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Imaging across the interface of small-scale breaking waves ALEXANDRA H. TECHET, JESSE L. BELDEN, MIT — Flow characteristics on both the air and water side of small scale spilling and plunging waves are investigated using fully time-resolved particle image velocimetry (PIV). PIV at 1000 frames per second (fps) is used to capture the flow field in both the air and water for waves generated by shoaling. Reynolds number of the waves is on the order of $Re = 9x10^4$ to $2x10^6$, where $Re = \frac{\rho\sqrt{g\lambda^3}}{\mu}$, ρ is fluid density, μ is fluid dynamic viscosity, g is gravity, and λ is the characteristic wavelength of the breaking wave before breaking. Isopropyl alcohol is mixed with the distilled water in the tank to reduce surface tension and thus achieve plunging breakers on this scale. Flow in the water is seeded using conventional silver-coated hollow glass spheres, whereas the quiescent air side (i.e. no wind) is seeded using micro-air balloons with high stokes drag and thus long settling times. Imaging of both the air and water are performed simultaneously and advanced image processing is performed to determine the water surface location and to avoid surface tracking during PIV processing. Repeatable, coherent vortical structures are revealed on the air-side of the waves and are considered mechanisms for energy transfer across the interface.

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