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The Cross-Stream Structure of the Crests of Breaking Waves[1]
J.D. DIORIO, X. LIU, J.H. DUNCAN, University of Maryland — The cross-stream profiles of spilling breaking waves (wavelengths 80-120 cm) are investigated experimentally. A programmable wave maker is used to generate Froude scaled wave packets (central frequencies 1.15 - 1.40 Hz and various wave maker amplitudes) that create breakers via dispersive focusing. A cinematic 2D LIF technique is used to measure the crest profile histories both in stream-wise and cross-stream planes. It is found that the cross-stream averaged amplitude undergoes periodic oscillations due to the passage of large streamwise (oriented parallel to the wave crest) ripples. Cross-stream ripples, while initially small, grow rapidly as breaking develops. These cross-stream ripples are in the range of 1-4 cm in wavelength and can have amplitudes comparable in size to the streamwise ripples. The amplitude of the cross-stream ripples grows with the gravity wavelength to the third power and shows periodic peaks that coincide with the troughs of the streamwise ripples. The cross-stream surface gradients show thin persistent surface "scars" that appear to be generated in the troughs of the streamwise ripples. The connection between these observations and a possible vortical model is discussed.

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James Duncan
University of Maryland

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