A Comparison of Transient Storage Parameter Estimates Between Composite and Component Reach Lengths in a Mountain Stream

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Abstract. Characterization of solute transport parameters from stream tracer experiments is often performed over finite reaches of 10's to 100's of m. It has not yet been established how solute transport parameter estimations, particularly those of transient storage, scale with increasing reach lengths. In this study we investigated the scaling of parameters of the OTIS solute transport model with increasing spatial scale. We analyzed data collected during a 3-hour constant rate solute injection into Uvas Creek, Santa Clara County, California on 9/26/1972 (Zand et al. 1976). A 635 m section of stream was delimited into five component reach lengths, each of which was monitored for over 24 hrs. A comparison was made between the transient storage parameter estimates for each of these component reach lengths (Scott, D. T. et al. 2003) with parameters estimated for several combinations of these component reaches. Ten composite reaches were formed through different permutations of successive component reaches of varying scale. In addition to the four parameters estimated through OTIS of dispersion, channel size, storage zone size and transient storage exchange (D,A,A_s,α respectiveley) we calculated the Dahmkoler number (DaI) and the proportion of median transport time due to storage (F_{med}^{200}) as an additional basis for comparison. We found that the length-weighted average of component reach D values always underestimated the D for their corresponding composite reach. This was also true for A in all but two cases. The converse was found for both A_s and α, for which the weighted component average was almost always higher than values found for composite reaches. With exception of the first two component reaches and their composite which were found to have almost no transient storage, the DaI numbers calculated for all reach lengths were extremely reasonable, being within an order of magnitude from 1 (optimal DaI). Calculations of the F_{med}^{200} were always higher for the weighted average of component reaches, in many cases by a factor ~ two.

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