Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

LES of scalar transport in wave and wind-driven flows with large-scale structures[1] CIGDEM AKAN, ANDRES TEJADA-MARTINEZ, University of South Florida, CHESTER GROSCH, Old Dominion University — Near-surface scalar (mass) transport results from large-eddy simulation (LES) of wind-driven flow with and without full-depth Langmuir circulation (LC) are reported. LC is generated by wave-current interaction and consists of counter rotating vortices aligned in the direction of the wind. LES driven by wind and wave forcing conditions measured during field observations of full-depth LC by Gargett and Wells (Journal of Fluid Mechanics, 576, 27-61, 2007) shows that this large-scale, downwind-elongated structure increases surface mass transfer velocity (a measure of mass transfer efficiency) by approximately 60 percent with respect to a similar flow without surface wave effects (i.e. without LC). The LES will be used to test the accuracy of surface renewal-based parameterizations (models) in predicting surface transfer velocity increase in flows with LC. Statistical analysis of LES variables will be presented demonstrating that full-depth LC dominates near-surface mass transport as well as transport everywhere else in the water column. In the absence of LC, near-surface small eddies contribute significantly towards the mass transport at the air-water interface.

[1]This work was supported through NSF grant CBET-0846510

Andres Tejada-Martinez
University of South Florida

Date submitted: 06 Aug 2010 Electronic form version 1.4