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Interactive comment on "Variability of the surface water partial pressure of CO_2 in the North Sea" *by* H. Thomas et al.

J. Paetsch (Referee)

paetsch@ifm.zmaw.de

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The manuscript "Variability of the surface water partial pressure of CO2 in the North Sea" by H. Thomas et al. is well organized and for readers familiar with the subject easy to read. The authors discuss a compact set of valuable observations from the CANOBA project 2001/2002.

Even though the partial pressure data itself were published partially elsewhere it is of great interest to assess the annual variability and the local mechanisms behind this variability.

The paper addresses the actual relevant question: What is the contribution of the shelf seas to the global carbon cycle? Which mechanisms are governing the carbon cycle on the shelf? The last question is clearly touched in the abstract but is not reflected in the title.

The concepts used were taken from other papers which were clearly named. The discussion part, especially the biologically related one, should be put in the context of relevant papers concerning the ecosystem North Sea (for example: Gazeau et al., 2004; Joint & Pomroy, 1993; Pätsch and Radach, 1997).

As the authors already mention their methods are straigth forward. This procedure increases the readability but sometimes decreases the thoroughness. An example may illustrate this: The calculation scheme by Takahashi et al. (2002) was applied for the open North Atlantic. The direct transfer of this method to the North Sea is straight forward and could be based on some additional tests. For example the calculated pCO2 of formula (1) could be checked against observed values in a scatter diagram. Also the "missing" delta pCO2 could be calculated by adding delta pCO2bio and delta pCO2temp; in case of simple superposition and absence of other sinks and sources this sum should compare to the corresponding observed value.

Formula (6) is implicitly linearised: It should be calculated for 276.8 + 0.5*delta pCO2bio and 276.8-0.5*delta pCO2bio.

As far as I understand the formula (6) was applied for the North Atlantic with a special relationship between salt and total alkalinity. This relationship is surely not valid for the North Sea. Formula (6) can be improved by switching to the thermodynamical relationship DIC=f(T, S, pCO2, observed alkalinity).

It is very difficult to read Fig1. At least colours and seasons should be assigned. It is somehow misleading when changes in AT (Fig 1c) are quantitatively compared with changes in pCO2 (Fig1a): Change of one unit AT normally induces a change of 3 units in pCO2.

Tab. 1 The sign of NCP does not correspond with the one in the text.

Fig. 2a This is not the figure discussed in the text.

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