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The 1994 heat wave in South Korea: mortality impacts and recurrence probability in a changing climate

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The study deals with mortality impacts of the July–August 1994 heat wave in the population of South Korea, including the megacity of Seoul (with the population exceeding 10 million for the city and 20 million for the metropolitan area), and estimates recurrence probability of the heat wave in a changing climate in terms of simulations of daily temperature series with a stochastic model. The 1994 heat wave is found exceptional with respect to both climatological characteristics and the mortality effects: significantly elevated mortality occurred in all population groups, including children up to 14 years of age, and the total death toll exceeded 3000 in the Korean population, which ranks the 1994 heat wave among the worst weather-related disasters in East Asia. The estimate represents net excess mortality as no mortality displacement effect appeared. A comparison with other documented natural disasters shows that the death toll of the heat wave was much higher than those of the most disastrous floodings and typhoons over Korean Peninsula in the 20th century. The mortality response was stronger in males than females although males are found to be less vulnerable during average heat waves.
A climatological analysis reveals that the July–August 1994 heat wave might be considered an extremely rare event with a return period in the order of hundreds of years if stationarity of temperature time series is assumed. However, under a more realistic assumption of gradual warming related to climate change, recurrence probability of an event analogous to the 1994 heat wave sharply rises for near-future time horizons. If warming of 0.04°C/year is assumed over 2001–2060, the recurrence interval of a very long spell of days with temperature exceeding a high threshold (as in the 1994 heat wave) is estimated to decrease to around 40 (10) years in the 2021–2030 (2041–2050) decade. This emphasizes the need for setting up an efficient heat-watch-warning system in this area in order to reduce human mortality impacts of heat waves.