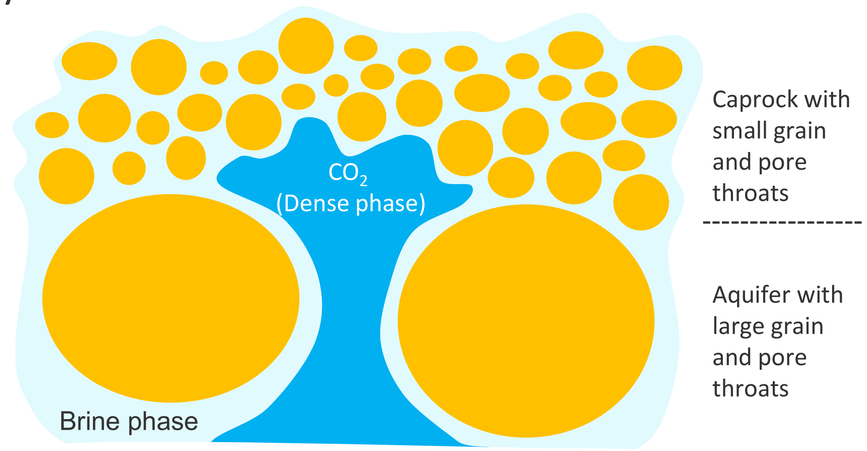
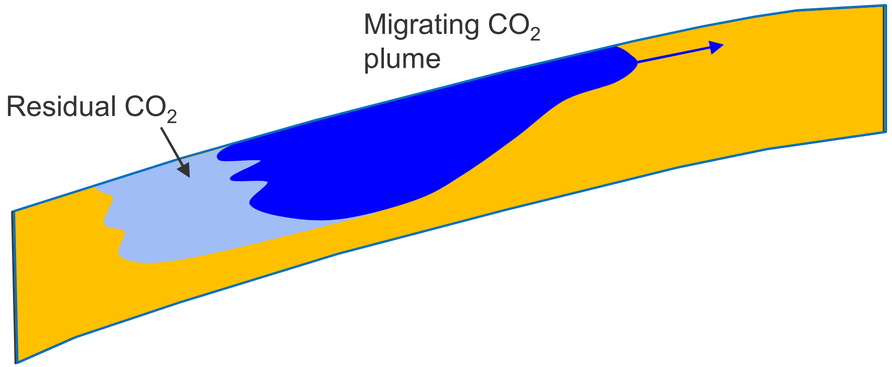
Capillary forces and CO_2 trapping

- Capillary forces (interfacial tension) play an important role in trapping of CO_2:
  - Both at the caprock interface (structural trapping)
  - And as residual CO_2 (as the plume migrates upwards)





Basic Trap behaviour

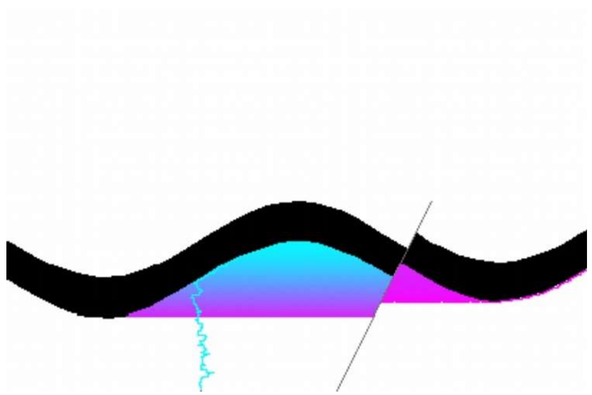
The thickness of a gas or oil column, Z_g, that can be retained against gravity by the capillary entry pressure of the sealing rock is given by:

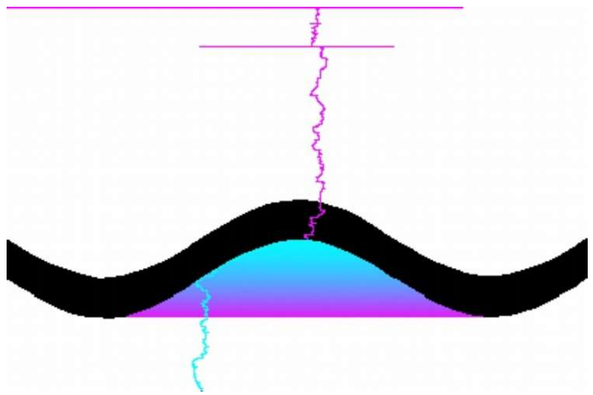
$$z_g = \frac{2\gamma \cos\theta (1/r_{cap} - 1/r_{res})}{g(\rho_w - \rho_g)}$$

r_{cap} and r_{res} are the pore throat radii in the cap rock and reservoir

γ is the interfacial tension, θ is the fluid contact angle

ρ_w and ρ_g are the densities of water and gas.





Analytical petroleum trap models (from Ringrose et al. 2000):

A. Filled petroleum trap with leaky fault and tight caprock (leaking via spill point);

B. Filled petroleum trap leaking through caprock ($P > P_{critical}$)