Geophysical Research Abstracts
Vol. 15, EGU2013-10974, 2013
EGU General Assembly 2013


# Generalised fifth-order nonlinear evolution equation for long internal waves in a rotating ocean

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A rigorous derivation of a nonlinear evolution equation for long internal waves in a rotating two-layer fluid is presented without the exploitation of the Boussinesq approximation and potential theory. Such approach is very convenient for the cases when the fluid flow is not potential, e.g., when the fluid rotation or/and viscosity effects are taken into consideration. The derived equation reads:

$$\frac{\partial}{\partial \xi}\left[\frac{\partial \zeta}{\partial \tau}+\alpha\zeta\frac{\partial \zeta}{\partial \xi}+\beta\frac{\partial^3 \zeta}{\partial \xi^3}+\varepsilon\left(\alpha_1\zeta^2\frac{\partial \zeta}{\partial \xi}+\gamma_1\zeta\frac{\partial^3 \zeta}{\partial \xi^3}+\gamma_2\frac{\partial \zeta}{\partial \xi}\frac{\partial^2 \zeta}{\partial \xi^2}+\beta_1\frac{\partial^5 \zeta}{\partial \xi^5}\right)\right]=\delta\zeta.$$

In the particular case $\varepsilon = \delta = 0$ this equation reduces to the classical KdV equation, whereas when $\varepsilon = 0$, but $\delta \neq 0$, the equation reduces to another well-known equation, the Ostrovsky equation, which is widely used currently in physical oceanography and other physical branches.

Stationary solutions to the derived equation are studied with application to the real oceanographic conditions.