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SCRUM Governing Equations

1.- Primitive Equations in (x,y,z,t) coordinates

$$\frac{D\vec{V}}{Dt} + f\hat{k}\times\vec{V} = -\frac{1}{\rho_0}\nabla_z p_T + \frac{\partial}{\partial z}\left(K_m\frac{\partial\vec{V}}{\partial z}\right) + \mathcal{D}_V + \mathcal{F}_V \qquad (1.1)$$

$$\frac{DT}{Dt} = \frac{\partial}{\partial z}\left(K_H\frac{\partial T}{\partial z}\right) + \mathcal{D}_T + \mathcal{F}_T \qquad (1.2)$$

$$\frac{DS}{Dt} = \frac{\partial}{\partial z}\left(K_H\frac{\partial S}{\partial S}\right) + \mathcal{D}_S + \mathcal{F}_S \qquad (1.3)$$

$$\frac{\partial p}{\partial z} = -g(\rho_0+\rho) \qquad (1.4)$$

$$\nabla_z\cdot\vec{V} + \frac{\partial w}{\partial z} = 0 \qquad (1.5)$$

$\vec{V} = u\hat{i} + v\hat{j}$ - horizontal velocity

$w = \frac{Dz}{Dt}$ - Vertical velocity

p_T - total pressure

T - Potential temperature

S - Salinity

$\rho_0 + \rho(x,y,z,t)$ - total potential density

g - Gravity (assumed constant)

K_M, K_H - Vertical eddy viscosity / diffusivity

$\mathcal{D}_V, \mathcal{D}_T, \mathcal{D}_S$ - horizontal viscous and diffusive terms

$\mathcal{F}_V, \mathcal{F}_T, \mathcal{F}_S$ - forcing terms

∇_z - Gradient along a level surface z=constant

f - Coriolis parameter