Geophysical Research Abstracts
Vol. 15, EGU2013-11843, 2013
EGU General Assembly 2013

CO_2 injection along a pipeline with transient approach

Víctor Bezos (1), Jesús Carrera (1), Luit Jan Slooten (1), Orlando Silva (2), Jacob Bear (3), and Myra Kitro-Belinkov (3)

(1) Institute of Environmental Assessment and Water Research IDAEA-CSIC, Barcelona, Spain. (victorbezos@gmail.com), (2) Fundación Ciudad de la Energía (CIUDEN), Programa de Almacenamiento Geológico de CO_2, Ponferrada, León, Spain, (3) Technion Israel Institute of Technology, Departament of Civil & Environmental Engineering, Haifa, Spain

CO_2 geological sequestration involves several processes. One of the more relevant of these processes is the CO_2 injection along a pipeline, because it links the capture and transport of CO_2 with its deep geological storage.

The knowledge of the CO_2 behavior within injection and monitoring wells is essential for designing efficient CO_2 storage strategies. In particular, a thorough modeling and simulation of CO_2 flow through the injection pipe is required to define operational protocols and to design the surface CO_2 conditioning facilities.

Much work has been performed on modeling the steady state multiphase flow in wellbores during CO_2 injection. However, relevant problems, including the displacement of the initial brine in the injection well, or the upwards flow of CO_2 during a push-pull test, require the modeling of transient conditions, which is the goal of the present work.

Here, we present the governing equations and preliminary results for the modeling of dynamic non isothermal CO_2 flow through an injection well, including displacement of the initial brine. The model considers continuity, momentum and energy equations, together with equations of state and some thermodynamic relations. These equations are solved using the simulation framework "Proost", which implements the finite element method. The code is verified by comparison with a steady-state solver for a range of surface injection conditions. The results obtained show pressure, velocity and temperature evolution, which allows quantifying the phase changes that gradually experiment the CO_2 through the injection pipe. We find the surface pressure required initially is much higher than steady-state because heat exchange with the formation reduces significantly the density of CO_2 at the borehole.