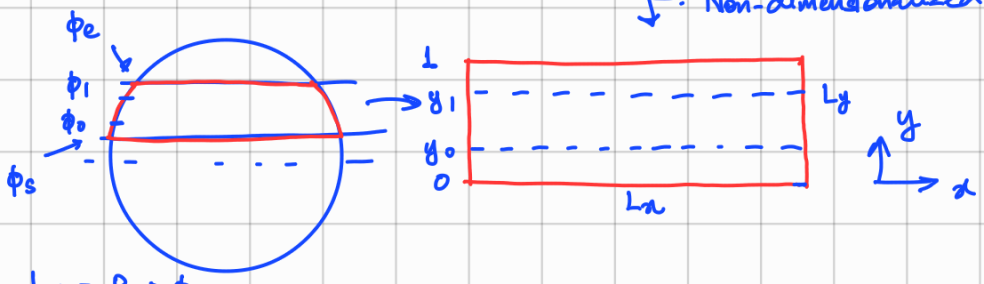
Models in a glance

$$\partial_t u + (u\cdot\nabla)u + \frac{(1+By)\,u^{\perp}}{Ro} = -\frac{\nabla h}{C} + \frac{\Delta u}{Re}$$

$$\partial_t h + \nabla\cdot(uh) = \frac{\Delta h}{Pe}$$

] Non-dimensionalized form

Model 1



↓ : Non-dimensionalized

$\Delta\phi = \phi_e - \phi_s$, $L_y = R\Delta\phi$

$\phi_s = 27.5^\circ$, $\phi_0 = 30^\circ$, $\phi_1 = 60^\circ$, $\phi_e = 62.5^\circ$

$\frac{L_x}{L_y} \approx 7$, $y_0 = \frac{1}{14}$, $y_1 = \frac{13}{14}$

$L_x = 2\pi R\cos\pi/4$, $L_y \sim 3891$ km, $R = 6370$ km

$\Delta\phi = 35^\circ$

$Ro = 0.30$, $B = 1.17$

$C = 0.06$, $Re = Pe = 3\times10^5$

$\nu = 10^3$, $L = 3891$ km

$U = 80$ m/s , $T^* \sim 13.5$ hours

Model 2

$\Delta\phi = 70^\circ$

$\phi_s = 10^\circ$, $\phi_0 = \frac{\pi}{7}$, $\phi_1 = \frac{5\pi}{14}$, $\phi_e = 80^\circ$

$\frac{L_x}{L_y} \sim 3.5$, $y_0 = \frac{11}{49}$, $y_1 = \frac{38}{49}$

$L_y = 7782$ km , $T^* = 27$ hours

$Ro = 0.40$ $\quad \nu = 10^3$

$B = 6.93$

$Re = Pe = 6\times10^5$

$C = 0.06$

Model 3

$\Delta\phi = 50^\circ$

$\phi_s = 20^\circ$, $\phi_0 = \frac{\pi}{7}$, $\phi_1 = \frac{5\pi}{14}$, $\phi_e = 70^\circ$

$\frac{L_x}{L_y} \sim 5$, $y_0 = \frac{4}{35}$, $y_1 = \frac{31}{35}$

$L_y = 5559$ km , $T^* = 19.3$ hours

$Ro = 0.29$ $\quad \nu = 10^3$

$B = 2.4$

$Re = Pe = 4\times10^5$

$C = 0.06$

Initial conditions :-

$$u_1 = \begin{cases} 0 & , y \geq y_1 \\ e^{\frac{-\alpha^2}{(y-y_0)(y-y_1)}}\cdot e^{\frac{+4\alpha^2}{(y_0-y_1)^2}} & , y_0 < y < y_1 \\ 0 & , y \leq y_0 \end{cases}$$

$u_2 = 0$

$h_{pert} = 0.01\cos(\pi y/2)\cdot e^{-c_1(x-x_0)^2}\cdot e^{-c_2(y-y_2)^2}$