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Supplementary Information for

Unaccounted CO_2 leaks downstream of a large tropical hydroelectric reservoir

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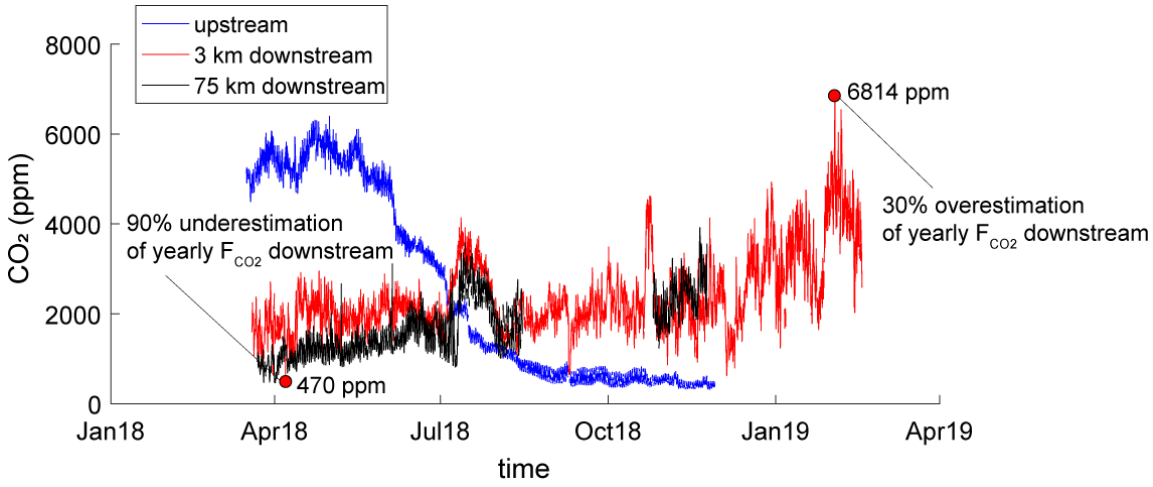

Figure S1. Calculated CO_2 concentration for the Zambezi River at Victoria Falls (upstream, blue curve), Siavonga (3 km downstream of Kariba Dam, red curve) and Chirundu (~75 km downstream of Kariba Dam, black curve). This third sensor was deployed to check that the pCO_2 after 75 km has not dropped significantly, meaning that the river is emitting all along this stretch. This justifies considering the entire river stretch as dam-impacted.
The red dots indicate the minimum and maximum CO_2 fluxes occurring at Siavonga in April 2018 and February 2019, respectively. These two values have been used to calculate the maximum under- and over-estimation potentially occurring in the yearly F_{CO2} downstream flux if calculated based only on one survey.
Gaps in the time series are due to periods of failure of the sensors. The total CO_2 entering the reservoir was calculated integrating over a year the saturation concentration at the water temperature measured at the Victoria Falls. Given some gaps in the Victoria Fall's data series (sensor working for less than 365 days), we used the available data and then we linearly scaled the obtained integral of CO_2 for a 365-day year.

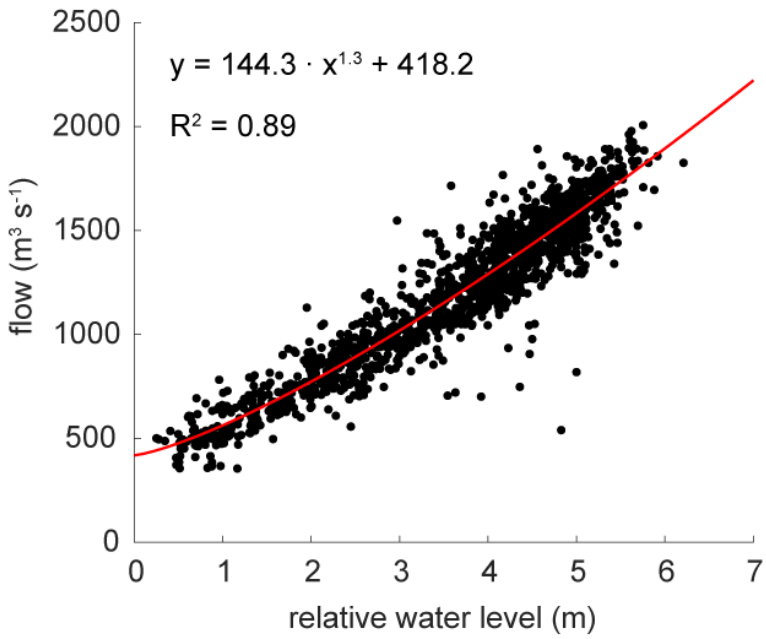

Figure S2. Relative rating curve for the Zambezi River 3 km downstream of Kariba Dam. The relative water level refers to the water level above the measuring sensor and the hourly flow data are provided by the two hydropower companies managing the Kariba Dam: Zambia Electricity Supply Corporation (ZESCO) and Zimbabwe Power Corporation (ZPC).

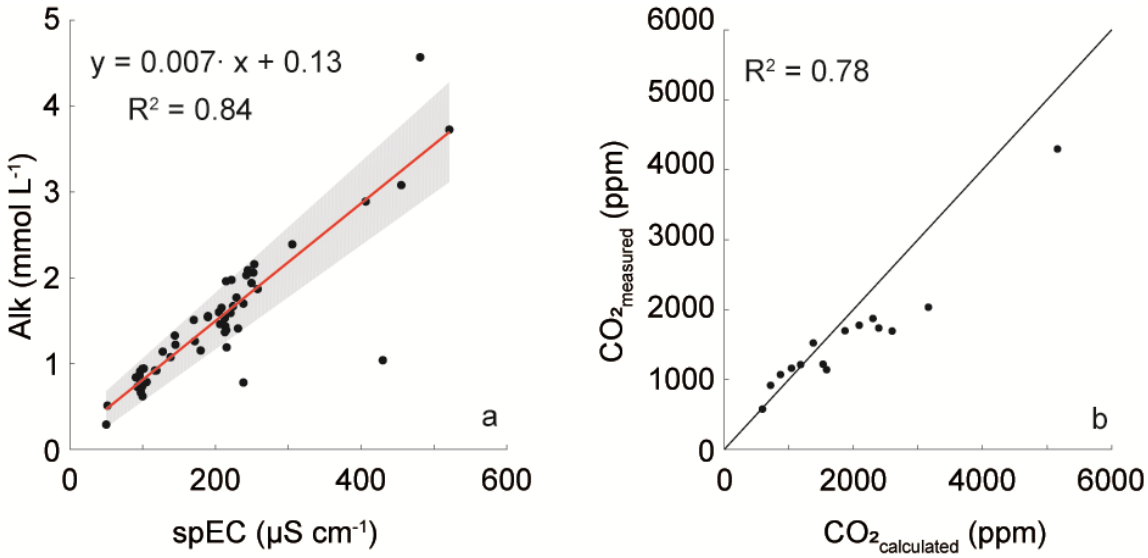

Figure S3. (a) Linear fit (red line) between specific conductivity and alkalinity used to reconstruct alkalinity at the hourly time resolution. R^2 indicates the coefficient of determination for the proposed linear fitting. (b) Comparison between calculated and measured CO_2 concentrations. The black line indicates the 1:1 line and R^2 indicates the coefficient of determination between the calculated and measured CO_2 values.

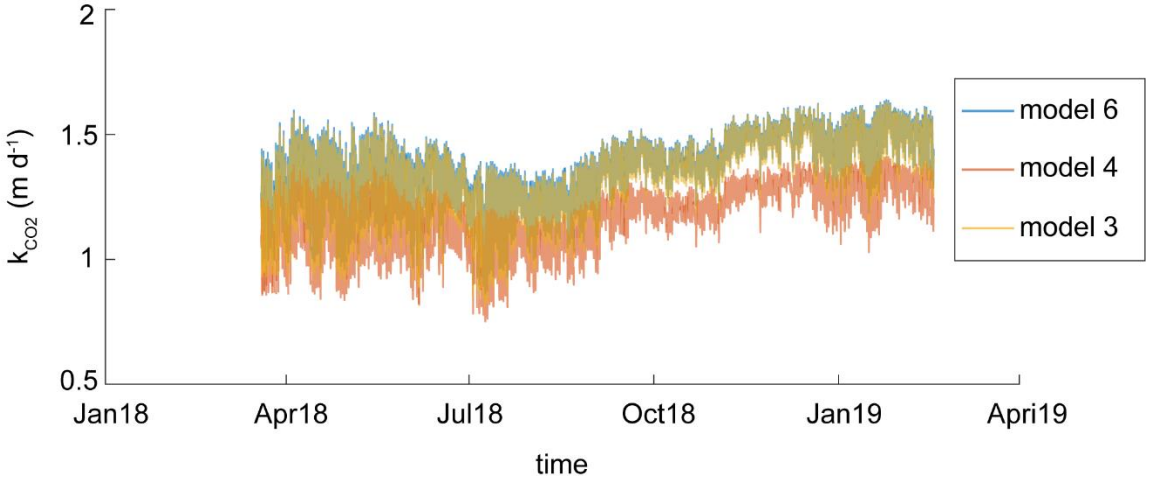

Figure S4. Hourly time series of the CO_2 gas transfer velocity at the water-air interface calculated using three of the different predictive models proposed by Raymond et al. (1).

SI References

1. P. A. Raymond, *et al.*, Scaling the gas transfer velocity and hydraulic geometry in streams and small rivers. *Limnol. Oceanogr. Fluids Environ.* **2**, 41–53 (2012).