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Saharan dust vertical distribution is controlled by convection and scavenging. Why do models miss this?

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Saharan dust represents more than 50% of the total desert dust emitted around the globe and its radiative effect significantly affects the atmospheric circulation at a continental scale. Atmospheric models often fail to represent the dust vertical distribution and the Saharan Air Layer. They underestimate the effects of deep convection on the vertical transport and of the role of scavenging on the confinement of dust aerosols in this layer. Using multi-year simulations performed with a variable-resolution climate model and processed-based analysis, we show that scavenging in deep convection and further re-evaporation of dusty rainfall in the lower troposphere are critical processes for explaining the vertical distribution of desert dust. They play a key role in maintaining a well-defined dust layer with sharp transition at the top of the SAL and in establishing the seasonal cycle of dust distribution.