

Estimation of GHG emissions and footprint from Daecheong Reservoir using G-res Tool

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Abstract

Reservoirs play a key role in the carbon cycle between terrestrial and marine systems and are pathways that release greenhouse gases (GHGs), CO₂, CH₄, and N₂O, into the atmosphere by decomposing organic matters. Developed countries have been actively conducting research on carbon emission assessment of dam reservoirs for over 10 years under the leadership of UNESCO/IHA, but associated research is very rare in Korea. In particular, the GHGs footprint evaluation, which calculates the change in net carbon emission considering the watershed environment between pre- and post- impoundment, is very important in evaluating the carbon emission of hydroelectric dams. The objective of this study was to estimate the GHG emissions and footprints in Daecheong Reservoir using the G-res Tool, an online platform developed by UNESCO/IHA. The G-res Tool estimates CO₂ and CH₄ emissions in consideration of diverse pathway fluxes of GHGs from the reservoir and characterizes changes in GHG fluxes over 100 years based on the expected lifetime of the dam. The input required to use the G-res Tool include data related to watersheds, reservoirs, and dams, and most were collected through the government's public portal. As a result of the study, the GHG footprint of Daecheong Reservoir was estimated to be 93 gCO₂eq/m²/yr, which is similar to that of other reservoirs around the world in the same climate zone. After impoundment, the CH₄ diffusion emission from the reservoir was 73 gCO₂eq/m²/yr, also similar to those of the overseas reservoirs, but the CH₄ bubbling emission, degassing emission, and CO₂ diffusion emissions were 44, 34, 252 gCO₂eq/m²/yr, respectively, showing a rather high tendency. Since the dam reservoir carbon footprint evaluation is essential for the Clean Development Mechanism evaluation of hydroelectric power generation, continuous research is needed in the future. In particular, experimental studies that can replace the emission factors obtained from the overseas dam reservoirs currently used in the G-res Tool should be promoted.

Keywords : GHG footprint, Carbon emission, Daecheong Reservoir, G-res Tool

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