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A tidal flat as a source AND a sink of atmospheric carbon dioxide

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For a period of three years, the exchange of CO2 between the atmosphere and a tidal flat has been monitored using benthic chambers during emersion. The recorded fluxes showed a clear relationship with the diurnal light cycle, i.e. release of CO2 to the atmosphere during darkness and uptake when sufficient light was available. This suggests that respiration during the night and net benthic photosynthesis during daytime are the most important processes driving the exchange and other processes like dissolution of carbonates and calcification are of minor importance.
The fluxes recorded during dark incubations revealed a strong exponential response with air temperature, whereas fluxes during periods of illumination were proportional to, or showed saturation with increasing irradiation. Maximum values of CO2 flux during illumination showed a fair relationship with Chl a content of the upper sediment, corroborating the importance of benthic photosynthesis in CO2 exchange.
Temperature, light and inundation periods were used to interpolate the exchange for night and daytime periods, in order to construct annual CO2 budgets. Day averaged fluxes showed strong seasonality with high fluxes in summer and low fluxes in winter. On inter-annual scales, the tidal flat during emersion appeared as a sink for atmospheric CO2 during one year and a small source during the surrounding years.