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Summertime dust uplift over West Africa

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West Africa generates approximately 25 to 50% of the global emissions of mineral dust, which subsequently impacts on weather, climate and biogeochemical processes. The present day global dust emission rate is uncertain to within at least a factor of two, while model estimates for 2100 range from a 60% decrease to a 3.8-fold increase as compared to present-day estimates, making it impossible to predict the climate impact reliably. Our understanding of the winds generating dust uplift suffers from limited observations and insufficient representation of key meteorological processes in numerical models. Here the use of eleven days of continental-scale simulations at a convection-permitting resolution demonstrates that cold pool outflows from convection generate on the order of half the dust uplift in West Africa. Climate models do not realistically represent convective outflows and predict incorrect patterns of dust emission with an incorrect diurnal cycle. They are therefore expected to misrepresent feedbacks between convection, precipitation and dust uplift. This limits the confidence of dust uplift predictions in a future climate. The common practice of tuning climate models cannot resolve this problem. A realistic representation of the dust cycle in these models requires targeted efforts to develop computationally inexpensive ways to incorporate the effects of cold pool outflows from convective storms.