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Changing patterns in the burial of sedimentary organic carbon in marine sediments: from present to future

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Marine sediments are among the most important sinks of organic carbon (OC) over geological time-scales, hence regulating concentrations of atmospheric CO_2. However, the magnitude and spatial distribution of OC buried in marine sediments remain unresolved due to limited data and different modelling approaches. In this study, we quantify present-day global OC burial and project changes by 2100 under different Shared Socioeconomic Pathway (SSP) scenarios. This is achieved by harnessing the Modern Ocean Sediment Archive and Inventory of Carbon (MOSAIC) database [1] and adapting the Comprehensive Ensemble Pipeline for Habitat modelling Across Large-scale Ocean Pelagic Observation Datasets (CEPHALOPOD) [2]. This permits us to predict the spatial distribution of all the parameters needed to quantify OC burial, such as surficial OC content, mixing rates, sedimentation rates, and OC reactivity. Preliminary results indicate that the distribution of OC content is driven by factors that promote its production (e.g., nutrient concentrations) and its preservation (e.g., bottom oxygen concentration and temperature). Projected changes according to CMIP6 model predictions of environmental conditions vary between scenarios. Under strong emission reductions of the SSP1-1.9 scenario, OC contents in marine sediments show no significant change by 2100 within model uncertainties. In contrast, if high emissions continue under the SSP5-8.5 scenario, OC contents in productive eastern boundary margins will decrease by 25-50%, associated with reduced nutrient availability and a warming ocean. In other continental margins, OC contents will increase (>100%) due to declining oxygen concentrations. In conjunction with changes of the other parameters, these findings highlight the sensitivity of OC burial to climate change under different scenarios, possibly exacerbating the capacity of the seafloor to sequester OC and thus regulating concentrations of atmospheric CO_2 in the future.

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