

Decadal changes of carbon dioxide in the Scheldt estuary

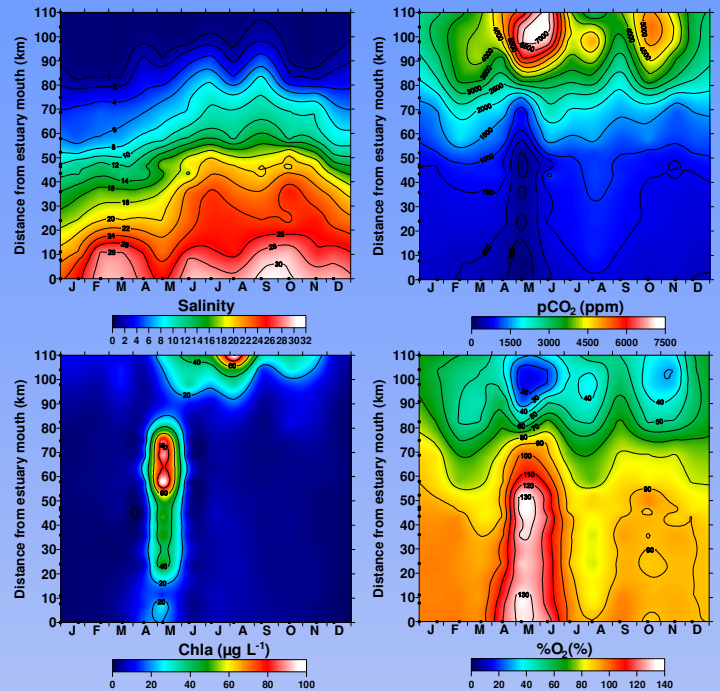
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Seasonal variations of pCO₂ in the whole estuary

The seasonality and spatial variability in the Scheldt estuary of pCO₂ measured with an equilibrator coupled to an infra-red gas analyser was investigated by monthly cruises in 2008. Whatever the season, pCO₂ values are higher upstream and decrease downstream as salinity increases. Upstream, two seasonal maxima of pCO₂ coinciding with oxygen saturation level (%O₂) minima occur in May and October. This corresponds to the periods of high O₂ consumption and CO₂ production due to bacterial respiration and nitrification. In mid-summer (July-August), light availability is maximum upstream leading to a phytoplankton bloom in the freshwater reaches (as indicated by the increase of chlorophyll-a (Chla) and %O₂ and decrease of pCO₂). Downstream, the major seasonal feature is the marked spring increase of Chla and %O₂ and a decrease of pCO₂ (below atmospheric equilibrium ~380 ppm). This feature extends from the mouth of the estuary to about salinity 5 where is located the downstream limit of the estuarine maximum turbidity zone. In fall, there is a slight decrease of %O₂ and an increase of pCO₂ downstream related to the collapse of primary production due to light limitation, and degradation of organic matter.



Decadal changes of pCO₂ in the upper estuary and in the whole estuary

pCO₂ was measured continuously with an equilibrator coupled to an infra-red gas analyser in the upper Scheldt estuary (Ste Anna Station, city of Anvers) since late 2002. Data-set shows that annual average pCO₂ values remained stable from 2003 to 2006, and strongly declined in 2007 and 2008, at salinities < 2. This corresponds to the response of carbon cycling in the upper Scheldt estuary to the on-set on the Brussels North sewage treatment plant. To check the impact of the response of C cycling in the upper Scheldt estuary downstream we carried out a monthly monitoring in the whole salinity gradient of the estuary, and results were compared with data obtained in the late 1990's during the BIOGEST project. Data show that pCO₂ values from freshwaters to about salinity 15 were systematically higher in 1997/1998 than 2008. Hence the impact of changes in carbon cycling in the upper estuary seem to impact pCO₂ dynamics down to salinity 15.

