

The total and net emission of CO₂ from a large reservoir in subtropical area

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The Xinanjiang Reservoir (E118°42'~E118°59', N29°28'~N29°58') is a large artificial reservoir in subtropical area, which has a surface area of 567 km², with a mean water depth of 34 m, and is in an oligotrophic state at present. In order to estimate the annual diffusion flux of CO₂ from this reservoir, the partial pressure of CO₂ in surface water and along the water column was determined using a continuous measurement system from upstream to central reservoir, during five seasonal curises.

Results showed that, CO₂ diffusion from the reservoir surface had important seasonal patterns. In total, about 88.9 kton a⁻¹ CO₂ was emitted to the atmosphere from the Xinanjiang Reservoir surface, while 39% of it (35.1 kton a⁻¹) was absorbed by surface water in warm seasons for the reason of photosynthesis. Downstream and turbine had a comparable CO₂ outgas flux of 61.5 kton a⁻¹. When taking the whole reservoir surface, turbine and downstream into account, the Xinanjiang Reservoir system had a net CO₂ emission flux of 115.3 kton a⁻¹. In comparison with reservoirs in other area, the Xinanjiang Reservoir in the present study had lower CO₂ flux, which is obviously lower than that of tropical reservoirs, and is at the similar level of boreal reservoirs.

In addition, we suggest a hydrological retention time model for the CO₂ emission estimation from the reservoir in low to mid-latitude areas. It should be mentioned that, data from reservoirs in high latitude and tropical area was not included in this retention time model, due to the possibility of ice coverage and melting in high latitude reservoirs. Reservoirs in tropical area generally have quite high CO₂ emission, which should be explained by other mechanisms.

In summary, it should be paid more attention of the seasonal patterns of CO₂ diffusion flux from reservoir surface and the quite high CO₂ flux in the downstream, when estimating the CO₂ emission from the global reservoirs, especially the hydro-electrical reservoir.