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**BGD** 11, C2401–C2403, 2014

> Interactive Comment

## Interactive comment on "The influence of ocean acidification on nitrogen regeneration and nitrous oxide production in the North-West European shelf sea" by D. R. Clark et al.

## Anonymous Referee #2

Received and published: 12 June 2014

Within the manuscript field measurements of dissolved inorganic nutrients (NO3+NO2, PO4) and nitrous oxide concentrations from a one month summer cruise around the British Isles as well as some stations within the Skagerrak and Bay of Biscay are presented. Rate measurements of NH4+, NO2- and NO3-uptake and regeneration were performed on selected stations, using a well elaborated N15 methodology. Those field data are embedded in a comprehensive suite of biogeochemical and hydrographic measurement parameters contributed by other cruise participants as well as satellite data on temperature and phytopigments. A variety of biogeochemically characteristic situations (summer stratified waters, coccolithophore bloom, storm induced nutrient input...) along the cruise trip could be characterized. Thoroughly chosen correlative





statistics have been applied relating measured nitrogen cycle parameters to any other measurement parameter. No consistent correlations could be detected among locations. Water column nitrification was quantified but evidence for N2O production was not found. Nevertheless, it is a nice and comprehensive field dataset on important water column processes of which rate measurements are yet sparse, and as such it deserves publication. Additionally to the observational data, experimental data evaluating the effect of future increased CO2 levels and resulting ocean acidification on nitrogen cycling and potential N2O production are included in the manuscript. Short term bioassays conducted on five characteristic stations in cooperation with co-workers investigating other chemical and biological aspects, seem to be well planned and neatly carried out. A direct effect of CO2 on bacterial ammonia oxidation or N2O production could not be detected. However, treatment related changes in cell abundance and community size structure as well as DMS concentrations were observed by other cruise members working with the same bioassays. Results are presented within the same issue Richier et al. (2014) and Hopkins et al. (2014), respectively. An initial decrease in nano flagellate abundance in response to sudden acidification resulted in overall decreased production and nutrient uptake as well as a presumed "stress release "of DMS. The data are as such fairly well presented, and discussed and should thus be published. The strategy to detect correlations between random combinations of variables (p3130) using multivariate statistics appears to be very thoroughly applied and objective in this manuscript. However, it makes the reader fear that important patterns or reasonable differences among locations may be overseen in the search for universal patterns. As pointed out by referee one, for most of the tested pairs educated hypothesis are lacking and pseudo correlations would be likely (e.g. [CO32-] vs. NH4+ oxidation rate). Situations as the ones nicely discussed on page 3136 line 22 – 3138 line 8 are highly interesting. Obviously due to inconsistent data, such a discussion concerning the OA data is lacking. However, I miss a discussion on the effect of whether the shock response of small flagellates to increased CO2 postulated by Richier et al. (2014) and Hopkins et al. (2014). That should have had a measur-

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11, C2401–C2403, 2014

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able effect on nitrogen cycling? Are there methodical reasons that the approach did not find differences? Could measurement precision be enhanced by excluding large zooplankton from bioassays (P 3134 line 16-19)? Were bioassay bottles agitated to keep particles in suspension? Could settling of particles have affected OA results? Technical comments Long sentences e.g. p 3114 line 22 -27 or 3119 line 21-26 should be revised. Explanation of Fig. 11 is missing in the results part The cruise track is scaled in three ways, distance in km as well as a time scale in Julian days (Fig. 1) as well as the five OA stations named E1-5. It is difficult to directly compare observational data presented on the distance scale in Fig. 3, to nitrogen cycle data in Fig. 4 and 5. Please include days in Fig. 3 or homogenize. Please indicate data points by dots at sampling depth within Fig. 3. Carbonate chemistry is reasonably well reported, but please replace intended CO2 levels by actual measured partial pressures in bottom category bar (Fig. 8 and 9) and further legends. In this case deviations from intended values are hardly relevant but nevertheless it is misleading to title a 912 $\mu$ atm treatment consequently 1000 $\mu$ atm.

11, C2401–C2403, 2014

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