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**A Numerical Study of Interfacial Turbulent Transport of Passive Scalars** ALIREZA KERMANI, XIN GUO, LIAN SHEN, Department of Civil Engineering, Johns Hopkins University — We perform direct numerical simulation (DNS) to study interfacial transport of passive scalars in free-surface turbulence. Based on DNS data, we obtain correlation between surface flux and surface age, which is defined based on the intervals of replacements of fluid elements close to the surface with fluid elements from the bulk of the flow. Contribution of different turbulence structures to interfacial transport has been quantified. It is found that surface age distribution can be used to quantify interfacial scalar transport accurately. The random surface renewal theory of Danckwerts (1951) has been modified to obtain an appropriate distribution of surface age. This modified distribution agrees well with the numerical result obtained with a highly accurate Lagrangian-Eulerian method that we develop for surface element residence time quantification. The new distribution with its clear physical explanation can be used to model interfacial transport of passive scalars including gas and heat.

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