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Variability of the millennial sea-level histories along the western African coasts since the Last Glacial Maximum

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The production of standardized relative sea-level (RSL) databases with a full consideration of uncertainty from many coastlines of the globe have enabled the exploration of RSL variability since the Last Glacial Maximum (LGM, 25 to 21 ka BP). Here, we expanded the global databases by evaluating 430 radiocarbon dated sea-level index points (SLIPs), which provided insights into the variability of RSL along the Atlantic African coast (Morocco to South Africa).

Sea-level data were standardized following the International Geoscience Programme (IGCP) protocols to produce a suite of validated SLIPS as well as limiting points. The Atlantic African coast database was grouped in 21 regions according to geographical position and the distance from LGM ice-sheets. We applied a Gaussian model to estimate regional rates of RSL change and compared the regional data with the ICE-6G Glacial Isostatic Adjustment (GIA) model predictions.

Our analysis indicates the RSL lowstand at the end of LGM was above -105 ± 4 m as indicated by a suite of marine limiting points. Since the LGM, RSL rose rapidly with average rates of up to 15 mm a^{-1} between 16 and 9 ka, notably in the Gulf of Guinea. The rates of RSL rise decrease to < 3 mm a^{-1} after ~7 ka BP. The mid-Holocene illustrates the emergence of a RSL high-stand which exceed the present mean sea-level between ~6.5 and ~4.5 ka BP. This high-stand is spatially variable and, in some regions was observed at elevations up to 2.5 m (e.g., Morocco, West Sahara, Congo, Namibia). In late Holocene RSL dropped gradually to the present datum. However, the coastal sector comprised between Senegal and Angola reveal late Holocene fluctuations, which are not reproduced by current GIA models. The Atlantic African coast database indicates RSL is controlled by the complex interplay by glacio-isostatic subsidence, rotational effects, ocean syphoning, continental levering, and 3-D variations in mantle viscosity structure as well as local forcing (e.g., compaction related subsidence). The Atlantic African coast database offers the possibility to better understand past RSL thereby providing constraints for more robust future sea-level projections of the west African coast in the framework of the on-going climatic change.