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Multiyear convective-permitting simulations of the effect of megacities on extreme precipitation

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Urban areas are very vulnerable to extreme precipitation, which is already increasing due to global climate change. In addition, urbanization itself has been shown to strengthen extreme precipitation events, by destabilizing the boundary layer and enhancing convection. However, the robustness of this response and the effect of urbanization on the frequency of extreme events are still unclear. In this work, we perform convection-permitting simulations with the Weather Research and Forecasting (WRF) model using the single layer urban canopy model and a high resolution inventory of anthropogenic heat emissions. These simulations are performed for 5 years to study the influence of 3 megacities (Tokyo, New York City, Paris) on extreme urban precipitation. Specifically, we assess how urbanization affects the probability density functions of daily and subdaily extreme precipitation in megacities. We also examine the associated changes in the surface energy and water budget, atmospheric profiles, circulation, and clouds, in order to understand the processes driving these changes in extremes.