Heat-stress increase under climate change twice as large in cities as in rural areas

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Urban areas, being warmer than their surroundings, are particularly vulnerable to global warming and associated increases in extreme temperatures. Yet ensemble climate-model projections are generally performed on a scale that is too coarse to represent the evolution of temperatures in cities. Here, for the first time, we combine a 35-year convection-permitting climate model integrations with information from an ensemble of general circulation models to assess heat stress in a typical densely populated mid-latitude maritime region. We show that the heat-stress increase for the mid-21st century is twice as large in cities compared to their surrounding rural areas. The exacerbation is driven by the urban heat island itself, its concurrence with heatwaves, and urban expansion. Cities experience a heat-stress multiplication by a factor 1.4 and 15 depending on the scenario. Remarkably, the future heat-stress surpasses everywhere the urban hot spots of today. Our novel insights exemplify the need to combine information from climate models, acting on different scales, for climate-change risk assessment in heterogeneous regions. Moreover, these results highlight the necessity for adaptation to increasing heat stress, especially in urban areas.