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Climatology and Trends in Concurrent Temperature Extremes in the Global Extratropics

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Simultaneous occurrences of multiple heatwaves or cold spells in remote geographical regions have drawn considerable attention in the literature, due to their potentially far-reaching impacts. These include widespread crop failures, increased mortality, wildfires, power supply disruptions and more. We introduce a flexible toolbox to identify and study such concurrent temperature extremes, with adjustable parameters that different users can tailor to their specific needs and impacts of interest. We then use the toolbox to present a climatological analysis of concurrent heatwaves and cold spells in the global midlatitudes. Specific geographical areas, such as Western Russia, Central Europe, Southwestern Eurasia and Western North America, emerge as hotspots for concurrent temperature extremes. Concurrent heatwaves are becoming more frequent, longer-lasting and more extended in the Northern Hemisphere, while the opposite holds for concurrent cold spells. Concurrent heatwaves in the Southern Hemisphere are comparatively rare. However, their sharp increase in recent decades means that they are becoming an emerging hazard in the Southern midlatitudes. Notably, trends in concurrent temperature extremes are significantly stronger than the corresponding trends in all temperature extremes. This suggests that concurrent heatwaves will be an increasingly important climatic hazard in both absolute and relative terms in a future, warmer, climate.