The Surface Wave Influence on Mixed-Layer Frontal Currents and Multi-scale Turbulence

Nonhydrostatic, Ageostrophic, Submesoscale Frontgenesis under Wave and Wind Forcing

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A new form of the Boussinesq Craik-Leibovich eq.

$$\frac{\partial \mathbf{u}}{\partial t} + \underline{\underline{(\mathbf{u}^L \cdot \nabla)\mathbf{u}}} = -\nabla p - \mathbf{f} \times \mathbf{u}^L + b\hat{z} - \underline{\underline{u_j^L \nabla u_j^S}}$$

Lagrangian advection: responsible for the MKE-TKE conversion

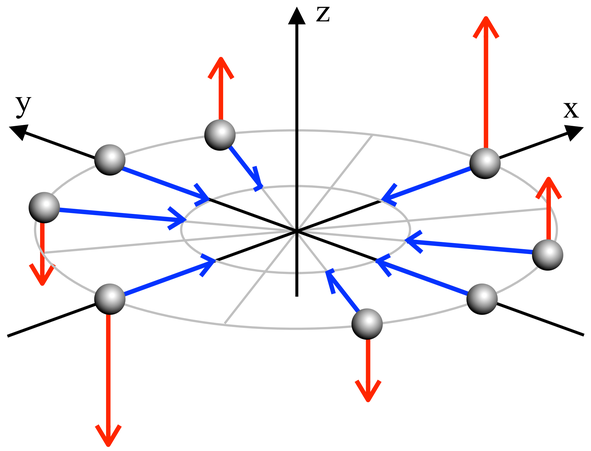
Stokes-shear force: The wave energy transfers via this term.

For horizontally uniform Stokes drift with $w^L = 0$

$$\frac{\partial u}{\partial t} + u^L\frac{\partial u}{\partial x} + v^L\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z} = -\frac{\partial p'}{\partial x} + fv^L$$

$$\frac{\partial v}{\partial t} + u^L\frac{\partial v}{\partial x} + v^L\frac{\partial v}{\partial y} + w\frac{\partial v}{\partial z} = -\frac{\partial p'}{\partial y} - fu^L$$

$$\frac{\partial w}{\partial t} + u^L\frac{\partial w}{\partial x} + v^L\frac{\partial w}{\partial y} + w\frac{\partial w}{\partial z} = -\frac{\partial p'}{\partial z} + b' - u'\frac{\partial u^S}{\partial z} - v'\frac{\partial v^S}{\partial z}$$



: Stokes-shear force : water parcel

: turbulent velocity

Wave-influenced Sawyer-Eliassen eq.

$$N_*^2\frac{\partial^2\psi}{\partial y^2} + F_*^2\frac{\partial^2\psi}{\partial z^2} + 2M_*^2\frac{\partial^2\psi}{\partial y\partial z} = 2Q_2 + S_{turb} + S_{SSF}$$