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Transverse dispersivity – reliable field data and implications

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Transverse dispersivities, acting orthogonally to the mean flow direction, have been less studied than the longitudinal one, though recent studies demonstrated their relevance to bio-degradation of contaminant plumes and to mixing of reactive solutes. Stochastic theories showed that transverse dispersivities in heterogeneous aquifers are smaller than the longitudinal one, but much larger than pore scale dispersivities. Their inference from experimental data is a difficult and error prone procedure, requiring a level of knowledge of solute plumes not commonly available in applications. Therefore, it is common practice to set transverse dispersivities as a fraction of the longitudinal one, with the ratio $1/10$ being the most frequently used. In the present work we collected field scale reliable estimates of transverse dispersivities from existing publications and explored possible scale relationships aiming at identifying guidance criteria for applications. Our investigation showed that a large number of estimates available in the literature are of low reliability and should be discarded. The remaining, reliable estimates are formation-specific, span three orders of magnitude and do not show any clear scale-dependence on the plume traveled distance. The ratios with the longitudinal dispersivity are also site specific and vary in the same proportion. In view of these findings we conclude that the reliability of field estimates of transverse dispersivities depends crucially on the type of analysis that the data allow. In applications in which they play a significant role, inference of transverse dispersivities should be part of site characterization, and not adopted from data collected for other purposes.