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On a new type of solitary surface waves in finite water depth

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In this paper, a new type of solitary surface waves in a finite water depth is found by analytically solving the fully nonlinear wave equations. Using a new type of base functions which decays exponentially in the horizontal direction, this new type of solitary surface waves is gained first by means of linear wave equations, and then confirmed by the fully nonlinear wave equations. The new type of solitary surface waves have many unusual characteristics. First, it has a peaked crest. Secondly, it may be in the form of depression, which has been often reported for internal solitary waves but never for free-surface solitary ones, to the best of author's knowledge. Third, its phase speed has nothing to do with wave height, say, the peaked solitary waves are non-dispersive. Finally, its horizontal velocity at bottom is always larger than that on surface. All of these are so different from the traditional periodic and solitary waves that they clearly indicate the novelty of the peaked solitary waves. Based on the new peaked solitary surface waves, a new explanation to the so-called rogue waves and some theoretical predictions are given. All of these are helpful to deepen our understandings and enrich our knowledge about solitary waves.

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