Two quantitative estimation examples

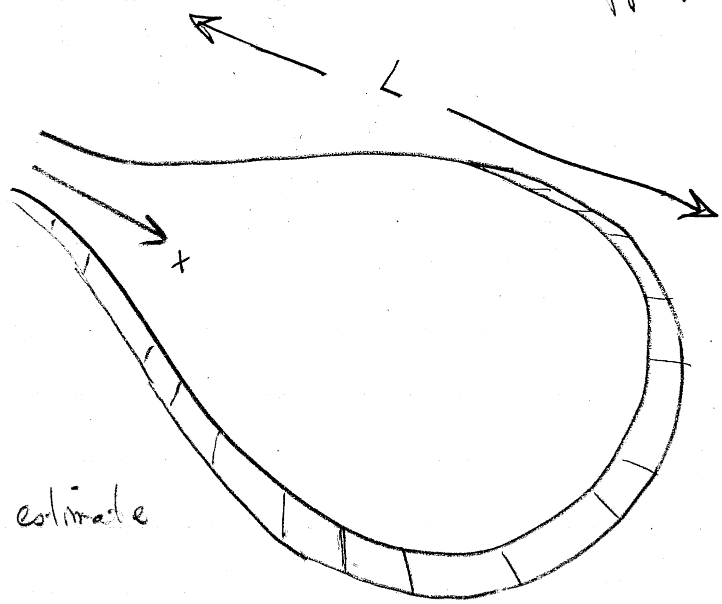
(1) rate of deposition $\left[\frac{\partial \eta}{\partial t} \equiv r\right]$ from <u>spatial</u> term $\left(\partial q_{sx}/\partial x \text{ or } \partial q_{sy}/\partial y\right)$

one way of estimating a magnitude for q_s is (see <u>Estimation</u> notes for another way):

$q_s = u h C$ $\quad$ u = flow speed $\quad$ h = flow depth
C = avg. sediment concentration

so e.g. $u = 1\,m/s$ $\quad h = 1\,m$ $\quad C = 10^{-3}$ (1000 ppm)

$q_{so} = 10^{-3}\ m^2/s$



1-porosity

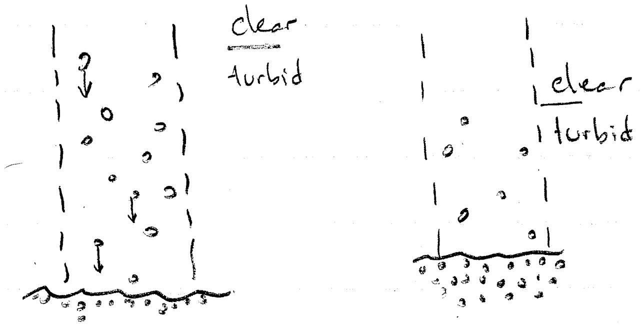
$C_0 \frac{\partial q_s}{\partial x} \sim q_{so}/L$

typical & handy way to estimate a derivative!

if $L = 10\ m$ $\quad r \sim 1.6 \times 10^{-4}\ m/s$ or $1\ m$ in $\lesssim 2\ hr$
$C_0 = 0.6$

(2) r from temporal term

flow brought abruptly to rest → sediment settles out of water column (you can simulate by shaking up a cylinder of water & sand)



sediment settles at speed w_s so

$$\frac{\partial}{\partial t}\int_h c\,dz \simeq c\,w_s = C_o r$$

$$r = \frac{c\,w_s}{C_o} \sim 10^{-3}\,w_s$$ (using $c = 1000$ ppm $= 10^{-3}$)

if $D = 1$ mm $\quad w_s \sim 0.1$ m/s

$r \sim 10^{-4}$ m/s $\quad$ 1 m in $\lesssim$ 3 hr