Modeling wellbore and reservoir carbon dioxide flow for the Heletz experiment

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Field carbon dioxide injection experiments are necessary for demonstration, increasing the scientific understanding and quantification of the relevant processes occurring during geological storage in deep saline aquifers. As part of the large scale EU-FP7 project MUSTANG, a carbon dioxide injection experiment is to be carried out at the Heletz site, Israel. Estimating the well head conditions is an important part of planning the experiment and an approach is presented here for determining wellhead conditions needed to ensure that at least a specified flow rate is provided to the formation, given target layer conditions, while still respecting pressure buildup constraints. The main part of the study combines the multiphase flow in the target layer using the well known TOUGH2/ECO$_2$N model, with the flow in the injection pipe solving the 1D steady, real gas, augmented Euler equation. The Matching is carried on in a two-stage process.The second part consists of a transient simulation of the combined well-reservoir flow using the new T2WELL software for the same parameters. Preliminary conclusions of the comparison of the two strategies are derived. Sensitivity analyses were carried out with respect to target layer properties and to pipe model assumptions