

Supporting information of:

An energetic view on the geographical dependence of the fast aerosol radiative effects on precipitation

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Content:

Figs. S1-S6.

Supplementary material containing the absolute precipitation change (compared to the reference simulation) for the aqua-planet simulations with the step-wise increase in the aerosol plume latitude centre (Fig. S1) and the absolute precipitation changes at the centre of the aerosol plume as a function of the centre latitude location in the same simulations. In addition, it contains zonal and meridional cross sections across the aerosol plumes' centre of differences from the reference simulation of the three components of the wind speed and temperature in the AMIP simulations with the idealized aerosol perturbation in Africa (Figs S3-4), the absolute precipitation change, in the AMIP simulations forced by the European aerosol plume with 10 times larger AOD compared to the default set-up (Fig. S5), and the relative precipitation changes in the AMIP simulations with the more realistic aerosol distribution (Full plume) for 4 different levels of AOD (Fig. S6).

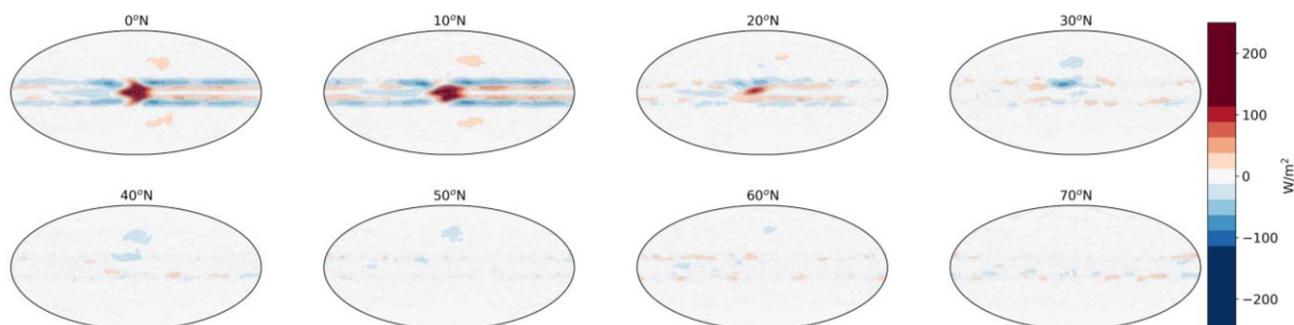


Figure S1. The absolute precipitation change (compared to the reference simulation) for the aqua-planet simulations. For each simulation the aerosol plume centre is indicated in the title. The relative precipitation change is presented in Fig. 3 in the main text.

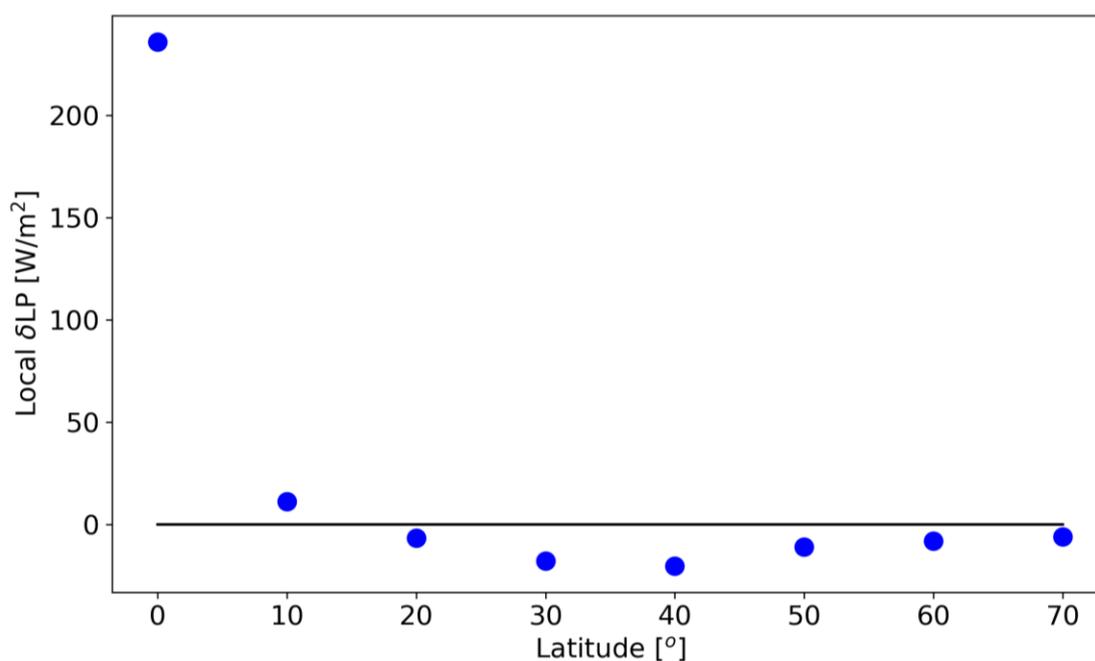


Figure S2. The absolute precipitation change (compared to the reference simulation) at the centre of the aerosol plume as a function of the centre latitude location in the aqua-planet simulations. The relative precipitation change at the plume centre is presented in Fig. 4 in the main text.

Figure S3 demonstrate that a zonal circulation is formed as a response of absorbing aerosols ($SSA=0.8$) over Africa. This circulation includes upward motion of air above Africa, westwards wind at the upper troposphere (~ 15 km), subsidence at the east tropical Atlantic and a returning flow (westwards) near the surface.

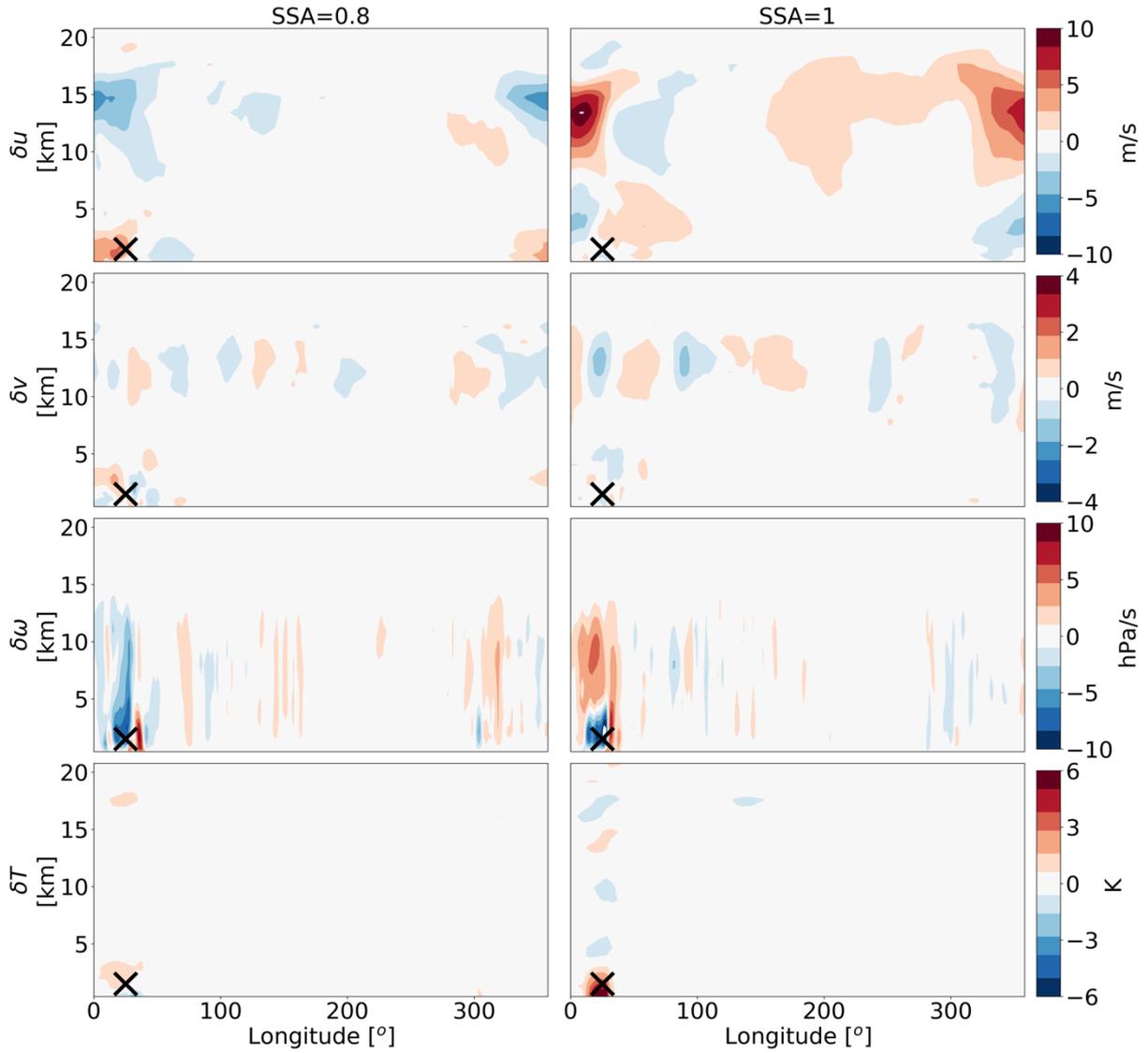


Figure S3. Zonal cross-sections across the latitude of the aerosol plumes' centre (marked by "x") of differences from the reference simulation in eastward winds (δu), northward winds (δv), vertical winds ($\delta \omega$), and temperature (δT). The left column presents the simulation in which the aerosol plume is located over Africa with absorbing aerosols (SSA=0.8), while the right column presents the simulation with the same plume location but with scattering aerosols (SSA=1).

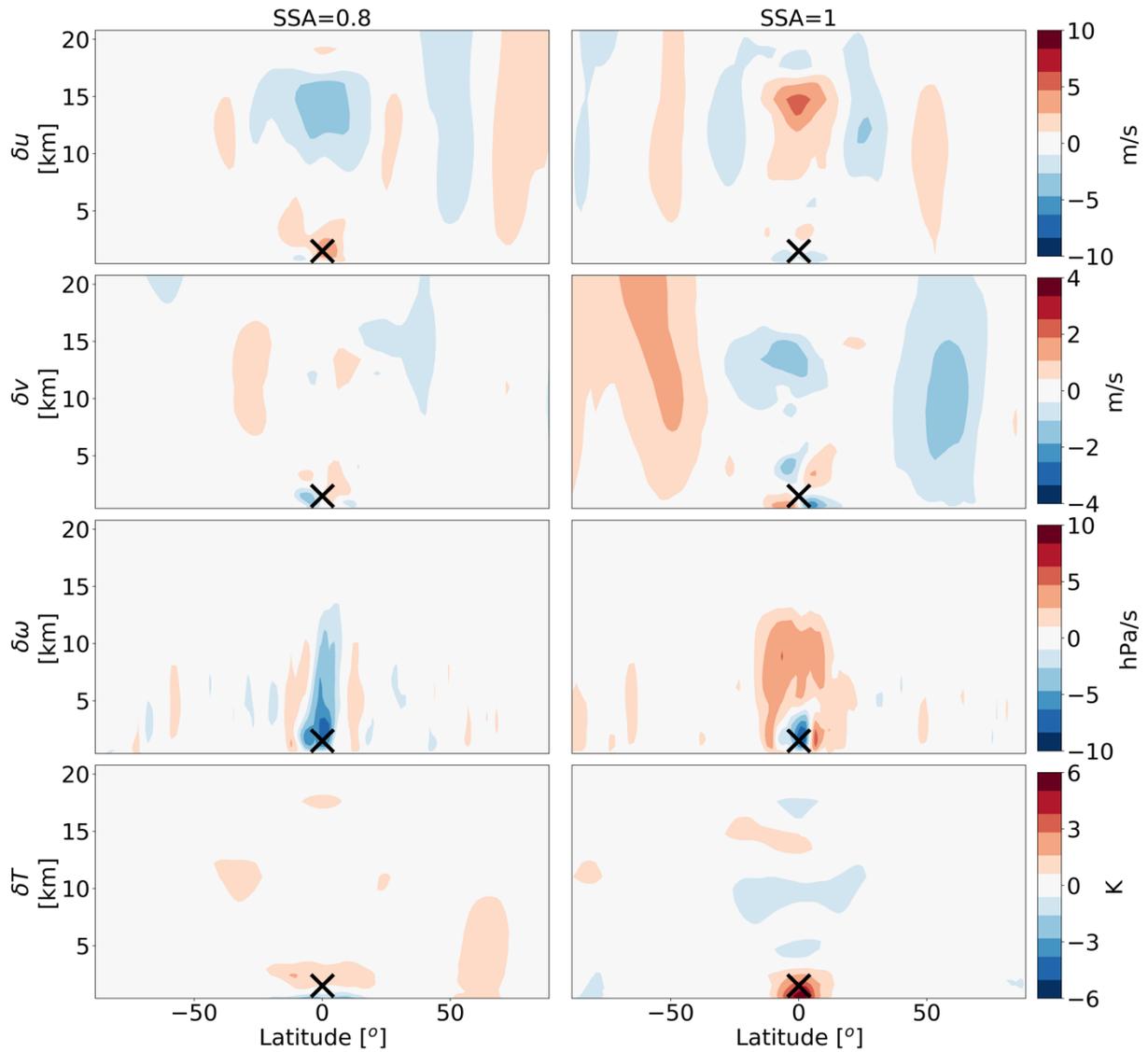


Figure S4. Meridional cross-sections across the longitude of the aerosol plumes' centre (marked by “x”) of differences from the reference simulation in eastward winds (δu), northward winds (δv), vertical winds ($\delta \omega$), and temperature (δT). The left column presents the simulation in which the aerosol plume is located over Africa with absorbing aerosols (SSA=0.8), while the right column presents the simulation with the same plume location but with scattering aerosols (SSA=1).

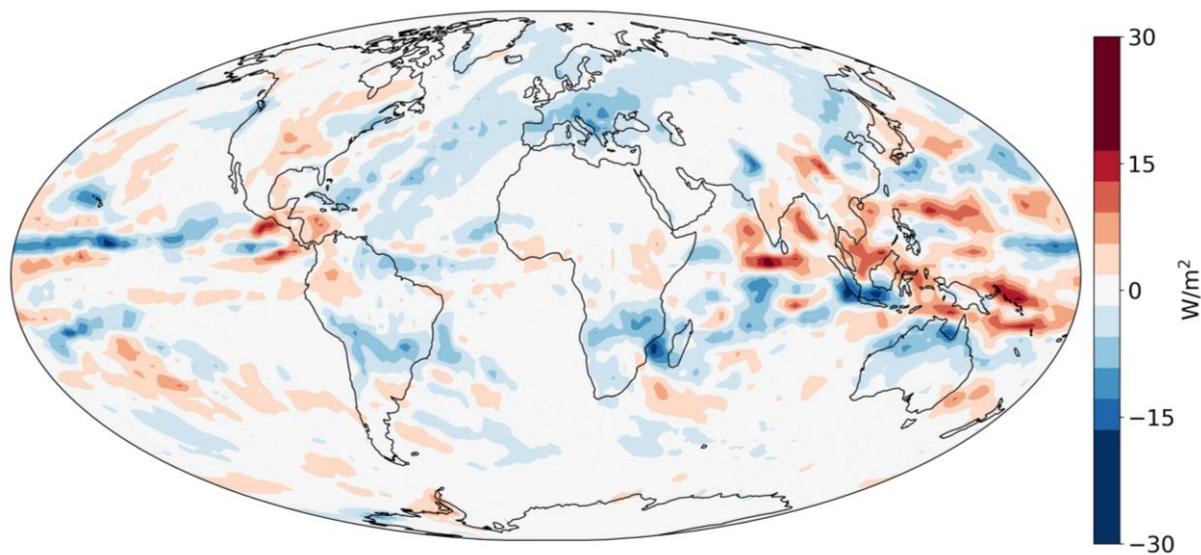


Figure S5. The precipitation latent heating change (compared to the reference simulation), in the AMIP simulations forced by the European aerosol plume with 10 times larger AOD compared to the default set-up.

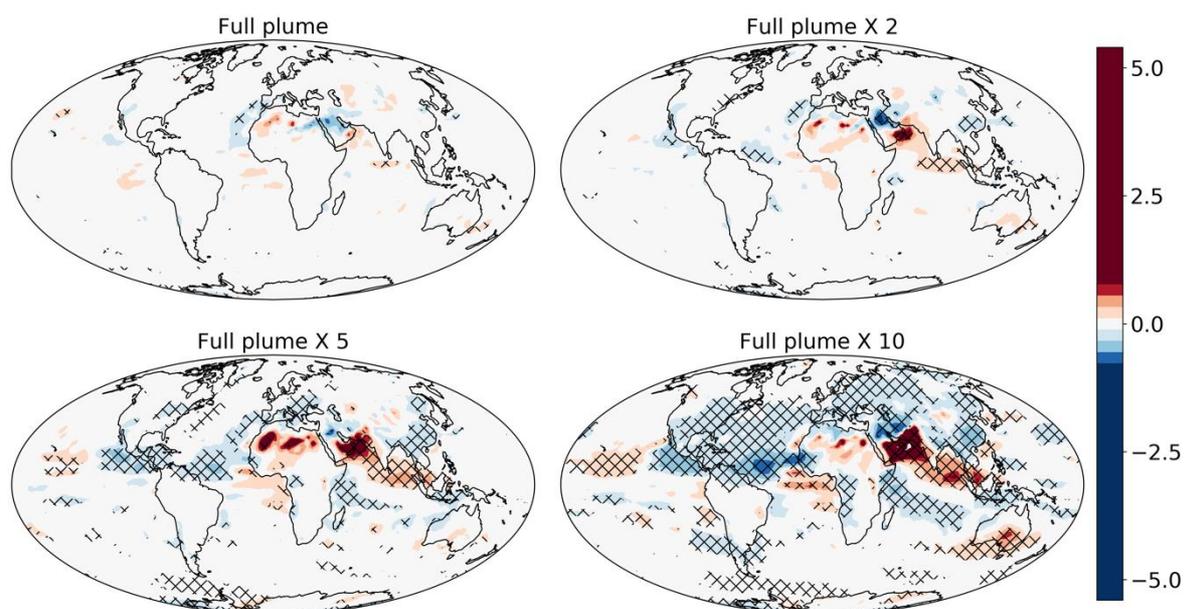


Figure S6. The relative precipitation change (compared to the reference simulation), in the AMIP simulations forced by the full global distribution of aerosols for a few levels of AOD compared to the Full plume simulation (indicated in the title of each subplot). The absolute precipitation change is presented in Fig. 15 in the main text.