

## ***Interactive comment on “Variability of the surface water partial pressure of CO<sub>2</sub> in the North Sea” by H. Thomas et al.***

### **Anonymous Referee #2**

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This paper is one in the series of several papers coming out of the intensive survey of the carbonate chemistry of the North Sea initially reported by Thomas et al. (2004). The paper, which is clearly written, presents a set of calculations following the now standard procedure proposed by Takahashi et al. (2002) to explore the temperature-related and other effects on controlling PCO<sub>2</sub> in the North Sea. If the calculations accompanied the initial presentation of the dataset, they would be helpful for reader to better understand the controlling factors associated with the observed CO<sub>2</sub> sink. Now the CO<sub>2</sub> sink scenario has been reported in at least two publications (Thomas et al., 2004; 2005), which attribute the CO<sub>2</sub> sink mainly to biological uptake coupled with efficient export of POC to the bottom layer of the North Sea; the bottom water is purged of the added carbon by lateral circulation. Besides, there has been other more sophisticated approach (Bozec et al., submitted) to address the critical issue, namely, the net community production. The calculations presented here do not seem to reveal

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any critical new insight of the processes happening in the North Sea, but demonstrate the usefulness of the procedure proposed by Takahashi et al. (2002) in delineating the two major effects.

In short, this paper suffers from two major deficiencies: (1) poor justification for the assumptions associated with the calculation, and (2) lack of supporting evidence to validate the results of calculation, which are elaborated below.

(1) Poor justification of assumptions: The non-temperature controls on the PCO<sub>2</sub> are more than just biological effects of carbon fixation. Notably the air-sea exchange, the benthic generation of alkalinity, vertical and lateral mixing of water masses with different carbonate chemistry may affect the PCO<sub>2</sub> of the shelf-slope water. There is hardly any argument in the manuscript addressing these alternative contributing factors.

(2) Lack of supporting evidence: If all non-temperature effect is attributed to biological carbon fixation, it would be gratifying to see some quantitative evidence indicating that the biological activities are capable of realizing such a demand of CO<sub>2</sub> uptake. Unfortunately, as the paper goes, readers find no such evidence to convince themselves that the results of calculation reflect what have actually happened in the North Sea. The readers can only accept the two equations proposed by Takahashi et al. (2002) as the natural law rather than empirical formulas.

If the two weaknesses can be amended with proper materials, the paper may be considered for publication in Biogeosciences.

#### References

Bozec, Y., Thomas, H., Elkalay, K., De Baar, H. (2005) The continental shelf pump in the North Sea - evidence from summer observations, *Mar. Chem.*, 93, 131-147.

Bozec, Y., Thomas, H., Schiettecatte, L.-S., Borges, A. V., Elkalay, K., de Baar, H. (submitted) Assessment of the processes controlling the seasonal variations of dissolved inorganic carbon in the North Sea. *Limnol. Oceanogr.*

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Takahashi, T., Sutherland, S.C., Sweeney, C., Poisson, A., Metz, N., Tilbrook, B., Bates, N.R., Wanninkhof, R., Feely, R.A., Sabine, C., Olafsson, J., Nojiri, Y. (2002) Global sea-air CO<sub>2</sub> flux based on climatological surface ocean pCO<sub>2</sub>, and seasonal biological and temperature effects. *Deep-Sea Research II* 49, 1601-1622.

Thomas, H., Bozec, Y., de Baar, H. J. W., Elkalay, K., Frankignoulle, M., Schiettecatte, L.-S., Kattner, G., and Borges, A. V. (2005) The Carbon budget of the North Sea, *Biogeosciences*, 2, 87-96, 2005, SRef-ID: 1726-4189/bg/2005-2-87.

Thomas, H., Bozec, Y., Elkalay, K., and De Baar, H. (2004) Enhanced open ocean storage of CO<sub>2</sub> from shelf sea pumping, *Science*, 304, 1005-1008.

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