



## **Quantifying the Importance of Rapid Adjustments for Global Precipitation Changes**

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Different climate drivers influence precipitation in different ways. Here we use radiative kernels to understand the influence of rapid adjustment processes on precipitation in climate models. Rapid adjustments are generally triggered by the initial heating or cooling of the atmosphere from an external climate driver. For precipitation changes, rapid adjustments due to changes in temperature, water vapor, and clouds are most important. In this study we have investigated five climate drivers (CO<sub>2</sub>, CH<sub>4</sub>, solar irradiance, black carbon, and sulfate aerosols) using results from 11 climate modeling groups within the Precipitation Driver Response Model Intercomparison Project (PDRMIP). The fast precipitation responses to a doubling of CO<sub>2</sub> and a 10-fold increase in black carbon are found to be similar, despite very different instantaneous changes in the radiative cooling, individual rapid adjustments, and sensible heating. The model diversity in rapid adjustments is smaller for the experiment involving an increase in the solar irradiance compared to the other climate driver perturbations, and this is also seen in the precipitation changes.