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Airflow over groups of water waves SHAR SAJJADI, Embry-Riddle Aeronautical University, JULIAN HUNT, University College London — An analytic in conjunction with a numerical model is developed for the turbulent shear flow of an airflow over steadily moving wave groups in which individual waves are unsteady. Firstly this shows, by linear theory, for the individual waves in the group the combined effects of the unsteady critical layer flow, and the viscous/turbulent sheltering on the lee sides of the wave. Secondly, by using weakly non-linear theory to analyze the disturbed air flow over the waves in groups, it is shown how the air speed over the downwind part of the group is lower over the upwind part. This asymmetry causes the critical layer height to be lower over the downwind part, which leads to critical-layer-effect producing a net horizontal force on the waves, in addition to the sheltering effect. This analysis, which is confirmed by numerical solutions, shows why the critical layer is present over monochromatic waves but does not produce a net force, despite earlier arguments to the contrary. The concepts based on this analysis indicate how the effects of wave dynamics also affect the wave growth.

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