Relating nutrient uptake with transient storage in forested mountain streams

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ABSTRACT: Streams control the timing and delivery of fluvial nutrient export from watersheds, and hydraulic processes such as transient storage may affect nutrient uptake and transformation. Although we expect that hydraulic processes that retain water will increase nutrient uptake, the relationship between transient storage and nutrient uptake is not clear. To examine this relationship, we injected a conservative tracer and nutrients (ammonium and phosphate) into 13 streams for a total of 37 injections at Hubbard Brook Experimental Forest (HBEF), New Hampshire. Transient storage was estimated by fitting conservative solute data to a one-dimensional advection, dispersion, transient storage model. To correct for variation in depth and velocity among streams, we considered nutrient uptake as a masstransfer coefficient (V_f), which estimates benthic demand for nutrients relative to supply. Transient storage decreased with increasing specific discharge (discharge per unit stream width). Transient storage explained only 14% of variation in ammonium V_f during the entire year and 35% of variation during summer months. Phosphate uptake was not related to transient storage, presumably because P uptake is predominantly by chemical sorption at HBEF. At HBEF, surface water pools can store water but were not modeled as such by use of the transient storage model. These pools were probably not important areas of nutrient uptake; further variation in the relationship between nutrient uptake and transient storage may be explained by biological demand.