



Carbon dioxide, methane and nitrous oxide emissions from the human impacted Seine watershed in France.

Audrey Marescaux, Vincent Thieu, and Josette Garnier

Sorbonne Universités, Université Pierre et Marie Curie, Centre National de la Recherche Scientifique, Institut Pierre Simon Laplace, UMR 7619 METIS, Paris, France

River and lake greenhouse gas (GHG) emissions have been demonstrated as a significant part of the global carbon cycling. We estimated carbon dioxide (CO₂) emissions from the Seine hydrosystem based on measurements and calculations of CO₂ partial pressures (pCO₂) from 12 field campaigns conducted between 2010 and 2017, which were compared with methane (CH₄) and nitrous oxide (N₂O) emissions in the drainage network.

The main stem of the Seine River showed that CO₂ followed the same spatial trends than N₂O and CH₄ with concentration peaks downstream effluents from wastewater treatment plants enriched in organic matter increasing mineralization. Whereas CO₂ was more concentrated in first Strahler orders (SOs) due to allochthonous organic carbon inputs from soils, and enriched CO₂ groundwater discharges, high N₂O and CH₄ values can be respectively interpreted in terms of denitrification in riparian wet areas and of anoxic decomposition of organic-rich wetlands. In addition a seasonal trend for all the GHGs was observed with higher concentrations during the summer when temperature promotes mineralization and low water decreases the dilution of organic matter.

Budgets of GHG taking into account hydrosystems, agricultural and non agricultural areas, were estimated at 59 800 106 kg CO₂eq yr⁻¹ (CO₂: 79%, CH₄: 13%, N₂O: 8%). We were able to confirm that the main sources of CH₄ and N₂O were agricultural areas emissions while CO₂ was mainly emitted by non agricultural areas (transports, industries, residential and tertiary sectors...).