Quantitative reconstruction of primary productivity in low latitudes during the Last Glacial Maximum and the mid- to Late Holocene from a global *Florisphaera profunda* calibration dataset

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In this study, we investigated the modern biogeography and environmental factors controlling the global distribution of the coccolithophore species *Florisphaera profunda*. This species typically has been used as a primary productivity proxy by the palaeoceanographic community. However, its robustness as a productivity proxy has only been evaluated regionally and in surface sediment samples. Here, we have developed a full calibration study that included 26 sediment traps, 1258 surface sediment samples (mainly from the published literature, and which are distributed globally), and satellite estimates of net primary productivity (NPP), in order to evaluate the potential of this species as a global indicator of ocean primary productivity. We also assessed the limitations and potential bias of this approach. Sensitivity analyses of surface sediment and sediment-trap *%F. profunda* to different environmental variables indicated that this shows its best response to NPP at low latitudes (between 30°N and 30°S). In contrast, at higher latitudes, the *F. profunda* relative abundance is mainly controlled by other factors, such as temperature or assemblage composition. Therefore, the interpretation of *%F. profunda* as a productivity indicator in the fossil record in high-latitude regions should be made with caution. Using the surface-sediment data, we developed a new global, low-latitude NPP-*%F. profunda* calibration model to reconstruct this key component of the marine carbon cycle. We applied the calibration model to published downcore *F. profunda* relative abundance data from 105 globally-distributed sediment cores that cover the Last Glacial Maximum and mid- to Late Holocene. A 15% higher NPP during glacial times compared to the Holocene was observed at low latitudes, reflecting the relevance of these latitudes in the global carbon cycle. Our study provides a substantial advance in quantifying past changes in NPP. It also adds information to the general understanding of how the earth's climate affected past ocean productivity, and how future climate changes will potentially affect it.