Geophysical Research Abstracts, Vol. 7, 06354, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06354

An advanced marine ecosystem model for Earth System simulations

M. Vichi (1), S. Masina (1), N. Pinardi (1,2) and A. Navarra (1)

National Institute of Geophysics and Volcanology, V. Donato Creti, 12, 40128 Bologna. Italy (vichi@bo.ingv.it / +39 051 4151499) (2) Laboratorio SINCEM , Corso di Scienze Ambientali, University of Bologna, Via S.Alberto 163, 48100 Ravenna, Italy (n.pinardi@sincem.unibo.it / +39 0544 600323)

Simplified marine carbon cycle models commonly used for climate change studies do not capture processes that may be key elements of feedback mechanisms, such as phytoplankton species succession, macro- and micro-nutrients co-limitation, light acclimation, microbial loop dynamics and dissolved organic carbon dynamics. We present the implementation of an advanced marine ecosystem model that includes these important mechanisms. The model (a.k.a. ERSEM) was originally developed for regional coastal applications, and is applied here for global ocean climate simulations, starting from the assumption that a set of biological first principles does exist and is common to biological groups living in different areas of the ocean. The model is based on considerations of the observed physiology of marine plankton, taking into account interactions of the organisms with environmental conditions and cycles of the major biogeochemical elements (C, N, P, Si, O, Fe). The control simulation is a 25 year run (1976-2001) of the ecosystem model coupled with the OGCM OPA, forced with prescribed atmospheric fluxes from ERA40 and climatological atmospheric iron dust deposition. Model results are compared with satellite observations of chl-a from the CZCS and SeaWiFs eras, and with nutrient field data from the WOA01. The results reveal a reasonably good agreement with the spatial and temporal patterns observed in the global ocean. The response of phytoplankton to the seasonal cycle and climate interannual variability is adequately represented in most of the areas. The largest mismatch with the observations is found in the Southern Ocean, where the interaction between light acclimation, iron availability and zooplankton predation is more complex and difficult to represent in deterministic models. The model results are probably

limited by the poor representation of the functional groups of metazoans, but clearly indicate the model capability to capture the basic properties of many important biogeochemical provinces, particularly in the Equatorial Pacific and North Atlantic.