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## Effect of different rates and modes of artificial upwelling on particle flux and potential POC deep export

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To counteract climate change, measures to actively remove carbon dioxide from the atmosphere are required, since the reduction of global CO<sub>2</sub> emissions alone will not suffice to meet the 1.5 °C goal of the Paris agreement. Artificial upwelling in the ocean has been discussed as one such carbon dioxide removal technique, by fueling primary production in the surface ocean with nutrient-rich deep water and thereby potentially enhancing downward fluxes of organic matter and carbon sequestration. In this study we tested the effect of different rates and modes of artificial upwelling on carbon export and its potential attenuation with depth in a five-week mesocosm experiment in the subtropical Northeast Atlantic. We fertilized oligotrophic surface waters with different amounts of deep water in a pulsed (deep water fertilization once at the beginning) and a continuous manner (deep water fertilization every four days) and measured the resulting export flux as well as sinking velocities and respiration rates of sinking particles. Based on this, we applied a simple one-dimensional model to calculate flux attenuation. We found that the export flux more than doubled when fertilizing with deep water, while the C:N ratios of produced organic matter increased from values around Redfield (6.6) to ~8-13. The pulsed form of upwelling resulted in a single export event, while the continuous mode led to a persistently elevated export flux. Particle sinking velocity and remineralization rates were highly variable over time and showed differences between upwelling modes. We stress the importance of experiments with a prolonged application of artificial upwelling and studies including real world open water application to validate the CO<sub>2</sub> sequestration potential of artificial upwelling.