Simulating the growth and distribution of planktic foraminifer using an ecophysiological multi-species model

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Résumé en anglais	We present an eco-physiological model reproducing the growth of eight foraminifer species (Neogloboquadrina pachyderma, Neogloboquadrina incompta, Neogloboquadrina dutertrei, Globigerina bulloides, Globigerinoides ruber, Globigerinoides sacculifer, Globigerinella siphonifera and Orbulina universa). By using the main physiological rates of foraminifers (nutrition, respiration, symbiotic photosynthesis), this model estimates their growth as a function of temperature, light availability, and food concentration. Model parameters are directly derived or calibrated from experimental observations and only the influence of food concentration (estimated via chl-a concentration) was calibrated against field observations. Growth rates estimated from the model show positive correlation with observed abundance from plankton net data suggesting close coupling between individual and assemblage growth rates. This observation was used to directly estimate potential abundance from the model-derived growth. Using satellite data, the model simulate the dominant foraminifer with a 70.5% efficiency when compared to a data set of 576 field observations worldwide. Using outputs of a biogeochemical model of the global ocean (PISCES) instead of satellite images as forcing variables gives also good results, but with lower efficiency (58.9%). The model also correctly reproduces the relative worldwide abundance and the diversity of the eight species when compared to core tops observations both using satellite and PISCES data. This model allows prediction of the season and water depth at which each species has its highest growth potential. This offers promising perspectives for both an improved quantification of paleoceanographic reconstructions and for a better understanding of the foraminiferal role in the marine carbon cycle.
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