Gypsum dissolution is not a universal integrator of "water motion"

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Limnol. Oceanogr., 45(1), 2000, 145-158 | DOI: 10.4319/lo.2000.45.1.0145

ABSTRACT: The dissolution of gypsum or plaster of Paris has been widely used as an inexpensive integral measure of []water motion[] in the field and in laboratory tanks for studies of physical-biological interactions. Commonly, gypsum-dissolution rates have been calibrated to steady flow speed or velocity in the laboratory and the calibrations have been applied to dissolution (i.e., mass-transfer) rates in the field or in tanks. We evaluated the gypsum-dissolution technique in a steady-flow, a fluctuating-flow, and a mixed-flow environment by comparing dissolution rate to direct flow measurements with an acoustic Doppler velocimeter. We found that dissolution rates were related to steady flow and to fluctuation intensity in the exclusively steady-flow and fluctuating-flow environments, respectively. The relationships were weak in the mixed-flow environment. Finally, dissolution and thus mass-transfer relationships were different in each flow environment, and the effects of steady flow and fluctuation intensity were not additive. Providing that it is rigorously checked and appropriately calibrated, the dissolution technique can be used to measure steady flow speed or fluctuation intensity in a steady-flow or fluctuating-flow environment, respectively. However,\ comparisons of dissolution rates between steady-flow, fluctuating-flow, and mixed-flow environments or within environments that change over time to determine water motion will be misleading. The gypsum-dissolution tech-nique can be used as a good direct indicator of mass-transfer rates. However, mass-transfer rates are different in different flow environments. The gypsum-dissolution technique is not a universal integrator of []water motion.[]