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Northern African vegetation and land cover changes led to increased Arctic warming during the mid-Holocene

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The mid-Holocene (MH) was characterized by substantial vegetation changes over northern Africa, termed the Green Sahara. Concurrently, several proxy reconstructions have indicated anomalous warmth over some Arctic regions during the MH, with some records also indicating an abrupt cooling coinciding with the Saharan desertification. This has prompted studies into a potential teleconnection between the MH Green Sahara and the Arctic, leading to conflicting hypotheses regarding the dominant direction and mechanism for this teleconnection.

In this study, we analysed outputs from four fully coupled global climate models to identify the impact of the Green Sahara on the Arctic region. Through the difference of two sets of mid-Holocene simulations – with and without the Green Sahara – we isolated the effect of the northern African vegetation and land cover changes on Arctic temperatures. We show that simulations incorporating the Green Sahara yield considerably higher Arctic warming relative to simulations without explicit prescriptions of vegetation changes. We also conducted atmosphere-only global climate model simulations to identify whether or not Arctic temperature changes impacted northern African precipitation. Our results suggest that while the Arctic temperature changes induced changes to the atmospheric circulation over northern Africa, they were too weak to substantially contribute to Saharan desertification.