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The density stratification and amplitude dispersion of internal waves

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We consider the theoretical model of large amplitude internal solitary waves propagating in a weakly stratified fluid under gravity. It is well known that steady 2D Euler equations of non-homogeneous fluid reduce in this case to the second-order quasi-linear equation for a stream function (the Dubreil-Jacotin–Long equation). Subsequently, the shape of traveling solitary wave can be determined in the long-wave scaling limit by solving the dispersive KdV-type model equation. The non-linear terms of this equation depend considerably on the instantaneous fine-scale density profile formed over background linear- or exponential stratification (Benney&Ko, 1978; Borisov&Derzho 1990; Derzho&Grimshaw 1997; Makarenko, 1999; Makarenko, Maltseva and Kazakov, 2009). Now we derive and analyze Fredholm-type integral equations coupling immediately the fluid density coefficient with the dispersion function for internal solitary waves. The inverse problem which means to find the fine-scale density by known curve of the amplitude dispersion is discussed in more details.