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Increasing compound concurrent hot day and night extremes in five big cities of Switzerland

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The interaction of multiple hazards across various spatial and temporal scales typically causes compound climate and weather extreme events. Compound concurrent hot day and night extremes that combine daytime and nighttime heat are of greater concern for health than individual hot days or hot nights. Continuous day and nighttime heatwaves can exacerbate human discomfort and therefore increase the risks of heat-related morbidity and mortality. However, little is known about the evolution of such events in the observed and projected climate. Four compound event types, namely (a) preconditioned, (b) multivariate, (c) temporally compounding, and (d) spatially compounding events were introduced in the literature that facilitates the selection of the proper approaches in the study of compound extreme events. The impact of a single or the combination of multiple types could shape more severe extreme events. In our study, we considered the temporally compounding and multivariate types and used climate observations (1981-2020) and high-resolution bias-corrected climate model scenarios of Switzerland (CH2018). Our analyses show that the average frequency and intensity of compound consecutive hot days and nights increase in five big cities of Switzerland until 2100 under RCP4.5. We projected 1.83 ± 0.07 (days decade^{-1}) for Basel, 1.57 ± 0.1 (days decade^{-1}) for Bern, 2.34 ± 0.13 (days decade^{-1}) for Geneva, 2.55 ± 0.17 (days decade^{-1}) for Lugano, and 1.93 ± 0.12 (days decade^{-1}) for Zürich. Moreover, we found an increase in the intensity of summertime (April-October) compound hot extremes days and night in Basel (0.28 ± 0.03 °C decade^{-1}), Bern (0.23 ± 0.02°C decade^{-1}), Geneva (0.37 ± 0.04 °C decade^{-1}), Lugano (0.4 ±0.07°C decade^{-1}), and Zürich (0.44 ± 0.05°C decade^{-1}).