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Evaluation of CO_2 migration and formation storage capacity in the Dalders formations, Baltic Sea - Preliminary analysis by means of models of increasing complexity

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We present preliminary data analysis and modeling of CO_2 injection into selected parts of the Dalders Monocline and Dalders Structure, formations situated under the Baltic Sea and of potential interest for CO_2 geological storage. The approach taken is to use models of increasing complexity successively, thereby increasing the confidence and reliability of the predictions. The objective is to get order-of-magnitude estimates of the behavior of the formations during potential industrial scale CO_2 injection and subsequent storage periods. The focus has been in regions with best cap-rock characteristics, according to the present knowledge. Data has been compiled from various sources available, such as boreholes within the region.

As the first approximation we use analytical solutions, in order to get an initial estimate the CO_2 injection rates that can be used without causing unacceptable pressure increases. These preliminary values are then used as basis for more detailed numerical analyses with TOUGH2/TOUGH2-MP (e.g. Zhang et al, 2008) simulator and vertical equilibrium based (e.g. Gasda et al, 2009) models. With the numerical models the variations in material properties, formation thickness etc., as well as more processes such as CO_2 dissolution can also be taken into account.

The presentation discusses results from these preliminary analyses in terms of estimated storage capacity, CO_2 and pressure plume extent caused by various injection scenarios, as well as CO_2 travel time after the end of the injection. The effect of factors such as number of injection wells and the positioning of these, the effect of formation properties and the boundary conditions are discussed as are the benefits and disadvantages of the various modeling approaches used.

References:

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Zhang et al, 2008. Report LBNL-315E, Lawrence Berkeley National Laboratory.