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Generalised hyperbolic state space models with application to spatio-temporal heat wave prediction

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As global warming progresses, it is increasingly important to monitor and analyse spatio-temporal patterns of heat waves and other extreme climate-related events that impact urban areas. In this work, we present a novel dynamic spatio-temporal model by combining a state space model (SSM) and a generalised hyperbolic distribution to flexibly describe a spatial-temporal profile of the tail behaviour, skewness and kurtosis of the local urban temperature distribution of the greater Tokyo metropolitan area. Such a model can be used to study local dynamics of temperature effects, specifically those that characterise extreme heat or cold. The focus of the application in this paper will be heat wave events in the greater Tokyo metropolitan area which is known to be prone to some of the most severe heat wave events that have one of the largest population exposures due to high density living in Tokyo city.

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