in the ocean is one potentially important component of the climate system, and in this study a coupled 3-dimensional physical-biogeochemical model have been used to study the cycling of carbon, plant nutrients and oxygen in the world oceans. The global carbon cycle model focuses on physical and biogeochemical processes with characteristic time scales ranging from a month to a decade, and includes ecosystem dynamics as well as a description of the carbonic acid system in seawater. The model represents an extension to existing global carbon cycle models, where seasonal cycling of carbon and nutrients are ignored. Two additional differences between existing carbon cycle models and the present model are that the present model uses surfaces of constant density (*i.e.*, isopycnic surfaces) as the vertical coordinate, and that the upper oceanic mixed layer is explicitly modelled. The modelling activities are focused in processes occurring on the seasonal time scale, and quantities like the global scale surface concentration of CO_2; the exchange of CO_2 across the air-sea interface; and the planktonic new, regenerated and export productions will be examined.

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Modeling distinct vertical biogeochemical structure of the Black Sea: Dynamical coupling of the oxic, suboxic, and anoxic layers.

A 17-compartment, one-dimensional, vertically-resolved, physical-biogeochemical model is used to explore quantitatively the processes governing the Black Sea vertical biogeochemical structure, and to provide a unified representation of the dynamically coupled oxic-suboxic-anoxic system. The model relates the annual cycle of plankton production to organic matter generation and remineralization-ammonification-nitrification-denitrification chain of the nitrogen cycle as well as anaerobic sulfide oxidation in the suboxic-anoxic interface zone. The simulations, as validated by a specific data set for the jellfish Aurelia-dominated eutrophic ecosystem of the late 1970's and 80's, reproduce reasonably well the observed annual plankton structure involving a series of successive phytoplankton, mesozooplankton, the heterotrophic dinoflagellate Noctiluca scintillans and the gelatinous carnivore Aurelia blooms over the year. The model simulations indicate that the oxygen consumption in the remineralization and nitrification together with a lack of ventilation of subsurface waters due to presence of strong stratification are two main factors limiting biogeochemical activity to upper ~75 m of the water column, which approximately corresponds to the level of nitrate maximum. The position and thickness of the subsequent zone of about 20-30 m, known as the suboxic layer, is therefore mainly controlled by the upper layer biogeochemical processes instead of oxygen-hydrogen sulfide interactions near the anoxic interface. The quasi-permanent character of this layer within the last several decades is maintained by a constant rate of nitrate supply from the nitrate maximum zone. It is consumed to oxidize sinking particulate organic matter as well as hydrogen sulfide and ammonium transported upwards from deeper levels.

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