



## **Simulation of Saharan mid-level clouds with a high resolution regional model**

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The simulation of the Saharan mid tropospheric clouds is investigated with the Weather Research Forecast (WRF) atmospheric model at cloud permitting (4Km) horizontal grid-spacing in a regional configuration. These simulations show that when the vertical grid is typical of that used in GCMs (roughly 40 levels) this limits the models' ability to simulate the magnitude of the Sahara mid-level clouds. It is only when the vertical resolution becomes high enough, with multiple levels within the mid-level cloud layer, that simulated Saharan clouds approach realistic amounts. Specifically, the use of 87 vertical levels, with roughly 26 levels within the mid-level cloud layer, allows the model to simulate 50-80% of the observed clouds. The improvement of cloud simulation also affects the simulation of precipitation, reducing the dry model bias over the Sahara.

Additionally, we use these findings to address a paleoclimatological problem like the Mid-Holocene Saharan Greening using convection permitting resolution, which hasn't been done before. According to the results, the precipitation response over the Sahara to changes in the TOA insolation may be a function of the cloud fraction of mid-level clouds, with better simulation of mid-level Saharan clouds producing a greater local precipitation response to changes in the TOA insolation.