

Boundary	Condition		
$z = 0$	Known concentration	(1)	$ALK(0) = ALK_0$
$z = z_{\text{bio}}$	Continuity	(2)	$ALK(z_{\text{bio}}^-) = ALK(z_{\text{bio}}^+)$
	Flux	(3)	$-(D_{\text{ALK},0} + D_{\text{bio}}) \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{bio}}^-} = -D_{\text{ALK},0} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{bio}}^+}$
$z = z_{\text{ox}}$	Continuity	(4)	$ALK(z_{\text{ox}}^-) = ALK(z_{\text{ox}}^+)$
	Flux	(5)	$-D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{ox}}^-} + F_{\text{ALK}}(z_{\text{ox}}) = -D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{ox}}^+}$
	where		$F_{\text{ALK}}(z_{\text{ox}}) = \frac{1-\phi}{\phi} \cdot \left(ALK^{\text{H}_2\text{S}} \cdot \gamma_{\text{H}_2\text{S}} \cdot (1 - \gamma_{\text{FeS}}) + ALK^{\text{FeS}} \cdot \gamma_{\text{FeS}} \right) \\ \cdot \left(\int_{z_{\text{NO}_3}^{\text{SO}_4}} \sum_i \text{SO}_4\text{C} \cdot k_i \cdot \text{POC}_i \, dz \right) \\ + \frac{1-\phi}{\phi} \cdot \left(ALK^{\text{NIT}} \frac{\gamma_{\text{NH}_4}}{1+k_{\text{NH}_4}} \int_{z_{\text{NO}_3}}^{z_{\text{max}}} \sum_i \text{NC}_i \cdot k_i \cdot \text{POC}_i \, dz \right)$
$z = z_{\text{NO}_3}$	Continuity	(6)	$ALK(z_{\text{NO}_3}^-) = ALK(z_{\text{NO}_3}^+)$
	Flux	(7)	$-D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{NO}_3}^-} = -D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{NO}_3}^+}$
$z = z_{\text{SO}_4}$	Continuity	(8)	$ALK(z_{\text{SO}_4}^-) = ALK(z_{\text{SO}_4}^+)$
	Flux (with AOM)	(9)	$-D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{SO}_4}^-} + F_{\text{ALK}}(z_{\text{SO}_4}) = -D_{\text{ALK}} \cdot \frac{\partial ALK}{\partial z} \Big _{z_{\text{SO}_4}^+}$
	where		$F_{\text{ALK}}(z_{\text{SO}_4}) = \frac{1-\phi}{\phi} \cdot \left(ALK^{\text{AOM}} \gamma_{\text{CH}_4} \cdot \int_{z_{\text{SO}_4}}^{z_{\text{max}}} \sum_i k_i \cdot \text{POC}_i \, dz \right)$
$z = z_{\text{max}}$	Zero ALK flux	(10)	$\frac{\partial ALK}{\partial z} \Big _{z_{\text{max}}} = 0$