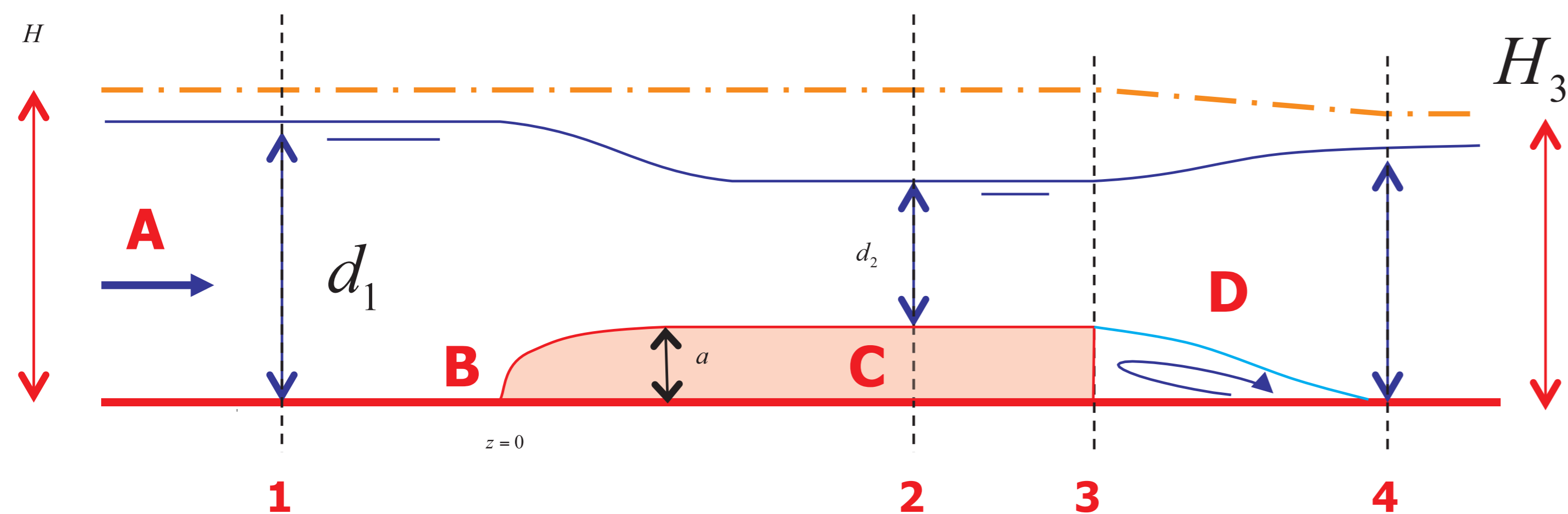


# Rapidly varying flow over a weir

## The long crested Weir



parallel streamlines above the weir  
velocities in the downstream wake

⇒ hydrostatic pressure in 3:  $F_{p,3} = \frac{1}{2} \rho g d_3^2$

momentum transport in 3 above  $a$ :

⇒  $F_{mv,3} = \rho U_3^2 (d_3 - a) = \rho U_2^2 d_2$

transect 3 → transect 4

volume balance:

$$q = U_3 (d_3 - a) = U_2 d_2 = U_4 d_4$$

momentum balance x-direction:

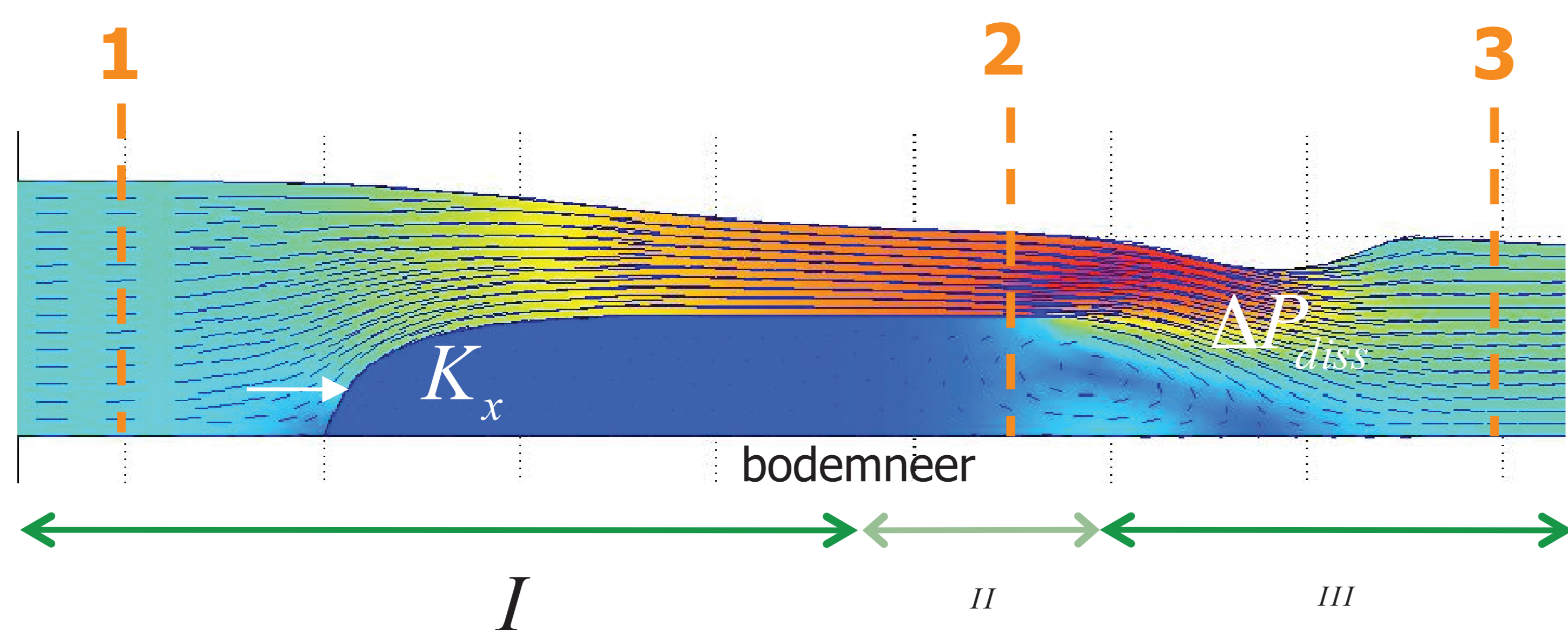
$$\frac{1}{2} g (a + d_2)^2 + \frac{q^2}{d_2} = \frac{1}{2} g d_3^2 + \frac{q^2}{d_3}$$

$q$  and  $d_2$  known:

$$\Rightarrow d_3 = \sqrt{(a + d_2)^2 + \frac{2q^2}{g} \left( \frac{1}{d_2} - \frac{1}{d_3} \right)}$$

energy dissipation:

$$\Delta P_{diss} = P_3 - P_4 = \rho g Q (H_3 - H_4)$$



- Inflow (I & II):
  - Accelerating
  - Small energy losses (streamlined):

$\Delta P_{diss} = 0$   
determine flow through energybalance  
force via momentumbalance

- Outflow (III):
  - decelerating, separation and mixing (wake)
  - Main energy losses

Force  $K_x = 0$   
determine flow via momentumbalance  
dissipation via energybalance

