

Effect of varying injection rates and absolute permeability on plume shape

Figure 1 shows free-phase CO_2 saturation in a 2-D domain, which is rotated by 4 degrees counter-clockwise. CO_2 is injected over 30 meters at the bottom of the left boundary. It quickly moves upwards to the impermeable caprock (top boundary), accumulates there and spreads out in lateral direction. Figure 1 represents a case where 0.001 kg/s CO_2 is injected into a domain with an absolute permeability of 10^{-13} m^2 .

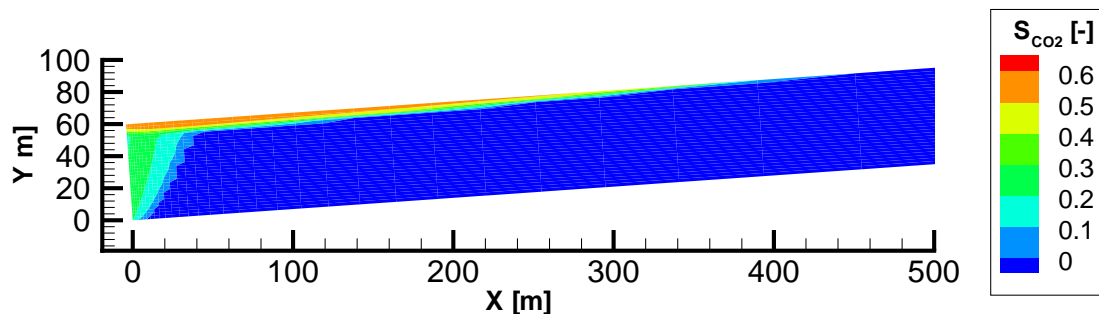


Figure 1: Case 1 plume shape after 1800 Days, i.e. $1.55 \cdot 10^5 \text{ kg}$ CO_2 injected.

Questions you should try to answer:

- What does the plume shape look like for different setups of K_h
- What does the plume shape look like for different setups of injected mass rate (MASS_INJ)?
- Can you find similarities in plume shape among the cases? Which setups look similar?
- According to what rule do they look similar?

Do the following to setup and run a simulation case and analyse it in the following:

- Edit file 'MODIFY_ME'
- Run the case by './PlumeShape PlumeShape.scr'
- Watch the time of a running simulation by 'tail -f PlumeShape.log — grep EP:'
- Investigate result by 'tecplot tpfilm.0001.plt' then
 - press 'OK'
 - Select 'FRAME'
 - Select 'Paste Style From File'
 - Select 'Style.sty'

Optionally: The domain is rotated by 4.0 degrees counter-clockwise (dip), in TEC-PLOT the grid can be rotated with

- Select 'DATA'
- Select 'ALTER'
- Select '2D ROTATE'
- Enter 'Angle' (=dip, e.g. 4.0)
- Select 'Zone1'
- Press Compute
- Plot the CO₂ mass in the model domain by './Plot-Mass'

Note: The simulation runs longer, the lower the mass injection rate is. This is because the TECPLOT result file (tpfilm.0001.plt) is produced when $1.55 \cdot 10^5$ kg CO₂ are injected (rule of thumb: 'MASS_INJ' of -0.01 takes 2 minutes, 'MASS_INJ' of -0.001 takes 6 minutes, 'MASS_INJ' of -0.0001 takes 25 minutes).