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Modelling the alkenone proxy: application to the NW African upwelling and the Atlantic Ocean

X. Giraud

Research Center Ocean Margins, University of Bremen, Germany,
xgiraud@palmod.uni-bremen.de

The alkenone index, based on calibrations and laboratory experiments, is widely used to reconstruct paleo-SSTs. The modelling approach proposed here aims to investigate how this temperature proxy is produced at the sea surface and recorded in the sediments. A biogeochemical model with two phytoplankton groups has been developped, to distinguish between the coccolithophores, producing alkenones, and a group comprising other phytoplankton. The Regional Ocean Modelling System (ROMS-AGRIF) is used to simulate the ocean circulation and can be applied regionally or at the basin scale.

Applied for present day conditions in the NW African coastal upwelling between 19°N and 27°N, we observe a cooling of the sediment record compared to the annual mean SSTs.Despite the seasonality of the coccolithophore production, this temperature difference is not mainly due to a seasonal bias, nor to the lateral advection of phytoplankton and phytodetritus seaward from the cold near-shore waters, but to the production depth of the coccolithophores.

If coretop alkenone temperatures are effectively recording the annual mean SSTs, the amount of alkenone produced must vary among the coccolithophores in the water column and depend on physiological factors (e.g. growth rate, nutrient stress).The application at the scale of the Atlantic basin highlights the importance of the different planktonic regimes.