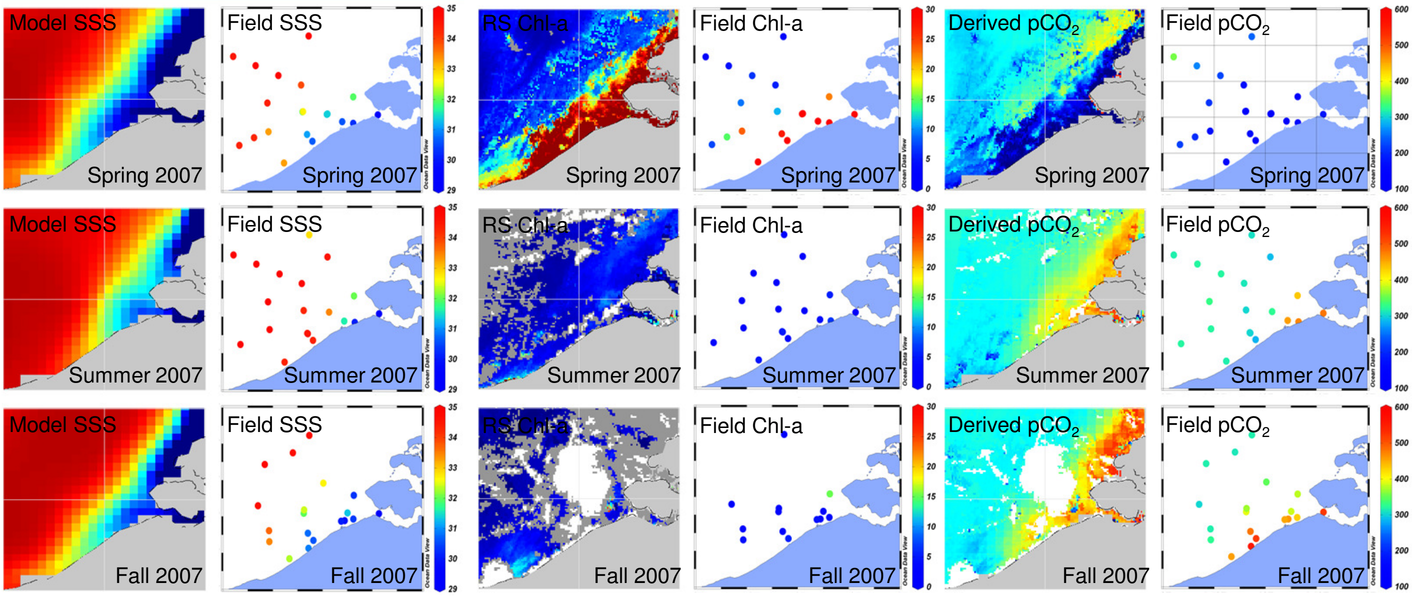
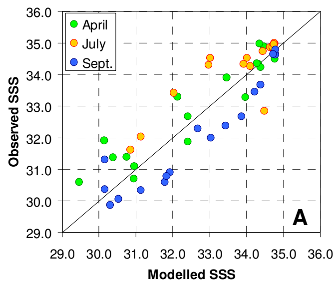
Estimating pCO_2 from remote sensing in the Belgian Coastal Zone

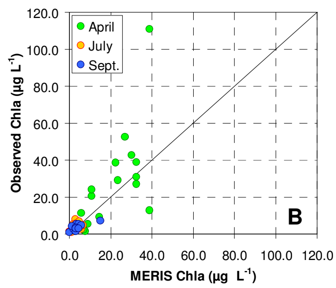
Borges A.V.[1,*], K. Ruddick[2], J. Harlay[1]

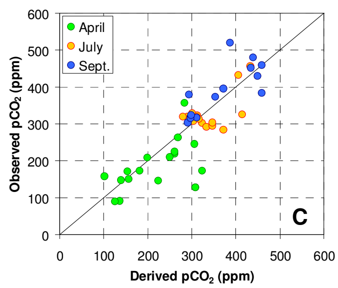
[1]University of Liège (BE), [2]Royal Belgian Institute of Natural Sciences, MUMM (BE)

* alberto.borges@ulg.ac.be









We report the first trials to retrieve pCO_2 fields from a combination of remote sensed chlorophyll-a (Chl-a) and modelled sea surface salinity (SSS) fields, based on data acquired in April 2007, July 2007 and September 2007 in the Belgian coastal zone, in the frame of the BELCOLOUR-2 project (http://www.mumm.ac.be/BELCOLOUR/).

We developed algorithms to compute pCO_2 from Chl-a and SSS. The pCO_2 data were normalised to a temperature of 10°C (pCO_2@10°C) to remove the thermodynamic effect of temperature change on the solubility coefficient of CO_2. We used multiple polynomial regressions to derive the algorithms due to the non-linear relationship between pCO_2, SSS and Chl-a. Three cruises were carried out in 2007 on board the research vessel Belgica, to cover spring (23-26/04/2007), summer (02/07-06/07/2007) and fall periods (17/09-19/09/2007). Underway measurements of pCO_2 were carried out using an equilibrator and a non-dispersive infra-red CO_2 analyzer. Chl-a input data for the pCO_2 algorithm was obtained from the Medium Resolution Imaging Spectrometer Instrument (MERIS) algal2 pigment index product. SSS data used as input for the pCO_2 algorithm was obtained from the COHERENS 3D hydrodynamical model as implemented for the Southern North Sea and English Channel on a 5.8 km x 4.6 km (1/12°x1/24°) horizontal grid.

Modelled SSS and field data compared well with observations in terms of spatial patterns and seasonality. The most prominent seasonal feature of SSS was the decrease of the extension of the river plume in July compared to April and September. Point by point comparison shows that modelled SSS was within about ± 1 of observations. Remote sensed Chl-a compared well with observations in terms of spatial patterns and seasonality. The most prominent seasonal feature of Chl-a was the marked phytoplanktonic bloom in spring. Point by point comparison suggest that remote sensed Chl-a could have been under-estimated compared to observations.

Derived pCO_2@10°C compared well with observations in terms of spatial patterns and seasonality. The most prominent seasonal feature of pCO_2@10°C was the marked decrease of pCO_2@10°C during the spring phytoplankton bloom. Point by point comparison suggest that derived pCO_2@10°C could have been over-estimated compared to observations, due to the possible under-estimation of Chl-a.

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