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Continuous measurement of dissolved methane in surface waters: a new method tested in the Scheldt Estuary

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Global oceanic contribution to the methane (CH_4) atmospheric burden is estimated to range between 0.6 and 1.2 Tg yr^{-1}. However, uncertainties associated with these estimates are quite large. Given the critical role of CH_4 in atmospheric chemistry, a better characterization of its sources and sinks is needed in order to improve climate predictions.

Dissolved CH_4 concentrations in coastal zones are several orders of magnitude higher than those in the open ocean. As a consequence, an estimated 9 % of the global marine CH_4 emissions is coming from estuaries. The distribution of CH_4 in estuarine systems is governed mainly by riverine inputs, diffusion from sediments and emission to the atmosphere. The contribution of these different pathways is highly dependent on the type of estuaries and might vary in the context of climate change.

The Scheldt estuary (North Sea) is one of the most polluted estuaries in Europe. In order to better evaluate its contribution to the global atmospheric CH_4 budget and to test our new continuous analytical system, we embarked aboard the Simon Stevin for several cruises in 2015 and 2016. We performed continuous CH_4 concentration measurements in the water column using a CONTROS HydroC® CH_4 sensor. Discrete samples were collected simultaneously for gas chromatography analyses and calibration of the sensor. Our first results reveal a gradual increase of CH_4 concentrations in surface waters from the mouth of the estuary towards the port of Antwerp. This pattern has been observed under different tidal conditions.

We also sampled water for CH_4 stable isotope measurements to investigate the formation and removal pathways in the Scheldt estuary. While biogenic CH_4 dominates at the mouth of the estuary (North Sea), we observe a clear trend towards isotopically heavier CH_4 upstream. This trend, associated with an increase in concentration, points towards strong release of oxidized CH_4 upstream and/or the presence of a heavy isotope enriched CH_4 source in the Scheldt tidal river around the port of Antwerp that might be of anthropogenic origin.