

QG equation for potential vorticity

$$\begin{aligned}q_t &= -\psi_x - rJ(\psi, q) - r_{\text{kb}}\Delta\psi + r_{\text{kh}}\Delta^2\psi - r_{\text{kh}2}\Delta^3\psi + \tau, \\q &= \Delta\psi - F\psi, \\J(\psi, q) &= \psi_x q_y - \psi_y q_x,\end{aligned}$$

where

- q is the potential vorticity,
- F – Froude number,
- r – a multiple for the nonlinear advection term,
”sort of Rossby number”,
- r_{kb} – bottom friction,
- r_{kh} – horizontal friction,
- $r_{\text{kh}2}$ – biharmonic horizontal friction,
- τ – curl of the surface stress.

The forcing is set as $\tau = A \sin(2\pi k \frac{x}{L_x})$, where A, k – coefficients, and L_x – domain size in X direction.