On the use of pelagra sediment traps and radionuclides (^{234}th, ^{210}po) for estimating particle export efficiency

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The Particle Export Efficiency (PE_{eff}), defined as the ratio carbon export/primary production (PP), is commonly used as a metric of the magnitude of the Biological Carbon Pump (BCP)[1] [2]. The PE_{eff} varies regionally but also seasonally, however, factors driving PE_{eff} variability remain unclear potentially skewing estimates of the global magnitude of the BCP [3]. Often, PE_{eff} overlook limitations of the method employed regarding the influence of the biogeochemical dynamic relative to the sampling time.

Here we compare three approaches to estimate PE_{eff}: using radioactive pairs (1) ^{238}U-^{234}Th, (2) ^{210}Pb-^{210}Po, (3) neutrally buoyant sediment traps (PELAGRA) along with satellite-derived estimates of PP integrated over time scale similar to that of the three export approaches. Carbon export flux and PP were examined to determine the conditions under which each approach is the most appropriate to estimate PE_{eff}. ^{234}Th and ^{210}Po based carbon export fluxes were an order of magnitude higher than that of PELAGRA likely due to bloom dynamic and their longer flux integration time scales [4]. Differences in PEeff were mainly driven by carbon export flux estimates rather than the PP suggesting that PELAGRAs provide instantaneous estimates, while 210Po, 234Th provide more seasonally averaged estimates. Changes in phytoplankton community structures potentially inducing changes in particle size spectra may explain differences between 234Th and 210Po estimates of PEeff.

[1] Henson et al. (2011) *Geophys Res Lett* **38**. [2] Siegel et al. (2014) *Global Biogeochemical Cycles* **28**: 181-196. [3]. Henson et al. (2015) *Global Biogeochemical Cycles*. **29**: 33-45 [4]. Le Moigne et al. (2013) *Deep Sea Research Part I* **72**: 88-101.