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Laboratory study of the structure of the airflow and separation above surface waves FABRICE VERON, MARC BUCKLEY, University of Delaware, School of Marine Science and Policy — The effects of the surface waves on the airflow dynamics greatly influence the flux of momentum between the ocean and the atmosphere. While we know that most the surface stress is supported by the wave-coherent stress carried in large part by the small gravity-capillary wind waves, the role of the airflow separation above these small waves is not well understood. We present experimental results on the details of the airflow above surface gravity waves for a several wind speeds, wave ages and slopes. The bulk of the results presented were obtained from a series of laboratory experiments that took place at the University of Delaware's Air-sea interaction facility. Airflow velocities were obtained using high resolution concatenated PIV, and wave profiles and spectra were measured by dual-beam laser-induced fluorescence. We observe direct evidence of intermittent airflow separation past the crest of the wind waves. The separation leads to dramatic along-wave variability in the surface viscous tangential stress which in turn may affect wave growth and the air-water momentum balance. Despite the intermittent aspect of this phenomenon, proper orthogonal decomposition (POD) of the wave phase-locked velocity products suggests that airflow separation generates intense mixing and transport of surface generated vorticity within the airflow. These results hold for wind speeds that would normally be considered low to moderate.

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