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Thermodynamic simulation of gas caverns with GUSTS V.2

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Abstract

As associated with the rise in natural gas trading, gas storage caverns are increasingly being designed for high frequency cycling. Quick gas operations induce more complex cavern behavior and therefore increase the need for thermal simulation and numerical modeling.

Today, thermodynamic simulators are used not only to predict the cavern parameters (pressure, temperature, inventory ...) for defined gas operations but also to optimize cavern performances. Geostock has developed a thermodynamic simulator called GUSTS V.2 (Geostock underground storage thermodynamic simulator).

In addition to improving user interface issues, GUSTS V.2 provides more features as compared to a typical software like SCTS: Simulation of brine compensated gas operation and application to all gas products (e.g. hydrogen).

GUSTS V.2 is based on a real gas equation of state. The gas thermodynamic properties are calculated using REFPROP software developed by NIST (National Institute of Standards and Technology). The heat exchange between the gas and surrounding rocks is taken into account in the cavern as in the well borehole.

This paper briefly presents the theoretical basis for GUSTS V.2 and its user interface features. Some validation cases and applications are also discussed.

Key Words: Caverns for gas storage, thermodynamic simulation, first gas filling, analytical modeling

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