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Significant reduction of unequal population exposure to climate extremes by achieving the carbon neutrality

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Climate extremes, such as hot temperature and heavy precipitation events, have devastating effects on human societies. As the planet warms, they have become more intense and more frequent. To avoid irreversible damage from climate extremes, many countries have committed to achieving net-zero anthropogenic carbon emissions, or carbon neutrality, by 2050s. Here, we quantify the impact of carbon neutrality on population exposure to climate extremes using multi-model projections from the Coupled Model Intercomparison Project Phase 6 (CMIP6) based on the Shared Socioeconomic Pathway (SSP)1-1.9 and SSP3-7.0 scenarios. It is found that the increasing exposure of the population to hot-temperature and heavy-precipitation extremes can be substantially reduced by 87–98% in the late 21st century by achieving carbon neutrality. The benefits of carbon neutrality are particularly pronounced in Africa and Asia. The potential benefits of carbon neutrality are also significant in North America, Europe, and Oceania, where a reduction in climate extremes is more than twice as important as population decline in reducing population exposure to climate extremes. These results provide important scientific support for ongoing efforts to achieve net-zero carbon emissions by 2050s to reduce potential climate risk and its inequity across continents.