



Carbon dioxide and methane dynamics in estuaries

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We carried out a literature overview to synthesize current knowledge on CO₂ and CH₄ dynamics and fluxes with the atmosphere in estuarine environments. Estuarine systems are highly dynamic in terms of carbon cycling and emit CO₂ to the atmosphere at rates that are quantitatively significant for the global C cycle. This emission of CO₂ to the atmosphere is strongly supported by the net heterotrophic nature of these ecosystems. The robustness of the evaluation of the emission of CO₂ from estuarine ecosystems has increased in last years due to increasing data availability and improvements in the surface area estimates by types. At present, the lack of sufficient data is the major limitation in the quantification of the spatial and temporal variability of CO₂ fluxes in estuarine environments. Regarding future observations, there is also a need for sustained measurements to unravel inter-annual variability and long-term trends of CO₂ and CH₄ in estuarine environments. Indeed, due to the strong linkage with river catchements, inter-annual variability of CO₂ and CH₄ in estuarine environments is expected to be strong. Data used in the present synthesis were either obtained by the authors, data mined from publications or communicated by colleagues. There is a need for publicly available and quality checked data-bases for CO₂ and CH₄ in estuarine environments. Not only cross-system meta-analysis of data (CO₂, CH₄, O₂, ...) can be enlightening as explored in the present work, but also considering the uncertainties in the evaluation of the gas transfer velocity, there could be a need for future re-evaluations of air-water CO₂ and CH₄ fluxes, requiring access to the raw pCO₂ and [CH₄] data.