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Greenhouse gas emissions from reservoir water surfaces: A new global synthesis

Keywords: carbon, methane, ebullition, hydropower

Collectively, reservoirs created by dams are thought to be an important source of greenhouse gases (GHGs) to the atmosphere. So far, efforts to quantify, model, and manage these emissions have been limited by data availability and inconsistencies in methodological approach. Here we synthesize worldwide reservoir methane, carbon dioxide, and nitrous oxide emission data with three main objectives: (1) to generate a global estimate of GHG emissions from reservoirs, (2) to identify the best predictors of these emissions, and (3) to consider the effect of methodology on emission estimates. We estimate that GHG emission from reservoir water surfaces account for 0.8 (0.5-1.2) Pg CO_2-equivalents per year, equal to ~1.3 % of all anthropogenic GHG emissions, with the majority (79%) of this forcing due to

methane. We also discuss the potential for several alternative pathways such as dam degassing and downstream emissions to contribute significantly to overall GHG emissions. Although prior studies have linked reservoir GHG emissions to system age and latitude, we find that factors related to reservoir productivity are better predictors of emission. Finally, as methane contributed the most to total reservoir GHG emissions, it is important that future monitoring campaigns incorporate methane emission pathways, especially ebullition.