Building a processed-based understanding of discharge-driven variability in CO_2 and CH_4 emissions

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Streams and rivers are important players in global carbon cycles. They simultaneously transform and transport terrestrially and locally fixed carbon, and some of this carbon is released to the atmosphere as carbon dioxide (CO_2) and methane (CH_4). Emissions of these climate-relevant gases from streams and rivers are significant to both greenhouse gas budgets and carbon cycle models. Emission estimates have improved over the last ~10-15 years and are now spatially explicit to the reach scale, but only temporally resolved to the monthly or seasonal scale. Overall, temporal variability in emissions is relatively less understood than spatial variability, in part, due to limited observation and documentation of controls acting at the sub-monthly scale. This talk will focus on the importance of building a process-based understanding of hydrologic controls on CO_2 and CH_4 emissions. Emissions are driven by two factors: 1) the air-water concentration gradient of the gas of interest and 2) the gas transfer velocity, or a physical parameter controlling the rate of emission. Results show that both factors can be strongly modulated by river discharge, sometimes in divergent ways. As more extreme hydrologic conditions (both floods and droughts) are predicted with climate change, discharge-driven variability in CO_2 and CH_4 emission is important to consider for more accurate carbon cycle models and greenhouse gas budgets.