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Carbon and Oxygen Dynamics in Shelf and Coastal Seas: a Physical-Biogeochemical Modelling and Satellite Approach

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The current study presents the development and results of an accurate physical-biogeochemical coupled model that simulates oxygen and carbon cycles in shelf and eutrophicated/sensitive areas of the European seas. Our approach includes the hydrodynamic forcing simulated with a 3-D hydrodynamic General Estuarine Transport Model (GETM) coupled to a 1-D biogeochemical model called Oxygen Depletion Index model (ODIN). The ODIN model includes coupled benthic/pelagic processes specifically addressing oxygen quantification in the sediment, as well as in the bottom, intermediate and surface layers of the water column. Primary production data derived from SeaWiFS is included as an input to the ODIN model. ODIN is calibrated and validated using field data in different basins of the Baltic Sea at the level of the oxygen dynamics. The primary objective of a dynamic quantification of the carbon and oxygen cycles for the water and sediment compartments in diverse physical and ecological conditions is met. The descriptive capability of the coupled model is assessed and validated in several Mediterranean Sea shelf and coastal areas exposed to diverse topography, hydrodynamic regimes, and biogeochemical conditions. Comparison with results from other coupled physical/biogeochemical models with different degree of complexity is also included. In the context of the implementation of European water polices the model will support the quantitative assessment of the sensitivity and vulnerability of coastal marine areas with regard to anoxia and hypoxia as major impact of eutrophication.