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New processes to counteract sedimentation of coarse dust particles are required for climate models to agree with aircraft observations

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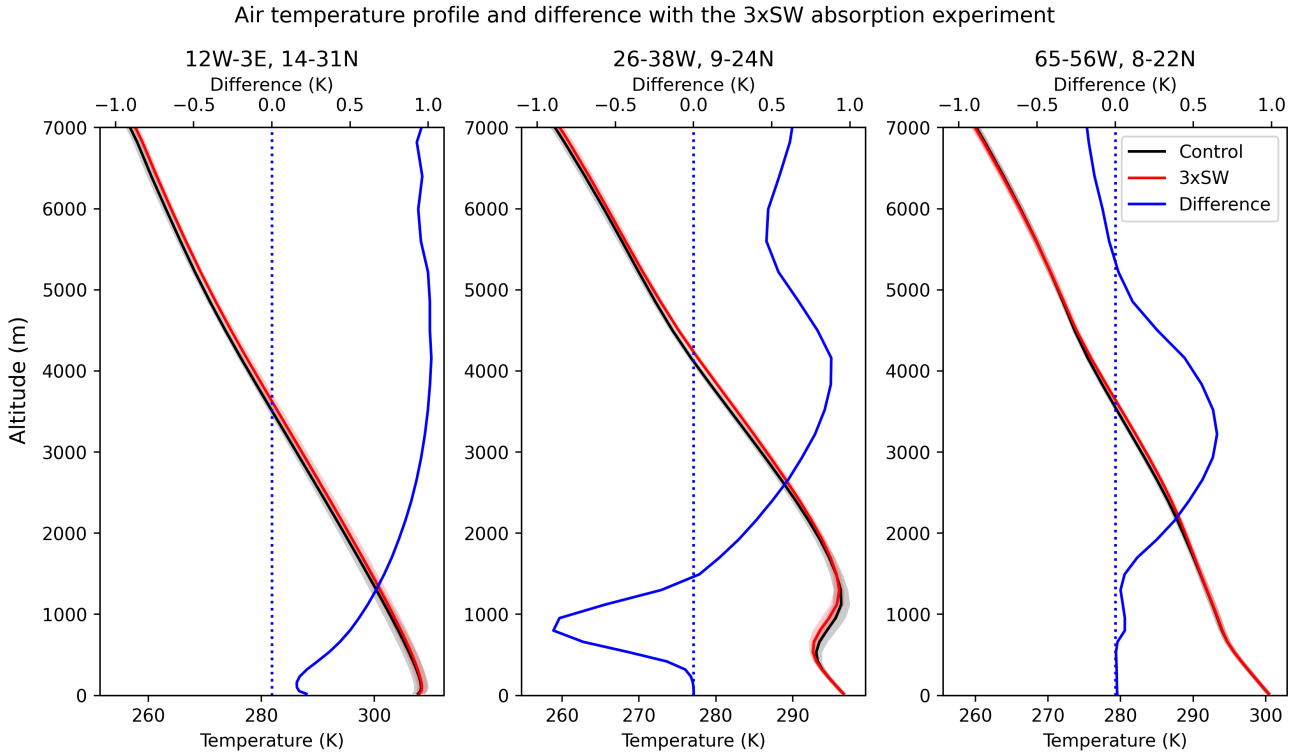

Figure S1: Mean air temperature (in K) profiles at the west Sahara, mid-east Atlantic, and Caribbean in the REcontrol (black) and 3xSW (red) on the lower x-axis, with the difference shown in blue (in K) on the upper x-axis. The vertical dotted line represents no difference between the two profiles.

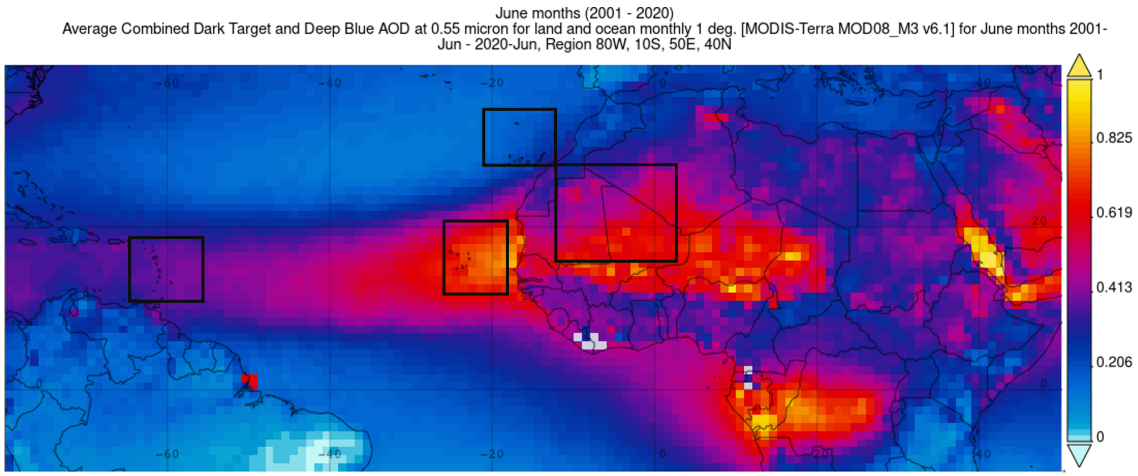

Figure S2: Average combined Dark Target and Deep Blue AOD at 550 nm from MODIS-Terra for June months 2001-2020. Black boxes mark the regions used in the study based on the locations of the in-situ aircraft observations used for comparison. The mean AOD in the Sahara box is lower than in the Cape Verde box; this is partly due to the position of the box (further north than the peaks in Saharan AOD), and to differences in the satellite retrieval over land and ocean that lead to either an underestimation over the land, or an overestimation over the eastern Atlantic.

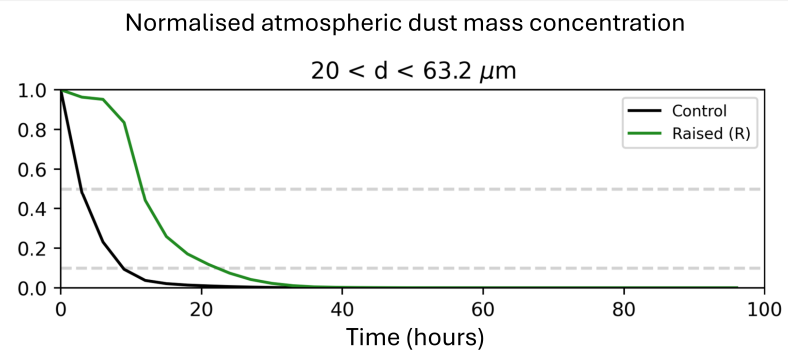

Figure S3: Normalised global atmospheric size bin 6 dust mass in a control (black line) and Raised (green line) simulation over 96 hours. Grey dashed lines are shown at 0.5 and 0.1, representing a loss of 50% and 90% of the original dust mass. In the control experiment (and the raised dust experiment), 50% of size bin 6 dust was removed from the atmosphere after 2.85 hours (11.56 hours), and 90% was removed after 8.85 hours (22.2 hours). To create the raised experiment, total column dust mass between 2°W-8°E, 14-27°N at the Sahara was lofted to a thin layer at 5 km altitude for model initialisation. Total dust mass was conserved between the control and raised experiments.