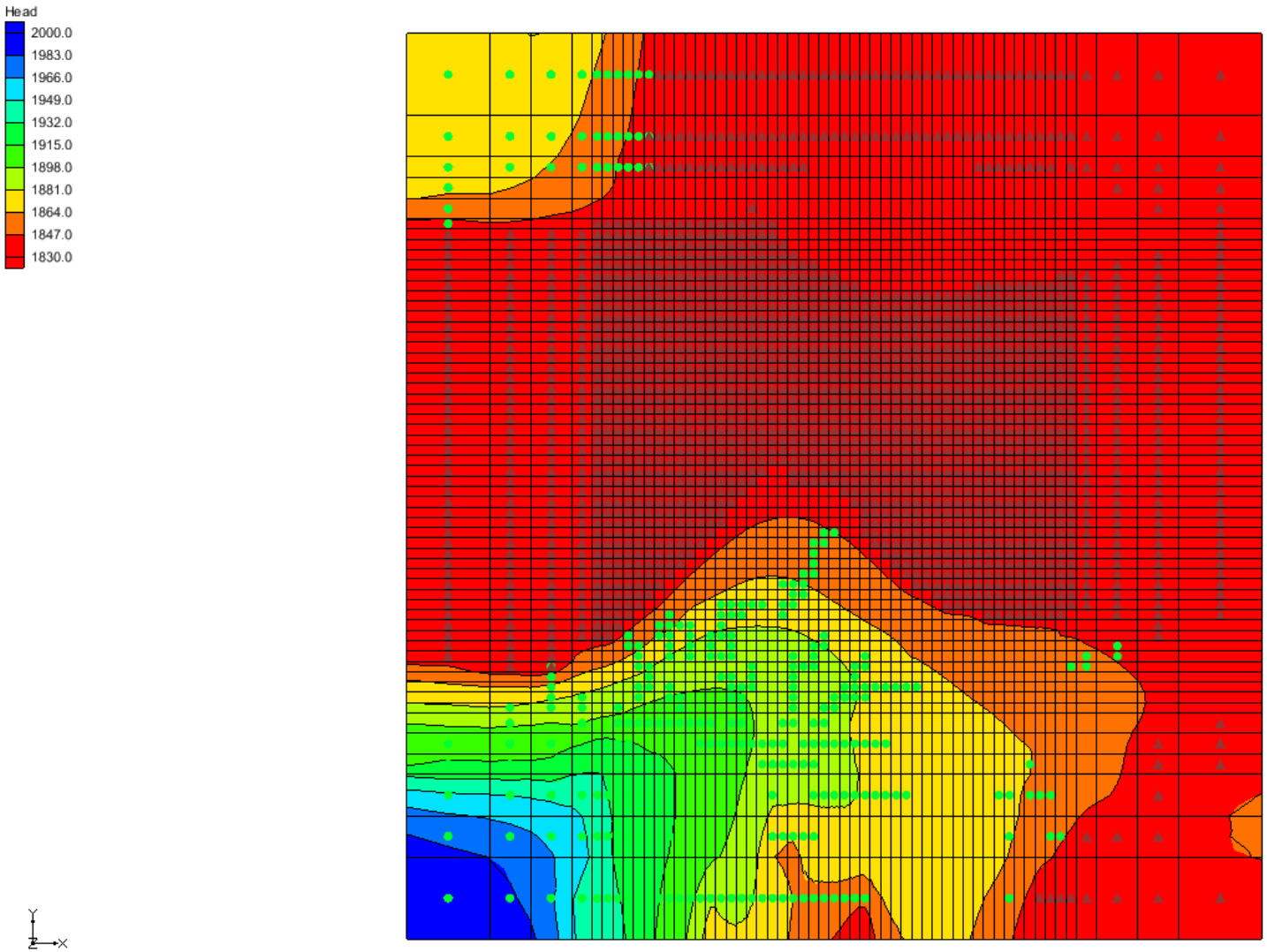
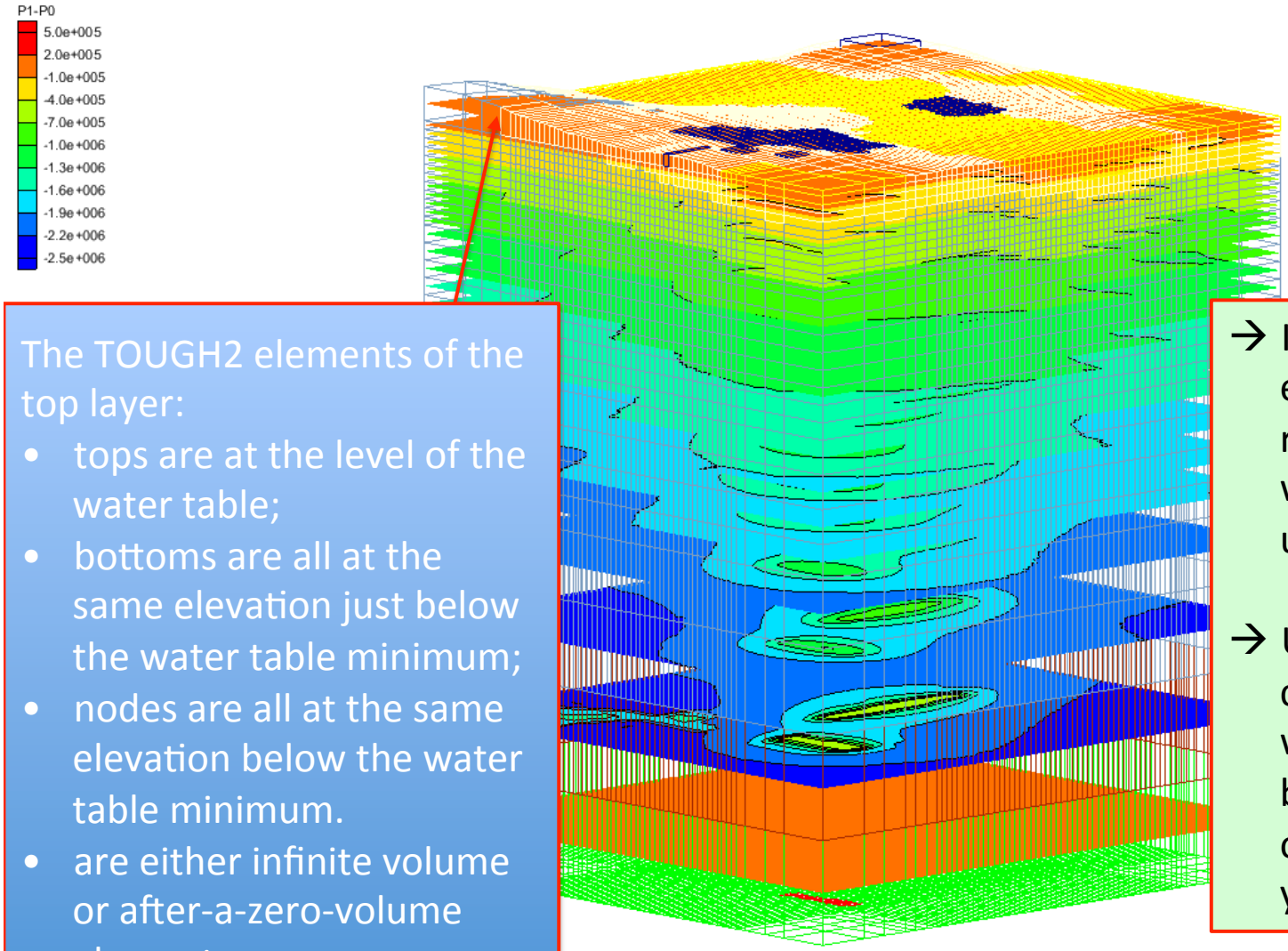
2 simple approximation to model water table boundary condition effect in TOUGH2

Water table computed by MODFLOW



TOUGH2 output
Pressure changes due to geothermal field development



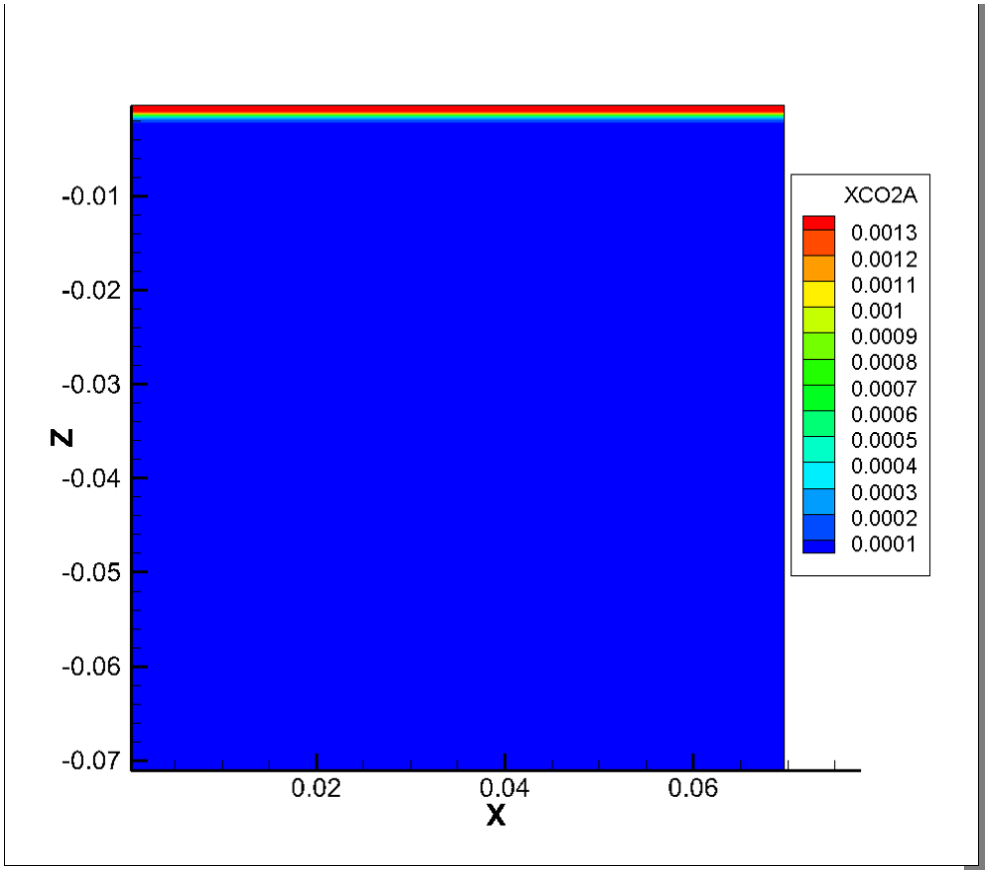
The TOUGH2 elements of the top layer:

- tops are at the level of the water table;
- bottoms are all at the same elevation just below the water table minimum;
- nodes are all at the same elevation below the water table minimum.
- are either infinite volume or after-a-zero-volume elements.

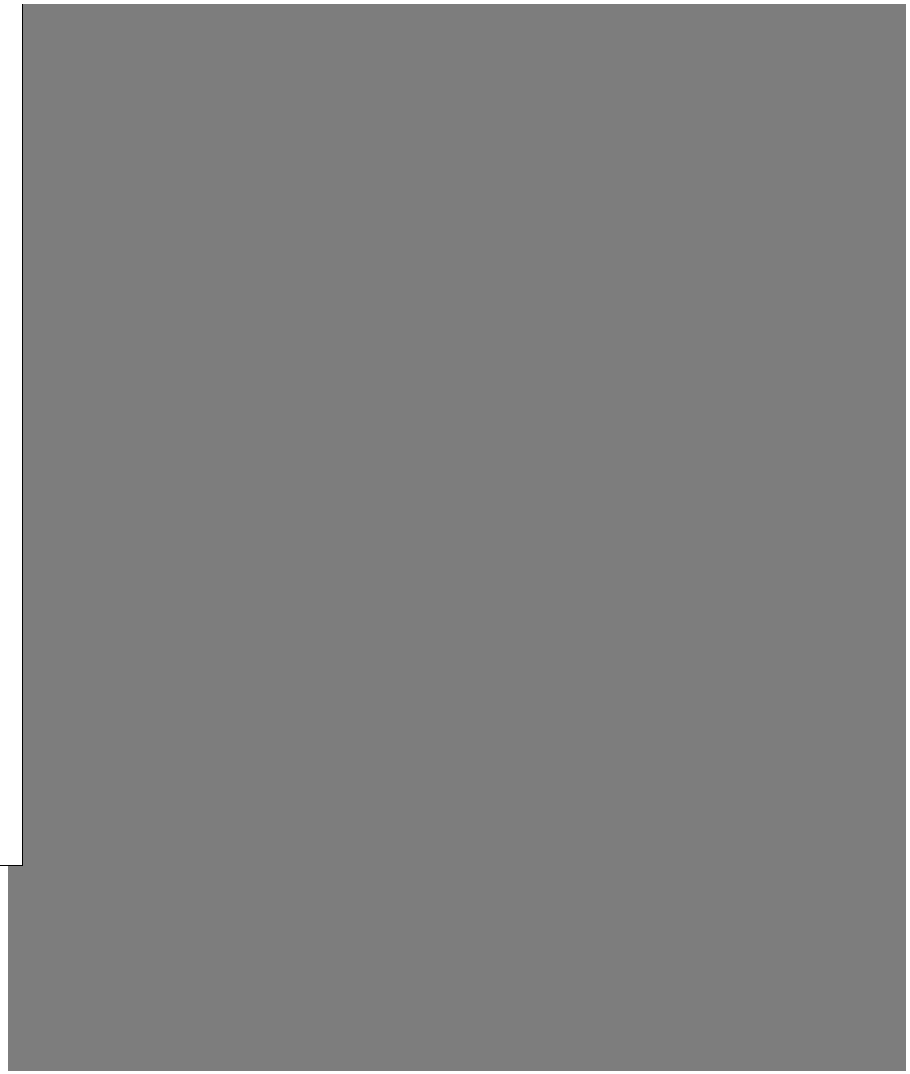
→ In this way the elements pose the right pressure and water flow to the underlying elements.

→ Usually, I use a condition of fully water-saturated cell, but you may give a bit of gas if this is good for your model.

Convection induced by CO_2 diffusion

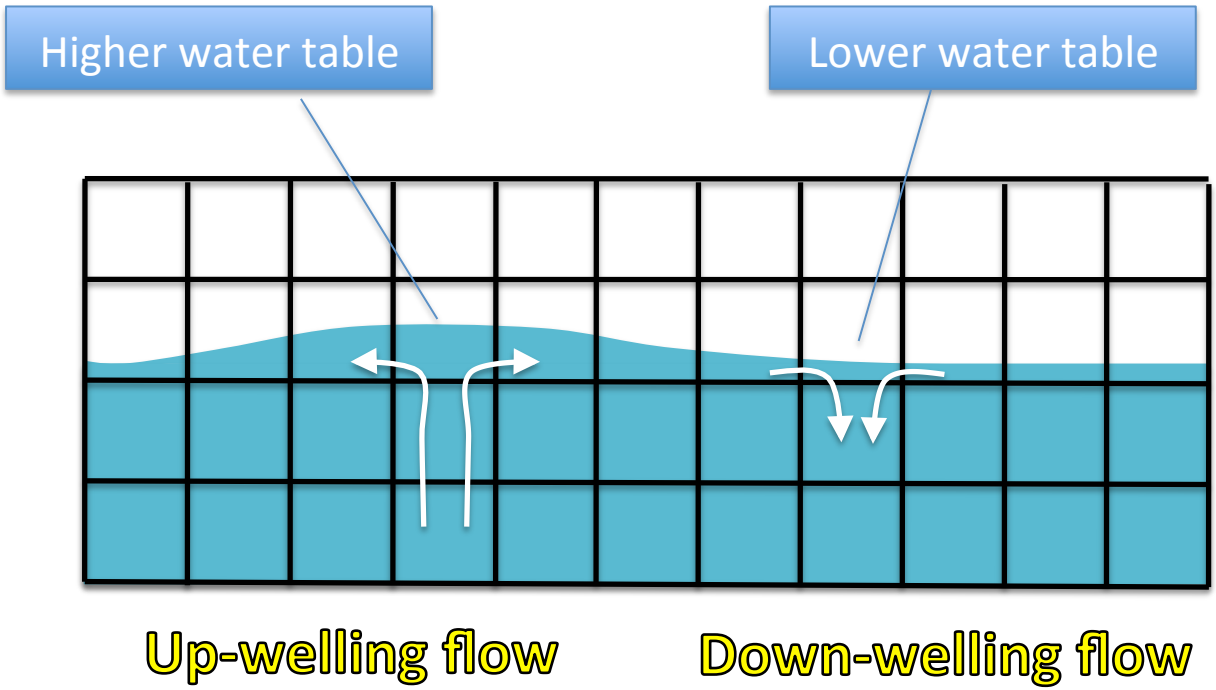


Free surface BC



Tim Kneafsey's CO_2 Fingering in a Hele-Shaw cell exp.

TOUGH2 does not model a free surface



The pressure of both two-phase cells is the gas pressure, independent of the “level” of water in the cell.

TRIC
(by every body else, …, Stefan, Curt, Andrea)

- 1. Simulate water "level" in the two-phase cell by saturation.

- 2. Make capillary pressure vary linearly with saturation
  - from $P_{cap} = 0.$ at $S_{aq} = 0.$
  - to $P_{cap} = \rho g h$ at $S_{aq} = 1.$
  - where h = cell thickness

so that

acqueous phase pressure = gas pressure – capillary pressure

- 3. Make
  - $k_{rg} = 1\text{-}S_{aq}$
  - horizontal $k_{rl} = S_{aq}/2$
  - vertical $k_{rl} = 1.$