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Calibrating charcoal preserved in marine sediments to reconstruct paleofire regimes: Iberian Peninsula case study

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Abstract

Projected warming scenarios suggest fire risk increases in certain regions, in particular in the Mediterranean region. However, large uncertainties remain because fire is a complex process, which is difficult to integrate into global modelling. Moreover, because climate is changing rapidly, models must be tested not only with modern observations, but also with observations from climate conditions very different from today. Marine sediments are a source of past fire history data that can provide such information. However, charcoal (the fire proxy) in marine sediments must be calibrated, i.e. linking the amount of charcoal found in sediments to fire regime metrics in order to benchmark quantitative models. Microcharcoal concentration was quantified in several interface sediment samples from the Atlantic Ocean margin off the Iberian Peninsula. Microcharcoal concentration was compared with parameters linked to the microcharcoal production source area (burnt area, net primary productivity, type of burnt plants, watershed size), and to the transport/deposition (wind, currents, bathymetry, distance to the river's mouth, sedimentary discharge). Our results show a great heterogeneity in the spatial distribution of microcharcoal concentrations. However, the south of the Iberian margin is characterized by higher mean concentration than the northern region. Burnt area and the numbers of fires partially explain this pattern. Our results suggest that the high winter net primary productivity of grassland and dry shrubland and the hot and dry climate observed in the southern region explain high microcharcoal concentration values in the south of the Iberian margin. Additionally, the bathymetry and the distance from the river's mouth influence the distribution of concentration within this area.