



A unified theory of waves in a general ocean

Yeli Yuan and Ming Lu

First Institute of Oceanography, State Oceanic Administration, Qingdao China (luming@fio.org.cn)

In consideration of the requirements of the dynamical explanation of the typical wave phenomenon in the China Seas and the analytical estimation of the ocean fluxes transported by wave stirring, a unified theory of wave-type perturbation, as an instability analysis model of a general ocean, was presented in the paper. In the theory, the assumptions of non-curl of the sea waves, rigid plate of the internal ones and long wave of the inertial ones are abandoned and the varied topography is dealt with by a variable combination transformation. The analytical solution of the linearized governing equations suitable for the ocean with arbitrary velocity shear, density gradient, flow-path curvature and topography variation divides the perturbation motion into three kinds according to their frequency domains. They are the sea surface wave-type, internal wave-type and inertial wave-type motions. The three kinds of wave-type perturbations can be described by the derived solutions in form of Fourier integral and complex frequency-wave number relation. The latter includes three components of the sea surface complex frequency-wave number relation, the vertical invariance of the complex frequency and the expression of vertical wave number and describes the three dimensional propagation and exponential growth of the wave-type perturbations. This work is crucial to improve the understanding of wave-ocean circulation coupled processes.