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An Analytical Model for Oceanic Whitecap Coverage

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ABSTRACT

Using a threshold criterion governing the onset of wave breaking, we derived an analytical expression for the whitecap coverage of the ocean. This expression is a function of the wave steepness in terms of the significant slope and the ratio of the frictional velocity of the wind to the phase velocity of the energy-containing waves. Theoretically, this analytical expression works only for the narrowband wave field. However, the comparison with the field data of Snyder et al. suggests that the present model could be applied to fresh wind-wave fields. Since the present approach is based on the probability density function of wave breaking with or without wind stress, it is believed that this analytical expression will offer a more reliable answer than the traditional empirical formula.

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