2D - dispersion

1/ No sorption $\Rightarrow R = 1$.

2/ $$\varepsilon \frac{\partial \langle c \rangle^\alpha}{\partial t} = \varepsilon \, \mathrm{div}\left(\bar{\bar{D}} \cdot \overrightarrow{\mathrm{grad}} \langle c \rangle^\alpha\right) - \mathrm{div}\left(\langle \vec{v} \rangle \langle c \rangle^\alpha\right)$$

$$\bar{\bar{D}} = \begin{pmatrix} D_{\parallel} & 0 \\ 0 & D_{\perp} \end{pmatrix}$$

$$\varepsilon \frac{\partial \langle c \rangle^\alpha}{\partial t} = \varepsilon \, \mathrm{div}\left(D_{\parallel} \frac{\partial \langle c \rangle^\alpha}{\partial x} \vec{e}_x + D_{\perp} \frac{\partial \langle c \rangle^\alpha}{\partial y} \vec{e}_y\right) - \overrightarrow{\mathrm{grad}} \langle c \rangle^\alpha \cdot \langle \vec{v} \rangle - \cancel{\mathrm{div}\langle \vec{v} \rangle} \times \langle c \rangle^\alpha$$

$\rightarrow$ Incompressibility $\Rightarrow \mathrm{div}\langle \vec{v} \rangle = 0$

$$\Rightarrow \varepsilon \frac{\partial \langle c \rangle^\alpha}{\partial t} = \varepsilon \left[D_{\parallel} \frac{\partial^2 \langle c \rangle^\alpha}{\partial x^2} + D_{\perp} \frac{\partial^2 \langle c \rangle^\alpha}{\partial y^2} \right] - \frac{\partial \langle c \rangle^\alpha}{\partial x} \langle \vec{v} \rangle_x$$

3) $$P_e = \frac{l_x \langle \vec{v} \rangle^\alpha}{D_m} = \frac{l_x \langle \vec{v} \rangle}{\varepsilon D_m}.$$

$\uparrow$ molecular diffusion