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The role of North African rivers in driving Mediterranean-Atlantic exchange

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The main driver for exchange through the Gibraltar Strait today is the density contrast between Mediterranean and Atlantic water. Mediterranean water is more saline than Atlantic water because the amount of water the Mediterranean loses through evaporation exceeds both precipitation and freshwater input from rivers. This means it has a negative hydrologic budget. In the Late Miocene however, a very large river known as the Esohabi River drained across North Africa and had its mouth in the Gulf of Sirt. This river was sourced in palaeo-Lake Chad and was strongly influenced by precession-driven monsoonal rainfall. Multiple General Circulation Model simulations through a single precessional cycle indicate that river water may only have reached the Mediterranean in significant quantities in summer during particular orbital configurations e.g. precession minima combined with eccentricity maxima. However, during high amplitude eccentricity maxima, the volume of water supplied through the Esohabi and Nile rivers may have been sufficient to switch the hydrologic budget from negative to positive. In doing so, the fresh water supply should have reduced the salinity of the Mediterranean and consequently the density contrast with adjacent Atlantic water leading to a reduction in exchange.
In this presentation we explore the evidence for the timing and nature of freshwater input to the Mediterranean from North Africa. We also consider how relevant this freshwater flux may be in determining some of the major environmental and sedimentological changes in the Late Miocene to early Pliocene including some of the salinity changes that occurred during the Messinian Salinity Crisis.