



$$\nabla' \cdot \mathbf{u}' = 0$$

$$D'_t \mathbf{u}' + \frac{1}{Ro} \hat{\mathbf{z}} \times \mathbf{u}' = -\nabla' p' + Ri T' \hat{\mathbf{z}} + \frac{1}{La_t^2} \mathbf{U}_s \times \boldsymbol{\omega}' + \frac{1}{R_*} \nabla'^2 \mathbf{u}'$$

$$\left(D'_t + \frac{1}{La_t^2} \mathbf{U}_s \cdot \nabla' \right) T' + w' \partial_z (\bar{T} + T_B) = \frac{1}{Pr R_*} \nabla'^2 T'$$



PE	Order	SRCL	Order
∇_h	$\mathcal{O}(\varepsilon)$	∇'_h	$\mathcal{O}(1)$
∂_z	$\mathcal{O}(1)$	∂_z	$\mathcal{O}(1)$
∂_T	$\mathcal{O}(\varepsilon)$	∂_t	$\mathcal{O}(1)$
$\bar{\mathbf{U}}_h$	$\mathcal{O}(1)$	\mathbf{u}'_h	$\mathcal{O}(1)$
\bar{W}	$\mathcal{O}(\varepsilon)$	w'	$\mathcal{O}(1)$
\bar{P}	$\mathcal{O}(1)$	p'	$\mathcal{O}(1)$
$\partial_z (\bar{T}, T_B)$	$\mathcal{O}(\varepsilon)$	T'	$\mathcal{O}(\varepsilon)$
$\bar{T} - T_B$	$\mathcal{O}(\varepsilon)$	Ro	$\mathcal{O}(\varepsilon^{-1})$
A	$\mathcal{O}(\varepsilon)$	Ri	$\mathcal{O}(\varepsilon^{-1})$
La_t	$\mathcal{O}(1)$	R_*	$\mathcal{O}(1)$

$$\nabla_h \cdot \bar{\mathbf{U}}_h + \partial_z \bar{W} = 0$$

$$\bar{D}_T \bar{\mathbf{U}}_h + \frac{1}{Ro} \hat{\mathbf{z}} \times \left(\bar{\mathbf{U}}_h + \frac{1}{La_t^2} \mathbf{U}_s \right) + \nabla_h \cdot \left(\overline{v'_h v'_h} \right) + \frac{1}{A} \partial_z \left(\overline{w' \mathbf{u}'_h} \right) = -\nabla_h \bar{P} + \frac{1}{La_t^2} \bar{\mathbf{U}}_s \times \bar{\boldsymbol{\omega}} \cdot \hat{\mathbf{z}}$$

$$\partial_z (\bar{P} + \overline{w' w'}) = Ri (\bar{T} - T_B)$$

$$\left(\bar{D}_T + \frac{1}{La_t^2} \mathbf{U}_s \cdot \nabla_h \right) (\bar{T} + T_B) + \partial_z (\overline{w' T'}) = \bar{D}_T + \bar{\mathcal{F}}_T$$