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Biogeosciences Discussions

Interactive comment on "Seasonal cycling of phosphorus in the southern bight of the North Sea" *by* C. van der Zee and L. Chou

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Reply to Anonymous Referee #2

We thank the referee for his/her comments on and interest in our manuscript. Here are our answers to the points raised by Referee #2.

Butler et al. (1979) noted large fluctuations in inorganic nutrient ratios but a rather stable ratio of total dissolved nitrogen over total dissolved phosphorus (TN:TP). These observations do not fit in our results. The NO3:PO4 ratio in the study of Butler et al. varied between 3 and 13, whereas in our study this ratio varied between 1 and 220. The DON:DOP ratio varied respectively from 25 to 42 in the study of Butler et al. and between 2 and 181 in our study. Butler et al. found TN:TP ratios ranging from 17 to 24; in our study TN:TP ranged from 5 to 107. Although in our study the range of the TN:TP ratio is smaller than the ranges of the NO3:PO4 and DON:DOP ratios, a significant seasonal fluctuation of TN:TP is clearly observed for the Belgian coastal zone of the North Sea. The ranges of all three ratios are larger in our study than in the study of Butler et al. One reason could be that the seasonal pattern of DON in the

Belgian coastal zone shows maximal values before the minimal concentrations of NO3 are reached. In the study of Butler et al., the highest values of DON were observed after the minimal values of NO3 were reached but when the NO3 values were still low. Thus, the TN value is more constant throughout the year in the study of Butler et al. The TN:TP ratio follows the trend of the TN, because of the much larger variation in TN than in TP observed in our study. It is difficult to say what causes the difference between DON seasonal patterns of the two studies. However, there is an important difference in the nitrogen availability between the two systems. The Belgian coastal zone is far more polluted with nitrogen. Ammonium, for example, is often below detection and always below 2μM in the study of Butler et al. in contrast to the Belgian coastal zone and the maximal nitrate concentration is one order of magnitude higher in our study. The minimal nitrate concentrations, however, are similar, resulting in a larger variation of NO3 values in our case. The PO4 concentrations in our study reached much lower levels during the phytoplankton bloom than in the study of Butler et al. There is also a difference in the way the values were obtained in the two studies that renders a direct comparison more difficult. We sampled the surface water and each data point represented only one sample at the date of sampling. In the study of Butler et al., each data point represented a monthly mean of samples taken from different depths (in a stratified water column) and different years (between 1969 and 1977). Butler et al. have noted that NO3 is depleted in the upper layer in summer, but the lower layer remains relatively rich so that there are wide variations from the mean value of the whole water column.

"From the POP and DOP graphs in the present paper it seems that at times in Summer more total organic phosphorus is present than PO4 in Winter. I would expect lower values during Summer as found by Butler et al. (1979)." In figure 4 of our manuscript, the units of the PO4 and DOP are in μM on the left Y-axis, but the POP is given as POP content in the suspended matter in μmol g-1 on the right Y-axis. To make a direct comparison between the PO4 and total organic phosphorus (e.g. DOP plus POP) concentrations, the POP content needs to be converted into concentration in μM units

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using the suspended matter data. We made the conversion and except for 4 data points (one point at the stations ZG02, #230, #700 and B07), all the values of total organic phosphorus concentration are lower in summer than the PO4 in winter. Butler et al. (1979) did not include POP in their study, but only DOP. When we compare DOP in summer with PO4 in winter, we also find lower values during summer.

Interactive comment on Biogeosciences Discussions, 1, 681, 2004.