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The ForamClim Ecophysiological Model for Planktic Foraminifera: How physiology constrain ecological niches, abundance and potential depth and season of growth for eight foraminifera species

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We present here what we think is the first eco-physiological model reproducing the growth of different foraminifera species in function of environmental parameter. By reproducing the main physiological rates of foraminifera (nutrition, respiration, symbiotic photosynthesis), this model estimates their growth in function of temperature, light availability and food concentration. The growth model is calibrated with controlled cultures (newly performed experimental observations or published data) for eight foraminifer species including Neogloboquadrina pachyderma (dextral and sinistral forms), Neogloboquadrina dutertrei, Globigerina bulloides, Globigerinoides ruber, Globigerinoides sacculifer, Globigerinella siphonifera and Orbulina universa. The growth rate estimated for each foraminifera species is related to population abundance using field observation which allows prediction of the foraminifera species assemblage in the water column. Using satellite data, the model, compared to published plankton tows, predict the seasonal distribution of dominant foraminifer species worldwide with efficiency higher than 70%. It reproduces successfully the worldwide pattern of foraminifer abundance, the species assemblages observed in the water column and in sediment core tops. The model, used in combination with a large scale ocean model,

allows the prediction of the season and water depth at which most of the population has developed. This offers larges perspectives for both actual understanding of foraminifera role in the carbon/carbonate ocean cycle and for better quantification of paleoceanographic proxies. Forclim is a program supported by the Agence Nationale pour la Recherche and Institut National des Sciences de l'Univers, France.