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DNS of scalar transfer across an air-water interface during inception and growth of Langmuir circulation AMINE HAFSI, ANDRES TEJADA-MARTINEZ, University of South Florida, FABRICE VERON, YI MA, University of Delaware, USF/UDEL COLLABORATION — Upon a blowing of a wind over an initially quiescent air-sea interface, first short capillary waves are generated which in time coexist with longer waves as part of a broad spectrum of waves. The interaction between the Stokes drift velocity induced by surface gravity waves and the mean current induced by surface wind stress leads to Langmuir turbulence (LT) characterized by Langmuir circulation (LC) consisting of parallel downwind-elongated, counter rotating vortices roughly aligned in the direction of the wind. The typical length scale of LC ranges from several centimeters when short capillary waves first appear up to tens of meters when the spectrum of waves broadens. Results are presented from direct numerical simulation (DNS) of an initially quiescent coupled air-water interface driven by an air flow with free stream speed of 5 m/s. Cases with a freely deforming interface (characterized by gravity-capillary waves giving rise to small-scale LC) and with the interface intentionally held fixed (i.e. without LC) will be compared to understand the mechanisms by which the LT enhances scalar transfer from the airside to the waterside and bulk concentration throughout the water column. Time-permitting, we will compare our results with available laboratory physical experiments.

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