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# Modeling the Maastrichtian (Late Cretaceous) Landscape Using a Coupled Ocean-Atmosphere GCM and Detailed Global Paleo-DEM

The past surface relief of the Earth is an essential boundary condition for studies of past climatology and oceanography using GCMs (General Circulation Models). It also provides the geographic context for understanding and modeling surface processes, including palaeo-drainage, which governs the nature and flux of material to the world's shelves.

Here we present a modeling study of the Maastrichtian using the "state-of-the-art" HadCM3 coupled ocean-atmosphere GCM. We have compiled a detailed global palaeogeography from which we have generated a paleo-DEM (Digital Elevation Model) using the hydrological tools in ArcGIS, complete with reconstructed river systems and drainage basins. This paleo-DEM provides the geographic boundary condition for the modeling experiments and ensures internal consistency between defined paleodrainages and climate-ocean model results ($CO_2$ has been set at 4 x pre-industrial, which represents the upper published limit for the Maastrichtian).

The results indicate a Maastrichtian world dominated by high temperatures (sea surface temperatures as high as 30-35 C in the tropics) and a greatly enhanced hydrological cycle when compared with the Present, with global average runoff 2.5 times higher than today's. With the associated changes in vegetation and geography, this has major implications for understanding weathering and sediment transport patterns, especially since these differences are not evenly distributed. For example, the model hypothesizes persistent high runoff draining into the Iullemmeden Basin of North Africa, augmented with seasonal influxes from the Hoggar Massif. But, in contrast along the Tethyan margin of Africa, high evaporation rates result in little runoff reaching the coast, which is dominated by carbonates and evaporites. These results can then be ground-truthed against geological observations to quantitatively assess the robustness of the model.