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## Development of future heatwaves under different adaptation levels

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The 2018 and 2019 heatwaves set all-time temperature records around the world and were associated with adverse effects on human health, agriculture, natural ecosystems and infrastructure in the affected regions. Often, severe impacts relate to the joint spatial and temporal extent of the heatwaves, but most research generally focuses either on spatial or temporal attributes of heatwaves. In addition, possible effects of adaptation are generally ignored, i.e. the extent to which society or ecosystems might be able to adapt to on-going changes in mean climate or associated extremes.

Here, we analyze the largest spatiotemporally contiguous heatwaves -- i.e. three-dimensional (space-time) clusters of hot days -- in simulations of global state-of-the-art Earth System models. To assess the role of different levels of adaptation, we use three different thresholds to define a hot day: *no* adaptation (time-invariant climatological threshold), *seasonal* adaptation to the new summer means, *full* adaptation (hot days defined relative to the future climatology).

We find a strong increase of spatiotemporally contiguous heatwaves with global warming for the *no* adaptation case whereas changes for the other two adaptation thresholds are much less pronounced. In particular, no or very little changes in the overall magnitude, spatial extent and duration are detected when heatwaves are defined relative to the future climatology using a temporally moving threshold (*full* adaptation). This suggests a dominant contribution of thermodynamic compared to dynamic effects.

Given the implied time scale, *full* adaptation is a rather unrealistic assumption. Hence, both strong mitigation and adaptation are necessary to limit impacts of heatwaves in the future.