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Response Of Ocean Carbon Export To Different Model Algorithms

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Effects of climate change on the biological carbon pump (BCP) and vice-versa, and the influence of change in ecosystem structure on the dynamics of BCP are vital topics to understand the role of oceans in the global carbon cycle and sequestration of greenhouse gases. Construction of a complete carbon budget, requires better understanding of air-sea exchanges and the processes controlling the vertical and horizontal transport of carbon in the ocean, particularly the biological carbon pump. Improved parameterization of carbon sequestration within ecosystem models is vital to better understand and predict changes in the global carbon cycle. However, due to the complexity of processes controlling particle aggregation, sinking and decomposition, existing ecosystem models necessarily parameterize carbon sequestration using simple algorithms. For this reason, the primary aim of this study is to provide new parameterizations of the downward flux of organic carbon, suitable for inclusion in numerical models. The study area was chosen to be the North Atlantic Basin (NA) and the surrounding shelf seas. In the scope of this study, first, the skill of existing models in representing particle fluxes were compared theoretically. The unique algorithms used in three state-of-the art ecosystem models ERSEM, PISCES and MEDUSA have been compared and tested against observational data collected at the PAP mooring site. For testing purposes, algorithms were inserted into a common 1D pelagic ecosystem model. Following comparison of existing algorithms, new experimental results obtained from targeted mesocosm experiments and open ocean observations, will be utilized to develop improved formulations. New algorithms will be compared to existing model formulations using a standard validation data set complied within the framework of BASIN. In order to assess algorithm response under differing hydrographic environments, each set of algorithms will be tested within a 1D framework at three sites in the N Atlantic (PAP, ESTOC and BATS). Ultimately it is intended to feed improved algorithms to the 3D modelling community, for inclusion in coupled numerical models.