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Comment

***Interactive comment on* “Carbon and nutrient mixed layer dynamics in the Norwegian Sea” by H. S. Findlay et al.**

Anonymous Referee #1

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Review-Addendum

The comparison between modelled alkalinity and alkalinity data from OWS-M is critical to the Findlay et al. manuscript as it provides the base for the estimated role of coccolithophores in the Norwegian Sea (see S1693 in my original review: Biogeosciences Discuss., 4, S1690–S1695, 2007.)

a)

After submitting my original review of the manuscript of Findlay et al., I realised a little inconsistency between this model paper and the accompanying data paper of Skjelvan

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et al (Inorganic carbon time series at Ocean Weather Station M in the Norwegian Sea, Biogeosciences Discuss., 4, 2929-2958, 2007). Note that Ingunn Skjelvan is also a co-author of the Findlay et al. paper.

Findlay et al. write on page 3236 (line 12ff): “The data were collected every month from January 2002 to December 2005 from the Norwegian Sea at Ocean Weather Station M, ... (Skjelvan et al., 2007; ...). Data used here includes nitrate concentrations, ..., C_T and A_T and represents the values at depth $\leq 20\text{m}$.” That is, the Skjelvan et al. manuscript is the data source for Findlay et al.

Checking the paper of Skjelvan et al. 2007, I find that no A_T (total alkalinity) data are reported or used in this paper. When computing changes in anthropogenic carbon over time the authors refer to the eMLR method of Friis et al 2005, which applies multi linear regression analysis between total dissolved inorganic carbon and temperature, nutrients and *alkalinity*. The Skjelvan modification of the eMLR method, however, uses *salinity* instead.

When one of the reviewers of the Skjelvan et al. paper (M. Alvarez, Interactive comment on Biogeosciences Discuss., 4, 2929, 2007; S1353) asks: “why not using the TA data and comment them?”, Skjelvan et al. respond “When it comes to alkalinity, we have measured this parameter at only about half of our stations from OWSM (due to instrumental problems). At present we are not satisfied with our correction procedure and it is unclear if/when the data can be used.” (Biogeosciences Discuss., 4, S1413–S1415, 2007)

I am left behind with a little ambiguous feeling. Most probably, the expression “it is unclear when the alkalinity data can be used” refers to the full dataset. Nevertheless, as no alkalinity data are presented in Skjelvan et al., Findlay et al. should clarify the origin and quality of the alkalinity data they use in their manuscript. In particular since a certain noisiness in the alkalinity data is evident from Fig. 7a of Findlay et al.

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b)

In their Figure 7a, Findlay et al. present total alkalinity data which are not-normalised to a given salinity, a procedure often applied, but not without pitfalls (Friis et al. 2003, GRL, doi:10.1029/2002GL015898). However, seasonal changes of non-normalised alkalinity data can be due to calcification but may also be effected by seasonal changes in salinity. The Skjelvan et al. manuscript indicates that the latter is likely very relevant at OWS-M. Skjelvan et al. show in their Figure 4e regular seasonal excursions of 0.3 to 0.4 salinity units, translating into a 1% seasonal change in total alkalinity, or $> 20 \text{ uEq kg}^{-1}$, due to the salinity fluctuation. Given that Findlay et al find a modelled seasonal decrease of 38 uEq kg^{-1} , which already is an upper limit of the data based total alkalinity change, salinity changes contribute at least 50% to the alkalinity seasonality. We are left with a small and very uncertain alkalinity signal that may be due to calcifying organisms. This needs to be more properly presented and explored in the Findlay et al. manuscript.

Together with the overall scatter in the alkalinity data reported by Findlay et al., the take home message is that the alkalinity data from OWS-M cant constrain the significance of a model that includes a specific calcifyer functional type of phytoplankton. This enforces the need of using *additional* quantitative metrics to constrain the model presented in the Findlay et al. manuscript.

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