

Similarity Reductions of Barotropic and Quasi-geostrophic Potential Vorticity Equation

HUANG Fei

Laboratory of Physical Oceanography, Ocean University of China, Qingdao 266003, China
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Abstract: The (2+1)-dimensional nonlinear barotropic and quasi-geostrophic potential vorticity equation without forcing and dissipation on a beta-plane channel is investigated by using the classical Lie symmetry approach. Some types of group-invariant wave solutions are expressed by means of the lower-dimensional similarity reduction equations. In addition to the known periodic Rossby wave solutions, some new types of exact solutions such as the ring solitary waves and the breaking soliton type of vorticity solutions with nonlinear and nonconstant shears are also obtained.

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Key words: similarity reductions, potential vorticity equation, Rossby waves, ring solitary waves, breaking solitary solutions

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