

Interactive comment on “Links between surface productivity and deep ocean particle flux at the Porcupine Abyssal Plain (PAP) sustained observatory” by H. Frigstad et al.

Anonymous Referee #1

Received and published: 26 April 2015

General comments:

Frigstad et al. present data from the PAP site in the northeast Atlantic, with estimates of seasonal NCP and new production that will be useful for the scientific community. A particle tracking method is used to examine source regions of material within a sediment trap, and the manuscript demonstrates that the site shows high flux attenuation by calculating the export ratio and transfer efficiency. Time-series stations such as the PAP site are of great importance in evaluating changes in the environment and understanding these important biogeochemical processes. With further clarification and inclusion of the errors involved, and mixing influences this paper could be a valid contribution to productivity estimates in this region. If the following issues are addressed, I

C1720

support the publication of this manuscript.

Specific comments:

p.5176 line 25 The error associated with the calculation of DIC from calculated TA and measured CO_2 should be quantified. The error quoted as $3 \mu \text{ mol kg}^{-1}$ is the measurement uncertainty if DIC were measured discretely, which is not the case in the method presented. Please quantify this error and calculate how this error propagates into the NCP estimates.

p.5178 line 11 Please include justification/reference for why all particles are assumed to have a sinking speed of 100 m d^{-1} .

p.5177 line 4 and figure 3 How can mixing be assumed negligible? Kortzinger et al. (2008) demonstrate that mixing plays an important role in increasing NO_3 and DIC concentrations in the mixed layer during winter months at the PAP site. Using the method presented, the positive NCP and new production values in figure 3 are not necessarily solely due to biological drawdown, but are actually where the biological drawdown exceeds mixing and remineralisation. This assumption should be discussed further, and made clearer to the reader.

Figure 3. Why are the productive periods (grey shaded) different for NO_3 MLD and NCPMLD? Using the MLD it should be possible to determine if the mixed layer is deepening, and therefore give an indication of when high concentrations of DIC and nutrients are being entrained in to the mixed layer. The summer months before the mixed layer deepens may be a better period to calculate NCP and new production from?

Figure 3. Please include a table of the different years used to calculate the monthly values and the inter-annual variability. This would be useful to the reader and might also explain why some of the error bars are so small in the figure.

p.5192 figure 1. The MLD looks like it goes shallower than 30 m during the summer,

C1721

would this influence your calculations of NCP and new production within the mixed layer as your sensors are at 30 m? Please clarify this and discuss if necessary.

Figure 3 and figure 4. It would be beneficial to the reader if the units of CO₂ flux, NCP, new production, Satellite derived NPP were all in mmol m⁻² d⁻¹ so that they are more easily comparable. Please make units consistent throughout the manuscript.

p.5199 Figure 4. Please add a time dimension to this plot, it is difficult to trace the particle with time without knowing which month the coloured dots are representing. It may also be useful to include a 100km box around the PAP site for reference, and to demonstrate that the source region is outside of the box in some years.

Technical corrections:

p.5171 line 1 Is nitrate being measured, or nitrate + nitrite as it is in Hartman et al. 2012. On first use of NO₃ please clarify this within the manuscript.

p.5171 line 15 closing brackets missing

p.5196 Figure 2. Add '(black dots)' to legend

p.5199 Figure 4. Make text on axes bigger, and add label to the colour bar including the units

Interactive comment on Biogeosciences Discuss., 12, 5169, 2015.