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Interactive comment on "Effect of enhanced pCO_2 levels on the production of DOC and TEP in short-term bioassay experiments" *by* G. A. MacGilchrist et al.

Anonymous Referee #2

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This study is part of a joined field study on the northwestern European Shelf and reports results of short-term bottle experiments with manipulation of pCO2 by addition of acid. Here, the focus is on DOC and TEP concentration that show variable responses to the pCO2 treatment between different stations. Given that organic matter production, in general, is impacted by a multitude of environmental factors such as nutrient, light, temperature and CO2 concentration as well as by ecology, i.e. phytoplankton species composition, grazing and bacterial/viral abundance, it is not surprising that the authors observed differences in the response direction and magnitude of organic matter production, including TEP, during their incubation experiments. DOC concentration on the other hand was not significantly affected by pCO2. This is not really surprising either,

because DOC is produced by autotrophic as well as by heterotrophic processes that may respond differently to a pCO2 increase. Moreover, a significant DOC effect, i.e. beyond the limits of analytical error, needs a strong signal, which cannot be expected in short-term experiments with low biomass.

The manuscript is well written and clearly structured. The attempt to disentangle potential co-factors between stations is particularly nice.

Other comments: - Data presented in this manuscript could be better compared to observations available in the accompanying manuscripts of the special issue. This information is not readily accessible, because in some of the other manuscripts the stations are named differently; or not the same stations were sampled in the same regions? Information needed to be considered for this manuscript are the initial pCO2, the pCO2 evolution during the incubations, phytoplankton species composition, primary production, and if available bacteria abundance. I suggest adding this information to the manuscript.

- Page 3706: Were the bottles filled without headspace? Were they aerated during the experiment? How stable was the pCO2 over the incubation time? Please give actual values.

- What means 'ambient' in this respect? How variable was the initial pCO2 between stations? Please give actual values.

- TEP method: Alcian Blue adsorbs to surface polysaccharides of coccolithophores that may have been present in the areas studied. Were the filters examined microscopically to ensure that stained material was 'free' TEP and not stained surface polysaccharides? How high was the coccolithophore abundance at each station? Maybe phytoplankton composition could explain the relationship between TEP and Chl a observed in E3-5? Could it even be that coccolithophores grew better at lower pCO2? Please add more information on species composition.

- Figures 4 and 5; there are no error bars indicated in the figures. Was the propagation of the analytical error taken into account?

- Fig. 3; please add x-axis legend

-Fig. 5; please use same units for TEP and Chla (μg L-1)

- How meaningful is the regression analysis in Fig. 5, given that production and degradation processes likely show different relationships between TEP and Chl a? Moreover, the data used in Fig. 5 are not independent as the response 0-96 is always the average of the values 0-48 and 48-96. Thus, the number of observations is increased artificially. Regression lines should, if at all, be calculated without 0-96 values. Also consider possibility of direct staining of cells with Alcian Blue at E3-5 (nanoplankton!) mentioned above.

- page 3715: The study by Engel (2002) also considered pCO2 values below present day. The increase in TEP concentration with increasing pCO2 was clearly observed when going from past to present day pCO2, whereas there was almost no TEP increase towards future pCO2. This is a clear difference to the design and outcome of this study.

- The authors should stress that the observed declining situation encountered in E1, E2 and partly E3 is different from earlier studies cited here that mainly considered biomass build-up phases; e.g. blooms, or culture experiments.

Interactive comment on Biogeosciences Discuss., 11, 3701, 2014.