Production history using on Salt, Lithium, CO_2 mass fraction in the production wells and fluid enthalpy

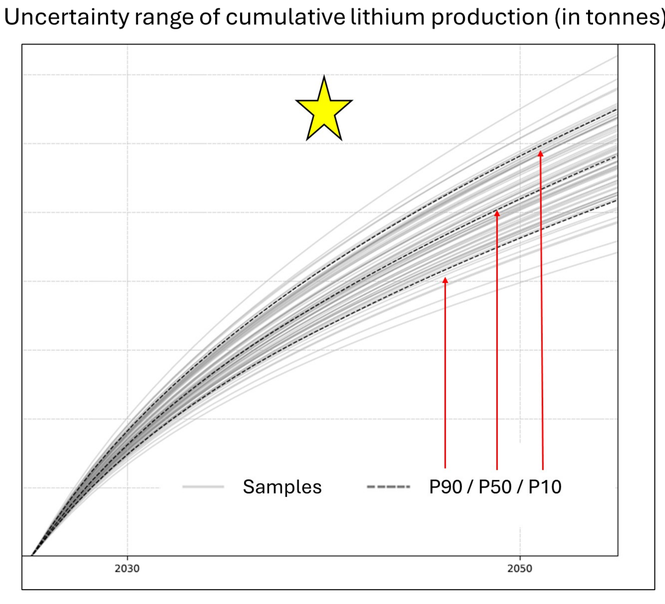
High fidelity of physical models with from historical publicly available datasets

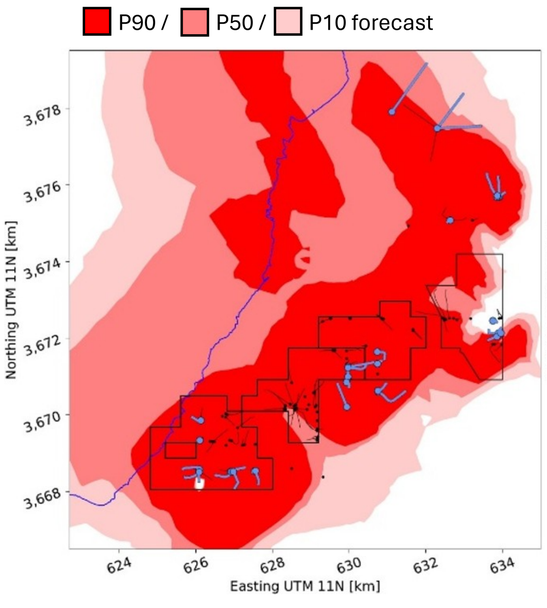


Examples of samples production history results in the central region for well IID 16

CONCLUSION

- High fidelity of calibrated models with historical data
- High Chloride and lithium rich brines in the Salton Sea
- Strategic Scenarios with range of uncertainties
- Cumulative lithium, steam, analysis of reinjection returns
- P10/P50/P90 production probabilities delivered
- Probabilistic spatial distribution of Lithium concentrations





Acknowledgements

We acknowledge the support by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), Geothermal Technologies Office, under Award Number DE-AC02–05CH11231 with Lawrence Berkeley National Laboratory. In addition, this work was supported by Lithium Valley Commission. The authors would also like to thank Seequent for their ongoing collaboration and support.

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