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New Integral Model of Surface Wave Propagation

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An Integral Model of Surface Wave Propagation ispresented under the Lee of different Shapes of wavy surfaces of ideal fluid, which are self-consistent with wind stress. These are calculated based on a new integral equation defining pseudo stream function of waves as functional of the surface elevation. A calculated integral expression is derived for arbitrary wave amplitudes, limited by the depth of a fluid layer only. The procedure can be applied for both shallow and deep waters. From condition of nullification of second order of magnitude terms in this expression follows the well-known dispersive relations. Solutions in the form of infinitesimal and non-linear Stokes waves as well as Russell solitons, which are derived from the equation. The integral equation is used for calculation of new types of disturbances propagating along a free surface. For example, conditions of Russell coupled regular and randomized multisolitons propagations are defined. Shapes of wind-induced surges or recessions are calculated too. It is shown that in windy conditions ripples are running along the surface of long wave crests in the direction of wind. Viscosity effects lead to wave attenuation and formation of the wave boundary layer on a free surface, providing additional transportation of contaminants in a narrow sub-surface layer.