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A numerical study of phytoplankton dynamics in the German Bight

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The coastal southern North Sea ecosystem has been intensively studied in the past few decades. However, major problems related to the timing and intensity of the annual phytoplankton blooms are still unsolved. A high-resolution physical-biological model is used to highlight and address this issues by integrating the recent continuous measurements of a single Ferry-box route (between Cuxhaven-Harwich) and satellite-derived (MERIS) chlorophyll-a (Chl-a) data. A classical nitrogen-based NPZD model has been adapted to study the phytoplankton dynamics in the German Bight(6.00E-9.15E). The biological box model is coupled with a two-dimensional nested grid transport model with a spatial resolution of 1 km. The simulations have been focused on the spring periods of the years 2004 and 2005.

The modelled phytoplankton distribution is in good agreement with the general understanding of coastal phytoplankton dynamics. By investigating the effects of suspended particulate matter (SPM) and river discharge, we suggest that the major factor controlling the spring blooms is light availability rather than nutrient. Interestingly, alongshore currents play a significant role in the phytoplankton spatial distribution in the shallow coastal water.

Some discrepancies in relation to Chl-a amongst the ferry-box observations, the MERIS-derived data and the model results illustrate the limitation of the Euler-based approach. The continuous ferry-box data also reveal the weaknesses of the classical NPZD model particularly due to a lack of regulation mechanisms (parameters are typically kept constant) allowing phytoplankton to respond differently to a changing environment. Possible improvements include the adoption of: 1) a Lagrangian ap-

proach, 2)parameter regulation (adaptive) mechanisms, 3) advanced data-assimilation techniques, and 4) the coastal benthic exchange dynamics.