Geophysical Research Abstracts
Vol. 19, EGU2017-15501, 2017
EGU General Assembly 2017

Ocean Acidification Impacts on Marine Carbon Export

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As the oceans take up about 30% of anthropogenic CO_2 emissions, a variety of biogeochemical processes are affected by the seawater's increasing acidity. In this model study, we investigate the effect of ocean acidification on marine carbon export, focusing on the role of transparent exopolymer particles (TEP). These gel particles are formed from dissolved polysaccharides, mainly released by phytoplankton, and have an impact on the aggregation and sinking of organic particles. We test the hypothesis that a higher CO_2 concentration in the water leads to an enhanced export of particulate organic carbon. We build on observed biogeochemical relationships and calibrate our model with data from ocean acidification mesocosm experiments (e.g., PeECE III, Bergen, 2005). A one-dimensional model is devised for our analysis, simulating a water column of up to 20 meters. The vertical mixing in the model is a function of density gradients, calculated from observed temperature and salinity fields. This approach provides a well-mixed surface layer and a weakly-mixed pycnocline at a realistic depth for each simulated experiment. Our model explores different biogeochemical mechanisms to explain observed correlations and helps to complete the picture given by measurements and statistical analyses.