

CE202A Vadose Zone Hydrology

In this question you are asked to consider the profiles of soil moisture and the pressure head between ground surface and a shallow water table. In each item below you are asked to explain your results and state your assumptions and modeling choices.

- (a) Plot schematically the pressure head profile in the case of steady state infiltration. Neglect root uptake effects.
- (b) Discuss and demonstrate how you will obtain the soil moisture profile corresponding to (a).
- (c) Show how that profile would change in response to increase in the infiltration (several snapshots).
- (d) Revisit (a) but this time recognizing root uptake: show how the baseline profile (shown in (a)) would change, considering various rates of root uptake and for different values of rooting depth.
- (e) Revisit (a) only that we consider now evaporation instead of infiltration. What conditions are needed to have a steady state pressure-head profile? Draw such profile schematically.

CE202B Comp

In this question you are asked to consider the first two moments of the concentration (mean and variance).

- (a) Plot schematically the evolution of the mean concentration field in the case of instantaneous injection, assuming large Peclet numbers
- (b) Plot the corresponding variance fields
- (c) Plot the corresponding coefficient of variations
- (d) Show how to derive the concentration variance in the case of high Peclet number and a small sampler, as a function of the source concentration and the mean concentration. Assume that the concentration at the source is C_0 .
- (e) Indicate how your results in (c) would change for lower Peclet numbers
- (f) Indicate how your results in (c) would change for an increase in the sampler's scale.
- (g) Discuss the scale dependence of the concentration variance. Draw analogies and dissimilarities between diffusion and field-scale transport.