1. Calculate the BL curve:

For now, ignore the capillary pressure effects. Then,

1. Relative perm curves: Corey Brooks
   1. Data needed:
      * Perm distr
      * Rel perm curves
      * Macroscopic velocity
      * Phase density
      * Phase viscosities

**Describe in words what happens when CO2 is injected:**

The formation is initially saturated with brine, all of it being in the aqueous phase. As the CO2 is injected, it initially displaces the brine. The CO2 at this time is all in the supercritical/gas phase. As the carbon enters a grid-block, it displaces the in-place brine which moves out of that grid block into neighboring blocks.

* At any random grid block, suppose there is CO2 and brine, with a part of the CO2 in the aqueous phase.
* The neighboring grid blocks also have various proportions of CO2 and brine, with part of the CO2 dissolved. The amount of dissolved CO2 depends on the pressure.
* When CO2 moves into this grid block, what happens:
  + It displaces a bit of both CO2 and brine: how much?
    - Maybe, we can assume that the incoming CO­2 only displaces brine
    - There has to be maximum saturation of the CO­2, depending on the irreducible water saturation
    - If the amount of CO2 entering looks like it would displace extra (reduce water saturation below irreducible) water, then CO2 is also displaced.
    - The CO2 itself can only move if its saturation is above the saturation of the two-phase/brine front.
  + Part of it dissolves in the brine, depending on the pressure
* When brine moves into a grid block:
  + It should follow the same rules as the CO2
* When both brine and CO2 move into the same grid block:

Version 1: Single-phase flow with BL:

Equations:

|  |  |
| --- | --- |
|  | … (1) |
|  | … (2a) |
|  | … (2b) |

1. Injection
   1. Calculate total PV
   2. Calculate injection rates in terms of PV per day.
   3. Calculate number of CO2 particles injected per day as:
   4. Inject CO2 at injector location
2. Calculate *vmacro* in each direction as :
3. Calculate transition probability for each neighbor:
   1. Calculate the relative perm of CO2 and brine using eqn 2a and 2b. Use saturation for the target cells – **function to do this**
   2. Calculate front velocity from *fW* using saturation from target cells
      1. Find front saturation **– function to do this**
      2. Using target cell satn, find fW for 0.01 either side, and calculate dfW/dSW. – **function for this**
   3. Move CO2 by transition probability:
      1. Calculate transition probability:
      2. If saturation is less than front saturation, don’t move!
      3. Normalize Tr, TrN
      4. Sample from TrN and move
4. Proxy responses to be recorded:
   1. ???

Version 2:

Equations:

|  |  |
| --- | --- |
|  | … (3) |
|  | … (4a) |
|  | … (4b) |

1. Injection
   1. Calculate total PV
   2. Calculate injection rates in terms of PV per day.
   3. Calculate number of CO2 particles injected per day as:
   4. Inject CO2 at injector location
2. Calculate *vmacro* in each direction as :
3. Calculate transition probability for each neighbor:
   1. Calculate the relative perm of CO2 and brine using eqn 2a and 2b. Use saturation for the target cells – **function to do this**
   2. Calculate front velocity from *fW* using saturation from target cells
      1. Find front saturation **– function to do this**
      2. Using target cell satn, find fW for 0.01 either side, and calculate dfW/dSW. – **function for this**
   3. Move CO2 by transition probability:
      1. Calculate transition probability:
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