Evaluating the Variability of Gas Transfer Velocity in Mountain Streams as a Function of Stream Kinematics and CO_2 Mass Balance

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Mountain streams comprise a large fraction of waterways worldwide and are known to be large contributors of greenhouse gases to the atmosphere. One of the challenges in accurately estimating CO_2 fluxes from surface waters in mountainous streams include the accurate estimation of the gas transfer velocity (K), which represents the rate of bidirectional gas exchange between surface water and atmosphere. More explicitly, K describes the physical efficiency of gas exchange metabolism, and therefore holds great importance in understanding the interconnectedness between our atmosphere and the CO_2 off- gassed, at any single time point, from water- shed environments. Here I present direct measurements of K through two independent methods. One method was based on kinematic variables such as water velocity and termed $K_{Kin\text{-}600}$. Another method focused on CO_2 mass balance utilizing Fick's law of diffusion to calculate a $K_{Eff\text{-}600}$. I found that both methods correlated well on days of high and low discharge. However, at intermediate discharge, the two values did not correspond, suggesting an overcoming of kinematic variables or mass balance effects past an equilibrium point. Overall, this comparison is, to the best of our knowledge, the first of its kind in the high elevation, mountain stream environment of the Paramos in the Andes mountains. This study suggests that evaluations of stream metabolism of CO_2 should factor in both kinematic influence, and CO_2 mass balance depending on stream conditions.