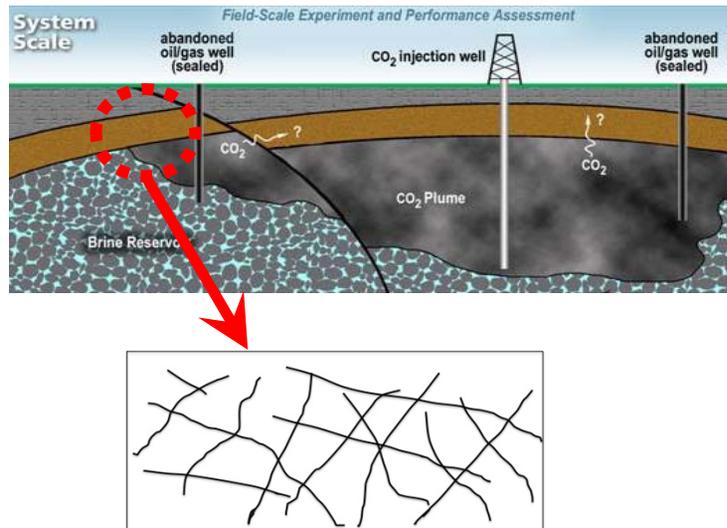


# Impact of layer thickness and well orientation on caprock integrity for geologic carbon storage

Pania Newell, Mario Martinez & Peter Eichhubl



## Scientific Achievement

We developed a coupled flow and geomechanics model investigating caprock integrity with respect to injection strategies (rates, wellbore orientation) and geologic layer thickness & properties during CO<sub>2</sub> sequestration

## Significance and Impact

- Advancement in our fundamental understanding of caprock integrity of geological carbon storage units is critical in the long-term performance of the system.
- Reactivation of pre-existing or newly formed fractures may provide a leakage pathway across caprock layer(s), which may influence the caprock integrity.

## Research Details

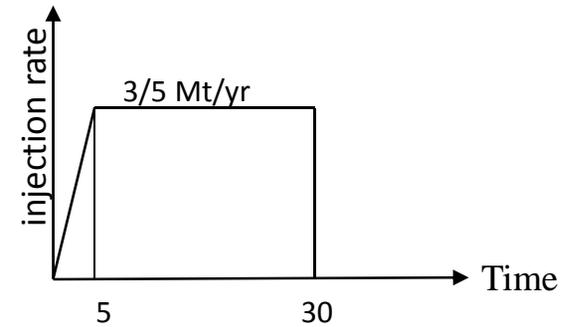
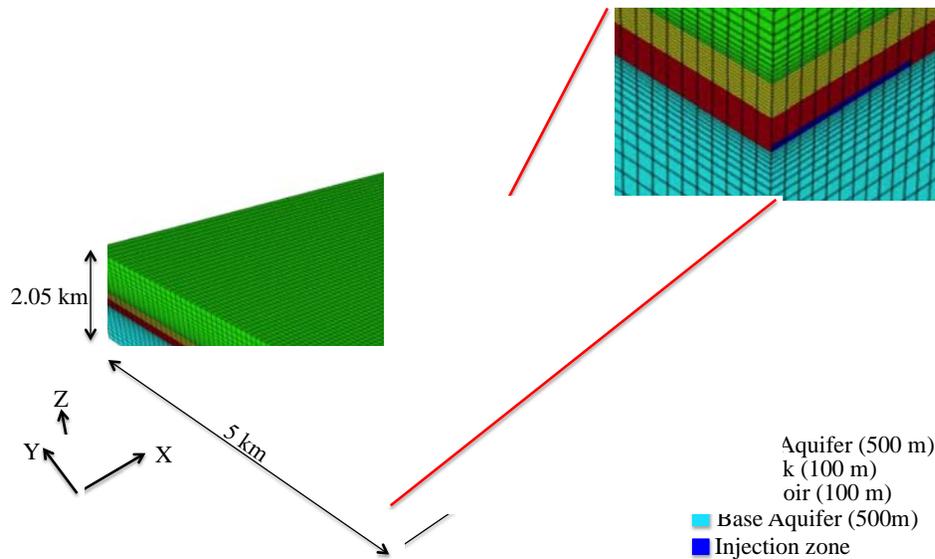
- The leakage is mainly dominated by injection rate and wellbore orientation then layer thickness.
- Reactivation of pre-existing fractures changes caprock permeability up to 2 orders of magnitude.
- Surface uplift is primarily dominated by injection rate.

Newell P., Martinez M.J. and Eichhubl P., Impact of layer thickness and well orientation on caprock integrity geologic carbon storage, Journal of Petroleum for Science and Engineering, special issue: Energy Frontier Research, April 2016, <http://dx.doi.org/10.1016/j.petrol.2016.07.032>

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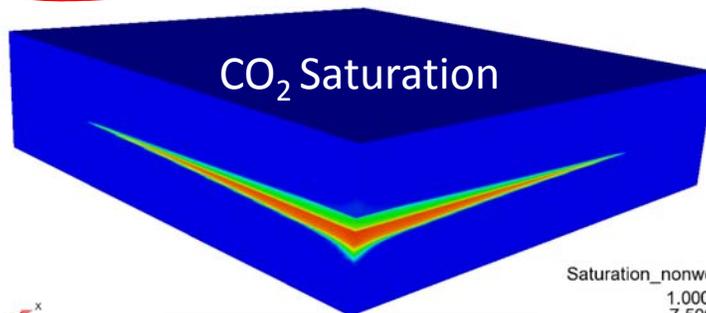
# Model problem and set-up



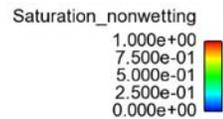
Investigation of:

- pre-existing fracture
- wellbore orientation
- injection rate
- layer thickness

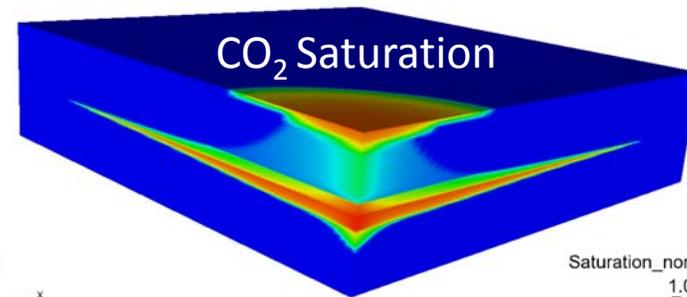
Time = 50 years



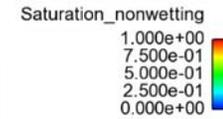
No Joint, 3 Mt/yr



Time = 30 years



With Joint, 5 Mt/yr



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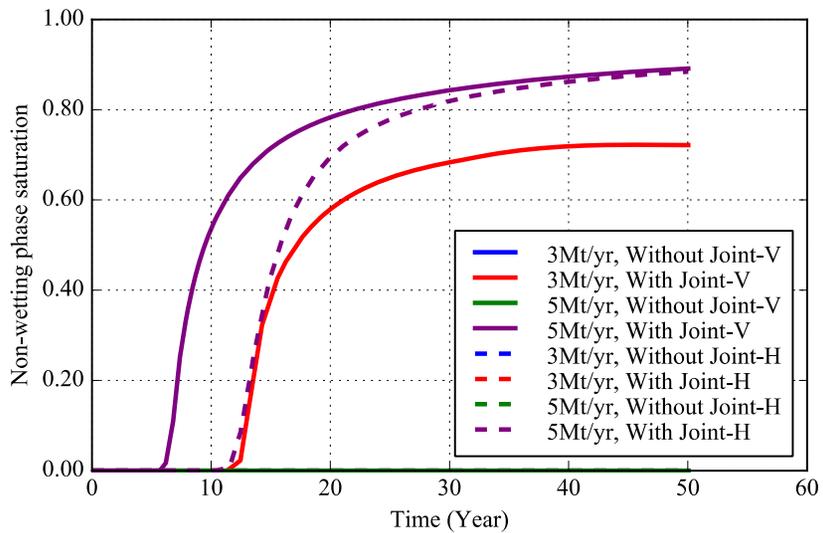
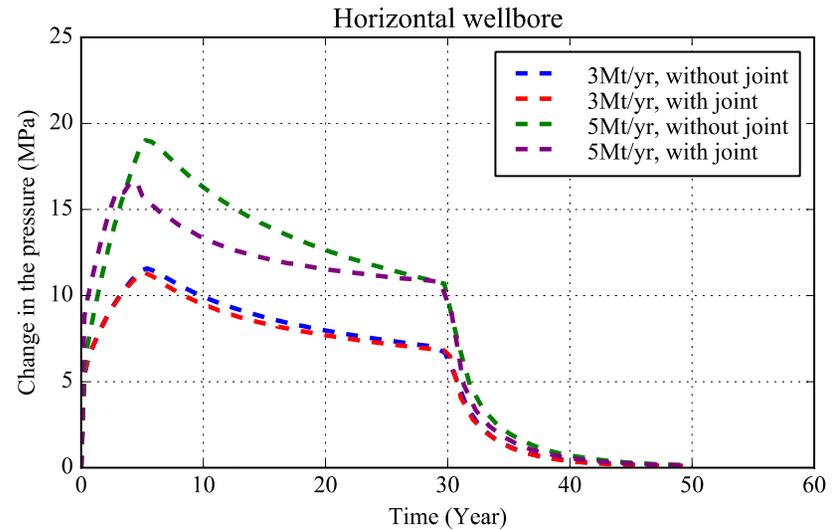
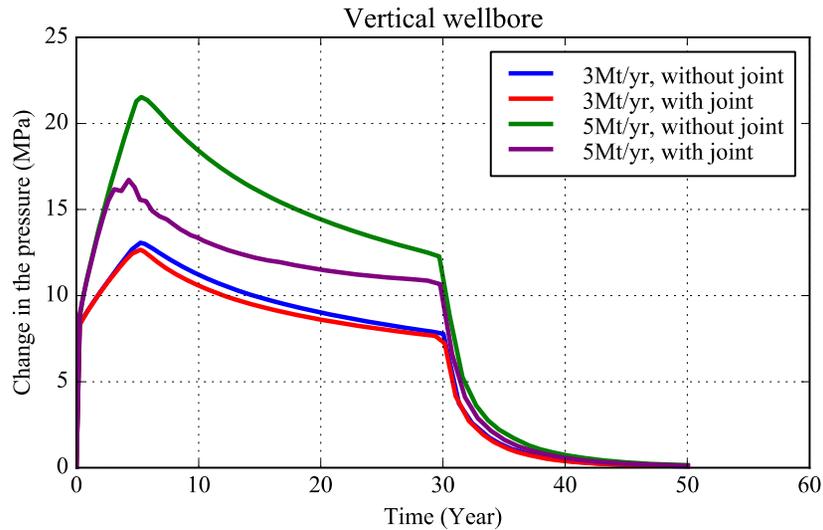
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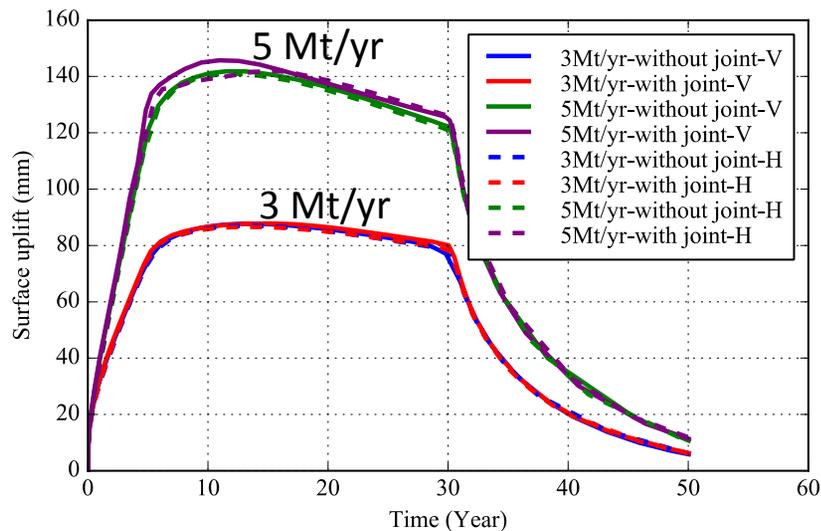
# Impact of the wellbore orientation



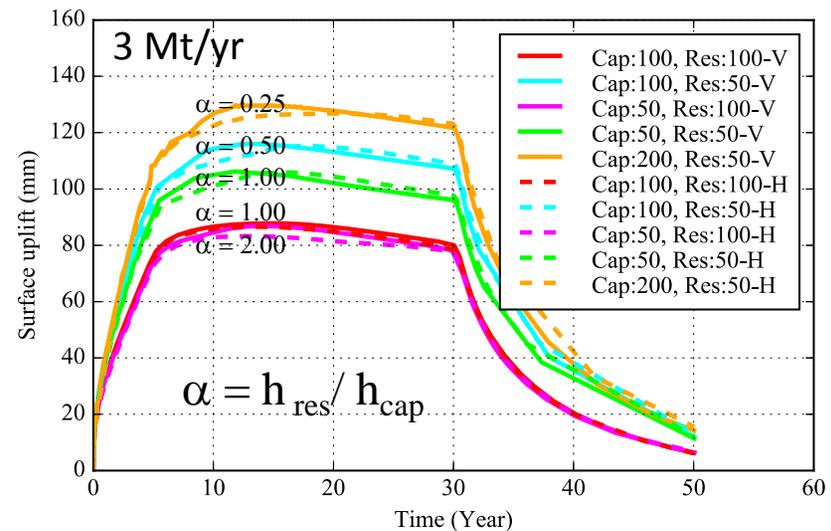
- Pressure relaxation as a result of joint activation
- Higher pressure in vertical wellbores
- No leakage for lower injection rates in horizontal wellbores
- Delay in the leakage process in horizontal wellbores with higher injection rate



# Impact of layer thickness and well orientation on surface uplift



- Surface uplift is primarily dominated by the injection rate.
- Accounting for pre-existing fractures does NOT impact the surface uplift.
- Wellbore orientation does NOT impact the surface uplift.



- The layer thickness has a significant impact on the surface uplift.



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