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Particle resolved DNS study of turbulence effects on hyporheic mixing in randomly packed sediment beds[1] SHASHANK KARRA, Oregon State University and Pacific Northwest National Laboratory, XIAOLIANG HE, Pacific Northwest National Laboratory, SOURABH APTE, Oregon State University, TIMOTHY SCHEIBE, MARSHALL RICHMOND, YUNXIANG CHEN, Pacific Northwest National Laboratory — High-fidelity direct numerical simulations (DNS) are used to investigate the interactions between stream flow turbulence and groundwater flow through a porous sediment bed. The mixing between the surface water and groundwater occurs in the porous region beneath the streams, termed as the hyporheic zone. Permeability Reynolds number Re_k, which represents the ratio of sediment permeability length scale to the viscous length scale, is varied (2.56, 6.6 and 13.0) to understand its influence on hyporheic mixing at the sediment-water interface (SWI). Statistics of mean flow and turbulence are compared to the data from experimental setup of Voermans *et al.* (J. Fluid Mech., vol. 824, 2017, pp. 413-437). It is found that at the SWI, stream-wise and vertical turbulence intensities, form-induced vertical and shear stress increase with Re_k, consistent with the experimental data. The double averaged (DA) TKE budget is analyzed to quantify the relative importance of different terms in energy transport mechanisms. Eulerian two-point cross correlations are computed to investigate the influence of turbulence and fluctuating pressure on sweep and ejection motions near the SWI. The anisotropy distribution of Reynolds stress at SWI is studied to analyze the turbulence structures.

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