Using Dynamically Downscaled Climate Data to Improve Resilience Planning

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Background/Objectives. Global climate models (GCMs) provide broad insights into the types of climate impacts that regions might expect to experience in the future, such as higher temperatures and increased precipitation. However, the coarse spatial resolution of GCMs (100 to 200 km grid cells) hinders efforts to conduct reliable, localized assessments of climate-related risks, given that climate impacts can vary substantially across these distances. This knowledge gap can make targeted risk responses and long-term planning for climate resilience difficult. In response, climate scientists at Argonne National Laboratory have applied *dynamical downscaling* techniques to translate future climate scenarios into local-scale impacts (12 km grid cells) across nearly the entire continental United States.

Approach/Activities. The purpose of this project is to demonstrate the capabilities of dynamically downscaled climate data in risk analysis and resilience planning. We do this by using localized climate projections under multiple climate scenarios to evaluate future neighborhood- and community-level vulnerability to heat waves and higher temperatures. Specifically, we use demographic information and geospatial property data for a sample of U.S. counties – with information on building features, construction type, occupancy, and location relative to community resources such as cooling centers – to evaluate extreme heat risk and vulnerability at the building- and community-scale. We also consider the area's land cover and other natural features. While rising temperatures will afflict many communities across the U.S., this analysis identifies those areas within a locality which are relatively ill-equipped to handle increases in extreme temperatures and quantifies their expected heat vulnerability at mid- and end-of-century.

Results/Lessons Learned. Our study finds significant variation across and within communities in the presence of infrastructure and other features for minimizing the impacts of extreme heat. Many of these areas are projected to experience substantial temperature impacts by mid-century, posing a serious threat to public health.

As a demonstrative analysis, this project highlights recent advances in high-resolution climate modeling and presents the findings of a practical application of this data to help improve resilience planning. Granular climate projections, in combination with targeted building, demographic, land use, and infrastructure data, can better inform policy and planning for the individual, community and region. The insights from this study, for example, can be used to pinpoint risk reduction subsidies, or help utilities identify and plan for those areas that will likely need greater future capacity. More broadly, this type of analysis can help state and local planners identify neighborhoods and communities with critical, immediate needs during heatwaves, thereby improving emergency response.