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Green Sahara impact on mid-latitudes during mid-Holocene

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In the mid-Holocene (6 kyr before present), North Africa was characterised by a vegetated Sahara and a stronger summer monsoon, resulting in a wetter climate. These conditions, induced by the different Earth's orbital parameters, and maintained by the precipitation-vegetation feedback, were associated with a substantial change of the regional atmospheric dynamics, with influences extending across the global Tropics and beyond.

In this study, we explore the mid-latitude response to the vegetated Sahara in the mid-Holocene. We use the EC-Earth climate model to simulate the North African environment during mid-Holocene, i.e. extensive vegetation over the Sahara, and a consequent reduced dust emission. Vegetation and dust reduction are prescribed both in combination and in isolation, to determine the specific responses to the individual forcings.

A significant response at mid-latitudes is simulated during boreal summer, when the precipitation-vegetation feedback is maximum in the Sahara. Results show increased precipitation over Mediterranean and Middle East, and warm anomalies across western Europe. This response is associated with the modification of the atmospheric circulation in the Euro-Atlantic sector. Specifically, the intensification of the subtropical jetstream favours precipitation across the Middle East, while a positive anomaly in the North Atlantic Oscillation leads the warming further west. These results suggest important implications for the understanding of future climate scenarios in the region, since a number of simulations project wetter conditions in North Africa.