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Short Wind Waves and Surface Wind Drift

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Short wind waves and wind drift shears have been subjects of profound studies among oceanographers. Under the assumption of small monochromatic surface waves on a steady horizontally uniform surface shear of an inviscid fluid, the governing equation becomes the well-known Rayleigh equation. The exact analytical solutions are found for a very limited number of current profiles. For arbitrary current profiles, approximate solutions are used (Stewart and Joy 1974, Shrira 1993). The conditions for the approximations are often violated in the case of short wind waves and wind drift shear. As an alternative approach, the piecewise linear approximation is explored. We provide a proof of the convergence of the piecewise linear approximation under certain conditions. The first application is finding the neutral modes which determine the boundaries of linear instability regions. The second aim is to invert surface shear current from measured short surface wave propagation speeds.

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