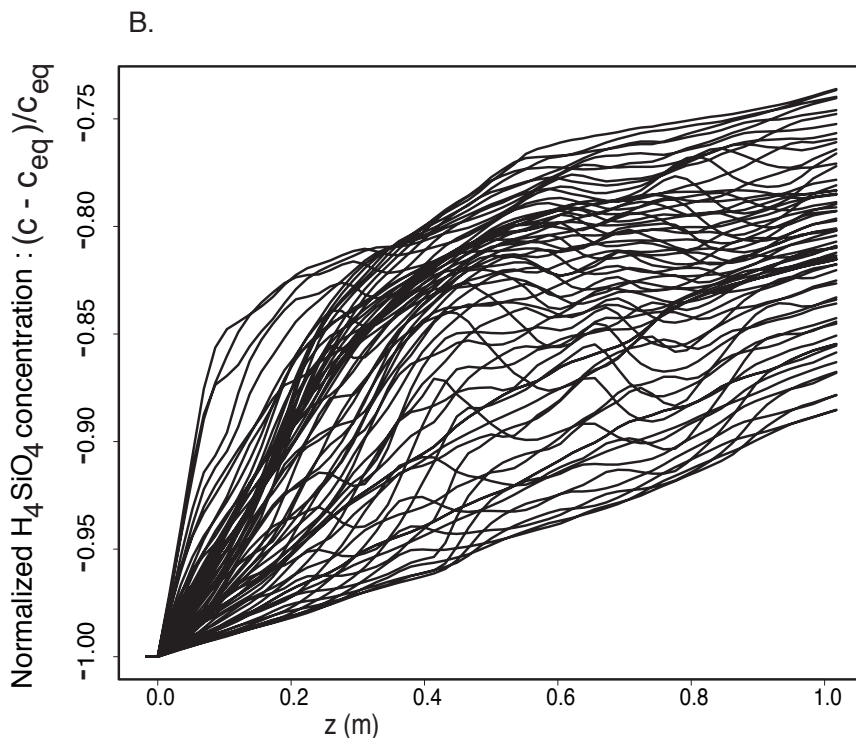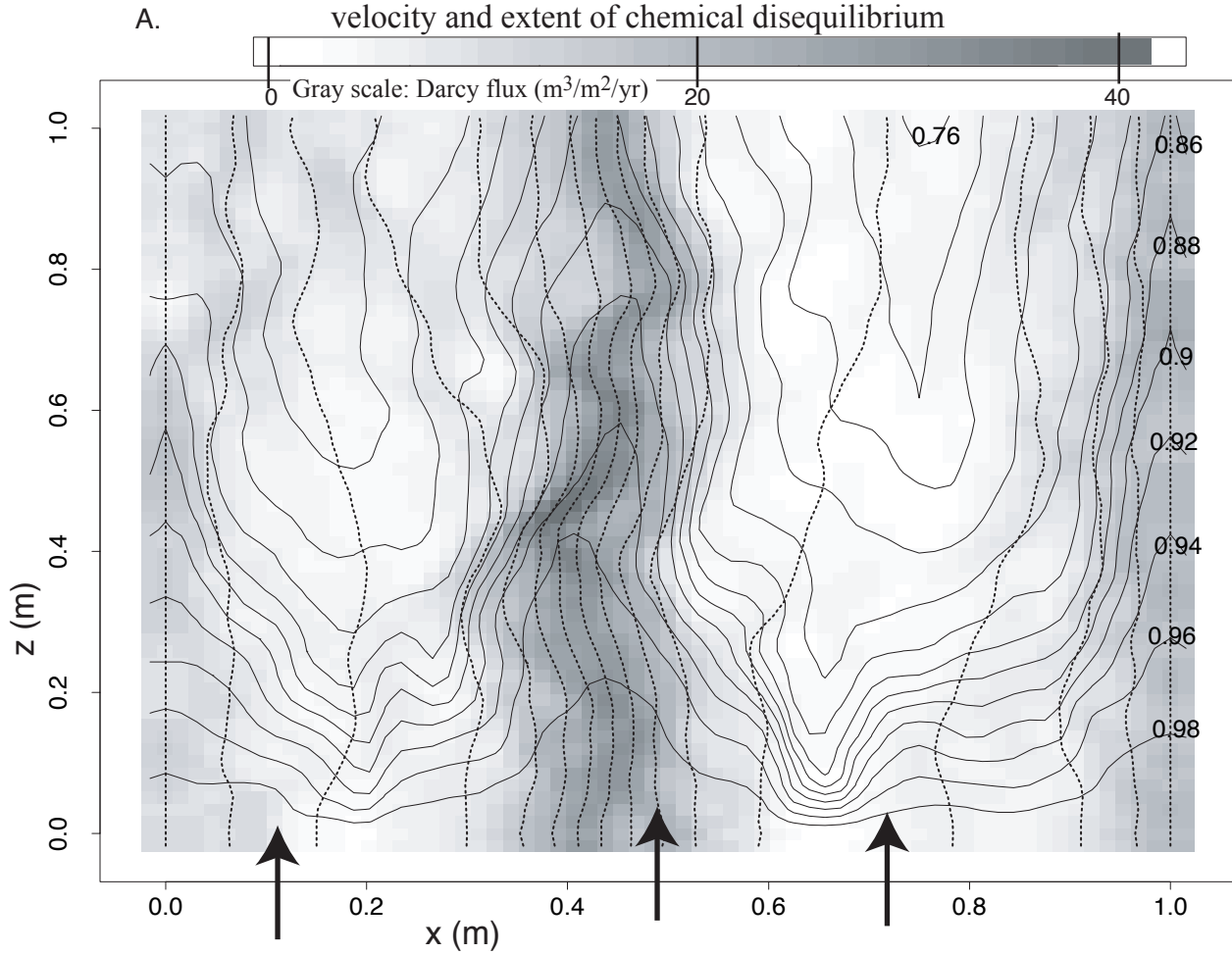Effect of permeability heterogeneity on flow velocity and extent of chemical disequilibrium

**A**. Quasi-steady flow through a heterogeneous porous medium. Fluid injected at z=0, with flow parallel to the dashed curves, and Darcy velocity in gray scale with an average magnitude of 9.4 $m^3/m^2$/yr: a value between typical fluxes in soils and typical column kinetic dissolution experiments (e.g., White and Brantley, 2003, used a value of 175 $m^3/m^2$/yr in their experiment). Solid curves are the silicic acid concentration normalized as $(c - c_{eq})/c_{eq}$ to indicate the deviation from the equilibrium value $c_{eq}$. Initial conditions: 24.5 vol. % quartz in an otherwise inert matrix. porosity=0.02, T=25 $^o$C, $\log_{10}$(permeability ($m^2$)): (min,mean,max)=(-14.5,-13.1,-12). **Faster flow favors greater deviation from equilibrium**.

**B.** Concentration along vertical cuts of part A, at each x location of the grid. **The considerable variation observed increases with stronger permeability heterogeneity used in other simulations.** from V31B-0592, Fall Meeting, AGU, Bolton (2006)

Figure 2.