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Assessing Multidimensional Climate Extremes and Associated Vulnerabilities Across the United States

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Climate change is intensifying the occurrence of various extreme weather events across different geographic regions. While most research tends to concentrate on individual extremes, such as heatwaves, droughts, or floods, there's been minimal exploration into how multiple, diverse extremes interact and compound impact social vulnerability. This study analyzes the overlapping spatial and temporal impact of temperature, precipitation, and hydroclimatic extremes across the US in the context of climate change.

Using data and predictions from global and regional climate models for present (including historical) and future emissions scenarios, we compute several indices of different extremes related to heatwaves, floods, and droughts. The aim is to categorize regions, or states or counties, based on their exposure to simultaneous extremes, incorporating social vulnerability and socioeconomic factors. The combination of exposure to multiple hazards and social vulnerability reveals regions in the US that face the highest risks from climate change.

Understanding the likelihood of compound climatic extremes occurring in areas with vulnerable populations can significantly aid in planning for adaptation and reducing the risk of disasters. By employing machine learning techniques to predict both multidimensional extremes and social vulnerability, policymakers can tailor evidence-based strategies to enhance community resilience. The methodology and findings provide a framework for evaluating multidimensional climate risks, applicable not just in the US but also in other countries and regions worldwide.