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Some notes on eddy viscosity in wall-bounded turbulent bubbly flows TIAN MA, Duke University, Department of Civil Environmental Engineering, YIXIANG LIAO, DIRK LUCAS, Helmholtz-Zentrum Dresden-Rossendorf, Institute of Fluid Dynamics, ANDREW BRAGG, Duke University, Department of Civil Environmental Engineering, HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF, INSTITUTE OF FLUID DYNAMICS TEAM, DUKE UNIVERSITY, DEPARTMENT OF CIVIL ENVIRONMENTAL ENGINEERING TEAM — Recently, based on data from DNS, Ma et al. (Phys. Rev. Fluids 2, 034301, 2017) proposed a model for closing the bubble-induced turbulence (BIT) in a typical Euler-Euler two-equation model, which appears to yield improved performance for predicting k and ε over the previous models. The present study departures from this BIT model and purpose to use the same DNS data to investigate the behavior of the C_μ constant and standard eddy viscosity definition. It can be shown that C_μ constant computed using the DNS database has a very different behavior than that in single-phase flow. Checking closely, the deficiency originates from the description of the standard eddy viscosity that is intrinsic to this general hierarchy of Euler-Euler $k-\varepsilon$ type model, hence, cannot be overcome by a more complex correction function for C_μ. Departing from this point, a modification to the definition of the eddy viscosity in bubbly flows is derived for the Euler-Euler two-equation models. We focus on the intermediate region – a region extended from the core region, where bubble-induced production and dissipation are nearly in balance, and find that the modified model can lead to significantly improved predictions for the mean liquid, when compared with DNS data.

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