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Mapping Heat-related Risks for Community-based Adaptation Planning under Uncertainty

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Climate change is leading to more frequent and intense heat waves. Recently, epidemiologic findings on heat-related health impacts have reinforced our understanding of the mortality impacts of extreme heat. This research has several aims: 1) to promote climate prediction services with spatial and temporal information on heat-related risks, using GIS (Geographical Information System), and digital mapping techniques; 2) to propose a visualization approach to articulating the evolution of local heat-health responses over time and the evaluation of new interventions for the implementation of valid community-based adaptation strategies and reliable actionable planning; and 3) to provide an appropriate and simple method of adjusting bias and quantifying the uncertainty in future outcomes, so that regional climate projections may be transcribed into useful forms for a wide variety of different users.

Following the 2003 European heat wave, climatologists, medical specialists, and social scientists expedited efforts to revise and integrate risk governance frameworks for communities to take appropriate and effective actions themselves. Recently, the Coupled Model Intercomparison Project (CMIP) methodology has made projections possible for anyone wanting to openly access state-of-the-art climate model outputs and climate data to provide the backbone for decisions. Furthermore, the latest high-solution regional climate model (RCM) has been a huge increase in the volumes of data available.

In this study, we used high-quality hourly projections (5-km resolution) from the Non-Hydrostatic Regional Climate Model (NHRCM-5km), following the SRES-A1B scenario developed by the Meteorological Research Institute (MRI) and observational data from the Automated Meteorological Data Acquisition System, Japan Meteorological Agency (JMA). The NHRCM-5km is a dynamic downscaling of results from the MRI-AGCM3.2S (20-km resolution), an atmospheric general circulation model (AGCM) driven by the ensemble of mean sea surface temperatures derived from the CMIP3 coupled GCMs. This contribution demonstrates how composite heat-related risk maps with a visualization of combined predicted population and the 5-km resolution climate projections, can be used in community-based adaptation planning in Japan. To test this approach, Tokyo (area 2190.9 km^2; population 13.50 million as of 1 December 2015), a Japanese megacity, was chosen for a pilot study. Our challenges will be facilitated by the formation of research partnerships involving epidemiologists, climate scientists, and local stakeholders. Hopefully, the methodology could be transferred to developing countries to aid in planning heat adaptation.